

Epidemiology

1.7 million TBI occur in US annually

Of the 1.7 million, 81% ED visits, 16.3% hospitalizations, 3% deaths

Bimodal age distribution- 15-19 to 25 years and 2nd peak in elderly >65. Higher mortality in older.

Male to female ratio 2.5:1, and mortality 3-4x greater in males

MVA most common cause in adolescents and adults (~50%)

The single most common cause of death and injury in MVA is ?

Violence/assault is second leading cause of TBI in young adults

ETOH in 86% of TBI patients

Geriatric and pediatric TBI

Geriatric- Risk of TBI increases sharply after 65 and due to falls.

Severity of TBI and mortality is higher in elderly

Pediatric TBI is leading cause of death in children >1 y.o

10 in every 100,000 children die every year from head injuries

Annual incidence of TBI in children is 185 per 100,000

Transportation>falls>sports>assault

Posttraumatic Agitation

Subtype of delirium unique to TBI which occurs during period of Posttraumatic amnesia

Combination of aggression, disinhibition, akathisia, and emotional lability.

Score of ≥ 21 on the Agitated Behavior Scale (ABS)

Occurs as patients become more responsive in early states of recovery. Can be seen as a good sign.

Usually lasts 1-14 days, possibly longer

Common in frontotemporal lesions- arousal, attention, executive control, memory and limbic behavioral functions.

Agitated Behavior Scale (Corrigan 1989)

1. Short attention span, easy distractibility, inability to concentrate.
2. Impulsive, impatient, low tolerance for pain or frustration.
3. Uncooperative, resistant to care, demanding.
4. Violent and or threatening violence toward people or property.
5. Explosive and/or unpredictable anger.
6. Rocking, rubbing, moaning or other self-stimulating behavior.
7. Pulling at tubes, restraints, etc.
8. Wandering from treatment areas.
9. Restlessness, pacing, excessive movement.
10. Repetitive behaviors, motor and/or verbal.
11. Rapid, loud or excessive talking.
12. Sudden changes of mood.
13. Easily initiated or excessive crying and/or laughter.
14. Self-abusiveness, physical and/or verbal.

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Items

- Each item rated 1 (none) – 4 (extreme) per 8h shift
- Total score range: 14 – 56
- Cutoff for agitation: total score > 21

The Galveston Orientation and Amnesia Test (GOAT)

Question	Error score	Notes
What is your name?	/ 2	Must give both first name and surname.
When were you born?	/ 4	Must give day, month, and year.
Where do you live?	/ 4	Town is sufficient.
Where are you now?		
(a) City	/ 5	Must give actual town.
(b) Building	/ 5	Usually in hospital or rehab center. Actual name necessary.
When were you admitted to this hospital?	/ 5	Date.
How did you get here?	/ 5	Mode of transport.
What is the first event you can remember after the injury?	/ 5	Any plausible event is sufficient (record answer).
Can you give some detail?	/ 5	Must give relevant detail.
Can you describe the last event you can recall before the accident?	/ 5	Any plausible event is sufficient (record answer).
What time is it now?	/ 5	1 for each half-hour error, etc.
What day of the week is it?	/ 3	1 for each day error, etc.
What day of the month is it? (i.e. the date)	/ 5	1 for each day error, etc.
What is the month?	/ 15	5 for each month error, etc.
What is the year?	/ 30	10 for each year error.
Total Error:		
100 - total error		Can be a negative number.

76-100 = Normal
66-75 = Borderline
< 66 = Impaired

Diagnosis

Diagnosis of exclusion after physical, medical, psychiatric, and neurological conditions have been ruled out

Pain (fractures, post-operative, heterotopic ossification, spasticity, wounds, or other noxious stimuli)

Environmental: Excessive stimulation, Restraints -"ICU Syndrome" vital signs, alarms, medication administration, constant lighting, and ambient hallway noise, staff.

Tubes/lines

Rancho Los Amigos Scale

Level I	No Response: Total Assistance
Level II	Generalized Response: Total Assistance
Level III	Localized Response: Total
Level IV	Confused/Agitated: Maximal Assistance
Level V	Confused, Inappropriate Non-Agitated: Maximal Assistance
Level VI	Confused, Appropriate: Moderate Assistance
Level VII	Automatic, Appropriate: Minimal Assistance for Daily Living Skills
Level VIII	Purposeful, Appropriate: Stand-By Assistance
Level IX	Purposeful, Appropriate: Stand-By Assistance on Request
Level X	Purposeful, Appropriate: Modified Independent

Diagnosis

Medical- Metabolic disturbance (electrolytes, thyroid, hypoglycemia), Infection, Hypoxemia, pulmonary embolism, Urinary retention/incontinence

Neurological: Hydrocephalus, Seizures, Rebleed, Headache

Psychiatric: Premorbid or exacerbation of premorbid

Substance/medication related: Acute intoxication Withdrawal -Alcohol, Opioids, Benzodiazepines

Management and treatment options

FIRST LINE: Environmental Modification-***Avoid going straight to medications.

Reduce stimuli

b. Limit number of visitors at one time

c. Staff and family should speak in low volume, slowly, one at a time

Avoid/minimize restraints: Use non-contact restraints if able (safety net beds), padded hand mittens, one-to-one staff supervision

Minimize tubes and lines: May cover them (abdominal binder, etc)

Frequent re-orientation by staff and family

Obtain any hearing devices or vision aids from home to improve orientation

Consistent schedule and staff

Timed toileting

Create a familiar environment: Allow family to bring in personal possessions

*****Monitor sleep cycle and sleep quality**

Behavioral Modification

Allow patient to be safely active on the unit.

Mobile patients may benefit from a locked unit.

De-escalation techniques (discuss in future slides)

Pharmacologic Management

Medications which slow cognition may prolong/exacerbate agitation. Dopaminergic agents should be avoided

Antipsychotics: Typical Antipsychotics: Not recommended as first line, rescue only ie Haldol

Droperidol: Found to be faster and superior to Haldol, Ativan, and Benadryl in controlling acute agitation

Cognitive improvement seen after discontinuing typical antipsychotics

Associated with extrapyramidal side effects, dystonic reactions, restlessness, Neuroleptic Malignant Syndrome, QTc prolongation ;Not recommended as long-term agents

Pharmacologic Management

Atypical antipsychotics

i. Quetiapine (Seroquel): - Effective in treating agitation -Better side effect profile compared to typical agents

Olanzapine (Zyprexa): - Effective in treating agitation - Favorable side effect profile when compared to other antipsychotics. Available orally or IM

Risperidone, Ziprasidone

Pharmacologic Management

Anxiolytics

Benzodiazepines -Impair cognition and may cause paradoxical agitation, anterograde amnesia, disinhibition, respiratory depression, impaired coordination

Useful for rapid resolution of violent agitation (rapid onset of action) iv. Lorazepam preferred -Less effect on cardiovascular and respiratory centers than other benzodiazepines Doses of 0.5-1mg q8h, titrating up to maximum of 8-12mg/day

Discontinue as soon as possible to minimize chances of delaying cognitive recovery

Pharmacologic Management

Buspirone

Preferred anxiolytic in TBI patients

No significant adverse neurological or cognitive effects, non-sedating, non-addictive, does not interact with other CNS agents, not a respiratory depressant

Pharmacologic Management

Beta blockers ****

Propranolol- Best evidence for efficacy in treating post-traumatic agitation with minimal side effects per Cochrane review

Reduces agitation intensity and need for physical restraints, improves restlessness and disinhibition.

Side effects -Hypotension and bradycardia are limiting side effects -May also cause depression and lethargy -No adverse effect on motor recovery

Starting dose: up to 40-60mg/day divided into BID –QID dosing

Lipophilic properties -More effective CNS penetration -Propranolol is the most lipophilic beta blocker

Pharmacologic Management

Anticonvulsants

Valproic acid (Depakote)- Initial dose of 250mg BID, may be titrated up 250mg every 2-3 days to maximum of 1000-2500mg/day

Side effect limitations: hepatotoxicity, thrombocytopenia. Monitor labs.

More common side effects of sedation, nausea, and vomiting, are limited by meal-time administration and gradual titration

Less likely than carbamazepine to have negative impact on cognition and has safer side effect profile

Pharmacologic Management

Neurostimulants

Amantadine Can be effective for both acute and chronic TBI agitation. Shown to improve cognition

Side effects: Overstimulation, irritability, hypomania, agitation - Increased HR and BP, use with caution in patients with dysautonomia and cardiovascular complications

Lowers seizure threshold

Some side effects potentiated when combined with anticholinergic agents: hallucinations, confusion, nightmares

Pharmacologic Management

Methylphenidate (Ritalin) Useful in both acute and chronic TBI agitation. Improves cognition similarly to Amantadine. Quick onset of action Dosing: 10-60 mg/day in divided doses, usually at 8AM and noon

Bromocriptine: Dopaminergic neurostimulator like Amantadine

Dextroamphetamine: Sympathomimetic neurostimulator like Methylphenidate

Pharmacologic Management

Antidepressants

Selective Serotonin Reuptake Inhibitors (SSRIs) -Useful for behavioral syndromes in TBI

Trazodone

Others: Sertraline Fluoxetine, Paroxetine, Citalopram

Tricyclic Antidepressants

Bupropion- Useful for restlessness at 150mg daily

Pediatric Pharm Management

Table 5. Antiepileptics

Medication	FDA Approval in Pediatric Patients	FDA Pediatric Dosages	Mechanism of Action	FDA Indications	TBI Usage	Serious Reactions	Warnings
Divalproex	Yes, children >10 y old	Initial dosage 10-15 mg/kg/d	Suggested to increase brain concentrations of GABA	Mania, epilepsy, migraine	Agitation, headache	Teratogenicity, pancreatitis	Hepatotoxicity
Valproic acid	Yes, children >10 y old	Initial dosage 10-15 mg/kg/d	Suggested to increase brain concentrations of GABA	Seizure, mania, migraine HA	Agitation	Teratogenicity, pancreatitis	Hepatotoxicity
Carbamazepine	Yes, children >12 y old	Age based	Suggested to increase GABA	Bipolar disorder, epilepsy, trigeminal neuralgia	Agitation, chronic headache	Aplastic anemia, agranulocytosis	Toxic epidermal necrolysis and Stevens-Johnson syndrome
Lamotrigine	Yes, patients ≥2 y old	Age and weight based	Unknown	Seizure, bipolar disorder,	Agitation		

FDA = Food and Drug Administration; GABA = γ -aminobutyric acid; TBI = traumatic brain injury.

Pediatric Pharm Management

Table 6. Antidepressants

Medication	FDA Approval in Pediatric Patients	FDA Pediatric Dosages	Mechanism of Action	FDA Indications	TBI Usage	Serious Reactions	Warnings
Amitriptyline	Yes, children >12 y old	10 mg	Inhibits norepinephrine and serotonin reuptake	Depression	Depression, agitation, chronic pain	Ventricular arrhythmias, torsades de pointes	Suicidality
Sertraline	Yes	Maximum of 200 mg/d	Selective serotonin reuptake inhibitor	Depression, OCD, panic disorder, PTSD, PMDD	Depression, agitation	Neuroleptic malignant syndrome, serotonin syndrome	Suicidality
Citalopram	Yes	Maximum 40 mg/d	Selective serotonin reuptake inhibitor	Depression	Depression, agitation, anxiety, OCD, stuttering	Neuroleptic malignant syndrome, serotonin syndrome	Suicidality
Paroxetine	No	N/A	Serotonin reuptake inhibitor	Depression, OCD, panic disorder, PTSD, GAD, PMDD	Depression, agitation	Neuroleptic malignant syndrome, serotonin syndrome	Suicidality
Fluoxetine	No	N/A	Inhibition of CNS neuronal uptake of serotonin	PMDD	Depression, agitation	Neuroleptic malignant syndrome, serotonin syndrome	Suicidality

N/A= not applicable; OCD = obsessive compulsive disorder; PTSD = post-traumatic stress disorder; PMDD = premenstrual dysphoric disorder; GAD = generalized anxiety disorder; CNS = central nervous system; FDA = Food and Drug Administration.

Pharmacologic Management

Choose agent based on clinical presentation.

Every TBI is different.

Restlessness/Akathisia: Frequent ambulation, Beta-blocker

Hyperadrenergic state: Beta-blocker

Episodic Behavior Dyscontrol / Mood Lability: Anticonvulsants/Mood stabilizers; possibly Atypical antipsychotics, SSRI, Neurostimulator. Anxious/fearful: Buspar, SSRI/TCA, Trazodone

Paranoid: Atypical antipsychotic

Start low, go slow

Ideal agent is non-sedating, not affecting cognitive recovery, low side effect profile

May need to discontinue drugs which may amplify agitation: i. Narcotics ii. Benzodiazepines iii. Dopamine agonists (e.g. metoclopramide) iv. H2-receptor antagonists (e.g. famotidine) v. Anticholinergic medications (e.g. oxybutynin)

TBI management

What is the best management of a traumatic brain injury patient with agitation?

- Medications
- Sleep
- Family
- Safety
- Pain control
- Restraints
- Time
- Prepared staff and rehab facility

De-escalation Techniques and Staff preparation

Educate staff and family on how to approach TBI patient

Use social greetings: these are cues to relax -Speak calmly, slowly, briefly, clearly, and directly

Do not need to correct confused statements. Instead of disagreeing, make a neutral statement or re-direct attention to another topic

Explain what you are going to do before you do it (e.g. vitals, procedures, physical exam, etc)

Avoid sudden grabbing or touching of the patient.

Approach from the front. -Do not crowd patient

Provide patient with choice instead of command.

Therapies in quiet area, at bedside

Positive reinforcement

Give patient ample time to process information and formulate responses

Break down difficult tasks into small steps

Self Reflection



Self Reflection on....

- How do you prepare (as a medical professional/facility)
- How do you manage your anxiety and assumptions
- How do you manage conflict
- What is your self awareness and emotional intelligence?

How do you and your facility prepare?

- Consult service/ Review of records
- Speak with patient and family before transfer
- Restraints? Discuss with family beforehand and with patient if appropriate.
- Discharge planning, best support available
- Emergency discharge plan
- Be ready to evaluate for capacity. Psychology services?
- Knowledge of a TBI patient on the unit

Thank you!

Questions?