

- **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

- 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

- 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)

- 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

- Common sequelae of blast injury

<ul style="list-style-type: none"> ▪ Brain injury ▪ Amputations ▪ Fractures ▪ Wounds ▪ Psychological (e.g. PTSD) ▪ Crush injuries ▪ Burns ▪ Auditory/vestibular 	<ul style="list-style-type: none"> ▪ 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

- | | |
|--|--|
| <ul style="list-style-type: none"> ▪ Safety ▪ <u>War</u>: Hypervigilant & focused on safety ▪ <u>Home</u>: need escape routes, unable to relax, ▪ may become overprotective ▪ Trust ▪ <u>War</u>: Quickly learn not to trust people ▪ <u>Home</u>: may test people, may misperceive ▪ others' intentions | <ul style="list-style-type: none"> ▪ Intelligence ▪ <u>War</u>: Seemingly unimportant info can be used by enemy ▪ <u>Home</u>: May reveal little. May see chit chat as frivolous. Perceived as deceitful ▪ Mission-Orientation ▪ <u>War</u>: Mission takes precedence over everything ▪ <u>Home</u>: May conserve energy by not initiating, waiting til things reach crisis. May get angry at people who disrupt or suggest changes to plans |
| <ul style="list-style-type: none"> ▪ Anger ▪ <u>War</u>: Anger is channeled on battlefield ▪ <u>Home</u>: Rapid change from calm to anger, ▪ reactions out of proportion to situation | <ul style="list-style-type: none"> ▪ Decision-Making ▪ <u>War</u>: Decisions follow a chain of command ▪ <u>Home</u>: Decision-making is more collaborative, may need more info or defer decisions. May avoid decision-making if overaccustomed to following orders |
| <ul style="list-style-type: none"> ▪ Predictability ▪ <u>War</u>: Predictability makes you vulnerable ▪ <u>Home</u>: May have difficulty making/keeping appts. May be perceived as deceptive or unreliable | <ul style="list-style-type: none"> ▪ Emotions ▪ <u>War</u>: Overcome emotions to function ▪ <u>Home</u>: 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.
 - E.g. “Whatever it Takes Model, (Willer & Corrigan, 1994)

- 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 Secret 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

<ul style="list-style-type: none"> ▪ <u>Auditory (APT)</u> ▪ Sustained attention ▪ Listening for ↓ numbers ▪ Alternating attention ▪ Listening for ↓ numbers / ↑ numbers 	<ul style="list-style-type: none"> ▪ <u>Visual (Captain's Log software)</u> ▪ 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
 - Eg. 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
 - Reminder watches
 } offers alarm feature
 - 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
 - Checks
 - 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
 - generates and mails bills
 - Occupational therapy
 - Monitors accuracy of check register
 - Functions as bank to record deposits and supply checks and registers as needed
 - Other staff
 - Receive bills and forward information on timeliness and accuracy to occupational therapy
 - Interdisciplinary money management
 - Low-level
 - 1-2 bills per week
 - 3-day window to pay bills
 - Pay in only one place
 - Intermediate
 - 3-5 bills per week
 - 2 day window to pay bills
 - Pay in two places
 - High-level
 - > 5 bills per week
 - 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 – SQ3R (Franklin, 1941)
 - Graphic organizers (Strangman, N., Hall, T., & Meyer, A., 2003)

References

- Bordin, E.S. (1979). The generalizability of the psychoanalytic concept of the working alliance. *Psychotherapy: Theory, Research, and Practice*, 16: 252-260.
- Crosson, B.C., Barco, P.P., Velozo, C.A., Bolesta, M.M., Werts, D., & Brobeck, T. (1989). Awareness and compensation in post-acute head injury rehabilitation. *Journal of Head Trauma Rehabilitation*, 4: 46-54.
- Finset, A. (1995). Team development and memory training in traumatic brain injury rehabilitation: two birds with one stone. *Brain Injury*, 9, 49-507.
- Levine, B., Robertson, I.H., Clare, L., Carter, G., Hong, J., Wilson, B.A., Duncan, J., & Stuss, D.T. (2000). Rehabilitation of executive functioning: an experimental-clinical validation of Goal Management Training. *Journal of the International Neuropsychological Society*, 6: 299-312.
- MacLennan, D.L. A Simulated College Experience for Adults with Acquired Brain Injury. Presented at 17th National Symposium of the Brain Injury Association, New Orleans, November 1998.
- Malec, J. (2005). Personality, depression, and outcome after traumatic brain injury. Paper presented at the 12th Annual Mayo Brain Injury Conference. Mayo Clinic, Rochester, Minnesota.
- Mateer, C.A. (2005). Fundamentals of cognitive rehabilitation. In P.W. Halligan & D.T. Wade (Eds.), *The Effectiveness of Rehabilitation for Cognitive Deficits* (pp. 21-29). New York: Oxford.
- McGee, T. (1997). *How to Become a Superstar Student*. Chantilly, VA: The Teaching Company
- Prigatano, G.P., Klonoff, P.S., O'Brien, K.P., Altman, I.M., Amin, K., Chiapello, D., Shepherd, J., Cunningham, M., Mora, M. (1994). Productivity after neuropsychologically oriented milieu rehabilitation. *Journal of Head Trauma Rehabilitation*, 9(1): 91-102.
- Prigatano, G.P. (1999). *Principles of Neuropsychological Rehabilitation*. New York: Oxford.
- Schacter, D.L., Rich, S.A., & Stamp, M.S. (1985). Remediation of memory disorders: Experimental evaluation of the spaced-retrieval technique. *Journal of Clinical & Experimental Neuropsychology*, 7:79-96.
- Schutz, L.E. & Trainor, K. (2007). Evaluation of cognitive rehabilitation as a treatment paradigm. *Brain Injury*, 31, 545-557.
- Sherer, M. (2005a). Loss of self: Impaired self-awareness after traumatic brain injury. Paper presented at the 12th Annual Mayo Brain Injury Conference. Mayo Clinic, Rochester, Minnesota.
- Sohlberg, M.M. & Mateer, C.A. (1987). Effectiveness of an attention training program. *Journal of Clinical & Experimental Neuropsychology*, 9: 117-130.

Sohlberg, M.M., McLaughlin, K.A., Pavese, A., Heidrich, A., & Posner, M.I. (2001). Evaluation of Attention Process Training and brain injury education in persons with acquired brain injury. *Journal of Clinical & Experimental Neuropsychology*, 22, 656-676.

Strangman, N., Hall, T., & Meyer, A. (2003). Graphic organizers and implications for universal design for learning: Curriculum enhancement report. National Center on Accessing the General Curriculum.

Teuber, H. (1964). The riddle of frontal lobe function in man. In J.M. Warren & K. Akert (Eds.), *The Frontal Granular Cortex and Behavior* (pp. 410-444). New York: McGraw-Hill.

Wijdicks, E.F.M. & Wijdicks, C.A. (2006). The portrayal of coma in contemporary motion pictures. *Neurology*, 66, 1300-1303.

Willer, B. and Corrigan, J.D. (1994). Whatever it takes: a model for community-based services. *Brain Injury*, 8, 647-659.

Ylvisaker, M. & Feeney, T.J. (1998). *Collaborative Brain Injury Intervention*. San Diego: Singular.