

Lecture: (3)

THE APPROACH TO COMA AND ALTERED CONSCIOUSNESS

عمل: عبدالكريم راشد، عبد الرحمن الحربي ، شادي أبو طاعه، جهاد حمدان،
طارق السوداني، جود عبدالغني، حنين الملاح، نور الجبور

DEFINITION

Coma is defined as a **state of unarousable unresponsiveness**. Typically, the patient lies with eyes closed and does not open them even to vigorous stimulation, such as sternal rub, nasal tickle, or nailbed pressure.

Alterations in consciousness short of coma are often described using terms such as **drowsiness, lethargy, obtundation**, and stupor, but these terms tend to be used imprecisely and it is generally best to describe simply how the patient responded to various degrees of stimulation.

The neurologic evaluation and management of a patient with coma or altered consciousness can be intimidating for the student, because such patients are usually critically ill and may require prompt intervention.

- The **Glasgow Coma Scale** assigns a **numerical score to a patient's level of responsiveness** and is commonly used by neurosurgeons in cases of head trauma.
- Its utility lies in **its ease of use** by nurses and paramedics, its inter-rater reproducibility, and its prognostic value following head injury.
- Although the GCS **describes a level of responsiveness**, it does not assist in determining the cause of coma.

TABLE 38-2**Glasgow Coma Scale**

BEHAVIOR	RESPONSE	SCORE
Eye opening response	Spontaneously	4
	To speech	3
	To pain	2
	No response	1
Best verbal response	Oriented to time, place, and person	5
	Confused	4
	Inappropriate words	3
	Incomprehensible sounds	2
	No response	1
Best motor response	Obeys commands	6
	Moves to localized pain	5
	Flexion withdrawal from pain	4
	Abnormal flexion (decorticate)	3
	Abnormal extension (decerebrate)	2
	No response	1
Total score:	<i>Best response</i>	15
	<i>Comatose client</i>	8 or less
	<i>Totally unresponsive</i>	3

CLINICAL APPROACH

An algorithm for approaching patients with coma or altered consciousness is presented in Figure 3-1. The initial steps of stabilization and evaluation culminate in **the neurologic exam**, which is performed with **two goals** in mind: **to assess brainstem function** and **to look for focal signs**. The differential diagnosis and further investigations stem from this clinical assessment.

1- Remember the ABCs. In any patient with altered consciousness, the airway, breathing, and circulation (ABC) should be checked and maintained.

2- Look for obvious clues to etiology. A brief history and general exam should be performed to search for obvious clues.

CONT...

3- Try reversing common reversible etiologies. Most emergency departments make it standard practice to administer naloxone, thiamine, and dextrose to any patient with depressed consciousness and no obvious etiology (coma cocktail: Dextrose, oxygen, naloxone, and thiamine)

Dextrose

used: To treat **Hypoglycemia**

Mechanism: is a simple sugar that provide immediate **glucose** which is crucial for brain function

Thiamine

to prevent or treat **wernicke's encephalopathy**

is a **vitamin (B1)** that is essential for **glucose metabolism** in brain

Naloxone

to **reverse opioid overdose**

is an **opioid antagonist**, reversing the effect of opioid drugs (morphine, heroin)

**** rationale for decline in use:**

1-Advanced diagnostics: the availability of bedside tests like point-of-care glucose testing allows for more targeted therapy.

2-risks: some components of coma cocktail, like **naloxone**, can cause **withdrawal symptoms** in opioid-dependent individuals. similarly, **dextrose** can be **harmful in patient is not hypoglycemic** , particularly in stroke patient.

CONT...

4- check brainstem reflexes and look for focal signs.

5- Assess for all medication exposure. All comatose patients should have a toxicology screen for substances of abuse and other drugs.

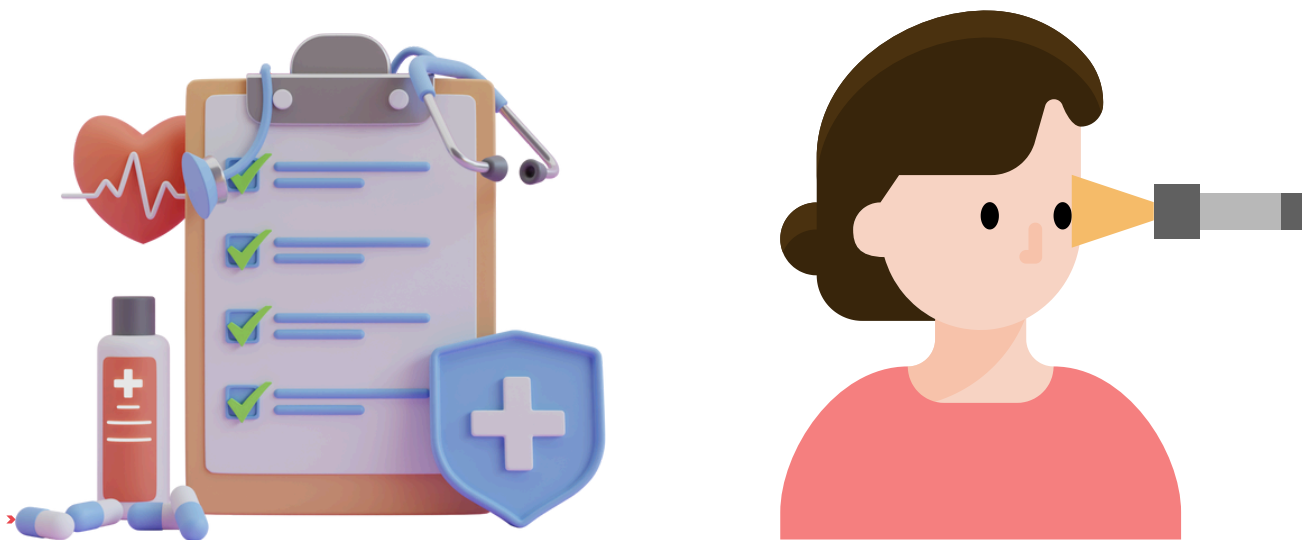
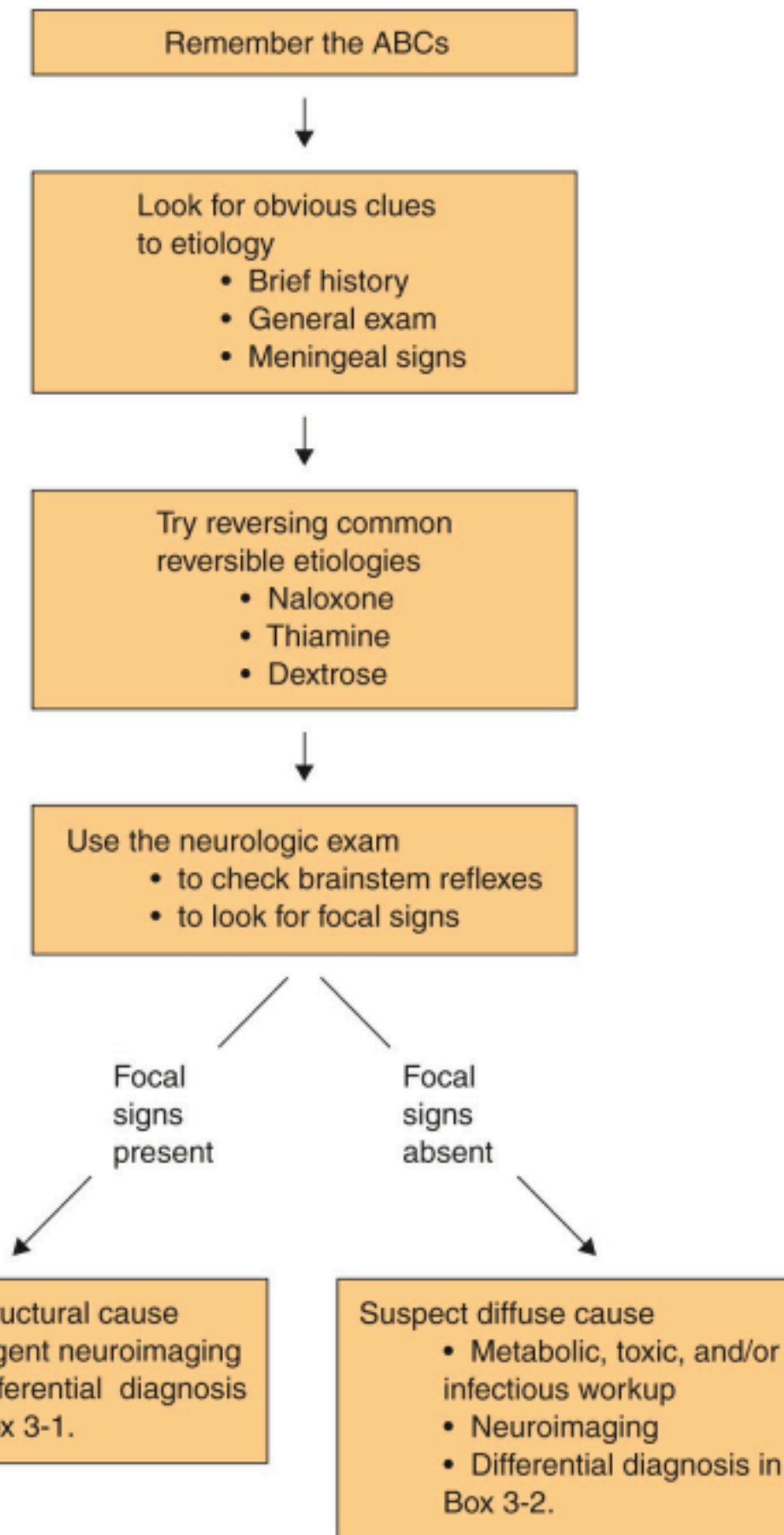


FIGURE 3-1. The approach to coma and altered consciousness. [ABC: airway, breathing, and circulation.]

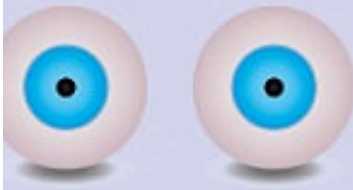
Neurologic Examination of the Comatose Patient

- The neurologic exam of a comatose patient should be systematic and structured.

1. Mental Status Examination

Assessing Level of Consciousness

- Apply an increasing gradient of stimulation:
 - Loud verbal stimuli → Does the patient open their eyes?
 - Noxious stimuli (sternal rub) → Any movement or vocalization?
- If arousable, assess briefly for:
 - Attention
 - Language function (e.g., aphasia)
 - Visuospatial function & neglect

Behaviour	Response
 Eye Opening Response	4. Spontaneously 3. To speech 2. To pain 1. No response
 Verbal Response	5. Oriented to time, person and place 4. Confused 3. Inappropriate words 2. Incomprehensible sounds 1. No response
 Motor Response	6. Obeys command 5. Moves to localised pain 4. Flex to withdraw from pain 3. Abnormal flexion 2. Abnormal extension 1. No response

CONT...

2. Cranial Nerve (CN) Examination

- Most important for assessing brainstem function.
- If patient is arousable, test CNs as in a routine exam.
- If patient is not arousable, test key brainstem reflexes:
 - Pupillary reflex (CN II, III)
 - Corneal reflex (CN V, VII)
 - Oculocephalic reflex (CN III, IV, VI, VIII)
 - Gag reflex (CN IX, X)

3. Fundoscopic & Visual Field Examination

- Funduscopy exam should always be performed.
- In unresponsive patients, assess for blink to visual threat.
- Visual field deficits may suggest focal brain pathology.

Cranial nerve overview

Use this table to aid cranial nerve assessment.

Number	Assessment mnemonic	Cranial nerve	Function
Location: Above the brainstem			
I	1 nose	Olfactory	Sensory
II	2 eyes	Optic	Sensory
Location: Midbrain			
III	3, 4, and 6 make the eyes do tricks	Oculomotor	Motor
IV	3, 4, and 6 make the eyes do tricks	Trochlear	Motor
Location: Pons			
V	5 rhymes with tri	Trigeminal	Motor and sensory
VI	3, 4, and 6 make the eyes do tricks	Abducens	Motor
VII	7 on your face	Facial	Motor and sensory
VIII	8 in your ear	Acoustic	Sensory
Location: Medulla oblongata			
IX	9 and 10 under the chin	Glossopharyngeal	Motor and sensory
X	9 and 10 under the chin	Vagus	Motor and sensory
XI	11 (one) on each shoulder	Spinal accessory	Motor
XII	12 stick out the tongue	Hypoglossal	Motor

CONT...

TABLE 3-1. Brainstem Reflexes

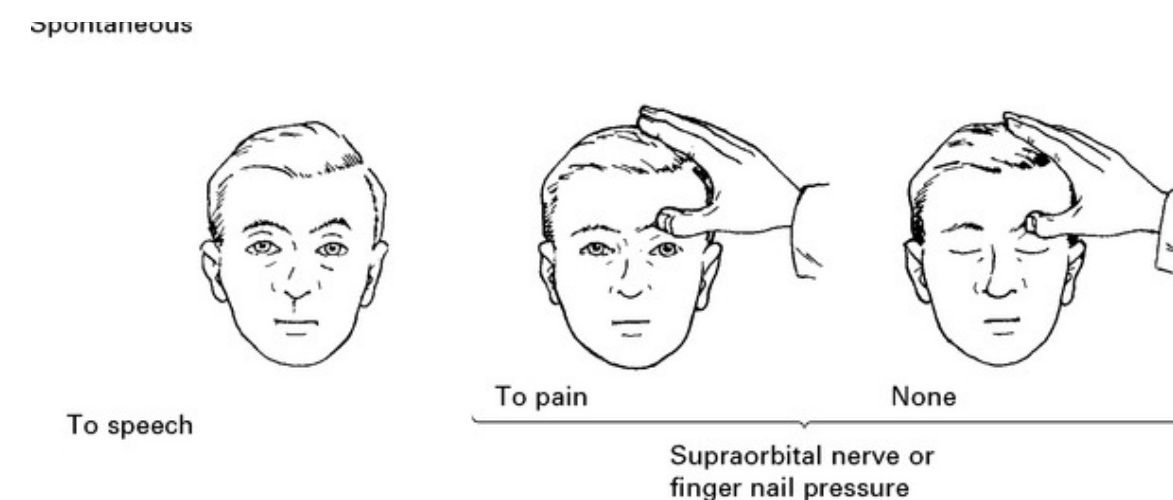
Reflex	Cranial Nerves Involved	How to Test
Pupillary	II (afferent); III (efferent)	Shine light in each pupil and observe for direct (same side) and consensual (contralateral) constriction
Oculocephalic (doll's eyes)	VIII (afferent); III, IV, VI (efferent)	Forcibly turn head horizontally and vertically and observe for conjugate eye movement in opposite direction (contraindicated if cervical spine injury has not been ruled out)
Caloric testing (if necessary) ^a	Same	Inject 50 mL ice water into each ear and observe for conjugate eye deviation toward the ear injected
Corneal	V ₁ (afferent); VII (efferent)	Touch lateral cornea with cotton tip and observe for direct and consensual blink
Gag	IX (afferent); X/XI (efferent)	Stimulate posterior pharynx with cotton tip and observe for gag

^aCaloric testing should be performed if turning the head is contraindicated or does not result in eye movement. The external auditory canal should be examined first with an otoscope to exclude tympanic perforation or obstruction by wax. Never assume the eyes are immobile unless caloric testing has been done.

CONT...

4. Facial Motor & Sensory Testing

- If patient cannot follow commands, look for:
 - Facial asymmetry at rest (flattened nasolabial fold).
 - Response to noxious stimuli (supraorbital pressure).
- Bilateral nasal tickle tests CN V (sensation) and CN VII (motor response).
- which is Less painful than supraorbital pressure but still effective.



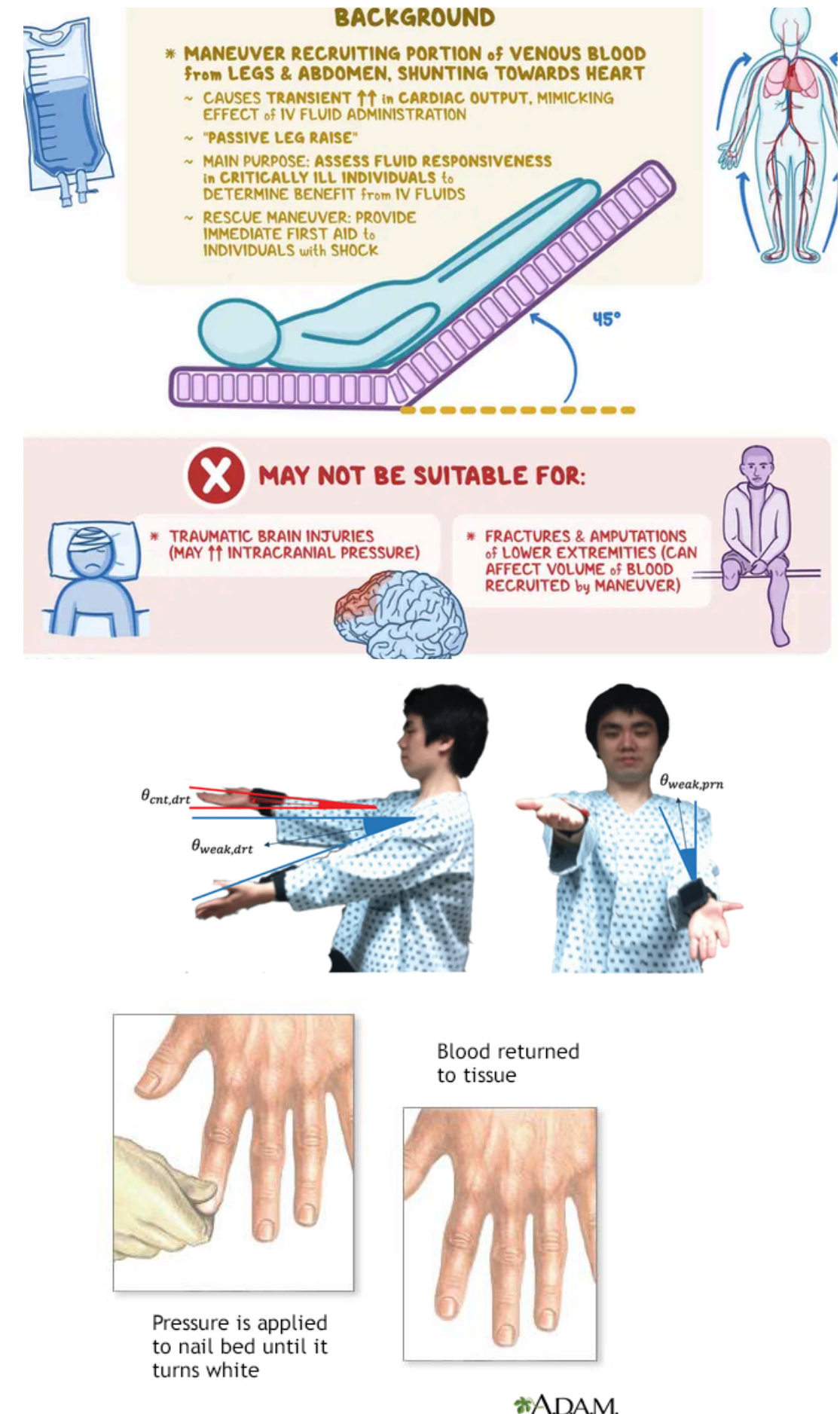
CONT...

5. Motor Examination Overview

- Assess motor tone in all extremities.
- If patient can cooperate:
 - Arm drift test: Ask patient to hold arms extended.
 - Leg elevation test: Observe for downward drift.
- If unable to cooperate:
 - Observe for asymmetry in spontaneous movements.
 - Ask caregivers if all extremities have moved symmetrically.

6. Response to Noxious Stimuli

- Apply nailbed pressure or pinch on a flexor surface.
- Observe speed and strength of withdrawal.
- Consider that withdrawal abnormalities may be due to:
 - Motor dysfunction
 - Sensory loss



CONT...

7. Posturing as a Neurologic Sign

- Decorticate posturing → Damage above the brainstem.
- Decerebrate posturing → Brainstem dysfunction.
- Can occur spontaneously or in response to noxious stimuli.

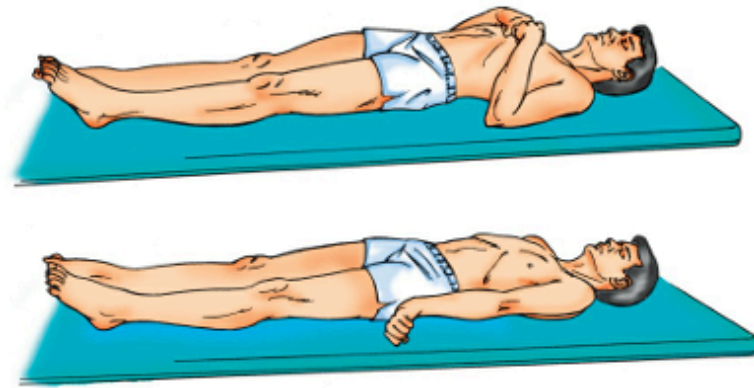
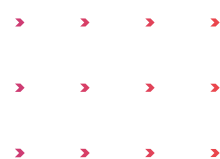


FIGURE 3-2. Decorticate (above) and decerebrate (below) posturing. Both indicate brainstem dysfunction, although decorticate posturing suggests dysfunction slightly more superior than decerebrate posturing. (LifeART image Copyright © 2012 Lippincott Williams & Wilkins.)

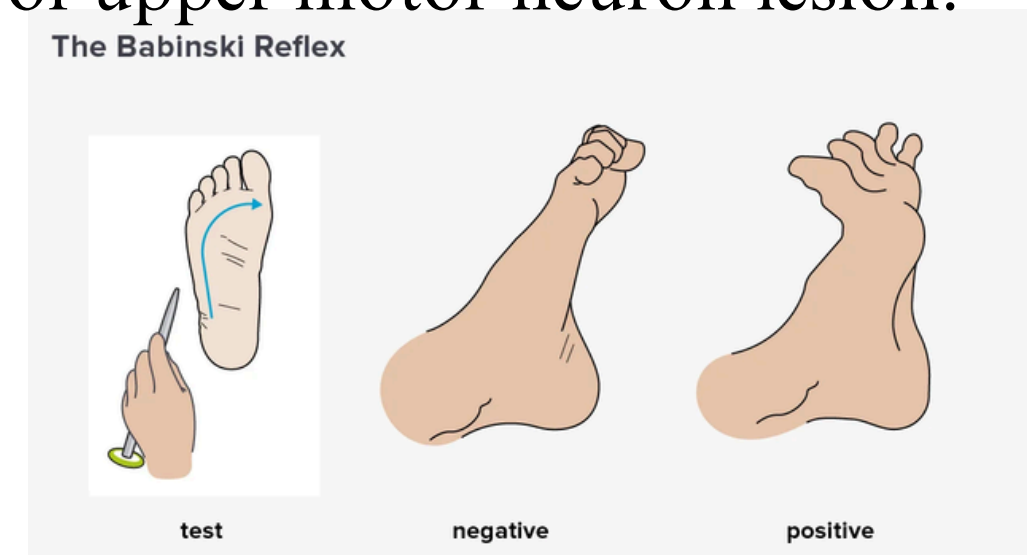
9. Sensory Testing

- Limited in altered consciousness patients.
- Test for light touch and pain sensation using noxious stimulation.
- Gross sensory abnormalities may be detected using the limb withdrawal test.



8. Reflex Testing

- Muscle stretch reflexes can be tested as in a routine exam.
- Look for the Babinski sign as an indicator of upper motor neuron lesion.



10. Coordination Testing

- Can be tested only if the patient is arousable.
- Includes finger-to-nose and heel-to-shin tests if possible.



DIFFERENTIAL DIAGNOSIS

In theory, there are two main ways in which consciousness can be depressed: the brainstem can be dysfunctional or both cerebral hemispheres can be dysfunctional simultaneously.

For examples , acute disease in the brainstem (e.g. pontine hemorrhage) can lead to coma, as can processes affecting both cerebral hemispheres at once (e.g.,hypoglycemia)

Unilateral cerebral hemispheric lesions, however, can also lead to coma if they are large or severe enough to cause swelling and compression of the opposite hemisphere or downward pressure on the brainstem.

CONT...

Interpretation of information obtained from the physical exam of a comatose patient usually follows two main principles :

1- BRAINSTEM REFLEXES (CORNEAL , PUPILLARY AND GAG REFLEXES) :

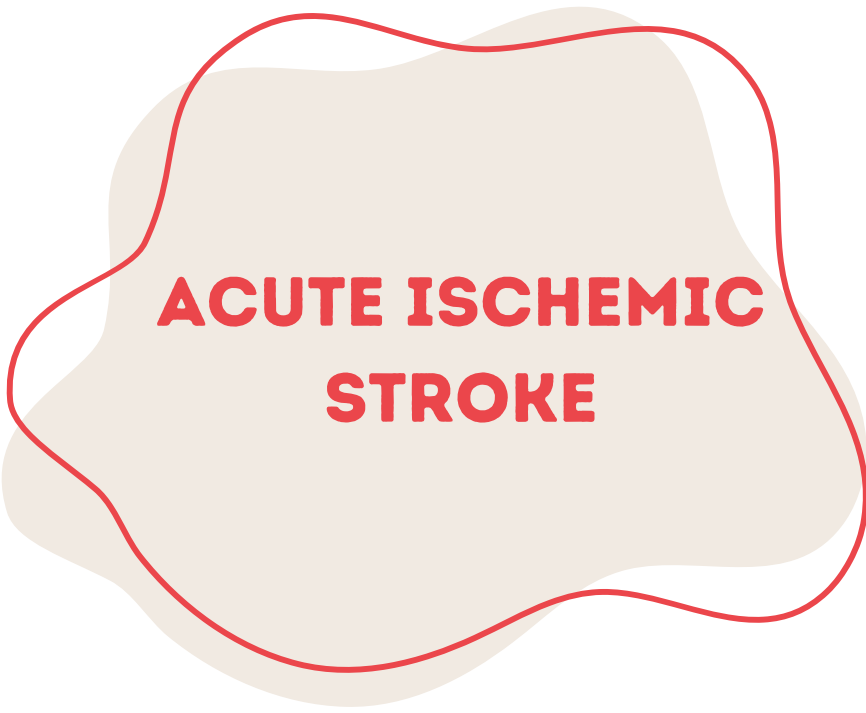
Mild cases of depressed consciousness usually presents with preserved brainstem reflexes . While in severe cases , reflexes are absent regardless of the etiology .

2- FOCAL NEUROLOGICAL SIGNS

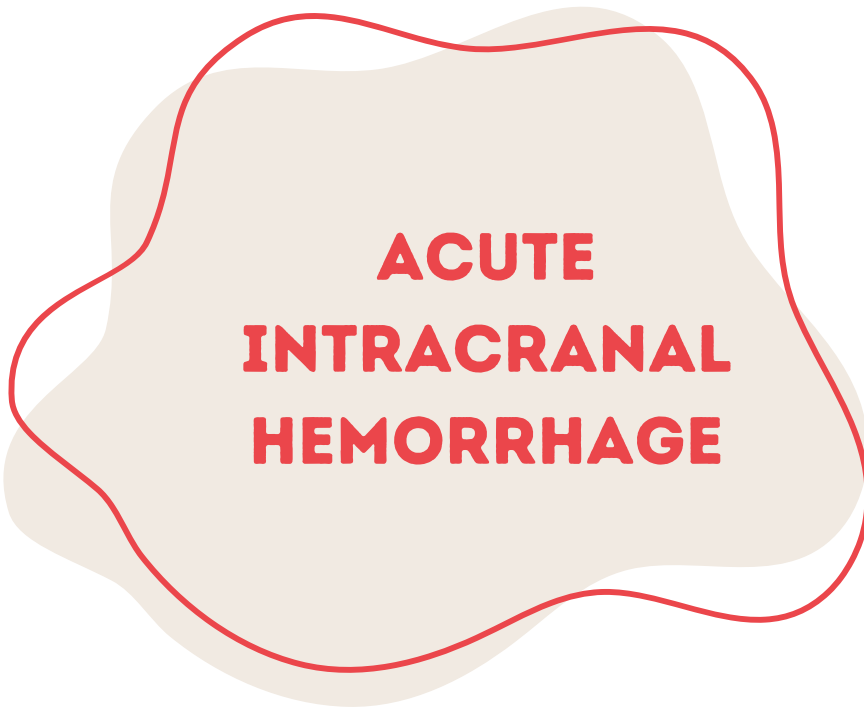
If a brainstem reflex is abnormal in an asymmetric fashion, such as a unilateral unreactive pupil, this would be interpreted as a focal sign and suggests compression of, or primary disease in, the brainstem

CONT...

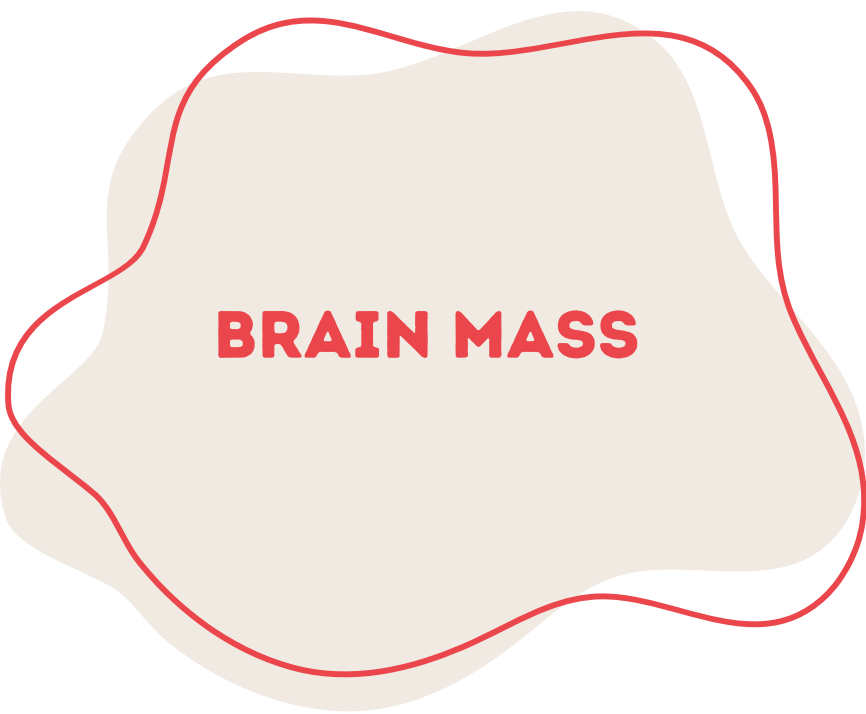
The presence of focal signs either on cranial nerve examination or in the remainder of the examination including such findings as hemiparesis, aphasia, reflex asymmetry, facial droop, or a unilateral Babinski sign suggests a structural cause of depressed consciousness



**ACUTE ISCHEMIC
STROKE**



**ACUTE
INTRACRANIAL
HEMORRHAGE**



BRAIN MASS

DIFFUSE CAUSES OF DEPRESSED CONSCIOUSNESS

The absence of focal signs suggests a diffuse cause of depressed consciousness, including metabolic, toxic, or hypoxic-ischemic etiologies .

Examples include coma from fulminant hepatic failure, barbiturate overdose, or anoxia following cardiac arrest.

Remember to review medications that were administered to the patient prior to the exam when interpreting these findings because sedatives and paralytics can influence the clinical findings and may mask brainstem function transiently

BOX 3-2. Diffuse Causes of Depressed Consciousness

Metabolic
Electrolyte abnormality
Hyponatremia, hypernatremia, hypocalcemia, hypercalcemia, hypomagnesemia, hypermagnesemia, hypophosphatemia
Glucose abnormality
Hypoglycemia, nonketotic hyperosmolar coma, diabetic ketoacidosis
Hepatic failure
Uremia
Thyroid dysfunction
Myxedema coma, thyrotoxicosis
Adrenal insufficiency
Toxic
Alcohol
Sedatives
Narcotics
Psychotropic drugs
Other exogenous toxins (carbon monoxide, heavy metals)
Infectious
Meningitis (bacterial, viral, fungal)
Diffuse encephalitis
Hypoxic-ischemic
Respiratory failure
Cardiac arrest
Other
Subarachnoid hemorrhage
Carcinomatous meningitis
Seizures or postictal state

KEY POINTS

In theory, consciousness can be depressed either by **dysfunction of the brainstem** or **dysfunction of both** cerebral hemispheres simultaneously; in reality, large unilateral hemispheric lesions (with pressure on the other side) qualify as well.

The presence or absence of brainstem reflexes **suggests how deep the coma is.**

The presence of focal signs suggests a **structural cause of coma.**

The absence of focal signs suggests a **diffuse cause of coma**, such as metabolic, toxic, infectious, or hypoxicischemic etiologies.

LABORATORY AND RADIOLOGICAL STUDIES

- **Structural causes OR Diffuse causes ??**
- **Presence of Focal Findings = Structural cause = urgent head imaging (non-contrast CT)**
- **Absent Focal Findings = Diffuse cause = extensive workup**

Structural Causes Investigations

If a structural cause is suspected one should look for signs of a large acute stroke, intracranial hemorrhage, or mass lesion using non-contrast CT.



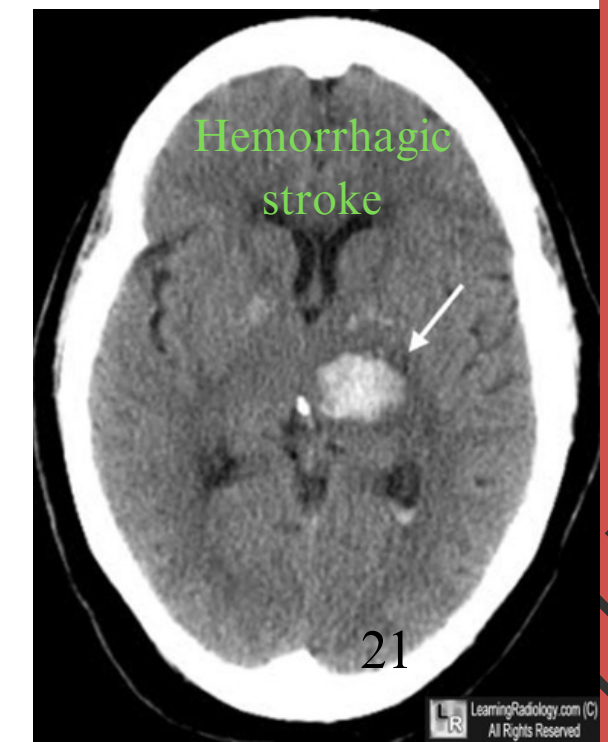
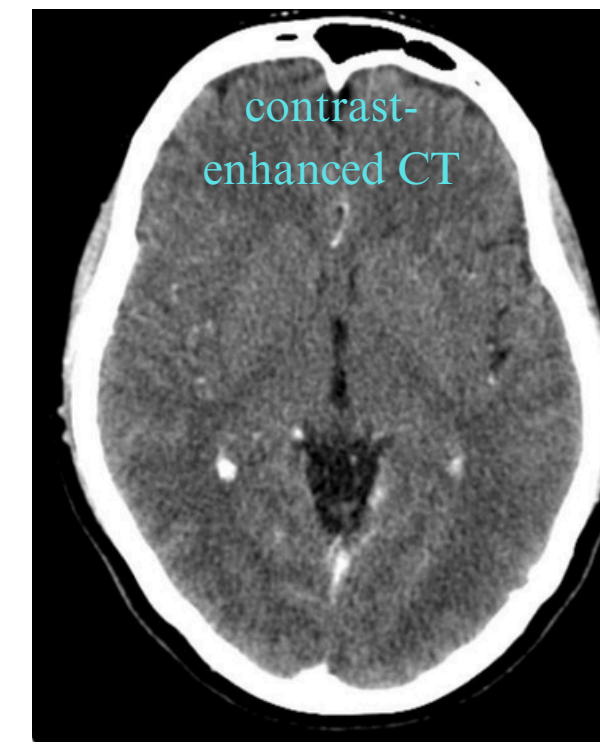
- **Why CT not MRI ??**

While MRI is excellent for detailed imaging, **CT is often the first choice for initial imaging.**

1. CT scans are more available.
2. Quicker to perform even when brainstem problems are suspected.

- **Why Non-contrast CT?**

1. It clearly shows hemorrhages.
2. contrast can mimic the appearance of a hemorrhage



Diffuse Causes Investigations

- Extensive Workup must cover **metabolic, toxic, or infectious causes.**

Basic Workup:

1. **Blood tests:** CBC, Electrolytes, Glucose, and LFT.
2. **Toxicology screen** (to check for drugs or poisons)
3. **Head imaging;** Global hypoxic-ischemic injury, diffuse cerebral edema, bilateral lesions that mimic diffuse issues.
4. **Lumbar Puncture (after excluding ↑ ICP, to prevent brain herniation)**
5. **EEG.**

□ EEG is often done for coma patients. It can help:

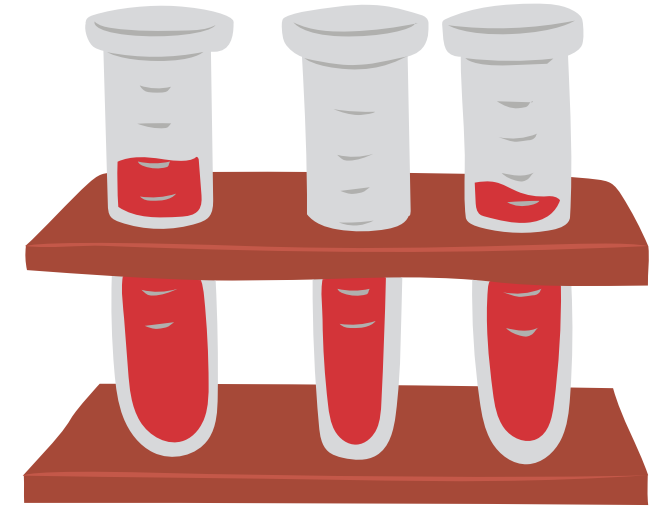
- Assess the depth of a coma.
- Identify specific patterns that may indicate particular conditions (like hepatic encephalopathy or anoxic brain injury)
- Diagnose non-convulsive status epilepticus as a cause of coma.



Almost without exception, a head CT should be done before LP



Special Cases



- ❑ If an **infection is suspected**:
a **chest X-ray**, **urinalysis**, and **blood or urine cultures** might be needed.
- ❑ In **women of reproductive age**, it is also necessary to obtain a **pregnancy test**,
as this impacts medication management.
- ❑ If a **basic workup is unrevealing**, one should search for more unusual causes
(such as myxedema coma, by checking TFT)
- ❑ If **bacterial meningitis is suspected**, **empiric antibiotics** should be given quickly,
even before the CT scan is performed.

TREATMENT AND PROGNOSIS

Treatment varies based on diagnosis.

Types of causes:

Metabolic

Infectious

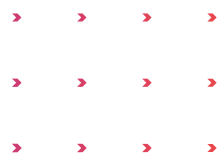
Toxic

Structural

MANAGEMENT

Metabolic, infectious, and toxic causes require: >> Primarily medical management.

Structural causes may need >> Neurosurgical intervention.



MANAGING INCREASED ICP

When **ICP** is suspected:

1-Raise head of bed.

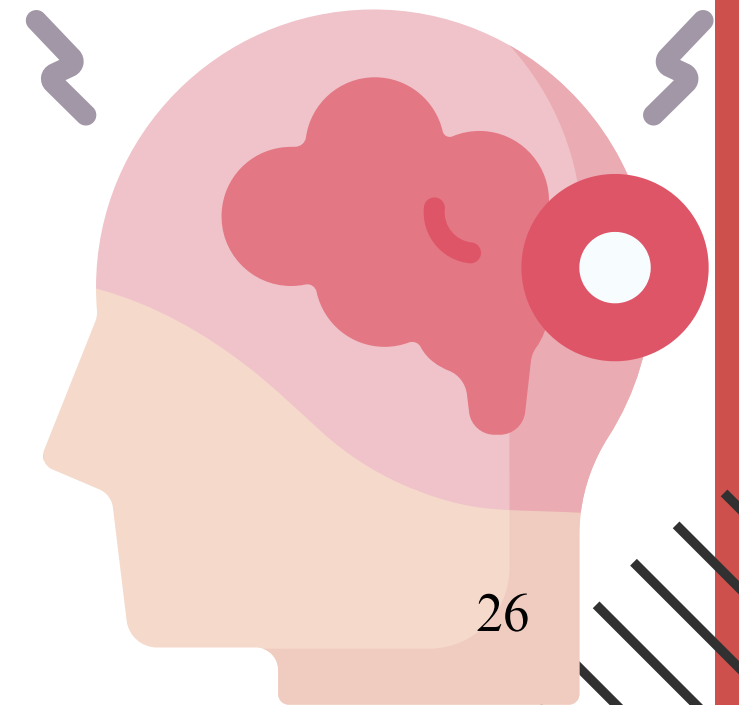
2-Hyperventilation.

3-Osmotic diuretics (e.g., mannitol)

Use **corticosteroids** for **edema in brain tumors**.

The lowering of ICP may be a **neurologic or neurosurgical emergency** if the patient **shows signs of brain herniation**.

In Cases of Brain Herniation Immediate treatment may be necessary.



Prognosis

The prognosis of depressed consciousness is mostly dependent on **etiology**.

The patient with a **barbiturate** overdose may recover **completely**, whereas one with a severe anoxic injury often does not.

Age is an important prognostic factor as well.

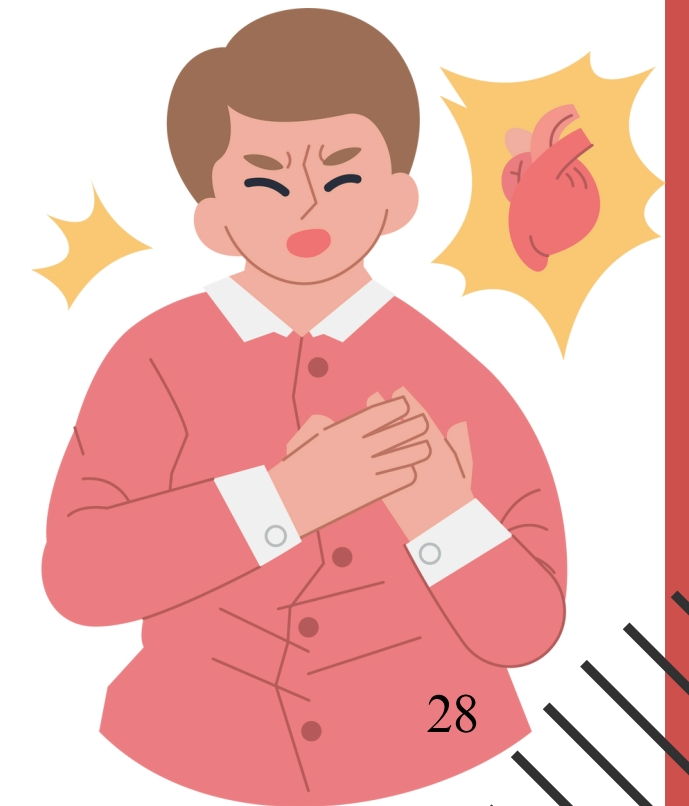
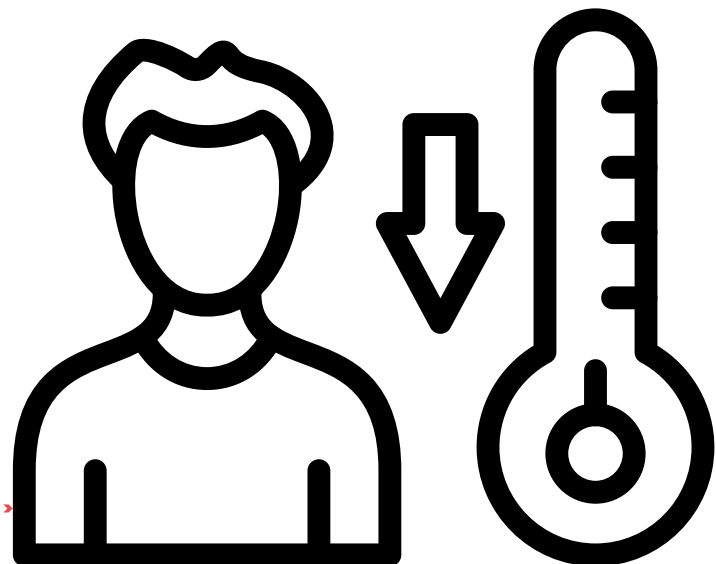


CARDIAC ARREST CARE

Standard care: **Therapeutic hypothermia (32°C to 34°C)**

The standard of care for patients with cardiac arrest is usually to undergo therapeutic hypothermia (aiming for a core body temperature between 32°C and 34°C) in the acute phase, which has been demonstrated to **lead to better neurologic outcomes** compared with normothermia or hyperthermia.

Prognosis affected by: **Circumstances** and **duration** of cardiac arrest.



THANK YOU

