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Topic: Traumatic Brain Injury

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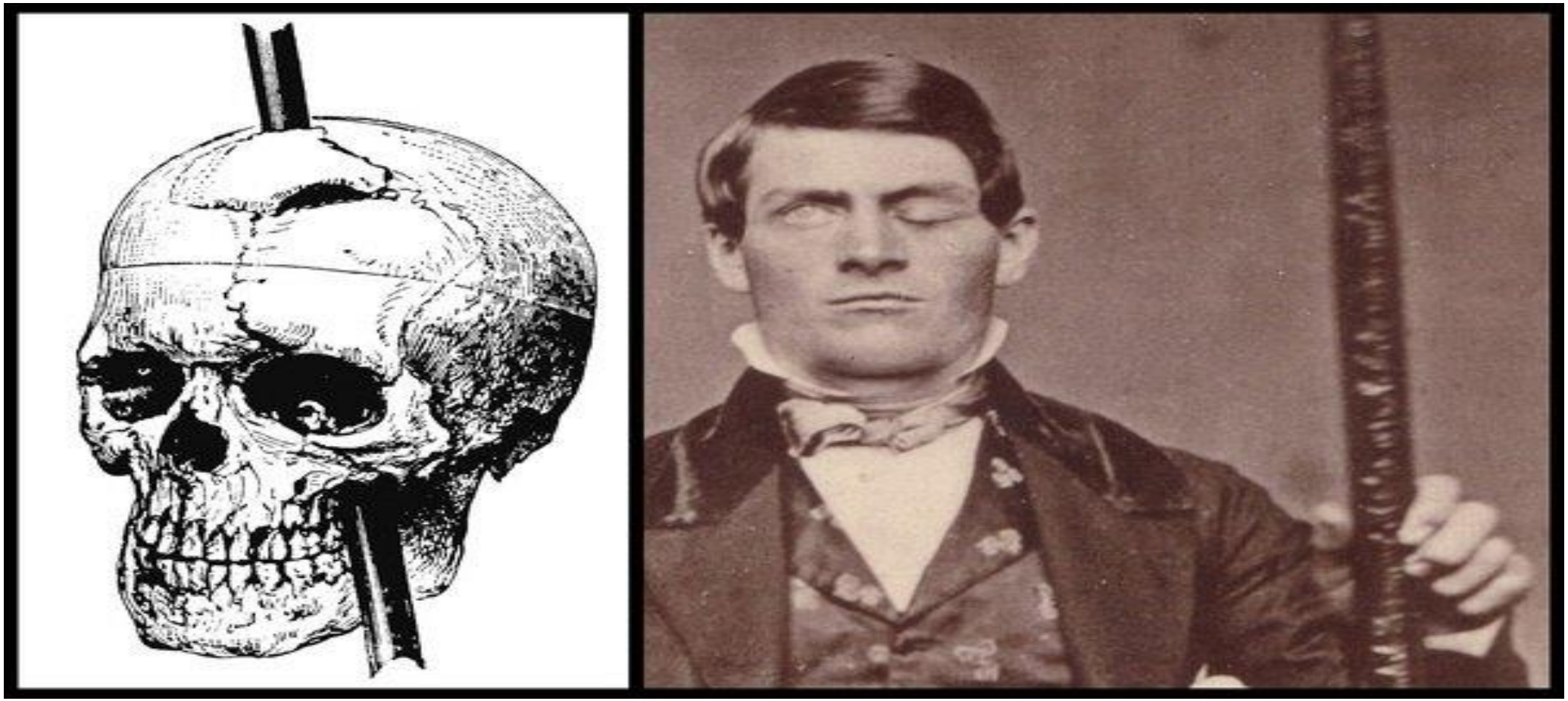
TRAUMATIC BRAIN INJURY



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Definition: TBI is defined by insult to the brain caused by an external physical force. It is also called as traumatic brain/head injury(THI).It includes any trauma to scalp,brain and skull.

History:

PHINEAS GAGE (1823-1860) is one of the earliest documented cases of severe brain injury. **Gage** is the index case of an individual who suffered major personality changes after brain trauma. As such, he is a legend in the annals of neurology, which is largely based on the **study** of brain-damaged patients.

Phineas Gage is often referred to as one of the most famous patients in neuroscience. He suffered a traumatic brain injury when an iron rod was driven through his entire skull, destroying much of his frontal lobe.

Causes of acquired brain injury:

1.Traumatic causes:

Motor vehicle accident: 19%

Falls:32%

Violence: 15%

Sports and recreation:10%

Types of head injury:

A. Depending upon type of injury

1.Open head injury:There is tissue laceration and contusion,serious injury can cause infection.eg,skull fracture tearing the dura matter of brain.

2.Closed head injury: Depression of skull that **doesn't tear dura matter**.

- Laceration: Complete tearing of brain tissue,tearing of blood vessels.
- Contusion: Bruising,mixing of blood with brain tissue
- Concussion: Movement of brain within the skull.

B.Depending upon location

1.Scalp laceration: The most minor type of head trauma.

Scalp is highly vascular so any trauma to it leads to profuse bleeding.

Infection is seen.

It may lead to hypoxia.

2.Basilar skull fracture:

Leakage of CSF, into the ear is otorhhea and to the nose is rhinorehhea.

HALO sign or Battle's sign is seen: ecchymosis is seen under skin over temporo-occipital region.

Injury to ICA can occur.

C. Depending upon the occurance:

1.Primary injury: Damage to the brain directly due to the trauma

2.Secondary injury: Hematoma,swelling,infection and ischemia can occur.

Cellular process and biochemical cascade after the trauma is seen.

- **Blast Injury:**
- Primary blast injury results from the direct effect of blast overpressure on brain.
- three mechanisms by which primary blast brain injury may occur:

(1) direct transcranial blast wave propagation;

(2) the transfer of kinetic energy from the blast wave through the vasculature, which triggers pressure oscillations in the blood vessels leading to the brain;

(3) elevations in cerebrospinal fluid (CSF) or venous pressure caused by compression of the thorax and abdomen and by propagation of a shock wave through the blood vessels or CSF

D.According to the mechanism of injury:

1.Focal injury:

- Focal brain injury is localized to the area of the brain under the site of impact on the skull.The damage can be in the form of heamatoma,edema,contusion or laceration.
- A severe blow to the head may result in brain damage not only directly opposite from the site of imapact. This results from brain bouncing and making contact with the skull at a opposite from the site of initial impact.
- It is called as coup-contercoup injury.
- Common site: Anterior-inferior temporal lobes and prefrontal lobe.

2.Diffuse axonal injury:

- Accleration, deceleration and rotational forces cause DIA, which is characterised by wide spread shearing and retraction of damaged axons.

- It has less clinical recovery

3.Hypoxic-Ischemic injury.

4.Increased intracranial pressure:

- Because the rigid skull surrounds the brain,swelling or abnormality of brain fluid dynamics often results in increased ICP.Elevated ICP may also results in hamatoma(Epidural,subdural,intracerebral)
- Normal IPC-4 to 15 mm Hg or 102-104mmH2O.
- S/S of raised ICP:

Clinical Signs of Increased ICP

- Signs which are almost always present
  - Depressed level of consciousness (lethargy, stupor, coma)
  - Hypertension, with or without bradycardia
  - Cushing triad: hypertension, bradycardia, and respiratory depression
- Symptoms and signs which are sometimes present
  - Headache
  - Vomiting
  - Papilledema
  - Sixth cranial nerve palsies

TYPE	LOCATION	CAUSE	ANATOMIC STRUCTURES	CLINICA EFFECTS
1.Uncal	Tentorial notch	Mass lesion in temporal lobe or middle fossa	Hippocampal gyrus,uncus,oculomotor nerve,cerebral peduncle midbrain-ascending RAS,PCA	Paresis of nerve 3,hemiparesis,coma,homonymous hemianopia.
2.Cental(transtentorial)	Tentorial notch,midbrain	Mass lesion in frontal,parietal ,occipital lobe,progession of uncal herniation	Midbrain,pons,ascending RAS,lower cranial nerves.	Decerebrate rigidity,coma
3.Tonsilar(foramen magnum)	Foramen magnum,medulla	Mass lesion in posterior fossa	Cerebellar tonsils,descending RAS,vasomotor centers	Neck pain,stiffness,flaccidity, coma,alteration in pulse,respiration,BP.


DECORTICATE RIGIDITY
Flexed
Plantar flexed
Internally rotated
Flexed
Adducted


DECEREBRATE RIGIDITY
Plantar flexed
Flexed
Pronated
Extended
Adducted

Impairments:

1.Neuromuscular:

- impaired motor function
- Upper extremity and lower extremity paresis
- impaired coordination
- impaired postural control.
- abnormal tone
- Abnormal gait.
- Abnormal involuntary movements such as tremor and chorea form and dystonic movements are less common.

2.Cognitive Impairments:

Cognition is the mental process of knowing and applying information

- Many cognitive functions are controlled in the frontal lobes. This makes people with TBI particularly susceptible to cognitive impairments.
- Cognition includes arousal, attention, concentration,memory, learning, and executive functions.
- Executive functions can be categorized as planning, cognitive flexibility, initiation and self generation,response inhibition, and serial ordering.

3.Altered Consciousness:

1.Coma:

- In a **coma** the arousal system is not functioning.
- The **patient's eyes are closed**,there are **no sleep/wake cycles**, and the patient is **ventilator dependent**.
- There is **no auditory or visual function** and **no cognitive** or **communicative function.**

2. **vegetative state**

- There is **disassociation** between wakefulness and awareness.
- The higher central nervous system (CNS) centres are not integrated with the brainstem.
- The **brainstem is able to manage basic cardiac, respiratory**, and other vegetative functions and the patient can be weaned off the ventilator.
- The **eyes may be open** though **awareness of surroundings is absent**, and **sleep/wake cycle is present**.
- Patients may **startle to visual or auditory stimuli** and **briefly orient to sound or visual stimuli.**
- Meaningful **cognitive and communication function is absent.**
- Reflexive **smiling/crying may be present.**
- A **withdraw response to noxious stimuli is present. movements are nonpurposeful and reflexive in response to external stim**

3.Minimally conscious state

- There is minimal evidence of self or environmental awareness.
- Similar to a vegetative **state, sleep/wake cycles are present.**
- Instead of withdrawing or posturing to noxious stimuli, patients in a minimally conscious state will **localize to noxious stimuli** and may **inconsistently reach for objects**.
- Patients may **localize to sound location** and **demonstrate sustained visual fixation.**

4.Obtunded:The patient in an obtunded state sleeps often and when aroused exhibits decreased alertness and interest in the environment and delayed reactions.

5. **Stupor** is an unresponsive state from which the patient can be aroused only briefly with vigorous, repeated sensory stimulation.

4.Neurobehavioral Impairments:

Common behavioral sequelae include **low frustration tolerance, agitation**, disinhibition, apathy, emotional lability, mental inflexibility, aggression, **impulsivity, and irritability**.

5.Communication Impairment:

- Patients may also **exhibit difficulties communicating in distracting environments**, reading social cues, and adjusting communication to meet the demands of the situation.

6. Dysautonomia:

Elevated sympathetic nervous system activity occurs as a normal response to trauma,usually overactive.

- Increased sympathetic activity results in **increased heart rate, respiratory rate**, and **blood pressure, diaphoresis** and **hyperthermia.**
- Other symptoms of dysautonomia include decerebrate and decorticate posturing, hypertonia, and teeth grinding. This is called as ***paroxysmal sympathetic hyperactivity .***

7.Post-traumatic Seizures:

Between 12% and 50% of people with severe TBI develop post-traumatic seizures.

Secondary Impairments:

- Deep vein thrombosis
- Heterotopic ossification
- Pressure ulcer
- Pneumonia
- Chronic pain
- Contractures
- Decreased endurance
- Muscle atrophy
- Fracture
- Peripheral nerve damage

Diagnosis and prognosis:

1.Glasgow coma scale:

- Traumatic brain injury is generally categorized as severe, moderate, or mild using the *Glasgow Coma Scale* (GCS).
- The GCS, developed by Teasdale and Jennett, is the most widely used clinical scale that measures level of consciousness and helps define and classify the severity of injury.
- The GCS is comprised of three response scores: motor response, verbal response,and eye opening.
- The scores from the separate responses are summed to provide a score between 3 and 15.

8 or less- severe

9 to 12- moderate

13 to 15- mild brain injury

GLASGOW COMA SCORE

Eye(s) Opening	
Spontaneous	4
To speech	3
To pain	2
No response	1
Verbal Response	
Oriented to time, place, person	5
Confused/disorientated	4
Inappropriate words	3
Incomprehensible sounds	2
No response	1
Best Motor Response	
Obeys commands	6
Moves to localised pain	5
Flexion withdraws from pain	4
Abnormal flexion	3
Abnormal extension	2
No response	1
Best response	15
Comatose patient	8 or less
Totally unresponsive	3

Glasgow outcome scale

GOS	GOSE	Interpretation
1 = Dead	1 = Dead	Dead
2 = Vegetative state	2 = Vegetative state	Absence of awareness of self and environment
3 = Severe disability	3 = Lower severe disability	Needs full assistance in ADL
	4 = Upper severe disability	Needs partial assistance in ADL
4 = Moderate disability	5 = Lower moderate disability	Independent, but cannot resume work/school or all previous social activities
	6 = Upper moderate disability	Some disability exists, but can partly resume work or previous activities
5 = Good recovery	7 = Lower good recovery	Minor physical or mental deficits that affects daily life
	8 = Upper good recovery	Full recovery or minor symptoms that do not affect daily life

2. Duration of **post-traumatic amnesia** (PTA), the length of time between the injury and the time at which the patient is able to consistently remember ongoing events, is also an important factor in predicting recovery,by the ***Galveston Orientation and Amnesia Test*** **(GOAT).**

- Patients with PTA less than 48.5 days are likely to have higher *Functional Independence Measure* (FIM) scores at discharge from inpatient rehabilitation;
- patients with PTA less than 27 days are likely to be employed
- patients with PTA less than 34 days are likely to have a good overall recovery
- PTA less than 53 days are likely to be living without assistance

TABLE 24-1 ■ SEVERITY OF TRAUMATIC BRAIN INJURY

MEASUREMENT	MILD	MODERATE	SEVERE
Glasgow Coma Scale	13-15	9-12	3-8
Loss of consciousness	<30 min	30 min-24 hr	>24 hr
Posttraumatic amnesia	0-1 day	>1 to ≤7 days	>7 days

3.Ranchos los amigos level of cognitive functions:

It is a scale used to examine cognitive and behavioural recovery in individuals with TBI.

It is the most important scale used for treatment plan.

I. ***No Response****:* Patient appears to be in a **deep sleep** and is **completely unresponsive** to any stimuli.

II**.** ***Generalized Response****:* Patient reacts **inconsistently** and **nonpurposefully** to stimuli in a **nonspecific manner**. **Responses are limited** and often the same regardless of stimulus presented. Responses may be physiological changes, **gross body movements, and/or vocalization**.

III. ***Localized Response****:* Patient **reacts specifically but inconsistently** to stimuli. Responses are directly related to the type of stimulus presented. May **follow simple commands** such as closing eyes or squeezing hand in an inconsistent, delayed manner.

IV. ***Confused-Agitated****:* Patient is in **a heightened state of activity**. Behavior is **bizarre** and **nonpurposeful relative to immediate environment**. Does not discriminate among persons or objects; is **unable to cooperate** directly with treatment efforts. Verbalizations frequently are incoherent and/or inappropriate to the environment; **confabulation** may be present**. Gross attention** to environment is very **brief**; **selective attention** is often **nonexistent**. Patient **lacks short- and long-term recall.**

V. ***Confused-Inappropriate:*** Patient is able to **respond to simple commands fairly consistently.** However, with **increased complexity of commands** or lack of any external structure, responses are **nonpurposeful, random**, or fragmented. **Demonstrates gross attention to the environment** but is highly distractible and **lacks ability to focus attention on a specific task**. Verbalization is often **inappropriate and confabulatory**. **Memory is severely impaired**; often shows inappropriate use of objects; may perform previously learned tasks with structure but is **unable to learn new information**.

VI. ***Confused-Appropriate:*** Patient shows **goal-directed behavior** but is dependent on external input or direction. Follows **simple directions consistently** and **shows carryover for relearned tasks such as self-care**. Responses may be incorrect due to memory problems, but they are **appropriate to the situation**. **Past memories** show more depth and **detail** than recent memory.

VII. ***Automatic-Appropriate:*** Patient appears **appropriate and oriented** within the hospital and home settings; goes through daily routine automatically, but frequently robot-like. Patient shows minimal to no confusion and has **shallow recall of activities**. **Shows carryover for new learning** but at a decreased rate. With structure is **able to initiate social or recreational activities**; **judgment remains impaired.**

VIII. ***Purposeful-Appropriate:*** Patient is **able to recall and integrate past and recent events and is aware of and responsive to environment**. **Shows carryover for new learning** and needs no supervision once activities are learned. May continue to show a **decreased ability of tolerance for stress, and judgment in emergencies or unusual circumstances.**

4.Glosgow coma outcome scale:It is used to assess outcome after TBI.

It consists of five categories:

1.Dead

2.Vegitative

3.Severely disabled

4.Moderately disabled

5.Good outcome

Physiotherapy management:

RLA stage 1,2,3 or acute stage management:

Examination:

- medical record.
- Arousal, attention, and cognition
- Integument integrity
- Sensory integrity
- Motor function
- Range of motion
- Reflex integrity
- Ventilation and respiration/gas exchange
- Abnormal posturing

Goals:

1.Physical function and level of alertness are increased.

2. The risk of secondary impairments is reduced.

3.Motor control is improved.

4.The effects of tone are managed.

5.Postural control is improved.

6.Tolerance of activities and positions is increased.

7. Joint integrity and mobility are improved or remain functional.

8. Family and caregivers are educated on patient’s diagnosis, physical therapy interventions, goals, and outcomes.

9.Care is coordinated among all team members.

1.Preventing Secondary Impairments:

- Because of the patient's inability to move at these levels, he or she is susceptible to indirect impairments such as contractures, decubiti, pneumonia, and DVT.
- **Proper positioning** both in bed and in a wheelchair is essential.
- **Appropriate positioning** will assist in preventing skin breakdown and contractures, improve pulmonary hygiene and circulation, and may modify muscle tone
- **Turning** will help prevent skin breakdown and pneumonia. Patients should be repositioned every 2 hours when in bed
- **Splints** may be used to assist in positioning.(c bar,web spacer,future dynamic splint)
- **Special boots** can be used to position the foot to prevent foot drop and skin breakdown on the heel

- **Specialized air mattresses** are another effective way to assist with the prevention of pressure sores.
- ***Serial casting*** may be used to maintain or improve ROM.

Serial casting is often used for plantar flexors or biceps contractures resulting from either increased tone or prolonged shortening of the muscle.

In approximately 2 to 5 days the cast is removed. The muscle is stretched again and another cast is applied.

Proper wheelchair positioning- is important. Because of reduced postural control at these levels, a reclining wheelchair or a tilt-in-space wheelchair is typically required. Proper pelvic positioning and head positioning are key elements in promoting good posture in a wheelchair.

2.Improving respiratory function- postural drainage, percussion, vibration, and positioning to prevent pulmonary complications and improve pulmonary function

3.Postioning and handling of the patients:

Area	**Positioning**	**Handling**
Head	1.Neutral position 2.Roll placed behind neck to support head and neck curvature 3.Roll parallel to the head to prevent lateral flexion and rotation.	1.Gentle ROM when ICP is stable 2.Hands at base of skull or on the sides of head.
Trunk	1.Rolls behind shoulders 2.Rolls behind hip if rotation is occurring 3.Normal alignment needs to be maintained.	Hands on scapula;rhythmical protraction-retraction,elevation-depression. Hands on pelvis:elevation depression When pt is stable-roll segmentally

Upper extremity	**1.Rolls behind shoulders** **2.Cone in hand if fingers in flexion** **3.Wedges between fingers if adducted** **3.When stable: turn onto side for weight bearing into arm**	**1.Relaxation of scapula** **2.Rom** **3.Compressions**
Lower extremity	Hips and knees supported in slightly flexed position. No pressure on ball of the foot medially. Roll between legs if strong adduction or internal rotation.	Hand on lateral side of the sole of foot – ROM foot,ankle,knee,Hip.

4.Early mobility:

- PROM exercises are given
- Mobilisation of scapula
- Joint compressions.
- Avoid forceful passive movements.

5.Early transition to sitting position:

- Upright sitting is extremely important because it addresses elements of treatment goals for the early levels of recovery.
- As soon as medically stable, the patient should be transferred to a sitting position and out of bed to the wheelchair.
- Head should be properly supported, because the patient is not likely to have adequate neck and head control to maintain an upright posture without support wheelchair. All precautions should be observed.

- Use of a tilt table is also advantageous because it allows early weight-bearing through the LEs.
- The upright position, both on a tilt table and in a wheelchair, may improve overall level of alertness.

6.To improve arousal and alertness:

Coma stimulation.

Coma stimulation

Rationale and Goals:

1.It affects the RAS and increases arousal and attention

2.It prevents environmental or sensory deprivation.

3.It heightens the patients responses to stimuli.

4.It provides opportunities for the patients to respond to the environment in an adaptive way.

Principles:

1.Do not harm

2.Check vitals signs(BP,HR,RR)

3.Aviod or minimize stimulation programme with comatose patients having ventriculostomy, increased ICP,CPP. Monitor CPP and ICP during and after the treatment.

4.Control the environment to eliminate distractions.To be simple and uncluttered,limited no of people around,TV off and door is closed during the treatment.

5.Organize the stimuli, involve only 1 or 2 modalities of senses at a time.

6.Explain to the patient before and while the stimuli are presented.

7.Keep sessions relatively brief-patients can usually tolerate up to 15-30 minutes.

8.Allow extra time for the patient to respond(because of slow information processing)

9.1 or 2 minutes between the administration of different stimuli.

10.Conduct sessions frequently, allowing patients to respond several times daily.

11.Select meaningful stimuli, such as voice of family and friends, favorite music etc.

12.Stimuli that have emotional significance to the patient are usually more likely to elicit responses.

13.Try stimulating all senses, and vary the stimuli in nature and intensity to maximize the possibility of increasing arousal.

14.Do an ongoing evaluation of stimuli to which the patient responds, as well as those to which the patient does not respond.

15.Increase the frequency and rate of responses, the period of time that patient can maintain alertness, the variety of responses and quality of attention to the environment.

16.Avoid over stimulation.

17.Include participation by family and others in their program.

Techniques of coma stimulation:

Approaching the patient:

- Introduce yourself
- Talk to the patient slowly, and in a normal tone of voice.
- Keep sentences short and give the patient extra time to think about what u have said.
- Orient patient to the date,time,place and reason for being in the hospital.

1.Visual stimulation:

- Provide visually stimulating environment at the bedside,such as colourful,familiar objects,family photographs(labelled).

- Provide normal **visual orientation**,by positioning patient upright in bed/wheelchair.
- **Eliminate distraction** to allow focus on visual stimuli.
- Attempt visual focusing first then tracking.
- Tracking usually begins in the centre or midline.

2.Auditory stimulation:

- Hospital staff should be encouraged to **talk to the patient**.
- **Information sheet** about the patients likes and dislikes to be available.
- Use **radio,tape.recordings of familiar voice** etc,for 10-15 mins at intervals throughout the day.
- Focusing and locating sound and look for patients response when you change the location of a sound

- For eg,call the patient’s name,clap your hands,ring bell,whistle etc for 5-10 se at a time.
- Avoid stimulation that evokes stratified responses.

3.Touch or tactile stimulation:

- Tactile input can be facilitatory or inhibitory.
- Pressure to the oral area, and slow stroking of the spine tend to produce a facilitatory responses.The face and especially the lips and mouth are the most sensitive areas.
- Use of variety of textures such as personal **clothing,blanket,stuffed animals,lotions** can be used.
- Use of **variety of tempertures**,such as warm and cold clothes or metal spoons dipped for 30 secs in hot and cold water.

- Avoid use of unpleasant stimuli such as pinprick,ice to face or body it may trigger SNS response,i.e increased BP,HR and salivation and decrease GI activity.

4.Movement and position stimulation:

- Changes in body position such as **roll, tilt table** to bring the patient to a more upright position,and movement activities like **ROM exercises**.
- Slow movements tend to be inhibitory,while fast movements pattern are facilitatory(arousal)

- Monitor patients ICP and vitals
- Avoid spinning movements.

5.Smell stimulation(olfactory):

- Use of perfume,flavoured extracts,coffee grinds,shampoo and favorite food. Also garlic and mustard as a noxious stimuli.
- Duration:less than 10 secs
- Avoid touching the skin with scent.
- No response to smell is seen in case of first cranial nerve injury, tracheostomy, nasogastric tubes.

6.Taste and oral stimulation:

- Provide taste stimulation,unless patient is not prone to aspiration by using a cotton swab dipped in a sweet,salty or sour solutions.

- Provide oral stimulation during routine mouth care,by using a flavoured cleasing agent,such as mint or lemon,provided patient do not have bite reflex.

- Use of sponge-tipped or a soft brush to diminish hypersensitivity and abnormal oral/facial reflexes.

- Provide stimulation to lips and area around the mouth,If patient demonstrated defensiveness to touch such as pursing of lips,closing the mouth or pulling away from stimulus, gently continue with stimulation to decrease defensive reactions and increase level of awareness.

- Do not attempt feeding to comatose patients.

Program:

- Stimulate All senses
- 3 times in a day
- 6 days in a week
- Each sense stimulation lasting for 15 -20 mins
- 2 -3 hours gap between each session.

Advantages:

1. May give family hope and decrease the family's feelings of loss, anger and denial.
2. Allows family to take active role in the treatment process.
3. May decrease distress of the family.
4. May shorten duration of coma.

Disadvantage:

1.May raise false hopes

2.May create additional emotional/financial stress to the family.

3.Lack of specific procedure to follow coma stimulation treatment process.

4.There is no standard criteria for frequency,intensity,durationa nd type of stimulus given.

5.Overstimulation may prolong vegetative state.

RLA 4,5,6

Examination:

1.Aerobic capacity/endurance

2.Arousal, attention, and cognition

Coma Recovery Scale–Revised, Disorders of Consciousness Scale, Rancho Los Amigos Levels of Cognitive Functioning, Moss Attention Rating Scale, Test of Everyday Attention,Trail Making Test Part B, Galveston Orientation and Amnesia Test, Orientation Log Behavioral status *Supervision Rating Scale, Neurobehavioral Rating Scale–Revised, Agitated Behaviour Scal*

3. Cranial nerve integrity

4. Gait, locomotion, and balance

Berg Balance Scale, Community Balance and Mobility Scale,High-Level Mobility Assessment Tool, 10-Meter Walk Test, 6-Minute Walk Test,Modified Walking and Remembering Test

Goals:

Special consideration for confused agitated patients(RLA-4):

1. **Consistency:**
2. **Expect no carryover**
3. **Model Calm behaviour**
4. **Expect egocentricity**
5. **Flexibility options**
6. **Safety**

Treatment Goals:

1.To normalize the muscle tone

2.To improve motor control:

A. To improve joint integrity and flexibility

B. To improve strength

3.To improve postural control and functional mobility(pre locomotor training)

4.Ti improve locomotion

5.To improve transfers

RLA 6 7:

1.To maintain the effects of tone

2.To improve balance

3.To improve aerobic function

4.To improve functional training

5.To maintain mobility.

Restorative Versus Compensatory-Based Interventions

- The compensatory approach seeks to improve functional skills by compensating for the lost ability

- restorative rehabilitative experience that allows the patient to practice using the affected arm for everyday tasks will result in greater functional independence and affected UE use

Task-Oriented Approach

- task-oriented approach for improving mobility skills such as walking, Stair climbing and running

Constraint-Induced therapy

- involves promoting the use of the more affected UE for up to 90% of waking hours and reducing the use of the least affected UE.

Aerobic and Endurance Conditioning

- walking, jogging, treadmill, elliptical machines, and ergometers, circuit training.
- Intensity should be at 60% to 90% of age predicted maximal heart rate, for 20 to 40 minutes per session, three to four times a week.

Electrical Stimulation

- can be an effective addition to early, task-oriented training sessions.

Case study

- A 29 year old in ICU with head injury because of road traffic accident. Patient is unconscious and on artificial respiration. He has history of DVT. Write the short term & long term goals for the patient.

References

- Darcy Umphred Neurological Rehabilitation 5th Edition
- O’Sullivan Physical Rehabilitation 6th edition