VA/DoD CLINICAL PRACTICE GUIDELINE FOR THE MANAGEMENT OF STROKE REHABILITATION

Department of Veterans Affairs

Department of Defense

And

The American Heart Association/ American Stroke Association

Prepared by:

THE MANAGEMENT OF **STROKE REHABILITATION** Working Group

With support from:

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&

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QUALIFYING STATEMENTS

The Department of Veterans Affairs (VA) and The Department of Defense (DoD) guidelines are based on the best information available at the time of publication. They are designed to provide information and assist in decision-making. They are not intended to define a standard of care and should not be construed as one. Also, they should not be interpreted as prescribing an exclusive course of management.

Variations in practice will inevitably and appropriately occur when providers take into account the needs of individual patients, available resources, and limitations unique to an institution or type of practice. Every healthcare professional making use of these guidelines is responsible for evaluating the appropriateness of applying them in any particular clinical situation.

Version 2.0 2010

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INTRODUCTION

This update of the Clinical Practice Guideline for the Management of Stroke Rehabilitation was developed under the auspices of the Veterans Health Administration (VHA) and the Department of Defense (DoD) pursuant to directives from the Department of Veterans Affairs (VA). VHA and DoD define clinical practice guidelines as:

> *"Recommendations for the performance or exclusion of specific procedures or services derived through a rigorous methodological approach that includes:*
>
> *Determination of appropriate criteria such as effectiveness, efficacy, population benefit, or patient satisfaction; and Literature review to determine the strength of the evidence in relation to these criteria."*

This VA/DoD Stroke Rehabilitation guideline update builds on the 1996 VA *Stroke/Lower Extremity Amputee Algorithms Guide* and the 2003 VA/DoD Guideline for the *Management of Stroke Rehabilitation in the Primary Care Setting*. The 2003 version of this guideline focused on stroke rehabilitation, utilizing a team model of intervention and interactions with patients and families (caregivers & support systems).

Algorithms:

This guideline has been developed using an algorithmic approach to guide the clinician in determining care and the sequencing of interventions on a patient specific basis. The clinical algorithm incorporates the information presented in the guideline in a format that maximally facilitates clinical decision-making. The use of the algorithmic format was chosen because such a format improves data collection, facilitates diagnostic and therapeutic decision-making, and changes in patterns of resource use. However, *this should not prevent providers from using their own clinical expertise in the care of an individual patient.* Guideline recommendations are intended to support clinical decision-making and should never replace sound clinical judgment.

The VA developed an algorithm for the Stroke/Lower Extremity Amputee Algorithms Guide (1996) and the results of implementation of this guideline demonstrated the utility of the algorithm, as well as the feasibility of implementing a standard algorithm of rehabilitation care in a large healthcare system (Bates & Stineman, 2000).

The algorithm of the 2003 version of the guideline was modified to emphasize early decision-making regarding discharge to home/community. The key decisions in early stages of the assessment and management of a patient recovering from stroke include assessment of rehabilitation needs and the appropriateness of providing these interventions in both community and outpatient rehabilitation settings.

The interventions module on this 2010 update has been reorganized, and the recommendations are formulated to address possible impairment regardless of care setting.

Target Population:

This guideline applies to adult patients (18 years or older) with post-stroke functional disability who may require rehabilitation in the VHA or DoD health care system.

Audiences:

The guideline is relevant to all healthcare professionals providing or directing treatment services to patients recovering from a stroke, in any healthcare setting (primary care, specialty care, and long-term care) and in community programs.

Stroke Rehabilitation:

Stroke is a leading cause of disability in the United States. (AHA, 1999) Forty percent of stroke patients are left with moderate functional impairment and 15% to 30% with severe disability. Effective rehabilitation interventions initiated early after stroke can enhance the recovery process and minimize functional disability. Improved functional outcomes for patients also contribute to patient satisfaction and can reduce potentially costly long-term care expenditures. Substantial evidence indicates that patients do better with a well-organized, multidisciplinary approach to post-acute stroke care.

The highest priorities of early stroke rehabilitation are to prevent recurrence of stroke, manage comorbidities and prevent complications. In addition to facilitating mobilization and resumption of self care activities, ensuring proper management of general health functions and providing emotional support to the patient and family are important. Following the "acute" phase of stroke care, the focus of care turns to recovery of physical and cognitive deficits, as well as compensation for residual impairment.

There is a growing body of evidence that indicates patients do better with a well-organized, multidisciplinary approach to post-acute stroke care (Cifu & Stewart, 1999; Evans et al., 1995; Stroke Unit Trialists' Collaboration, 2002). For this Guideline update, the VA/DoD Stroke Rehabilitation Working Group only focused on the rehabilitation phase of the post-acute care. Secondary Prevention of Stroke will not be addressed in this update. Providers may refer to the revised AHA/ASA Guideline for Prevention of Stroke in Patients with Ischemic Stroke or Transient Ischemic Attack (http://stroke.ahajournals.org/cgi/content/full/37/2/577)..

Duncan, Horrner and colleagues (2002) found that greater adherence to post-acute stroke rehabilitation guidelines was associated with improved patient outcomes and concluded that "compliance with guidelines may be viewed as a quality of care indicator with which to evaluate new organizational and funding changes involving post-acute stroke rehabilitation."

Stroke in VA population:

The Veterans Health Administration (VHA) of the Department of Veterans Affairs (VA) estimates that 15,000 veterans are hospitalized for stroke-related diagnoses each year (VA HSR&D, 1997). In 2006, the number of new stroke patients at the VA was 5766 with an additional 5920 being identified in 2007. Although a significant percentage of these patients (87.60% & 83.89% respectively) received an initial assessment, the percentage who received comprehensive rehabilitation (22.30% &22.50%) was quite low.

There are only 45 rehabilitation bed units (RBU) in the VA today. Many veterans, who are admitted to a VA Medical Center after suffering a stroke, will find themselves in a facility that does not offer comprehensive, integrated, coordinated care. In a VA rehabilitation field survey published in December 2000, over half of the respondents reported that the "rehabilitative care of stroke patients was incomplete, fragmented, and not well coordinated" at sites lacking a RBU (VA Stroke Medical Rehabilitation Questionnaire Results, 2000).

Stroke in DoD population:

Newly diagnosed stroke cases in the DoD for 2006 (1926) and 2007 (1888) were understandably considerably lower than those in the VA for the same time periods. Comprehensive treatment for stroke patients in DoD medical facilities is given primarily at medical centers. Smaller DoD community hospitals may have limited resources to see both inpatients and outpatients relying more on the TRICARE network for on-going stroke rehabilitation services

Outcome Measures:

The Working Group (WG) agreed on the following health related outcome of post-stroke rehabilitation:

- Morbidity (secondary complication)
- Mortality
- Quality of life
- Functional status (physical, cognitive, vocational, social)
- Patient satisfaction
- Access to care
- Utilization of healthcare

Effective rehabilitation improves functional outcome. An indicator for improvement is the positive change in the Functional Independence Measures (FIM™) (UDS_{MR} for1997, 1998) score over a period of time in the post-acute care period. Within the Veterans Health Administration (VHA) this measure is captured in the Functional Status and Outcomes Database for rehabilitation. All VA stroke patients should be entered into the database, as directed by VHA Directive 2000-016 (dated June 5, 2000; Medical Rehabilitation Outcomes for Stroke, Traumatic Brain, and Lower Extremity Amputee Patients). This tool has been tested extensively in rehabilitation for reliability, validity, and sensitivity, and it is by far the most commonly used outcome measure. A return to independent living requires not only the ability to perform basic activities of daily living (ADLs), but also the ability to carry out more complex activities (i.e., instrumental activities of daily living (IADL). IADL's include activities such as shopping, meal preparation, use of the telephone, driving a car, and money management. These functions should be evaluated as the stroke survivor returns to the community. New stroke specific outcome measures, such as the Stroke Impact Scale (Duncan, Reker, et al., 2002), may be considered for a more comprehensive assessment of functional status and quality of life.

Guideline Goals:

The most important goal of the VA/DoD Clinical Practice Guideline for the Management of Stroke Rehabilitation is to provide a scientific evidence-base for practice evaluations and interventions. The guideline was developed to assist facilities to implement processes of care that are evidence-based and designed to achieve maximum functionality and independence as well as improve patient and family quality of life. To facilities lacking an organized RBU, it will provide a structured approach to stroke care and assure that veterans who experience a stroke will have access to comparable care, regardless of geographic location. The algorithm will serve as a guide to help clinicians determine best interventions and timing of care for their patients, better stratify stroke patients, reduce re-admissions, and optimize healthcare utilization. If followed, the guideline is expected to have a positive impact on multiple measurable patient outcome domains.

Development Process:

The development process of this guideline follows a systematic approach described in "Guideline-for-Guidelines," an internal working document of the VA/DoD Evidence-Based Practice Working Group that requires an ongoing review of the work in progress. Appendix A clearly describes the guideline development process followed for this guideline.

The Offices of Quality and Performance and Patient Care Service, in collaboration with the network Clinical Managers, and the Medical Center Command of the DoD identified clinical leaders to champion the guideline development process. During a preplanning conference call, the clinical leaders defined the scope of the guideline and identified a group of clinical experts from the VA and DoD that formed the Guideline Development Working Group.

At the start of the update process, the clinical leaders, guideline panel members, outside experts, and experts in the field of guideline and algorithm development were consulted to determine which aspects of the 2003 guideline required updating. These consultations resulted in the following recommendations that guided the update efforts: (1) update any recommendations from the original guideline likely to be effected by new research findings; (2) provide information and recommendations on health systems changes relevant to stroke rehabilitation care; (3) address content areas and models of treatment for which little data existed during the development of the original guideline; and (4) review the performance and lessons learned since the implementation of the original guideline.

Review of literature and evidence:

Recommendations for the performance or inclusion of specific procedures or services in this guideline were derived through a rigorous methodological approach that included the following:

- Determining appropriate criteria such as effectiveness, efficacy, population benefit, or patient satisfaction
- Performing a comprehensive literature search and selection of relevant studies since 2002 to identify the best available evidence and ensure maximum coverage of studies at the top of the hierarchy of study types

- Reviewing the selected studies to determine the strength of the evidence in relation to these criteria
- Formulating the recommendations and grading the level of evidence supporting each recommendation

The VA/DoD Stroke Rehabilitation Working Group builds on the 2003 version of the guideline and incorporates information from the following existing evidence-based guidelines/reports:

- **The Evidence-Based Review of Stroke Rehabilitation** – (www.ebrsr.com) – Update 2009
- **Royal College of Physicians;** National clinical guidelines for stroke: second edition. June 2004.
- For the **Canadian Stroke Network:** .Neil F. Gordon, MD, PhD, Co-chair; Meg Gulanick, PhD, APRN, Co-chair; Fernando Costa, MD; Gerald Fletcher, MD; Barry A. Franklin, PhD; Elliot J. Roth, MD; Tim Shephard, RN, MSN: Canadian Best Practice Recommendations for Stroke Care (Update 2008) Guidelines 2006.

These literature searches were conducted covering the period from January 2002 through March 2009 that using the terms Cerebrovascular Disorders and rehabilitation or rehab. Adding a stroke text word did not appear to be useful in that sensitivity was not enhanced but specificity was decreased. Electronic searches were supplemented by reference lists and additional citations suggested by The WG. The identified and selected studies on those issues were critically analyzed, and evidence was graded using a standardized format. The evidence rating system for this document is based on the system used by the U.S. Preventive Services Task Force (USPSTF).

If evidence exists, the discussion following the recommendations for each annotation includes an evidence table identifying the studies that have been considered, the quality of the evidence, and the rating of the strength of the recommendation [SR]. The Strength of Recommendation, based on the level of the evidence and graded using the USPSTF rating system (see Table: Evidence Rating System), is presented in brackets following each guideline recommendation.

Evidence Rating System

SR	
A	A strong recommendation that clinicians provide the intervention to eligible patients. *Good evidence was found that the intervention improves important health outcomes and concludes that benefits substantially outweigh harm.*
B	*A recommendation that clinicians provide (the service) to eligible patients.* *At least fair evidence was found that the intervention improves health outcomes and concludes that benefits outweigh harm.*
C	*No recommendation for or against the routine provision of the intervention is made.* *At least fair evidence was found that the intervention can improve health outcomes, but concludes that the balance of benefits and harms is too close to justify a general recommendation.*
D	*Recommendation is made against routinely providing the intervention to asymptomatic patients.* *At least fair evidence was found that the intervention is ineffective or that harms outweigh benefits.*
I	*The conclusion is that the evidence is insufficient to recommend for or against routinely providing the intervention.* *Evidence that the intervention is effective is lacking, of poor quality, or conflicting, and the balance of benefits and harms cannot be determined.*

SR = Strength of recommendation

Where existing literature was ambiguous or conflicting, or where scientific data was lacking on an issue, recommendations are based on the clinical experience of the Working Group. Although several of the recommendations in this guideline are based on weak evidence, some of these recommendations are strongly recommended based on the experience and consensus of the clinicians and researchers of the Working Group. Recommendations that are based on consensus of the Working Group include a discussion on the given topic.

No [SR] is presented for these recommendations. A complete bibliography of the references in this guideline can be found in Appendix E

This Guideline is the product of many months of diligent effort and consensus building among knowledgeable individuals from the VA, DoD, and a guideline facilitator from the private sector. An experienced moderator facilitated the multidisciplinary Working Group. The draft document was discussed in three face-to-face group meetings. The content and validity of each section was thoroughly reviewed in a series of conference calls. The final document is the product of those discussions and has been approved by all members of the Working Group.

The list of participants is included in Appendix D to the guideline.

Implementation:

The guideline and algorithms are designed to be adapted by individual facilities in consideration of local needs and resources. The algorithms serve as a guide that providers can use to determine best interventions and timing of care for their patients in order to optimize quality of care and clinical outcomes.

Although this guideline represents the state of the art practice on the date of its publication, medical practice is evolving and this evolution requires continuous updating of published information. New technology and more research will improve patient care in the future. The clinical practice guideline can assist in identifying priority areas for research and optimal allocation of resources. Future studies examining the results of clinical practice guidelines such as these may lead to the development of new practice-based evidence.

Stroke Rehabilitation - Guideline Working Group Update 2010

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KEY POINTS

- The primary goal of rehabilitation is to **prevent complications, minimize impairments, and maximize function.**
- Secondary prevention is fundamental to **preventing stroke recurrence (**see: AHA/ASA Guideline for Prevention of Stroke in Patients with Ischemic Stroke or Transient Ischemic Attack).
- **Early** assessment and intervention is critical to optimize rehabilitation.
- **Standardized** evaluations and valid assessment tools are essential to the development of a comprehensive treatment plan.
- Evidence-based interventions should be based on **functional goals.**
- Every candidate for rehabilitation should have access to an **experienced and coordinated** rehabilitation team in order to ensure optimal outcome.
- The **patient and family and/or caregiver** are essential members of the rehabilitation team.
- **Patient and family education** improves informed decision-making, social adjustment, and maintenance of rehabilitation gains.
- The rehabilitation team should utilize **community resources for community reintegration.**
- **Ongoing** medical management of risk factors and co-morbidities is essential to ensure survival.

OUTCOME MEASURES

1. Effective rehabilitation improves functional outcome. An indicator for improvement is the positive change in the Functional Independence Measures (FIM™) score over a period of time in the post-acute care period. Within the Veterans Health Administration (VHA) this measure is captured in the Functional Status and Outcomes Database for rehabilitation. All stroke patients should be entered into the database, as directed by VHA Directive 2000-016 (dated June 5, 2000; Medical Rehabilitation Outcomes for Stroke, Traumatic Brain, and Lower Extremity Amputee Patients).

2. Additional indicators that should be measured at three months following the acute stroke episode may include the following:
    - Functional status (including activities of daily living [ADL] and instrumental activities of daily living [IADL])
    - Rehospitalizations
    - Community dwelling status
    - Mortality

The primary outcome measure for assessment of functional status is the FIM™ (UDSMR, 1997) (see Appendix B). The FIM™ has been tested extensively in rehabilitation for reliability, validity, and sensitivity, and is by far the most commonly used outcome measure. A return to independent living requires not only the ability to perform basic ADLs, but also the ability to carry out more complex activities (i.e., IADLs) such as shopping, meal preparation, use of the phone, driving a car, and money management. These functions should be evaluated as the patient returns to the community. New stroke specific outcome measures, such as the Stroke Impact Scale (Duncan, Reker, et al., 2002), may be considered for a more comprehensive assessment of functional status and quality of life.

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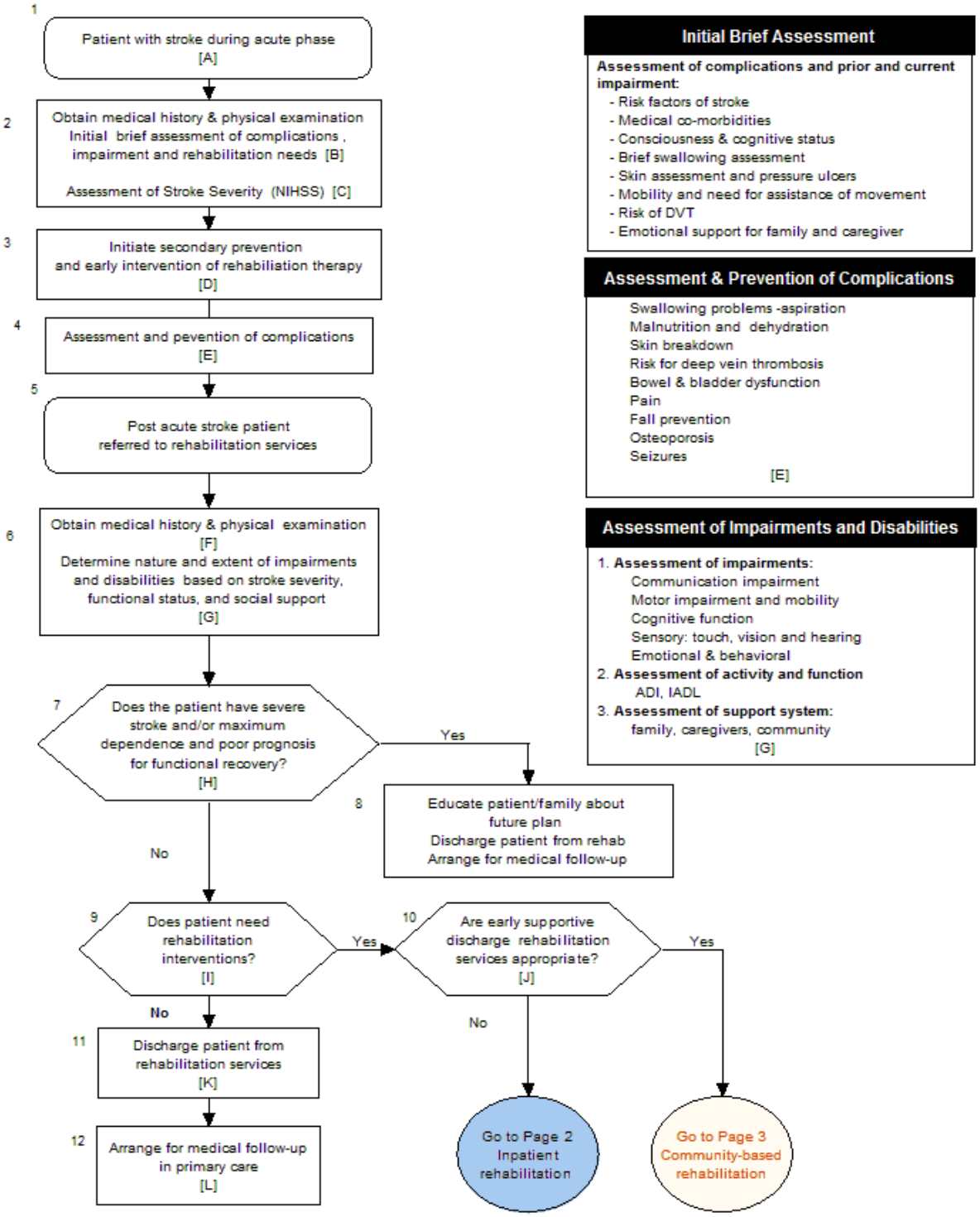

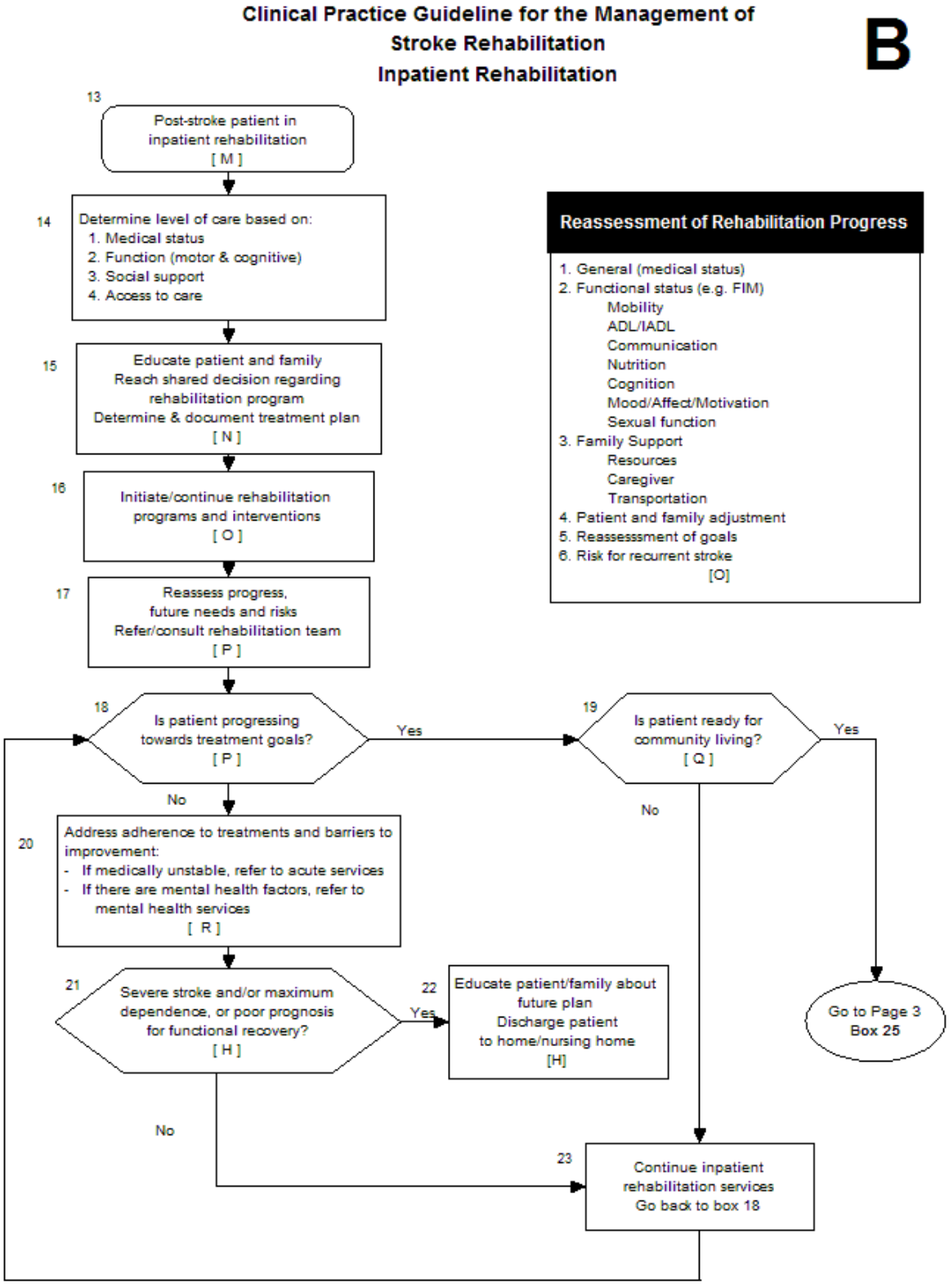
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Stroke Rehabilitation
Inpatient Rehabilitation
B
13
Post-stroke patient in inpatient rehabilitation [M]
14
Determine level of care based on:
1. Medical status
2. Function (motor & cognitive)
3. Social support
4. Access to care
15
Educate patient and family
Reach shared decision regarding rehabilitation program
Determine & document treatment plan
[N]
16
Initiate/continue rehabilitation programs and interventions
[O]
17
Reassess progress, future needs and risks
Refer/consult rehabilitation team
[P]
Reassessment of Rehabilitation Progress
1. General (medical status)
2. Functional status (e.g. FIM)
Mobility
ADL/IADL
Communication
Nutrition
Cognition
Mood/Affect/Motivation
Sexual function
3. Family Support
Resources
Caregiver
Transportation
4. Patient and family adjustment
5. Reassesssment of goals
6. Risk for recurrent stroke
[O]
18
Is patient progressing towards treatment goals?
[P]
Yes
19
Is patient ready for community living?
[Q]
Yes
No
No
20
Address adherence to treatments and barriers to improvement:
- If medically unstable, refer to acute services
- If there are mental health factors, refer to mental health services
[R]
21
Severe stroke and/or maximum dependence, or poor prognosis for functional recovery?
[H]
22
Yes
Educate patient/family about future plan
Discharge patient to home/nursing home
[H]
Go to Page 3
Box 25
No
23
Continue inpatient rehabilitation services
Go back to box 18

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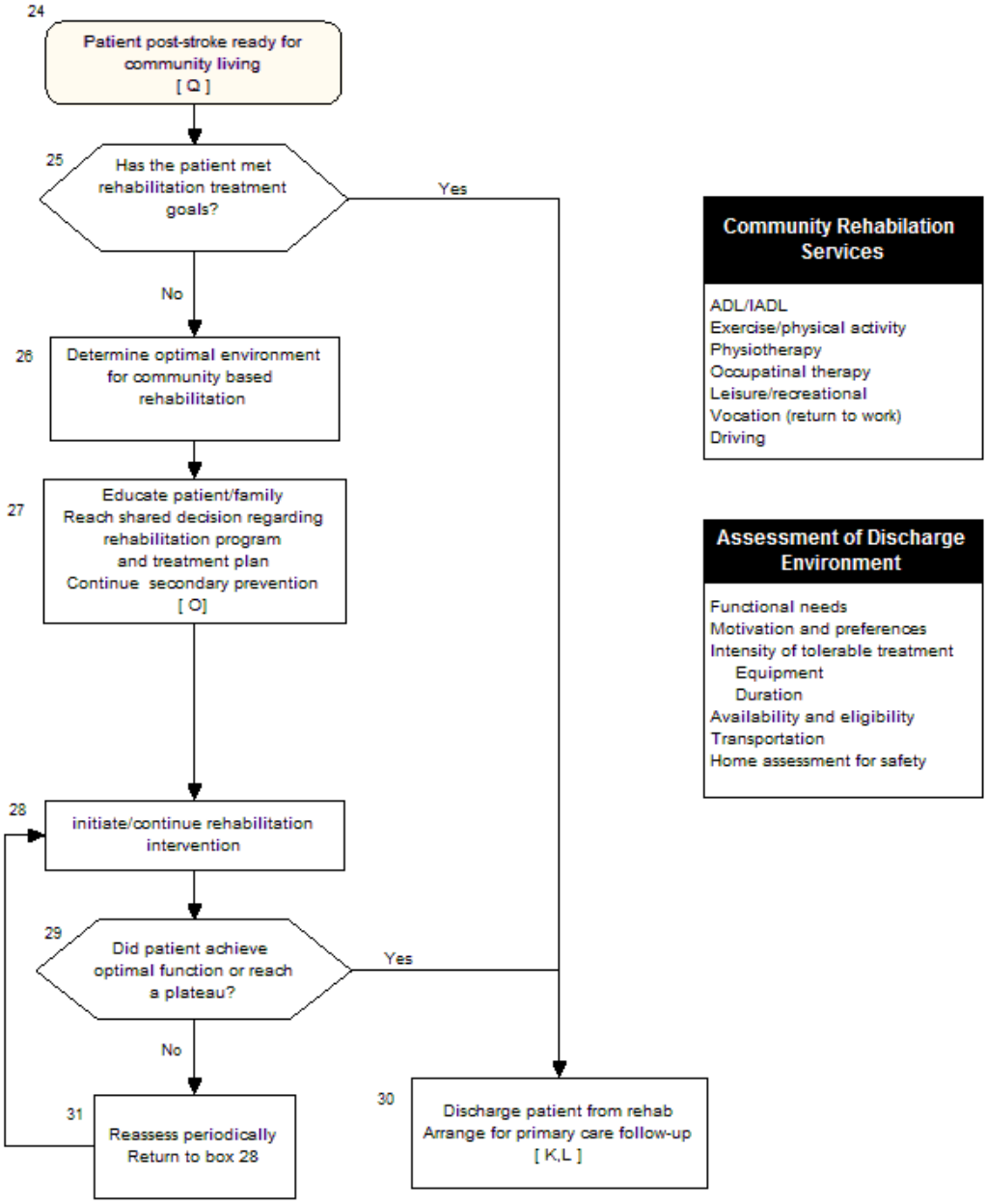
Community Based Rehabilitation



ANNOTATIONS

ASSESSMENT

The highest priorities of early stroke rehabilitation are to prevent recurrence of stroke, manage comorbidities and prevent complications. Ensuring proper management of general health functions, mobilization and encouraging resumption of self-care activities as well as provision of emotional support to the patient and family are important. Following the "acute" phase of stroke care, the focus of care turns to recovery of physical and cognitive deficits, as well as compensation for residual impairment.

Annotation A. Patient with Stroke during the Acute Phase

1 REHABILITATION DURING THE ACUTE PHASE

AHCPR (1995) defines "acute care" as the period immediately following the onset of an acute stroke. Patients with an acute stroke are typically treated in a medical service or in a specialized stroke unit, and rehabilitation interventions are normally begun during the acute phase.

Because of the nature of the neurological problems and the propensity for complications, most patients with acute ischemic stroke are admitted to a hospital. A recent meta-analysis demonstrates that outcomes can be improved if a patient is admitted to a facility that specializes in the care of stroke. The goals of early supportive care after admission to the hospital are to:

a Observe changes in the patient's condition that might prompt different medical or surgical interventions

b Facilitate medical and surgical measures aimed at improving outcome after stroke

c Institute measures to prevent complications

d Begin planning for therapies to prevent recurrent stroke

e Begin efforts to restore function through rehabilitation or other techniques

After stabilizing the patient's condition, the following can be initiated when appropriate; rehabilitation, measures to prevent long-term complications, chronic therapies to lessen the likelihood of recurrent stroke, and family support (AHA, 1994).

1.1 Organization of Post-Stroke Rehabilitation Care

Over the years, the organization and delivery of stroke care has taken many forms and may range from minimal outpatient services to intensive inpatient services on a specialized rehabilitation unit with an interdisciplinary team. Lacking a clear evidence base, the types of services provided to patients with stroke are widely variable. The Agency for Healthcare Policy and Research Guideline for Post-Stroke Rehabilitation (AHCPR, 1995) concluded, "A considerable body of evidence, mainly from countries in Western Europe, indicates that better clinical outcomes are achieved when patients with acute stroke are treated in a setting that provides coordinated, multidisciplinary stroke-related evaluation and services. Skilled staff, better organization of services, and earlier implementation of rehabilitation interventions appear to be important components."

The VA/DoD Working Group reviewed the literature addressing the question of organization of care. Although the reviews and trials make it clear that rehabilitation is a dominant component of organized services, it is not possible to specify precise standards and protocols for specific types of specialized units for stroke patients. Limitations stem from imperfections in the way the reviews and trials controlled for differences in the structure and content of multidisciplinary/standard care programs, the period defined as acute post-stroke care, staff experience and staff mix, and patient needs for rehabilitation therapy (i.e., stroke severity and type).

Annotation B. Initial Assessment of Complications, Impairment and Rehabilitation Needs

1.2 Brief Assessment

BACKGROUND

Initial assessment during the acute phase should focus on the critical risk factors and complications that are life threatening and need to be addressed early. The team that manages the acute phase will usually complete the assessment (Stroke teams, Emergency Department, or Neurology). Once stabilized, a more comprehensive assessment will be done to determine level of impairment and rehabilitation needs (see Annotation G).

RECOMMENDATIONS

1. The initial assessment should have special emphasis on the following:

Medical Status

a. Level of consciousness and cognitive status
b. Risk factors for stroke recurrence
c. History of previous antiplatelet or anticoagulation use, especially at the time of stroke
d. Medical co-morbidities (See Annotation E: 3.1-3.5)

Risk of Complications

e. Screening for aspiration risk (Brief swallowing assessment) (see Section 1.3)
f. Malnutrition and dehydration (See Annotation E: 2.2)
g. Skin assessment and risk for pressure ulcers (see Annotation E: 2.3)
h. Risk of deep vein thrombosis (DVT) (see Annotation E: 2.4)
i. Bowel and bladder dysfunction (see Annotation E: 2.5)
j. Sensation and pain (see Annotation E: 2.6)

Function

k. Motor function and muscle tone
l. Mobility, with respect to the patient's needs for assistance in movement
m. Emotional support for the family and caregiver.

1.3 Screening for Aspiration Risk

BACKGROUND

Bacterial pneumonia is one of the most serious complications in stroke patients (Weimer, 2002) and is mainly caused by aspiration (Horner, 1988). Aspiration is frequently found in patients with reduced consciousness and in those with swallowing disturbances. Oral feeding should be withheld until the patient has demonstrated intact swallowing with small amounts of water and intact coughing on command. Malnutrition and dehydration are also potentially serious consequences of dysphagia.

Screening for dysphagia is a process used to identify those patients who are at risk for aspiration, malnutrition or dehydration and who need a further clinical assessment by a professional trained in the diagnosis and management of dysphagia. **Although a wide variety of screening and assessment tests are available for use, none have acceptable sensitivity and specificity to ensure accurate detection of dysphagia.**

RECOMMENDATOINS

1. Strongly recommend that all acute/newly diagnosed stroke patients be screened for swallowing

problems prior to oral intake of any medication, foods, or fluids to determine risk for aspiration.

2. Screening should be performed by an appropriately trained provider within the first 24 hours of admission to determine the risk of aspiration:
    - Low risk for aspiration: Patients who are cooperative, able to talk, voluntarily cough, swallow saliva and pass a simple swallowing screening test (water)
    - High risk for aspiration: Patients who are non cooperative, failed the simple swallowing screening test (wet hoarse voice or coughing are noted, or volume of water consumed is below population norms), or have a history of swallowing problems, aspiration or dysphagia
3. Patients who are not alert should be monitored closely and swallowing screening performed when clinically appropriate.
4. If screening results indicate that the patient is at high risk for dysphagia, oral food and fluids should be withheld from the patient (i.e., the patient should be Nil per os [NPO]) and a comprehensive clinical evaluation of swallowing food and fluids be performed within 24 hours by a clinician trained in the diagnosis and management of swallowing disorders.

DISCUSSION

The incidence of dysphagia is reported to be between 29-67% in acute stroke patients (Martino et al., 2009). Some of the variability is related to differences in the timing and method of the swallowing assessment. The presence of dysphagia can be identified based on clinical or radiographic examinations, or both.

Screening alone is inadequate to safely detect the presence or absence of dysphagia or aspiration. However, it is important for patients with swallowing problems to be identified as early as possible to allow more severely impaired patients to be managed without delay. Screening for dysphagia is essential on initial admission to develop treatment plans, determine if patient should remain Nil per os (NPO) and whether a nasogastric (NG) tube will be necessary, as well as other issues related to eating and nutrition, aspirating, and swallowing food.

Joint Commission guidelines (JCAHO, 2006) state, "A screen for dysphagia should be performed on all ischemic/hemorrhagic stroke patients before [they are] given food, fluids, or medication by mouth." Their rationale is that 27-50% of stroke patients develop dysphagia, 43-54% of stroke patients with dysphagia will experience aspiration, 37% of patients who develop aspiration will develop pneumonia, and if not part of a dysphagia diagnosis and treatment program, 3.8% of those will die. Other adverse effects that can be avoided include malnutrition and increased length of hospital stay."

Hinchey et al., (2005) surveyed 15 acute care hospital sites to determine if dysphagia screening protocols were in place and to establish the adherence level by comparing the incidence of pneumonia between institutions with or without formal screening in place. The incidence of dysphagia in 6 sites, which had a formal dysphagia screen, was 78% compared with 57% at sites with no formal screen. The pneumonia rate at sites with a formal dysphagia screen was 2.4% versus 5.4% (p=0.0016) at sites with no formal screen. There was no difference in median NIHSS stroke severity (5 versus 4; P=0.84) between the sites with and without a formal screen.

McCullough et al. (2005) conducted a study, involving 165 participants, to determine the utility of clinical swallowing examination (CSE). Findings were compared with a previous investigation of 60 patients, as well as with other research on CSEs. The results suggest that clinicians can make an accurate judgment of the occurrence of aspiration in most post stroke patients. However, ruling out aspiration when it is absent appears more problematic.

EVIDENCE STATEMENTS

Incidence of dysphagia/aspiration: The incidence of dysphagia appears to be quite high following acute stroke, with between one-third to two-thirds of all stroke patients affected. Video modified barium swallow (VMBS) studies are the "gold standard" for diagnosing dysphagia and aspiration. The incidence of aspiration in the acute phase of stroke varies from 21- 42% and decreases to less than 12% by 3 months post stroke. Between one-third and one-half of patients who aspirate following stroke are silent aspirators (i.e., penetration of food below the level of the true vocal cords, without cough or any outward sign of difficulty).

Aspiration and Pneumonia: Aspiration following stroke appears to be associated with an increase in the incidence of pneumonia. The risk of developing pneumonia appears to be proportional to the severity of aspiration.

Assessment of Dysphagia: There is consensus opinion that acute stroke survivors should be nil per os (NPO) until swallowing ability has been determined. There is consensus opinion that a trained assessor should screen all acute stroke survivors for swallowing difficulties as soon as they are able. There is consensus opinion that a specially trained therapist should assess all stroke survivors who fail swallowing screening and identify the appropriate course of treatment. There is consensus opinion that an individual trained in low-risk feeding strategies should provide feeding assistance or supervision to all stroke survivors. There is consensus opinion that a dietician should assess the nutrition and hydration status of all stroke patients who fail swallowing screening. There is consensus opinion that dysphagic stroke patients typically require diets with modified food and liquid textures.

There is moderate evidence that screening protocols for dysphagia can reduce the incidence of pneumonia, and limited evidence that individuals with dysphagia should feed themselves to reduce the risk of aspiration.

- No controlled trials were found that compared the effectiveness of a screening program versus no screening for identifying patients who are at increased risk of pneumonia and nutrition problems. Two systematic reviews that included case series showed that patients who have abnormal screening tests are at increased risk of pneumonia and nutrition problems compared to patients who have normal screening tests (ECRI, 1999; Perry & Love, 2001).
- The only two signs that seem predictive of aspiration are severe dysphagia and abnormal pharyngeal sensation (ECRI, 1999; Perry & Love, 2001). The ECRI (1999) reports that individual signs and symptoms do not adequately predict pneumonia nor detect aspiration during a bedside evaluation.
- The same two systematic reviews, along with a third (Martino et al., 2000), showed that routine screening compared with no screening may decrease the risk of pneumonia, but this is based on very limited data from case series, cohort studies, and a single historical-controlled trial. One systematic review included cost-effectiveness analyses that suggested that routine screening with a preliminary bedside evaluation followed by either a full bedside evaluation or video fluoroscopic swallow study (VFSS) when the preliminary study is abnormal may be cost-effective, if the assumptions used in the analyses are correct (ECRI, 1999).

Annotation C	**Assessment of Stroke Severity**

1.4 Use of Standardized Assessments

BACKGROUND

Comprehensive assessment of patients with stroke is necessary for appropriate clinical management and evaluation of outcomes for quality management and research (Duncan et al., 1999). The AHCPR Post-Stroke Rehabilitation Guideline recommends the use of well-validated, standardized instruments in evaluating stroke patients. These instruments help to ensure reliable documentation of the patient's neurological condition, levels of disability, functional independence, family support, quality of life, and progress over time (AHCPR, 1995).

RECOMMENDATIONS

1. Strongly recommend that the National Institutes of Health Stroke Scale (NIHSS) be used at the time of presentation/hospital admission, or at least within the first 24 hours following presentation. [A]
2. Recommend that all patients should be screened for depression and motor, sensory, cognitive, communication, and swallowing deficits by appropriately trained clinicians, using standardized and valid screening tools. [C]
3. If depression, or motor, sensory, cognitive, communication, or swallowing deficits are found on

initial screening assessment, patients should be formally assessed by the appropriate clinician from the coordinated rehabilitation team. [C]

4. Recommend that the clinician use standardized, validated assessment instruments to evaluate the patient's stroke-related impairments, functional status and participation in community and social activities. [C]
5. Recommend that the standardized assessment results be used to assess probability of outcome, determine the appropriate level of care, and develop interventions.
6. Recommend that the assessment findings be shared and the expected outcomes discussed with the patient and family/caregivers.

DISCUSSION

The AHCPR (1995) guideline recommends, "Screening for possible admission to a rehabilitation program should be performed as soon as the patient's neurological and medical condition permits. The individual(s) performing the screening examination should be experienced in stroke rehabilitation and preferably should have no direct financial interest in the referral decision. All screening information should be summarized in the acute medical record and provided to the rehabilitation setting at the time of referral."

The AHCPR guideline panel evaluated the strengths and weaknesses of a battery of standardized instruments for assessment of stroke patients. Appendix B includes a list of preferred standard instruments recommended by the AHCPR guideline panel for patient assessment in stroke. Certain tests have established protocols for credentialing that must be adhered to (e.g., Functional Independence Measure [FIM™]; National Outcome Measure System [NOMS]; and National Institutes of Health Stroke Scale [NIHSS]). However, only the FIM™ and the NIHSS are widely used.

A partial listing of standardized tools can be found at The University of Kansas Landon Center on Aging Web site at http://www2.kumc.edu/coa/SIS/SIS_pg2.htm Although the listing is not all inclusive, it provides references, tools and an Access database (toolbox) that may be useful to the coordinated rehabilitation team in completing formal assessments.

New stroke specific outcome measures that may be useful for assessing functional status and quality of life are currently under development (see Appendix B).

The NIHSS Score (See Section 4.1)

The NIHSS score strongly predicts the likelihood of a patient's recovery after stroke. A score of ≥16 forecasts a high probability of death or severe disability, whereas a score of ≤6 forecasts a good recovery (Adams et al., 1999).

Patients with a severe neurological deficit after stroke, as measured by the NIHSS, have a poor prognosis. During the first week after acute ischemic stroke, it is possible to identify a subset of patients who are highly likely to have a poor outcome (Frankel et al., 2000).

EVIDENCE TABLE

	Recommendation	Sources	LE	QE	SR
1	Assess stroke severity using the NIHSS score	Adams et al., 1999 Frankel et al., 2000	I	Good	A
2	Screen for complications using standardized and valid screening tools	AHCPR, 1995 § Working Group Consensus	III	Poor	C
3	Formal assessment by appropriately trained clinicians	RCP, 2000 SIGN, 1997	III	Poor	C
4	Standardized assessment tools	Duncan et al., 1999	III	Poor	C

LE = Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; § = Systematic Review (see Appendix A)

Annotation D. Initiate Secondary Prevention and Early Interventions

1.5 Secondary Stroke Prevention

BACKGROUND

Following a stroke, patients are at increased risk for additional cerebrovascular events. Specific therapy and risk factor reduction must be an integral part of any plan for stroke rehabilitation and recovery. The need for secondary prevention of stroke is lifelong and continues beyond the period of rehabilitation.

For specific evidence-based recommendations providers may refer to the AHA/ASA **Guidelines for Prevention of Stroke in Patients with Ischemic Stroke or Transient Ischemic Attack.** (Ralph et al., 2006)

(http://stroke.ahajournals.org/cgi/content/full/37/2/577)

1.6 Early Intervention of Rehabilitation Therapy

BACKGROUND

Studies generally support early rehabilitation interventions for the medically stable patient with an acute stroke to prevent complications of stroke such as deep vein thrombosis (DVT), skin breakdown, contracture formation, constipation, and pneumonia and to improve functional outcomes. Early therapy interventions, including a progressive increase in activity levels should be initiated as soon as medically tolerated. Early rehabilitation should also include self-care activities and socialization.

The physical demands of rehabilitation are substantial. A patient's tolerance for therapy will depend on several factors including the severity of the stroke, medical stability, mental status, and level of function.

RECOMMENDATIONS

1. Strongly recommend that rehabilitation therapy should start as early as possible, once medical stability is reached. [A]
2. Recommend that the patient receive as much therapy as "needed" and tolerated to adapt, recover, and/or reestablish the premorbid or optimal level of functional independence.

DISCUSSION

Early Initiation of Therapy

One systematic review on early rehabilitation following stroke concluded that therapy initiated within 3-30 days post stroke "appears to have a strong relationship" with improved functional outcome at hospital discharge and follow-up (Cifu & Stewart, 1999). Ottenbacher & Jannell (1993) in a meta-analysis that included 36 studies and 3717 stroke survivors, also demonstrated a positive correlation between early rehabilitation intervention and improved functional outcome. Maulden et al. (2005) reported findings of a large prospective observational study from six rehabilitation programs in the United States, concluding that "fewer days from stroke symptoms onset to rehabilitation admission is associated with better functional outcomes at discharge and shorter LOS."

Paolucci and colleagues (2000) examined differences in outcomes for patients for whom therapy was initiated 20 days apart. They found a strong inverse relationship between the start date and outcome (albeit with wide confidence intervals and a greater dropout risk). Treatment initiated within the first 20 days post stroke was associated with a significantly high probability of excellent therapeutic response (OR=6.11; 95 percent CI; 2.03-18.36), while beginning later was associated with a poor response (OR=5.18; 95 percent CI; 1.07-25.00). Early intervention was associated with a five times greater risk of dropout than that of patients with delayed treatment (OR=4.99; 95 percent CI; 1.38-18.03). Gagnon et al. (2006) however, in a retrospective review of 418 stroke patients, did not find a significant difference in discharge FIM scores, FIM gain, or rehabilitation LOS between 3 groups of stroke patients; those who had an early rehabilitation onset (0-20 days), moderate rehabilitation onset (20-40 day) or long onset (>40 days).

In an observational cohort study of 969 patients, Maulden et al. (2005) found that fewer days from stroke symptom onset to rehabilitation admission were associated with better functional outcomes, and that for severely impaired patients, the relationship was strongest. For patients with moderately severe stroke, fewer days from stroke symptom onset to rehabilitation admission was associated significantly with shorter rehabilitation LOS. In another large observational cohort study in Italy, Musicco et al. (2003) found that patients who received rehabilitation early (within 7 days after stroke) had better long-term outcomes than did those who started rehabilitation after more than 1 month (OR = 2.12; 95% CI, 1.35-3.34), or from 15 to 30 days after the acute cerebrovascular event (OR = 2.11; 95% CI, 1.37-3.26).

Wade et al. (1992) conducted a comparison of an experimental group of patients who received 3 months of physiotherapy at home immediately after a stroke, and a control group of patients who received therapy after a 3-month delay. The study demonstrated that physiotherapy initiated early after stroke slightly improved gait speed (i.e., a few seconds over 10 meters), but the improvement was not maintained 3 months after physiotherapy stopped.

The relationship between improved functional outcomes and early initiation of rehabilitation may not be entirely causal because patients with more severe strokes may have more medical issues and complications, which can prolong medical instability and thus delay participation in rehabilitation. However, there is no evidence to suggest that rehabilitation should not begin as soon as medical stability has been reached.

EVIDENCE TABLE

	Recommendation	Sources	LE	QE	**SR**
1	Early initiation of therapy	Cifu and Stewart, 1999 (§) Gagnon et al., 2006 Maulden et al., 2005 Musicco et al., 2003 Ottenbacher & Jannell, 1993 Wade et al., 1992 Paolucci, 2000	I	Good	A

LE = Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; § = Systematic Review (see Appendix A)

Annotation E. Assessment and Prevention of Complications

RECOMMENDATIONS

1. Recommend that risk of complications should be assessed in the initial phase and throughout the rehabilitation process and followed by intervention to address the identified risk. Areas of assessment include:
    a. Swallowing problems (risk of aspiration) (see 2.1)
    b. Malnutrition and dehydration (See 2.2)
    c. Skin assessment and risk for pressure ulcers (see 2.3)
    d. Risk of deep vein thrombosis (DVT) (see 2.4)
    e. Bowel and bladder dysfunction (see 2.5)
    f. Sensation and pain (see 2.6)
    g. Risk of falling (see 2.7)
    h. Osteoporosis (see 2.8)
    i. Seizures (see 2.9)

Annotation F. Obtain Medical History and Physical Examination

BACKGROUND

Stroke rehabilitation begins during the acute hospitalization, as soon as the diagnosis of stroke is established and life-threatening problems are controlled. The highest priorities are to prevent recurrence of stroke and complications and begin mobilization. A thorough history and physical examination is necessary to identify and begin treatment for:

- Risk factors for stroke recurrence
- Medical co-morbidities
- Complications
- Functional impairments

RECOMMENDATIONS

1. A thorough history and physical examination should be completed on all patients and should include, at a minimum:
    a. Chief complaint and history of present illness
    b. Past medical and psychiatric history
    c. Past surgical history
    d. Medications
    e. Allergies
    f. Family history
    g. Social history
    h. Functional history
    i. Review of systems
    j. Physical examination
    k. Imaging studies
2. The assessment should cover the following areas:
    a. **Risk of Complications** (swallowing problems, malnutrition, skin breakdown, risk for DVT, bowel and bladder dysfunction, falls, and pain) (see Sections 2.1-2.7)
    b. **Determination of Impairment** (Communication, Cognition, Motor, Psychological, and Safety Awareness) (see Annotations G: 4.1-4.6) and assessment of prior and current functional status (e.g., FIM™) (see Annotation G: 5.1)
    c. **Assessment of participation in community and social activities, and a complete psychosocial assessment** (Family and Caregivers, Social Support, Financial, and Cultural Support) (see Annotation G: 6.1)

2 PREVENTION OF COMPLICATIONS

2.1 Swallowing problems, Aspiration Risk

BACKGROUND

A swallowing screening of all acute/newly diagnosed stroke patients should be performed within the first 24 hours after admission and prior to fluid and food intake to determine those at risk for dysphagia. Those patients identified by the screening test to be at risk for dysphagia need a comprehensive clinical assessment by a professional trained in the diagnosis and management of dysphagia. A clinical assessment is a more comprehensive systematic process for the purposes of diagnosing dysphagia and making treatment recommendations.

RECOMMENDATIONS

Assessment

1. Recommend all patients receive evaluation of nutrition and hydration status, as soon as possible after admission. Food and fluid intake should be monitored daily in all patients and body weight should be determined regularly.
2. Recommend that if screening for swallowing problems indicates that the patient is at risk for dysphagia, the patient should be Nil per os (NPO) and a comprehensive clinical evaluation of swallowing of food and fluid be performed within 24 hours by a professional trained in the diagnosis and management of swallowing disorders. Documentation of this exam should include information about signs and symptoms of dysphagia, likelihood of penetration and aspiration, and specific recommendations for follow-up including need for a dynamic instrumental assessment, treatment, and follow-up. [I]
3. Recommend patients who are diagnosed as having dysphagia based on comprehensive clinical evaluation of swallowing should have a dynamic instrumental evaluation to specify swallowing anatomy and physiology, mode of nutritional intake, diet, immediate effectiveness of swallowing compensations and rehabilitative techniques, and referral to specialist. The optimal diagnostic procedure (VFSS, FEES) should be determined by the clinician based on patient needs and clinical setting.

DISCUSSION

Early detection of dysphagia through screening allows treatment to be implemented sooner after a stroke, shortening recovery time and reducing rehabilitation costs (Martino et al., 2000).

Bedside exams: Cohort studies have shown that full bedside evaluations can detect patients who are at risk for pneumonia and nutrition problems, but the magnitude of the increased risk for patients with abnormal tests is not clear. Water swallow tests alone do not seem to be as accurate as full bedside exams. Limited data suggest that the accuracy of water swallow tests or full bedside evaluations may be increased by combining of indicators (Mari et al., 1997; Logemann et al., 1999).

Videofluoroscopy/modified barium swallow (VFSS): Cohort studies have shown that patients who aspirate on VFSS are at increased risk of developing pneumonia and nutrition problems as compared to patients with normal tests. There is no good evidence that VFSS is more or less accurate than bedside exams in predicting pneumonia or other complications (ECRI, 1999).

Fiberoptic endoscopic examination of swallowing (FEES): Case series comparing FEES and VFSS have shown that each test detects some patients who aspirate that the other test does not, and that neither test is clearly better than the other. One small cohort study showed that FEES was very sensitive, but not specific in predicting pneumonia (Lim et al., 2001).

One cohort study (20 subjects) showed that FEES with VFSS improved prognostication for pneumonia over VFSS alone (Aviv, 2000).

Examination of treatment strategies by x-ray can impact diet and recovery from dysphagia. About 83 percent of patients may receive changes in at least one of five important clinical variables after VFSS: referrals to other specialists, swallowing therapy, compensatory strategies that improve swallowing, changes in mode of nutritional intake, and diet (Martin-Harris et al., 2000).

2.2 Malnutrition and Dehydration

BACKGROUND

Adequate nutrition after stroke is critical to recovery. Stroke survivors may have unique nutritional issues such as altered consciousness, chewing and swallowing difficulties (dysphagia), sensory or perceptual deficits, reduced mobility, and loss of appetite, as well as depression, which can cause decreased interest in eating. Patients tend to become dehydrated after stroke and during the acute hospitalization. Assessment of nutrition and hydration status includes monitoring intake, body weight, urinary and fecal outputs, caloric counts, and levels of serum proteins, electrolytes and blood counts.

RECOMMENDATIONS

1. Recommend all patients receive evaluation of nutrition and hydration, as soon as possible after admission. Food and fluid intake should be monitored in all patients, and body weight should be determined regularly.
2. Recommend that a variety of methods be used to maintain and improve intake of food and fluids. This will require treating the specific problems that interfere with intake, providing assistance in feeding if needed, consistently offering fluid by mouth to patients with dysphagia, and catering to the patient's food preferences. If intake is not maintained, feeding by a feeding gastrostomy may be necessary.
3. Patients at high risk for, or problems with, nutrition and their family/caregiver should receive counseling by a Registered Dietitian upon discharge regarding healthy diet and food choices.

DISCUSSION

It is unclear how patients with dysphagia should be fed and treated after acute stroke. A Cochrane review (Bath et al., 2000) concluded that percutaneous endoscopic gastrostomy (PEG) feeding may improve outcome and nutrition as compared with NGT feeding in patients with dysphagia. A more recent systematic review (Foley et al., 2008) evaluated the efficacy of a broader range of dysphagia treatments including: texture-modified diets, general dysphagia therapy programs, non-oral (enteral) feeding, medications, and physical and olfactory stimulation. In this review, 15 RCTs were identified. In contrast with the findings of a previous Cochrane review (Bath et al., 1999), there was evidence that nasogastric tube feeding was not associated with a higher risk of death compared to percutaneous feeding tubes. General dysphagia therapy programs were associated with a reduced risk of pneumonia in the acute stage of stroke. Standardized diets and diet terminology should be utilized to improve communication between professionals and to improve patients' safety, and other considerations (ADA, 2002; McCallum, 2003).

No single dysphagia diet exists. Diets include modified food and liquid textures. Special diets are based upon four distinct consistencies: thick fluids, pureed, minced and soft chopped. A dysphagia soft diet excludes all hard, small and stringy food particles (Bach et al., 1989). However, the risk of aspiration of pureed food was recently reported by Perlman et al. (2004). Compared to patients with normal sensation and pharyngeal squeeze, the percentage of aspirators increased to 67% in patients with moderately decreased sensation and absent motor function. The results of this study suggest that motor strength may be more important than sensory impairment in the prediction of aspiration.

Changes to the diet can be made as the patient's dysphagia improves and the risk of aspiration lessens. Dietary management is often directed by the results of the VMBS studies. Special techniques such as compensatory head and neck postures (Logemann, 1983), double swallowing or coughing after swallowing (Horner et al., 1988b) may be employed. Although thickened fluids may help to reduce the risk of aspiration and associated morbidity, Finestone et al. (2001) reported that patients restricted to thickened

fluids do not drink sufficient quantities to meet their fluid needs and are at risk for dehydration. Churchill et al. (2004) also found that patients with dysphagia had a higher risk of becoming dehydrated.

A study by Diniz et al. (2009) compared liquids and pudding-like feeds using nasoendoscopy (n=61). Aspiration occurred in only 3 patients with the spoon-thick consistency vs. 21 with the liquid consistency. There were no episodes of laryngeal penetration with pudding-like fluids and 8 incidences with thin liquid. However, Leder & Suiter (2008) reported than the placement of NG feeding tubes did not increase the risk of aspiration for liquid or pureed food consistencies. This study included patients with dysphagia with a broad range of etiologies, including stroke (n=1,260).

2.3 Prevention of Skin Breakdown

BACKGROUND

The incidence of pressure ulcers ranges from 0.4% to 38% in acute care and 2.2% to 23.9% in long term care settings (Lyder, 2003). The physical impairments following stroke place patients at higher risk for a pressure ulcer that, once developed, can be difficult and costly to treat and often result in pain, disfigurement, and prolonged hospitalization. Prevention of pressure ulcers depends on early identification of patients at risk and reliable implementation of prevention strategies for patients identified to be at risk. Patients at highest risk for skin breakdown are those with: 1) dependence in mobility, 2) altered sensation, 3) fecal and urinary incontinence, 4) excessively low or high body mass index, and 5) diseases associated with cachexia (Berkowitz et al., 2001a&b).

RECOMMENDATIONS

Assessment

1. Recommend a thorough assessment of skin integrity be completed upon admission and monitored at least daily, thereafter. [C]
2. Risk for skin breakdown should be assessed using a standardized assessment tool (such as the Braden Scale). [I]

Treatment

3. Recommend the use of proper positioning, turning, and transferring techniques and judicious use of barrier sprays, lubricants, special mattresses, and protective dressings and padding to avoid skin injury due to maceration, friction or excessive pressure. [C]

DISCUSSION

A valid and reliable pressure ulcer risk assessment tool, such as the Braden Scale, can help predict the risk of pressure ulcer development and thus help the rehabilitation team implement interventions to prevent skin breakdown. Such interventions may include, but are not limited to, the following; repositioning, mobilization, turning, proper transfer techniques, and the use of skin care/incontinence products and surface pressure reducing devices. Treatment of any skin breakdown should begin promptly and be monitored daily (Reddy, 2006; AHCPR, 1995; Sussman & Bates-Jensen, 1998).

EVIDENCE TABLE

	Recommendation	Sources	QE	Overall Quality	**R**
1	Assessment of skin integrity	AHCPR, 1995 Sussman & Bates-Jensen, 1998	I	Poor	C
2	Interventions for prevention of skin breakdown	AHCPR, 1995 Reddy, 2006	I	Poor	C

LE = Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; § = Systematic Review (see Appendix A)

2.4 Risk for Deep Vein Thrombosis (DVT)

BACKGROUND

Prevention of DVT and the attendant risk of venous thromboembolism and pulmonary embolism are important in stroke patients and is an important initial treatment decision. The first line treatment is early ambulation. Walking as little as 50 feet per day, with or without assistance, significantly decreases the incidence of DVT post-stroke (Reding & Potes, 1988). While heparin will prevent DVT, it will not prevent recurrent strokes or improve stroke recovery (Adams et al., 2007). The PREVAIL study (Sherman et al. 2007; Muir, 2008) determined that low molecular weight heparin (40 mg per day, starting between 24-48 hours after stroke onset) was superior to using 5000U of unfractionated heparin twice daily. In patients who are not ambulatory, anti-embolic stocking (i.e. compression stockings) and intermittent pneumatic compression may enhance the benefit from heparin treatment to reduce the incidence of DVT and DVT complications. Prevention of pulmonary embolus (PE) with the use of retrievable or permanent inferior vena cava filters (IVCF) may be considered for some patients who are at high risk of complications of DVT (such as those who have a documented lower extremity DVT) or who are not good candidates for heparin.

RECOMMENDATIONS

Assessment

1. Concurrent risk factors that increase the risk of DVT should be assessed in all patients post stroke to determine the choice of therapy. These risk factors include mobility status, congestive heart failure (CHF), obesity, prior DVT or pulmonary embolism, limb trauma or long bone fracture.

Treatment

2. Recommend all patients be mobilized, as soon as possible.
3. Recommend the use of subcutaneous low-dose low molecular weight heparin (LMWH) to prevent DVT/ PE for patients with ischemic stroke or hemorrhagic stroke and leg weakness with impaired mobility.
4. Attention to a history of heparin-induced thrombocytopenia will affect treatment choice. A platelet count obtained 7-10 days after initiation of heparin therapy should be considered.
5. Consider the use of graduated compression stockings or an intermittent pneumatic compression device as an adjunct to heparin for non-ambulatory patients or as an alternative to heparin for patients in whom anticoagulation is contraindicated.
6. Consider IVCF is patients at risk for PE, in whom anticoagulation is contraindicated.

DISCUSSION

The largest study for subcutaneous unfractionated heparin, the International Stroke Trial (IST, 1997), established that LDUH was safe in ischemic stroke. This trial also demonstrated a dose response rate for hemorrhagic complications.

Comparative trials for DVT/PE prevention in a stroke population have not been performed; however, randomized trials of several LMWH and heparinoid products in ischemic stroke patients and other patient populations suggest an

efficacy and safety superior to unfractionated heparin for DVT prevention. The TOAST study (1997) demonstrated the safety of danaparoid in acute ischemic stroke patients, but the intravenous route, anticoagulation monitoring, and continuous dosing limits extrapolation to prophylactic use. Two recent meta-analyses found that LMWH reduced DVT and PE but increased bleeding in ischemic stroke victims (Bath et al., 2000; Bijsterveld et al., 1999). Another recent LMWH trial found a dose-response effect for DVT prevention and intracranial hemorrhage rate, both increasing at higher doses (Bath et al., 2001). Specific treatment recommendations regarding optimal LMWH agent and dosing cannot be made from the existing data.

The use of non-pharmacological approaches to DVT/PE prevention, such as intermittent pneumatic compression, graduated compression stockings, and early mobilization, appear to have some beneficial effect although they were not tested fully in RCTs. Graded compression stockings produced a reduction in DVT incidence comparable to that in other patient groups (odds ratio=0.43, 95% CI), but the reduction was not statistically significant, and the magnitude of the effect size requires confirmation (Muir et al., 2000). Use of pneumatic compression devices combined with subcutaneous heparin and antiembolic hose reduce the risk of DVT and pulmonary embolism in stroke patients (Kamran et al., 1998). The morbidity and mortality associated with DVT/PE is sufficient reason to continue these clinical practices. These interventions can be used in combination with, or as alternatives to anticoagulation.

There are no data from randomized, double-blinded clinical trials on the use of anticoagulants for DVT prophylaxis after intracerebral hemorrhage, but there are increasing data on this topic that might be shared. See, for example, Tetri et al., 2008 and Orken et al., 2009. Since the risk of worsening brain hemorrhage if LDUH or LMWH are used is uncertain, graduated compression stockings or sequential compression devices are recommended.

2.5 Bowel and Bladder

BACKGROUND

Urinary and fecal incontinence are both common in the early stages post-stroke; 40-60% of people admitted to the hospital after a stroke can have problems with urinary incontinence, with 25% of stroke survivors still having problems on hospital discharge and 15% remaining incontinent after one year. Increased age, increased stroke severity, the presence of diabetes, prostate hypertrophy in men, preexisting impairment in urinary function and the occurrence of other disabling diseases increase the risk of urinary incontinence in stroke.

Incontinence is a major burden on caregivers once the patient is discharged home. Management of both bladder and bowel problems should be seen as an essential part of the patient's rehabilitation, as these problems can seriously hamper progress in other areas and influence disposition planning. Acute use of an indwelling catheter may facilitate management of fluids, prevent urinary retention, and reduce skin breakdown in patients with stroke; however, use of an indwelling urinary catheter greater than 48 hours post-stroke increases the risk of urinary tract infection.

Fecal incontinence occurs in a substantial proportion of patients after a stroke, but clears within two weeks in the majority of patients (Brockelhurst et al., 1985). Continued fecal incontinence signals a poor prognosis. Diarrhea, when it occurs, may be due to medications, initiation of tube feedings, and exacerbation of a pre-existing colitis or infections. It can also be due to leakage around a fecal impaction. Treatment should be cause specific (AHCPR, 1995).

Constipation and fecal impaction are more common after stroke than fecal incontinence. Immobility and inactivity, inadequate fluid or food intake, depression or anxiety, a neurogenic bowel, constipating side effects of medications, the inability to perceive bowel signals, lack of transfer ability, and cognitive deficits may each contribute to this problem. Goals of management are to ensure adequate intake of fluid, bulk, and fiber and to help the patient establish a regular toileting schedule. Bowel training is more effective if the schedule is consistent with the patient's previous bowel habits (Venn et al., 1992). Stool softeners and judicious use of laxatives may be helpful.

RECOMMENDATIONS

Assessment

1. Recommend a structured assessment of bladder function in acute stroke patients, as indicated. Assessment should include:
    - Assessment of urinary retention through the use of a bladder scanner or an in-and-out catheterization
    - Measurement of urinary frequency, volume, and control
    - Presence of dysuria.
2. There is insufficient evidence to recommend for or against the use of urodynamics over other methods of assessing bladder function.

Treatment

3. Consider removal of the indwelling catheter within 48 hours to avoid increased risk of urinary tract infection; however, if a catheter is needed for a longer period, it should be removed as soon as possible.
4. Recommend the use of silver alloy-coated urinary catheters, if a catheter is required.
5. Consider an individualized bladder training program (such as pelvic floor muscle training in women) be developed and implemented for patients who are incontinent of urine.
6. Recommend the use of prompted voiding in stroke patients with urinary incontinence.
7. Recommend a bowel management program be implemented in patients with persistent constipation or bowel incontinence. [I]

DISCUSSION

There is limited evidence to suggest that specialized professional input using systematic methods to assess and manage incontinence problems following stroke may improve some outcomes (Thomas, 2007).

There are no systematic reviews evaluating the usefulness of urodynamics in the setting of post-stroke incontinence. Weak trial data (i.e., low quality RCT in the non-stroke setting and prospective and retrospective cohort studies of patients post-stroke) suggests that urodynamic evaluation may be important in males if empiric anticholinergic therapy is planned, or if urinary incontinence does not resolve within the expected time frame. Retrospective cohort data suggest that, in males with stroke, symptoms do not reliably predict the presence of obstructive findings on urodynamic testing.

A systematic review of diagnostic test studies did not conclusively recommend bladder scanning as an adjunct to bedside clinical evaluation for incontinence over other methods of assessing urinary retention, such as in-and-out catheterization.

Use of an indwelling catheter should be limited to patients with incontinence that cannot be managed any other way. Studies performed in non-stroke populations clearly demonstrate the increased risk of bacteriuria and urinary tract infections (Bjork et al., 1984; Sabanthan et al., 1985; Warren et al., 1982).

A meta-analysis (Saint et al., 1998) concluded: “Silver alloy-coated urinary catheters are significantly more effective in preventing urinary tract infections than are silver oxide catheters. They are more expensive, but may reduce overall costs of care, as catheter related infection is a common cause of nosocomial infection and bacteremia.” This analysis covered a diverse patient population, and was not specific to stroke.

There is systematic review evidence of low to medium quality studies that weakly supports pelvic floor muscle training in women to improve mean voiding frequency post-stroke however there was no change in the average number of incontinence episodes (Thomas, 2007).

There is no evidence that timed voiding trials are better than voiding on request in reducing incontinence episodes.

There is no evidence for or against initiating a bowel program.

2.6 Pain

BACKGROUND

Pain can develop due to exacerbation of a pre-existing condition (e.g., increases in musculoskeletal pain due to weakness), a direct consequence of the stroke (e.g., pain associated with intracranial hemorrhage). Pain may also develop due to consequences of a stroke (for example, central "thalamic" pain), pain due to musculoskeletal consequences of a stroke such as shoulder subluxation leading to pain, or the emergence of complex regional pain syndrome (CRPS, also known as reflex sympathetic dystrophy). Pain occurring post-stroke may include joint pain from spasticity, immobility, muscle weakness, headache, centrally mediated pain, and shoulder pain. Prevention, assessment, and treatment of pain should continue throughout rehabilitation care.

RECOMMENDATIONS

Assessment

1. Recommend pain assessment using the 0 to 10 scale. [C]
2. Recommend a pain management plan that includes assessment of the following: likely etiology (i.e., musculoskeletal and neuropathic), pain location, quality, quantity, duration, intensity, and aggravating and relieving factors. [C]

Treatment

3. Recommend balancing the benefits of pain control with possible adverse effects of medications on an individual's ability to participate in and benefit from rehabilitation. [I]
4. When practical, utilize a behavioral health provider to address psychological aspects of pain and to improve adherence to the pain treatment plan. [C]
5. When appropriate, recommend use of non-pharmacologic modalities for pain control such as biofeedback, massage, imaging therapy, and physical therapy. [C]
6. Recommend that the clinician tailor the pain treatment to the type of pain. [C]
7. Musculoskeletal pain syndromes can respond to correcting the underlying condition such as reducing spasticity or preventing or correcting joint subluxation.
8. Non-steroidal anti-inflammatory drugs (NSAIDs) may also be useful in treating musculoskeletal pain.
9. Neuropathic pain can respond to agents that reduce the activity of abnormally excitable peripheral or central neurons.
10. Opioids and other medications that can impair cognition should be used with caution.
11. Recommend use of lower doses of centrally acting analgesics, which may cause confusion and deterioration of cognitive performance and interfere with the rehabilitation process. [C]
12. Shoulder mobility should be monitored and maintained during rehabilitation. Subluxation can be reduced and pain decreased using functional electrical stimulation applied to the shoulder girdle. [B]

DISCUSSION

Neuropathic pain associated with stroke usually falls into two categories: a) pain resulting from cerebral reorganization following stroke and b) pain resulting from spinal nerve root or peripheral nerve irritation that develops as a secondary consequence of motor deficits associated with the stroke. Pain resulting from cerebral injury associated with the stroke often develops due to damage to cerebral pathways involved in processing pain. The central nervous system processes pain information, modulates the perceived intensity of pain and enables an individual to focus on pain information coming from specific regions of the body. If a stroke damages the pain processing networks, an individual can develop pain in the absence of an ongoing noxious stimulus. Motor deficits resulting from a stroke can cause movement patterns that injure peripheral nerves or nerve roots. For example, an abnormal gait can alter the normal loading of the lumbar spine leading to herniation of a lumbar vertebral disc. The

herniated disc can irritate a lumbar nerve root leading to neuropathic pain. Abnormal patterns of movement can also lead to irritation of peripheral nerves.

Shoulder pain is a frequent delayed consequence of stroke associated with upper extremity paresis and immobility. This complication compromises use of the upper extremity and can evolve into complex regional pain syndrome II (also known as reflex sympathetic dystrophy).

Research has found the following:

- Electrical stimulation improved pain-free shoulder range of motion (Price & Pandyan, 2001) and reduced pain intensity with benefit lasting for at least one year after stimulation stopped (Van Peppen et al., 2004; Chae et al., 2005).
- There was insufficient evidence to draw conclusions on the effect of supportive devices (such as slings, wheelchair attachments) in preventing pain (Ada et al., 2005).
- Strapping delayed the onset of pain but did not decrease the severity of pain (Ada et al., 2005).
- Intra-articular corticosteroid injections did not significantly improve shoulder pain (Snels et al., 2000). A high percentage of people also reported adverse effects.
- Ultrasound was not effective in reducing shoulder pain (Inaba & Piorkowski, 1972).
- Preventing contracture and subluxation should help to prevent pain, and interventions aimed at reducing trauma to the shoulder, such as educating all staff, carers and stroke survivors, should also help to prevent shoulder pain. Such education may include strategies to care for the shoulder during manual handling and transfers and advice regarding positioning (Australian Acute Musculoskeletal Pain Guidelines Group, 2003).

EVIDENCE TABLE

	Recommendation	Sources	LE	QE	SR
1	Recommend to assess pain intensity using a pain scale	Australian Acute Musculoskeletal Pain Guidelines Group, 2003 Moulin et al., 2007	II	Fair	C
2	Recommend to assess nature and location of pain	Australian Acute Musculoskeletal Pain Guidelines Group, 2003 Moulin et al., 2007	II	Fair	C
3	Recommend to balance benefits vs. Side effects of pain treatment interventions	Australian Acute Musculoskeletal Pain Guidelines Group, 2003 Moulin et al., 2007 Dworkin et al., 2003, 2007 Jensen, 2002	II	Good	C
4	Consider use of a health psychologist	Kerns & Habib, 2004 Turk, 2006	II	Good	C
5	Consider use of non-pharmacological agents in pain management	Australian Acute Musculoskeletal Pain Guidelines Group, 2003 Moulin et al., 2007 Kerns & Habib, 2004 Turk, 2006	II	Good	C
6	Tailor pain management plan to patient needs	Australian Acute Musculoskeletal Pain Guidelines Group, 2003 Moulin et al., 2007 Kerns & Habib, 2004 Turk, 2006 Dworkin et al., 2003, 2007 Jensen, 2002	II	Good	C
7	Avoid or use with caution centrally acting analgesics	Australian Acute Musculoskeletal Pain Guidelines Group, 2003 Moulin et al., 2007 Dworkin et al., 2003, 2007 Jensen, 2002	II	Good	C
8	FES for patients who have shoulder subluxation with or without shoulder pain	Price & Pandyan, 2001 Van Peppen et al., 2004 Chae et al., 2005	I	Good	B

LE = Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; § = Systematic Review (see Appendix A)

2.7 Fall Prevention

BACKGROUND

Falls are a leading cause of injury-related death for individuals age 65 and older. Stroke impacts mobility and places patients at higher risk for falls. Risks for falling while hospitalized include both patient health and institutional factors. Patient characteristics associated with falling include weakness, dizziness, altered mobility, confusion or other cognitive deficits, depression, substance abuse history, prolonged hospital stay, lack of exercise, multiple medications, visual impairment and incontinence. After discharge, the risk of falling is related to fear of falling, weakness and balance disorders as well as environmental factors. It is critical to identify patients at high risk for falling and institute appropriate interventions to minimize their risk while on an inpatient setting and to provide appropriate education and training for safe discharge.

RECOMMENDATIONS

1. Recommend that all patients be assessed for fall risk during the inpatient phase, using an established tool. [B]
2. Recommend that fall prevention precautions be implemented for all patients identified to be at risk for falls while they are in the hospital.
3. Refer to the falls prevention toolkit on the National Center for Patient Safety (NCPS) for specific interventions.
4. Recommend regular reassessments for risk of falling including at discharge, ideally in the patient's discharge environment. [B]
5. Recommend that patient and family/caregiver be provided education on fall prevention both in the hospital setting and in the home environment. [B]

DISCUSSION

Studies have shown that 40% or more of stroke survivors will have a fall in the first 6 months post-stroke (Andersson, 2006; Belgan, 2006; Kerse, 2008; Mackintosh et al., 2005). Falls in the community tend to occur when patients are walking or transferring, and patients tend to fall to their weaker side (Mackintosh et al., 2005).

Fall prevention programs such as the one developed by the National Center for Patient Safety (NCPS) are comprehensive and are recommended for use with all patients at risk for falling, including those with stroke.

Education is considered to be an important part of multi-component intervention programs for fall prevention (Gillespie, 2004). Specific educational goals have been included in a number of studied programs as fundamental components of fall prevention interventions. These goals include increasing older adults' activity level, improving ability to identify and mitigate fall hazards in the home, and providing information to make good choices about footwear. In a large randomized trial (Haines, 2004) a targeted multiple interventions falls prevention program was implemented in addition to usual care, compared with usual care alone, and reduced the incidence rate of falls by 30% in a subacute hospital setting.

EVIDENCE TABLE

	Recommendation	Sources	QE	Overall Quality	**R**
1	Falls assessment	Andersson, 2006 Mackintosh, 2005	II-2	Fair	B
2	Falls Reassessment	Andersson, 2006 Mackintosh, 2005	II-2	Fair	B
3	Patient and family/caregiver education	Haines 2004 Gillespie, 2004	I	Fair	B

LE = Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; § = Systematic Review (see Appendix A)

2.8 Osteoporosis

BACKGROUND

Osteoporosis, combined with an increased risk of falls, contributes to post-stroke hip fractures which occur in up to 15% of individuals with hemiparesis due to stroke (Chiu et al., 1992; Mulley & Espley, 1979; Myint et al., 2007; Poplinghler & Pillar, 1985). Fractures are usually on the paretic side because subjects are more likely to fall on their paretic sides and osteoporosis is more severe on the paretic side (Beaupre & Lew, 2006; Marsden et al., 2008; Sato, 2000). Fractures at other sites on the paretic side are also more common after stroke (Beaupre & Lew, 2006; Marsden et al., 2008; Myint et al., 2007). Early ambulation and movement of the paretic limbs will reduce osteoporosis (Beaupre & Lew, 2006; Marsden et al., 2008; Myint et al., 2007). Medications including vitamin D/calcium supplementation, biphosphonate medications and other treatments to reduce bone loss may reduce the risk of osteoporosis and fracture (Beaupre & Lew, 2006; Marsden et al., 2008; Myint et al., 2007).

RECOMMENDATIONS

1. Early mobilization and movement of the paretic limbs will reduce the risk of bone fracture after stroke. [A]
2. Consider medications to reduce bone loss which will reduce the development of osteoporosis. [B]
3. Consider assessing bone density for patients with known osteoporosis who have been mobilized for 4 weeks before having the patient bear weight.
4. Assess for level of Vitamin D and consider supplemental Vitamin D in patients with insufficient levels. [B]

EVIDENCE TABLE

	Recommendation	Source	LE	QE	Benefit	SR
1	Early mobilization and movement	Beaupre & Lew, 2006 Marsden et al., 2008 Myint et al., 2007	II-1	Good	substantial	A
2	Medications to reduce bone loss	Beaupre & Lew, 2006 Marsden et al., 2008 Myint et al., 2007	II-1	Good	moderate	B
3	Supplement Vit D	Sato et al., 2005	I	Good	moderate	B

LE = Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; § = Systematic Review (see Appendix A)

2.9 Seizures

BACKGROUND

The prevention, recognition, and treatment of seizures and epilepsy post-stroke are important components of the rehabilitation process. Epilepsy refers to recurrent seizures. Stroke is a leading cause of symptomatic epilepsy in adults, accounting for up to one-third of newly diagnosed seizures among the elderly.

RECOMMENDATIONS

Assessment

1. Obtain an EEG of individuals who have a clinical seizure or manifest in a prolonged or intermittent stage of consciousness.

Treatment

2. Treat patients with post-stroke epilepsy with anti-epileptic medications (AEDs). [B]
3. Consider the side effect profile of AEDs when choosing a chronic anticonvulsant. [B]
4. Leviteracetam, and lamotrigine are the first-line anticonvulsants for post-stroke seizure and epilepsy in elderly patients or in younger patients requiring anticoagulants. [B]
5. Extended-release carbamazepine might be a reasonable and less expensive option in patients under 60 years of age with appropriate bone health who do not require anticoagulation. [C]
6. Prophylactic treatment with an AED is not indicated in patients without a seizure after a stroke. [A]

DISCUSSION

About 3% to 5% of stroke patients will have a remote seizure, and 54% to 66% will develop recurrent seizures, which are diagnosed as epilepsy (Ryvlin et al., 2006). The most common seizures following a stroke are focal seizures with or without secondary generalization. There are two temporally and clinically distinct patterns of seizures. A seizure that occurs in the first two weeks after a stroke does not strongly portend epilepsy. Consequently, a single seizure that occurs in the first two weeks after a stroke does not require sustained anticonvulsant treatment (De Reuck et al., 2008). A seizure at stroke onset is usually associated with a cardio-

embolic stroke. In contrast seizures that occur later after a stroke are more likely to be a harbinger of epilepsy. The risk of epilepsy after a stroke depends upon the location, nature, and size of the infarct or hemorrhage. In general, cortical lesions, particularly in epileptogenic zones such as the medial temporal lobe or inferior frontal lobes cause seizures more commonly than subcortical, deep white or gray matter cerebral lesions; isolated and uncomplicated cerebellar or brainstem lesions rarely cause seizures. Hemorrhages, particularly lobar hemorrhages, are more epileptogenic than ischemic infarctions. Routine prophylactic pharmacologic treatment with anti-epileptic medications is not required in these circumstances (De Reuck et al., 2008). In patients with recurrent seizures post-stroke, the choice of AED is usually based upon the efficacy and minimizing anticonvulsant side effects (Ryvlin et al., 2006). At present, low-dose lamotrigine, gabapentin or leviteracetam are the optimal first-line therapy for post-stroke seizure and epilepsy in elderly patients or in younger patients requiring anticoagulants (Kutlu et al., 2008; Ryvlin et al., 2006). Low-dose extended-release carbamazepine might be a reasonable and less expensive option in patients under 60 years of age with appropriate bone health who do not require anticoagulation (Ryvlin et al., 2006).

3 MEDICAL CO-MORBIDITIES

3.1 Diabetes/Glycemic Control

BACKGROUND

Glycemic control has been studied extensively in hospitalized stroke patients. The incidence of hypoglycemia is low but can mimic stroke. Hyperglycemia during stroke is common, can adversely affect ischemic damage and is associated with poorer outcomes. Epidemiological data shows an association between hyperglycemia during stroke, regardless of a patient's prior diabetes history, with higher morbidity, higher mortality, longer hospital stays, reduced long-term recovery, and diminished ability to return to work. . However, a benefit of tight glycemic control upon hospitalized patients has not been confirmed by the NICE_SUGAR study.

RECOMMENDATIONS

1. Recommend obtaining clinical information for a history of diabetes or other glycemic disorder and including a blood test with admission labs in a patient with suspected stroke. [A]
2. Recommend monitoring blood glucose levels for a minimum of 72 hours post-stroke. [B]
3. Insulin should be adjusted to maintain a BG < 180 mg/dl with the goal of achieving a mean glucose around 140 mg/dl. Evidence is lacking to support a lower limit of target blood glucose but based on a recent trial suggesting that blood glucose < 110 mg/dl may be harmful, we do not recommend blood glucose levels < 110 mg/dl. [A]
4. Insulin therapy should be guided by local protocols and preferably "dynamic" protocols that account for varied and changing insulin requirements. A nurse-driven protocol for the treatment of hypoglycemia is highly recommended to ensure prompt and effective correction of hypoglycemia. [I]
5. To minimize the risk of hypoglycemia and severe hyperglycemia after discharge it is reasonable to provide hospitalized patients who have DM and knowledge deficits, or patients with newly discovered hyperglycemia, basic education in "survival skills". [I]
6. Patients who experienced hyperglycemia during hospitalization but who are not known to have DM should be re-evaluated for DM after recovery and discharge. [B]
7. Recommend maintenance of near-normoglycemic levels (80-140 mg/dl) for long-term prevention of microvascular and macrovascular complications. [A]

DISCUSSION

Glucose management is dependent on local protocols and may be achieved by use of intravenous, subcutaneous, or oral medications. Acutely, insulin infusion is the preferred means. There is additional evidence that maintaining blood sugars to near-normoglycemic levels in diabetic patients with ischemic stroke or TIA may reduce macrovascular complications. The target range for glycemic control should be individualized, based on the

provider's appraisal of the risk-benefit ratio and discussion of the target with the individual patient. For those with diabetes and a history of stroke, oral diabetic medications are associated with a reduced risk for recurrent stroke (Sacco, 2006; EBRSR). (See VA/ DoD CPG for management of Diabetes Mellitus.)

EVIDENCE TABLE

	Recommendation	Sources	QE	Overall Quality	R
1	Upon admission for suspected stroke, obtain clinical information for a history of diabetes or other glycemic disorder and include a blood glucose with admission labs	Adams et al., 2007 Bruno et al., 1999, 2002 Gentile et al., 2006 Scott et al., 1999	I	Good	A
2	Monitor blood glucose levels for a minimum of 72 hours post-stroke	Allport et al., 2006 Baird et al., 2003	II-2	Fair G	B
	Continuous IV insulin infusion appears to be the safest and most effective method of treating hyperglycemia in the ICU. Scheduled subcutaneous insulin regimens appear to be preferable to sliding scale insulin monotherapy. Hypoglycemia may be more common when total pre-hospitalization insulin dose is continued in the hospital.	Meijering, 2006 (SR) Umpierrez et al., 2009 Umpierrez et al., 2007 Smiley et al., 2009	I	Fair	B
	Treating hyperglycemia to glucose < 180 mg/dl is effective in improving outcomes in the surgical and medical ICU, appears to be effective in those with AMI, and may be effective in those with acute stroke. Hyperglycemia is independently associated with increased morbidity and mortality in patients with acute stroke and in general medical/surgical wards. Blood glucose < 110 mg/dl may be harmful.	Baird et al., 2003 Bruno et al., 1999, 2002 Van den Berghe et al., 2001, 2006 Bilotta 2007 Observational: Capes 2001, Falciglia 200	I II-2	Good	A
4	In diabetic patients with ischemic stroke or TIA, maintain blood sugars to near-normoglycemic levels to reduce microvascular complications	Reichard, 1993 Sacco, 2006	I	Good	A

LE = Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; § = Systematic Review (see Appendix A)

3.2 Cardiac

BACKGROUND

Cardiac disease is a frequent co-morbidity in stroke patients. Cardiac diseases commonly seen include coronary heart disease (CHD), valvular heart disease, congestive heart failure (CHF) and atrial fibrillation. CHD has many risk factors in common with ischemic stroke including hypertension, dyslipidemia, diabetes, and cigarette smoking. Interventions to modify risk factors common to stroke and heart disease should be undertaken. There is a substantial literature on the value of exercise in patients with cardiovascular disease which forms the basis for many of the physical aspects of post myocardial infarction (MI) cardiac rehabilitation. Studies that investigate the benefits and risks of physical therapy exercise in the setting of acute and subacute stroke patients undergoing rehabilitation therapies have shown the benefit of improved aerobic capacity and cardiovascular fitness without reported increased

risk. Some caution should be exercised in recommending therapy programs that stress the cardiovascular system in patients with recent or significant CHD.

Pharmacologic principles in management of heart disease can be found in the AHA scientific statements and guidelines and the VA/DOD clinical practice guideline for IHD, and are not addressed here.

RECOMMENDATIONS

1. Monitor vital signs at the time of physical therapy interventions, particularly in patients with CHD.
2. Consider modifying or discontinuing therapy for significant changes in heart rate, blood pressure, temperature, pulse-oximetry, or if symptoms develop including excessive shortness of breath, syncope, or chest pain.
3. Management of heart disease and cardiac rehabilitation should follow AHA, VA/DoD, and AHCPR guidelines.

3.3 Hypertension

BACKGROUND

Control of blood pressure during the initial and subsequent phases of rehabilitation is important: the goal in the first weeks after stroke is to bring BP control to recommended levels (see VA/DoD Guideline for Hypertension and JNC-7). This must be done in a controlled fashion, avoiding hypotension and the risk of collateral circulation failure to the brain early after stroke, and conversely, avoiding undue hypertension, which is a risk factor for stroke. Risks of over-aggressive, early BP lowering include dehydration with renal dysfunction and syncope, whereas risks of delayed lowering include persistent negative effects of elevated BP on kidneys, heart, vasculature, and brain. Specific classes of medications, such as ACE-Inhibitors and HCTZ (hydrochlorothiazide) have an independent (of their BP lowering action) risk reduction for recurrent stroke. Initiation of proper medications during the initial hospitalization lead to greater likelihood of subsequent compliance and an early reduction in the risk of early progression of stroke, which is variously estimated at a risk of 10-25% in the first 3 months, much of the risk occurring in the first 2 weeks. Hypertension is the major risk factor for stroke in the population in general, and treatment of hypertension reduces the risk of stroke.

RECOMMENDATIONS

1. Blood pressure should be carefully monitored following stroke.
2. The type of stroke (ischemic, hemorrhagic, aneurismal), the clinical situation, and co-morbidities must be considered in blood pressure management.
   (See VA/DoD CPG for Management of Hypertension.)

3.4 Substance Use Disorders (SUD)

BACKGROUND

1. Substance abuse increases the risk of stroke and stroke recurrence. Intravenous substance abuse increases the risk of endocarditis and marantic vascular aneurysms. Agents that increase blood pressure can increase the risk of stroke and predispose to intracranial hemorrhage. Ethanol abuse is associated with increased risk of stroke and intracranial hemorrhage. Tobacco abuse increases the risk for stroke and cardiovascular disease. While ethanol use in moderation may have beneficial effects on the cardiovascular system, stroke survivors should be educated about the risks associated with excessive alcohol usage.

RECOMMENDATIONS

1. People who have survived a stroke should be educated about the risks associated with excessive alcohol usage, substance abuse, and the risk for stroke recurrence.
2. Patients who are smokers should be counseled about the benefits of smoking cessation on reducing the risk for a future stroke, and they should be considered for nicotine replacement therapy and other interventions that promote smoking cessation.

DISCUSSION

Tobacco abuse prolongs hospital stays (Appelros, 2007), impairs recovery, and increases the risk for stroke and cardiovascular disease (Hackam & Spence, 2007).

3.5 Post Stroke Depression

A variety of neuropsychiatric sequelae are typically seen following stroke. These have the potential to negatively impact the patient's ability to fully participate in rehabilitation, lengthen recovery time, and lower quality of life perception. Post-stroke depression is associated with poor rehabilitation results and ultimately poor outcome. In clinical practice, only a minority of depressed patients are diagnosed, and even fewer are treated. Depression has been reported in up to 33% of stroke survivors, compared with 13% of age- and sex-matched controls (Paulucci, 2006), but reliable estimates of the incidence and prevalence of depression in a stroke cohort are limited (Hackett, 2005). Predictors of post-stroke depression in the rehabilitation setting include increasing physical disability, cognitive impairment, and stroke severity (Hackett, 2005). The use of standardized depression screening tools (i.e., PHQ-2 and PHQ-9) is recommended for all stroke patients unless it is inappropriate because of aphasia or cognitive impairments.

RECOMMENDATIONS

1. There are several treatment options for the patient with stroke and mild depression that can be used alone or in combination based on the patient's individual need and preference for services. Refer to VA/DoD guidelines for the management of Major Depression Disorder (MDD).
2. Patients diagnosed with moderate to severe depression after stroke should be referred to Mental Health specialty for evaluation and treatment.
3. There is conflicting evidence regarding the use of routine pharmacotherapy or psychotherapy to prevent depression or other mood disorders following stroke.
4. Patients with stroke who are suspected of wishing to harm themselves or others (suicidal or homicidal ideation) should be referred immediately to Mental Health for evaluation.
5. Recommend that patients with stroke should be given information, advice, and the opportunity to talk about the impact of the illness upon their lives.

Other Mood Disorders

6. Patients following stroke exhibiting extreme emotional lability (i.e. pathological crying/tearfulness) should be given a trial of antidepressant medication, if no contraindication exists. SSRIs are recommended in this patient population. [A]
7. Patients with stroke who are diagnosed with anxiety related disorders should be evaluated for pharmacotherapy options. Consider psychotherapy intervention for anxiety and panic. Cognitive Behavioral Therapy has been found to be a more efficacious treatment for anxiety and panic disorder than other therapeutic interventions.
8. Recommend skills training regarding Activities of Daily Living (ADL's), and psychoeducation regarding stroke recovery with the family.
9. Encourage the patient with stroke to become involved in physical and/or other leisure activities.

DISCUSSION

Mood disorders, especially post-stroke depression, frequently go undertreated due to the overlap of vegetative symptoms including sleep disturbance, decreased appetite, fatigue, and feelings of hopelessness. While some symptoms, such as emotionalism, are likely to naturally decrease over time without intervention, prolonged presence of psychological distress requires intervention by an experienced mental health professional. Various pharmacological agents have been evaluated related to the effectiveness of stroke management. A review of the findings for specific drugs can be found at *www.ebrsr.com*. Overall, the most common drugs studied were tricyclic antidepressants and SSRIs with SSRIs being preferable due to their rapid effect and few side effects (Bhogal, 2005). Heterocyclic antidepressants have demonstrated promising benefit. Negative side effects such as confusion, drowsiness, and agitation were noted in a geriatric sample. A Cochrane review by Hackett (2004) found no evidence to support the routine use of pharmacotherapy or psychotherapy treatment for depression after stroke. In a later systematic review (Hackett et al., 2008) a small but significant effect of pharmacotherapy (not psychotherapy) on treating depression and reducing depressive symptoms was found, as was a significant increase in adverse events.

Prevention of Depression

There is no good evidence to recommend psychotherapy for treatment or prevention of post-stroke depression. EBRSR suggests that early initiation of antidepressant medication in non-depressed patients is effective in preventing post stroke depression. The heterogeneity and methodological shortcomings of psychotherapy studies makes it difficult to reach conclusions on interventions to manage and prevent depression after stroke. For example, in psychotherapy studies, the sample sizes are often small and there is a lack of operational definition of the depression concept. Additionally, there is not a consistent type of therapy used and interpersonal factors tend to account for some of the effectiveness/lack of effectiveness. Anderson, Hackett and House (2004) found a small but significant effect of psychotherapy improving mood, but no effect of either pharmacotherapy or psychotherapy on the prevention of depressive illness, disability, or other outcomes. Khan-Bourne and Brown (2003) also demonstrated promising benefit for Cognitive Behavior Therapy (CBT) in neurologically impaired patients, but more research is needed in this area. Smith et al. (2008) found in a meta-analysis of 17 trials that providing information improves patient and caregiver knowledge of stroke and aspects of patient satisfaction, and reduces patient depression scores. However, the reduction in depression scores was small and probably clinically insignificant.

EVIDENCE TABLE

	Recommendation	Sources	QE	Overall Quality	R
1	Pharmacotherapy for depression	Anderson, 1995 Bhogal et al., 2005 Chen et al., 2006 Cole et al., 2001 Gill & Hatcher, 2001 Kimura et al., 2000 Miyai & Reeding, 1998 Ried,Tueth, & Jia, 2006 Robinson et al., 2000 Van de Meent et al., 2003 Wiart et al., 2000	I	Good	A
2	Pharmacotherapy for emotional lability	Brown et al., 1998 Burns et al., 1999 Choi-Kwon et al, 2006 Cole et al., 2001 House et al., 2004 RCP, 2000 Robinson et al., 1993	I	Good	A
3	Psychotherapy	Anderson et al., 2004 Grober et al., 1993 Hackett, 2008 Lincoln & Flannaghan, 2003 Lincoln et al., 1997	II	Fair	C
4	Information/advice	RCP, 2000 Smith, 2008	I	Fair	B
5	Routine use of prophylactic antidepressants is not effective	Anderson, 2004 Almeida et al., 2006 Dam et al., 1996 Palomaki et al., 1999 Raffaele et al., 1996 Robinson et al., 2000	I	Good	D

LE = Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; § = Systematic Review (see Appendix A)

4 ASSESSMENT OF IMPAIRMENTS

Annotation G. Determine Nature and Extent of Impairments and Disabilities

4.1 Global Assessment of Stroke Severity

BACKGROUND

The National Institutes of Health Stroke Scale (NIHSS) is a standardized, validated instrument that assesses severity of neurological impairment after stroke (See Appendix B). It is designed so that virtually any stroke will register some abnormality on the scale. The scale has an administration time of 5 to 10 minutes. The NIHSS score is based solely on examination and requires no historical information or contributions from surrogates. It can be administered at any stage by any trained clinician.

The original 11 items of the NIHSS do not test distal upper extremity weakness, which is more common in stroke patients than proximal arm weakness. An additional item examining finger extension is often added to the NIHSS. Although not contributing to the total NIHSS score, this item should be recorded as part of the NIHSS assessment.

RECOMMENDATIONS

1. Strongly recommend the patient be assessed for stroke severity using the NIHSS at the time of presentation/hospital admission, or at least within the first 24 hours following presentation. [A]
2. Strongly recommend that all professionals involved in any aspect of the stroke care be trained and certified to perform the NIHSS. [A]
3. Consider reassessing severity using the NIHSS at the time of acute care discharge to validate the first assessment or identify neurological changes.
4. If the patient is transferred to rehabilitation and there are no NIHSS scores in the record, the rehabilitation team should complete an NIHSS.

DISCUSSION

The NIHSS is used to guide decisions concerning acute stroke therapy (NINDS tPA Stroke Study Group, 1994). Initial scores have been used to stratify patients according to severity and likely outcome. The presentation NIHSS score was highly correlated with outcome in retrospective analyses of two randomized clinical trials (Adams et al., 1999; Frankel et al., 2000). A second assessment serves as a re-check of the initial measurement and may be more accurate, as the patient will have been stabilized and may be better able to cooperate with the examiner, thus improving the accuracy of scoring.

Because the severity of stroke as assessed by the NIHSS may influence decisions concerning the acute treatment of stroke patients (such as the use of thrombolytic therapy), application of this scale in clinical settings is becoming more common (Odderson, 1999).

The NIHSS score strongly predicts the likelihood of the patient's recovery after stroke. A score of >16 forecasts a high probability of death or severe disability, whereas a score of <6 forecasts a good recovery (Adams et al., 1999). Patients with a severe neurologic deficit after stroke, as measured by the NIHSS, have a poor prognosis. During the first week after acute ischemic stroke, it is possible to identify a subset of patients who are highly likely to have a poor outcome (Frankel et al., 2000).

Potential examiners become certified in the NIHSS by watching a training videotape and passing an examination that involves scoring patients shown on a test tape (Lyden et al., 1994). Training is now most commonly taken on-line, rather than by use of videotape. Certified examiners may be of any background (e.g., physician, nurse, therapist, or social worker) (Dewey et al., 1999; Goldstein & Samsa, 1997; Powers, 2001). Inter-rater reliability between examiners for most items of the NIHSS is high (Goldstein et al., 1989), making the scale highly reproducible. Retrospective estimation of the initial NIHSS score from the admission neurological examination is

possible and fairly accurate (Bushnell et al., 2001; Kasner et al., 1999; Williams et al., 2000), although actual testing is preferable.

Continuing validation of the predictive value of the NIHSS within the VA/DoD healthcare system through ongoing prospective data collection is encouraged.

EVIDENCE Table

	Recommendation	Sources	LE	QE	SR
1	Assess stroke severity using the NIHSS score.	Adams et al., 1999 Frankel et al., 2000	I	Good	A

4.2 Assessment of Communication Impairment

BACKGROUND

Disorders of communication (i.e., problems with speaking, listening, reading, writing, gesturing, and/or pragmatics) and related cognitive impairments may occur in as many as 40 percent of post-stroke patients. The most noticeable communication disorders occurring post-stroke are aphasia and dysarthria, while some patients also suffer from varying degrees of dementia.

RECOMMENDATIONS

1. Assessment of communication ability should address the following areas: listening, speaking, reading, writing, gesturing, and pragmatics. Problems in communication can be language-based (as with aphasia), sensory/motor based (as with dysarthria), or cognitive-based (as with dementia).
2. Assessment should include standardized testing and procedures. [B]

RATIONALE

Accurate diagnosis is crucial to identify the various factors affecting communication so that appropriate treatment may be administered effectively. Assessment is also important for determining the patient's capability for understanding instructions, expressing his or her wants and needs, and understanding of, and contributing to, their plan of care (including consent forms and advance directives).

Standard testing and procedures provide reliable and valid measures of abilities and degree of impairments, allowing for accurate measurement of change over time. In most cases, standardized testing also provides normative group data revealing the patient's performance relative to others and providing a means to predict future change.

EVIDENCE STATEMENTS

Standardized testing may be more suitable for patients with acute aphasia, while functional tests are more suitable in the subacute/chronic stage (Laska et al., 2007).

EVIDENCE TABLE

	Recommendation	Sources	QE	Overall Quality	**R**
1	Standardized testing is recommended for early assessment.	Laska et al., 2007	II	Fair	B

LE = Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; § = Systematic Review (see Appendix A)

4.3 Assessment of Motor Impairment and Mobility

BACKGROUND

Motor Assessment

Impairments resulting from stroke (weakness, incoordination, limited endurance, spasticity and sensory deficits, balance) limit the ability of a person with stroke to use the paretic upper extremity. This hemiparesis is one of the most common problems experienced after stroke and interferes with the ability to complete daily life tasks and contributes to decreased quality of life. There are many components that contribute to motor function.

Muscle Tone Assessment

A stroke along the motor pathways of the brain can cause changes in muscle tone (the resting activity of the muscles) that could be hypertonic (increased resting muscle activity) or hypotonic (decreased resting muscle activity). In either case, the individual will need to learn to adapt to the different way his/her body now moves. In some cases, this change can result in altered movement patterns, changes in functionality and can lead to safety issues (e.g., an individual who is too hypotonic to support their weight on a limb) or hygiene issues (e.g., an individual's tone is so great that bathing becomes difficult).

Mobility Assessment

Many patients present with limitations in mobility due to impaired strength, altered tone, impaired endurance, or impaired coordination and neuromuscular recruitment. These deficits may lead to decreased gait speed, increased energy expenditure, and decreased safety with mobility (whether it be via ambulation or use of wheelchair). Impaired mobility often significantly reduces functional independence level and increases burden of care.

RECOMMENDATIONS

Motor Assessment

1. Motor function should be assessed at the impairment level (ability to move in a coordinated manner in designated patterns), and at the activity level (performance in real life or simulated real life tasks), using assessments with established psychometric properties.
2. The following components should be considered in assessment of motor function: muscle strength for all muscle groups, active and passive range of motion available, muscle tone, ability to isolate the movements of one joint from another, gross and fine motor coordination.
3. The daily use of the paretic extremity should be assessed using a self-report measure (e.g., the Motor Activity Log), and with accelerometry.
4. Balance should be assessed using a standardized assessment tool (e.g., Berg Balance Scale).
5. Apraxia should be assessed using an established apraxia measure (e.g., Florida Apraxia Screen).

Mobility

6. Stroke survivors with impaired mobility should be referred to a mobility-training program (physical therapy and/or occupational therapy) where specific and individualized goals can be established.

4.4 Assessment of Cognitive Function

OBJECTIVE

Identify areas of cognitive impairment.

BACKGROUND

Impairments in cognitive functioning are common following a stroke. In particular, impairments in attention, memory, and executive functioning (i.e., integrating multiple and complex processes) can be especially disabling.

These deficits may characteristically change throughout the recovery process. As such, ongoing assessment of arousal and cognition is important for determining the patient's capabilities and limitations for coping with his/her stroke and assuring success of the rehabilitation process. Psychological distress such as post stroke depression can also negatively influence ones cognitive abilities, and as such, test interpretation should be made with this in mind. The results of the assessment may impact the choice of treatment and disposition.

RECOMMENDATIONS

1. Assessment of arousal, cognition, and attention should address the following areas:
    a. Arousal
    b. Attention deficits
    c. Visual neglect
    d. Learning and Memory deficits
    e. Executive function and problem-solving difficulties

2. There is insufficient evidence to recommend for the use of any specific tools to assess cognition. Several screening and assessment tools exist. (See Appendix B for standard screening instruments for cognitive assessment.)

4.5 Assessment of Sensory Impairment: Touch, Vision and Hearing

BACKGROUND

A comprehensive assessment of patients with stroke is necessary for accurate diagnosis and appropriate clinical management. Anatomic localization of lesions can usually be determined through careful delineation of neurologic deficits. Sensory deficits following stroke frequently accompany motor impairments in the same anatomic distribution. Clinical examination of sensation involves testing for pain, temperature, touch, point position, vibration. A thorough sensory examination should also include an assessment of vision and hearing.

RECOMMENDATIONS

3. Recommend that all patients be screened for sensory deficits by appropriately trained clinicians. This assessment should include an evaluation of sharp/dull, temperature, light touch, vibratory and position sensation.
4. Consider using Semmes-Weinstein monofilament to assess cutaneous sensation.
5. Recommend that all individuals with stroke should have a vision exam that includes visual acuity, contrast sensitivity (using Pelli chart), perimetry for visual field integrity, eye movements (including diplopia) and visual scanning.
6. Recommend that a careful history related to hearing impairment be elicited from the patient and or family and that a hearing evaluation be completed for patients who demonstrate difficulty with communication where hearing impairment is suspected.

4.6 Assessment of Emotional and Behavioral State

BACKGROUND

Assessment of one's emotional state and corresponding behaviors is important to promote adherence to rehabilitation, facilitate better adjustment to disability, and improve quality of life. Behaviors and emotions fluctuate as psychological concerns change and may provide evidence that the patient has moved to a new stage of recovery. For example, increasing levels of depression often co-exist with increasing levels of insight into one's deficits. In general, a patient's level of psychological adjustment can be viewed as the combination of three features: (1) the patient's pre-morbid psychological status, personality, and coping ability (2) the patient's

psychological response to his or her new deficits and required lifestyle changes, and (3) pathological alterations in brain chemistry influencing mood, behavioral control, and insight. A thorough assessment of psychological status beyond general mental status is needed as cognitive deficits typically cloud the clinical picture.

RECOMMENDATIONS

1. Initial evaluation of the patient should include a psychosocial history that covers pre-morbid personality characteristics, psychological disorders, pre-morbid social roles, and level of available social support.
2. Brief, continual assessments of psychological adjustment should be conducted to quickly identify when new problems occur. These assessments should also include ongoing monitoring of suicidal ideation and substance abuse. Other psychological factors deserving attention include: level of insight, level of self-efficacy/locus of control, loss of identity concerns, social support, sexuality, and sleep.
3. Review all medications and supplements including over the counter (OTC) medications that may affect behavior and function.
4. Inclusion of collateral information (e.g., spouse, children) is recommended to obtain a comprehensive picture of the patient's pre-morbid functioning and psychological changes since the stroke.
5. There is insufficient evidence to recommend the use of any specific tools to assess psychological adjustment. Several screening and assessment tools exist. (See Appendix B for standard instruments for psychological assessment.)
6. Post-stroke patients should be assessed for other psychiatric illnesses, including anxiety, bipolar illness, SUD, and nicotine dependence. Refer for further evaluation by mental health if indicated.

5 ASSESSMENT OF ACTIVITY AND FUNCTION

Analysis of function focuses on the measurement of task specific activities that are essential to support the well-being of an individual. The assessment of function is accomplished via a test or battery of tests in which the results can be used as (1) an information base for setting realistic goals, (2) an indicator to the patient of current abilities that documents progression toward more complex functional levels, (3) an index for decisions on admission and discharge from a rehabilitation or extended care facility, and (4) a guide for determining the safety of an individual in performing a particular task and the risk of injury with continued performance. The discharge environment must support the functional abilities of the patient.

5.1 ADL, IADL

BACKGROUND

Activities of daily living (ADL) are basic self care activities while instrumental activities of daily living (IADL) are skills beyond basic self-care skills needed to function independently at home and in the community. A large number of individuals with stroke experience limitations in the ability to complete basic self care, such as bathing and dressing even long after rehabilitation. Such disability may prevent return to community living, contributes to reduced participation, and adds to caregiver strain. Successful performance of complex components of IADL tasks (i.e., cooking, cleaning, shopping, and housekeeping) requires higher-level neuropsychological organization than is required for performance of basic self-maintenance tasks (i.e., bathing and dressing), and individuals with stroke often show even greater limitations in their ability to complete IADLs than ADLs. For a patient planning to return to an assisted living situation, further independence may not be required or expected. For many patients, however, IADLs are central to independent living. Cognitive functioning and comprehension are also factors for independent living.

RECOMMENDATIONS

1. Recommend that a standardized assessment tool be used to assess functional status (ADL/IADL) of stroke patients. [B]
2. Consider the use of the Functional Independence Measure (FIM™) as the standardized functional assessment. (See Appendix B – Functional Independence Measure [FIM™] Instrument, and a list of other standard instruments for assessment of function and impact of stroke)

DISCUSSION

Standard measurement tools may be employed to objectively document the over-all functional status of a patient who survived a stroke. The most widely used tool for measuring functional status is the Functional Independence Measure (FIM™), although others exist (e.g., Barthel; Lawton). VHA Directive 2000-16 (June, 2001) states that all VA facilities will complete a FIM™ assessment on all stroke patients with rehabilitation needs. Assessment of function may include, but is not limited to the following:

- Aerobic capacity and endurance
- Arousal, attention, and cognition
- Assistive and adaptive devices
- Balance
- Circulation (i.e., cardiovascular signs/symptoms and response to position change)
- Continence
- Gait
- Joint integrity and mobility
- Locomotion
- Motor function (i.e., movement patterns, coordination, dexterity, and agility)
- Muscle performance-strength, power, and endurance
- Orthotic, protective, and supportive devices
- Pain

- Posture
- Range of motion
- Reflex integrity
- Sexual activity
- Self care (ADL and IADL)

EVIDENCE TABLE

	Recommendation	Sources	QE	Overall Quality	R
1	Standardized functional assessment tool (e.g., FIM™)	Lin, 2001 Ottenbacher et al., 1996	II-2	Fair	B

LE = Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; § = Systematic Review (see Appendix A)

6 ASSESSMENT OF SUPPORT SYSTEMS

6.1 Patient, Family Support, and Community Resources

BACKGROUND

Stroke is a family illness that impacts family roles and dynamics in a variety of ways. In order for patients to sustain the gains made during inpatient care and make further progress in the community, it is essential that the rehabilitation team view the patient and family/caregiver as the unit of care. The rehabilitation team must have a comprehensive understanding of the needs and preferences of the family unit and be familiar with the post-discharge environment. The team must understand the patient and family/caregiver history, expectations, coping styles, resources, emotional support system, and family dynamics.

RECOMMENDATIONS

1. Recommend all stroke patients and family caregivers receive a thorough psychosocial assessment with psychosocial intervention and referrals as needed.
2. The psychosocial assessment of both the patient with stroke and the primary family caregiver should include the following areas:
    a. History of pre-stroke functioning of both the patient and the primary family caregiver (e.g., demographic information, past physical conditions and response to treatment, substance use and abuse, psychiatric, emotional and mental status and history, education and employment, military, legal, and coping strategies)
    b. Capabilities and care giving experiences of the person identified as the primary caregiver
    c. Caregiver understanding of the patient's needs for assistance and caregiver's ability to meet those needs
    d. Family dynamics and relationships
    e. Availability, proximity, and anticipated involvement of other family members
    f. Resources (e.g., income and benefits, housing, and social network)
    g. Spiritual and cultural activities
    h. Leisure time and preferred activities
    i. Patient/family/caregiver understanding of the condition, treatment, and prognosis, as well as hopes and expectations for recovery
    j. Patient/family/caregiver expectations of stroke-related outcomes and preferences for follow-up care
3. Recommend a home assessment for all patients who will be discharged home with functional impairments.

Annotation H. Does the Patient have a Severe Stroke and/or Maximum Dependence and Poor Prognosis For Functional Recovery?

BACKGROUND

Patients who have had a severe stroke or who are maximally dependent in ADLs and have a poor prognosis for functional recovery are not candidates for rehabilitation intervention. Families and caregivers should be educated in the care of these patients. The family and caregiver education may include; preventing recurrent stroke, signs and symptoms of potential complications and psychological dysfunction, medication administration, assisted ADL tasks (e.g., transfers, bathing, positioning, dressing, feeding, toileting, and grooming), swallowing techniques, nutrition and hydration, care of an indwelling bladder catheter, skin care, contractures, use of a feeding tube, home exercises

(range of motion), and sexual functioning.

RECOMMENDATIONS

1. Families and caregivers should be educated in the care of patients who have experienced a severe stroke, who are maximally dependent in ADL, or have a poor prognosis for functional recovery; as these patients are not candidates for rehabilitation intervention.
2. Families should receive counseling on the benefits of nursing home placement for long-term care.

DISCUSSION

Exclusion from rehabilitation on the basis of post-stroke dependence remains a contentious issue. Patients with the most severe cognitive or physical impairments have been excluded from most rehabilitation trials, and therefore caution is required in extrapolating results to this group (van Peppen, 2007). Limited data suggest that active rehabilitation allows severely disabled patients to return home (Kalra, 1995; Schmidt, 1999). For those unable to participate actively, passive movements to prevent contractures or pressure sores have been recommended.

7 THE REHABILITATION PROGRAM

Annotation I. Does the Patient Need Rehabilitation Intervention?

7.1 Determine Rehabilitation Needs

OBJECTIVE

Identify the patient who requires rehabilitation intervention.

BACKGROUND

Patients who have had an ischemic or hemorrhagic stroke, with resulting impairments and limitations in activities, as identified on the brief assessment, should be referred to rehabilitation services for an assessment of rehabilitation needs.

Patients who have sustained an acute stroke should receive rehabilitation services if their post-stroke functional status is below their pre-stroke status and if there is a potential for improvement. If pre- and post-stroke functional status is equivalent, or if the prognosis is judged to be poor, rehabilitation services may not be appropriate for the patient at the present time. Better clinical outcomes are achieved when post-acute stroke patients who are candidates for rehabilitation receive multidisciplinary evaluation and intervention in a setting where rehabilitation care is formally coordinated and organized.

RECOMMENDATIONS

1. Once the patient is medically stable, the primary physician should consult with rehabilitation services (i.e., physical therapy, occupational therapy, speech and language pathology, kinesiotherapy, and Physical Medicine) to assess the patient's impairments as well as activity and participation deficiencies to establish the patient's rehabilitation needs and goals.
2. A multidisciplinary assessment should be undertaken and documented for all patients. [A]
3. Patients with no residual disability post acute stroke who do not need rehabilitation services may be discharged back to home.
4. Strongly recommend that patients with mild to moderate disability in need of rehabilitation services have access to a setting with a coordinated and organized rehabilitation care team that is experienced in providing stroke services. [A]
5. Post-acute stroke care should be delivered in a setting where rehabilitation care is formally coordinated and organized.
6. If an organized rehabilitation team is not available in the facility, patients with moderate or severe disability should be offered a referral to a facility with such a team. Alternately, a physician or rehabilitation specialist with some experience in stroke should be involved in the patient's care.
7. Post-acute stroke care should be delivered by a variety of treatment disciplines which are experienced in providing post-stroke care, to ensure consistency and reduce the risk of complications.
8. The multidisciplinary team may consist of a physician, nurse, physical therapist, occupational therapist, kinesiotherapist, speech and language pathologist, psychologist, recreational therapist, social worker, patient, and family/caregivers.
9. Patients who are severely disabled and for whom prognosis for recovery is poor may not benefit from rehabilitation services and may be discharged to home or nursing home in coordination with family/care giver.

DISCUSSION

Assessment of rehabilitation needs and readiness for rehabilitation participation should, at a minimum, include the following:

Medical Stability

- Medical work-up and treatment plan
- Stable vital signs for 24 hours
- No chest pain within the past 24 hours, with the exception of stable angina or documented non-cardiac conditions
- No significant arrhythmia
- No evidence of DVT

Rehabilitation needs

- Cognitive capability of participating in rehabilitation
- Willingness to participate in rehabilitation services
- Adequate prior functional status
- Capacity for improvement
- Functional deficits
- Assessment of training needs: family, major equipment, and vocation/leisure

Standard measurement tools may be employed to objectively document the over-all functional status of a patient who has survived a stroke. The most widely used tool for measuring functional status is the Functional Independence Measure (FIM™), although others exist (e.g., Barthel; Lawton).

Assessment of impairment and function should include, but is not limited to the following:

- Communication
- Motor performance
- Cognitive function
- Sensation
- Emotional status
- ADL and IADL
- Mobility

Need for Rehabilitation Services

Patients who retain their pre-stroke level of functioning and are independent with ADLs and IADLS typically will not require ongoing rehabilitation services. The patient and his/her family should be educated on the risks of recurrent stroke and be provided appropriate medical management to reduce risk of recurrent stroke.

Patients who have had a severe stroke, are maximally dependent in ADL, and have a poor prognosis for functional recovery, are not candidates for rehabilitation intervention.

The Advantage of Organized Stroke Services

There is clear evidence that organized care for selected post-stroke patients is worthwhile to achieve optimal outcomes, and the outcomes measured are substantial (i.e., mortality and dependency and return to community living. The Agency for Healthcare Policy and Research Guideline for Post-Stroke Rehabilitation (1995) concluded that "A considerable body of evidence, mainly from countries in Western Europe, indicates that better clinical outcomes are achieved when patients with acute stroke are treated in a setting that provides coordinated,

multidisciplinary stroke-related evaluation and services. Skilled staff, better organization of services, and earlier implementation of rehabilitation interventions appear to be important components."

In several randomized controlled trials, stroke unit care or organized inpatient multidisciplinary rehabilitation showed improved outcomes compared to "standard" care.

- The Stroke Unit Trialists' Collaboration Cochrane Review (updated in 2001) concluded, "Patients receiving organized inpatient stroke unit care were more likely to survive, regain independence, and return home than those receiving a less organized service." The Cochrane review further concluded, "Acute stroke patients should be offered organized inpatient stroke unit care, typically provided by a coordinated multidisciplinary team operating within a discrete stroke ward that can offer a substantial period of rehabilitation, if required. There are no firm grounds for restricting access according to a patient's age, gender, or stroke severity." However, the reviewers also cautioned that there could be a wide range of results because of varying outcome rates and confidence intervals. The most recent update of this systematic review involved investigators from nearly all the included trials to try to determine why stroke unit care was superior. They found little evidence of differences in staff numbers or mix, although a tendency was shown for assessment and therapy to begin earlier in organized settings.
- Evans and colleagues (1995) compared the effectiveness of multidisciplinary inpatient physical rehabilitation programs with standard medical care. Based on 11 studies, the researchers found that rehabilitation services improved short-term survival, functional ability, and most independent discharge location. However, they did not find long-term benefits. The authors suggested, "The lack of long-term benefits of short-term rehabilitation may suggest that therapy should be extended to home or sub-acute care settings, rather than being discontinued at discharge."
- Cifu and Stewart (1999) reviewed studies that investigated the type of inpatient rehabilitation (interdisciplinary versus multidisciplinary) as a predictor of outcome following a stroke. The authors concluded that an interdisciplinary setting (i.e., services "provided by diverse professionals who constitute a team that communicates regularly and uses its varying expertise to work toward common goals") is strongly related to improved outcome. A specialized multidisciplinary team (which usually includes similar professionals as an interdisciplinary team, but with less consistent "regular communication and common goal orientation") appears to be less effective if it lacks the organizational structure provided by regular communication. Other predictors for improved outcome at hospital discharge and follow-up were increased functional skills on admission to rehabilitation and early initiation of rehabilitation services. Specialized therapy and a greater intensity of therapy services had "a weak relationship with improved functional outcome at hospital discharge and follow-up" and the authors observed that the "current literature is too limited to allow an assessment of the relationship of specific types of non-inpatient rehabilitation services after stroke and functional outcome."

EVIDENCE TABLE

	Recommendation	**Source**	**LE**	**QE**	**SR**
1	Better clinical outcomes are achieved when post-acute stroke patients receive coordinated, multidisciplinary evaluation and intervention	Evans et al., 2001 Langhorne & Duncan, 2001 (SR)	I	Good	A
2	Interdisciplinary team approach	AHCPR, 1995 Cifu & Stewart, 1999 (SR) Evans et al., 1995 (SR) Evans et al., 2001 Stroke Unit Trialists, 2002 (SR)	I	Fair	B
	Multidisciplinary rehabilitation programs coordinated with the patient and family members/caregivers	Working Group Consensus	III	Poor	I

LE = Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; § = Systematic Review (see Appendix A)

Annotation J: Are early supportive discharge rehabilitation services appropriate?

7.2 Determine Rehabilitation Setting

BACKGROUND

Once the decision has been made that the post-stroke patient would benefit from rehabilitation services, the team must determine the best setting for ongoing rehabilitation. For many patients, physical and/or cognitive deficits can make them unsafe to function in their prior living setting and continued inpatient rehabilitation is the best option. For less severely disabled stroke patients, early supported discharge (ESD), or providing interdisciplinary rehabilitation in the home instead of in a hospital may be a viable option.

Early supported discharge is a model of care that links inpatient care with community services and allows the patients to be discharged home sooner with support of the rehabilitation team. To be effective, early supported discharge should only be considered when adequate community services for rehabilitation and for caregiver support are available, and can provide the level of intensity of rehabilitation service needed.

Rehabilitation Setting

Inpatient rehabilitation can take many forms ranging from minimal therapy services in a nursing home setting to services provided on a specialized rehabilitation unit. Inpatient rehabilitation can take place in a free standing rehabilitation hospital or a rehabilitation unit within a larger facility, and can also refer to programs where the patient is in residence during treatment, including nursing homes and chronic care facilities. No study has demonstrated the superiority of one type of rehab setting over another. Patient's individual needs, stamina and ability to participate as well as availability of resources must be considered on an individual basis. Regardless of the setting, the patient should be cared for by a coordinated, multidisciplinary team.

Intensity of Rehabilitation Treatment

There is evidence that higher intensity of physical and occupational therapy results in improved functional outcomes, particularly in patients with moderate impairment, however the effect is modest and the effect not maintained long term.

RECOMMENDATIONS

1. The medical team, including the patient and family, must analyze the patient's medical and functional status, as well as expected prognosis in order to establish the most appropriate rehab setting. [I]
2. The severity of the patient's impairment, the rehabilitation needs, the availability of family/social support and resources, the patient/family goals and preferences and the availability of community resources will determine the optimal environment for care. [I]
3. Where comprehensive interdisciplinary community rehabilitation services and caregiver support services are available, early supported discharge services may be provided for people with mild to moderate disability. [B]
4. Recommend that patients remain in an inpatient setting for their rehabilitation care if they are in need of daily professional nursing services, intensive physician care, and/or multiple therapeutic interventions.
5. Inconclusive evidence to recommend the superiority of one type of rehabilitation setting over another.
6. Patients should receive as much therapy as they are able to tolerate in order to adapt, recover, and/or reestablish their premorbid or optimal level of functional independence. [B]

DISCUSSION

Early Supported Discharge

There is a growing body of evidence that for selected stroke patients, early discharge to a community setting for ongoing rehabilitation can provide similar outcomes for patients, compared to inpatient rehabilitation.

Several RCTs and meta-analyses have been published demonstrating that rehabilitation at home is a safe and effective alternative form of treatment for patients with mild disability. The efficacy of early supported discharge for acute stroke patients, evaluated by the Early Supported Discharge (ESD) Trialists was first published in 2001 and updated in 2004. While ESD programs were associated with shorter periods of initial hospitalization, their impact on the well-being of caregivers remains unknown. While early supported discharge appears to offer the same benefits as in-hospital stroke rehabilitation units for a selected population, this concept has been largely tested in less severely disabled stroke patients.

One meta-analysis conducted by Langhorne (2005) found that ESD services reduce the inpatient length of stay and adverse events (e.g., readmission rates), while increasing the likelihood of independence and living at home. A meta-analysis conducted by Anderson et al. (2002), reported that programs of early supported discharge reduced hospital lengths of stays by an average of 13 days and were associated with an average of 15% cost savings compared to in-patient rehabilitation. The Canadian Coordinating Office of Health Technology Assessment (CCOHTA) conducted a review of early supported discharge (ESD) compared to usual care. The ESD patients showed a significant decrease in length of hospital stay (approximately 10 days) when compared to controls (Noorani et al., 2003).

The results of RCTs from the United Kingdom, Sweden, Norway, Canada and Australia have shown that highly selected, mildly impaired stroke patients can be managed successfully at home by an interdisciplinary team with similar outcomes compared to inpatient care. Unfortunately, the essential characteristics of an effective ESD program remain uncertain, and it is important to note that the stroke patients included in these studies had achieved relatively high levels of independence at the time of admission into the study. Nevertheless, patients were more satisfied with this type of care when compared to hospitalization and may have been more motivated.

For patients with moderate and severe strokes, Anderson et al. (2000b) suggested that early supported discharge was no longer cost-effective or advantageous, since the benefits were inversely proportional to the severity of the stroke. Bautz-Holter et al. (2002) reported non-significant differences in Nottingham Extended ADL scores at both three and six months in mildly impaired stroke patients receiving either conventional in-patient rehabilitation or early supported discharge. Kalra et al. (2000) examined the efficacy of stroke unit care compared to a stroke team or to domiciliary (at home) care for early stroke rehabilitation and reported that for patients with moderate to severe stroke, stroke unit care was "more effective in reducing mortality, the need for institutional care and dependence. Moreover, rehabilitation of patients randomized to domiciliary care proved difficult as one third of the 153 patients so randomized were admitted to the stroke unit within two weeks for a variety of care reasons."

Risks relating to caregiver strain might be expected with ESD, but there is little evidence to demonstrate whether or not this is the case.

One systematic review by Brady (2005) identified eight trials evaluating the economic implications of ESD compared with conventional care. All studies compared ESD using home based services compared to conventional services (noted to be either hospital rehabilitation or mix of hospital and community rehabilitation). These studies reported a trend for reduced costs of between 4-30% with ESD, however this cost saving was found to be statistically significant in only one of the six studies. The authors concluded that there was "moderate" evidence that ESD services provided care at modestly lower total costs than conventional care.

The Working Group consensus is that patients should remain in an inpatient setting for their rehabilitation care if they are in need of skilled nursing services, regular contact by a physician, and/or multiple therapeutic interventions.

Examples for "need of skilled nursing services" include (but are not limited to):

- Bowel and bladder impairment
- Skin breakdown or high risk for skin breakdown
- Impaired bed mobility
- Dependence for ADL

- Inability to manage medications
- High risk for nutritional deficits

Examples for "need of regular contact by a physician" include (but are not limited to):

- Medical comorbidities not optimally managed (e.g., diabetes and hypertension)
- Complex rehabilitation issues (e.g., orthotics, spasticity, and bowel/bladder)
- Acute illness (but not severe enough to prevent rehabilitation care)
- Pain management issues

Examples for "need of multiple therapeutic interventions" include (but are not limited to):

- Moderate to severe motor/sensory deficits, and/or
- Cognitive deficits, and/or
- Communication deficits

Studies of Care in the Acute and Post-Acute Rehabilitation Settings

Indreavik et al. (1997&1999) examined the long-term benefits for a combined acute and rehabilitation stroke unit in Norway. Starting with 220 patients, the researchers compared outcomes for surviving patients at 5 years (n=77) and 10 years (n=31) after discharge. Differences in treatment were confined to the first six weeks of treatment. Reportedly, there were no differences in the severity of the strokes in the control and experimental groups. The investigators used the Frenchay Activities Index (FAI), and the Nottingham Health Profile (NHP) to measure quality of life (81 percent of patients), and a visual analog scale fro pain (86 percent of patients). Functional status was measured using the Barthel Index (BI). More patients in the stroke unit group had an FAI score >30 than did patients in the general ward. The FAI and visual analog scale scores favored stroke unit patients (34.2 versus 27.2; P=0.01 for FAI and 72.8 versus 50.7 mm; P=0.002 for the visual analog scale). Patients in both groups who had better functional status measured by the BI also had higher quality of life scores. Acute care in a stroke unit improved quality of life for patients at 5 years (Indreavik et al., 1998). The researchers also studied survival, proportion of patients living at home, and functional status measured by the BI. Intention-to-treat analysis was used. At 5 years, the Kaplan-Meier survival curve analysis showed that survival was higher in the stroke unit group than in the ward care group (41 versus 29 percent; P=0.04). More patients who received stroke unit care were living at home (P=0.006), were independent (BI score >95; P=0.004), or were at least partly independent (BI score >60; P=0.006) (Indreavik et al., 1999). The groups did not differ for help or support received at home. Stroke unit care improved long-term survival and functional status and increased the number of patients living at home.

Kalra et al. (2000) in a randomized control trial assigned 457 acute stroke patients to three differing levels of treatment (stroke unit, general ward, domiciliary care). Patients who survived without severe disability at 1 year post-stroke in the three groups were: 129 (85 percent), 99 (66 percent), and 102 (71 percent) respectively. Stroke unit care was significantly better than the two lower levels of care. The net effect of the stroke unit was profoundly different for approximately 30 patients (20 percent of sample).

Studies of Care in the Post-Acute Rehabilitation Setting

Langhorne and Duncan (2001) conducted a systematic review of studies identified by the Stroke Unit Trialists' Collaboration that dealt with post-acute rehabilitation stroke services. They defined intervention as "organized inpatient multidisciplinary rehabilitation commencing at least one week after stroke" and sought randomized trials that compared this model of care with an alternative. In a heterogeneous group of 9 trials (6 involving stroke rehabilitation units and 3 involving general rehabilitation wards) recruiting 1,437 patients, organized inpatient multidisciplinary rehabilitation was associated with a reduced odds of death (OR = 0.66; 95% CI, 0.49 to 0.88; P<0.01), death or institutionalization (OR = 0.70; 95% CI, 0.56 to 0.88; P<0.001), and death or dependency (OR = 0.65; 95% CI, 0.50 to 0.85; P<0.001), which was consistent across a variety of trial subgroups. For every 100 patients receiving organized inpatient multidisciplinary rehabilitation, an extra 5 returned home in an independent state. This review of post-acute care concluded that there can be substantial benefit from organized inpatient multidisciplinary rehabilitation in the post-acute period, which is both statistically significant and clinically important.

One RCT by Evans et al. (2001) has been published since the most recent update of the collaboration's work. This study, which deals with both acute and rehabilitative care, sought to quantify the differences between staff interventions in a stroke unit versus staff interventions on a general ward supported by a stroke specialist team. Observations were made daily for the first week of acute care, but only weekly during the post-acute phase. During the observation period, the stroke unit patients were monitored more frequently and received better supportive care, including early initiation of feeding.

Due to the heterogeneity of the literature regarding patient samples, structural design, and outcome measures, it is difficult to identify a "best practice" that applies to all patients with stroke. The evidence does not indicate the specific nature of the intervention or provide explanation of the nature of the team approach or which factor has the greatest impact on patient outcome. The very nature of stroke and its complex effects create the need for a flexible and multifaceted treatment approach.

Intensity of Therapy

Two meta-analyses concluded that greater intensity of therapy produces slightly better outcomes (Langhorne et al., 1996; Kwakkel et al., 1999). Langhorne et al. (1996) concluded, "More intensive physiotherapy input was associated with a reduction in the combined poor outcome of death or deterioration and may enhance the rate of recovery." Kwakkel et al. (1999) also reported a small but statistically significant intensity-effect relationship in the rehabilitation of stroke patients. The recent meta-analysis (Van der Lee & Snels, 2001) of trials studying exercise therapy for arm function concluded, "The difference in results between studies with and without contrast in the amount or duration of exercise therapy between groups suggests that more exercise therapy may be beneficial." In all the reviews, insufficient contrast in the amount of rehabilitation between experimental and control conditions, organizational setting of rehabilitation management, lack of blinding procedures, and heterogeneity of patient characteristics were major confounding factors.

Regarding general factors affecting the effectiveness of rehabilitation, Cifu & Stewart (1999) concluded that greater intensity of therapy services has "a weak relationship with improved functional outcome." Only the early meta-analysis by Ottenbacher & Jannel (1993) has a neutral conclusion: "The improvement in performance appears related to early initiation of treatment, but not to the duration of intervention."

Four trials addressed intensity of physiotherapy or general rehabilitation services. Smith et al. (1981) randomized 133 discharged patients among intensive, routine, and no outpatient therapy and found a dose-response relationship with greater intensity, producing better performance on an index of ADL. Sivenius et al. (1985) divided 95 patients into intensive and normal treatment groups. Functional recovery, measured by motor function and ADL, was slightly better in the intensive treatment group. Rapoport & Eerd (1989) found that adding weekend physiotherapy services reduced length of stay by comparing time periods during which five days per week or everyday therapy sessions were provided. Partridge et al. (2000) did not find any differences in functional and psychological scores at six weeks in 104 patients randomized between standard 30 minutes and 60 minutes of physiotherapy. Subgroup analyses suggested however, that some subgroups may benefit.

Four additional trials targeted more specific disabilities of extremity function or gait. Sunderland et al. (1992) assigned 132 consecutive stroke patients to routine or enhanced treatment for arm function, the latter including both increased duration and behavioral methods. At six months, the enhanced group showed a slight but statistically significant advantage, particularly for those patients with milder impairment. Richards et al. (1993) randomized 27 patients to intensive, gait-focused physical therapy; early, intensive, conventional therapy; and routine conventional therapy in a small pilot study. At six weeks gait velocity was better for the intensive, gait-focused group, but this advantage was not sustained at three and six months. Lincoln et al. (1999) randomized 282 patients with impaired arm function to routine physiotherapy, additional treatment by a qualified physiotherapist, or additional treatment by the physiotherapy assistant. There were no differences among the groups on outcome measures of arm function and ADL at baseline, five weeks, three months, or six months. Parry et al. (1999) performed subgroup analyses of the same study and noted that patients with severe impairment improved little, but patients with lesser impairment may have benefited. Kwakkel et al. (1999) randomized 101 middle-cerebral-artery (MCA) stroke patients with arm and leg impairment to additional arm training emphasis, leg training emphasis, or arm and leg immobilization, each treatment lasting 30 minutes, five days a week, for 20 weeks. At 20 weeks the leg training group scored better for ADL, walking, and dexterity than the control, while the arm training group scored better only for dexterity.

The clinical trials provide weak evidence for a dose response relationship of intensity to functional outcomes. Interpretation of these studies is limited because some patients may not be able to tolerate higher-than-normal levels of therapy. Other patients may not benefit because they do not belong to a subset of patients for whom benefit has

been demonstrated. Because of the heterogeneity of the studies, no specific guidelines regarding intensity or duration of treatment are justified.

EVIDENCE TABLE:

	Recommendation	Source	LE	QE	R
1	Medical team must analyze medical/functional status	Working Group Consensus	III		I
2	Determine optimal environment of care	Working Group Consensus	III		I
3	Early Supported Discharge for mildly impaired patients	Donnelly et al., 2004 Langhorne et al., 2005 Teasell et al., 2003 Anderson et al., 2002 Brady et al., 2005 Patel, et al., 2004 Askim, Morkved, et al., 2006 Bautz-Holtert, Sveen, 2002 Diserens, Michel, et al, 2006 Fjaertoft, Indredavik, et al., 2004	I	Good	B
4	Referral to a facility with an organized rehabilitation team, for patients with moderate or severe symptoms, or involvement of a rehabilitation specialist with some experience in stroke	Evans et al., 2001 Langhorne & Duncan, 2001 (SR)	I	Fair	B
6	Intensity of therapy	Kwakkel et al., 1999 Langhorne et al., 1996 Lincoln et al., 1999 Parry et al., 1999 Rapoport & Eerd, 1989 Richards et al., 1993 Sivenius et al., 1985 Smith et al., 1981 Sunderland et al., 1992 Van der Lee & Snels, 2001	I	Fair	B

LE = Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; § = Systematic Review (see Appendix A)

Annotation K. Discharge Patient from Rehabilitation

See Section 8 –Discharge

Annotation L. Arrange For Medical Follow-Up

See Section 8.1 – Follow-up

Annotation M. Post-Stroke Patient in Inpatient Rehabilitation

Inpatient rehabilitation is defined as rehabilitation performed during an inpatient stay in a free standing rehabilitation hospital or a rehabilitation unit of an acute care hospital. The term inpatient is also used to refer generically to programs where the patient is in residence during treatment, whether in an acute care hospital, a rehabilitation hospital, or a nursing facility.

Patients typically require continued inpatient services if they have significant functional deficits and medical and/or nursing needs that requires close medical supervision and 24 hour availability of nursing care. Inpatient care may be appropriate if the patient requires treatment by multiple other rehabilitation professionals (e.g, physical therapists, occupational therapists, speech language pathologists, and psychologists).

Annotation N. Educate Patient/Family; Reach Shared Decision Regarding Rehabilitation Program; Determine and Document Treatment Plan

7.3 Treatment Plan

OBJECTIVE

Assure the understanding of common goals among staff, family, and caregivers in the stroke rehabilitation process, and therefore, optimize the patient's functional recovery and community re-integration.

BACKGROUND

Fundamental education for patients, families, and caregivers is essential to the creation of realistic and appropriate goals. Goals are central to the process of rehabilitation because rehabilitation involves behavioral change (Wade, 1998). The use of patient goals that transcend treating disciplines is a common method of creating consistency in the delivery of rehabilitation services; however, not all rehabilitation settings subscribe to their use. The setting of goals is a mechanism for active patient involvement and cooptation of the patient into the "rehabilitation team." Goal setting should use both short-term and long-term perspectives.

RECOMMENDATIONS

1. Patients and/or their family members should be educated in order to make informed decisions and become good advocates.
2. The patient/family member's learning style must be assessed (through questioning or observation) and supplemental materials (including handouts) must be available when appropriate.
3. The following list includes topics that (at a minimum) must be addressed during a patient's rehabilitation program:
    a. Etiology of stroke
    b. Patient's diagnosis and any complications/co-morbidities
    c. Prognosis
    d. Expectations for what to expect during recovery and rehabilitation
    e. Secondary prevention
    f. Discharge plan
    g. Follow-up care including medications.
4. The clinical team and family/caregiver should reach a shared decision regarding the rehabilitation program.
5. The rehabilitation program should be guided by specific goals developed in consensus with the patient, family, and rehabilitation team.

6. Document the detailed treatment plan in the patient's record to provide integrated rehabilitation care.
7. The patient's family/caregiver should participate in the rehabilitation sessions, and should be trained to assist patient with functional activities, when needed.
8. As patients progress, additional important educational topics include subjects such as the resumption of driving, sexual activity, adjustment and adaptation to disability, patient rights/responsibilities, and support group information.

The treatment plan should include documentation of the following:

- Patient's strengths, impairments, and current level of functioning
- Psychosocial resources and needs, including caregiver capacity and availability
- Goals:
  - personal goals (e.g., I want to play baseball with my grandson)
  - functional goals (e.g., ADL, IADL, mobility)
  - short term and long term goals
- Strategies for achieving these goals including :
  - resources and disciplines required
  - estimations of time for goal achievement
  - educational needs for patient/family
- Plans and timeline for re-evaluation

DISCUSSION

Education

Patients who have had a stroke and their family members are faced with making many decisions regarding immediate medical care, short-term and long-term follow-up, prognosis and expectations for recovery, as well as their overall medical picture. As health care providers, faced with these situations on a daily basis, it is easy to become somewhat numbed to the impact that a stroke has upon and individual and a family. It is imperative to provide appropriate education and counseling to help patients and their family members/caregivers make informed decisions about their care and to assist them in adjusting to any new roles that are emerging.

Shared Decision Making

Ideally, the patient and family/caregiver should be actively engaged members of the rehabilitation team. As such, they should participate in decision-making in order to facilitate the setting of personally-relevant goals and individually realistic strategies for reaching them.

Goal of Therapy

The post-stroke rehabilitation guideline published by the AHCPR (1995) does not address whether or not goals should be set, but rather how goals should be used. There is insufficient evidence to evaluate the value of consensus goal development in stroke rehabilitation. However, it is best common practice to develop comprehensive goals that cover the level of disability and include psychosocial needs. The guideline recommends that: "Both short-term and longer term goals need to be realistic as relates to current levels of disability and the potential for recovery."

The use of goal setting as a targeted outcome and subsequent outcome measure (e.g., Goal Attainment Scaling) has exhibited positive results in several clinical trials involving geriatric rehabilitation, brain injury rehabilitation, and mixed rehabilitation patients (Joyce et al., 1994; Smith et al., 1998; Stolle et al., 1999).

Setting patient goals has multiple utilities. Goals should be realistic targets for use by the patient, family, and staff. They can also serve in the capacity of a "self-fulfilling prophecy." Goals can create an environment of treatment consistency among treating disciplines, serve as benchmarks for response and recovery, and provide a basis for team meetings.

Treatment Plan

The treatment plan is determined on an individual basis for each patient, taking into account the patient/family's discharge goals and needs. The patient and family ultimately determine their treatment plan and establish short term and long-term goals.

Annotation O. Initiate/Continue Rehabilitation Programs and Interventions

7.4 Treatment Interventions

RECOMMENDATIONS

1. Initiate/continue rehabilitation program and interventions indicated by patient status, impairment, function, activity level and participation.

See Section 9: Rehabilitation Interventions

Impairments

a. Dysphagia
b. Muscle Tone
c. Emotional, Behavioral
d. Cognitive
e. Communication
f. Motor
g. Sensory

Activity

a. ADL/IADL
b. Mobility
c. Sexuality
d. Fitness endurance

Support System

a. Psychosocial needs/resources
b. Family/Community Support
c. Caregiver

Annotation P. Reassess Progress, Future Needs and Risks. Refer/Consult Rehabilitation Team

7.5 Assessment of Progress and Adherence

OBJECTIVE

Evaluate progress toward the common goals of patient, family, and staff, and care-givers using both formal and informal measures as indicated. Continue or modify treatment plans and goals based upon these assessments.

BACKGROUND

It is important to continue to monitor a patient as he/she participates in rehabilitation. The frequency of re-evaluation is often determined by the policy of the institution and/or setting in which services are provided. However, in the absence of such a scheduled re-evaluation, it is important to periodically reassess the patient, particularly when there is some change of status. Goals may be met or require modification. Patients may improve and be ready for discharge from rehabilitation services. In some cases, patients may improve to a level where new goals become apparent (e.g. improving to a level in which returning to work may be a possibility thus altering therapy needs). A patient's functional status may deteriorate or a patient may have stabilized functionally but fall short of the anticipated goals. In these situations, re-evaluation provides an opportunity for education, repeated psychosocial evaluation, and community resource needs re-assessment.

RECOMMENDATIONS

1. Patients should be re-evaluated intermittently during their rehabilitation progress. Particular attention should be paid to interval change and progress towards stated goals.
2. Patients who show a decline in functional status may no longer be candidates for rehabilitation interventions. Considerations about the etiology of the decline and its prognosis can help guide decisions about when/if further rehabilitation evaluation should occur.
3. Psychosocial status and community integration needs should be re-assessed, particularly for patients who've experienced a functional decline or reached a plateau.

DISCUSSION

Triggers for an additional or "unscheduled" rehabilitation re-evaluation can include:

- Change in medical status
- Change in social situation
- Change in rehabilitation setting
- Change in goals

Assessments may include both formal and informal measures. When available, collaborative information from families and caregivers is often helpful.

Goals should be re-evaluated periodically for attainability, appropriateness, and relevance. Documentation of attained and met goals should be made. At this point, some patients may present with new goals and others may be ready for discharge from rehabilitation services.

Patients who are improving and for whom further improvement is expected should continue their rehabilitation program.

Patients for whom no further improvement is expected (i.e. those who've reached a 'plateau') should be educated about their role in maintaining the current level of function (e.g. home exercise program).

Some patients may show a decline in functional status. The etiology(ies) of this decline should be sought and may include

- Recurrent stroke
- Medical complications/co-morbidities

- Mental health complications/co-morbidities
- Change in social situation

Annotation Q. Is Patient Ready for Community Living?

7.6 Transfer to Community Living

OBJECTIVE

Determine if patient is ready for discharge to a community setting.

BACKGROUND

Successful transition from inpatient care to the community requires careful assessment of the match between patient needs and the availability of formal and informal resources and support systems. The degree of impairment the patient has when discharged and the amount of family support that is available and capable of meeting the patients' needs directly impacts the degree of success of the transition back to the community. Systematic and thorough discharge planning which takes into account the needs of both the patient and the caregiver is key to successful transition and re-adjustment to community living.

Many individuals with stroke experience limitations in the ability to complete basic self care, such as bathing and dressing even long after rehabilitation. Such disability may prevent return to community living, contributes to reduced participation, and adds to caregiver strain.

RECOMMENDATIONS

1. Recommend that all patients planning to return to independent community living should be assessed for mobility, ADL and IADL prior to discharge (including a community skills evaluation and home assessment).
2. Recommend that the patient, family, and caregivers are fully informed about, prepared for, and involved in all aspects of healthcare and safety needs. [I]
3. Recommend that case management be put in place for complex patient and family situations. [I]
4. Recommend that acute care hospitals and rehabilitation facilities maintain up-to-date inventories of community resources, provide this information to stroke patients and their families and caregivers, and offer assistance in obtaining needed services. Patients should be given information about, and offered contact with, appropriate local statutory and voluntary agencies. [I]

DISCUSSION

Discharge planning should begin immediately when the patient is admitted to the inpatient facility and involve the patient, family, primary care provider, social services and rehabilitation team.

A patient is ready for discharge from an inpatient setting when:

- He/she has no skilled nursing needs or, if needs are present (e.g. wound care), can be met by caregiver or community support services
- Does not require regular physician care
- Has an environment available that is supportive of, or can be modified to, support the individual's specific functional deficits.
- Is functionally independent, or if requires some assistance, can be assisted by family or caregiver
- If additional rehabilitation services are required, they are available and accessible in the community

Successful performance of complex activities of instrumental activities of daily living (IADL) tasks (i.e., cooking,

cleaning, shopping, and housekeeping) requires higher-level neurophysiological organization than is required for performance of self-maintenance tasks (i.e., bathing and dressing) and individuals with stroke show often even greater limitations in their ability to complete IADLs than ADLs. For a patient planning to return to an assisted living situation, further independence may not be required or expected. For many patients, however, IADLs are central to independent living. Cognitive functioning and comprehension are also factors for independent living.

Minimal IADL skills required to stay at home alone include the ability to: (1) prepare or retrieve a simple meal, (2) employ safety precautions and exhibit good judgment, (3) take medication, and (4) get emergency aid, if needed. Refer to Table 1: Section 9: Intervention -ADL/IADL as a guide to differentiate between ADL and IADL.

EVIDENCE

	Recommendation	Sources	LE	QE	R
1	Assess prior to discharge for mobility, ADL, IADL, community skills and home assessment	Working Group Consensus	III	Poor	I
2	Patient and family/caregiver: Education and information	Working Group Consensus	III	Poor	I
3	Assign case management in complex situations.	Working Group Consensus	III	Poor	I
4	Maintain resource listing	Working Group Consensus	III	Poor	I

LE = Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; (see Appendix A)

7.7 Function/Social Support

BACKGROUND

Stroke is a family illness. In the aftermath of stroke, roles and responsibilities among the patient, family caregivers, and other family members often have to be re-negotiated. Family caregivers often become overwhelmed by the added responsibilities and role changes. These changes can lead to post-stroke co-morbidities and safety issues for both patients and caregivers. Upon discharge the patient and family lose the intensive support and services that they relied upon while the patient was in rehabilitation. Stroke patients and family caregivers often need long-term practical, emotional, psychosocial, and financial information and support to manage long-term stroke-related problems.

RECOMMENDATIONS

1. Patients and family caregivers should have their individual psychosocial and support needs reviewed on a regular basis post-discharge.
2. Referrals to family counseling should be offered. Counseling should focus on psychosocial and emotional issues and role adjustment.
3. Caregivers should be screened for high levels of burden and counseled in problem solving and adaptation skills as needed.
4. Caregivers and patients should be screened for depressive symptoms and referred to appropriate treatment resources as needed.
5. Health and social services professionals should ensure that patients and their families have information about the community resources available specific to these needs.
6. Provide advocacy and outreach to patients and families living in the community to help them adapt to changes and access community resources.

7.8 Recreational and leisure Activity

BACKGROUND

Individuals with stroke can reduce involvement in physical activity and leisure pursuits. The body function impairments experienced as a result of stroke may make it difficult or impossible to engage independently in physical activity and previous leisure pursuits. Minimal physical activity is a health risk and engagement in leisure activities is necessary for a healthy quality of life.

RECOMMENDATIONS

1. Recommend that leisure activities should be identified and encouraged and the patient enabled to participate in these activities. [I]
2. Therapy for individuals with stroke should include the development of problem solving skills for overcoming the barriers to engagement in physical activity and leisure pursuits.
3. Individuals with stroke and their caregivers should be provided with a list of resources for engaging in aerobic and leisure activities in the community prior to discharge
4. Recommend that the patient participates in a regular strengthening and aerobic exercise program at home or in an appropriate community program that is designed with consideration of the patient's co-morbidities and functional limitations. (See Intervention – Physical Activity) [B]

DISCUSSION

Participation in leisure activities is closely related to both health status and quality of life (Drummond, 1990; Jongbloed & Morgan, 1991; Krefting & Krefting, 1991; Shank, 1992; Sjogren, 1982). Interest in leisure and recreational activities may provide motivation to resume an active life. Muscle weakness and decreased endurance are common impairments following stroke and may persist after completion of formal rehabilitation. Stroke patients can make improvements in strength and endurance after formal rehabilitation is completed, which may improve function and decrease risk of further disease and disability.

EVIDENCE

	Recommendation	Sources	LE	QE	SR
1	Patient and family/caregiver: Encourage leisure activities	Working Group Consensus	III	Poor	I

LE = Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; (see Appendix A)

7.9 Return to Work

BACKGROUND

The AHCPR (1995) states, "Stroke survivors who worked prior to their strokes should, if their condition permits, be encouraged to be evaluated for the potential to return to work. Vocational counseling should be offered when appropriate." A meeting report by the American Stroke Association's 26th International Stroke Conference (2001) stated, "…the risk of stroke increases dramatically with age and the average age of workers is increasing." Because of the Social Security Administration's change in mandatory retirement age "…more people will be working at the time of stroke and as more treatments are developed, more survivors will be facing the possibility of re-employment."

RECOMMENDATIONS

1. Recommend that all patients, if interested and their condition permits, be evaluated for the potential of returning to work. [C]
2. Recommend that all patients who were previously employed, be referred to vocational counseling for assistance in returning to work. [C]

3. Recommend that all patients who are considering a return to work, but who may have psychosocial barriers (e.g. motivation, emotional, and psychological concerns) be referred for supportive services, such as vocational counseling or psychological services. [C]

DISCUSSION

There are many barriers to vocational reintegration that must be addressed if the stoke patient is to return to work. The type of work to which the patient is considering returning may be the single most significant determinant to successful reemployment. Re-training, or returning to school for alternative employment, requires a high level of motivation. Studies have indicated that successful reemployment may be dependent on support from family, return to work specialists, and employers.

EVIDENCE

	Recommendation	Sources	LE	QE	SR
1	Evaluate for the potential of returning to work	AHCPR, 1995	III	Poor	C
2	Refer previously employed patients to vocational counseling	AHCPR, 1995 American Stroke Association	III	Poor	C
3	Refer patients with psychosocial barriers who are considering returning to work to supportive services	AHCPR, 1995 American Stroke Association	III	Poor	C

LE = Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; (see Appendix A)

7.10 Return to Driving

BACKGROUND

The question of if, or when, a person can resume driving after a stroke can be difficult to answer. The family and medical staff will need to balance the patient's desire for independence with safety concerns. Safe operation of a vehicle requires multi-level functions (e.g., physical, cognitive, psycho-motor, perceptual-motor, and behavioral). Legal requirements vary from state to state.

RECOMMENDATIONS

1. Recommend all patients be given a clinical assessment of their physical, cognitive, and behavioral functions to determine their readiness to resume driving. In individual cases, where concerns are identified by the family or medical staff, the patient should be required to pass the state road test as administered by the licensing department. Each medical facility should be familiar with their state laws regarding driving after a stroke. [I]
2. Consider referring patients with residual deficits to adaptive driving instruction programs to minimize the deficits, eliminate safety concerns, and optimize the chances that the patient will be able to pass the state driving test. [I]

DISCUSSION

There are no incidence rates for motor vehicle accidents for post-stroke patients as a group. However, since most stoke patients are also older drivers, they should be considered at greater risk for motor vehicle accidents since older drivers (without stroke) are involved in more fatal motor vehicle accidents per miles driven (National Highway Safety and Traffic Administration [NHSTA]). Many factors contribute to this statistic; therefore, caution should be exercised not to over generalize. Currently there is only mild to moderate correlation of clinical exams to the pass/failure rate of post-stroke patients on state driving road tests.

EVIDENCE

	Recommendation	Sources	LE	QE	SR
1	Clinical assessment of the patient's physical, cognitive and behavioral functions to determine readiness for return to driving	Working Group Consensus	III	Poor	I
2	Referral to an adaptive driving program for individuals with residual deficits	Working Group Consensus	III	Poor	I

LE = Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; (see Appendix A)

7.11 Sexual Function

BACKGROUND

Sexual issues relate both to sexual function and to changes in body image as a result of the stroke. Sexual activity usually diminishes and sometimes ceases after stroke, but sex remains an important issue to the majority of post-stroke patients. Sexual issues are often not adequately addressed, despite evidence that patients and their partners welcome frank discussions.

RECOMMENDATIONS

1. Sexual issues should be discussed during rehabilitation and addressed again after transition to the community when the post-stroke patient and partner are ready.

DISCUSSION

The most important message is that sexual activity is not contraindicated after stroke. However, both parties need to recognize and adjust for the potential effects of motor, sensory, and self-esteem difficulties. Interventions that stress the importance of effective communication, sharing of concerns, and development of adaptive strategies to avoid fatigue, such as positioning, foreplay, and timing, are often helpful.

Annotation R. Address Adherence to Treatments and Barriers to Improvement:
If Medically Unstable, Refer to Acute Services
If There Are Mental Health Factors, Refer to Mental Health Services

BACKGROUND

During the rehabilitation process, patients will occasionally experience unexpected barriers to their continued progress or to their ability to adhere to the treatment plan. These include medical complications and mental health factors that make it difficult to participate/adhere to treatment goals. Lack of or incorrect information about diagnosis, prognosis, treatment rationale, and need for behavioral change may also become barriers to improvement.

RECOMMENDATIONS

1. When an encountered barrier, such as a medical illness, makes participation difficult, referral to the appropriate service for treatment is warranted.
2. When the issue is related to mental health factors, assessment of these factors by a psychiatrist/psychologist and intervention/treatment is appropriate.

DISCUSSION

Most often, assessment and treatment of medical complications can occur in the rehabilitation setting and will not require a transfer to another service. Once the barriers have been successfully addressed, re-examination of treatment goals may be helpful.

Psychosocial status and community integration needs should be re-assessed, particularly for patients who have experienced a functional decline or reached a plateau. Reassessment following a change in psychosocial status may result in new rehabilitation needs and goals. For example, a caregiver returns to work or the family moves from one home to another: now, the patient may need new strategies for managing toileting or a mid-day meal, accessing transportation, and getting around in a new environment. Assessments may include both formal and informal measures, and collaborative information from family and caregivers is often helpful.

8 DISCHARGE FROM REHABILITATION

Annotation K. Discharge Patient from Rehabilitation

OBJECTIVE

Ensure that the patient's medical and functional needs are addressed after discharge from rehabilitation services.

RECOMMENDATIONS

1. Recommend that the rehabilitation team ensure that a discharge plan is complete for the patient's continued medical and functional needs prior to discharge from rehabilitation services.
2. Recommend that every patient participate in a secondary prevention program (see Annotation D). [A]
3. Recommend post-acute stroke patients be followed by a primary care provider to address stroke risk factors and continue treatment of co-morbidities.
4. Recommend patient and family are educated regarding pertinent risk factors for stroke.
5. Recommend that the family and caregivers receive all necessary equipment and training prior to discharge from rehabilitation services. [I]
6. Family counseling focusing on psychosocial and emotional issues and role adjustment should be encouraged and made available to patients and their family members upon discharge.

DISCUSSION

The time of discharge from inpatient care to home (or to residential living or nursing home) constitutes an important watershed. Living with disabilities after a stroke is a lifelong challenge during which people continue to seek and find ways to compensate for or adapt to persisting neurological deficits. For many stroke patients and their families, the real work of recovery begins after formal rehabilitation.

The first few weeks after discharge from an inpatient stay following a stroke are difficult as the patient attempts to use newly learned skills without the support of the rehabilitation environment or team. The full impact of the stroke may not become apparent until the patient has been home a few weeks and tries to continue with his/her life. Adequate support from family and caregivers is critical to a successful outcome. It is also important to assure that all necessary equipment and support services are in place.

Patients who receive rehabilitation services require follow-up with their primary care provider within one month of discharge. They also require follow-up with the rehabilitation professional at a point in time 3 to 6 months after discharge.

Evans et al. (1995) after noting that rehabilitation services are effective in improving short-term survival, functional ability, and the most independent discharge location, have suggested that "the lack of long-term benefits of short-

term rehabilitation may suggest that therapy should be extended to home or sub-acute care settings, rather than being discontinued at discharge. These services should be organized and in place at the time of discharge."

Caregiving can be extremely taxing, both physically and emotionally. Adverse health effects on caregivers include increased risk of depression (Blazer et al., 1987; Kramer et al., 1985; Lichtenberg & Barth, 1990; Schultz et al., 1990), increased use of health services, and the self-administration of medications prescribed originally for the stroke patient (Lichtenberg & Gibbons, 1992). Depression has been associated with physical abuse of the patient (Joslin et al., 1991) and a greater likelihood of nursing home placement (Stephens et al., 1991). Clinicians need to be sensitive to the potential adverse effects of care giving on family functioning and the health of the caregiver. Opportunities for respites may be extremely important. Clinicians should work with the patient and caregivers to avoid negative effects, promote problem solving, and facilitate reintegration of the patient into valued family and social roles. Preexisting organizational and functional characteristics of the family may have important effects on a successful transition to community living. A caregiver is more likely to give adequate support if he/she is a spouse who is knowledgeable about stroke and its disabilities, is not depressed, and lives in an otherwise well-functioning family unit (Evans et al., 1992).

Community supports can help buffer the effects of disabilities on the patient, family and caregivers. Educational support can be provided through printed materials, videos, computer programs, information on support groups etc. The availability of emotional support and physical services such as homemaker home health, Meals-on-Wheels, devices (e.g., ramps), and equipment may also be crucial to a successful outcome.

EVIDENCE

	Recommendation	Sources	QE	Overall Quality	R
1	Patient and family/caregiver: Education and information Equipment and training	Working Group Consensus	III	Poor	I
1	Secondary prevention program	See Annotation D	I	Good	A

LE = Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; § = Systematic Review (see Appendix A)

Annotation L. Arrange For Medical Follow-Up

8.1 Long-Term Management

BACKGROUND

For many stroke patients and their caregivers, access to community resources and formal support services post-stroke is limited and for those living in rural areas, may not exist. Telephone, telehealth, and web-based support services can provide important links to primary care providers, specialty care, and other services, for patients and their family caregivers who are unable to travel to a facility for care. These technologies can be used for distance counseling, problem solving, and educational sessions; transmission of critical data, such as blood pressure, pulse, and weight readings and International Normalized Ration (INR) values; and for providing in-home tele-rehabilitation. While much of the current technology provides an asynchronous connection, technology that provides real-time video encounters with a health care professional is an option that many patients and caregivers may prefer.

Following a stroke, patients are at increased risk for additional cerebrovascular events. Specific therapy and risk factor reduction must be an integral part of any plan for stroke rehabilitation and recovery. The need for secondary prevention of stroke is life-long, and continues beyond the period of rehabilitation. (See AHA Guideline for Secondary Prevention, 2009)

RECOMMENDATIONS

1. Recommend post-discharge telephone follow-up with patients and caregivers be initiated and include problem solving and educational information.
2. If available, asynchronous and real-time tele-health, video, and web-based technologies, (e.g., web-based support groups, tele-rehabilitation), should be considered for patients who are unable to travel into the facility for care and services.

Follow-up

3. Ongoing monitoring of anticoagulant or antiplatelet therapy, treatment of hypertension and hypercholesterolemia, and other secondary prevention strategies are lifelong needs of patients after stroke and should normally be performed by the patient's primary healthcare provider.
4. Recommend post-acute stroke patients be followed up by a primary care provider to address stroke risk factors and continue treatment of co-morbidities.
5. Patient and family should be educated regarding pertinent risk factors for stroke.
6. Provide patient information about, and access to community based resources.

DISCUSSION

Patients who do not require any additional rehabilitation services and are discharged to home (or in the case of profoundly disabled patients, to a nursing home), require follow-up with their primary care provider within one month of discharge.

Patients who receive rehabilitation services also require follow-up with the rehabilitation professional at a point in time 3 to 6 months after discharge.

TREATMENT INTERVENTION
for REHABILITATION OF STROKE

REHABILITATION INTERVENTION

This section includes recommendations for intervention and treatment that address possible impairments in patients recovering from stroke. In general, patients should receive the intensity and duration of clinically relevant therapy defined in their individualized rehabilitation plan and appropriate to their needs and tolerance levels. All patients with stroke should begin rehabilitation therapy as early as possible once medical stability is reached. The rehabilitation interventions described in this section should apply regardless of the specific rehabilitation setting and may be applicable during inpatient as well as after discharge and follow-up in community outpatient rehabilitation.

9 DYSPHAGIA MANAGEMENT

BACKGROUND

The management goals of dysphagia in the stroke patient are prevention of aspiration, malnutrition, and dehydration and restoration of normal swallow. Therapeutic management or intervention concerning the method of nutritional intake should be based on the physiologic findings of the dynamic instrumental assessment. Treatment is compensatory or rehabilitative in nature and focuses on pathophysiology identified during dynamic assessment. Compensatory strategies provide immediate benefit through the elimination of symptoms. Compensatory strategies involve various postural changes to facilitate safe swallowing or modifying volume and viscosity of food and fluids which alter swallowing biomechanics and physiology. Rehabilitative strategies focus on changing swallowing physiology. Rehabilitative therapy techniques can be direct (performed during the swallow) or indirect (performed without a bolus) and include swallowing maneuvers designed to exert voluntary control over specific components of the swallow, physiotherapeutic exercise, or utilization of thermal-tactile application to improve motor or sensory functioning. Compensatory strategies may be combined with swallowing maneuvers to facilitate return to oral intake.

Comprehensive evaluation and discussion of risks and benefits of enteral feeding should be conducted to guide patient, family, and team decision-making process and support. Standardized diets and diet terminology should be utilized.

RECOMMENDATIONS

1. An oral care protocol should be implemented for patients with dysphagia and dentures to promote oral health and patient comfort.
2. Patients with persistent dysphagia should be offered an individualized treatment program guided by a dynamic instrumental swallowing assessment. The treatment program may include:
    a. Modification of food texture and fluids to address swallowing on an individual basis
    b. Education regarding swallowing postures and maneuvers on an individual basis following instrumental assessment to verify the treatment effect
    c. Addressing appropriate method of medication administration for patients with evidence of pill dysphagia on clinical or instrumental assessment
    d. Training patients and care givers, in feeding techniques and the use of thickening agents
    e. Patients with chronic oropharyngeal dysphagia should be seen for regular reassessment to ensure effectiveness and appropriateness of long-standing diet, continued need for compensations, and/or modification of rehabilitative techniques.

DISCUSSION

Stroke that is affecting the hemisphere with the dominant swallowing projection results in dysphagia. The recovery has been correlated with compensatory changes in the previously non-dominant, unaffected hemisphere. This asymmetric bilaterality may explain why up to half of stroke patients are dysphagic and why many will regain a safe swallow over a comparatively short period. The rehabilitation treatment program should be individualized (Singh and Hamdy, 2005).

Examination of treatment strategies by x-ray can impact diet and recovery from dysphagia. About 83 percent of patients in VFSS may receive changes in at least one of five important clinical variables: referrals to other specialists, swallowing therapy, compensatory strategies that improve swallowing, changes in mode of nutritional intake, and diet (Martin-Harris et al., 2000).

A systematic review of two RCTs found there was inconclusive evidence for the effectiveness of direct methods (Bath, 1999). A study by Elmstahl (1999) found that the use of swallowing therapy (including direct and indirect methods) resulted in improved swallowing functions and improved nutritional conditions.

Exercise that collectively recruited the supra-hyoid, infra-hyoid and sternocleidomastoid muscles had a positive effect for people with specific dysphagia (Shaker, 2002).

Electrical stimulation and thermal tactile stimulation reduced the severity of swallow impairment (Freed, 2001; Leelamanit, 2002). Possible contraindications to this therapy must be assessed (e.g., pregnant, presence of pacemaker) and only be considered by providers experienced with this intervention and applied according to published parameters.

There are no quality studies evaluating the intensity and frequency of dysphagia therapy. A systematic review of clinical trials concluded that "despite the newly published RCTs, few utilize the same treatment and outcomes thereby limiting the evidence to support the medical effectiveness of common dysphagia treatments used for patients recovering from stroke" (Foley, 2008).

The EBSRS (2009) summary of evidence concluded, "There is moderate evidence that a short course (two weeks) of formal dysphagia therapy does not improve clinical outcomes. There is moderate evidence that a one-month dysphagia intervention program does not improve the likelihood of returning to a normal diet by six months. However, there is also moderate evidence that such a program may reduce the likelihood of chest infections and death or institutionalization. There is consensus opinion that if dysphagia is severe and expected to last more than 6 weeks, a gastrostomy or jejunostomy feeding tube may be indicated."

10 NUTRITION MANAGEMENT

BACKGROUND

Malnutrition is a relatively common problem post stroke because patients' intake of calories and protein is low following stroke. The major effect on the gastrointestinal tract following stroke is impairment of oral, pharyngeal and esophageal functions, manifested as dysphagia. The nutritional status following stroke can have an impact on functional recovery and mortality. Poor nutrition has been found to predict lower functional status following stroke.

Patients with dysphagia after stroke should be provided with an appropriate modified diet, after consultation with a dietitian and considered for alternative feeding using feeding tubes. Oral supplementation may be considered for patients who are safe with oral intake, but do not receive sufficient quantities to meet their nutritional requirements. (See Section 9 – Dysphagia)

RECOMMENDATIONS

1. The nutritional and hydration status of stroke patients should be assessed within the first 48 hours of admission.
2. Stroke patients with suspected nutritional and/or hydration deficits, including dysphagia, should be referred to a dietitian.
3. Consider the use of feeding tubes to prevent or reverse the effects of malnutrition in patients who are unable to safely eat and those who may be unwilling to eat.
4. Oral supplementation may be considered for patients who are safe with oral intake, but do not receive sufficient quantities to meet their nutritional requirements.

DISUCSSION

Finestone et al., (2003) found that stroke patients may be particularly vulnerable to protein-energy malnutrition due to a variety of factors that affect their willingness or ability to self-feed, such as loss of appetite associated with depression, cognitive deficits, dysphagia (difficulty swallowing), visual neglect, upper extremity paresis, and apraxia (an inability to use objects correctly) The Post-Stroke Rehabilitation Outcomes Project (James et al., 2005), studied

the outcomes of 919 patients from six inpatient rehabilitation sites and demonstrated that tube feeding is an effective intervention. Patients with both moderate and severe stroke who had received tube feeding during hospital stay but who were not discharged with a feeding tube in place achieved greater increases in total FIM gains and experienced greater improvement in severity of illness by the time of discharge.

The FOOD trial (Teasell and Foley, 2005) was a randomized control trial evaluating 3 distinct nutritional interventions. 859 acute stroke patients with dysphagia were randomized to receive early enteral feeding vs. delayed. The outcome of death or disability was evaluated at 6 months. Early tube feeding was associated with an absolute reduction in risk of death of 5.8% (95% CI -0.8 to 12.5, p=0.09) and a reduction in death or poor outcome of 1.2% (-4.2 to 6.6, p=0.7). Most results however were not statistically significant. The group of patients with dysphagia in this trial (n-321) was randomized to receive a nasogastric (NG) tube or a percutaneous endoscopic gastrostomy (PEG) tube for enteral feeding. PEG feeding was associated with an absolute increase in risk of death of 1.0% (-10.0 to 11.9, p=0.9) and an increased risk of death or poor outcome of 7.8% (0.0 to 15.5, p=0.05).

EBRSR (2009) conclusion regarding the use of enteric feeding tubes is that there is strong evidence that intragastric feeding is associated with fewer mechanical complications compared to nasogastric feeding for stroke patients who require long term (>28 days) non-oral feeding.

Oral supplementation was evaluated in one branch of the FOOD study. Acute stroke patients without dysphagia (n=4,023) were randomized to receive an oral nutritional supplement (540 Kcals) in addition to a hospital diet, provided for the duration of their entire hospital stay. The outcome of death or disability was evaluated at 6 months. Supplemented diet was associated with an absolute reduction in risk of death of 0.7% (95% CI -1.4 to 2.7) and an increased risk of death or poor outcome of 0.7% (-2.3 to 3.8). The result was compatible with a 1% or 2% absolute benefit or harm from oral supplements.

Rabadi et al. (2008) conducted a randomized trial of 102 stroke patients admitted for inpatient rehabilitation who had lost 2.5% of their pre-stroke weight during the acute admission period. Subjects were randomized to receive a either a regular supplement (381 Kcals, 15g protein) or intensive supplement (720 Kcals, 33g protein) daily throughout their hospital stay. The results showed that patients receiving intensive nutritional supplementation improved more than those on standard nutritional supplements on measures of motor function (total FIM, FIM motor subscore, 2-minute and 6-minute timed walk tests, were all significant ($p < 0.002$). The difference in FIM change scores was 31.5 (intensive group) vs. 22.9 (regular group). They did not, however, improve on measures of cognition (FIM cognition score). A higher proportion of patients who received the intensive nutritional supplementation went home compared to those on standard supplementation (43% vs. 63%, $p = 0.05$).

In pooled analyses of the results of 4 trials, EBRSR conclusion was that Oral supplementation in patient post stroke improves energy and protein intake although it may not necessarily improve functional outcomes.

11 COGNITIVE REHABILITATION

11.1 Non-Drug Therapies for Cognitive Impairment

BACKGROUND

Impairments in cognitive functioning are common following a stroke. In particular, impairments in attention, memory, and executive functioning (i.e., integrating multiple and complex processes) can be especially disabling. The treatment of cognitive deficits through cognitive remediation designed to reduce deficits can be approached in a variety of ways. Cicerone and colleagues (2005) completed a comprehensive review of the evidence-based literature for cognitive remediation for both traumatic brain injury (TBI) and stroke. The review revealed a large number of RCTs in a variety of areas of cognitive functioning and provided comprehensive guidelines for cognitive rehabilitation specific to these populations. There is support for cognitive remediation of deficits in both the acute and post-acute phases of recovery from stroke and TBI, although some of the improvements were relatively small and task specific. Some benefits were specific to the TBI population, although it seems reasonable to extend some of these results to the stroke population.

RECOMMENDATIONS

1. Recommend that patients be given cognitive re-training, if any of the following conditions are present:
    a. Attention deficits [A]
    b. Visual neglect [B]
    c. Memory deficits [B]
    d. Executive function and problem-solving difficulties [C]
2. Patients with multiple areas of cognitive impairment may benefit from a variety of cognitive re-training approaches that may involve multiple disciplines. [C]
3. Recommend the use of training to develop compensatory strategies for memory deficits in post-stroke patients who have mild short term memory deficits. [B]

DISCUSSION

Two RCTs and two Level II studies demonstrated improved attention in post-acute stroke rehabilitation patients through utilization of a variety of treatment approaches with differing levels of complexity and response demands. The interaction and monitoring of activities by therapists were also considered important aspects of these treatments. The results seen were fairly small and task specific and the ability to generalize these to stroke patients is unclear. There was insufficient evidence to distinguish between spontaneous recovery and interventions in moderate to severe patients in the acute recovery phase.

Evidence from six Level I studies and eight Level II studies exists to support the utilization of visual spatial rehabilitation for visual neglect after a right CVA.

Four RCTs utilizing TBI patients demonstrated some benefit for memory functioning. Three of these studies reported an increase in memory function based on neuropsychological measures and decreased subjective complaints of memory. The fourth study showed similar benefits when patients were stratified by severity of initial memory impairments. The use of training to develop compensatory strategies for memory deficits has been found beneficial in stroke patients who have mild impairments and who are fairly independent in daily function, actively involved in identifying their memory problems, and are capable and motivated to incorporate use of the strategy. No data specifically utilizing stroke patients was identified.

A Cochrane review (Cicerone et al., 2005) with one RCT (n=12) showed no significant improvement for memory functioning or subjective memory complaints.

Three studies with various non-RTC designs and relatively small sample sizes (n=43) looked at executive functioning in stroke and TBI patients. Benefit from formal problem-solving strategies and the ability to apply these strategies to everyday situations and functional activities was found for patients with executive function and problem-solving dysfunction. There is some evidence that the promotion of awareness and self-regulation through verbal instruction, questioning and monitoring can improve problem-solving skills.

EVIDENCE TABLE

	Recommendation	Sources	LE	QE	SR
1	Use of training to improve attention in post-acute stroke	Cicerone et al., 2005 Gray et al., 1992 Nieman et al., 1990 Sohlberg et al., 1987 Strache, 1987	I I I II II	Good	A
2	Use of training to compensate for visual neglect following a right CVA	Cicerone et al., 2005	I	Good	B
3	Use of training to develop compensatory strategies for a mild short-term memory deficit	Cicerone et al., 2005 Ryan & Ruff, 1988	I	Good	B
4	Use of formal problem solving strategies	Cicerone et al., 2005	II	Fair	C
5	Multimodal intervention for multiple cognitive deficits	Cicerone et al., 2005	III	Fair	C

LE=Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; §=Systematic Review (see Appendix A)

11.2 Use of Drugs to Improve Cognitive Impairment

BACKGROUND

Vascular cognitive impairment affects up to 60% of stroke survivors and is associated with decreased function, increased dependence and higher mortality. Post-stroke dementia is estimated to occur in 26% of stroke patients (Black, 2007). Patients with vascular cognitive impairment may benefit from the same pharmacologic interventions used in Alzheimer's disease. Further study is needed before definitive recommendations can be made.

Evidence no longer supports the use of central nervous system stimulants to improve participation in stroke rehabilitation or to enhance motor recovery.

While undergoing rehabilitation for stroke, patients may receive a variety of medications to treat complications of the stroke or other unrelated medical conditions. Medications that cross the blood brain barrier and have central nervous system effects may have potentially deleterious or beneficial effects on stroke recovery and should be used with caution.

RECOMMENDATIONS

1. Consider using acetylcholinesterase inhibitors (AChEIs), specifically galantamine, donepezil, and rivastigmine, in patients with vascular dementia or vascular cognitive impairment in the doses and frequency used for Alzheimer's disease.
2. Consider using the NMDA receptor inhibitor memantine (Namenda) for patients with vascular dementia (VaD) or vascular cognitive impairment (VCI). [B]
3. The use of conventional or atypical antipsychotics for dementia-related psychosis or behavioral disturbance should be used with caution for short term, acute changes.
4. Recommend against centrally acting a2-adrenergic receptor agonists (such as clonidine and others) and a1-receptor antagonists (such as prazosin and others) as antihypertensive medications for stroke patients because of their potential to impair recovery. [D]
5. Recommend against the use of amphetamines to enhance motor recovery following stroke. [D]

DISCUSSION

Vascular dementia (VaD) is an impairment of memory and other cognitive domains in patients with ischemic cerebrovascular disease. VaD is the second most common dementia, following Alzheimer's disease; and the combination of Alzheimer's and cerebrovascular disease is the most common neuropathologic finding in population

autopsy studies (Black, 2007)

11.2.1 Cholinesterase Inhibitors

AChEIs include galantamine (Razadyne), donepezil (Aricept), and rivastigmine (Exelon). The evidence support for the use of AChEIs in VaD and VCI is much less robust than for Alzheimer's disease, nevertheless, modest benefits seem to accrue in patients with VaD and vascular cognitive impairment (VCI) (Craig & Birks, 2005). Long term studies have not been done, with most trials lasting 24 to 28 weeks. The memantine benefit appears to accrue from worsening of the control group. Galantamine, a reversible, competitive acetylcholinesteraseinhibitor (AChEI), is approved for the treatment of mild-to-moderate Alzheimer disease (AD).

11.2.2 NMDA Receptor Inhibitor Memantine

Numerous good quality studies have examined the effects of amphetamine on motor recovery following stroke (Martinsson, 2003; Platz, 2005; Sonde, 2007; Treig, 2003). Overall, there did not appear to be a significant treatment effect, despite positive animal studies and a physiologically based mechanism of action.

Limited data support the use of other neurotransmitter-releasing agents to promote stroke recovery, including methylphenidate (Grade et al., 1998), levodopa (Scheidtmann et al., 2001) and norepinephrine precursor L-threo-3,4-dihydroxyphenylserine [L-DOPS] (Nishino et al., 2001).

The Cochrane Review evaluated pharmacological treatment following stroke with aphasia (Greener et al., 2001). A total of 10 trials were identified as suitable for review. The drugs reviewed included piracetam, bifemalane, piribedil, bromocriptine, idebenone, and Dextran-40. Weak evidence supported piracetam, a drug currently not available in the United States, for use in aphasia recovery. Insufficient safety data and the lack of adequately designed clinical trials to fully evaluate the efficacy of the listed pharmaceutical agents were noted. Dextroamphetamine in a recent trial was tested in a small, randomized trial in aphasia not evaluated in the Cochrane review (Walker-Batson et al., 2001). The drug was beneficial for aphasic patients, but the beneficial effects did not appear to be sustained at six months. There is insufficient data on optimal dosing and safety precludes routine use of these medications for aphasia.

In retrospective analyses of data collected during stroke clinical trials (Goldstein, 1995; Troisi et al., 2002), CNS depressants such as neuroleptics, barbiturates, benzodiazepines, and anticonvulsants have been associated with poorer outcomes. In the human studies, it is difficult to separate cause and effect, since the conditions treated by these medications, when occurring after stroke, may themselves be associated with more severe brain injury and worse outcome. In the absence of additional data, clinicians should limit the use of these medications in patients recovering from stroke as much as is practical. Routine use of these medications for minor indications (e.g., use of benzodiazepines for mild insomnia during inpatient rehabilitation) is discouraged.

11.2.3 α2-adrenergic Receptor Agonists

BACKGROUND

Centrally acting α2-adrenergic receptor agonists (such as clonidine and others) and a1-receptor antagonists (such as prazosin and others) have been associated with poorer outcomes in at least one retrospective analysis (Goldstein, 1995; Trosi et al., 2002) Data support the beneficial effects of other classes of antihypertensives (ACE inhibitors, angiotensin receptor blockers, and diuretics) for secondary stroke prevention, and these drugs are generally preferred as first line agents for hypertension control in patients following stroke.

EVIDENCE TABLE

	Recommendation	Sources	LE	QE	Benefit	R
1	**doneprezil** taken for 24 weeks improves cognitive function in patients with probable or possible vascular dementia	Craig & Birks, 2005	I	Good	Subst	A
2	**rivastigmine** is associated with more stable cognitive performance and improved behavioral outcomes among patients with subcortical vascular dementia	Craig & Birks, 2005	I	Good	Subst	B
3	**galantamine** is associated with improvements in cognitive and functional ability	Craig & Birks, 2005	I	Good	Subst	C
	Treatment with **memantine** is associated with stabilization or improvement of cognitive function	Martinsson et al., 2003 Platz et al., 2005 Sonde et al., 2007 Treig et al., 2003	I	Good	Mod	B
4	a2-adrenergic receptor agonists are associated with poorer outcomes and should be avoided	Goldstein et al., 1995 Trosi et al., 2002	I-*2*	Fair	None	D

LE=Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; §=Systematic Review (see Appendix A)

11.3 Apraxia

BACKGROUND

Apraxia is neurological deficit that often occurs following stroke in which the patient demonstrates difficulty performing learned purposeful movement regardless of the intent and physical capability to perform to specific task. This motor planning difficulty significantly impacts performance of daily activities and return of independence following stroke. Utilizing task-specific training to address motor deficits following stroke may be important.

RECOMMENDATIONS

1. Insufficient evidence to support specific therapeutic interventions for apraxia following stroke. [I]

EVIDENCE STATEMENTS

A systematic review (West, 2008) of 3 randomized trials that assessed various interventions (strategy planning for ADLs, sensory stimulation, proprioceptive stimulation, verbal or physical cuing and motor facilitation concludes that there is insufficient evidence to support specific therapeutic interventions to effect apraxia following stroke. Further research in this area is warranted.

EVIDENCE TABLE

	Recommendation	**Sources**	**LE**	**QE**	**SR**
1	Interventions to address apraxia	West, 2008 [*§*]	I	Poor	I

LE=Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; §=Systematic Review (see Appendix A)

11.4 Hemispatial Neglect / Hemi-inattention

BACKGROUND

Stroke, especially within the right hemisphere, may affect a person's awareness of the space around them (usually on the left), and the space occupied by their body. For example, they may not be fully aware of (or 'neglect') their

left arm, fail to move into the neglected hemispace, or fail to attend to things that are positioned in space on their left (e.g., a dining fork). These patients often fatigue easily. The presence of a unilateral spatial neglect (USN) has deleterious effects on all aspects of a person's daily activities and negative impact on functional recovery, length of rehabilitation stay, and need for assistance after discharge.

RECOMMENDATIONS

1. Recommend cognitive rehabilitation for patients with unilateral spatial neglect such as cueing, scanning, limb activation, aids and environmental adaptations. [B]
2. Nursing and therapy sessions (e.g., for shoulder pain, postural control, feeding) need to be modified to cue attention to the impaired side in patient with impaired spatial awareness. [I]

DISCUSSION

Evidence for interventions in this area is wide ranging. Reported incidence of USN ranges from 8% to 95%, however, sample selection, definitions of USN and methods used to assess USN are not consistent in all studies that report its incidence. Interventions to improve neglect may be classified into a) those which attempt to increase the patient's awareness of or attention to the neglected space or b) those which focus on the remediation of deficits of position sense or body orientation.

A systematic review (Bowen et al., 2007) examined 15 controlled trials of cognitive rehabilitation for neglect and found that, overall, there was some evidence that cognitive rehabilitation for neglect improves performance on neuropsychological tests, but evidence of little or no effect of intervention on increased activity.

Cognitive rehabilitation was defined as therapeutic activities designed to reduce directly the level of cognitive deficits or the resulting disability, and could include structured therapy sessions, computerized therapy, prescription of aids and modification of the patient's environment (Bowen et al., 2007).

In addition to the studies examined in this review, three further controlled trials have been identified and the findings are mixed (Hajek et al., 1993; Niemeier et al., 2001; Zeloni et al., 2002).

Of the various types of intervention studies, visual-scanning training appeared to reduce symptoms of spatial neglect and associated disability Niemeier et al., 2001). There were insufficient quality studies for the use of Fresnel prisms, half visual field eye patches, mirror therapy, activation treatments, caloric stimulation, TENS, and computer-based rehabilitation.

EVIDENCE TABLE

	Evidence	Sources	LE	QE	Net Ben	SR
1	Cognitive rehabilitation for patients with unilateral spatial neglect such as cueing, scanning, limb activation, aids and environmental adaptations	Bowen, et al., 2007 Neimeier, et al., 2001	I	Poor	None/Small	C
2	Modified nursing and therapy sessions (e.g., for shoulder pain, postural control, feeding) to cue attention to the impaired side in patient with impaired spatial awareness	Work Group Consensus	III	Poor		I

LE=Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; §=Systematic Review (see Appendix A)

12 COMMUNICATION

BACKGROUND

Rates of spontaneous improvement of speech, language, and cognition impairments secondary to stroke decrease with time post-stroke, making early treatment of communication disorders an important step towards achieving independence and improving quality of life. Goals of treatment are to: 1) facilitate recovery from communication difficulties; 2) assist patients in developing strategies to compensate for residual communication impairments; and 3) counsel and educate people in the patient's environment to facilitate communication, decrease isolation, and meet the patient's wants and needs. Specific approaches to treatment depend on numerous factors, including the subtype and severity of the disorder; co-existing communication and cognitive problems; and pre-morbid variables such as education, vocation, and learning style.

RECOMMENDATIONS

1. If the communication assessment indicates impairment in speech, language, and/or cognition, treatment should be considered for those affected components. Treatment can be provided individually, in groups, or by computer or trained volunteer under the supervision of a clinician.
2. Maximum restoration of the impaired ability should initially be considered:
    - For dysarthria (and other impairments of speech), treatment can include techniques to improve articulation, phonation, fluency, resonance, and/or respiration
    - For aphasia (and other impairments of language), treatment can include models designed to improve comprehension (e.g., stimulation/facilitation) and/or expression (e.g., word retrieval strategies) of language. It is recommended that the rate of treatment ("intensity", "dosage") should be higher rather than lower
    - For dementia (and other impairments of cognitive aspects of communication), treatment can include techniques to maximize attention, memory, problem-solving, and executive functions
3. Once maximum restoration is achieved, compensation of the remaining impairment should be considered:
    - For dysarthria, compensatory approaches include prostheses (e.g., palatal lift for hypernasality), alternate modalities (e.g., writing or gesturing), and augmentative/alternative communication (AAC) devices (e.g., a portable typing device that generates synthesized speech)
    - For aphasia, compensatory approaches include alternate modalities (e.g., gesturing) and AAC devices (e.g., a portable electronic pointing board)
    - For dementia, compensatory approaches include memory books, portable alarms, Personal Digital Assistants (PDA's), and similar devices to provide reminders and other information as needed.
4. Once maximum restoration and maximum benefits of compensation are achieved, counsel and educate those closest to the patient to modify the patient's environment to minimize and eliminate obstacles to communication, assisting them in such activities as helping them pay their bills or recording a message on their phone answering machine instructing callers to leave a message.

EVIDENCE STATEMENTS

Six systematic reviews (five general, one constraint-induced) indicated that aphasia treatment is effective (Cherney et al., 2008; Cicerone et al., 2005; Pedersen et al., 2001; Robey, 1994 & 1998; Whurr et al., 1997).

Two meta-analyses (Robey, 1994 & 1998) that included observational and quasi-experimental studies addressing treatment outcomes of adults with aphasia at different recovery periods concluded:

- Recovery of treated individuals was nearly two times that of untreated individuals when treatment was

begun in the acute stage (less than four months from insult). Furthermore, treatment brought about an appreciable, but smaller, improvement when begun after the acute period (Robey, 1994)

- Outcomes for treated individuals are superior to those for untreated individuals in all stages of recovery. Outcomes are greatest when begun in the acute stage of recovery (Robey, 1998)
- Four RCT treatment studies demonstrated statistically significant improvement for stroke patients with chronic aphasia when compared to untreated stroke patients (Cicerone et al., 2005; Doesborgh et al., 2004; Elman & Bernstein-Ellis, 1999; Katz & Wertz, 1997). Treatment provided in the studies included computerized stimulation/facilitation (Katz & Wertz, 1997), computerized compensatory strategies (Doesborgh et al., 2004), group treatment (Elman & Bernstein-Ellis, 1999), and constraint-induced (Cicerone et al., 2005).
- Two RCT treatment studies (Katz & Wertz, 1997; Doesborgh et al., 2004) and two small group studies (Fink et al., 2002; Pedersen et al., 2001) support the use of computerized treatment for aphasia under the supervision of a clinician
- Two systematic reviews (one apraxia of speech, one dysarthria) of single-case and small studies investigating various treatments indicated positive outcomes for non-stroke neurological adults with motor speech problems (Wambaugh et al., 2006; Yorkston et al., 2007)
- One systematic review investigating various treatments indicated that treatment of cognitive-communication problems is effective (Cicerone et al., 2005)
- Insufficient evidence exists to support pharmacological intervention and the safety of its use for patients with aphasia (Greener et al., 2001; Ricci et al., 2002; Walker-Batson et al., 2001)
- Benefit of trained volunteers incorporated into a treatment program to improve communication has been demonstrated (Greener et al., 1999; Kagan et al., 2001; Marshall et al., 1989)
- Positive outcomes from group treatment have been demonstrated in randomized group studies although the existence of benefits is not clearly known (Greener et al., 1999; Worrall & Yiu, 2000)
- Benefits of augmentative/alternative communication (AAC) devices are evident for non-verbal patients suffering from dysarthria, but not clearly demonstrated for severely-impaired adults with aphasia (Aftonomos et al., 1997)
- Rate of treatment should be higher rather than lower (Denes et al., 1996; Hinckley et al., 1998; Pulvermuller et al., 2001)

EVIDENCE TABLE

	Recommendation	Sources	LE	QE	SR
1	Language treatment is effective	Cherney et al., 2008 Cicerone et al., 2005 Robey, 1994, 1998 Whurr et al., 1997	I	Good	A
2	Early treatment is more effective than later	Robey, 1994, 1998	I	Good	A
3	Language treatment is efficacious	Doesborgh et al., 2004 Elman & Bernstein-Ellis, 1999 Katz & Wertz, 1997 Pulvermuller et al., 2001	I	Good	A
4	Computerized language treatment is efficacious	Doesborgh et al., 2004 Fink et al., 2002 Katz & Wertz, 1997 Pedersen et al., 2001	I	Good	A
5	Treatment of motor speech (apraxia of speech, dysarthria) is supported	Wambaugh et al., 2006 Yorkston et al., 2007	II	Poor	I
6	Treatment of cognitive problems is effective	Cicerone et al., 2005	I	Good	A
7	Insufficient evidence for pharmaceutical intervention	Greener et al., 2001 Ricci et al., 2002 Walker-Batson et al., 2001	I	Poor	I
8	Incorporation of trained volunteers is supported	Green et al, 1999 Kagan et al., 2001 Marshall et al., 1989	II	Fair	B
9	Group treatment is supported.	Elman et al., 1999 Greener et al., 1999 Wertz et al., 1981 Worrall et al., 2000	II	Fair	B
10	Augmentative/Alternative Communication devices may improve functional communication	Aftononmos et al., 1997	II	Fair	B
11	High rate of treatment is supported	Denes et al., 1996 Hinkley et al., 1998	I	Good	B

LE=Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; §=Systematic Review (see Appendix A)

13 MOTOR IMPAIRMENT and RECOVERY

13.1 Treatment Approach

BACKGROUND

Several theoretical models of motor behavior exist. These models serve as the foundation for treatment approaches for central nervous system (CNS) dysfunction. Traditional approaches to CNS dysfunction are based on reflex or hierarchical models of motor control. Contemporary models of motor control and learning focus on the interaction of higher and lower centers of control and view the nervous system as one system among many that influence motor behavior. Contemporary task oriented approaches focus on the interaction of multiple systems and assume that motor control and behavior are organized around goal directed and functional activities, rather than on muscles or movement patterns.

Unilateral muscle dysfunction post stroke is well defined. Recovery of affected muscle groups is essential to regain function. Many approaches to motor recovery such as NDT/Bobath, Brunnstrom, PNF, conventional strengthening strategies (PREs, isometrics, isokinetics), and others have been shown useful as adjuncts to rehabilitation, however no one approach has proven more useful than the others. The best approach to rehab will incorporate a combination of these techniques throughout the recovery process.

RECOMMENDATIONS

1. Strongly recommend a comprehensive motor recovery program early on in stroke rehab.
2. There is insufficient evidence to recommend for or against using NDT in comparison to other treatment approaches for motor retraining following an acute stroke. [I]
3. Recommend that motor recovery program should incorporate multiple interventions, emphasizing progressive difficulties, repetition, and functional task practice, [B]
4. Interventions for motor recovery (including improving ambulation) should include cardiovascular exercise fitness and strengthening. [A] (see Sections 13.1.5, and 13.7)

DISCUSSION

13.1.1 Multimodal Approach

The synthesis of the evidence suggests that a multimodal approach can lead to improved outcomes. Improving balance and mobility requires adequate practice of the activity, a progression in the difficulty of the tasks, sufficient intensity, frequency and duration of practice sessions, and functional task specific activities. These interventions are best provided by several different modes, i.e. multi-modal interventions. Combining specific interventions that have been shown to be efficacious, repetition, and practice as well as engaging the patients will lead to better outcome.

The current level of evidence for multi-modal interventions is limited, because most trials are small with design limitations, with inadequate control groups. The studies are inconsistent in comparing levels of intensity of therapy received, the timing of treatment in relation to the onset of stroke, and have inadequate monitoring of adverse events. The evaluation of the sum of these studies suggests high intensity therapy, usually physical therapy, and repetitive task training, improves walking (Langhorne et al., 2009). Although the existing evidence is limited by poor trial designs, some studies of sufficient sample size and homogeneity show that improvement of walking improves ADLs, participation and quality of life (QOL).

A meta-analysis of RCTs conducted by Langhorne (2009) demonstrates that “cardiovascular fitness training, incorporating a mixture of cardio-respiratory and strength training, high intensity physiotherapy and repetitive task training showed a consistent pattern of improvement in walking speed.” Other modalities, like treadmill training motor approaches, and electro-mechanical assisted gait training devices, show a trend towards a positive effect, but are compromised by few studies and small numbers.

13.1.2 Repetitive Movement

One systematic review of **repetitive movement** practice has indicated that such practice is not beneficial for facilitating motor recovery after stroke. Multiple RCTs of therapies in which actual tasks are practiced have shown to facilitate motor skill gains (Volpe, 2008; Woldag et al., 2003; Wolf, et al., 2006). French et al. (2008), in a systematic review, summarized fourteen trials with 17 intervention-control pairs that included 659 patients assessing repetitive task training after stroke. The results showed statistically significant for walking distance (mean difference (MD) 54.6, 95% CI 17.5 to 91.7); walking speed (standardised mean difference (SMD) 0.29, 95% CI 0.04 to 0.53); sit-to-stand (standard effect estimate 0.35, 95% CI 0.13 to 0.56); and of borderline statistical significance for functional ambulation (SMD 0.25, 95% CI 0.00 to 0.51), and global motor function (SMD 0.32, 95% CI -0.01 to 0.66). There were no statistically significant differences for hand/arm function, or sitting balance/reach. The author concluded that repetitive task training resulted in modest improvement in lower limb function, but not upper limb function. Training may be sufficient to have an impact on daily living function. However, there is no evidence that improvements are sustained once training has ended.

13.1.3 Neurophysiological Approaches (Neurodevelopmental Therapy/Bobath, Brunnstrum, PNF)

Three RCTs were found from the literature review (Brunham & Snow, 1992; Mulder et al., 1986; Wagenaar et al., 1990); however, the studies were too small or poorly designed to serve as models for the use of NDT for motor retraining following stroke. These studies have also produced conflicting results. Brunham & Snow (1992) compared NDT to "conventional physiotherapy" and found "the results favored conventional therapy over NDT, although all patients attained their goals regardless of treatment type." Mulder and colleagues (1986) compared "electromyographic (EMG) feedback in the re-learning of motor control to the effects of a conventional physical therapy procedure (i.e., NDT)" and results of the study found no significant differences. Wagenaar and colleagues (1990) found that there were no significant differences between patients treated with NDT versus the Brunstrom method.

A systematic review by Eng (2007) concluded that Neurodevelopmental approaches were equivalent or inferior to other approaches to improve walking ability.

Two systematic reviews (Luke et al., 2004; Langhammer et al., 2010) and 9 small RCTs (Gelber, et al., 1995; Langhammer, et al., 2000; Platz, Eickhof et al., 2005a; Dickstein, et al., 1986; Wagenaar, et al., 1990; van der Lee, et al., 1999; Basmajian, et al., 1987; Van Vliet, et al., 2005) that tested the efficacy of the neurophysiological approaches. While in each case, there were improvements in motor function with these therapies, no trial showed that these approaches were superior to the respective comparison therapies. Some trials (e.g., Langhammer, et al., 2000; van der Lee, et al., 1999; Platz, et al, 2005) showed an advantage of the comparison therapy over the neurophysiological approach.

EVIDENCE TABLE

	Recommendation	Sources	LE	QE	SR
1	Comprehensive motor recovery program early on in stroke rehabilitation	Group Consensus	III	Poor	I
2	Insufficient evidence to recommend for or against using NDT in comparison to other treatment approaches	Group Consensus	III	Poor	I
3	Motor recovery program should include multiple interventions emphasizing progressive difficulties, repetition, and functional task practice	Langhorne, 2009 [SR]	I	Fair	B
4	NDT for motor retraining following acute stroke as compared to other treatment approaches	Bruhnam & Snow, 1992 Mulder et al., 1986 Wagenaar et al., 1990	I	Fair	C
5	NDT(Bobath), Brunnstrom, and PNF - utilizing Proprioceptive Neuromuscular Facilitation techniques are not superior in improving motor impairments post stroke	Luke et al., 2004 [§] Langhammer, et al., 2010) [§] Gleber, et al., 1995 Langhammer, et al., 2000 Platz, et al., 2005 Dickstein, et al., 1986 Wagenaar, et al., 1990 van der Lee et al., 1999 Basmajian, et al., 1987 Van Vliet, et al., 2005	1	Fair	C

LE=Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; §=Systematic Review (see Appendix A)

13.1.4 Task Specific Approach

There is *strong* evidence that task-specific training improves motor recovery.

- Sullivan (2007) demonstrated improved walking speed in BWSTT vs. cycling.
- Ada (2003) in a randomized trial with follow-up in 3 months conducted a 4-week treadmill training (30 min 3 times per week) program combined with overground walking which increased walking speed and walking capacity.
- Richards (2004) compared one group walking with technology (TDM/kinetron) and another group walking only; both groups improved, neither one did better than the other.
- Blennerhassett & Dite (2004) demonstrated that task related practice in a circuit class format was a practical and effective means to provide supervised additional practice that led to significant and meaningful functional gains.
- Salbach et al. (2004) conducted a task oriented intervention comprised of 10 functional tasks designed to strengthen the lower extremities and enhance walking balance, speed and distance. They found enhanced walking competence compared to the control group in the first year post stroke, particularly in people with moderate walking deficits.
- Marigold (2005) conducted a study in which community dwellers (chronic stroke) were randomized to stretching and weight shifting group and an agility group. Although exercise led to improvements in all clinical outcome measures for both groups, the agility group demonstrated greater improvement in step reaction time and paretic rectus femoris postural reflex onset latency than the stretching/weight-shifting group. Fewer falls in platform translation were also reported.
- Dean (2007) investigated the effect of sitting training protocol in people early after stroke on sitting ability. Sitting training protocol that involved practicing reaching tasks beyond arm's length were compared to sham sitting training protocol that involved practicing cognitive-manipulative tasks within arm's length. After two weeks of training, the experimental group had increased their maximum reach distance, decreased their movement time, increased their peak vertical force through the affected foot and increased their peak vertical force through the affected foot during standing up. Improvement was maintained at 6 month follow-up assessment.

- Yang (2005) demonstrated that asymmetric gait pattern in patients post stroke could be improved by receiving additional backward walking therapy. Subjects participated in 40 min of conventional training program three times a week for three weeks. Subjects in experimental group received additional 30 min of backward walking training for three weeks at a frequency of three times per week that resulted in increased speed, stride length and symmetry index compared to the control.
- Yang (2006) in a study which included four-week task-oriented progressive resistance strength training compared to no treatment demonstrated significant improvement in muscle strength for strong side muscle groups and paretic side muscle groups. The experimental group showed significant improvement in functional performance except for the step test. In the control group, the number of repetitions of the step test significantly decreased (-20.3%) with no change in other functional tests.

EVIDENCE TABLE

	Evidence	Sources	LE	QE	SR
1	Task Specific Training – improved function dependent on activity tested (reach, gait, and other outcomes)	Ada, 2003 Dean, 2008 Marigold, 2005 Richards, 2004 Blennerhassett & Dite, 2004 Salbach et al., 2004 Sullivan, 2007 Yang, 2005, 2006	I	Fair	B

LE=Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; §=Systematic Review (see Appendix A)

13.1.5 Strengthening and Exercise

BACKGROUND

Paresis or weakness of the lower extremities is a common impairment after a stroke. Weakness in the lower extremities causes difficulty with mobility and walking. Stroke damages upper motor neurons, depriving lower motor neurons of descending excitatory input, leading to weakness and atrophy of muscle cell bulk. Strengthening exercises seek to increase the amount of force generated by muscle contraction. Exercise does not bring back upper motor neuron input, but works at the level of skeletal muscle using remaining innervation. Physiologically the increased force achieved with repetitive resistance exercise is due to hypertrophy of muscle cells. Strengthening exercises may include progressive resistive exercises (weight lifting), weight bearing, and isokinetic exercise. Exercise may also include tasks that incorporate sequencing and motor control, in addition to strengthening.

RECOMMENDATIONS

1. Consider using strength training as a component of the therapeutic approach in paretic patients. [B]

DISCUSSION

There is mixed evidence on the value of strengthening exercise post-stroke. Using a variety of interventions, some mixed with functional tasks, many small studies have shown positive outcomes, but others have not found significant changes. Many different functional outcomes have been measured including walking speed, FIMs, health profile measures, 6 minute walk, timed up and go (TUG), and muscle strength itself. Control groups have received usual care, upper limb exercises, therapeutic exercise, relaxation, and no specific treatment. Given the variety of intervention designs and outcome measures, it is difficult to combine these in a meta-analysis. Historically, strength training was avoided in stroke because of concern that this would increase spasticity, though these fears are unfounded. (Morris, 2004)

Studies have examined, progressive resistance training, weight bearing on the leg extensors [Nugent] isokinetic exercise, circuit training, free weights, weight machines, isometric exercise.

A meta analysis of 21 RCTs conducted by van de Port et al. (2007) showed that programs focusing on cardiorespiratory and gait oriented training are more beneficial in improving walking competency than programs centered on strengthening. Cardiorespiratory fitness programs had a nonsignificant medium effect size on gait speed. No significant effects were found for programs targeting lower-limb strengthening. In the best-evidence synthesis,

strong evidence was found to support cardiorespiratory training for stair-climbing performance. Although functional mobility was positively affected, there was no significant effect of gait training on activities of daily living, instrumental activities of daily living, or health-related quality of life.

Eng et al. (2007) found that strengthening exercises improve muscle strength, but not transfer to improved walking ability.

Evidence Table

	Evidence	Sources	LE	QE	SR
1	Strength training of weakened muscles post stroke	Cramp, 2006 § Mead et al., 2007 Moreland et al., 2003 Ouellette et al., 2004 Tihanyi et al., 2007	I	Poor	I

LE=Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; §=Systematic Review (see Appendix A)

13.2 Range of Motion (ROM)

BACKGROUND

Hemiparesis following stroke commonly contributes to decreased active and passive range of motion (ROM) of the involved joints. Profound hemiparesis can lead to joint contractures which predispose a patient to problems such as impaired mobility and pressure ulcers. Passive (PROM) and active (AROM) exercise are frequently employed to help reduce the risk of secondary musculoskeletal impairment from decreased joint ROM.

Stroke can worsen pre-existing osteoarthritis or lead to the genesis of osteoarthritis by producing muscle imbalances that result in inappropriate forces/torques across joints. Maladaptive activity patterns or postures can develop in upper or lower extremities after stroke as individual attempt to reacquire function. For example hyperextension of the knee in a paretic leg is a maladaptive activity pattern for weight bearing on a paretic lower extremity. Osteoarthritis can be painful and limit joint range of motion.

RECOMMENDATIONS

1. Consider active and passive ROM prolonged stretching program to decrease risk of contracture development (night splints, tilt table) in early period following stroke. [C]
2. Joint movement and positioning needs to be carefully monitored during rehabilitation to prevent the development of maladaptive activity patterns.

DISCUSSION

The majority of research on PROM following stroke has not demonstrated impact on contracture development. Most recent research (Robinson, 2008) suggests early prolonged PROM (weight bearing on tilt table and night splints) may prevent contracture development.

EVIDENCE TABLE

	Recommendation	Sources	LE	QE	R
1	Prolonged PROM and AROM prevent contractures, improves safety and independence with functional activities	Robinson, 2008	I	Poor	C

LE=Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; §=Systematic Review (see Appendix A)

13.3 Spasticity

BACKGROUND

Stroke patients with hemiplegia often develop abnormal patterns of increased muscle tone that are usually associated

with hyperactive stretch reflex. The combination of increased motor tone and reflex hyperactivity is spasticity. Spasticity may lead to muscle shortening, abnormal postures, pain and contracture. Contractures that restrict movement of the involved joint or are painful will impede rehabilitation and limit a patient's potential for recovery. Early treatment is key to managing this disabling complication. It is generally accepted to combine interventions that reduce spasticity with aggressive physical therapy in order to increase active and passive ranges of motion. Without physical therapy, an intervention may transiently reduce spasticity, but will not result in functional gains.

RECOMMENDATIONS

1. Consider deterring spasticity with antispastic positioning, range of motion exercises, stretching and splinting. Contractures may need to be treated using splinting, serial casting, or surgical correction. [C]
2. Consider use of oral agents such as tizanidine and oral baclofen for spasticity especially if the spasticity is associated with pain, poor skin hygiene, or decreased function. Tizanidine should be used specifically for chronic stroke patients. [B]
3. Diazepam and other benzodiazepines should be avoided during the stroke recovery period because this class of medication may interfere with cerebral functions associated with recovery of function after stroke, and these agents are likely to produce sedation which will compromise an individual's ability to participate effectively in rehabilitation. [D]
4. Consider use of botulinum toxin, on its own, or in conjunction with oral medication for patients with spasticity that is painful, impairs function, reduces the ability to participate in rehabilitation or compromises proper positioning or skin care. [B]
5. Intrathecal baclofen treatments may be considered for stroke patients with chronic lower extremity spasticity that cannot be effectively managed by oral medication or botulinum toxin. [B]
6. Consider neurosurgical procedures, such as selective dorsal rhizotomy or dorsal root entry zone lesion, for spasticity that cannot be managed by non-surgical modalities. [I]

DISCUSSION

Spasticity is defined as velocity-dependent hyperactivity of tonic stretch reflexes. It impairs motor performance following stroke and can result in significant pain and functional disturbances. The most impairing state from spasticity may be contractures, affecting or limiting limb function. Skin hygiene may also be a problem with spasticity.

Non-pharmacologic Treatment

Spasticity is typically treated in a stepwise approach, beginning with the least invasive modalities and progressing to more invasive. Positioning, passive stretching, and range of motion exercise may provide relief and should be done several times daily in persons with spasticity. Corrective measures for contractures that interfere with function include splinting, serial casting, or surgical correction. No reliable data exist to compare different physical therapy interventions, with or without antispastic medications. It is generally accepted that physical therapy can be used alone or to enhance the functional benefits of other treatments for spasticity.

Oral Medication

Tizanidine, baclofen, dantrolene, and diazepam are FDA approved oral medications in the United States for the treatment of spasticity. There is limited evidence from controlled trials of spasticity treatment in stroke patients, and the conclusions of the majority of these trials found that spasticity and pain may be reduced, but no significant functional gains were made. Tizanidine has been shown to have efficacy in chronic stroke patients with improvement in spasticity and pain without loss of motor strength, in an open label dose titration study (Gelber et al., 2001). Dantrolene has limited trial data to support its use in stroke and cited benefits of no cognitive side effects (Ketel & Kolb, 1984). Katrak et al. (1992) found that starting patients on Dantrolene Sodium early after a stroke, before the onset of disabling spasticity, produced no change in clinical tone or functional outcome. Oral baclofen has some data to support its use in stroke (Milanov, 1992). Reportedly, oral baclofen may cause significant sedation and have less impact on spasticity in stroke victims, in comparison to other disease conditions (Pedersen et al., 1974).

Botulinum Toxin

A systematic review (Francis et al., 2004) noted that patients with upper limb spasticity receiving botulinum toxin-A had reduced muscle tone and increased passive range of motion. One study also noted increased active range of motion in patients with upper limb spasticity. In patients with lower extremity spasticity resulting from stroke, the use of botulinum toxin-A resulted in decreased muscle tone and improved active and passive range of motion compared to functional electrical stimulation and physiotherapy. Injections of phenol were found to be more painful than those of botox-a. There is *strong* evidence that a combination of physiotherapy and Botulinum Toxin Injection is associated with improved upper extremity function.

Intrathecal baclofen

Intrathecal baclofen has been demonstrated to reduce spasticity in a small trial of chronic stroke patients (with stroke onset >6 months previous). There are several neurosurgical procedures for the treatment of spasticity, but they lack any clinical trial evidence. Of these, the most common are selective dorsal rhizotomy or dorsal root entry zone lesions. Significant risks are involved with these invasive procedures, to include operative complications and unintended spinal cord damage.

EVIDENCE TABLE

	Evidence	Source	LE	QE	SR
1	Use of antispastic positioning, range of motion exercises, stretching, splinting, serial casting, or surgical correction for spasticity	AHCPR, 1995 § RCP, 2000 § Working Group Consensus	III	Fair	C
2	Use of tizanidine (in chronic stroke patients), dantrolene, and oral baclofen for spasticity	Gelber et al., 2001, Ketel & Kolb, 1984 Milanov, 1992	II-1	Fair	B
3	Avoid drugs with central nervous system effects that may impair recovery	Goldstein, 1995 & 1998 Graham, 1999 Troisi et al. 2002	II-2	Fair	D
4	Use of botulinum toxin al improves spasticity	Francis. 2004 Bhakta et al., 2008 Brashear et al., 2002 Childers et al., 2004	I	Good	B
5	Use of intrathecal baclofen for chronic stroke patient	Meythaler et al., 2001 Francisco & Boake. 2003	II-1	Good	B
6	Use of certain neurosurgical procedures	Working Group Consensus	III	Poor	I

LE=Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; §=Systematic Review (see Appendix A)

13.4 Balance and Posture

BACKGROUND

Balance control, which requires the integration of visual, somatosensory, and vestibular input, is often impaired after stroke. Balance deficits have been implicated in the poor recovery of activities of daily living and functional mobility, as well as an increase in risk of falls.

Studies have shown conflicting results regarding the benefit of balance training through a variety of approaches including visual feedback, task specific methods, platform training, additional strength training and cycle training, aquatic therapy or tai chi Chuan training. The working group recommends that the best approach to rehab will incorporate a combination of these techniques throughout the recovery process.

RECOMMENDATIONS

1. Recommend that patients demonstrating balance impairments following stroke should be provided a balance training program. [C]

DISCUSSION

It is difficult to draw significant conclusions from the data reported in the literature. There have been several randomized controlled trials looking at balance. However, there is a significant lack of standardization of variables across studies. With the exception of task-specific training, most studies failed to identify significant differences between experimental and control groups with regards to balance measures. Pollock (2007) found no evidence that physiotherapy (single modality or combination) yielded improved postural control or functional independence.

Marigold (2005) demonstrated that group exercise programs, including agility or stretching/weight shifting exercises, improve functional balance and mobility and may lead to a reduction of falls. In a randomized controlled trial, Cheng (2001) also demonstrated a significant decrease in percent of falls for the task-specific trained group compared to controls.

A 2005 Cochrane review and an RCT by Eser (2008) showed no significant difference in postural sway with platform training. Hart (2004) suggested that Tai Chi yields improved balance post stroke and in a study of cycling, Katz-Leurer (2006) demonstrated that the cycling group showed improved balance after early duration of cycling program in addition to PT. Noh (2008) found that postural balance and knee flexor strength were improved after aquatic therapy.

EVIDENCE TABLE

	Recommendation	Sources	LE	QE	SR
1	Force platform biofeedback training leads to possible improvement in balance	Barclay-Goddard, 2004 Chen, 2002 Eser, 2008	I	Poor	C
2	Tai Chi improved socialization Possible improvement in balance	Hart, 2004	I	Poor	C
3	Aquatic therapy possible improvement in functional balance	Noh, 2008	I	Fair	B
4	Task specific training possible improvement in specific activity training	Marigold, 2008 Cheng, 2001	I	Poor	C
5	Cycling possible increase in functional balance	Katz-Leurer, 2006	I	Poor	C

LE=Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; §=Systematic Review (see Appendix A)

13.5 Lower Extremities

Gait Training Strategies

BACKGROUND

Following stroke, patients may presents with decreased motor control, weakness, incoordination, limited endurance, spasticity, poor balance and sensory deficits. These impairments *often* manifest themselves in impaired gait and decreased ambulatory independence. Impaired gait leads to an increase in falls risk and fractures, cardiovascular deconditioning, and social isolation.

Strength training, high intensity physiotherapy and repetitive task training showed a consistent pattern of improvement in walking speed. Modalities, like treadmill training motor approaches, rhythm auditory, electro-mechanical assisted gait training devices, show a trend towards a positive effect, but are compromised by few studies and small numbers.

RECOMMENDATIONS

1. Consider using treadmill training in conjunction with other task specific practice and exercise training techniques in individuals with gait impairments post stroke without known cardiac risks for treadmill exercise. [B]
2. Consider the use of partial bodyweight support for treadmill training (partial BWSTT) (up to 40% of individuals' weight) in conjunction with other task specific and exercise training techniques for individuals with gait impairments post stroke without known cardiac risks for treadmill exercise. [B]
3. Recommend for patient with foot drop, ankle foot orthoses (AFO) to prevent foot drop and improve knee stability during walking. [B]
4. Recommend Functional electrical stimulation (FES) as an **adjunctive** treatment for patients with impaired muscle contraction, specifically for patients with impaired gait due to ankle/knee motor impairment. FES can be utilized for individuals with acute or chronic deficits after stroke. [B]
5. Consider Transcutaneous electrical nerve stimulation (TNS or TENS) as an adjunctive treatment for enhancing recovery of gait function after stroke. [C]
6. Consider rhythmic auditory cueing as a modality to include in multimodal interventions to improve walking speed [B]
7. There is no sufficient evidence supporting use of robotic devices during gait training in patients post stroke [D]
8. Consider using Virtual Reality (VRT) to enhance gait recovery following stroke. [B]

13.5.1 Treadmill Training With and Without Body Weight Support

Treadmill training is a modality to improve walking recovery after stroke. It provides repetitive stepping, which may affect timing and sequence of lower extremity motor control, strength, and cardiovascular fitness. Treadmill training may be used with and without bodyweight support or the assistance of therapists for stepping. The development of treadmill as a modality was based on neurophysiologic studies in animals.

A Cochrane Review of body weight supported treadmill training by Moseley, (2005) reported that body weight supported treadmill training had no statistically significant benefit on walking speed. There was a trend toward more improvement in individuals who were already independent ambulators. A more recent systematic review by Dickenstein (2008) analyzed published studies by timing of intervention post stroke and with and without bodyweight support. The review demonstrated that individuals do improve walking speed with treadmill training. However no studies demonstrated an upgrade in functional walking level. The author (Dickenstein, 2008) concluded that treadmill training may not be superior to other training programs which encourage walking and are repetitive and intense. French et al. (2008) evaluated treadmill trials as a modality of repetitive functional task practice and demonstrated that repetitive functional task practice may improve walking, activities of daily living and be sustained for six months. Ada et al. (Stroke 2010) published the results of the MOBILIZE trial which compared bodyweight supported training with overground training in non-ambulatory patients who were within 4 weeks post

stroke The results of this trial demonstrated that the individuals receiving BSWT as an adjunct to usual care were more likely to become independent in ambulation in less time. The LEAPS (Duncan et al., 2007) trial and the AMBULATE (Ada, 2007) trial are large randomized clinical trials that are currently underway. These trials include treadmill training as a modality for walking recovery in stroke patients discharged to the community. These trials may provide more conclusive evidence for practice.

Treadmill training is equivalent to overground gait training in subacute rehabilitation, but beneficial effects compared with low intensity control groups in chronic stroke. A combination of treadmill with task-specific practice may be optimal (Eng et al., 2007).

Treadmill training has been investigated in a number of randomized trials as a single modality to improve walking or in combination with other interventions (e.g., overground training or usual care). The control comparisons have also been highly variable, including usual care, attention controls, and over ground training. It has been evaluated in acute, subacute and chronic patients and in individuals who are non-ambulatory as well as those with different levels of ambulatory capacity. The dosing levels (intensity, frequency, and duration) of training have been highly variable. The primary outcome for the treadmill training studies has been walking speed and secondary measures have assessed community, walking endurance, ambulation or stroke specific quality of life as an outcome. More recent studies have also investigated the sustainability of walking gains after completion of therapy. Adverse effects of treadmill training programs are not consistently reported. Given the small sample sizes, the heterogeneity of the trials, and the variability in control comparisons, the results of trials are conflicting but a synthesis of the evidence suggests that treadmill training may be a modality that should be considered as a part of multimodal interventions to improve walking. However, treadmill training may not be superior to interventions that are matched for practice and repetitive functional training. The use of this modality will be dependent on the individual patient, cardiac risk factors, and available resources.

- Ada (2003) in a randomized trial with follow-up in 3 month, 4-week treadmill training (30 min 3 times per week) combined with overground walking increased walking speed and walking capacity.
- Laufer (2001) tolerated TDM early on, improved functional ambulation, stride length and percent paretic stance time, and gastrocenemius muscle activity compared to conventional PT.
- Liston (2000) found no significant differences in chronic stroke patients who underwent treadmill retraining, compared to conventional rehabilitation.
- Pohl (2002) found speed dependent treadmill training (with the use of an interval paradigm to increase the treadmill speed stepwise according to principles of sport physiology) showed improvements in speed, cadence, stride length and functional ambulation compared to progressing treadmill training and conventional gait training.
- Richards (1993) observed that treadmill training combined with other gait-specific task improved gait velocity.
- Suputtitada (2004) compared the effect of Partial Body Weight Support Treadmill Training (PBWSTT) technique and floor walking training, on floor walking velocities and functional balance. PBWSTT was not statistically different than floor walking.
- Van Peppen (2004) systematic review of all physical therapy interventions post stroke found treadmill training without body weight support improved walking ability, but not speed.
- Barbeau (2003) Retraining gait in severely impaired stroke subjects with a percentage of their body weight supported resulted in better walking and postural abilities than did gait training in patients bearing their full weight. It appears that subjects with greater gait impairments benefited the most from training with BWS, as did the older patients with stroke. There is evidence of transfer from treadmill training to overground locomotion
- Author (year) Severely impaired patients 1-3 months post stroke demonstrated improvements in walking speed, endurance, Berg Balance Score and Motor Recovery (STREAM)
- Sullivan (2002) Training at speeds comparable with normal walking velocity was more effective in improving self-selected walking velocity (SSV) than training at speeds at or below the patient's typical overground walking velocity.
- Sullivan (2007) demonstrated improved walking speed in BWSTT compared to cycling. Task-specific training during treadmill walking with body-weight support was more effective in improving walking speed and maintaining these gains at 6 months.
- Duncan et al. (2007) have initiated a phase III, 5-year trial to compare BWSTT to home-exercise in

individuals with gait difficulties one-year post-stroke

EVIDENCE TABLE

	Recommendation	Sources	LE	QE	SR
1	Recommend using treadmill training in conjunction with conventional gait training techniques	Ada et al., 2003 Laufer et al., 2001 Liston et al., 2002 Pohl et al., 2002 Richards, 1993 Suputtitada, 2004	I	Fair	B

LE=Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; §=Systematic Review (see Appendix A)

13.5.2 Functional Electrical Stimulation

Functional electrical stimulation (FES) is electrical stimulation applied to a muscle, causing it to contract. FES has been used for several years as a therapy modality for post-stroke patients, but has not been a routine standard of care. FES is a time-limited intervention, generally used during the first several weeks after the acute stroke.

Several randomized controlled clinical trials reported that FES improved recovery of gait function after stroke when FES was compared to conventional therapy or added to a therapeutic modality. Daly et al. (2006) reported that subjects who received lower extremity FES via implanted percutaneous electrodes in conjunction with partial weight support treadmill training had larger gains improvement in gait compared with subject who received partial-weight supported treadmill training alone. The improvement in gait attained with FES was associated with functional recovery of life skills such as being able to attend religious services. Daly et al. (2007) reported that subjects treated with FES combined with body weight supported treadmill training had larger gains in walking speed and distance (on a six minute walk test) compared with subjects treated only with body weight supported treadmill training. Sheffler et al. (2006) compared an external FES device vs. an ankle-foot orthosis (AFO) for recovery of gait for subjects with foot-drop. The functional results were similar for subjects treated with an AFO vs. FES. Subjects preferred FES. Kottink et al. (2007) compared a two-channel FES device to conventional therapy for treating foot drop and found that walking speed improvement was greater for subjects treated with FES. In a subsequent study, Kottink et al. (2008) found that the benefits of the FES on walking speed were seen only if the device was active. Ng et al. (2008) reported that subacute stroke subjects treated with FES combined with partial weight supported treadmill training had greater recover of gait speed compared to subjects treated with overground gait training. McCabe et al. (2008) discussed the advantages of combining FES with robotic gait training.

Ng & Hui-Chan (2007) performed a RCT of gait rehabilitation in chronic stroke subjects. The subjects were divided into 4 treatment groups. The 4 treatment groups were: TNS alone, task-related therapy with sham TNS, TNS plus task-related therapy or no treatment. The subjects who received TNS plus task related therapy had greater improvements in gait speed compared to any of the other treatment groups.

EVIDENCE TABLE

	Recommendation	Sources	LE	QE	SR
1	Recommend FES for gait rehabilitation	Daly et al., 2006 Sheffler et al., 2006 Daly et al., 2007 Kottink et al., 2007 Ng et al., 2008 Kottink et al., 2008 McCabe et al., 2008	I	Good	B
2	Consider FNS gait rehabilitation	Ng & Hui-Chan. 2007	I	Good	B

LE=Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; §=Systematic Review (see Appendix A)

13.5.3 Rhythmic Auditory Cueing

A therapy approach to improve gait uses rhythmic auditory cues to synchronize movement and gait. The rhythm

serves as an anticipatory and continuous time reference on which movements are mapped within a stable temporal plate (Thaut et al., 2007). There is strong evidence that rhythmic auditory stimulation, in conjunction with physical therapy, results in a significant improvement in gait.

There is good evidence that rhythmic auditory cueing in conjunction with other physical therapy interventions may improve gait.

- Thaut et al. (1997) randomized 20 patients to receive either twice-daily gait training with the addition of rhythmic auditory stimulation (RAS) or to receive twice-daily gait training. Both groups improved stride parameters over 6 weeks of therapy with significant increase in velocity, stride length, and reduction in EMG amplitude of gastrocronemius muscle in favor of the RAS-training group. A large degree of restoration of swing symmetry in gait was noted.
- Schauer et al. (2003) conducted a small study of 23 stroke patients who were randomly assigned to receive either 15 sessions of conventional gait therapy or therapy sessions with musical motor feedback. Gait velocity, stride length, gait symmetry, foot rollover path length, and gait cadence significantly improved in the experimental group.
- Jeong et al. (2007) found no significant differences between community-dwelling subjects in an 8-week program of RAS-muscle movement program compared to usual care.
- Thaut et al. (2007) conducted a study in which stroke patients were randomized to receive a 3-week program of rhythmic auditory stimulation (RAS) (n=43) or neurodevelopmental therapy (NDT)/Bobath-based training (n=35). The differences from pre-to-post measurements were statistically significant for most outcomes, favouring RAS therapy. Effect sizes for RAS over NDT/Bobath training were 13.1 m/min for velocity, 0.18 m for stride length, and 19 steps/min for cadence.

EVIDENCE TABLE

	Recommendation	Sources	LE	QE	SR
1	Recommend RAS therapy for gait rehabilitation	Taut et al., 1997, 2007 Jeong et al., 2007 Shauer et al., 2003	I	Fair	B

LE=Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; §=Systematic Review (see Appendix A)

13.5.4 Ankle Foot Orthoses

It is common practice to use splints in the hemiplegic lower extremity in an attempt to prevent foot drop and control knee instability. In order to facilitate the swing phase of gait, an ankle foot orthosis (AFO) is often used to compensate for excessive ankle plantarflexion and a lack of knee flexion. The brace (usually plastic) is worn on the lower leg and foot to support the ankle, hold the foot and ankle in the correct position, and correct foot-drop. There is limited evidence that AFOs improve elements of gait.

There is limited evidence to guide practice in selection of different types of orthotic devices. Studies have shown that ankle foot orthoses (AFO's) improve gait in those with foot drop and unstable knee control.

Splinting of Lower Extremity in Stroke [Ankle Foot Orthosis (AFO**),** EBRSR, 2009**]**

Author, Year, Country	**Methods**	**Outcomes**
Miyazaki et al., 1997 Japan	In the 1st session, both anterior and posterior springs of the experimental AFO were used with 20 patients walking initially without the AFO and then walking using the AFO. In the 2nd session, only the anterior springs were used	Active ankle movement in the direction of plantarflexion varies significantly with changes in the rigidity and initial angle of AFOs in 11 of the 20 patients

Chen et al., 1999 China	24 patients took the postural stability test while wearing an AFO and not wearing AFO. Patients were randomized to first one treatment and then the other and tested for both	When wearing the AFO, there was no significant difference with small effect size in postural sway index, postural symmetry and maximal balance range in the anterior-posterior direction. There was a significant improvement and a large effect size in lateral weight shifting and weight bearing through the affected leg after weight shifted to the affected side
Hesse et al., 1999 Germany	21 patients were assessed when walking barefoot and then again when using a Valens caliper and a firm shoe.	Use of the caliper resulted in a significant increase of the relative single-stance period of the affected lower limb and of the relative terminal double-support duration. Swing symmetry significantly improved with the orthosis. Gait line of the affected lower limb significantly increased with caliper use and the loading rate of the nonparetic limb was greater. Ankle dorsifexion became larger and the plantar flexion during swing phase was significantly less. Paretic tibialis anterior activity decreased and the affected vastus lateralis increased with caliper use
Kosak et al., 2000 USA	56 patients were randomized to receive partial body weight-supported treadmill training (PBWSTT) or to receive aggressive bracing assisted walking (ABAW). Treatment sessions of up to 45 minutes, 5 days per week given as tolerated for the duration of the inpatient stay or until the patient could walk over-ground unassisted	No significant differences between groups were noted on any of the outcome measures. Both groups showed progress, more than tripling their walking endurance and doubling their walking speed
de Wit et al**.,** 2004 Netherlands	20 chronic stroke patients who had been wearing an AFO for at least six months were assessed with and without their AFO included, the order of which was randomized	The mean differences between groups were significant in favour of the AFO condition in the cores on the timed up and go(TUG) test 3.6 sec (95% CI 2.4-4.8) and in the stairs test 8.6 sec (95% CI 3.1-14.1), although the differences were not clinically significant. 70% of the patients reported feeling more self-confident while wearing the AFO
Pohl & Mehrholz, 2006 Germany	20 stroke patients (with an additional 8 traumatic brain injury patients) were randomly assigned to wearing ankle-foot othoses (AFO) for varying sequences or wearing only footwear	There was a significant reduction of postural sway with eyes opened and greater improvement of stance symmetry for the AFO group compared with the no AFO group. Significant between-group differences were seen for 3 gait parameters: stance duration at 90% body-weight (vertical ground reaction forces), deceleration forces (horizontal ground reaction forces and double stance duration
Wang et al., 2007 Taiwan	58 stroke patients with hemiparesis of (< 6 months) were evaluated for the balance and gait performance with and without an ankle-foot orthosis (AFO) on the affected side. Assessments took place 2 hrs apart	Measures of balance (% weight bearing difference, movement velocity, measured in degrees per sec and % maximal excursion) were all significantly better when patients were wearing the AFO. Gait parameters, speed, step length, stride length and base width were also significantly better when patients wore the AFO

Tyson & Rogerson, 2009 UK	20 stroke rehabilitation inpatients were fitted with, and given the opportunity to practice walking with several assistive devices. Their walking ability was assessed in random order: (1) with no device (control condition), (2) with a walking cane, (3) ankle foot orthosis, (4) slider shoe, and (5) a combination of all 3 devices	Functional mobility (functional ambulation categories-FAC) improved with all assistive devices relative to the control condition. The effect sizes associated with the treatments were: Cane: 1.68 (64% change), AFO: 1.04 (44% change), slider shoe (0.52 (18% change) and 1.65 (68% change) when all 3 devices were used simultaneously. There was no significant treatment effect with any of the devices in terms of walking impairments (speed, step length of the weak leg)

EVIDENCE TABLE

	Recommendation	Sources	LE	QE	SR
1	Ankle foot orthoses (AFO's) improve gait in those with foot drop and unstable knee controlled	Taut et al., 1997, 2007 Jeong et al., 2007 Shauer et al., 2003	I	Fair	B

LE=Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; §=Systematic Review (see Appendix A)

13.5.5 Mechanical-Assisted Training Devices (Robotics)

Electromechanical-assisted training devices have been tested for gait training. Most of these devices incorporate body-weight-support. Their main advantage over conventional gait training is that they reduce the need for intensive therapist involvement. These devices include the Lokomat, the Gait Trainer GT 1, and the AutoAmbulator

There is strong evidence that robotic devices are no more effective than therapist assistance in the improvement of functional walking performance.

- A Cochrane review (Mehrolz et al., 2007) including the results from 8 trials (414 participants) concluded that electromechanical-assisted training devices were associated with an increased odds of becoming an independent ambulator (OR: 3.06, 95% CI 1.85 to 5.06) and increased walking capacity, but were not associated with increases in gait velocity. The authors noted that their results should be interpreted with caution since the duration, intensity and frequency of treatments differed among studies and the use of an additional therapy (electrical stimulation) in some of the included trials may have resulted in an inflated treatment effect.
- Husemann et al. (2007) patients in both groups improved over the four-week treatment period from a median score of 0 at baseline to 1 at the end of treatment, but there was no statistically significant difference between groups.
- Hornby et al. (2008) greater improvement in speed and stance time in therapist driven facilitation compared to robots on lokomat.
- Mayr et al. (2008) Lokomat phases of ABA BAB study showed improved gait speed conventional.
- In a recent publication researchers have demonstrated that robot-assisted therapy improved outcomes in patients with long-term upper-limb deficits after stroke when therapy lasted over 36 weeks as compared with usual care. Robot-assisted therapy did not significantly improve motor function at 12 weeks, as compared with usual care or intensive therapy.

13.5.6 Virtual Reality

Virtual reality (VR) is the use of computerized technology to allow patients to experience and interact with three-dimensional environments. Simulated environments ("virtual environments") can be displayed on desktops screens, larger screens, 3D projection walls ("caves"), or with head mounted displays to allow increasing degrees of immersion in the environment. (Sisto, 2002) These interactions are designed to allow task specific practice that is engaging for the patient and realistic enough to create motor learning.

The field of VR in rehabilitation is a rapidly developing field. There are many reasons to consider its potential

benefits. An environment that creates a task specific practice environment that may be more stimulating or interesting to patients, is reproducible, and allows for measurement of progress has clear attraction. The progress in computer applications and technology is unlikely to abate soon.

It is difficult to compare studies with significant heterogeneity of the interventions, the sample populations and the outcome measurements. As of this writing the field consists of relatively small RCTs and case reports showing positive trends in most cases, and therefore a recommendation to consider these strategies is made.

The use of VR systems for improvement of gait, balance, and lower limb rehabilitation has been increasingly studied. A recent systematic review of VR in the stroke rehabilitation literature though February of 2005 found 3 studies on gait and balance and one on lower limb rehabilitation (Crosbie, 2007). Three subsequent studies (Yang, 2008; Kim, 2009; Mirelman, 2009) consist of RCTs evaluating gait. A study by You (2005), using fMRI, suggests that VR may help with cortical reorganization as the basis improved motor recovery.

A variety of other VR systems and tasks have been examined in recent studies including 3D immersive street crossing in patients with neglect (Kim, 2010), the effect of multi-tasking while walking and shopping in a virtual aisle (Kizony, 2010), VR programs at home (Tele-VR) (Piron, 2008), and training patients in using mass transit with a 2-D VR program (Lam, 2006). VR has also been used for upper extremity tasks. (See Upper extremity).

- Kim et al. (2009) 24 chronic, hemiparetic stroke patients were randomly assigned to either an experimental group (n = 12) or a control group. Both groups underwent conventional physical therapy. The experimental group received an additional 30 minutes of virtual reality therapy each session. Subjects in the experimental group showed significantly greater improvement in the Berg Balance Scale, gait velocity, cadence, step time, step length, and stride length.
- Yang et al. (2007) 20 subjects at least 6-months post stroke were assigned randomly to either the control group (n=9) or the experimental group (n=11). Subjects in the control group received the virtual reality-based treadmill training. Subjects in the experimental group improved more significantly in walking speed and community. At follow-up, the experimental group maintained a significantly faster community walking speed. There were no other significant differences between the groups.
- Mirelman (2009) examined 18 stroke patients in a single blinded RCT using a robot alone or robot with a virtual environment. The robot was a platform force feedback system, and the virtual environment coupled this with a desktop computer display, and required the patient to navigate a virtual plane or boat through a virtual environment and a series of targets. The patients with combined robot and VR made improvements in gait velocity, distance, and community ambulation, with results maintained at 3 month follow-up.
- Jaffe (2004) studied patients with virtual versus real stepping paradigms and found significant improvement in the fast gait velocities of the patients randomized to the virtual training intervention, though both groups improved in many aspects of gait functioning.

EVIDENCE TABLE

	Recommendation	Sources	LE	QE	SR
1	Consider VR for gait rehabilitation	Yang et al., 2008 Kim et al., 2009 Mirelman et al., 2009 Jaffe, 2004	I	Fair	B

LE=Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; §=Systematic Review (see Appendix A)

13.6 Upper Extremities

BACKGROUND

Impairments resulting from stroke (weakness, loss of range of motion, spasticity, sensory deficits, incoordination, and learned non-use) limit the ability of a person with stroke to use the paretic upper extremity. This hemiparesis is one of the most common problems experienced after stroke, interferes with the ability to complete daily life tasks and contributes to decreased quality of life. Summarizing the evidence is complicated by the paucity of large randomized clinical trials, the heterogeneity of the stroke population across and within studies, the lack of many studies comparing interventions of equal intensity, duration, and progression. Evidence has shown that improvements in the use of the paretic extremity in daily life can be improved both through increased ability to use the limb and through the amelioration of learned non- use, by therapy that is intensive, of sufficient duration, and progressive.

RECOMMENDATIONS

1. Recommend that UE functional recovery should consist of the practice of functional tasks, emphasizing progressive difficulty and repetition.
2. Recommend that treatment should be tailored to the individual patients considering the intervention that are most appropriate, engaging the patient, and are accessible and available.
3. Recommend Constraint-Induced Movement Therapy (CIMT) for individuals with at least 10 degrees of extension in two fingers, the thumb and the wrist. [A]
4. Recommend robot-assisted movement therapy as an adjunct to conventional therapy in patients with deficits in arm function to improve motor skill at the joints trained. [B]
5. Recommend bilateral practice to improve UE function. [B]
6. Recommend treatment with FES for patients who have impaired upper extremity muscle contraction, specifically with patients with elbow/wrist motor impairment. [B]
7. Recommend FES for patients who have shoulder subluxation.[B]
8. Consider FES and mental practice combined with repetitive and intense motor practice of functional tasks. [B]
9. Consider strengthening exercises in addition to functional task practice. [C]
10. Consider virtual reality as practice context. [C]
11. Insufficient evidence to recommend Mirror therapy. (I)
12. Do NOT use repetitive practice of movements in rehabilitation of upper extremity.

DISCUSSION

13.6.1 Constraint-Induced Movement Therapy

Constraint-Induced Movement Therapy is a multi-component therapy consisting of constraint of the non-paretic UE to prevent its use in daily activities, task practice with the paretic UE, and techniques to assist with transfer of recovering motor abilities into daily life use of the paretic UE. It was designed to overcome learned non-use and to reduce motor impairment.

Two systematic reviews and multiple RCTs (1 large sample) have demonstrated that CIMT is efficacious in improving motor function and use in individuals with at least 10 degrees of extension in 2 fingers and thumb extension. (Hakkennes, et al., 2005;Wolf et al., 2006, 2007; Taub et al., 2007; Page et al., 2008; Boake, et al., 2007; Brogardh et al., 2006; Lin,et al., 2007; Wu, et al., 2007a and b). There is little evidence to recommend a particular amount of CIMT, although several small RCT's have shown that modified CIMT protocols (1/2 hour to 1 hour per day of task practice plus 5-6 hours of mitt-wearing) have facilitated motor gains in individuals in acute rehabilitation (Page et al., 2008, 2005). Gains in functional use of the paretic extremity are larger than gains in motor skill.

13.6.2 Strengthening

Strengthening programs consist of requiring movements through progressively higher resistances. There are many

methods for strengthening, both low tech (elastic bands) and high tech (isokinetic machines such as the biodex). Despite fears that strengthening would increase abnormal movement patterns due to increasing spasticity, there is strong evidence that strengthening does not increase spasticity or abnormal movement patterns (Ada et al., 2006; Winstein, et al., 2004; Stein et al., 2004). In a systematic review of 21 RCTs, Ada et al. (2006) concluded that UE strengthening interventions slightly improved strength and activity. However, Stein et al. (2004) found that adding progressive resistance to robot-assisted UE training did not facilitate greater motor function gains than robot-assisted training without the resistance training. Similarly, Winstein and colleagues (2004) found that acutely, strength training through elastic band exercises resulted in equivalent motor gains as functional task training; the functional task training group, however, continued to improve at 9 months while the strength trained group did not. Importantly, both of these studies also showed that strength training did not increase spasticity. As Pak and Patton (2008) noted, it is not clear whether the strength training programs of either of these studies were of sufficient intensity to optimally induce strength gains in stroke survivors. Regardless, the current data support strengthening programs as an integral part of stroke rehabilitation for the UE.

13.6.3 Functional Electrical Stimulation/Neuromuscular Electrical Stimulation

Functional electrical stimulation (FES) also called functional neuromuscular stimulation (FNS) is electrical stimulation applied to a motor nerve to stimulate a muscle or muscle group to contract. FES has been used for several years as a therapy modality for post-stroke patients, but has not been a routine standard of care.

FES can be used in two ways. As a neuroprosthesis, FES can be used chronically to enable a paretic and non-trainable limb to function. The most common use for FES is as neurorehabilitation tool to assist in retraining a limb to perform functional voluntary tasks. FES can be used in conjunction with other techniques such as robotics and treadmill training and it has been used to reduce acute and chronic post-stroke deficits in upper or lower extremities.

It is believed that enhanced contractions provide the proprioceptive feedback to the brain to enhance the recovery of motor skills. It can be provided passively, where the individual is not asked to voluntarily contract the muscle, actively where the person is asked to contract the muscle but there is no check to see that he or she has done so, and in an EMG-triggered manner in which the person first contracts the muscle and only then sufficient contraction is achieved does the electrical stimulation is given to enhance the contraction. Electrodes can be surface applied or indwelling, the latter requiring the assistance of a professional who is able to surgically implant the electrodes.

Transcutaneous electrical nerve stimulation (TENS or TNS) is a technology that is related to FES. TENS is low level electrical stimulation applied to the skin. The stimulation is usually below the level that would produce muscle contraction. The mechanism of action of TENS for stroke rehabilitation is uncertain.

There is evidence from one systematic review (Pomeroy, 2006) and several small RCTs (Cauraugh and colleagues, 2002, 2003a,b,c, 2008; Kimberley, 2004; McDonnell et al., 2007) that FES/NMES may improve some aspects of UE motor skill and function. The intensity and duty cycle of the stimulation may be important parameters of this therapy that have not been well studied (Cauraugh, & Kim, 2003; Kowalczewski et al., 2007).

FES for improving upper extremity function has been done using surface electrodes. A small randomized controlled study comparing FES combined with task-specific upper extremity training to task specific training alone found that patients who received FES combined with task specific training had greater functional recovery (Alon et al., 2007). Rehabilitation training was done at home after discharge from hospital following the acute stroke. There are two small randomized controlled studies of FES for upper extremity deficits in chronic stroke patients. Hara et al. (2008) reported that a home program of upper extremity FES was able to improve wrist and finger extension and shoulder flexion. Daly et al. (2005) compared motor learning combined with FES to motor learning combined with upper extremity robotic training. Both groups demonstrated improvements in functional ability. The robot, which trained shoulder and elbow movements, was superior for improving shoulder function. FES which was applied to elbow, wrist and hand movements was superior for improving wrist and hand functions.

FES for shoulder subluxation uses implanted electrodes. A Cochrane report concluded that FES was effective in reducing shoulder subluxation (Price & Pandyan, 2001). A summary study of clinical trials (Van Peppen et al., 2004) also reported that FES was effective in reducing shoulder subluxation. A multicenter randomized clinical trial of FES for post-stroke shoulder subluxation reported that FES was more effective than using an arm sling in reducing shoulder pain due to subluxation (Chae et al., 2005). Pain reduction was maintained for more than one year after completion of the FES treatment.

13.6.4 EMG Biofeedback

Surface and computerized electromyographic (EMG) biofeedback have been used and documented in the treatment of stroke patients since the 1970s for improvement of arm function, gait, and swallowing. Biofeedback has been used primarily as an adjunct to conventional therapies.

Four meta-analyses have addressed biofeedback (Glanz et al., 1995; Moreland & Thomas, 1994; Moreland et al., 1998; Schleenbaker & Mainous, 1993). All four reviews showed trends toward improvements with biofeedback, but only two showed any statistically significant differences (Moreland et al., 1998; Schleenbaker & Mainous, 1993). The limited number of studies and small sample sizes may have led to a type II error. One small RCT, published since these meta-analyses, found no improvements in gait with the use of EMG biofeedback for post-stroke patients (Bradley et al., 1998). In addition, two small RCTs, published since the meta-analyses, showed no benefit when patients received balance training with a biofeedback apparatus that provided cues regarding their center of gravity (Geiger et al., 2001; Walker et al., 2000).

Due to methodological flaws in current studies, further research is indicated to assess the efficacy of biofeedback as an adjunct to conventional therapy for post-stroke patients

13.6.5 Mental Practice

Mental practice refers to the use of motor imagery (imaging oneself performing the requested tasks). It is considered that this imagery be from the first person perspective rather than mentally watching someone else doing the task and includes the imagining of both the normal proprioceptive sensations and visual sensations experienced during actual physical performance of the task.

Two systematic reviews and 7 RCTs investigated the efficacy of mental practice in improving UE function (Braun, et al, 2006; Zimmerman-Schlatter et al., 2008; Liu, et al., 2004; Page et al., 2001; Page et al., 2006; Page et al., 2007; Butler et al., 2006; Dijkeman et al., 2004). In general, these studies indicate that mental practice may be a beneficial intervention. Combining mental practice with physical practice is superior to mental practice alone (Dijkeman et al., 2004; Butler et al., 2006). Mental practice added to CIMT did not facilitate greater gains than Constraint-Induced Movement alone (Butler et al., 2006).

13.6.6 Bilateral Training

Bilateral training is the practice of simultaneous symmetrical movements (as in rolling a rolling pin with both hands). The rationale most often given for this kind of practice is the natural coupling of the limbs under symmetrical movements may facilitate the paretic limb and that simultaneous symmetrical movements may reduce inhibition from the healthy to the lesioned hemisphere, thereby increasing the lesioned hemisphere's potential for neuroplastic changes.

One systematic review (Cauraugh et al., 2006) and at least 1 small RCT (Hesse, et al., 2005) have shown that practicing symmetrical movements or tasks with both the paretic and nonparetic UE simultaneously(bilateral practice) improves motor skill in the paretic UE. There is conflicting evidence (1 small RCT; several non-randomized studies) whether or not bilateral practice is better than unilateral practice (Mudie, Mudie & Matyas, Cauraugh & Kim, 2002; Lewis, Byblow et al., 2000).

13.6.7 Robotic-assisted Therapy – Upper Extremity

Robot-assisted therapy applies forces to the affected limb during movement provided by a robot manipulator. The robot enables patients of any level of impairment to repetitively practice movement and functional tasks. Robots can operate from passive modes where the robot monitors activity to active modes where the robot corrects and assists in performing tasks. The robot can be programmed to give visual and auditory feedback during therapy.

Robotic-assisted therapy is the use of robots during the performance of practice tasks. The robots can assist the movement when the person is unable to initiate or complete the movements, can assist with the production of proper movement patterns, and, in some cases, provide resistance to the movements. The rationale for their use is that they may allow the ability to motor practice for those individuals who lack sufficient motor recruitment to produce movement and to allow the amount of practice that may be optimal for facilitating motor recovery in a cheaper manner than is possible with therapist-provided therapy.

There is evidence from 1 systematic review and multiple small RCTs that robot-assisted therapy may improve motor control of those UE areas trained. (Prange, 2006; Daly, 2005; Hesse, 2005; Lum, 2002; Lum, 2006; Masiero, 2006,

2007; Volpe 2008 a & b) It is not clear whether robotic therapy improves function at the activity or participation level (Volpe, 2008; Prange 2006). This may be a function that most robotic studies have used robots that exercise only the shoulder and elbow rather than the hand. Because few studies have compared robotic therapy to conventional therapy at comparable dose levels, it is unclear whether robotic therapy offers greater benefit to UE motor recovery than conventional therapy. Robotic therapy may be a cost effective way to achieve a greater amount of UE motor practice than can be provided with direct therapy.

- Volpe et al. (2000); Lum et al. (2002) Robot-assisted shoulder-elbow movement improved reaching. The evidence is not strong and there may be major resource implications for this intervention.
- Volpe (2008) Robotic training and an intensive movement protocol provided by physiotherapist improved upper extremity impairment measures of motor outcome significantly and comparably; there were no significant changes in disability measures. Motor gains were maintained at the 3-month evaluation after training
- EBRSR: There is *strong* evidence that sensorimotor training with robotic devices improves upper extremity functional outcomes, and motor outcomes of the shoulder and elbow. There is *strong* evidence that robotic devices do not improve motor outcomes of the wrist and hand.
- Bareca et al. (2003) included four studies in their review of sensorimotor training for the upper extremity (Feys et al., 1998; Jongbloed et al., 1989; Volpe et al., 1999, 2000). The authors concluded that stroke survivors who obtained sensorimotor stimulation showed more improvement at the end of the treatment phase compared to the control group. This improvement was still seen at follow-up 12 months later.

13.6.8 Mirror Therapy

In mirror therapy, the patient watches the reflection of his/her non-paretic UE in a mirror. The mirror is positioned such that the reflection is on the paretic side of the body. The patient is asked to perform a bilateral task, which is performed well with the non-paretic limb. The visual feedback of the reflection on the paretic side of the body also performing the task well matches the goal of the paretic arm performing the task well. In addition, this type of therapy may activate the mirror neuron system enhancing learning.

There are 2 RCTs that examined the efficacy of mirror therapy on the upper extremity after stroke. Altschuler et al. (1999) found that mirror therapy enhanced UE recovery. Yavuza and colleagues (2008) showed that mirror therapy was no better than conventional therapy in reducing spasticity in the upper extremity.

13.6.9 Virtual Reality

"Virtual reality is a computer based, interactive, multi-sensory environment that occurs in real time." (Henderson et al., 2007). Virtual reality ranges from interaction with a computer screen from outside the environment, such as with simple computer games, to completely immersive environments where the person has a strong sense of being within the virtual environment. Individuals perform different activities within these computer environments that have many characteristics of real world activities.

One systematic review was found (Henderson, et al., 2007). This review found one good quality RCT investigating immersive VR and 1 poor quality RCT investigating non-immersive VR. These studies indicated that motor practice within immersive VR is more effective than no therapy, but that non-immersive VR may be no better than conventional therapy, although the low quality of the latter RCT precludes definitive conclusions. There have been no studies comparing immersive VR to conventional therapy. The authors concluded that there was limited but encouraging evidence that VR is effective in post-stroke rehabilitation of the upper limb.

EVIDENCE TABLE

	Recommendation	Sources	LE	QE	Benefit	SR
1	Constraint Induced Movement Therapy improves use and motor skills in the paretic UE	Boake et al., 2007 Brogardh et al., 2006 Hakkennes et al., 2005 Lin et al., 2007 Page et al., 2008 Taub et al., 2007 Wolf et al., 2006, 2008 Wu et al., 2007a and b	I	Good	Substantial	A
2	Strength	Ada et al., 2006 [SR] Winstein et al., 2004 Stein et al., 2004 Pack et al., 2008	I	Fair	Mod	B
3	FES may improve aspects of UE function	Cauraugh et al., 2002, 2003a,b,c, 2008 Hara, 2008, 2006 Kimberley, 2004 McDonnell et al., 2007 Pomeroy, 2006 Daly et al., 2005 Alon et al., 2007	I	Fair	Moderate	B
4	FES for patients who have shoulder subluxation with or without shoulder pain	Price & Pandyan, 2001 Van Peppen et al., 2004 Chae et al., 2005	I	Good	Mod	B
5	EMG biofeedback	Glanz et al., 1995 [SR] Moreland & Thomas, 1994[MA] Moreland et al., 1998; [MA] Schleenbaker, 1993[SR] Bradley et al., 1998	I	Poor	Small	I
6	Bilateral practice improves UE function, but may not be better than unilateral practice	Lewis, Byblow Whitall, et al., 2000 Mudie; Mudie & Matyas, Cauraugh & Kim, 2002	I	Fair	Moderate	B
7	Robotic-assisted therapy improves motor skill at the joints trained	Daly, 2005 Hesse, 2005 Lum, 2002 Lum ,2006 Masiero, 2006, 2007 Prange, 2006 Volpe, 2008a & b	I	Fair	Moderate	B
8	Mirror therapy	Altschuler, et al., 1999 Yavuza et al., 2008	I	Poor	Small	I
9	Virtual reality	Henderson et al., 207	I	Poor	Small	C

LE=Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; §=Systematic Review (see Appendix A)

13.7 Cardiovascular Conditioning and Fitness

BACKGROUND

Activity intolerance is common post stroke, and may contribute to a decrease in aerobic capacity. Aerobic exercise training has been shown to benefit patients with a variety of diagnoses. However, this type of training has not traditionally been incorporated in stroke rehabilitation due to concerns of stroke recurrence or increases in spasticity. Recent studies and systematic reviews indicate that cardiovascular training post stroke leads to improved aerobic capacity and walking performance without untoward side effects.

RECOMMENDATIONS

1. Strongly recommend that patients participate in a regular aerobic exercise program at home or in an appropriate community program that is designed with consideration of the patient's co-morbidities and functional limitations. [A]

DISCUSSION

EBRSR (2009) provides the following summary of the evidence (Mobility and the Lower Extremity: p 64):

Several studies have demonstrated that exercise training can be effective for stroke patients (e.g., Brown and DeBacher ,1987; Monga et al., 1988; Potempa et al., 1995). Holt et al. (2001) demonstrated on a single patient that aerobic exercise training, on a static bicycle, enabled the patient to increase his walking speed, endurance and walking symmetry.

The American Heart Association (AHA) (Gordon et al., 2004) published exercise recommendations for stroke survivors. The recommendations include a regimen of aerobic exercises, strength training (including circuit training, weights and isometric exercises), flexibility (stretching), and coordination and balance activities. The guidelines are aimed at preventing the recurrence of a subsequent stroke and the improvement of sensorimotor function.

Pang et al. (2006) conducted a systematic review of aerobic exercise following stroke, which included 7 RCTs, evaluating patients in the acute (da Cunha et al., 2001; Katz-Leurer et al., 2003) subacute (Duncan et al., 2003) and chronic stages of stroke (Potempa et al., 1995; Chu et al., 2004) as well as one study which included 157 subjects with any form of brain injury (Bateman et al., 2001). Standardized effect sizes for the main outcomes of peak VO2 and peak workload were calculated. Exercise intensity ranged from 50% to 80% heart rate reserve, while duration varied from 20-40 min for 3-5 days a week. Regardless of the stage of stroke recovery, there was a significant benefit of therapy. Improvements were noted in the parameters of peak VO2, peak workload, walking speed and endurance.

A Cochrane review that examined the effects of physical training on reductions in death, dependency of disablement determined that definitive conclusions of efficacy could not be made due to the small body of literature (Saunders et al., 2004). Based on 11 published RCTs the authors concluded that there was no benefit of treatment on any of the primary outcomes assessed. However, EBRSR, based on reviewing all the individual studies, found strong evidence that while cardiovascular training post stroke improves level of physical fitness and gait performance; it does not result in additional improvement in ADL performance.

EVIDENCE TABLE

	Recommendation	Sources	QE	Overall Quality	R
1	Cardiovascular training improves level of physical fitness and gait performance	Saunders et al., 2004 Pang et al., 2006 Macko et al., 1997 Potempa et al., 1996 Rimmer et al., 2000b Teixeira-Salmela et al., 1999 Gordon et al., 2004	I	Good	A

LE=Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; §=Systematic Review (see Appendix A)

13.8 Adaptive Equipment, Durable Medical Devices, Orthotics, and Wheelchairs

OBJECTIVE

Minimally necessary assistive technology and training in its use should be available for individuals recovering from stroke to facilitate maximum independence in activity and participation.

BACKGROUND

Many patients require assistive devices, adaptive equipment, mobility aids, wheelchairs, and orthoses to maximize independent functioning following stroke. Many types of adaptive devices and durable medical devices (DME) are available. Type and level of functional deficit, degree of achieved adaptation, and the structural characteristics of the living environment determine the need for a particular item.

Walking devices are helpful for patients with mild gait impairments. These devices increase the base of support around a patient's center of gravity and reduce the balance and effort needed to walk. Walking aids include (but are not limited to) the following:

- **Single point canes**: Need to be fit to the patient and have rubber tips to improve traction.
- **Tripod or quad canes:** Have 3 to 4 points of contact and offer more stability than a single point cane; however, they are heavier, bulkier, and more awkward to use.
- **Walkers**: Support more body weight than canes; should be lightweight and foldable if the patient is planning to use it outside the home.
- **Rolling walkers**: Allow for more energy efficient ambulation. The two-wheeled walker is the most commonly used walker, because 4-wheeled walkers are less stable and require greater coordination.

Wheelchairs should be provided for patients with severe motor weakness or who easily fatigue. Wheelchair designs vary greatly and a wheelchair prescription should be specific to the patient's needs and environment and patient and family/caregiver preferences.

RECOMMENDATIONS

1. Recommend adaptive devices be used for safety and function if other methods of performing the task are not available or cannot be learned or if the patient's safety is a concern. [C]
2. Recommend lower extremity orthotic devices be considered, if ankle or knee stabilization is needed to improve the patient's gait and prevent falls. [C]
3. Recommend that a prefabricated brace be initially used and only patients who demonstrate long-term need for bracing have customized orthoses made. [C]
4. Recommend wheelchair prescriptions be based on careful assessment of the patient and the environment in which the wheelchair will be used. [C]
5. Recommend walking assistive devices be used to help with mobility efficiency and safety, when needed. [C]

DISCUSSION

There is a vast array of adaptive devices available, including devices to make eating, bathing, grooming, and dressing easier for patients with functional limitations. These devices should only serve as a supplement and should not be expected to take the place of the patient mastering the task in question. Additionally, many patients may need to use adaptive devices early during the rehabilitation following a stroke, but will not require long-term use. This should be taken into account when considering providing a device. Examples of adaptive devices include (but are not limited to) eating utensils with built-up handles, rocker knives, plate guards, non-skid place mats, long handled sponges for bathing, hand held showers, tub and shower chairs, grab bars for bathrooms, and elevated toilet seats.

Lower extremity orthoses, such as ankle-foot-orthoses (AFO) and knee-ankle foot-orthoses (KAFO), may be required if the patient has persistent weakness and instability at the ankle and/or knee joint following a stroke. Proper timing for using an orthosis can facilitate gait training and should be considered early on in the rehabilitation process to permit gait training to occur as early as possible. An orthosis should not be used as a substitute for functional exercise directed at regaining muscle strength and control, particularly if the prognosis for motor recovery

is good. Pre-fabricated orthoses can be used in the early stages of gait training, but a custom-fit device should be provided if it is determined that the patient may require long-term use of the orthosis.

Assistive devices - There is *moderate* evidence that a **quad cane** is more effective than a standard cane for reducing postural sway. There is limited evidence that walking with a cane can improve hemiplegic gait. There is *limited* evidence that use of canes is associated with improved functional mobility.

EVIDENCE

	Recommendation	Sources	LE	QE	SR
1	Use of adaptive equipment	AHCPR, 1995 Working Group Consensus	III	Poor	C
2	Use of lower extremity orthotic devices.	AHCPR, 1995 Working Group Consensus	III	Poor	C
3	Use of prefabricated braces	AHCPR, 1995 Working Group Consensus	III	Poor	C
4	Wheelchair prescriptions	AHCPR, 1995 Working Group Consensus	III	Poor	C

LE=Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; §=Systematic Review (see Appendix A)

14 SENSORY IMPAIRMENT

14.1 Sensory Impairment - Touch

BACKGROUND

Sensory impairment is common following stroke, and can interfere with functional activities. There is some evidence that tactile and kinesthetic sensation can be improved by sensory-specific training and that improvement in sensation may also improve activity. There is conflicting evidence for the effect of non-specific cutaneous stimulations when used in conjunction with conventional therapy.

RECOMMENDATIONS

1. Consider that all patients with sensory impairments be provided sensory-specific training
2. Consider that patients with sensory impairments be provided a trial of cutaneous electrical stimulation in conjunction with conventional therapy when appropriate.

14.2 Sensory impairment - Vision (Seeing)

BACKGROUND

Humans are visual creatures. The ability to accurately intake and perceive visual information is critical to successful completion of daily life tasks. After stroke, many of these processes can be impaired. Two of the most common visual impairments are visual field cuts and motility impairments (e.g. diplopia). The type of visual impairments experienced depends on lesion location. Many of these visual impairments are associated with increased disability.

RECOMMENDATIONS

1. Patient who have visual field cuts/hemianopsia or eye motility impairments after stroke should be provided with an intervention program for that visual impairment or compensatory strategies. [I]
2. Consider scanning training, visual field stimulation, prisms, and eye exercises as restorative intervention strategies.
3. Consider prisms and/or patching as compensatory intervention strategies.

DISCUSSION

While recently, it has been found that visual impairments are common after stroke, there is little evidence for how to ameliorate these problems. Studies for hemianopsia have suffered from either weakness in methods used to measure visual field changes and a lack of measuring generalization to everyday function. Studies have been small and often nonrandomized. Outcomes have been mixed. There are few studies regarding ocular motility interventions in stroke. The majority of this literature is in traumatic brain injury.

EVIDENCE TABLE

	Recommendation	Sources	LE	QE	SR
1	Interventions for visual field cuts / hemianopsia	Khan, 2008 Pellak, 2007 Poggel, 2004	I	Fair	I

LE=Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; §=Systematic Review (see Appendix A)

14.3 Sensory Impairment - Hearing

BACKGROUND

While hearing is not typically affected in stroke, many older stroke patients suffer from hearing loss which can interfere with their ability to participate in rehabilitation.

RECOMMENDATIONS

1. Recommend appropriate hearing aids be obtained and used, for patients with known hearing loss.

15 ACTIVITIES (ADL, IADL)

BACKGROUND

A large portion of time (19-43%) in inpatient stroke rehabilitation is spent on ADL training (Richards et al., 2005) because the ability to perform these activities is often necessary to move to levels of less structured care, particularly the ability to return to community living. Despite this, few studies have examined the most efficacious methods for facilitating improvements in ADL skills. Typically, ADLs are addressed with a mixture of restorative (e.g., motor training for the paretic UE) and compensatory interventions (e.g., one-handed techniques, adaptive equipment). In the U.S., much less time is spent on IADL training during inpatient rehabilitation because of the short lengths of stays. (Richards et al., 2005) As with ADLs, IADL training is a mixture of restorative and compensatory intervention. Compared to the ADL treatment literature there are even fewer studies examining the efficacy of IADL training.

RECOMMENDATIONS

1. Recommend all patients receive ADL training [A]
2. Recommend all patients receive IADL training in areas of need [C]
3. Recommend those individuals with stroke who exhibit ADL /IADL deficits should be given a training program that is tailored to the individual needs and anticipated discharge setting. [I]

DISCUSSION

Many of the studies reviewed in the motor recovery section have documented that improving motor, swallowing, cognitive, and psychosocial components is an important part of stroke rehabilitation (Studenski, 2005; Pohl, 2007; Donkervoort, 2005). The complexity of IADL and leisure activities often limits the impact of addressing just one or two Body Functions on engagement in these activities (Mead, 2007). Most studies of traditional inpatient rehabilitation, however, show that, in general, stroke survivors improve their ability to complete ADLs from admission to discharge (Ng, 2007; Teasell, 2006). Although level of ADL independence is linked to initial stroke severity, overall level of dependency, (Suzuki, 2006) and factors such as depression (Lai, 2002) play a part in the recovery process.

A large percentage of Occupational Therapy treatment is ADL and IADL focused. Teasell and colleagues (2005) reported that even severely impaired individuals can make gains in ADL performance with extended rehabilitation designed for their tolerance levels.

Collectively the evidence suggests that ADL and IADL training results in greater ADL and IADL independence than no ADL or IADL training (Landi, 2006; Leg, 2006; Trombly, 2002; Soderstrom, 2006; and Akinwuntan, 2005). Further, Liu and colleagues (2004) reported that training stroke patients to mentally rehearse ADL sequences and related problem solving resulted in even greater ADL gains than ADL training alone. Yet, some studies have found that ADL performance deteriorates within the first year after discharge from stroke rehabilitation (Grimby, 1998).

Two factors that may moderate ADL/IADL training gains are the amount and the type of rehabilitation received. For example, functional gains were less in individuals who received shortened lengths of stay in post-stroke inpatient rehabilitation due to the prospective payment system (Gillen, 2007). In a study comparing rehabilitation outcomes among four rehabilitation facilities in four different European countries (De Wit, 2007) stroke survivors in the United Kingdom facility had more favorable ADL outcomes than those in the three other facilities. The United Kingdom facility provided much more nursing care focused on practicing compensatory ADL techniques than the other facilities. In contrast, stroke survivors in the Swiss facility had better IADL outcomes compared to the other facilities; possibly due to the larger number of hours of OT they received. Even for individuals requiring chronic care, ADL training, environment adaptation, and remediation of impairments may at least retard deterioration of self-care abilities (Sackley, 2006). Jette and colleagues (2005) showed that higher intensities of therapy were associated with greater ADL recovery.

EVIDENCE TABLE

	Recommendation	Sources	LE	QE	SR
1	ADL/IADL training improves function IADL training improves function	Landi, 2006 Leg, 2006 Trombly, 2002 Soderstrom, 2006 Akinwuntan, 2005 Teasell, 2005 Liu and colleagues, 2004	I	Good Poor	A C

LE=Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; §=Systematic Review (see Appendix A)

Table 15-1: Activities in ADL and IADL

ADL	IADL
Mobility • Bed mobility • Wheelchair mobility • Transfers • Ambulation • Stair climbing	Home Management • Shopping • Meal planning • Meal preparation • Cleaning • Laundry • Child care
Self-Care • Dressing • Self-feeding • Toileting • Bathing • Grooming	Community Living Skills • Money/financial management • Use of public transportation • Driving • Shopping • Access to recreation activities
Communication • Writing • Typing/computer use • Telephoning • Using special communication devices	Health Management • Handling medication • Knowing health risks • Making medical appointments
Environmental Hardware • Keys • Faucets • Light switches • Windows/doors	Safety Management • Fire safety awareness • Ability to call 911 • Response to smoke detector • Identification of dangerous situations

Modified from: Pedretti LW. Occupational Therapy: Practice Skills for Physical Dysfunction. 4th ed. St. Louis: Mosby; 1996.

16 ADJUNCTIVE TREATMENT

16.1 Complementary Alternative Medicine (CAM) - Acupuncture

BACKGROUND

Acupuncture has been a Traditional Chinese Medicine treatment for thousands of years, and it has now gained the attention of Western medicine. There have been a number of evidence-based reviews on the use of acupuncture following stroke. Studies have examined various outcomes including death, institutionalization, functional independence, motor recovery, swallowing, spasticity, and pain. Most of these studies have been small, and the majority has methodological flaws (e.g. lack of a control group). There is no clear evidence as to the effect of acupuncture on stroke rehabilitation outcomes.

However, since complementary medicine may relate to particular cultural backgrounds or other belief systems, health professionals should be aware of and sensitive to the needs and desires of the stroke survivor and the family. Health professionals should be willing to discuss the effectiveness of therapy and different options of care within the context of the current health care system.

RECOMMENDATIONS

1. There is insufficient evidence to recommend acupuncture to improve stroke rehabilitation outcomes. [D]

DISCUSSION

Complementary and alternative therapies cover a range of practices including acupuncture, homoeopathy, traditional Chinese medicine, aromatherapy, music therapy, Reiki therapy and others. Although there have been a number of trials, primarily for acupuncture, there remains no evidence for the overall efficacy of complementary and alternative therapies (Park, 2001; Sze, 2002). Acupuncture may be useful in some situations for sensory stimulations to improve standing ability, as measured by using clinical scales (Johansson et al., 1993)

Homoeopathic interventions, however, may develop harmful interactions with certain medications and should be discussed with relevant health professionals.

- Sze et al. (2002) - This meta-analysis of 14 controlled trials concluded that in patients recovering from stroke, acupuncture has no additional effect on motor recovery but has a small positive effect on disability, which may be due to a true placebo effect and varied study quality. The efficacy of acupuncture without stroke rehabilitation remains uncertain, mainly because of the poor quality of such studies.
- Park et al. (2005) conducted a randomized trial of 116 patients (56 in the real acupuncture group and 60 in the sham group) evaluating the effect on function (ADL) and NIHSS scores and quality of life. The finding, consistent with those from other randomized trials of acupuncture in stroke rehabilitation, indicated no beneficial effect of acupuncture on recovery in ADL and health-related quality of life.
- Wu et al. (2006), in a Cochrane Report systematically reviewed the existing clinical evidence on traditional Chinese patent medicine (TCPM) for ischemic stroke. The review found insufficient good quality evidence on the effects of TCPM in ischemic stroke on the primary outcome (death or dependency). Some apparent benefit on neurological impairment was attributed to bias from poor methodology as to a real treatment effect.

EVIDENCE TABLE

	Recommendation	Sources	LE	QE	SR
1	Acupuncture	Sze et al., 2002 *§* Park et al., 2005 Wu et al., 2006 Johansson et al., 1993	I	Fair	D

LE=Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; §=Systematic Review (see Appendix A)

16.2 Hyperbaric oxygen (HBO)

Hyperbaric oxygen therapy (HBOT) is a controversial intervention that entails the therapeutic administration of 100% oxygen in a compression chambers using pressures greater than 1.0 atmosphere absolute (ATA). HBOT induces a state of increased partial pressure to the tissues and is suggested to provide several benefits as a result of protecting the area of the ischemic penumbra from further damage on reperfusion and may stimulate them to function normally. However HBOT has not been shown in research to be effective for post stroke rehabilitation and high dose oxygen therapy may be potentially toxic. Adverse events include damage to the ears or sinuses, oxygen toxicity, and claustrophobia.

RECOMMENDATIONS

1. The use of hyperbaric oxygen therapy is not recommended. [D]

DISCUSSION

There is *strong* evidence that hyperbaric oxygen therapy does not improve neurological status (EBSRS).

A Cochrane review (Bennett et al., 2005) identified only 3 small trials, involving a total of 106 patients, suitable for inclusion (Anderson et al., 1991; Nighoghossian et al., 1995; Rusyniak et al., 2003). The relative risk of death associated with HBOT at 3 and 6 months was not significantly reduced (RR =0.61, 0.17, 2.20). This was the only outcome with sufficient data to pool.

Carson et al. (2005) conducted a meta-analysis to investigate the risks and benefits of hyperbaric oxygen therapy in the treatment of stroke patients. They reviewed only 4 randomized controlled trials and one controlled trial, which included 218 patients plus an additional 17 observational studies. The evidence showed no effectiveness for hyperbaric oxygen therapy in post-stroke patients. The study concluded that, *"the overall evidence is insufficient to determine the effectiveness of hyperbaric oxygen therapy in any subgroup of stroke patients."*

EVIDENCE

	Recommendation	**Sources**	**QE**	**Overall Quality**	**R**
1	Hyperbaric oxygen Therapy	Bennett et al., 2005 Carson et al., 2005	I	Good	D

LE=Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; §=Systematic Review (see Appendix A)

17 FAMILY/COMMUNITY SUPPORT

BACKGROUND

The patient and family/caregivers should be given information and provided with an opportunity to learn about the causes and consequences of stroke, potential complications, and the goals, process, and prognosis of rehabilitation.

Training caregivers and patients with stroke improves mood and quality of life and reduces costs but does not affect patient mortality, institutionalization, or functioning. The presence and effectiveness of large social support networks can have a positive influence on the physical recovery and quality of life of the stroke survivor.

RECOMMENDATIONS

1. Patients and caregivers should be educated throughout the rehabilitation process to address patient's rehabilitation needs, expected outcomes, procedures and treatment as well as appropriate follow-up in the home/ community. [B]
2. Patient and caregiver education should be provided in both interactive and written formats. [B]
3. Caregivers should be provided in a variety of methods of training based on their specific needs, cognitive capability, and local resources; Training may be provided in individual or group format, and in community-based programs. [B]

DISCUSSION

A National Stroke Association survey (Jones, 2006) found that stroke survivors often do not reach their rehabilitation goals, and lack of information is a major barrier to continued recovery: 38% of 523 long-term stroke survivors reported a lack of information about community and rehabilitation resources.

Inadequate provision of information is predictive of poor quality of life in stroke patients and their families (O'Mahoney, 1997). There is some evidence that combining information with educational sessions improves knowledge and is more effective than providing information alone (Forster, 2001). As the patient progresses from hospital-based rehabilitation to the community, involvement of carers in rehabilitation becomes increasingly important. Formal training of caregivers in delivery of care reduces personal costs and improves quality of life (Kalra, 2004).

Forster and colleagues (2001) reviewed nine studies of educational intervention. The authors excluded trials in which information giving was only one component of a more complex rehabilitation intervention (e.g., family support worker trials). They found that in two good-quality trials (Evans et al., 1988; Rodgers et al., 1999) information-plus-education improved knowledge. Information-plus-education, however, had no effect on perceived health status and quality of life or on the Caregiver Hassles scale. One of the two relevant trials found an association between education provision and 4 of 7 subscales of a family functioning scale. However, 58 percent of the patients in that study did not attend 3 or more of the 6 classes offered. The authors wrote that "There is a suggestion that information provided in an educational context is more effective than the simple provision of a booklet or leaflet. However, the success of such strategies is limited if they are unacceptable to the patient." The authors concluded "The results of the review are limited by the variable quality of the trials and the wide range of outcome measures used. The general 'effectiveness' of information provision has not been conclusively demonstrated."

One systematic review (Bhogal, 2003) and one meta-analysis (Smith, 2008) looked at caregiver support interventions and found that social support improved patient outcomes and family functioning. A comparison of passive versus active information intervention determined that there was no significant effect on the number of cases of anxiety or depression in patients, carer mood or satisfaction or death. A qualitative analysis found no strong evidence of an effect on other outcomes. Meta-analyses showed a significant effect from information therapy on patient and carer knowledge, one aspect of patient satisfaction, and patient depression scores.

Six randomized controlled trials (2002 to 2007) that provide some evidence of the impact of caregiver support were identified. Sample sizes ranged from 62 to 127 patients and caregivers. Interventions consisted of counseling in the home setting, information packages, education, group program and services as part of an early supportive discharge program. Significant correlations were found with counseling in the home and activity level. Information packages modestly improved functional status and improved family functioning. Caregiver training produced a modest impact on caregiver burden, moderately high impact on quality of life, but social services support did not predict

caregiver outcomes. Education did not provide statistical support for effect on knowledge, though there was a trend in favor of the educational intervention. An early supported discharge program lowered burden scores for caregivers in comparison with usual care, even when the patients had major functional limitations.

An evidence-based educational program for stroke survivors after discharge home (Ostwald et al, 2008) described 39 comprehensive educational guidelines. The program recommended that educational programs provided to stroke survivors and their families be interactive, interdisciplinary, and focused on identified needs.

EVIDENCE TABLE

	Recommendation	Sources	LE	QE	SR
1	Patient and Caregiver Education	Bhogal et al., 2003 (§) Smith et al., 2008 (§) Kalra, 2004 Bjorkdahl et al., 2007	I	Fair	B
2	Education should be provided in an interactive and written format	Smith et al., 2008 (§) Forster, 2001 (§) Clark et al., 2003	I	Fair	B
3	Caregiver training should be provided in a variety of methods	Ostwald et al., 2008	II	Fair	B

LE=Level of Evidence; QE = Quality of Evidence; SR = Strength of Recommendation; §=Systematic Review (see Appendix A)

APPENDICES

APPENDIX A
Guideline Development Process

The update of the VA/DoD Clinical Practice Guideline for Management of Stroke Rehabilitation was developed following the steps described in "Guideline for Guidelines," an internal working document of the VA/DoD Evidence Based Practice Working Group, that requires an ongoing review of guideline works in progress.

The Offices of Quality and Performance and Patient Care Services of the VA, and the Army Medical Command of the DoD identified clinical leaders to champion the guideline development process. During a preplanning conference call, the clinical leaders defined the scope of the guideline and identified a group of clinical experts from the VA and DoD to form the Management of Stroke Rehabilitation Working Group (WG). For this guideline these WG participants were drawn from the fields of physical medicine & rehabilitation, internal medicine, primary care, neurology, geriatric medicine, social work, and rehabilitation (physical therapy, exercise physiology, occupational therapy, speech/language therapy, nursing, recreation therapy, and exercise therapy) who were also from diverse geographic regions, and selected from both VA and DoD health care systems. Experts representing the American Health association (AHA) were also part of the WG.

The WG participated in 3 face-to-face meetings to reach consensus about the guideline algorithm and evidence-based recommendations and to prepare a draft update document. The draft continued to be revised by the Working Group through numerous conference calls and individual contributions to the document.

Recommendations for the management of stroke rehabilitation were derived through a rigorous methodological approach that included the following:

- Determining appropriate criteria such as effectiveness, efficacy, population benefit, or patient satisfaction
- Reviewing literature to determine the strength of the evidence in relation to these criteria
- Formulating the recommendations and grading the level of evidence supporting the recommendation

After orientation to the guideline scope and to goals that had been identified, the WG developed a set of 35 researchable questions within the focus area of the guideline and identified associated key terms. This ensured that the guideline development work outside of meetings focused on issues that practitioners considered important. This also produced criteria for the literature search and selection of included studies that formed the body of evidence for this guideline update.

All questions specified (adapted from the Evidence-Based Medicine toolbox, Center for Evidence-Based Medicine, [http://www.cebm.net]):

- **P**opulation – Characteristics of the target patient population
- **I**ntervention – Exposure, diagnostic, or prognosis
- **C**omparison – Intervention, exposure, or control used for comparison
- **O**utcome – Outcomes of interest

These specifications served as the preliminary criteria for selecting studies. See *PICO Questions to Guide Literature Search (page 118)* for a complete listing and categorization of the questions.

Literature Search

An initial global literature search (using cerebrovascular disorders as a mesh term crossed with stroke as a text term) yielded 5, 612 abstracts which were reviewed, resulting in 832 references being selected for further analysis (199 Randomized clinical trials (RCTs), 19 Meta-analyses (MAs), 58 Systematic reviews

(SRs), 541 Reviews/observational studies, and 5 guidelines). Refinement of the review process with input from the WG members resulted in 301 studies being identified that met the baseline criteria for inclusion, addressed one or more of the researchable questions, and covered topic areas that had either not been addressed in the previous version of this guideline or had been included but not fully developed . A more detailed (full) search was conducted on each question, supplemented by hand searches and cross-referencing to search for relevant articles. The searches for these questions covered the period since the last VA/DoD CPG on Stroke (published after January 1, 2003 and before March, 2008 but ran in Pub Med most recently on March 2009).

Selection of Evidence

The evidence selection process was designed to identify the best available evidence to address each key question and ensure maximum coverage of studies at the top of the hierarchy of study types. Published, peer-reviewed RCTs, as well as meta-analyses and systematic reviews that included randomized controlled studies, were considered to constitute the strongest level of evidence in support of guideline recommendations. This decision was based on the judgment that RCTs provide the clearest, most scientifically sound basis for judging comparative efficacy. The WG also recognized the limitations of RCTs, particularly considerations of generalizability with respect to patient selection and treatment quality. When available, the search sought out critical appraisals already performed by others that described explicit criteria for deciding what evidence was selected and how it was determined to be valid. The sources that have already undergone rigorous critical appraisal include Cochrane Reviews, Best Evidence, Technology Assessment, AHRQ systematic evidence reports, and other published Evidence-based Clinical Practice Guidelines.

In addition to Medline/PubMed, the following databases were searched: Database of Abstracts of Reviews of Effectiveness (DARE), Cinahl/Medline/Embase/PsycINFO (OVID), and Cochrane Central Register of Controlled Trials. For Medline/PubMed searches, limits were set for language (English), and type of research (RCT, systematic reviews and meta-analysis). For prognostic and diagnostic questions (e.g., does test improve outcome?); cohort or other prospective non-RCT designs were considered.

The following inclusion criteria were used to select the articles identified in the literature search for possible inclusion:

- Published in United States, United Kingdom, Europe, Australia, Japan, New Zealand
- Full articles only published in English
- Study populations: age limited to adults 18 years of age or older; all races, ethnicities, and cultural groups
- Relevant outcomes able to be abstracted from the data presented in the articles
- Sample sizes appropriate for the study question addressed in the paper. RCTs were included if they were initiated with 30 or more participants

Preparation of Evidence Tables (Reports) and Evidence Rating

The results of the searches were organized in evidence reports, and copies of the original studies were provided to the WG for further analysis. Each reference was appraised for scientific merit, clinical relevance, and applicability to the populations served by the VA and DoD health care systems.

Recommendation and Quality Rating

Evidence-based practice involves integrating clinical expertise with the best available clinical evidence derived from systematic research.

A group of research analysts read and coded each article that met inclusion criteria. The articles were assessed for methodological rigor and clinical importance. Clinical experts from the VA and DoD WG reviewed the results and evaluated the strength of the evidence, considering quality of the body of evidence (made up of the individual studies) and the significance of the net benefit (potential benefit minus possible harm) for each intervention.

The overall strength of each body of evidence that addresses a particular Key Question was assessed using methods adapted from the U.S. Preventive Services Task Force (Harris, 2001). To assign an overall quality

[QE] (see Table A-2) of the evidence (good, fair, or poor), the number, quality, and size of the studies; consistency of results between studies; and directness of the evidence were considered. Consistent results from a number of higher-quality studies [LE] (see Table A-1) across a broad range of populations; supports with a high degree of certainty that the results of the studies are true and therefore the entire body of evidence would be considered ‘‘good” quality. A ‘‘fair” quality was assigned to the body of evidence indicating that the results could be due to true effects or to biases present across some or all of the studies. For a ‘‘poor” quality body of evidence, any conclusion is uncertain due to serious methodological shortcomings, sparse data, or inconsistent results.

The Strength of Recommendation [SR] was then determined based on the Quality of the Evidence [QE], and the clinical significance of the net benefit [NE] (see Table A-3) for each intervention, as demonstrated by the body of evidence. Thus, the grade (i.e., A, B, C, D or I) assigned to guideline recommendations reflect both variables; the Quality of the evidence and the potential clinical benefit that the intervention may provide to patients (see Table A4).

Table A-1: Level of Evidence (LE)	
I	At least one properly done RCT
II-1	Well-designed controlled trial without randomization
II-2	Well-designed cohort or case-control analytic study, preferably from more than one source
II-3	Multiple time series evidence with/without intervention, dramatic results of uncontrolled experiment
III	Opinion of respected authorities, descriptive studies, case reports, and expert committees

Table A-2: Overall Quality [QE]	
Good	High grade evidence (I or II-1) directly linked to health outcome
Fair	High grade evidence (I or II-1) linked to intermediate outcome; *or* Moderate grade evidence (II-2 or II-3) directly linked to health outcome
Poor	Level III evidence or no linkage of evidence to health outcome

Table A-3: Net Effect of the Intervention [NE]	
Substantial	More than a small relative impact on a frequent condition with a substantial burden of suffering; *or* A large impact on an infrequent condition with a significant impact on the individual patient level.
Moderate	A small relative impact on a frequent condition with a substantial burden of suffering; *or* A moderate impact on an infrequent condition with a significant impact on the individual patient level.
Small	A negligible relative impact on a frequent condition with a substantial burden of suffering; *or* A small impact on an infrequent condition with a significant impact at the individual patient level.
Zero or Negative	Negative impact on patients; *or* No relative impact on either a frequent condition with a substantial burden of suffering, or an infrequent condition with a significant impact on the individual patient level.

Table A-4: Final Grade of Recommendation [SR]				
	The net benefit of the intervention			
Quality of Evidence	Substantial	Moderate	Small	Zero or Negative
Good	A	B	C	D
Fair	B	B	C	D
Poor	I	I	I	I

Strength of Recommendation Rating [SR]

A	A strong recommendation that the clinicians provide the intervention to eligible patients. *Good evidence was found that the intervention improves important health outcomes and concludes that benefits substantially outweigh harm.*
B	A recommendation that clinicians provide (the service) to eligible patients. *At least fair evidence was found that the intervention improves health outcomes and concludes that benefits outweigh harm.*
C	No recommendation for or against the routine provision of the intervention is made. *At least fair evidence was found that the intervention can improve health outcomes, but concludes that the balance of benefits and harms is too close to justify a general recommendation.*
D	Recommendation is made against routinely providing the intervention to asymptomatic patients. *At least fair evidence was found that the intervention is ineffective or that harms outweigh benefits.*

I	The conclusion is that the evidence is insufficient to recommend for or against routinely providing the intervention. *Evidence that the intervention is effective is lacking, of poor quality, or conflicting, and the balance of benefits and harms cannot be determined.*

Lack of Evidence – Consensus of Experts

Where existing literature was ambiguous or conflicting, or where scientific data was lacking on an issue, recommendations were based on the clinical experience of the Working Group.

This update of the Stroke Rehabilitation Guideline is the product of many months of diligent effort and consensus building among knowledgeable individuals from the VA, DoD, and academia, as well as guideline facilitators from the private sector. An experienced moderator facilitated the multidisciplinary Working Group. The list of participants is included in Appendix D

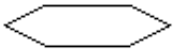
Algorithm Format

The clinical algorithm incorporates the information presented in the guideline in a format which maximally facilitates clinical decision-making. The use of the algorithmic format was chosen because of evidence showing that such a format improves data collection, facilitates diagnostic and therapeutic decision-making, and changes patterns of resource use.

The algorithmic format allows the provider to follow a linear approach to critical information needed at the major decision points in the clinical process and includes:

- An ordered sequence of steps of care
- Recommended observations
- Decisions to be considered
- Actions to be taken

A clinical algorithm diagrams a guideline into a step-by-step decision tree. Standardized symbols are used to display each step in the algorithm (Society for Medical Decision-Making Committee, 1992). Arrows connect the numbered boxes indicating the order in which the steps should be followed.

	Rounded rectangles represent a clinical state or condition.
	Hexagons represent a decision point in the guideline, formulated as a question that can be answered Yes or No. A horizontal arrow points to the next step if the answer is YES. A vertical arrow continues to the next step for a negative answer.
	Rectangles represent an action in the process of care.
	Ovals represent a link to another section within the guideline.

A letter within a box of an algorithm refers the reader to the corresponding annotation. The annotations elaborate on the recommendations and statements that are found within each box of the algorithm. Included in the annotations are brief discussions that provide the underlying rationale and specific evidence tables. Annotations indicate whether each recommendation is based on scientific data or expert opinion. A complete bibliography is included in the guideline.

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Management of Stroke Rehabilitation – PICO Questions to guide literature search

Assessment: Diagnosis

1. In patients with acute stroke, is there evidence that **non-instrumental dysphagia assessment/screening tests** identify aspiration?
2. In patients with acute stroke, is there evidence that **screening by nurses is comparable to screening by speech language pathologists** in identifying aspiration?

Prognosis

3. Is **home-based rehabilitation** as effective as **hospital based rehabilitation** post-stroke?
4. Is early **supported discharge** as effective as standard customary rehabilitation post stroke?
5. In patients with stroke, is **location of care as a proxy for intensity of service** (skilled nursing facility vs. acute rehabilitation unit) indicative of better outcomes?

Management

6. In patients with aphasia, is **impairment-based treatment (linguistic)** more effective than **functional treatment or no treatment**?
7. In patients with **acquired articulation disorders and/or voice disorders** (apraxia of speech, dysarthria, dysphonia) post-stroke, does treatment vs no treatment lead to better outcome?
8. In patients with aphasia, is **group therapy** as effective as **individual therapy** for aphasia?
9. In patients with aphasia, is **computerized treatment** as effective as **clinician-provided treatment** for aphasia?
10. In patients with stroke and dypsphagia, what **dietary modifications, positional maneuvers, and exercises** are effective in maintaining **adequate hydration and nutrition**? OR
    In adult patients with stroke and dysphagia, what **compensatory and rehabilitation treatments** are effective in maintaining **adequate hydration and nutrition**? In patients with aphasia, does **impairment-based treatment** or **functional treatment** compared with no treatment improve quality of life?
11. Does **robot-assisted therapy** improve the ability to use the paretic upper extremity (UE) (or improve UE function) in daily activities in:
    a. Patients with acute stroke?
    b. Patients with mild-moderate UE motor impairment?
    c. Patients with severe UE motor impairment?
12. Does **robot-assisted therapy** improve the ability to use the paretic UE (or improve UE function) in daily activities **better than traditional care or better than any other treatment of the same intensity and duration** in:
    a. Patients with acute stroke?
    b. Patients with mild-moderate UE motor impairment?
    c. Patients with severe UE motor impairment?

13. Does **strengthening the arm** post-stroke improve patient's ability to engage in desired activities and/or improve UE function in:
    a. Patients with acute stroke?
    b. Patients with mild-moderate UE motor impairment?
    c. Patients with severe UE motor impairment?
14. Does **reducing spasticity in the UE** result in increases in UE function and the ability to complete ADLs, IADLs in:
    a. Patients with acute stroke?
    b. Patients with mild-moderate UE motor impairment?
    c. Patients with severe UE motor impairment?
15. Does **cortical stimulation,** either through repetitive Transcranial Magnetic Stimulation (rTMS) or electrically (implanted electrodes or intercranial), **in addition to motor therapy** improve UE function in daily life activities and/or complete ADLs/IADL:
    a. Patients with acute stroke?
    b. Patients with mild-moderate UE motor impairment?
    c. Patients with severe UE motor impairment?
16. In patients post-stroke with upper extremity motor impairment, does the **use of constraint-induced** (or modified constraint-induced) treatment vs standard care improve UE functioning?
17. In patients with subacute stroke, does **mirror therapy** improve hand function better than standard care?
18. In patients post-stroke, can **supported treadmill training** assist walking ability better than standard techniques?
19. In patients post-stroke, is **locomotor treadmill training** with partial body-weight support before overground gait more efficacious than standard care?
20. In patients post-stroke, which **gait training strategies** are the most effective?
21. In patients post-stroke, are **ankle joint mobilizations** more effective in increasing ankle joint range of motion than standard care?
22. In patients post-stroke, does **mirror therapy** improve lower extremity motor recovery as compared to **sham therapy**?
23. In patients post-stroke, can **exercise training** improve cardiometabolic adaptation?
24. In patients post-stroke, does **progressive resistance training** improve muscle strength, tone, gait performance and perceived participation?
25. In patients post-stroke, do **strengthening interventions** vs standard care increase strength and activity?
26. In patients post-stroke, do **virtual reality-based approaches** enable walking compared to standard care?
27. In patients post-stroke, is **whole body vibration** more effective than standard care for improving balance recovery?
28. Do patients with chronic stroke benefit from an aerobic exercise program?
29. In patients post-stroke, is **exercise more effective than relaxation** in improving quality of life and physical function?
30. In patients post-stroke, does community exercise improve outcome for patient recovering at home?

Telemedicine

31. In patients post-stroke, does **remote/distance monitoring (telemedicine)** result in the same/better outcomes (utilization, comorbidity, functional independence, patient satisfaction) than treatment as usual follow-up

Medications

32. In patients post-stroke with mild cognitive impairment, do **anti-cholinesterase inhibitors** (donepezil, rivastigmine, galantamine) or memantine vs no specific pharmacologic treatment improve outcomes (raise scores on MMSE/other measures; reduce burden of care)?
33. In patients post-stroke with motor impairment, does **treatment with amphetamines, detroamphetamines, dopamine or dopamine agonists** vs pharmacologic treatment improve outcome (e.g., recovery time; walking speed)?

Depression

34. In patient post-stroke, does screening for and treatment of depression compare dot no screening or no treatment lead to better rehabilitation outcomes?
35. In patient post-stroke, does cognitive rehabilitation strategies aimed at spatial neglect lead to better outcome in reducing disability and improving independence?

APPENDIX B
Standard Instruments for Post-Stroke Assessment

Preferred Standard Instruments for Patient Assessment in Stroke (AHCPR, 1995)

Type	Name and Source	Approximate Time to Administer	Strengths	Weaknesses
Level-of-consciousness scale	Glasgow Coma Scale[a]	2 minutes	Simple, valid, reliable.	None observed.
Stroke deficit scales	NIH Stroke Scale [b]	2 minutes	Brief, reliable. Can be administered by non-neurologists.	Low sensitivity.
	Canadian Neurological Scale [c]	5 minutes	Brief, valid, reliable.	Some useful measures omitted.
Global disability scale	Rankin Scale [d,e]	5 minutes	Good for overall assessment of disability.	Walking is the only explicit assessment criterion. Low sensitivity.
Measures of disability/activities of daily living (ADL)	Barthel Index [f]	5-10 minutes	Widely used for stroke. Excellent validity and reliability.	Low sensitivity for high-level functioning.
	Functional Independence Measure (FIM™) [g]	40 minutes	Widely used for stroke. Measures mobility, ADL, cognition, functional communication.	"Ceiling" and "floor" effects.
Mental status screening	Folstein Mini-Mental State Examination [h]	10 minutes	Widely used for screening.	Several functions with summed score. May misclassify patients with aphasia.
	Neurobehavioral Cognition Status Exam (NCSE) [i]	10 minutes	Predicts gain in Barthel Index scores. Unrelated to age.	Does not distinguish right from left hemisphere. No reliability studies in stroke. No studies of factorial structure. Correlates with education.
Assessment of motor function	Fugl-Meyer [j]	30-40 minutes	Extensively evaluated measure. Good validity and reliability for assessing sensorimotor function and balance.	Considered too complex and time-consuming by many.
	Motor Assessment Scale [k]	15 minutes	Good, brief assessment of movement and physical mobility.	Reliability assessed only in stable patients. Sensitivity not tested.
	Motricity Index [l]	5 minutes	Brief assessment of motor function of arm, leg, and trunk.	Sensitivity not tested.
Balance assessment	Berg Balance Assessment [m]	10 minutes	Simple, well established with stroke patients; sensitive to	None observed.

Type	Name and Source	Approximate Time to Administer	Strengths	Weaknesses
			change.	
Mobility assessment	Rivermead Mobility Index [n]	5 minutes	Valid, brief, reliable test of physical mobility.	Sensitivity not tested.
Assessment of speech and language functions	Boston Diagnostic Aphasia Examination [o]	1-4 hours	Widely used. Comprehensive, good standardization data. Sound theoretical rationale.	Time to administer long. Half of patients cannot be classified.
	Porch Index of Communicative Ability (PICA) [p]	1/2-2 hours	Widely used. Comprehensive, careful test development and standardization.	Time to administer long. Special training required to administer. Inadequate sampling of language other than one word and single sentences.
	Western Aphasia Battery [q]	1-4 hours	Widely used. Comprehensive.	Time to administer long. “Aphasia quotients” and “taxonomy” of aphasia not well validated.
Depression scales	Beck Depression Inventory (BDI) [r]	10 minutes	Widely used. Easily administered. Norms available. Good with somatic symptoms.	Less useful in elderly and in patients with aphasia or neglect. High rate of false positives. Somatic items may not be due to depression.
	Center for Epidemiologic Studies Depression (CES-D) [s]	<15 minutes	Brief, easily administered, useful in elderly. Effective for screening in stroke population.	Not appropriate for aphasic patients.
	Geriatric Depression Scale (GDS) [t]	10 minutes	Brief, easy to use with elderly, cognitively impaired, and those with visual or physical problems or low motivation.	High false negative rates in minor depression.
	Hamilton Depression Scale [u]	<30 minutes	Observer rated. Frequently used in stroke patients.	Multiple differing versions compromise interobserver reliability.
Measures of instrumental ADL	PGC Instrumental Activities of Daily Living [v]	5-10 minutes	Measures broad base of information necessary for independent living.	Has not been tested in stroke patients.
	Frenchay Activities Index [w]	10-15 minutes	Developed specifically for stroke patients. Assesses broad array of activities.	Sensitivity and interobserver reliability not tested; sensitivity probably limited.
Family assessment	Family Assessment Device (FAD) [x]	30 minutes	Widely used in stroke. Computer scoring available. Excellent validity and reliability. Available in	Assessment subjective; sensitivity not tested; “ceiling” and “floor” effects.

Type	Name and Source	Approximate Time to Administer	Strengths	Weaknesses
			multiple languages.	
Health status/ quality of life measures	Medical Outcomes Study (MOS) 36-Item Short-Form Health Survey [y]	10-15 minutes	Generic health status scale SF36 is improved version of SF20. Brief, can be self – administered or administered by phone or interview. Widely used in the United States.	Possible "floor" effect in seriously ill patients (especially for physical functioning), suggests it should be supplemented by an ADL scale in stroke patients.
	Sickness Impact Profile (SIP) [z]	20-30 minutes	Comprehensive and well-evaluated. Broad range of items reduces "floor" or "ceiling" effects.	Time to administer somewhat long. Evaluates behavior rather than subjective health; needs questions on well-being, happiness, and satisfaction.

Note: ADL=activities of daily living. IADL=instrumental activities of daily living.

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Academy of Neurological Communication Disorders and Sciences: http://www.ancds.duq.edu/

University of Minnesota Duluth: http://www.d.umn.edu/~mmizuko/3411/may11.htm

Neuropsychology Central:
http://www.neuropsychologycentral.com/interface/content/resources/page_material/resources_general_materials_pages/resources_document_pages/aphasia_assessment.pdf

APPENDIX C
Acronym List

ACE	Angiotensin-Converting-Enzyme
ADL	Activities of Daily Living
AFO	Ankle-Foot-Orthoses
AHCPR	Agency for Healthcare Policy and Research
ASHA	American Speech and Hearing Association
BI	Barthel Index
CAD	Coronary Artery Disease
CEA	Carotid Endarterectomy
CHD	coronary heart disease
CI	Constraint Induced
CNS	Central Nervous System
CRPS	Complex Regional Pain Syndrome
CSE	clinical swallowing exam
CVA	Cerebrovascular Accident
DME	Durable Medical Devices
DoD	Department of Defense
DVT	Deep Vein Thrombosis
EMG	Electromyographic
ESD	Early Supported Discharge
FAI	Frenchay Activities Index
FDA	Federal Drug Administration
FEES	Fiberoptic Endoscopic Examination of Swallowing
FEESST	Fiberoptic Endoscopic Examination of Swallowing with Sensory Testing
FES	Functional Electrical Stimulation
FIM™	Functional Independence Measure
GAD	Generalized Anxiety Disorder
HDL	High-Density Lipoproteins
IADL	Instrumental Activities of Daily Living
KAFO	Knee-Ankle Foot-Orthoses
LDL	Low-Density-Lipoproteins
LDUH	Low-Dose Unfractionated Heparin
LMWH	Low Molecular Weight Heparin
MCA	Middle-Cerebral-Artery

NDT	Neuro Developmental Training
NHP	Nottingham Health Profile
NHSTA	National Highway Safety and Traffic Administration
NIH	National Institutes of Health
NIHSS	National Institutes of Health Stroke Scale
NOMS	National Outcomes Measurement System
PE	Pulmonary Embolism
PSD	Post-Stroke Depression
RBU	Rehabilitation Bed Units
RCP	Royal College of Physicians
RCT	Randomized Controlled Trial
ROM	Range of Motion
SIGN	Scottish Intercollegiate Guidelines Network
SLP	Speech and Language Pathologist
SSRI	Selective Serotonin Reuptake Inhibitor
TBI	Traumatic Brain Injury
USPSTF	U.S. Preventive Services Task Force
VFSS	Videofluoroscopy Swallowing Study

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APPENDIX E
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