Cognitive Rehabilitation after Blast Injury and Polytrauma

Blast Injury and Polytrauma

- Theaters of War
  - Operation Enduring Freedom (OEF)
  - Operation Iraqi Freedom (OIF)
  - Global War on Terrorism (GWOT)

- Brain injury as signature injury of OIF/OEF
  - Every war has a “signature injury”
    - Civil War: amputation
    - WWI: lung damage from gases
    - WWII: radiation from Hiroshima & Nagasaki
    - Korean War: circulation and joint problems from intense cold
    - Vietnam War: illnesses related to use of Agent Orange
    - OIF/OEF: Brain injury

- Polytrauma defined – VHA 2005
  - Injury to the brain in addition to other body parts or systems resulting in physical, cognitive, psychological, or psychosocial impairments and functional disability.
  - Injury to the brain is the impairment which guides the course of rehabilitation.

- New Challenges of blast injury and polytrauma
  - Emphasis on explosives as a primary weapon
  - High survival rate (Gawande 2004)
    - Revolutionary War = 50% mortality
    - Vietnam mortality = 24% mortality
    - OIF/OEF mortality = 10% mortality
  - Highly complex injuries

- Higher survival rates
  - Improved protective gear
  - Improved military medicine

- From the battlefield to the VA
  - Forward Surgical Teams
  - Combat Support Hospitals
  - Level IV Hospitals (e.g. Landstuhl)
  - Military Treatment Facility USA (e.g. Walter Reed Army Medical Center, National Naval Hospital)
  - VA Health Care Facility
o Blast Injury
  - Most common cause of injury
    - More than half of people with blast injury sustain some level of brain injury
      - Incidence in previous conflicts ~ 20%
    - At Polytrauma Rehabilitation Centers PRCs (Level I sites) 94% of polytrauma admissions have traumatic brain injury of all severities

o Blast-induced TBI
  - Do not have to be in close proximity to sustain a concussion/mild TBI
  - Many people are exposed to multiple blasts
  - TBI may not be as readily identified, particularly if occurring with other injuries requiring immediate attention.
  - + Penetrating injuries may result in focal brain impairments (e.g. aphasia)

o Blast Injury
  - Primary injury
    - Overpressurization/underpressurization wave
    - Air-filled organs most vulnerable
    - May cause brain injury
  - Secondary injury
    - Results from flying debris and fragments
    - Penetrating injuries, amputations, eye injuries
  - Tertiary injury
    - Caused by individuals being thrown by blast wind
    - Fractures, amputation, brain injury
  - Quaternary injury
    - Results from other explosion-related injuries – e.g. burns, toxic gases, crush injuries
  - Quinternary injury
    - Additives such as chlorine gas

o Common sequelae of blast injury
  - Brain injury
  - Amputations
  - Fractures
  - Wounds
  - Psychological (e.g. PTSD)
  - Crush injuries
  - Burns
  - Auditory/vestibular
  - Eye, orbit, face
  - Dental
  - Renal
  - Respiratory
  - Cardiac and vascular
  - Gastrointestinal
  - Pain
  - Infection
Psychological aspects of warfare: Battlemind

Psychological adjustments that are made in a theater of war that are adaptive in the war zone but become maladaptive if maintained on return to civilian life.

Battlemind

- **Safety**
  - **War**: Hypervigilant & focused on safety
  - **Home**: need escape routes, unable to relax,
  - may become overprotective

- **Trust**
  - **War**: Quickly learn not to trust people
  - **Home**: may test people, may misperceive
  - others’ intentions

- **Anger**
  - **War**: Anger is channeled on battlefield
  - **Home**: Rapid change from calm to anger,
  - reactions out of proportion to situation

- **Predictability**
  - **War**: Predictability makes you vulnerable
  - **Home**: May have difficulty making/keeping appts. May be perceived as deceptive or unreliable

- **Intelligence**
  - **War**: Seemingly unimportant info can be used by enemy
  - **Home**: May reveal little. May see chit chat as frivolous. Perceived as deceitful

- **Mission-Orientaion**
  - **War**: Mission takes precedence over everything
  - **Home**: May conserve energy by not initiating, waiting til things reach crisis. May get angry at people who disrupt or suggest changes to plans

- **Decision-Making**
  - **War**: Decisions follow a chain of command
  - **Home**: Decision-making is more collaborative, may need more info or defer decisions. May avoid decision-making if overaccustomed to following orders

- **Emotions**
  - **War**: Overcome emotions to function
  - **Home**: Unable to feel emotions. May lose interest in things they enjoyed. May resort to dangerous thrill-seeking behavior to feel stimulated.

- **PTSD**
  - Insomnia
  - Memory problems
  - Poor concentration
  - Depression
  - Anxiety
  - Irritability
  - Re-experiencing
  - Avoidance
  - Emotional numbing
- Chronic Pain
  - Insomnia
  - Memory problems
  - Poor concentration
  - Depression
  - Anxiety
  - Irritability
  - Fatigue
  - Reduced activity
  - Strong somatic focus
  - Fear/avoidance
  - Social withdrawal

- Polytrauma System of Care
  - Polytrauma Rehabilitation Centers (PRC)
    - 4 centers (Minneapolis, Tampa, Richmond, Palo Alto)
    - Provides most intense level of rehabilitation
      - Inpatient, outpatient, transitional/community reentry
    - Access to full range of medical and surgical services
    - CARF & JCAHO accredited for all levels of brain injury
  - Polytrauma Network Site (PNS)
    - 21 sites
    - CARF, JCAHO accredited
    - Inpatient, outpatient
    - Manages existing and emerging polytrauma sequelae independently and in consultation with PRC
    - Identifies new polytrauma pts not previously treated at PRCs
    - Acts as transition to home community
  - Polytrauma Support Clinic Team (PSCT)
    - Located close to pt’s home & community
    - Provides rehabilitation services to continue tx plans pts received from PRC or PNS sites
    - Provides care for newly identified mild TBI
    - Consults with PRC and PNS sites as needed for new, emerging, or complex polytrauma related sequelae
  - Polytrauma Point of Contact (PPOC)
    - Has extensive knowledge of the Polytrauma System of Care and referral patterns/procedures
    - Acts as entry point or reentry point to the system of care
    - Close to home
Cognitive Rehabilitation

Definition (Mateer 2005): “The application of techniques and procedures, and the implementation of supports to allow individuals with cognitive impairment to function as safely, productively, and independently as possible within their environment.”

Two approaches to rehabilitation: restorative and compensatory

- Restorative treatment
  - Direct treatment of cognitive impairment with intention of improving underlying cognitive abilities.
  - Typically involves repeated practice of specific drills that facilitate reorganization of brain processing.
  - Overall, research has not supported this approach. However, there is evidence to support restorative tx for attention.

- Compensatory treatment
  - Collaborative development of strategies that enable people to circumvent everyday problems resulting from impaired skills and abilities
  - People develop strategies that enable them to overcome weaknesses and be successful

- Process of Compensatory Treatments
  - Developing awareness of impairment
  - Modification of environments
  - Collaborative development of cueing strategies
    - External cueing strategies
    - Internal cueing strategies
  - Collaboration with others

Paradigm shift in focus of cognitive rehabilitation

- 1970s-mid 1980s cognitive rehabilitation was primarily restorative – i.e. cognitive drills
  - Emphasis on restorative treatment lends itself to multi-disciplinary tx teams with 1-2 team members delivering cognitive rehabilitation and others doing “business as usual.”

- Mid-1980s to present – increasing emphasis on functionally-driven compensatory treatment with much less emphasis on restorative treatment
  - Emphasis on functional compensatory treatments lends itself to interdisciplinary teams in which everyone on the team contributes to cognitive rehabilitation. Current cognitive rehabilitation is best delivered in an interdisciplinary format.
- **Interdisciplinary team**
  - A medical team in which the communication and distribution of power is lateral. All decisions are determined collaboratively by the group (adapted from Secrest 2000)

- **Why interdisciplinary teams?**
  - Better outcomes (Schutz & Trainor 2007)
  - Higher team satisfaction (Finset et al, 1995)
  - Stress of polytrauma care

  - **Treatment of Attention**

    - Sohlberg & Mateer’s levels of attention (Sohlberg & Mateer 1987)
      - Sustained attention: performing a single task over time
      - Sustained attention: performing a single task in the presence of distracting stimuli
      - Alternating attention: alternating attention between two tasks
      - Divided attention: dividing attention between two tasks

    - **Vigilance**
      - Vigilance – ability to detect relatively infrequent stimuli over time
        - Developed in WWII to study limits in attentional abilities in military personnel
      - In attention treatment
        - Vigilance tasks should be presented in both auditory and visual modalities.
        - Tasks can be designed to emphasize both sustained and alternating attention.

    - **Vigilance Tasks**
      - **Auditory (APT)**
        - Sustained attention
        - Listening for ↓ numbers
      - Alternating attention
        - Listening for ↓ numbers / ↑ numbers
      - **Visual (Captain’s Log software)**
        - Sustained attention
        - Scanning Reaction/Inhibition (beginner level)
      - Alternating attention
        - Scanning Reaction/Inhibition (intermediate level)

    - **Self-generated tasks**
      - Sustained attention
        - Serial subtraction by 2s
      - Alternating attention
        - Subtract by 4 / add by 1
      - Divided attention
        - Serial subtraction by 2s + card sort
Experiential task. Time to wake up and try this yourself!!! You will do a divided attention activity involving 3 tasks. Descriptions are as follows:

- **Stimulus Reaction/Inhibition (advanced level):** Squares will appear randomly on the computer screen. There is also a colored border at the edge of the screen. When the color of the square matches the color of the border, make a mark in the box below. Ignore the smaller squares that serve as distracter stimuli.

- **Add 3 / subtract 2:** Meanwhile I will be reading a list of numbers. At first, you will be adding 3 in your head. That is, if the second number you hear is 3 more than the number before it, I want you to say yes. So if you hear 2 followed by 5, you all say “YES.” These don’t come in nice, neat pairs, they can blend into each other – so I could say 2 followed by 5 (YES) followed by 8 (YES).

- **Convergent naming:** Three times during the course of this task (which will last about 3 minutes) I will give you clues to a word that I am thinking. You need to retain and integrate the clues so that at the end of the task you can provide the target word.

Use of video games in treatment
- Provide complex multi-modal stimulation requiring varied responses
- They are attentionally demanding
- They can be used in the context of divided attention tasks
- They are reinforcing – perceived as fun
- Pain management

Modifications for visual impairment - Dynavision
- Example of divided attention with dynavision

Combining attention training with functional tasks
- Example: Divided attention with map reading task

Compensatory treatment of attention – use of countdown timers
- People often report distractibility prevents them from finishing tasks
- Can collaboratively decide on attention span and set countdown timer just beyond that value
- When timer goes off – it is a cue to maintain goal
Awareness of Impairment

- Phenomenology of TBI (Prigatano 1999)
  - confusion
  - frustration

- Confusion in TBI
  - Why can’t I do what I used to do?
  - Why don’t people treat me the same way?
  - When will I get better? What if I don’t?

- Therapeutic alliance
  - An agreement of the client and the therapist on the tasks and goals of therapy as well as the interpersonal bond between client and therapist (Bordin, 1979)
  - May be most critical factor in the treatment of unawareness of impairment (Sherer 2005)

- Establishing the therapeutic alliance
  - Convey some level of understanding of their experience and that you have something to offer that will help
  - Offer a metaphor of therapeutic interaction that is collaborative in nature
    - E.g. presidential advisor (Ylvisaker & Feeney, 1998)

- Awareness of Impairment (Crosson et al, 1989)
  - The ability to understand that a function is impaired, recognize the impairment as it is manifested, and anticipate that a problem will result from that impairment

- 3 levels of awareness
  - Intellectual awareness
  - Emergent awareness
  - Anticipatory awareness

- Intellectual awareness
  - Shallow appreciation of impairment without ability to specify examples
  - Treatment implication: Clients have a strong need for education to provided information about what TBI is and is not
    - E.g. Misperceptions of coma (Widjicks & Widjicks 2006)

- Emergent awareness
  - Shows awareness of impairment at the time that they are experiencing difficulty
  - Treatment implication: Provide experiences in which clients can test themselves
Self-evaluation of predicted vs. actual performance

- Anticipatory awareness
  - Awareness of strengths and weaknesses is sufficient to predict difficult situations
  - Treatment implication: Provide a range of experiences so that people can begin to see patterns of impairment

- Education
  - General –
    - Handouts and discussion of sequelae of TBI
      - Unawareness
      - Attention
      - Memory
      - Executive Functions
    - Convert memory book to an awareness book
  - Patient specific
    - Records review (Sohlberg & Mateer, 2001)
  - Independent research
    - Transitional video (Ylvisaker & Feeney 1998)

- Transitional Video
  - Scripted by patient
  - Describes
    - Nature of injury
    - Strengths & weaknesses
    - Compensatory strategies
    - How others can be supportive

- Videotaped feedback
  - Can be useful for severely impaired patients with profound memory impairment

- Awareness and depression
  - The literature is mixed
  - Depression is correlated to the perception of disability (Malec, 2005).
  - Treatment implications:
    - Maintain hope
    - Demonstrate effectiveness of strategies.

- Maintaining hope while treating awareness
  - Recovery phase
  - Emphasize strengths as well as weaknesses
  - Demonstrate the effectiveness of strategies
○ Strategy development
  ▪ Collaborative
  ▪ Intent is to use a person’s strengths to overcome weaknesses to be successful
  ▪ Critical to follow-up experiential tasks that identify impairments with strategies that will allow the person to be successful.

○ Treatment of Memory
  ▪ Compensatory treatment
    • Environmental modifications
    • External cueing strategies
    • Internal cueing strategies
    • Interdisciplinary treatment / collaboration with others
  ▪ Developing Awareness
    • Education
    • Experiential tasks
  ▪ Environmental modifications
    • Labeling
    • Post-its
    • Strategic placement- specific locations for important items
  ▪ External cueing strategies
    • Checklists
    • Memory notebooks
    • Palm Pilots \{ offers alarm feature
    • Reminder watches
  ▪ External cueing strategies: Modifications for visual impairment
    • Voice Mate
    • TapMemo
  ▪ External cueing strategies: Modifications for aphasia
    • Pictorial memory book
    • Pictorial checklists
    • StepPad
    • Notes with hourly reminder alarms
    • Digital voice recorders
    • Voice Mate / TapMemo
  ▪ External cueing strategies: Modification for amputation + visual impairment
    • ID Mate
- **Internal cueing strategies**
  - Mnemonic strategies

- **Internal cueing strategies: Modification for visual impairment**
  - Use of tactile-kinesthetic modeling for route-finding

  - **Treatment of Executive Functions**
    - Treatment of Executive Functions
      - Developing awareness
        - Education (see appendix)
        - Experiential tasks
          - Locate BIA meeting
          - ID return to driving procedures
    - External cueing strategies – structured problem-solving guides
      - Goal Management Training (Levine et al, 2000)
    - Workbook therapy
      - No strong evidence that workbook therapy works
      - Need to apply strategies to functional activities
        - The “riddle of the frontal lobe” is the difference between knowing and doing. (Teuber, 1964)
        - Emotional dysregulation can undermine otherwise intact skills
      - Workbooks are useful for structured practice when used as a tool to practice specific compensatory strategies

  - **Treatment of Pragmatic Communication**
    - Development of awareness
      - Education
      - Video review
        - Hollywood videos
        - Client video
    - Internal cueing strategies – too many to list but will provide some specific examples focusing on a specific client
      - OIF Client
        -Verbose, tangential communication
    - Verbose / tangential speech: Education / awareness
      - Hollywood video
    - Structured practice: verbosity
      - Card activity
• Generalization
  • Self-Talk + Countdown Timer
    • I will listen carefully to people and give them the opportunity to talk
    • I will talk about topics that others are interested as well
    • If I make a mistake, I won’t apologize. I will refocus and listen

• Collaboration with others
  • Assisted cue and review
  • Advance scripting

○ Structuring acute rehabilitation for transition into the community
  ▪ Interdisciplinary money management
    • Clients receive “bills” for services
    • Bills are “mailed” – i.e. dropped off in room
    • Clients need to pay bills at a specified time
      o Checks
      o Pay by phone
    • Balance check register
    • Request checks and registers as needed
    • Can be combined with simulated “work” to generate “income”

• Interdisciplinary money management
  • Speech
    o generates and mails bills
  • Occupational therapy
    o Monitors accuracy of check register
    • Functions as bank to record deposits and supply checks and registers as needed
  • Other staff
    o Receive bills and forward information on timeliness and accuracy to occupational therapy

• Interdisciplinary money management
  • Low-level
    o 1-2 bills per week
    o 3-day window to pay bills
    o Pay in only one place
  • Intermediate
    o 3-5 bills per week
    o 2 day window to pay bills
    o Pay in two places
  • High-level
    o > 5 bills per week
    o 1 day window to pay bills
- Pay in 3 or more places

**Return to work**
- Simulated work
  - Used in conjunction with bill-paying module to generate income
  - Assesses ability to learn
  - Opportunity to develop and implement compensatory cognitive strategies
  - Simulate job procedures
    - Resume
    - Job application
    - Job interviews

**Simulated college experience** (MacLennan, 1998)
- Series of lectures - content focuses on
  - Nature and sequelae of TBI
  - Study skills
- Tests – questions assess
  - Recall memory (e.g. short-answer)
  - Recognition memory (e.g. multiple-choice; true/false)

- Simulated college experience
  - Awareness-building
    - Development of learning and academic strategies
      - Spaced-retrieval (Schacter, Rich, & Stampp, 1985)
      - Learning journal (McGee, 1997)
      - Writing papers (McGee, 1997)
      - Reading – SQR3 (Franklin, 1941)
      - Graphic organizers (Strangman, N., Hall, T., & Meyer, A., 2003)
References


