Case Study 1

Case Study 1

47 year old single male, vehicle collision, RLA-4 and combative

1.1 Problem List

Q1. Provide a problem list for this case study.

1.2 The Glasgow Coma Scale

Q2. Describe the Glasgow Coma Scale (GCS).

Q3. What are the strengths of the GCS?

Q4. What are the limitations of the GCS?

1.2.2 Glasgow Coma Scale as a predictor of Outcome

Q5. Is the Glasgow Coma Scale as determined in the field predictive of outcome?

1.3 The Berg Balance Score

Q6. Describe the Berg Balance Score.

Q7. What are the strengths of the Berg Balance Score?

Q8. What are the limitations of the Berg Balance Score?

1.4 Syndrome of Inappropriate AntiDiuretic Hormone (SIADH)

Q9. Describe the presentation of Syndrome of Inappropriate Antidiuretic Hormone (SIADH)? What is the etiology? How should it be treated?

1.5 Apraxias

Q10. Define and classify apraxia.

Q11. List the various types of apraxia, their lesion sites and their manifestations.

1.6 Ranchos Los Amigos Level of Cognitive Functioning Scale

1.6.1 Description of the RLA Cognitive Functioning Scale

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Q13. What are the various levels of the Rancho Los Amigos Levels of

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1.8 Medications to Assist with Sedation

Q23. What medications would you recommend to help him sleep?

1.9 Use of Sedatives and Antipsychotic Medications

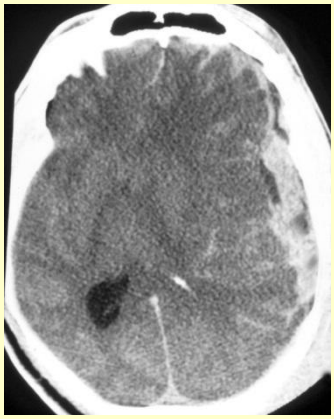
Q24. Describe the evidence including pros and cons of these medications.

Case Study 1

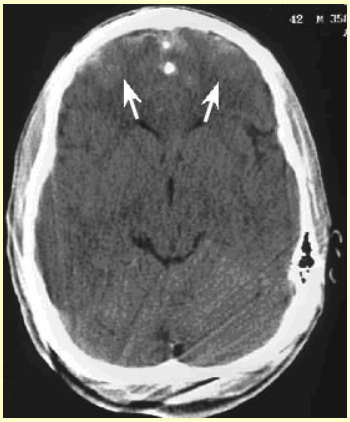
Case Study

A 47-year old male unbelted driver was involved in single vehicle rollover while intoxicated. He was thrown from his vehicle and found in ditch. Glasgow Coma Scale (GCS) was initially 3. There was a question as to whether he suffered a seizure. He progressed to a GCS 12-13 and combative but deteriorated again to a GCS 7 in ER and required intubation and ventilation.

The patient's injuries included a Rt. frontal smear subdural hematoma, traumatic subarachnoid /intraventricular hemorrhage and bifrontal and bitemporal contusions. He was not considered a surgical candidate. He also suffered a brachial plexus injury and road rash. He was admitted to rehab day 14 post-injury.



Subdural Hematoma (SDH)



Bifrontal Hemorrhagic Contusions

At the time of admission to rehabilitation he was oriented to name only and was unable to complete the mini-mental exam. He was able to only inconsistently understand what was being said to him and although he had fluent speech, it was often tangential or nonsensical. He was not able to properly use common objects (toothbrush, comb, cup) and was observed to attempt to eat soap and paper. He required for 2 persons moderate-maximum assist to stand and ambulate for short distances. His Berg Balance score is a 2. He falls twice in the first 24 hours before restraints were applied (to abdomen and limbs); he also continually wants to pull out G-J tube. He had failed an early VMBS swallowing study, had aspirated without coughing and was NPO but perseverates on the need to drink (He had SIADH and was on fluid restriction).

Pictures reproduced with permission [3]. Image reprinted with permission from eMedicine.com, 2009. Available at: http://emedicine.medscape.com/article/337782-media[4].

1.1 Problem List

Q1. Provide a problem list for this case study.

Answer

- Rt. frontal subdural hematoma
- Traumatic subarachnoid /intraventricular hemorrhage
- Bifrontal and bitemporal contusions
- Brachial plexus injury
- Road rash
- Oriented x1, cognitive problems
- Aphasic
- Apraxic
- Impaired balance, 2 person assist to ambulate
- Impulsive
- Perseverative
- Aspiration (silent)
- G-J tube
- SIADH

1.2 The Glasgow Coma Scale

1.2.1 Description, Strengths and Weaknesses

Q2. Describe the Glasgow Coma Scale (GCS).

Answer [1]

1. GCS score is a quick, simple and objective tool used during the initial examination to estimate severity of TBI.
2. The assessment is based on eye opening, verbal response, and motor response.
3. The rating scale consisting of 15 items in three basic categories: motor response (6 items), verbal response (5 items) and eye opening (4 items).

To view the Glasgow Coma Scale click here

Discussion

- The Glasgow Coma Scale (GCS) is a ***quick, simple and objective score to be used during the initial examination to estimate severity of TBI*****. The *****assessment is based on eye opening, verbal response, and motor response*****.**
- The rating scale consisting of 15 items in three basic categories: motor response (6 items), verbal response (5 items) and eye opening (4 items)[1].

- The lowest total score 3 is likely fatal damage, especially if both pupils fail to respond to light and oculovestibular responses are absent.
- ***A score < 8 is typically regarded as coma*** [5]
- Other categorical divisions are: scores of 13 – 15 represent mild injury, scores of 9 – 12 represent moderate injury and scores of 8 or less represent severe injury [1].

Q3. What are the strengths of the GCS?

Answer [1]

1. Simple, straightforward and brief bedside assessment.
2. The most familiar, most widely used instrument in the assessment of level of consciousness.
3. Established categories related to the presence of coma and severity of injury
4. Significant predictor of outcome following head injury.
5. Can be used by various groups of healthcare professionals regardless of level of education or ICU experience.

Q4. What are the limitations of the GCS?

Answer[1]

1. The application of painful stimulus is controversial.
2. Assessment of all components is comprised by aggressive, early interventions such as intubation and sedation.
3. Use of global score may result in a loss of information that adversely affects the predictive accuracy of the GCS.
4. Motor response has the greatest influence on the summary.
5. Individuals with the same GCS scores in varying permutations can have significantly difference risks for mortality.
6. Lack of experience and variability may result in inaccurate assessment.

1.2.2 Glasgow Coma Scale as a Predictor of Outcome

Q5. Is the Glasgow Coma Scale as determined in the field predictive of outcome?

Answer

1. Higher initial GCS scores tend to predict better recovery.
2. However, prediction of prognosis and severity may be improved by considering the CT scan results and other factors.
3. Hypoxia and hypotension can decrease the GCS; therefore, GCS values after resuscitation from cardiopulmonary insults are more specific.

4. Sedative medications can decrease GCS values and should be used only after full neurological evaluation [5].

Discussion

- ***The GCS score has been shown to have a significant correlation with outcome following severe TBI, both as the sum score [6;7] or as just the motor component [6;8-10].***

For a more detailed discussion of the GCS please see **ERABI/Assessment of Outcomes Following Acquired/Traumatic Brain Injury**.

1.3 The Berg Balance Score

Q6. Describe the Berg Balance Score.

Answer

1. Assessment of balance.
2. 14 items from 0-4 per item for maximum score of 56.
3. Score <45 is at risk of falling.

To view the Berg Balance Scale go to: **www.aahf.info/pdf/Berg_Balance_Scale.pdf**

Discussion

- The Berg Balance Scale provides a ***quantitative assessment of balance in older adults[11].***
- **It was *intended for use in monitoring the clinical status of patients or effectiveness of treatment interventions over time* [12].**
- The scale consists of 14 items (common to everyday life) requiring subjects to maintain positions or complete movement tasks of varying levels of difficulty.
- Administration of the scale requires a ruler, a stopwatch, chair, step or stool, room to turn 360 degrees and 10 – 15 minutes and is administered via direct observation of task completion[12;13].
- Items receive a score of 0-4 based on ability to meet the specific time and distance requirements of the test.
- A score of zero is represents inability to complete the item and a score of 4 represents the ability to complete the task independently.
- The maximum score is 56, although it is ***generally accepted that scores of less than 45 are indicative of balance impairment [14;15].***

Q7. What are the strengths of the Berg Balance Score?

Answer

Measures a number of difference aspects of balance, both static and dynamic.
Requires little equipment or space and no specialized training.
High levels of reliability even when test is administered by an untrained assessor.
Particularly well suited to acute stroke rehabilitation, as the majority of patients do not obtain maximum scores on admission to rehabilitation; likely similar with ABI.

Q8. What are the limitations of the Berg Balance Score?

Answer

1. Decreased sensitivity in the early stages post-stroke among severely affected patients as scale includes only one items relating to balance in the sitting position; likely also true with ABI patients.
2. Takes somewhat longer to administer than other balance measures and may not be suitable for the evaluation of active, elderly person, as the items included are not sufficiently challenging for this group.
3. No common standards for interpretation of BBS scores exist, their relationship to mobility status and the requirement for mobility aids.

For a detailed discussion on the advantages and limitations of the scale please see **ERABI/Assessment of Outcomes Following Acquired/Traumatic Brain Injury**.

1.4 Syndrome of Inappropriate AntiDiuretic Hormone (SIADH)

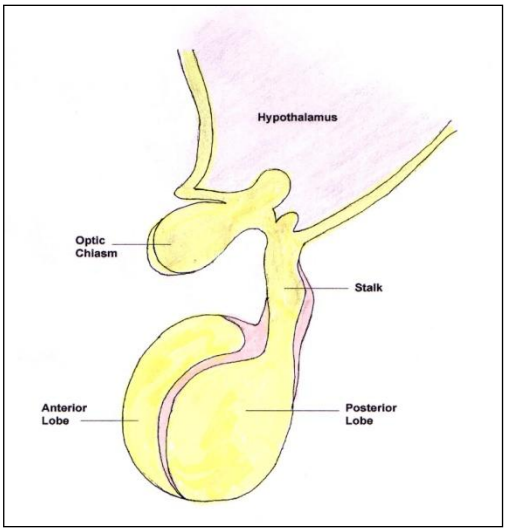
Q9. Describe the presentation of Syndrome of Inappropriate AntiDiuretic Hormone (SIADH)? What is the etiology? How should it be treated?

Answer

1. Hyponatremia (<135 mEg/L) and Hypo-osmolality (<280 mOsm/L); Urine osmolality is greater than that of plasma.
2. In extreme cases may present clinically with mental confusion, seizures and coma.
3. Result of excessive release of antidiuretic hormone (ADH).

Discussion

Figure 1: Diagram of Hypothalamic-Pituitary Axis



Etiology

- **The *posterior pituitary gland is responsible for the release of the hormone arginine vasopressin (AVP) also known as the antidiuretic hormone (ADH).* An *excessive release of this hormone often results in fluid overload or hyponatremia* (low serum sodium)[16]**
- The development of the SIADH is a common complication of a brain injury [17] and is often diagnosed several days post injury [18].
- The kidneys begin to conserve water [19] in response to an excessive release of ADH hormone.

Clinical Presentation

- SIADH should be suspected if a patient with TBI (who is not dehydrated or taking diuretics) presents with concentration [18-20]:
    - hyponatremia (<135 mEg/L),
    - hypo-osmolality (<280 mOsm/L),
    - a urine osmolality greater than that of plasma,
    - a urine sodium concentration that is usually above 25mEg/L,
    - normal acid-base and potassium balance,
    - and frequently a low plasma uric acid SIADH may present clinically with mental confusion, seizures and coma [18]

Treatment

- The main treatment is fluid restriction.
- Sodium correction may include:
    - Demeclocycline (Declomycin), a tetracylcline antibiotic, 600-1,200 mg/day[21]
    - Furosemide (loop diuretic) which increases “renal loss of water in excess of sodium” [22]
    - Vasopressin receptor antagonists such as Pressyn which can be administered to patients with chronic hyponatremia [21] but may bring about water intoxication
    - Osmotic diuretic (mannitol) increase excretion of free water [22]

For a more detailed discussion of SIADH and other neuroendocrine disorders post ABI please see **ERABI/Neuroendocrine Interventions Post ABI**.

1.5 Apraxias

Q10. Define and classify apraxia.

Answer

1. Apraxia is a disorder of voluntary movement where one cannot execute a purposeful activity despite the presence of adequate mobility, strength, sensation, coordination and comprehension.

Discussion

- ***Apraxia is a disorder of voluntary movement where one cannot execute willed, purposeful activity despite the presence of adequate mobility, strength, sensation, coordination and comprehension.***
- Alternatively, Caplan [23] refers to it as an inability to perform previously learned tasks when such an inability cannot be explained by weakness, aphasia, or sensory loss.
- The difficulty can be spontaneous and noted during everyday activities (e.g. difficulty with dressing, using utensils, starting the car, turning keys to open doors, and lighting a cigarette).
- In others the difficulty in performing motor tasks becomes evident when the patient is asked to do something [23].
- Apraxia is common in patients with left hemispheric strokes, especially in lesions involving the left frontal and parietal lobes.

Q11. List the various types of apraxia, their lesion sites and manifestations.

Answer:

Type	Site of Lesion	Manifestation
Motor or Ideomotor	Often left hemisphere.	Can automatically perform a movement but cannot repeat it on demand.
Ideational	Often bilateral parietal.	Can perform separate movements but cannot co-ordinate all steps into an integrated sequence.
Constructional	Either parietal lobe but right more often than left.	Unable to synthesize individual spatial elements into a whole (e.g., cannot draw a picture).
Dressing	Either hemisphere, right more	Inability to dress oneself despite

	often than left.	adequate motor ability.

1.6 Rancho Los Amigos Level of Cognitive Functioning Scale

Case Study (continued)

*The patient at time of admission to rehabilitation was deemed to be an **RLA-IV**. On the rehabilitation unit he is argumentative and is not easily re-directed. His voice will quickly escalate in volume and he will begin yelling. He makes less sense when he is agitated. Unfortunately, he cannot be physically re-directed as he will strike out at staff or attempt to pull them in to bite them. His most clear vocalizations are shouted profanity which is disturbing to others on the unit.*

1.6.1 Description of RLA of Cognitive Functioning Scale

Q12. Describe the Rancho Los Amigos Levels of Cognitive Functioning Scale

Answer

1. Describes 8 stages of cognitive function that brain injury patients typically progress.
2. Not an outcome measure but rather a global index used to describe awareness, environmental interaction and behavioural competence.
3. Used to monitor recovery.

For further details on the RLA-Cognitive Functioning Scale go to:
http://www.rancho.org/Research_RanchoLevels.aspx

Discussion

- The Rancho Los Amigos Levels of Cognitive Functioning Scale (LCFS) was ***intended to provide a description of 8 stages of cognitive function through which brain injured patients typically progress during their stay in hospital and acute rehabilitative care*** [24;25]
- It was not developed as a scale and is not considered to be an outcome measure.
- **It is a *global index used to describe awareness, environmental interaction and behavioural competence*** [26;27]**.**
- It is used to monitor recovery and classify outcome in patients with brain injury [28].

For a more detailed discussion of the RLA please see **ERABI/Assessment of Outcomes Following Acquired/Traumatic Brain Injury**.

Q13. What are the various levels of the Rancho Los Amigos Levels of Cognitive Functioning and what does this indicated about the individual? [24]

Answer

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

1.6.2 Strengths and Weaknesses of RLA LCFS

Q14. Describe Strengths and Weaknesses of Ranchos Los Amigos LCF Scale.

Answer

Strengths
1. Provides a quick and simple snapshot of level of recovery.
2. Useful for making quick comparisons between groups.
3. Simplicity and utility have resulted in widespread use

Weaknesses
1. Lack of standardization, which effects interobserver reliability.

Discussion

- The RLA-LCFS is a ***quick and simple way to provide a snapshot of an individual's level of recovery.***
- **Its *simplicity and utility have contributed to its widespread use* within** the United States [29;30].
- However, at present there is ***no standardized method to derive an LCFS rating*.**

- **It *focuses on the impact of cognitive dysfunction on arousal and overall behaviour, but does not provide information regarding specific domains of cognitive impairment* [31].**
- There is ***relatively little published evidence to support the reliability or validity* of the LCFS.**

1.6.3 Clinical Presentation of Ranchos Los Amigos – Level IV (RLA-IV)

Q15. How would an RLA-IV typically present?

Answer

A patient who has been diagnosed at RLA-IV may:
- be confused or frightened
- not be able to understand what he feels
- not be able to understand what is happening around him
- over react to what he is seeing or hearing
- be seen hitting, screaming, using abusive language, etc
- need to be restrained to avoid injuring himself
- not understand that people are trying to help him
- have difficulty following instructions; not be able to focus for more than a few minutes
- not be able to follow direction or have difficulty when expected to follow direction
- show difficulties in recognizing family and friends
- be able to feed or dress self with assistance
- have difficulty talking [32]

1.6.4 Treatment of Patient with Ranchos Los Amigos – Level IV (RLA-IV)

Q16. How should an RLA-IV be treated?

Answer

1. **Treatment goals** for an RLA-level IV (Confused –Agitated) include:
- Decrease intensity, duration and frequency of agitation
- Increase attention to the environment
- Team goal is to have the patient advance to a higher cognitive level.

2. **Treatment strategies** for patients include:
- Must not to be left alone
- The patient ‘s room must be kept to a minimum from noise and traffic
- Must be often familiarized with basic information
- Physical reassurance by talking to and touching the patient (if he does not object to physical contact)
- Accommodation in a highly-structured setting
- Remove patient from the group or change activity if his agitation increases
- Freedom of movement should be provided to control outbursts

- Stimulating simple self-care tasks and participation (eating, brushing hair, washing face)
- Use of psychotropic medications as a last resort [32]

1.7 Management of Agitation and Aggressive Behaviour

Case Study (continued)

The staff on the unit are becoming increasingly concerned about the patient's aggressive and agitated behavior – it is disruptive on the unit and there are concerns about staff getting hurt. They ask if the patient should not be medicated to improve his behavior.

1.7.1 Assessment of Agitation and Aggressive Behaviour

Q17. What assessment tool is available to measure agitated and aggressive behavior?

Answer

1. Agitated Behaviour Scale, designed to assess agitation in patients by those working with them. 14 item scale, with each item scoring 1-4 (total range 14-56)

Click here to view the Agitated Behavior Scale: http://www.tbims.org/combi/abs/absrat.html

Discussion

- To measure agitation post-injury ***the Agitated Behavior Scale*** was developed [33].
- According to Levy et al. [34], despite the availability of the scale, agitation remains unmeasured by most who work with the TBI population.
- The scale, which began as a 39 item scale, was reduced to ***14 items, with each item scoring 1 to 4, (from absent to present to an extreme degree).*** The scale which was originally tested by nurses, occupational therapists (OT), physiotherapists (PT) and other hospital staff, was designed to be used by allied health professionals [35].

Q18. What are the strengths and weaknesses of the ABS?

Answer

Strengths
1. The Length of the scale (14 questions)
2. The amount of time to complete it (< 30 minutes)

3. Its availability makes the scale very practical.

Weakness

1. Risk of over diagnosis of agitiation[2].

Q19. What are some of the practical advantages of using an objective scale for assessing agitation?

Answer

1. Assess pattern of agitation
2. Assess the level of agitation, which then can dictate treatment
3. Assess the response of agitation to interventions
4. Numbers mean something; ABS >21 = agitation, <23 unlikely to be violent, >28 = treatment with pharmacological agents

1.7.2 Treatments for Agitation and Agression Post-TBI

1.7.2.1 Non-Pharmacological Measures

Q20. What are some non-pharmacological methods for managing agitation and aggressive behaviour which would be applicable in this case?

Answer

- Do not leave alone
- Keep noise and traffic in room to a minimum
- Familiarize with basic information
- Physical reassurance through talking or touching patient
- Accomodation in a highly-structured setting
- Establish desired behaviour
- Remove patient from group or change activity if agitation increases
- Freedom of movement to control outbursts
- Stimulating simple self-care tasks and participation
- Assess for treatable pathology
- Assess for sleep/wake cycle

1.7.2.2 Pharmacological Measures for Aggressive and Agitated Behaviour

Q21. What are some principles for using pharmacological measures in the treatment of aggressive and agitated behaviour?

Answer

1. Pharmacological agents should only be used as a last resort (ABS > 28)
2. Careful considerations of the sensitivity of people with TBI to psychotropic medications which should be used with caution
3. With medications "start low and go slow" and titrate to an optimal dose; but get to a therapeutic dosing before abandoning use
4. Develop clear cut goals and metrics to assist in determining when to stop treatment (i.e. consider weaning off medication when ABS < 21).
5. Be alert to side effects and undesired effects
6. Minimize use of Benzodiazepines and neuroleptic antipsychotic medications such as Haldol as animal studies suggest these medications may slow brain recovery.

Q22. When non-pharmacological measures are unsuccessful which medications are recommended to decrease aggressive and agitated behaviours?

Answer

Initially

1. Atypical antipsychotics prn – Risperidone up to 3 gm daily; alternative Seroquel or Olanzepine

Later *(if ABS ≥ 28 then provide scheduled dose medications*

1. Beta-blockers
2. Anticonvulsants (i.e Valproic Acid)
3. SSRI (Sertraline)
4. Tricyclic antidepressants (Amtriptyline titrated up to 75 mg/day)
5. Methylphenidate
6. Avoid the use of antipsychotic drugs such as Haldol.

Discussion

- According to the newest version of ERABI [36]
- The use of multiple neuropharmacologic agents early in the treatment of posttraumatic brain injury agitation may be an effective therapeutic intervention for both behavioral and cognitive problems.
- The best evidence of effectiveness in the management of agitation and/or aggression following ABI was for beta-blockers [37] and ***anticonvulsants and beta-blockers are the two classes of drugs most often recommended.***
- More research is needed to assess the role of other medications and medication combinations such as Amantidine, Ritalin, Trazadone and Dexedrine [38].

ABIKUS Guideline (2007)[39]

Pharmacological Measures for Aggressive and Agitated Behaviour

1. *"There should be careful considerations of the **sensitivity** of people with traumatic brain injury to **psychotropic medication** before trial use. Psychotropic medications should be used with caution. Where medications are clinically indicated 'start low and go slow', keep under direct clinical monitoring to ensure that the drug is tolerated and producing the expected improvement and used with caution where indicated. (pg 18)*

2. *Perform a **detailed** physical **exam** prior to commencing any trial of medications. People with traumatic brain injury and their caregiver should be asked about any prescribed medications, over the counter remedies, herbs or supplements they are taking to check for potential interactions and adverse effects. (pg 18)*

3. *Appropriate investigations should be completed prior to medication trials to rule out and minimize metabolic abnormalities including evaluation of: plasma blood sugar, electrolytes, hormones, hemoglobin, oxygenation and infection. (pg 18)*

4. Clinicians should also consider the possibility of brain injury related sleep disorders as a cause of cognitive and other behavioural changes. (pg 18)

*5. Any trial of medication for a person with traumatic brain injury should be preceded by a **clear explanation** to the person with traumatic brain injury and their caregivers, and a caution that effects of medications are less predictable in people with traumatic brain injury. (pg 18)*

*6. **Minimize use of Benzodiazepines and Neuroleptic antipsychotic medications** as animal studies suggest these medications may slow recovery after brain injury. (pg 18)*

*7. **Beta Blockers** are recommended; a guideline for the treatment of aggression after TBI. Studies reported the efficacy of both Propranolol (maximum dose 420-520 mg/day) and Pindolol (maximum dose 40-100 mg/day) in the treatment of aggression in this population. (pg 19)*

*8. **Anticonvulsants:** Carbamazepine and/or Valproic Acid may be used to decrease the incidence of aggressive behaviours. (pg 19)*

*9. **Valproic Acid** may be preferred over Phenytoin post brain injury as it does not have any significant neuropsychological side effects, and is effective for controlling established seizures and stabilizing mood. (pg 19)"*

1.8 Medications to Assist with Sedation

Case Study (continued)

Sleep – Patient does not settle at night, will rest for 45 minutes at a time and take hours to re-settle. However, additional PRN's given at night make him very drowsy during the day and staff has been phoning for additional medications each night for the past week.

Q23. What medication would you recommend to help him sleep?

Answer

1. Medication of choice would be benzodiazepines (Lorazepam and Zopiclone have had the most research conducted on them).

Discussion

The following medications may be prescribed for sleep:

Diazepam (Valium Oral)

- Benzodiazepine which provides sedation, is used to treat muscle spasms, ***enhancing the effects of gamma-amino-butyric acid (GABA).***
- Diazepam is not useful to treat cognitive and attention disorders for patients with TBI[40].
- Diazepam can be used as treatment for patients who have sleep walking and night terrors[41].

Lorazepam and Zopiclone

- Given to a group of stroke and TBI patients in one RCT [42]
- Study findings noted there were no differences reported in the length of sleep, on quality of sleep, depth of sleep, feelings of being refreshed or alertness in each group.
- ***There is Level 1 evidence supporting the use of both lorazepam and zopiclone for insomnia symptoms post ABI*** [43]**.**

For more details on the effectiveness of various treatments to assist with sleep disorders and fatigue post ABI see **ERABI/Fatigue and Sleep Disorders Post ABI.**

1.9 Use of Sedatives and Antipsychotic Medications

Case Study (continued)

On the rehabilitation unit, the patient is on the following medications:

- *Nozinan 10mg TID + 20mg HS*
- *Trazodone 50mg HS*
- *Nurses have also asked for: Ativan, Haldol, Olanzapine, and Risperidone which he has received on an as need basis, outside of the treatment plan.*

Q24. Describe the evidence including pros and cons of these medications.

Answer

1. There is some evidence that **Nozinan** is a safe and effective treatment for controlling agitation post ABI. There is concern about how the drug could negatively impact neurorecovery.
2. There is evidence that early treatment with **Trazadone** is a safe and effective treatment for controlling agitation post TBI. There is concern about how the drug could negative impact neurorecovery.
3. There is strong evidence that **Lorazepam** is effective in treating insomnia post ABI.
4. There is some evidence that **Haldol** when used for agitation post ABI does nto seem to negatively affect rehabilitation.
5. There is very limited evidence (mostly case studies) that the **atypical antipsychotics, Olanzepine and Risperidone** can be used to treat psychosis after ABI.

Discussion

Nozinan (Methotrimeprazine)

- Is a psychotropic medication (mediated by dopamine blocking), tranquilizing, and analgesic properties.
- It appears to have an effect on opiate (pain) receptors as well [44].
- In a study by Maryniak et al.[45] they found that methotrimeprazine may be safe and effective for controlling agitation following ABI.
- ERABI [36] concluded there was Level 4 evidence that methotrimeprazine may be safe and effective for controlling agitation following ABI.

Trazodone

- Trazodone is antidepressant with a sedation effect and may useful for the treating of insomnia after TBI [46].
- Rosati [38] found trazodone was effective for in the early treatment of post-traumatic brain injury agitation.

- According to the ERABI [36] there is Level 4 evidence that early multiple neuropharmacological treatment that including trazodone may be effective for agitation after TBI.

Ativan (Lorazepam)

- Lorazepam is a benzodiazepine anti-anxiety medication which, because of its sedative effects, it also has been used for treatment of insomnia [47].

Haldol (Haloperidol)

- Haloperidol is a psychotropic treatment that assists in reducing agitation.
- In a study conducted by Rao et al.[48] they found no differences between the two groups of ABI patients regarding the success of rehabilitation.
- According to the ERABI, there is Level 4 evidence that haloperidol ***does not negatively effect the success of rehabilitation.***

Olanzapine and Risperidone

- Atypical antipsychotic drugs such as Olanzapine and Risperidone are increasingly being used as first line treatment for individuals with psychotic disorders and increasingly are being used for decreasing agitation and aggression.
- According to Volavka et al.[49] studies conducted have reported that ***these drugs can be effective for some patients with traumatic brain injury.***
    - It was recommended that one start with dose of olanzapine 2.5-5 mg QHS or BID and then increase in increments of 2.5-5 mg up to 20 mg/day.
    - Risperidone would start with 0.5 mg QHS or BID and increase in increments of 0.5-1mg up to 4-6 mg/day [46].

For a more detailed discussion on the use of sedatives and antipsychotics post ABI please see **ERABI/Mental Health Issues Post ABI.**

Summary of Medications Used in the Treatment of Agitation and Anxiety Post ABI[50]

Name and Description	Pros	Cons
Nozinan (methotrimeprazine), neuroleptic	Methotrimeprazine possesses antipsychotic, tranquilizing, anxiolytic, sedative and analgesic.	In high doses orthostatic hypotension can occur. Side effects include drowsiness; this may appear early in treatment but will gradually disappear during the first weeks or with an adjustment in the dosage.
Trazodone antidepressant	Prescribed for insomnia and depression	Side effects include *"drowsiness, seizures, anticholinergic effects, priapism in males (rare)"* (Woo & Nesathurai 2000).
Ativan (lorazepam), benzodiazepine	Well tolerated in patients with severe liver disease as it has short half-life of 6 to 8	Benzodiazepines should be avoided in patients with known or possible sleep apnea. Smaller doses needed in

	hours. Can be administered intravenously or intramuscularly. In most patients, the risk of dependency is low.	elderly patients. When the medication is suddenly withdrawn may develop rebound insomnia.
Haldol (Haloperidol), antipsychotic	Used for treatment of mental conditions, to control movements and reduce agitation. There is Level 4 evidence that haloperidol does not have a negative effect on the success of rehabilitation.	There have been cases of sudden death, QT prolongation and Torsades de Pointes (TdP) especially when haloperidol given intravenously, or at doses higher than recommended. Haloperidol is only approved for intramuscular injection (U.S.Food and Drug Administration, 2007). Intravenous administration is a common off-label clinical practice.
Olanzapine, atypical antipsychotic	*"Monotherapy with an antipsychotic such as olanzapine may be sufficient".* Medical Specialty Society *(2002)*.	*"The Medicines and Healthcare products Regulatory Agency (MHRA) has warned against the use of risperidone or olanzapine in the treatment of behavioural symptoms of dementia, due to increased risk of stroke and death. Olanzapine or risperidone should not be used for the management of disturbed/violent behaviour in service users with dementia"* (National Collaborating Centre for Nursing and Supportive Care 2005)
Risperidone, antipsychotic	Can be administered once daily. Available in long-acting form. Sublingual form (Risperdal M-Tab). Used off-label to treat Anxiety Disorder. Effective and is well tolerated at low doses.	

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