

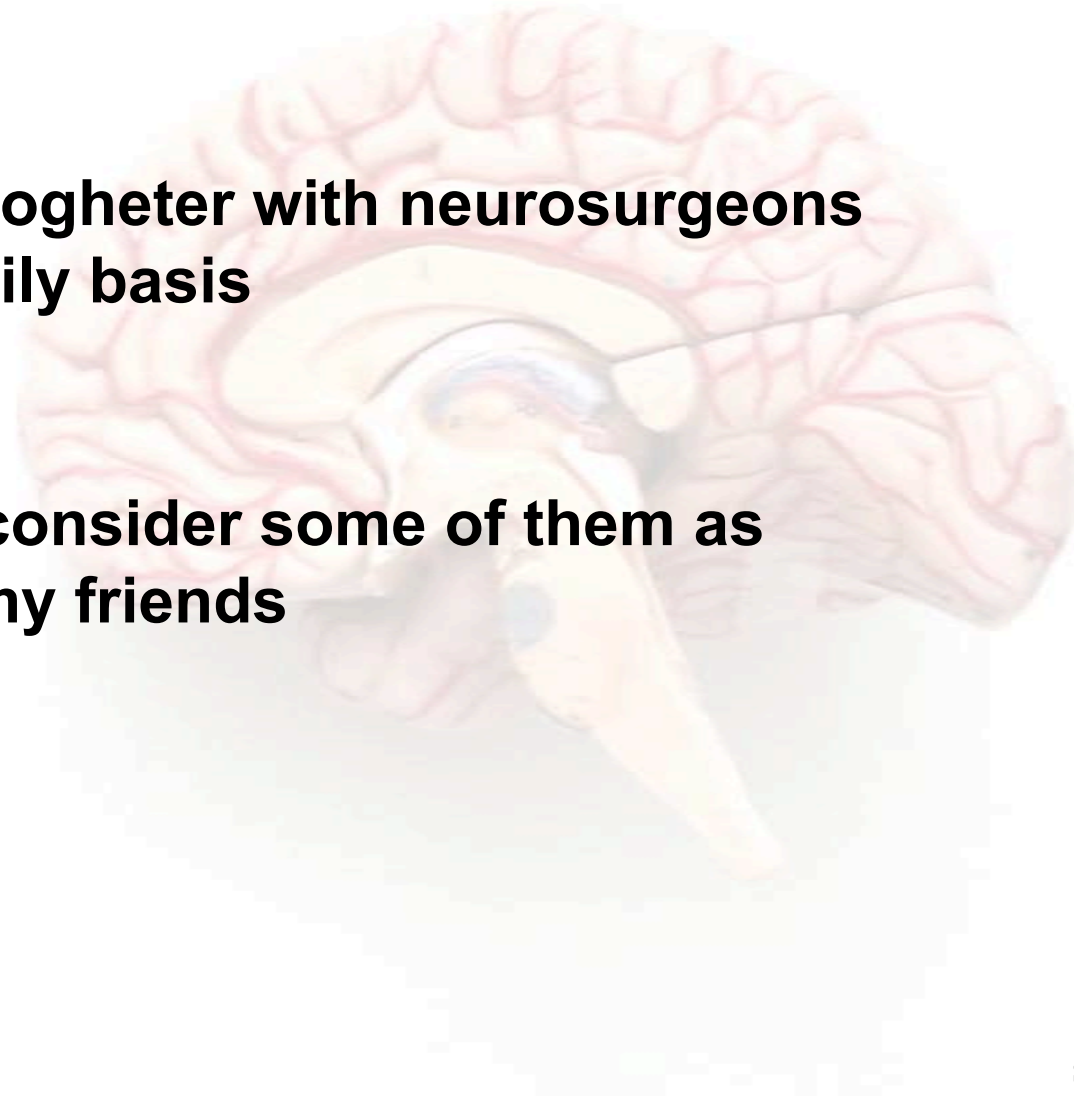
**The Neurotrauma Chain of Survival –
What the neurosurgeon needs to know
and what the prehospital care provider should do!**

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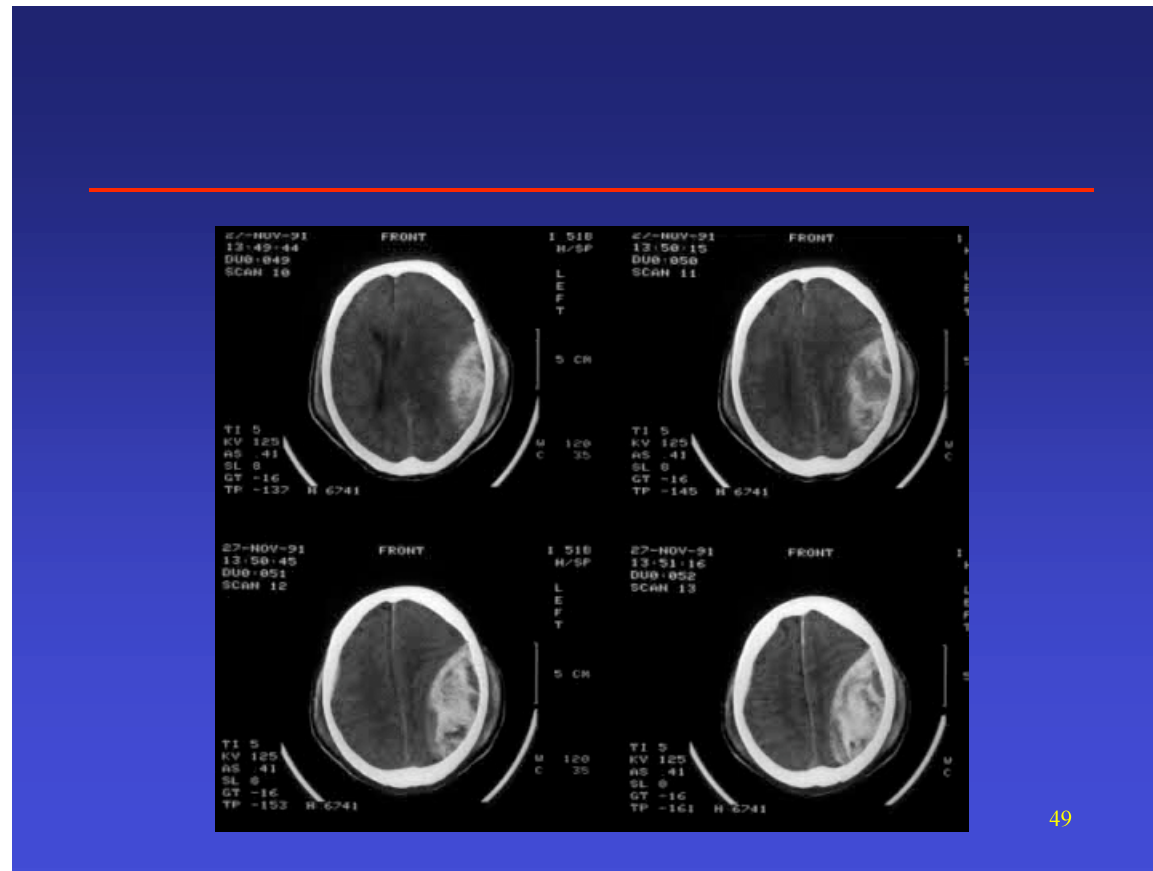
Conflict of interest!

**I work together with neurosurgeons
on a daily basis**

**I even consider some of them as
being my friends**



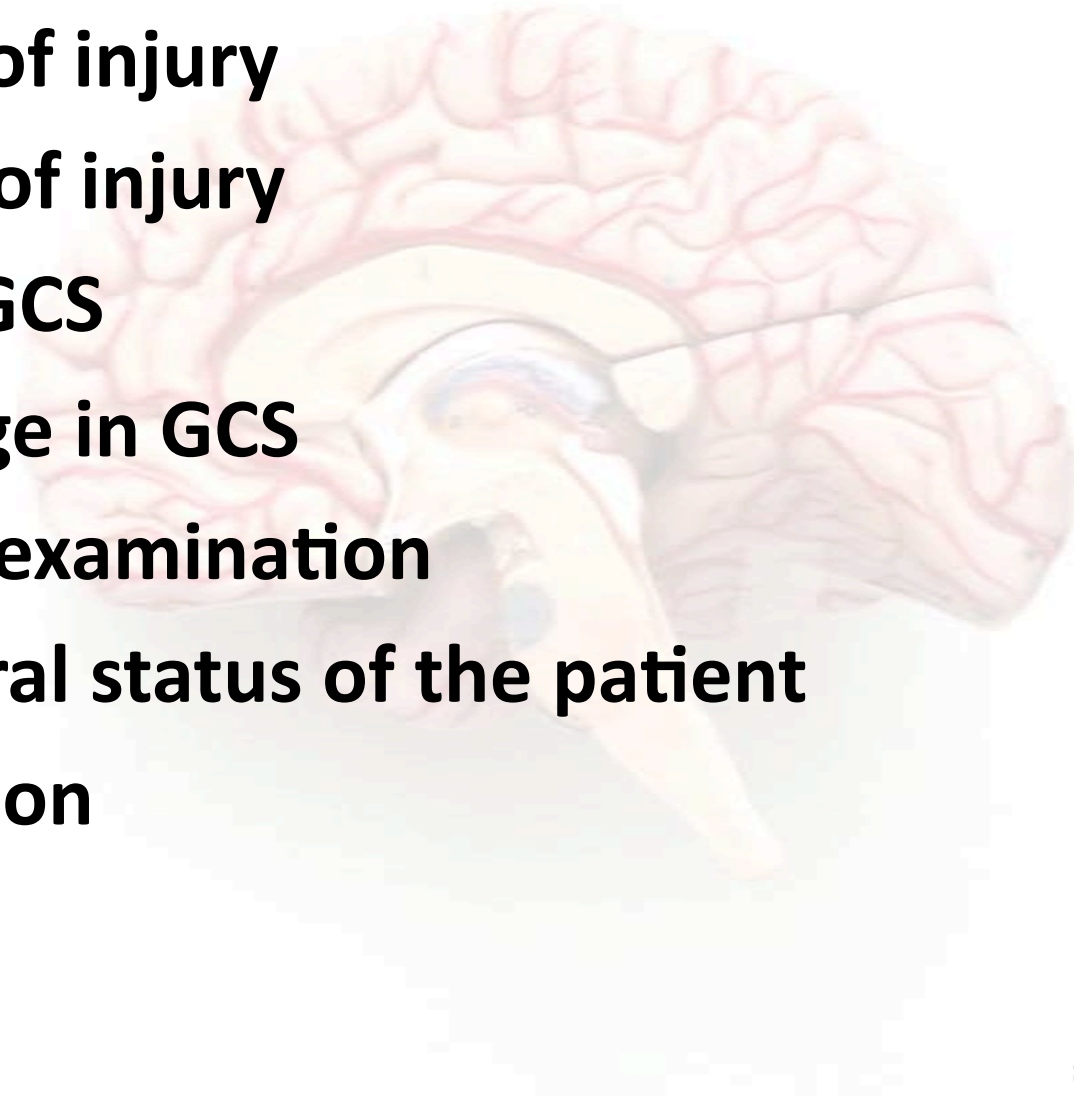
This is what the neurosurgeon wants to know



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What can we tell the neurosurgeon?

- **Type of injury**
- **Time of injury**
- **First GCS**
- **Change in GCS**
- **Pupil examination**
- **General status of the patient**
- **Location**



Type of injury

Road traffic accidents

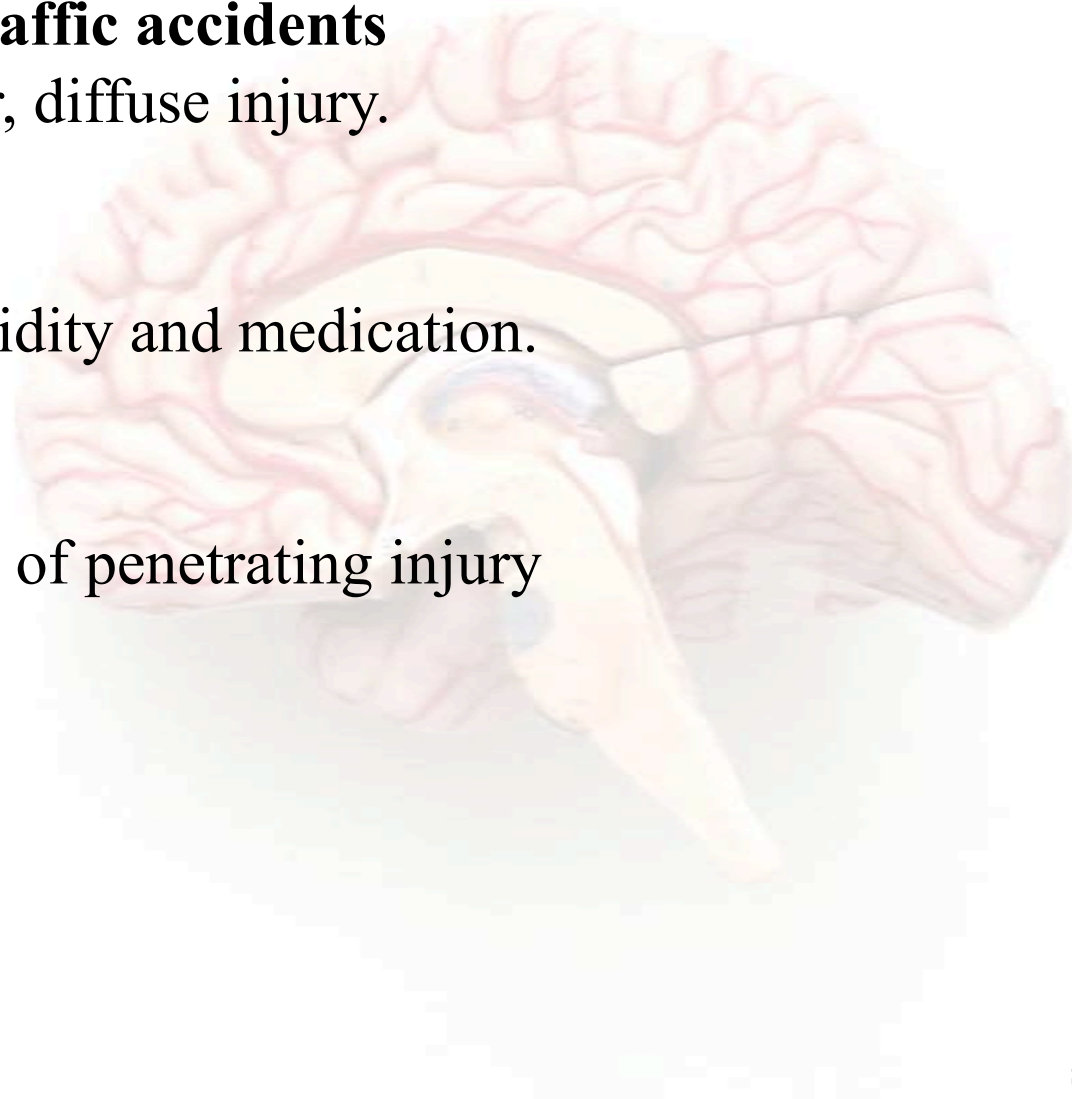
Younger, diffuse injury.

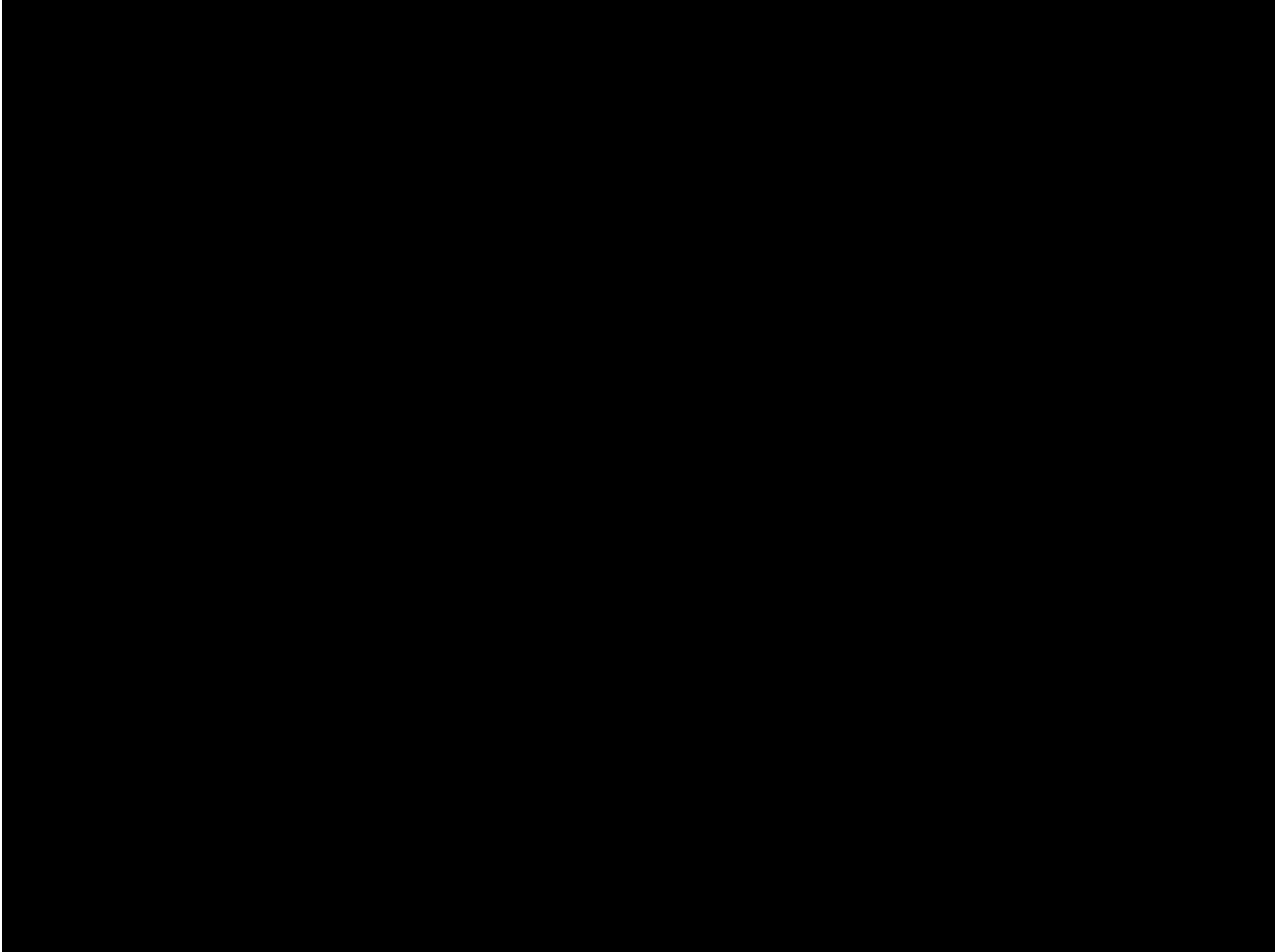
Falls

Comorbidity and medication.

Assault

Increase of penetrating injury







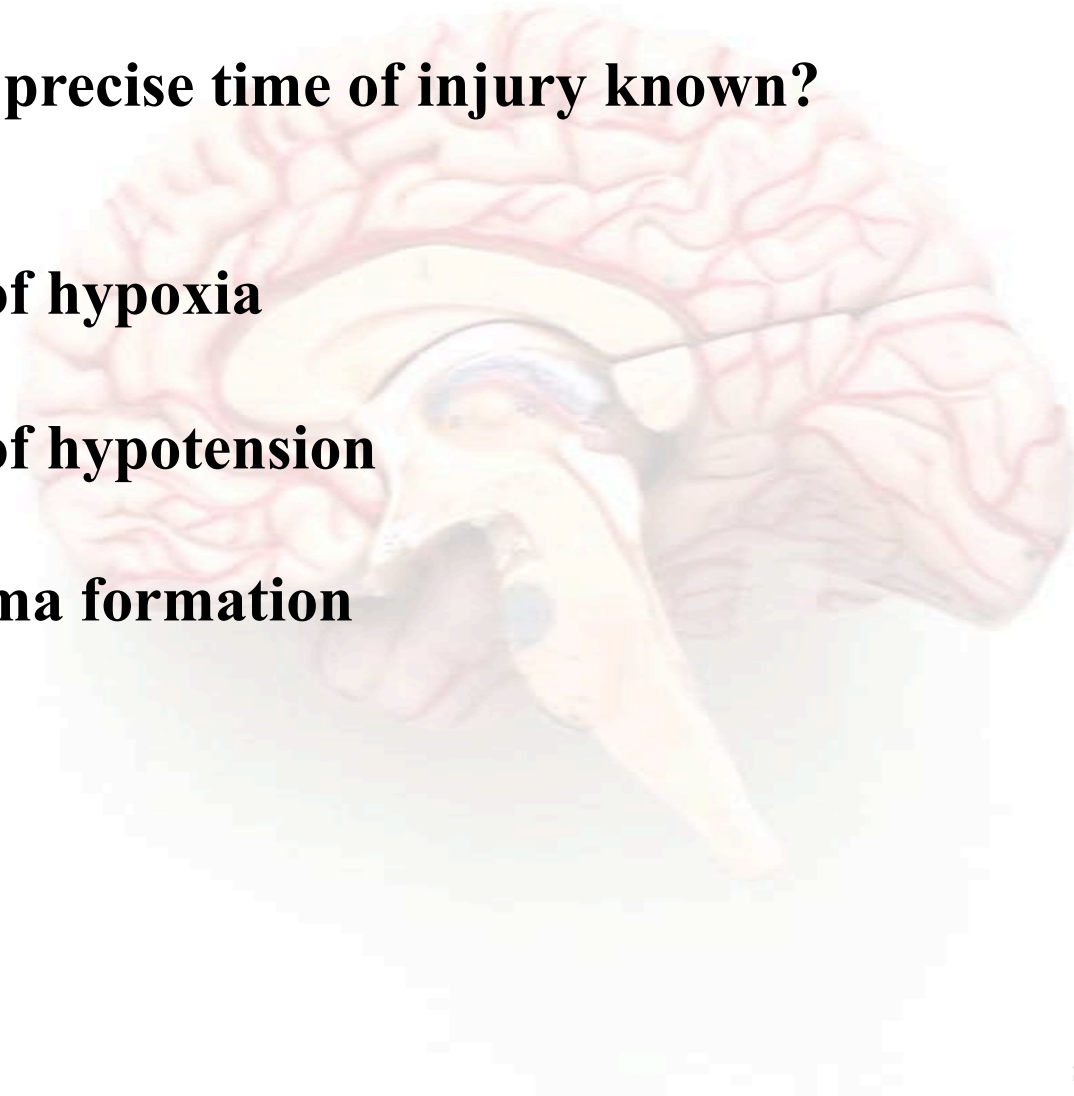
Time of injury

Is the precise time of injury known?

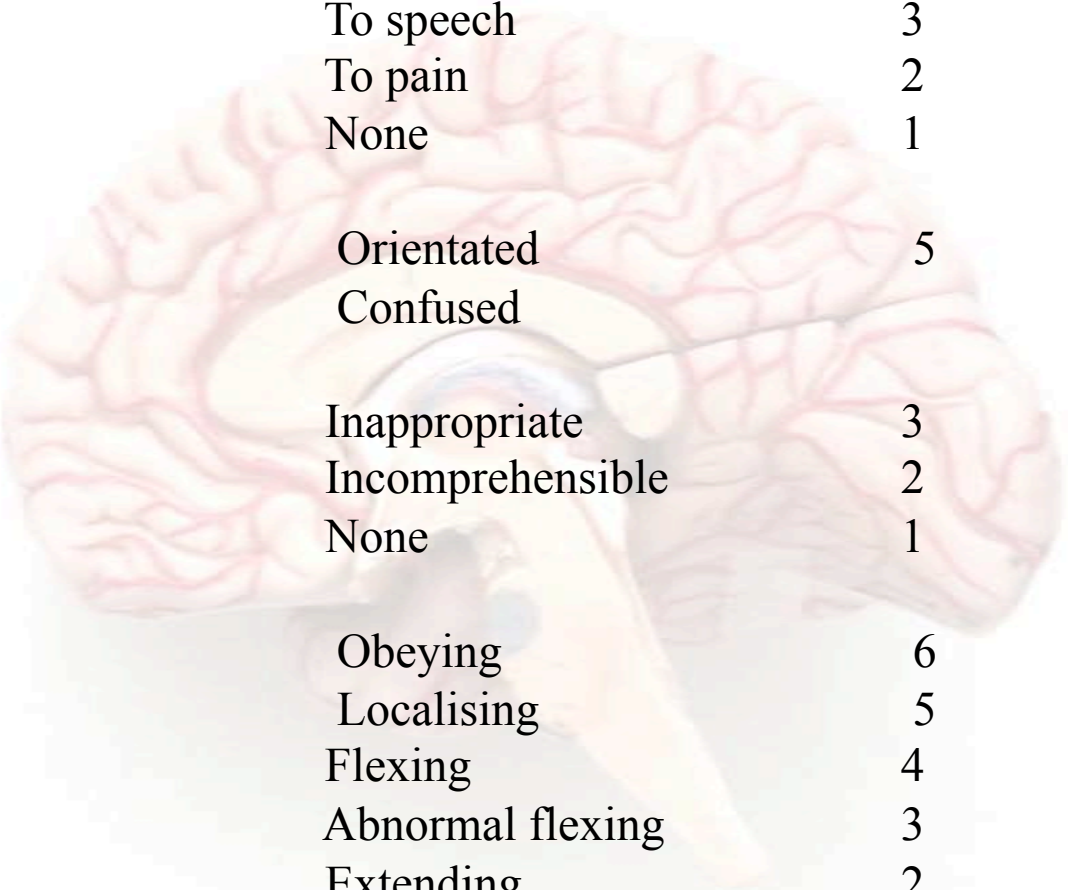
Risk of hypoxia

Risk of hypotension

Oedema formation



Glasgow Coma Score



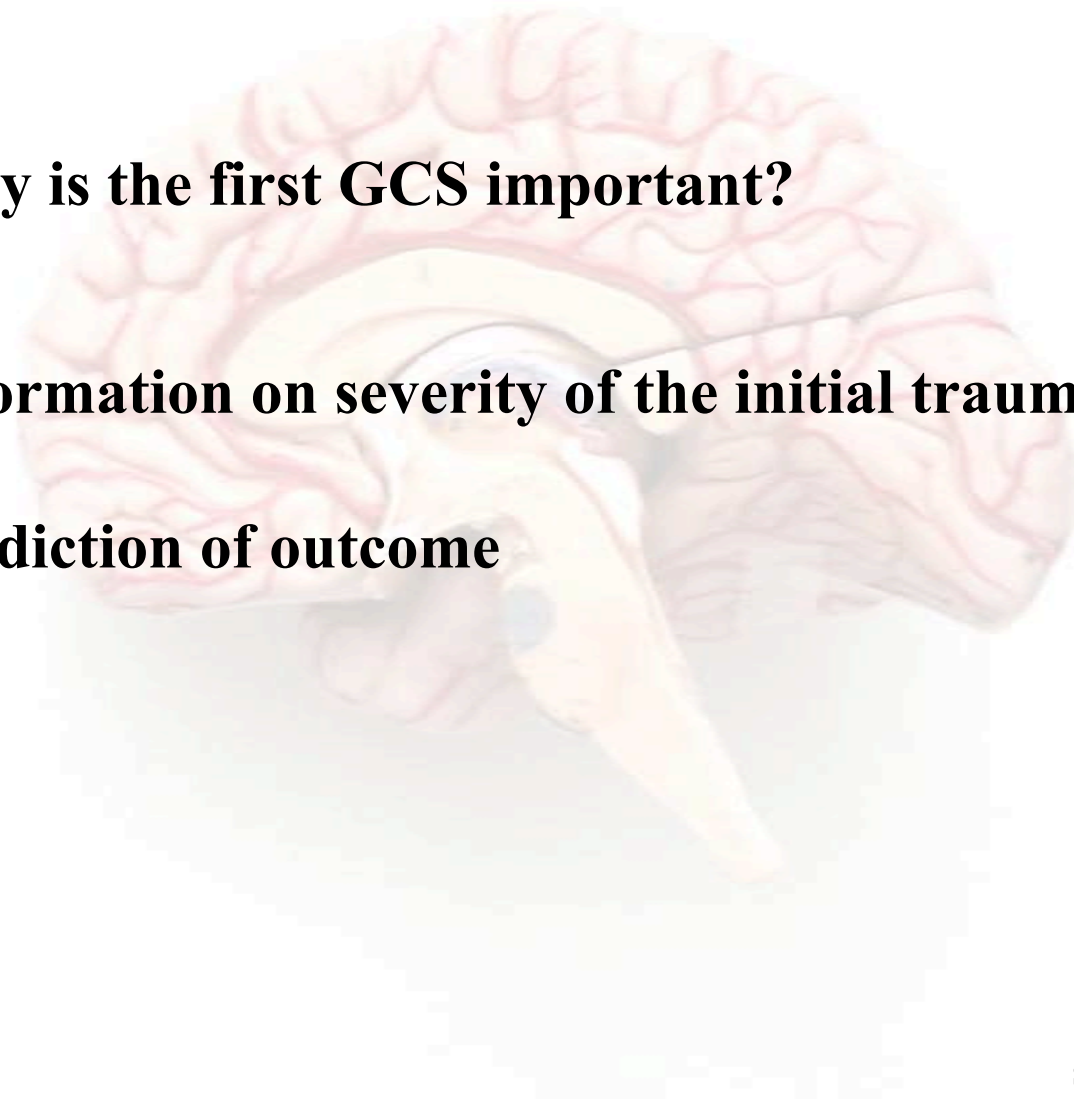
Eye opening	Spontaneous	4
	To speech	3
	To pain	2
	None	1
Best verbal response	Orientated	5
	Confused	4
	Inappropriate	3
	Incomprehensible	2
	None	1
Best motor response	Obeying	6
	Localising	5
	Flexing	4
	Abnormal flexing	3
	Extending	2
	None	1

First GCS

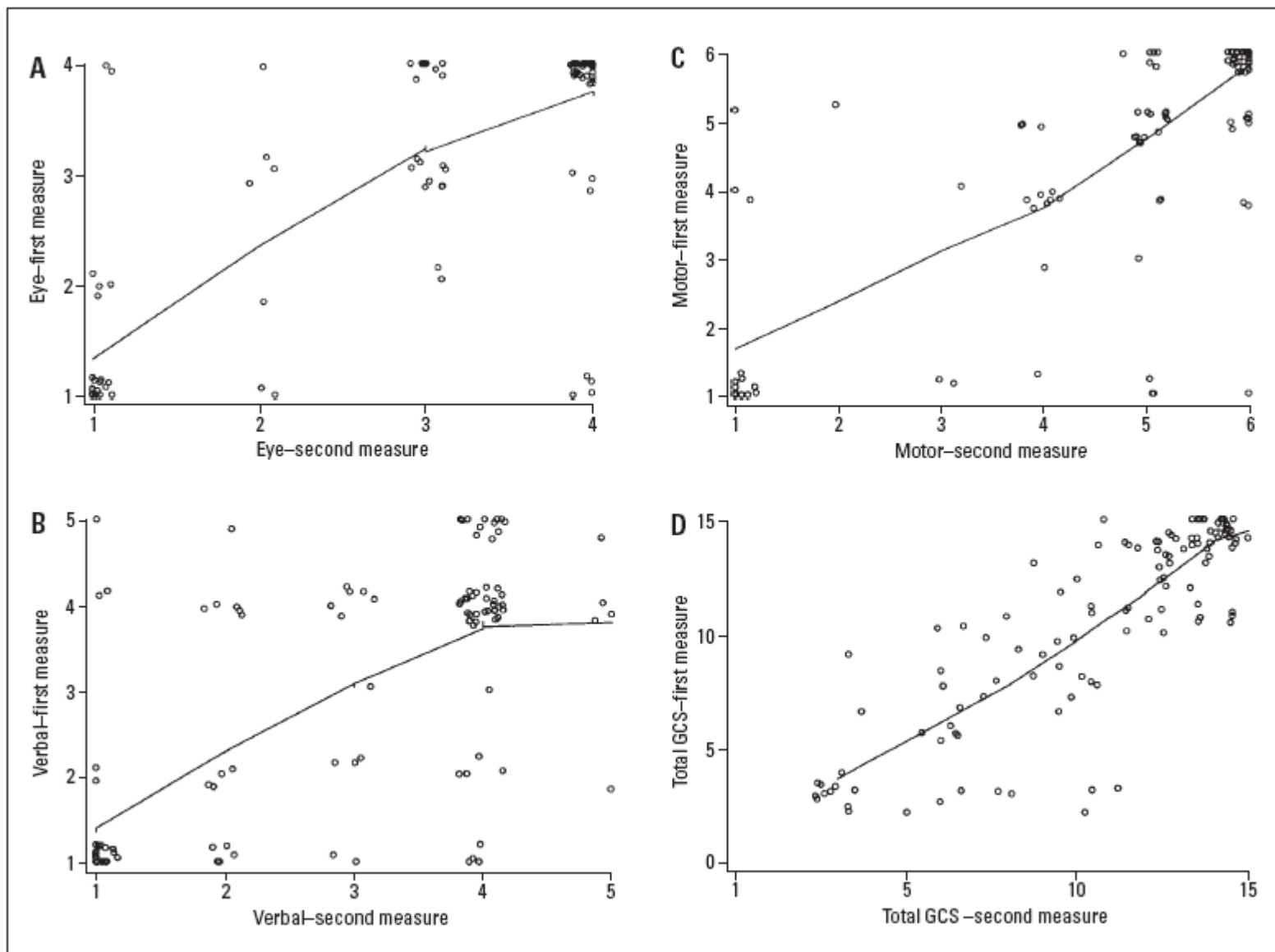
Why is the first GCS important?

Information on severity of the initial trauma

Prediction of outcome



Validity of GCS scoring



Change in GCS

3669 emergency medical system records linked to trauma registry

Table 2 Prehospital GCS Injury Severity Groups, Percent Agreement in Corresponding ED GCS Severity Group

Emergency Department GCS Severity Group	Prehospital GCS Severity Group		
	Mild (GCS Score 13–15; n = 2,618)	Moderate (GCS Score 9–12; n = 257)	Severe (GCS Score 3–8; n=177)
Mild	<u>97.9 (2,564)</u>	83.7 (215)	26.5 (47)
Moderate	0.9 (24)	<u>9.3 (24)</u>	10.2 (18)
Severe	1.2 (30)	7.0 (18)	<u>63.3 (112)</u>

Weighted κ = 0.53 (95% confidence interval 0.48–0.58)

Change in GCS

Decrease in GCS of 2 points after primary resuscitation increases mortality from 10% to 57%

Decrease in GCS of 2 points after primary resuscitation decreases the probability of good outcome from 68% to 20%

Pupil examination

Evidence of orbital trauma should be noted

Pupils should be measured after the patient has been resuscitated and stabilized

Note left and right pupillary finding.

Asymmetry is defined as > 1 mm difference in diameter

A fixed pupil is defined as < 1 mm response to bright light

General status of the patient

Extracranial injuries;

Spine

Chest

Abdomen

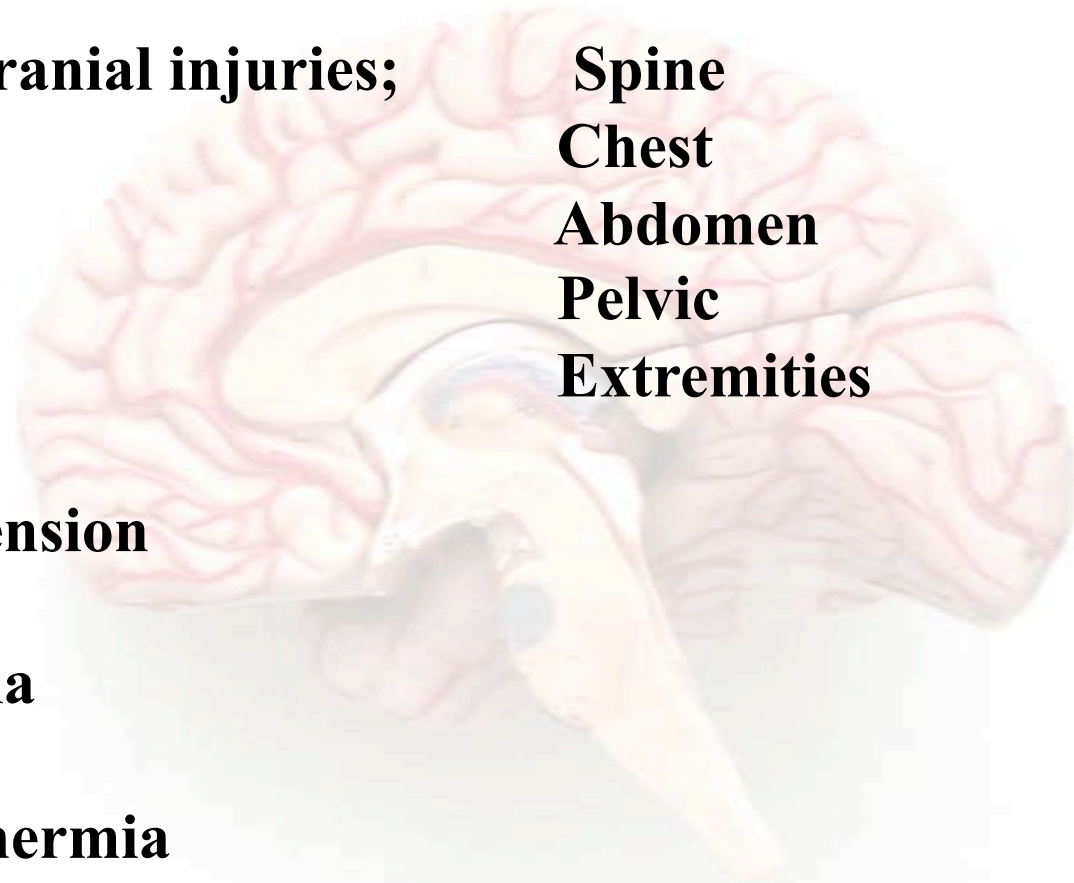
Pelvic

Extremities

Hypotension

Hypoxia

Hypothermia



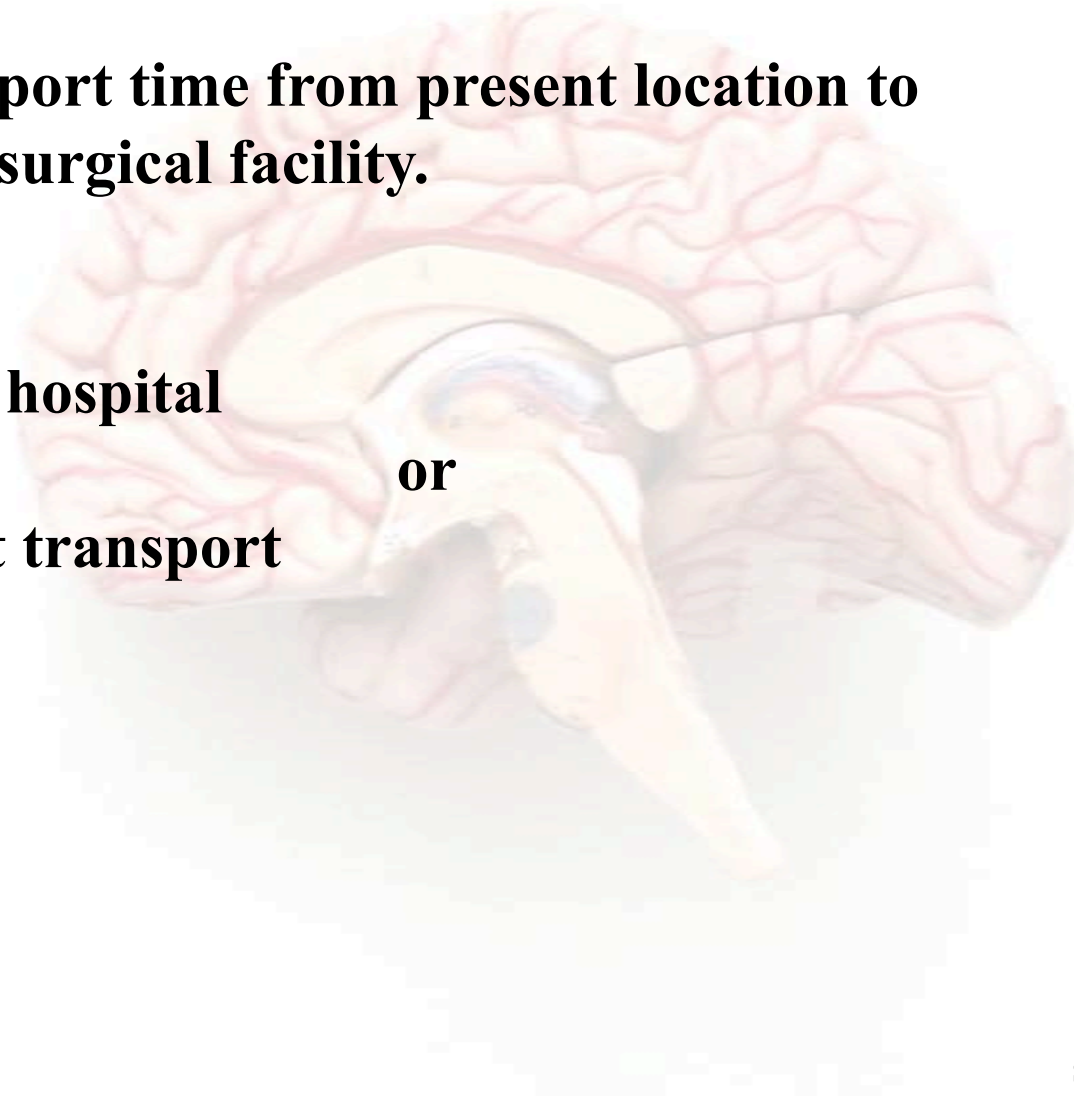
Location

**Transport time from present location to
neurosurgical facility.**

Local hospital

or

Direct transport

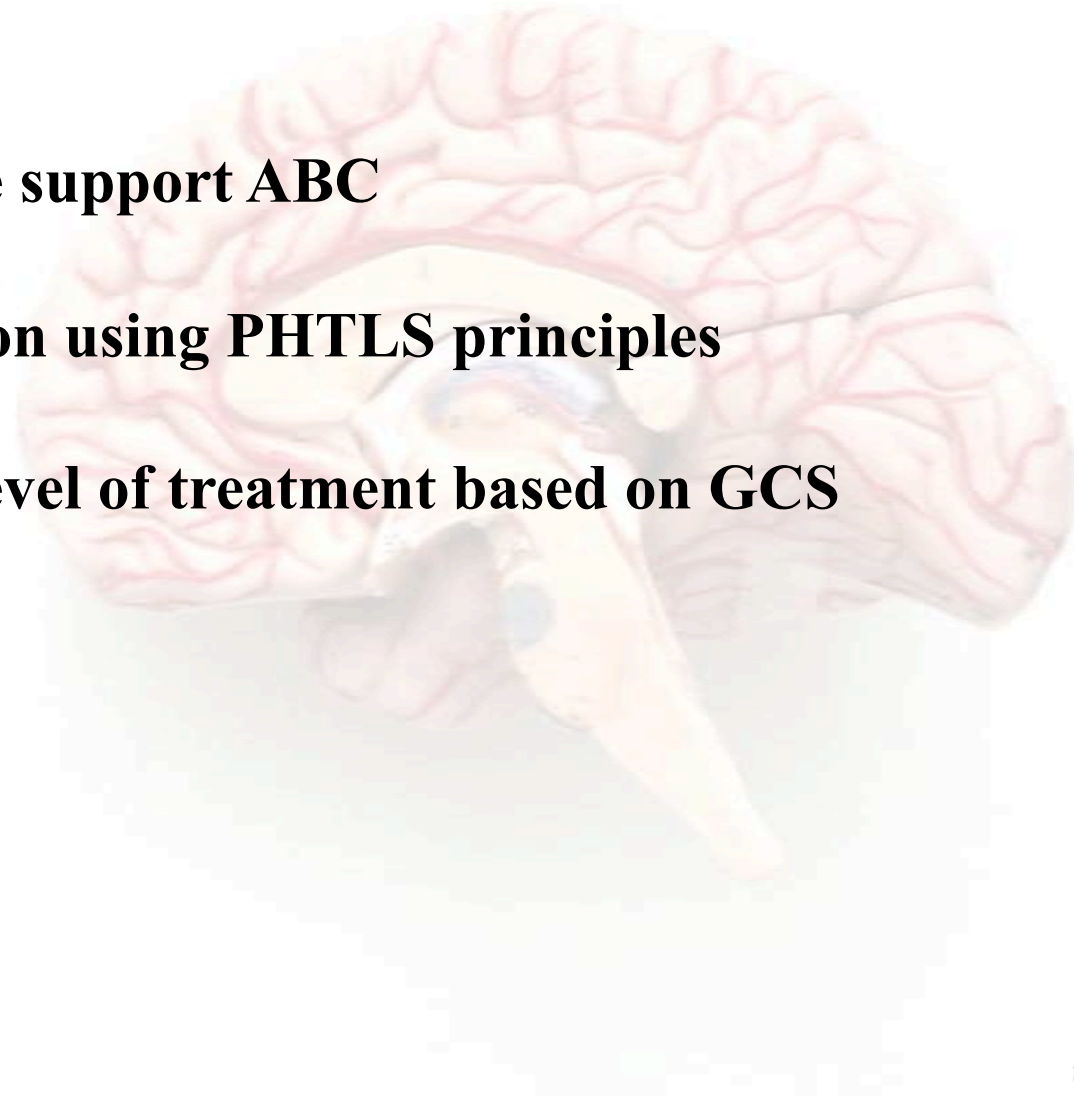


What should the EMS personnel do when facing a patient with a severe head injury?

Basic life support ABC

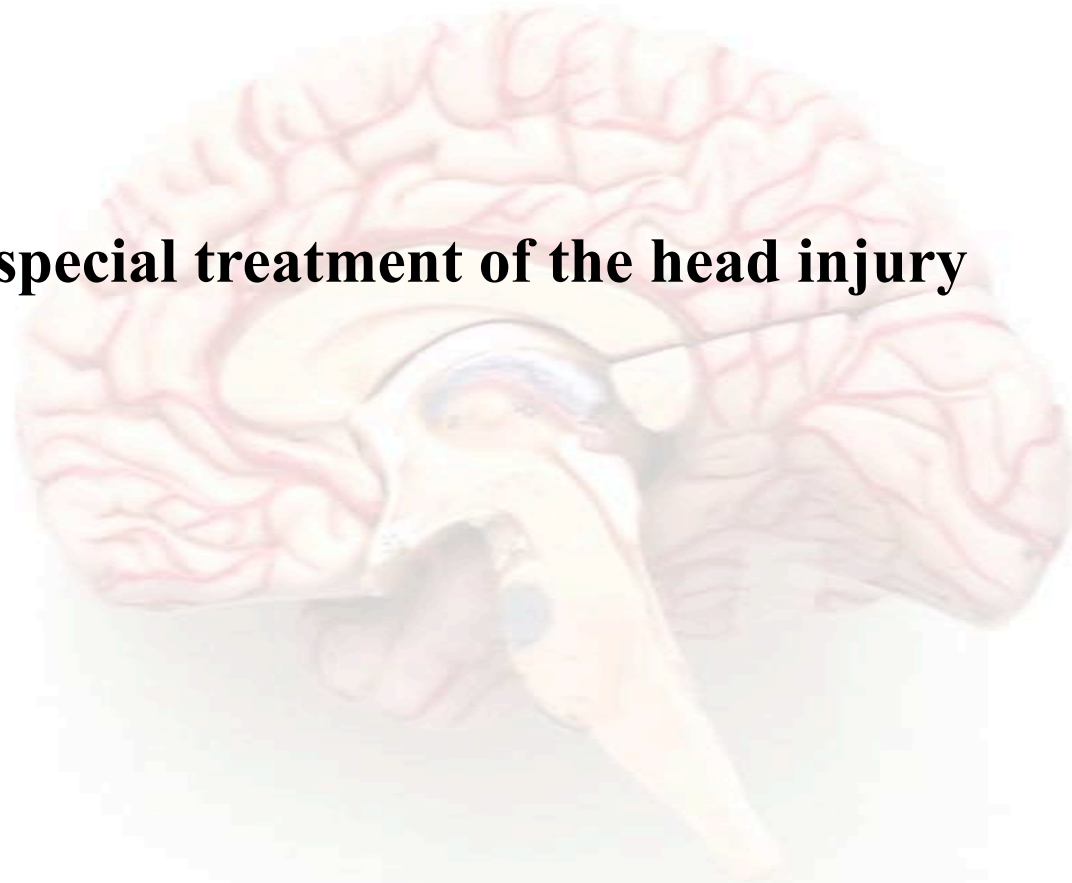
Extraction using PHTLS principles

Decide level of treatment based on GCS

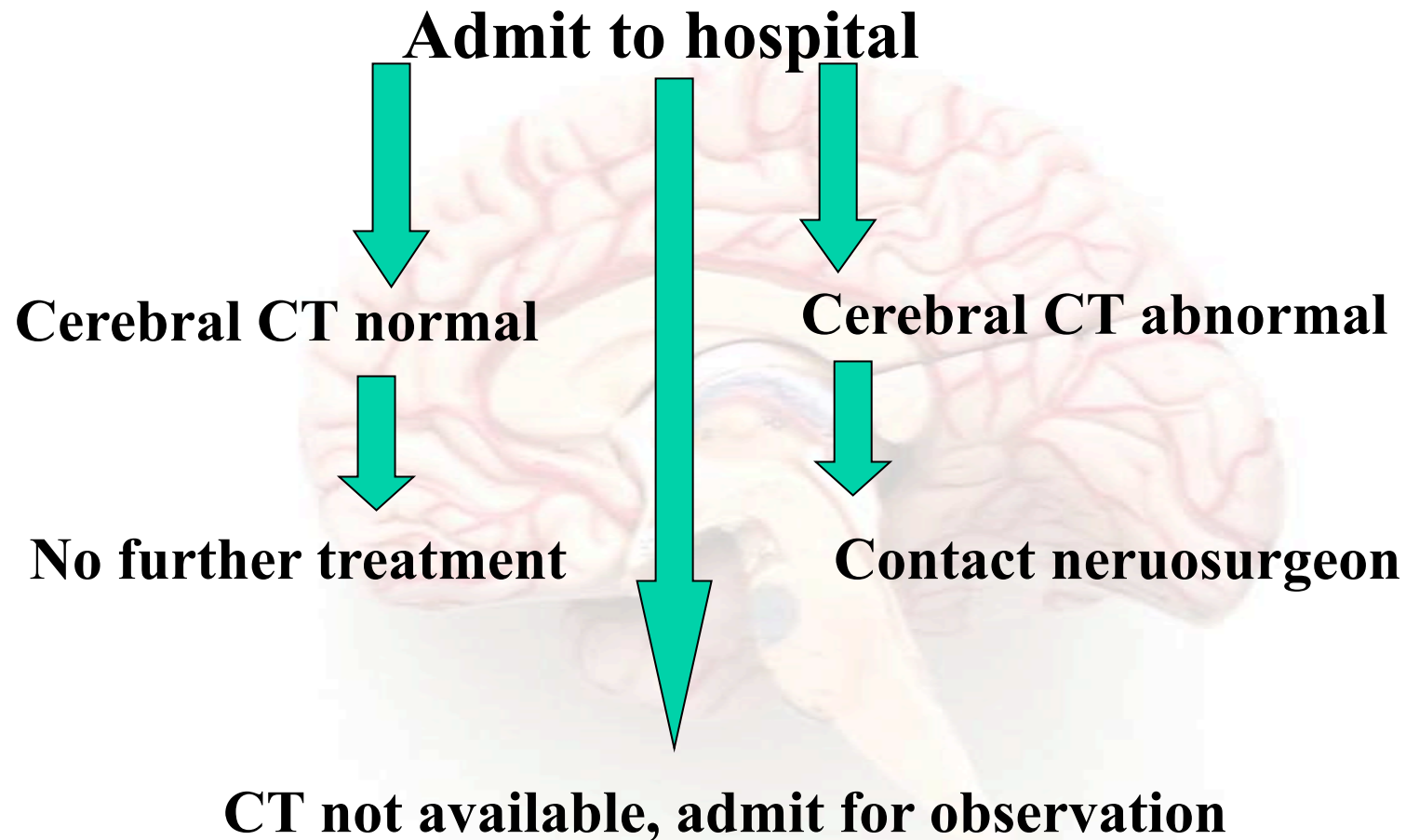


GCS 15 and no loss of consciousness

No special treatment of the head injury



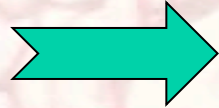
GCS 14-15 and/or loss of consciousness ≤ 5 min



GCS 9-13 and/or loss of consciousness > 5 min

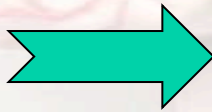
Always contact your local neurosurgeon

Normal CT



**Admit for observation on ICU
If decline in GCS, new CT**

Abnormal CT

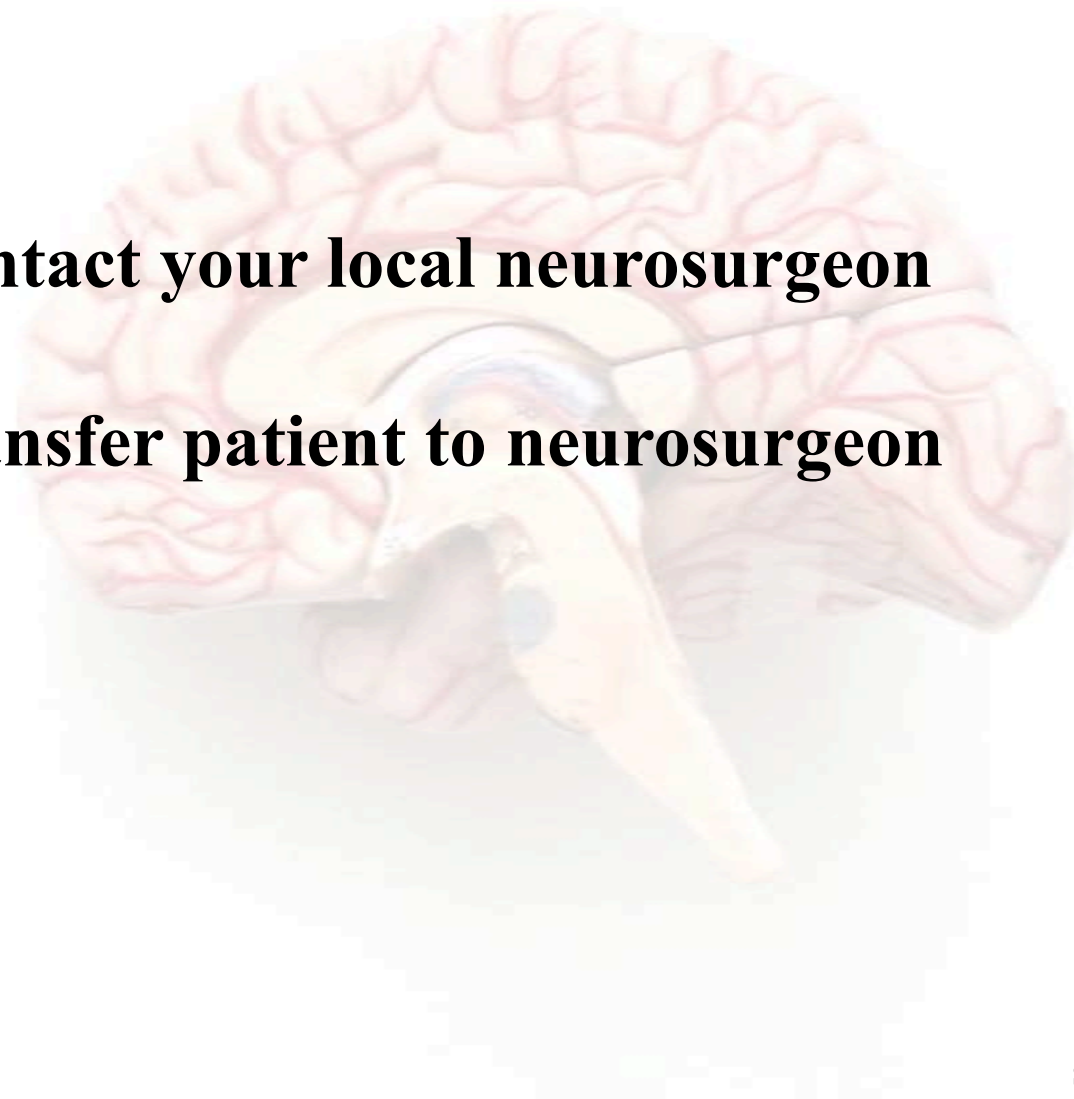


Transfer to Neuro ICU

GCS < 9

Contact your local neurosurgeon

Transfer patient to neurosurgeon



Oxygenation and blood pressure

- **Oxygenation should be measured with a pulse oximeter**
- **Blood pressure should be measured using the most accurate method available**
- **Oxygenation and blood pressure should be measured as often as possible and should be monitored continuously if possible**

Airway/ventilation/oxygenation

All patients with severe head injury should be given oxygen

Avoid hypoxemia and correct immediately when identified

Airway/ventilation/oxygenation

An airway should be established if

- GCS < 9 and**
- The airway is obstructed or**
- It is impossible to maintain sat > 90**

When endotracheal intubation is used to establish an airway, confirmation of placement of the tube in the trachea should include lung auscultation and end-tidal CO₂ determination

Airway/ventilation/oxygenation

Hyperventilation should be avoided unless the patient shows signs of herniation, and corrected immediately when identified

EMS systems implementing endotracheal intubation protocols should monitor blood pressure, oxygenation, and ETCO_2

Fluid resuscitation

The administration of fluids in the prehospital setting is recommended to avoid hypotension and/or limit hypotension to the shortest duration of time possible.

Hypertonic resuscitation in the prehospital setting, generally utilizing hypertonic saline with or without dextran, is recommended.

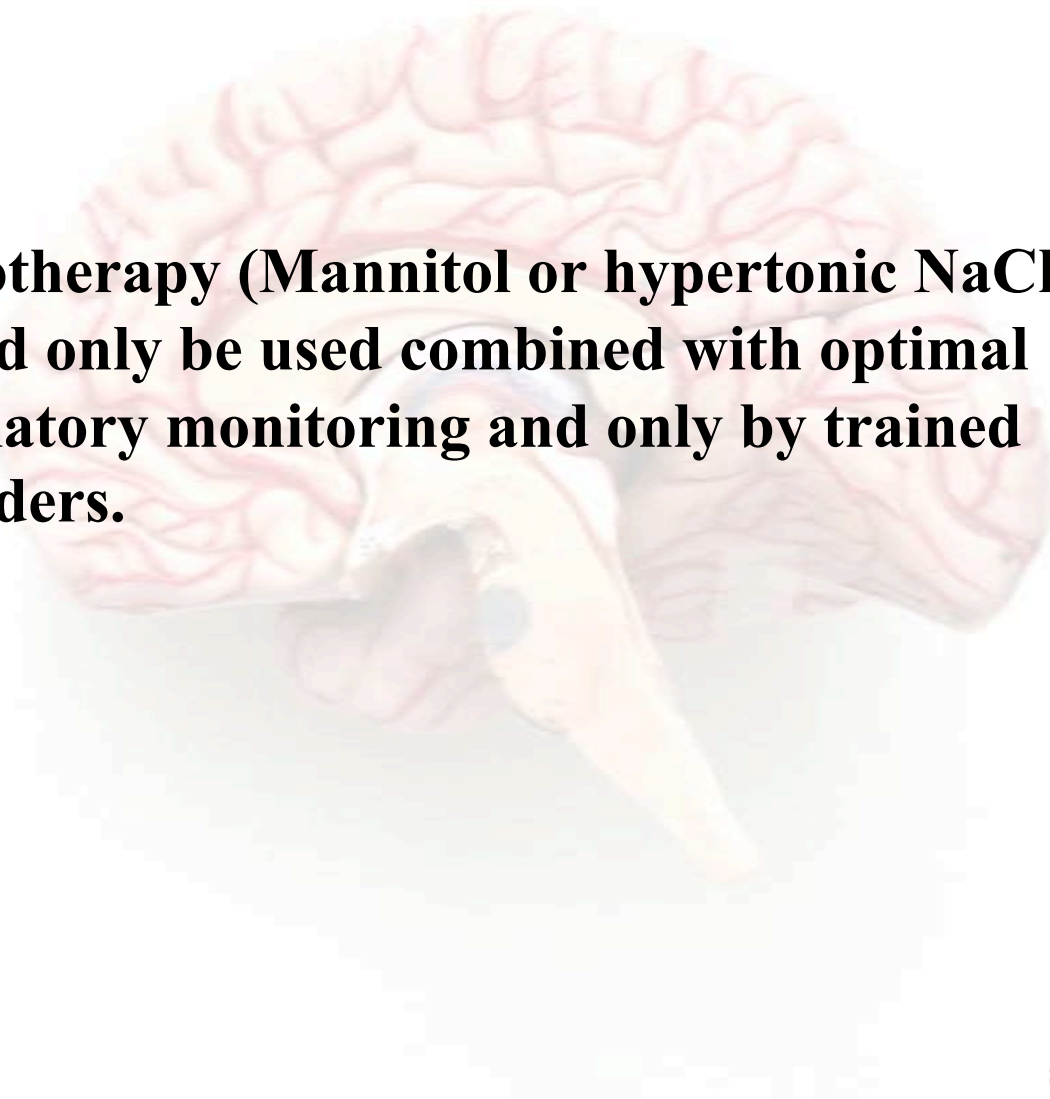
Signs of cerebral herniation

Clinical signs of cerebral herniation should lead to intubation and hyperventilation

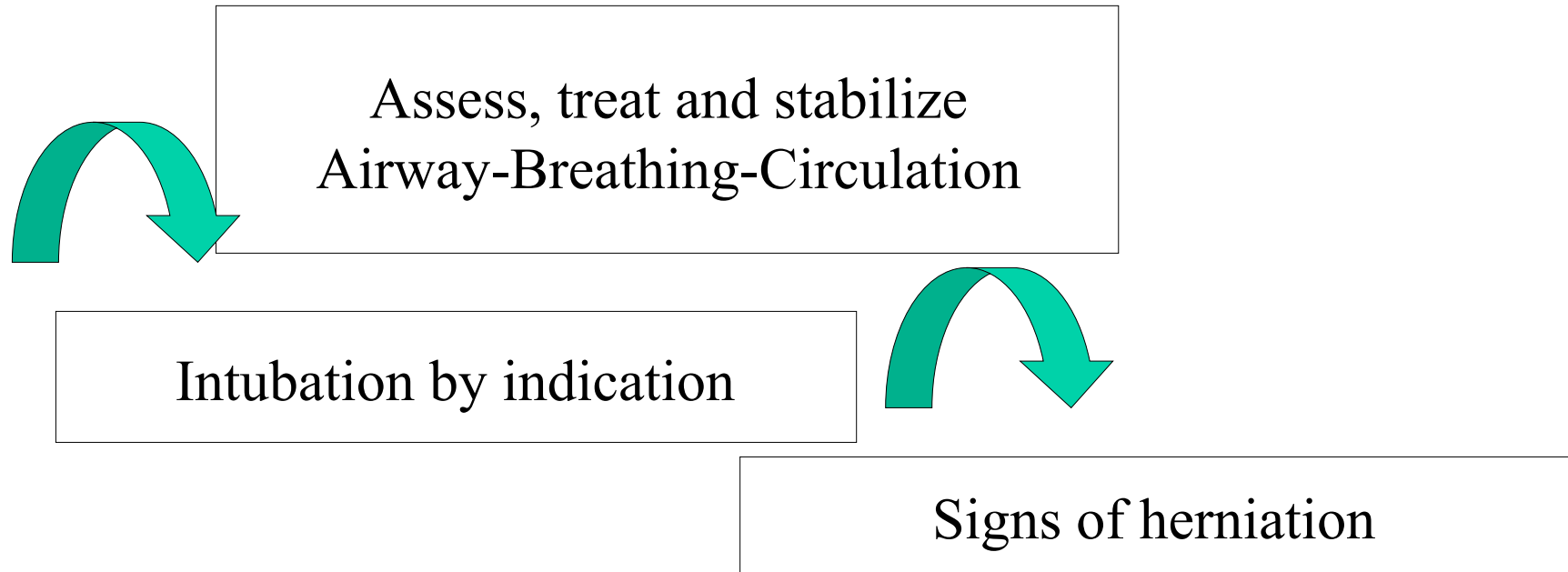
Neurologic status requires frequent reevaluation and, in the subsequent absence of clinical signs of herniation, hyperventilation should not be continued

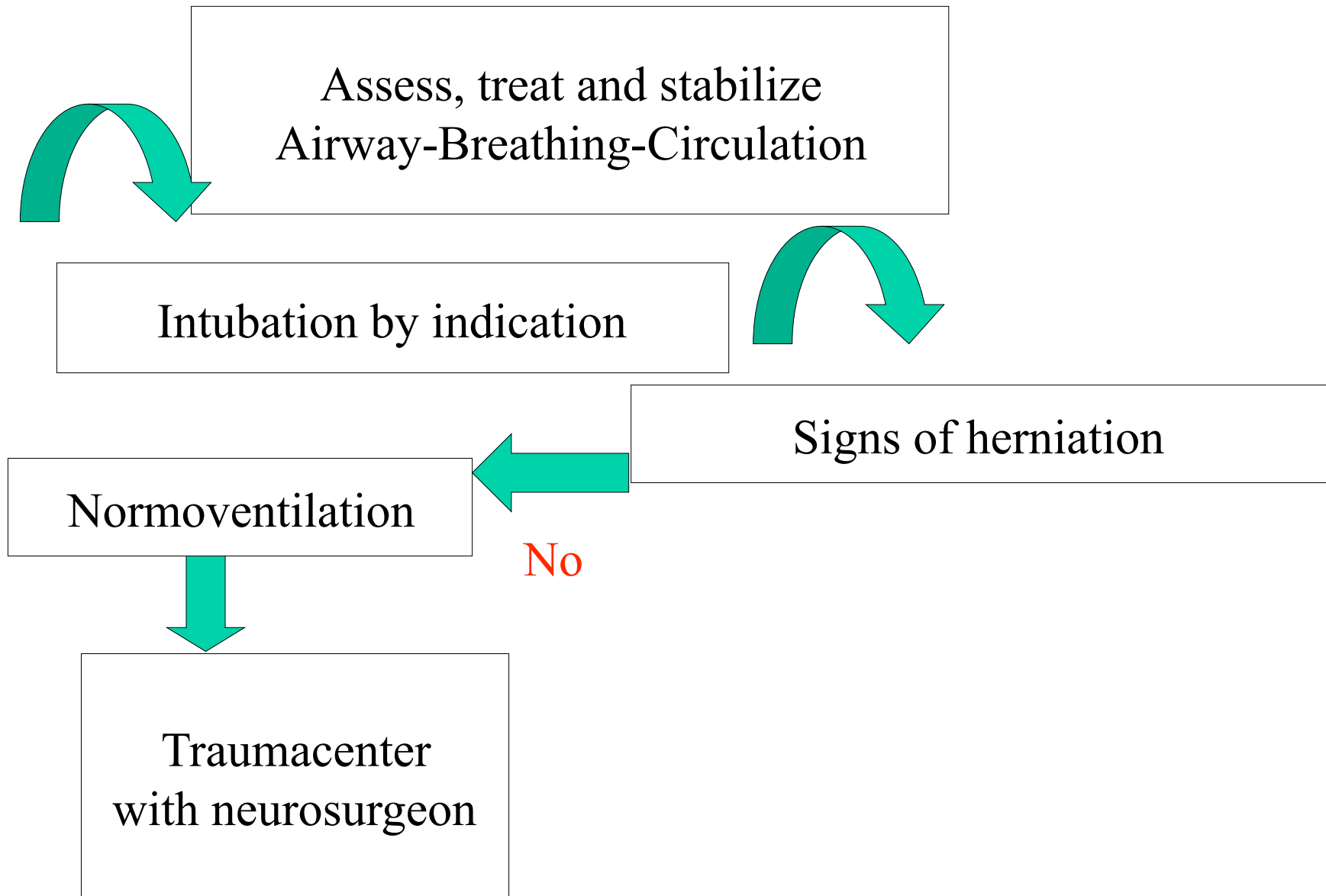
Signs of cerebral herniation

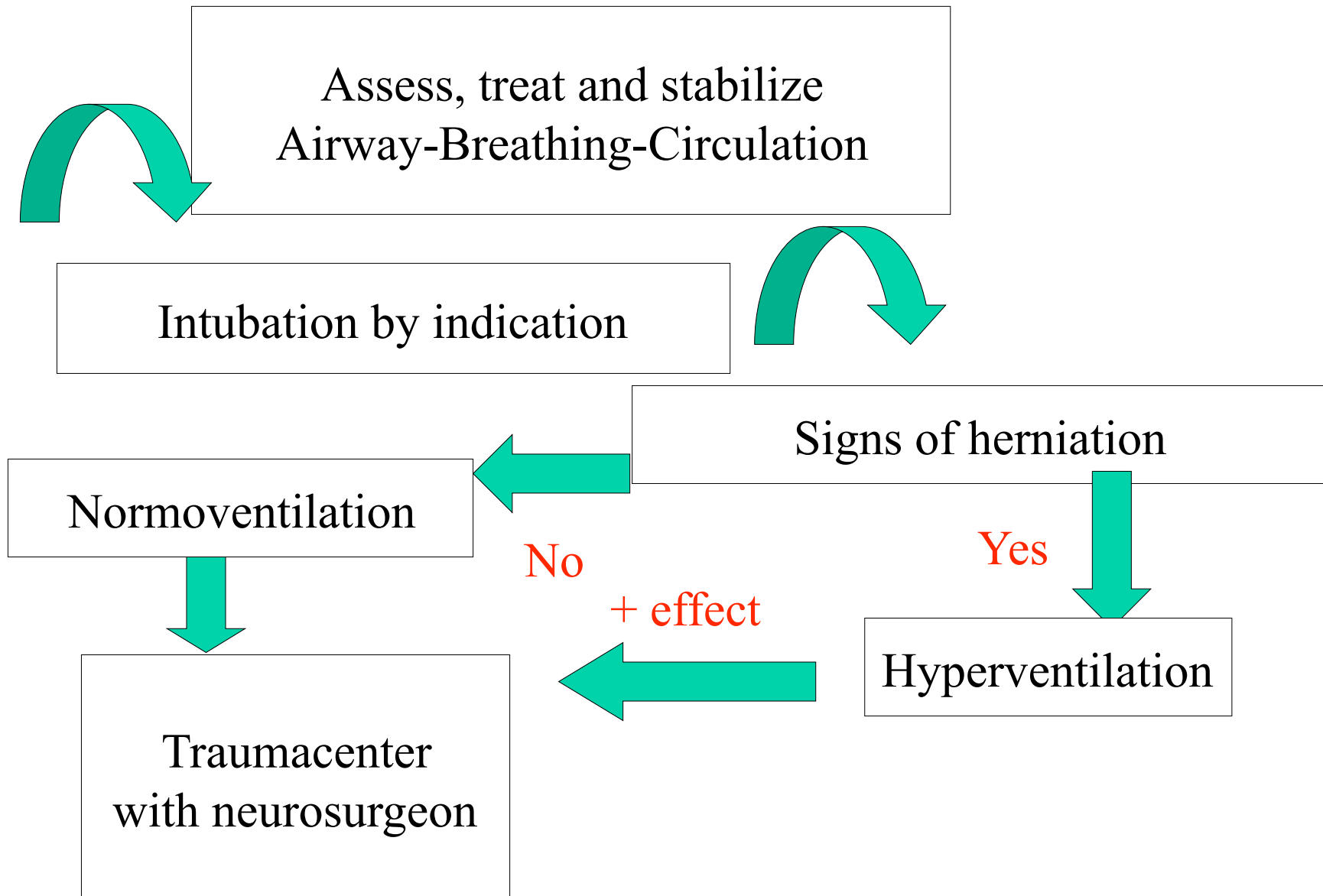
Osmotherapy (Mannitol or hypertonic NaCl) should only be used combined with optimal circulatory monitoring and only by trained providers.

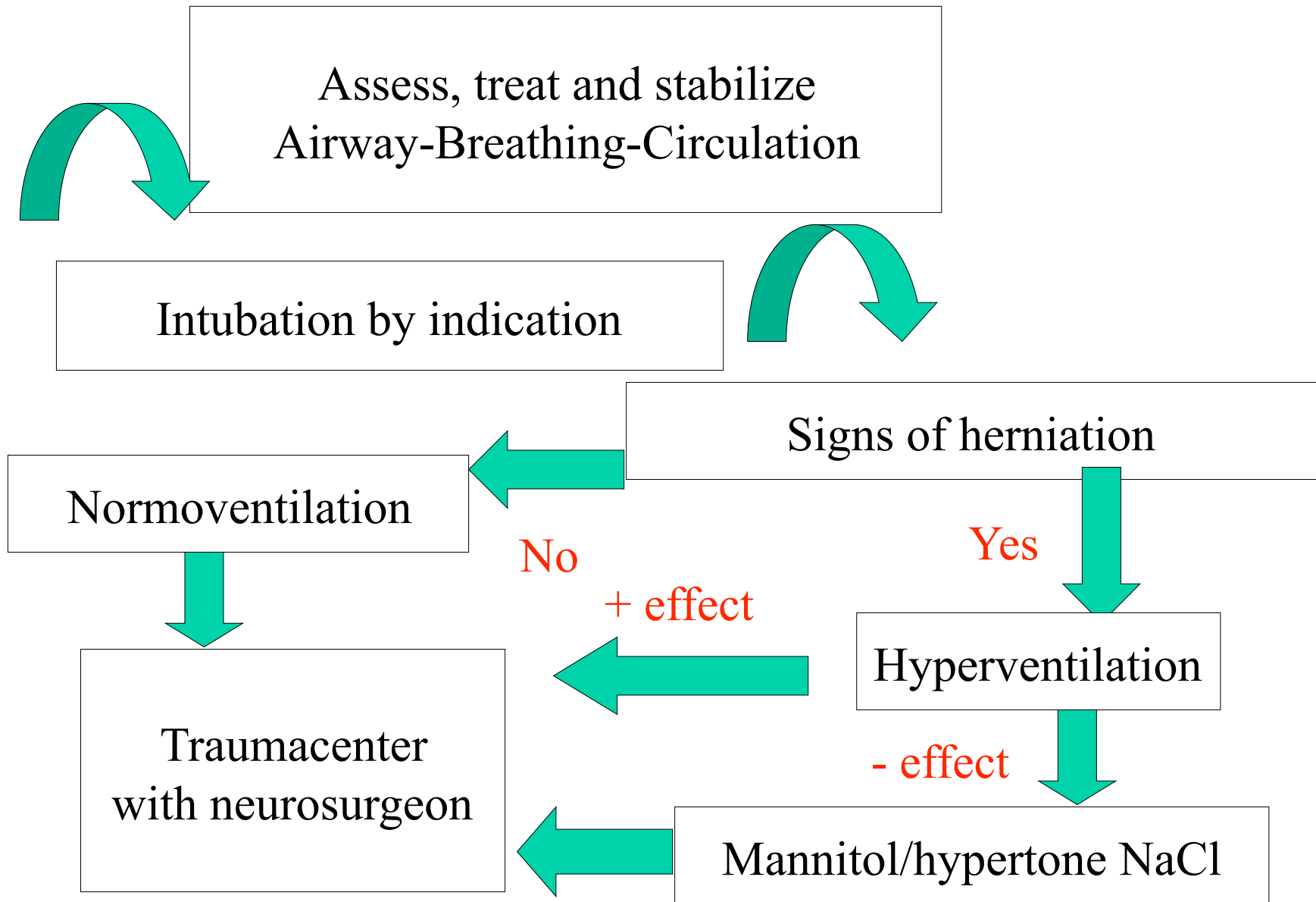


Assess, treat and stabilize
Airway-Breathing-Circulation







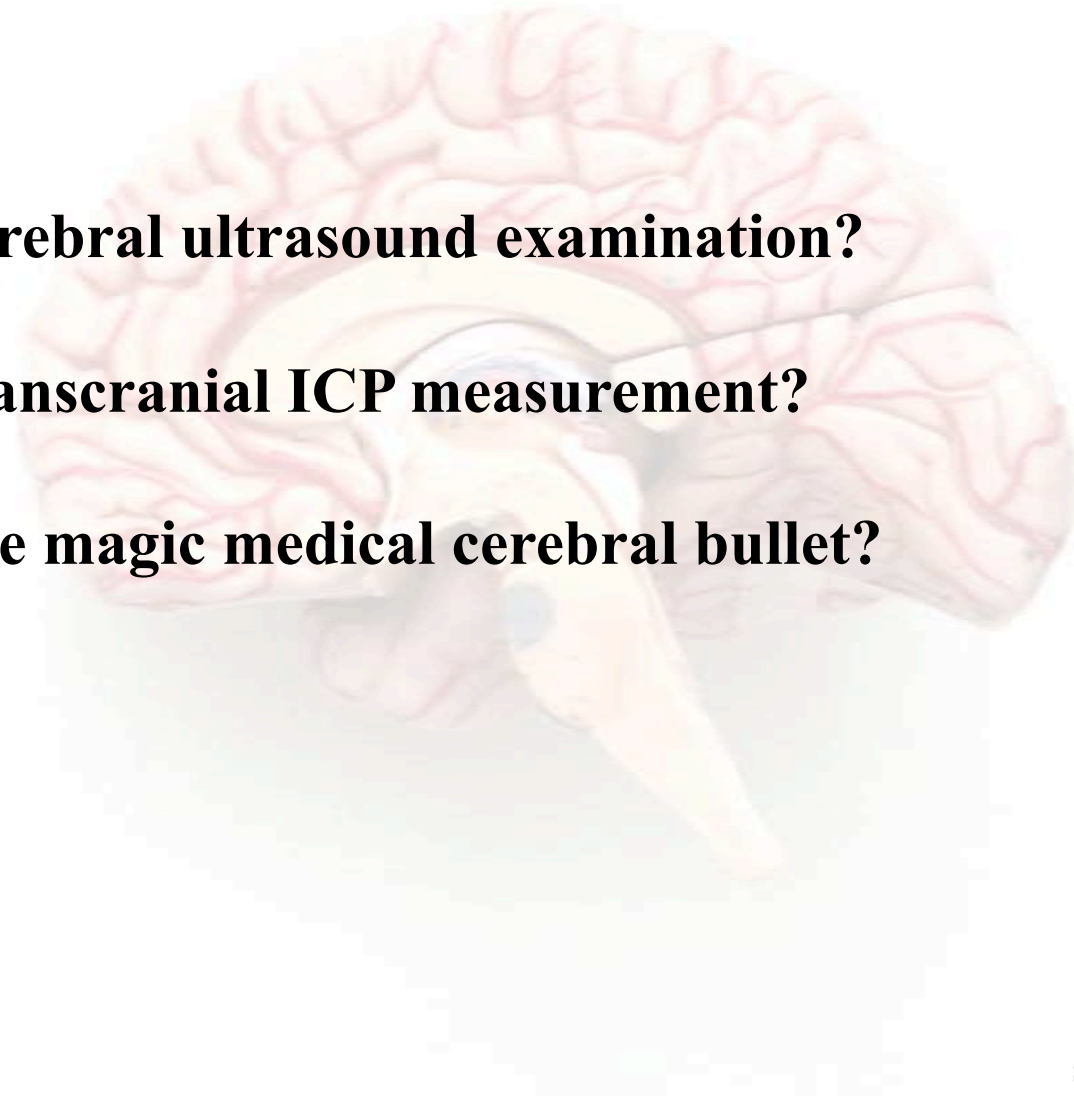


Perspectives for the future

Cerebral ultrasound examination?

Transcranial ICP measurement?

The magic medical cerebral bullet?





**THE BRAIN IS THE SECOND MOST
IMPORTANT ORGAN OF THE BODY**

Woody Allen