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# Dual Diagnosis: Traumatic Brain Injury and Spinal Cord Injury

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# Objectives

- **Discuss epidemiology of dual diagnosis and its impact on rehabilitation**
- **Discuss pharmacological interventions to improve neurocognitive/behavioral issues**
- **Discuss rehabilitation strategies to improve treatment of the dual diagnosis patient**



# Dual Diagnosis

	SKI	TBI
• Incidence:	12,000/yr	1.5-2mill/yr
• Prevalence:	@250,000??	@6 million
• Gender (male):	78%	70%
• Age:	16-35	15-24
• Etiology:	MCV; Falls; Violence; Sports	

Persons who sustain such injuries and how they occur are similar.

If the impact is severe enough to damage the spinal cord, it may also cause insult to the brain



# Dual Diagnosis: Epidemiology

- **16-59% TBI incidence when SCI is the primary injury**
  - Most are in the mild-moderate category
- **6% (2-19%) SCI incidence when TBI is the primary injury**
- **Reports vary upon method of data collection**
  - GCS – 25% (Wagner)
  - LOC &/or PTA – 42% (Davidoff)
  - Neuropsych tests – 56% (Wilmot)
  - Halstead Category Test – 57% (Davidoff)



# SCI with TBI

- **Mild TBI is frequently missed when the initial exam focuses on the SCI**

- Lack of screening by physician
- Lack of screening tests (often use CT?)
- Lack of psychological support services
- Difficulty testing high level injuries
- ? Specialized centers for rehabilitation



# Mild Brain Injury (Concussion)

- **At least one of the following:**
  1. Any period of loss of consciousness
  2. Any loss of memory for events immediately before or after the accident
  3. Any alteration in mental state at the time of the accident (eg. Feeling dazed, disoriented, or confused); and
  4. Focal neurological deficit(s) that may or may not be transient;
- **But...the severity of the injury doesn't exceed:**
  - PTA > 24 hours
  - After 30 minutes, an initial GCS of 13-15; and
  - LOC 30 minutes or less

# Dual Dx vs. SCI only

- (+) higher anatomical level of injury (i.e. cervical)
- (+) more likely to be a tetra (quad) than a paraplegic
- (+) more likely to be involved in MVC
- (+) need for ventilator support (Wilmot)

# Rehabilitation

- Requires intensive new learning to master skills and adapt to new lifestyle
- BI: retraining previously mastered skills (re-learning)
  - Task simplification and repetition
- SCI: new skills to perform tasks
- SCI/TBI – the prognosis, recovery, treatment, and rehabilitation become more complicated

# Dual Diagnosis (DD): Outcomes

- **Assumption:**

- Cognitive impairment limits or delays skill acquisition
  - A major concern in formulating and executing a successful rehab program

- **Functional outcome:**

- No conclusive prospective study has been published to date

- **What is available?**



# Classification & Outcome Measures



[www.tbims.org/combi](http://www.tbims.org/combi)



# Glascow Coma Scale (GCS)

## Eye Opening (E)

4=Spontaneous  
3=To voice  
2=To pain  
1=None

## Verbal Response (V)

5=Normal conversation  
4=Disoriented conversation  
3=Words, but not coherent  
2=No words.....only sounds  
1=None

## Motor Response (M)

6=Normal  
5=Localizes to pain  
4=Withdraws to pain  
3=Decorticate posture  
2=Decerebrate  
1=None

**Total = E+V+M**

## Injury

### Classification:

**Mild= 13-15**

**Moderate= 9-12**

**Severe= <=8**



# Galveston Orientation & Amnesia Test (GOAT)

*You are scoring only errors!*

- What is your name? (2)
- When were you born? (4)
- Where do you live? (4)

Where are you now?  
city? (5)hospital? (5) (*unnecessary to state name of hospital*)

- On what date were you admitted to this hospital? (5)
  - How did you get here? (5)
  - What is the first event you can remember *after* the injury? (5)
  - Can you describe in detail (eg. date, time, companions) the first event you can recall *after* the injury? (5)
  - Can you describe the last event you recall *before* the accident? (5)
  - Can you describe in detail (eg. date, time, companions) the first event you can recall *before* the injury? (5)
  - What time is it now? (*1 for each half hour removed from correct time to maximum of 5*)
  - What day of the week is it? (*1 for each day removed from correct one?*)
  - What day of the month is it? (*1 for each day removed from correct date to maximum of 5*)
  - What is the month? (*5 for each month removed from correct one to a maximum of 15*)
  - What is the year? (*10 for each year removed from correct one to maximum of 30*)
- (100-total error points)



**When patient scores  $\geq 76$  two times, they are out of PTA**

# Ranchos Los Amigos Scale

<b>Level I</b>	<b>No response</b>
<b>Level II</b>	<b>Generalized response</b>
<b>Level III</b>	<b>Localized response</b>
<b>Level IV</b>	<b>Confused/agitated</b>
<b>Level V</b>	<b>Confused/inappropriate</b>
<b>Level VI</b>	<b>Confused/appropriate</b>
<b>Level VII</b>	<b>Automatic, appropriate</b>
<b>Level VIII</b>	<b>Purposeful, appropriate</b>

# Ranchos Los Amigos Scale - revised

<b>Level I</b>	<b>No response</b>
<b>Level II</b>	<b>Generalized response</b>
<b>Level III</b>	<b>Localized response</b>
<b>Level IV</b>	<b>Confused/agitated</b>
<b>Level V</b>	<b>Confused/inappropriate</b>
<b>Level VI</b>	<b>Confused/appropriate</b>
<b>Level VII</b>	<b>Automatic, appropriate</b>
<b>Level VIII</b>	<b>Purposeful, appropriate</b>
<b>Level IX</b>	<b>Purposeful, appropriate- standby assistance upon requests</b>
<b>Level X</b>	<b>Purposeful, appropriate – modified independent</b>

# Outcome Assessment - BI

- **Awareness Questionnaire (AQ)**
- **Coma/Near Coma Scale (CNC)**
- **Mayo-Portland Adaptability Inventory (MPAI)**
- **Community Integration Questionnaire (CIQ)**
- **The Craig Handicap Assessment and Reporting Technique (CHART)**
- **Disability Rating Scale (DRS)**



# Outcome Assessment – BI (cont)

- **JFK Coma Recovery Scale**
- **Functional Assessment Measures (FAM)**
- **Glascow Outcome Scale (GOS)**
- **Functional Independence Measures (FIM)**
- **Level of Cognitive Functioning Scale (LCFS)**

# Prognostic Indicators

- **Age**
  - Younger adults have better prognosis than >60
- **Coma**
  - Longer duration correlated with worse motor and cognitive recovery
- **PTA**
  - The longer the worse prognosis

# Mild Brain Injury: Outcomes

- Recovery occurs fairly rapidly, and most patients are asymptomatic within 3 months
- 15% will experience symptoms beyond 3 months (Post-concussive syndrome)
- A week after a concussion
  - Baseline neuropsych scores normalize, but
  - fMRI reveals regional brain activation differs, with increased activation in parietal, lateral frontal and cerebellar regions
    - i.e. they return to normal but have to work harder to do so cognitively
- May explain the fatigue, memory impairment, balance issues, etc.



# Dual Diagnosis: In era of cost containment

- **Early identification of SCI/TBI is critical for appropriate delivery of rehab**
- **A SCI-TBI team approach**
  - Recognize a concomitant TBI early
  - Intervene early in the rehab process to *engage* the patient, family, insurance company, and staff
    - *Minimize disruptive TBI neuro-behavior*
    - *Structure treatment/rehab to maximize function*
    - *??? “No gold standard”*



# Dual Diagnosis: Process

- **Pre-screen patients for TBI as a routine part of admission process**
- **Provide education about the signs and symptoms of TBI in the SCI population**
  - Family
  - Staff
  - Referrers
  - Stakeholders
- **Develop conceptual framework for dealing with the DD patient**

# Pre-Admission Screen for DD

1. Mechanism of injury
2. LOC duration
3. GCS scores
4. PTA duration
5. Neurobehavioral symptoms (i.e. agitation)
6. Neurodiagnostic studies (i.e. CT, MRI)
7. Seizures
8. ETOH or other substance abuse
9. Associated injuries (i.e. resp insufficiency; hypotension)
10. History of TBI



# Signs of TBI – once admitted

- **Impaired attention**
  - Vacant stare
  - Delayed responses
  - Inability to focus
- **Slurred or incoherent speech**
- **Gross incoordination**
- **Disorientation (i.e. GOAT)**
- **Emotional reactions out of proportion**
- **Memory deficits**
- **Agitation/aggression**



# Psychosocial History

1. Developmental issues – ADD, ADHD, LD
2. Medical history – prior concussions/brain injuries
3. Educational attainment
4. Work history
5. Current stressors (lifestyle issues)
6. Coping style (positive and negative)
7. Support system

# DD: Treatment Concepts

- **Placement**
  - SCI without any signs of TBI → **SCI**
  - SCI with signs of mild to moderate TBI → **Dual Dx Team**
  - SCI with signs of severe TBI → **TBI**
- **Adapt TBI interventions for treatment taking into account the needs of the SCI patient**

# Issues in Dual Diagnosis

- **Medical Issues**
  - Neurocognitive/behavioral issues
  - Spasticity
  - Seizures
  - Thromboembolic disorders
- **Adaptive issues**
  - To assist in rehabilitation

# Neurocognitive/Behavioral Issues

**Irritability**

**Confusion**

**Attention**

**Agitation**

**Sleep/wake disturbance**

**Mood**



# Neurocognitive/Behavioral Issues

## •Cognitive

- Attention
- \*Memory
- Information processing
- Perception
- New learning
- \*Task initiation, planning, and sequencing
- Problem solving
- Decision making
- Insight

## •Behavioral

- Agitation
- Apathy
- Emotional lability
- Aggression
- Disinhibition



# Agitation

- **Why start with this?**

- Staff perspective – major demarcation of the DD patient

- **Scales:**

- Agitated Behavioral Scale (Corrigan, 1989)
  - 14 domains with a 4 point scale
  - Agitated when >21 points

- **Overt Agitation Scale (OAS)(1986)**

- **Variant of OAS (1997)**

- **“Less than half of Brain Injury Specialists use objective measures in their practice”**



# Rules of Thumb

- Can't rehab an agitated patient



- Can't rehab a sedated patient



# Agitation: Management

- **Consider causes of mental status change**
  - Infection; Hypoxia; hypoglycemia
  - Toxic levels of meds (i.e. Dilantin); Epilepsy
- **Environmental Modifications**
  - Low stimulation environment; Reduction of pain; Reduction of lines (IV, NG, catheters); and direct physical restraints
  - \*Family education and training
- **Provide good sleep/wake cycle**
- **Pharmacologic intervention**



# Interventions for the Agitated Patient

- **Use preventative measures**

- Minimize environmental triggers
- +/- Reinforcement (reward the good; ignore the bad)
- Behavioral contracts
- Relaxation methods

- **Lower stimulation level**

- i.e. quiet room; quiet side of gym

- **Provide simple commands**



# Interventions for the Agitated Patient (cont)

- **Distract, distract, distract**
- **Provide options (but limit choices)**
- **Notify of inappropriate behavior/provide alternatives**
- **Re-orient, clarify purpose of tasks**
- **Speak calm/firm/kind tone of voice**



# Medications

- Meds commonly used in SCI can have deleterious effects in the DD patient (i.e. Benzodiazepines)
- *Know drugs that may impair recovery*
- Start LOW and GO SLOW
- Response to any agent is unpredictable
- Injured brain is more sensitive to side effects
- Ultimate goal is to substitute non-pharmacological interventions

# Acute Agitation

## • Pro/short term

- \*Risperidone (Risperdal)
- Olanzapine (Zyprexa)
- Trazodone (Desyrel)
- Ziprasidone (Geodon)
- \*Quetiapine (Seroquel)
- Neuroleptics
- Benzodiazepines (last resort)
- \*Beta blockers

## • Long term

- \*Divalproex (Depakote)
- \*Trazodone
- \*Buspirone (Buspar)
- Carbamazepine (Tegretol)
- SSRI's
- Olanzapine; quetiapine;
- Risperidone; Ziprasidone
- Aricept
- Beta blockers

**Can start a long acting & short acting at the same time**



# Antipsychotics

- Haloperidol (Haldol)

- *Not recommended*
- Droperidol- Acts faster & is superior

- **Works almost exclusively on D2 antagonism**

- Cause of extrapyramidal side effects

- **Slows motor recovery in animals**

- Better options:

- Zyprexa
- Risperdal
- Geodon
- Abilify

- **Less D2 receptor activity and more serotonin activity**

- Decreases the unwanted side effects of typical antipsychotics

# Antidepressants

- Used often in SCI and TBI (30-50% of patients)
- Be aware of actions and interactions



# Antidepressants

- Nafazodone and Trazodone: 5HT antagonist and reuptake inhibition
  - Highly sedating and possible role in agitation
  - Used for sleep
- Mirtazepine (Remeron): NE and 5HT antagonist
  - used for depression and insomnia
- Venlafaxine (Effexor): 5HT/NE reuptake inhibitor: more 5HT when lower; more NE when higher dose
- Duloxetine (Cymbalta): balanced NE/5HT reuptake inhibitor

# Antidepressants

- MAOI: not typically used

- Tricyclics (TCA's):

- Not favored as first line because of:
  - Anticholinergic side effect on cognition
  - Cardiac slowing
  - Lowered seizure threshold
- But may be preferred if trying for pure arousal in low level (vegetative) patient
  - **Protriptyline** is most activating



# Benzodiazepines

- Used often in SCI for anxiety and spasticity
- Slows motor recovery
- Paradoxical agitation in adults
- Shorter acting Benzodiazepines (Lorazepam [Ativan]) for acute mania and psychiatric emergencies
- Should be reserved for emergent situations or acute alcohol withdrawal

# Beta-Blockers

- **Propranolol is most studied; in episodic dyscontrol/rage/aggression**
  - Switch BID Propranolol to LA, qday dosing
- **Cochrane database review:**
  - Good evidence of efficacy
- **May cause hypotension and bradycardia**
  - Problem especially in SCI
  - **Pindolol (Visken)** avoids bradycardia





# Neurostimulants



- **May decrease agitation secondary to poor attention and hypoarousal states**
- **Last dose given 6-8 hours prior to bed time**
  - 8 am and 12 noon dosing

## 1. Bromocriptine

## 2. Amantidine

- May also improve arousal in some patients

## 3. Proadrenergic medications : Ritalin & dextroamphetamine

- May increase concentration and processing as well

# Fatigue

- Nonspecific feeling of exhaustion, tiredness, or weakness/Failure to initiate or sustain attentional tasks and physical activities

- Most common symptom of depression (47%)

- Incidence: 20-60% in TBI; 20-50% in SCI

- **Fatigue management**

- Prioritize activities
- Streamline and plan schedule ahead of time
- Pace the program. Give mini-breaks
- Conserve energy
- Take on the most demanding tasks when most rested
- Diet: good nutrition



# Fatigue: Medications

- **Psychostimulants (Amphetamines; Methylphenidate; and Pemoline)**
  - Augments the release of catecholamines from the synapses
  - Dosed BID with 2<sup>nd</sup> dose given 6-8 hours prior to bedtime
- **\*Modafanil – *reports in SCI***
  - Mode of action unknown
  - Thought to affect the subcortical structures (anterior hypothalamus, hippocampus, amygdala)
- **Strattera (Amomoxetine) – SNRI**

**Anecdotal evidence for all of these**



# Meds for Fatigue/Arousal

• “While many clinicians use neurostimulant medications for the treatment of hypoarousal in persons with TBI, unfortunately the literature to support their use, while somewhat promising, is sparse, being based on small-sample studies”

- Gordon et al AJPM&R 2006
- State of the Science Review

# Sleep Disturbances

- **Incidence**
  - Insomnia (36-70%) vs hypersomnia (32-98%)
- **Check if medication induced**
  - antidepressants; stimulants; etc.
- **r/o Obstructive Sleep Apnea (OSA)**
- **Non-pharmacological interventions**
  - Keep interruption and noise down at night
  - Avoid lengthy naps during the day
  - Keep a regular sleep schedule daily including weekends and holidays
  - Avoid coffee, alcohol, sodas, and strenuous exercise late

# Sleep Disturbances: Rx Treatment

- **Initiation:**
  - Zolpidem (Ambien)
  - Avoid benzodiazepines (alters sleep stages 3 and 4)
  - Eszopiclone (Lunesta): not restricted to short-term use
- **Maintenance:**
  - Trazodone
  - Chloral hydrate (loses effectiveness)
  - Remeron
  - Melatonin
  - Ramelteon (Rozerem) – melatonin receptor agonist
  - \*Avoid Benadryl (hangover; paradoxical agitation; anticholinergic side effects)

# Rozerem

- **Works directly on sleep cycle**
  - Suprachiasmatic nucleus
- **Not controlled**
  - No abuse potential
- **No rebound insomnia**
- **Well tolerated**
  - Chronically and in elderly
- **Mechanism: Melatonin receptor agonist**

# Seizure: Prevention

- Seizures in the 1<sup>st</sup> week are (?) not predictive of developing post-traumatic epilepsy (PTE)
- Prevention is appropriate for only 1 week
  - Temkin; AANS & AAPMR & AANEEM Guidelines
- No proof that any agent is effective *prophylaxis* against ultimate development of PTE
- If continues anti-epileptic drugs (AEDs) > 1 wk, *switch* to med with behavior & mood modulating properties
  - i.e. Valproate (Depakote), Carbamazepine (Tegretol) or Lamotragine (Lamictal)

# Spasticity: *Medications*

- **SCI and BI – UMN lesions**
- **4 commonly used and approved medications**
  - Baclofen (Lioresal) – slows new learning, especially at higher doses
  - Diazepam (Valium) – slows new learning
  - Dantrium sodium (Dantrium) – works at muscle level within sarcoplasmic reticulum; rare s.e. of liver failure
  - Tizanidine (Zanaflex) – central alpha 2 agonist; careful of hypotension s.e.; slows new learning
- **Other medications:**
  - Clonidine – slows new learning; hypotension s.e.
  - \*Neurontin
  - Cyproheptadine

# Spasticity: Treatment Options

- **Rehabilitation**

- Modalities
- Stretch
- Facilitatory or inhibitory patterns
- Casting
- Splints

- **Injections**

- Botulinum toxin (Botox)
- Phenol

- **Surgical**

- Intrathecal baclofen pump (ITB)



# Thromboembolic Disorders

- Incidence is high in SCI = 49-100%
- Usual prophylaxis in SCI
  - Venodyne (pneumoboots); LMWH; TEDs
- Issue in BI: *risk of bleeding with LMWH*
- What happens if DVT is left alone?
  - Untreated proximal DVT after ICH led to fatal PE in 10-20% and nonfatal PE in 10-20%
- Is an IVC filter enough?
  - DVT (clinical/subclinical) occurred in 6-32%, filter thrombosis in 3.6-11.2% and symptomatic insertion site thrombosis in 7-17%
  - PE w/ IVC filter: 2.8-3.5% from 6-18 months

# DVT Prophylaxis in TBI

- Majority of literature suggests benefits of chemoprophylaxis may outweigh the risks
- Early chemoprophylaxis still remains a controversial and concerning issue
- If used- used typically about 14 days

# Adapting Strategies to Structure Treatment & Meet Therapy Goals

- **Benefits from a SCI modeled rehabilitation program with treatment modified in proportion to the extent and persistence of the TBI**

# Treatment for Mild-Mod Injuries

- **Compensation**
- **Environmental modification**
- **Remediation**
- **TEAM APPROACH**
  - Not reporting, but listening and problem solving
  - Must have a common philosophy and approach
  - This requires investment of education



# Treatment Approach with the DD Patient

- **Integration of compensatory training, environmental modifications and remediation is critical when teaching SCI-specific tasks**
- **Approach to mobility & ADL skills with DD will differ from patients with SCI only or TBI only**

# Impaired Memory in DD Patient

- Impacts new learning, retention of information & recall

- Orientation to current events may be confused

- If Post Traumatic Amnesia present, this will obviously affect memory skills

- **Treatment Interventions**

- Orientation to person, place, time
- Maintain daily logs
  - Orientation reminders
  - Information related to specific SCI skills
- Daily structure
- Continual repetition of tasks
- Video, written instruction of specific tasks
- Posted reminders in patient room



# Impaired Attention in DD Patient

- Distractible

- Shortened attention to a task

- Sustained, Divided, Alternating, Selective Attention impairments possible

- Treatment Interventions

- Limit distractions (environment, noise)
- Structure session
- Short learning segments
- Treatment and Goals to incorporate varied types of attention (i.e. sustained vs. divided attention)
- Use of list of purpose/goal of tasks as reference tool



# Impaired Problem Solving in DD

- Impaired ability to sequence skills

- Impaired ability to organize information in order to solve a problem

- **Treatment Interventions**

- Fragmenting ADL & mobility skills
- Incorporate simple written instructions; calendars
- Therapist to discuss problem solving aloud
  - Review steps of tasks daily
- Anticipate problems that may arise in daily activities & review ways to problem solve
  - Example: What to do when urological supplies are depleted?



# Impaired Decision Making in DD

- **Family members may need to assist with moderate to complex decision making**

- D/C planning
  - D/C site
  - Services needed
  - Etc.
- DME needs

- **Other considerations**

- Task simplification
  - Simplify activity
  - Gradually increase steps for tasks/incorporate into goal setting



# Behavioral Deficits: Agitation

- **Restless vs. Combative**

- **Treatment interventions:**

- Lower level of stimulation
- What is environmental or verbal trigger & what is consequence?
  - Discussing prognosis leading to agitation...remove trigger!
- Simple commands n& offer options rather than use open ended questions
- Prepare several activities – patient's with limited attention
- Incorporate rest periods
- Redirection
- Identify & address behaviors via Agitated Behavior Scale (ABS)



# Behavioral Deficits: Disinhibition

- **Inappropriate comments or behaviors**
- **Treatment interventions**
  - Ignore behavior
  - Re-direction & move on to other activity
    - Caution with re-direction if it will escalate patient
  - Remove from situation
  - Institute behavior plan & have all disciplines aware to insist with reducing behaviors

# Behavioral Deficits

- **Poor insight & Impulsivity**

- Reinforce safety – particularly with transfers and other mobility skills

- **Lability**

- Typically has a trigger
- Acknowledge the behavior and move on
  - “I know you want to go home, but right now we are working on...”

- **Cognitive & behavioral issues may take lead over other functional training, until individual can retain new info**



# Dual Diagnosis

- **Combines cognitive-behavioral impairment new learning and physical impairment new learning**
  - Making for a complex situation
- **New learning will be more difficult for the DD patient**
- **EXTEND EXPECTED TIMELINE OF ACHIEVEMENT OF GOALS**
  - DD patient may not achieve goals in a typical SCI timeline
    - Depends on severity of BI
    - Depends on recovery
- **Patience...Patience...Patience!**



# Summary

- **Dual diagnosis is far more common than most SCI clinicians, families and case managers realize**

- Recognition – look for it!
- Adjustment of program
- Proper setting and pharmacological intervention
- Education of patient and family
- Education of staff
- Do research and publish



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**Thank You  
for coming**

**Questions?**