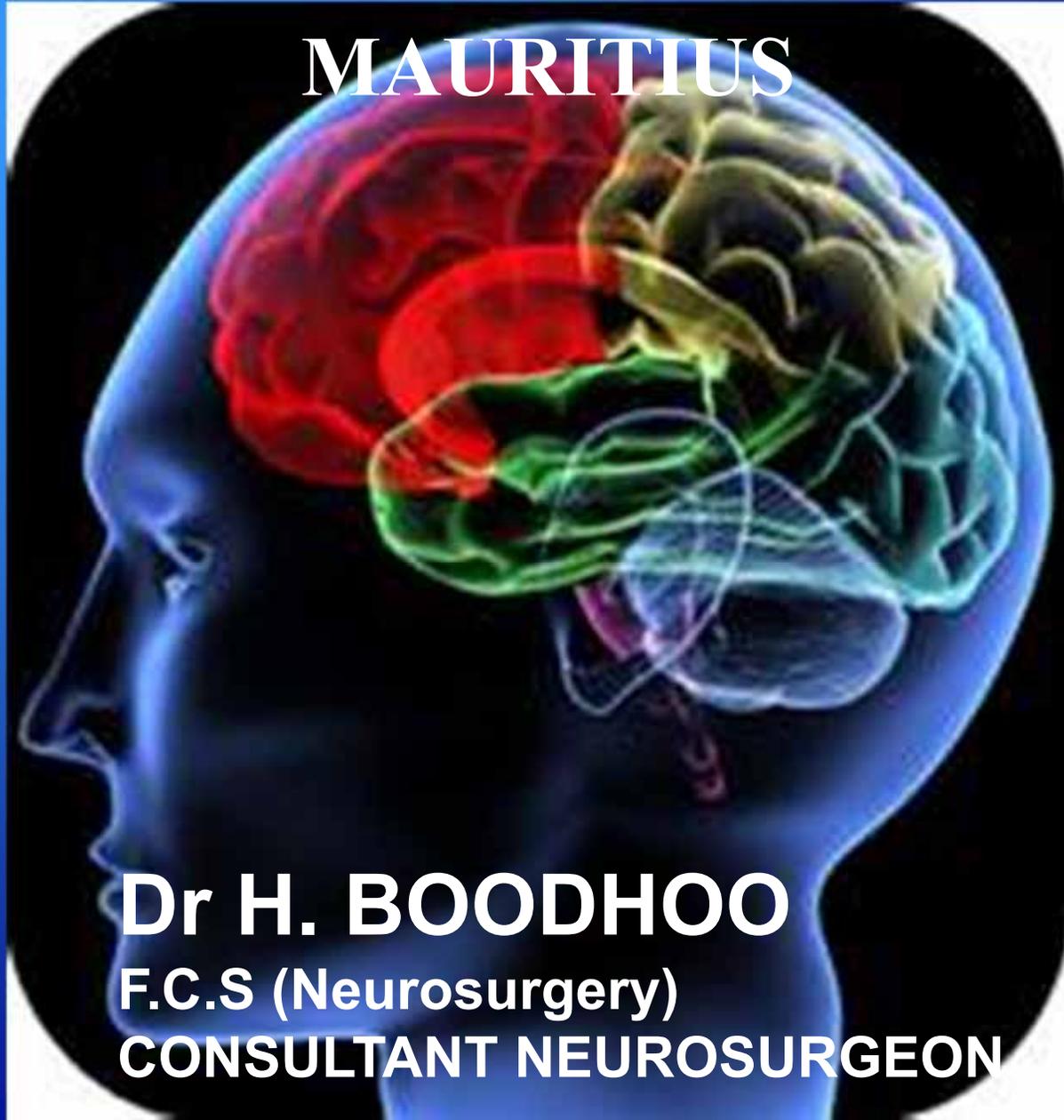


# TRAUMATIC BRAIN INJURY IN MAURITIUS



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# TRAUMATIC BRAIN INJURY STUDY 2008-2010 VICTORIA HOSPITAL

- Road Traffic accident (2/3 to 3/4 death due to head injury)
- Fall (pediatric + adult- alcohol)
- Interpersonal Violence
- Others

# TRAUMATIC BRAIN INJURY

- Magnitude of the problem (**statistics**)
- Pathophysiology and Mechanism
- Emergency Response (**SAMU**)
- Accident/ Emergency Dept
- Investigations (**Radiology**)
- Medical and Surgical Management
- Intensive care unit
- Follow up/Rehabilitation & Support services

# Accidents de la route

## STATISTICS

Année	Accidents	Fatal	Blessures graves	Blessures légères	Année	Accidents	Fatal	Blessures graves	Blessures légères	Année	Accidents	Fatal	Blessures graves	Blessures légères
1981	3,149	108	269	2,772	1991	4,025	168	296	3,561	2001	3,264	126	288	2,850
1982	2,460	99	147	2,214	1992	4,395	119	378	3,898	2002	2,904	158	216	2,530
1983	2,531	102	305	2,124	1993	4,160	157	322	3,681	2003	2,698	131	291	2,276
1984	2,329	82	253	1,994	1994	3,947	154	330	3,463	2004	2,951	144	245	2,562
1985	2,685	104	266	2,315	1995	3,586	173	280	3,133	2005	2,760	136	358	2,266
1986	2,834	109	226	2,499	1996	3,774	153	238	3,383	2006	2,522	134	348	2,040
1987	3,294	112	255	2,927	1997	3,755	146	261	3,348	2007	3,055	140	500	2,415
1988	3,004	122	282	2,600	1998	3,828	162	281	3,385	2008	3,435	168	512	2,755
1989	3,141	130	250	2,761	1999	3,405	170	237	2,998	2009	3,655	140	479	3,036
1990	3,575	144	315	3,116	2000	3,291	163	266	2,862	2010	3,677	160	587	2,930

# LES 33 ROUTES les plus meurtrières

Le trajet entre les Plaines-Wilhems et le Nord est le plus dangereux avec 23 « black-spots » sur un total de 33. C'est ce qui ressort de la liste préparée par la Traffic Management & Road Safety Unit (TMRSU).

**Eshan Dinally**  
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La vigilance est plus que nécessaire sur le trajet entre Curepipe et Grand-Baie/Goodlands. Ces cinq dernières années, il a enregistré le plus grand nombre d'accidents de la route tuels et graves. Pour cause, la Traffic Management Road Safety Unit (TMRSU) en a répertorié 70 % des « black-spot ». Soit 23 sur un total de 33.

De Curepipe aux points d'entrée de Port-Louis, Nationale et la route Royale sont jonchées de neuf black-spots ». Plus précisément, trois sur la nationale : entre la jonction de Grewals et Camp Chapelon, entre Bagatelle et Montagne-Ory à l'échangeur de St-Jean. Trois sur la route royale, communément appelée « Vieux chemin » : entre la jonction Pointe-aux-Sables/GRNO et Cité Vallijee, entre Bell Village et Brabant Road et entre Beau-Bassin (marché) et Chapman Hill. Et trois autres aux Plaines-Wilhems : entre St-Aubin et Riverside Road (Phoenix), entre Eau-Coulée et Malartic Road (Curepipe) et entre La Caverne et Bonne Terre.

À Port-Louis, TMRSU a décelé six « black-spots » - entre Bell Village et Caudan, Place

d'Armes et Quai D, Quai D et Rond-point Cocoterie/Roche-Bois, Jonction Pointe-aux-Sables/GRNO et Cité Vallijee, Bell Village et Brabant Road et Abercombic - Route Nicolay. Par ailleurs, entre Port-Louis et Grand Baie/Goodlands, neuf « black-spots » ont été identifiés. (Voir la liste plus loin).



## Black-spot

Une route est déclarée « black-spot » à la constat sur six ans. Elle est placée sur la liste durant cette période, le nombre d'accidents causant des blessés graves dépasse 1. Un accident fatal comporte 12 points et un faisant des blessés équivaut à 8 points.

## La liste noire

- Autoroute M1 : Port-Louis – Plaisance**
1. Bell Village - Caudan
  2. Jonction Grewals - Camp Chapelon
  3. Bagatelle - Montagne Ory
  4. L'échangeur de St-Jean
- Autoroute M2 : Port-Louis – Pamplémousses**
5. Place d'Armes - Quai D
  6. Quai D - Rond-point Cocoterie/Rocher
  7. (a) Cocoterie - Riche-Terre
  - (b) Bois Marchand - Calebasses
- Nationale A1 : Port-Louis – St-Jean**
8. Jonction Pointe-aux-Sables/GRNO -
  9. Bell Village - Brabant Road
  10. Beau-Bassin (Marché)- Chapman Hill
  11. Richelieu
- Route A2 : Port-Louis - Flacq**
12. Le Hochet – Terre Rouge
  13. Abercombic – Route Nicolay
- Route A3 : Rivière Noire**
14. Bambous – Jonction Route Médine
  15. Village de La Gaulette
- Route A4 : Terre Rouge – Grand-Baie**
16. Triolet (Lady Sushill SSS) – Route Bord
  17. Jonction de Solitude
- Route A5 : Mapou - Goodlands**
18. Jonction Grand-Gaube – Goodlands
- Route A7 : Moka – Camp de Masque - Flacq**
19. Jonction B47 – St Pierre Traffic Centre
- Route A9 : Savanne**
20. St. Aubin – Union Ducray
- Route A10 : Phoenix - Plaisance**
21. St. Paul – Riverside Road (Phoenix)
- Route A12 : Plaine Magnien - Mahébourg**
22. Eau Coulée – Malartic Road (Curepipe)
  23. Beau Vallon – Mahébourg
- Route B3 : Candos - Vacoas**
24. La Caverne – Bonne Terre
- Route B4 : St-Paul**
25. Ligne Berthaud – Golf Road
- Route B9 : Black River Savanne Coast Road**
26. Riambel
- Route B12 : The Vale**
27. Bois Rouge – Fond du Sac
- Route B 17 : Plaine-des-Papayes**
28. Poste de police – Ecole primaire Bois
- Route B19 : Montagne Longue/Crève-Coeur**
29. Notre-Dame
- Route B28 : Flacq – Mahébourg**
30. Caroline – Bel-Air Rivière Sèche
- Route B34 : Flic-en-Flac**
31. Médine Branch Road – Anna Branch
- Route B45 : Chemin Vingt-Pieds**
32. Sotisse – Plaine des Papayes
- Route B63 : Sivananda Road**
33. Curepipe – Jonction Floréal

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## STATISTICS

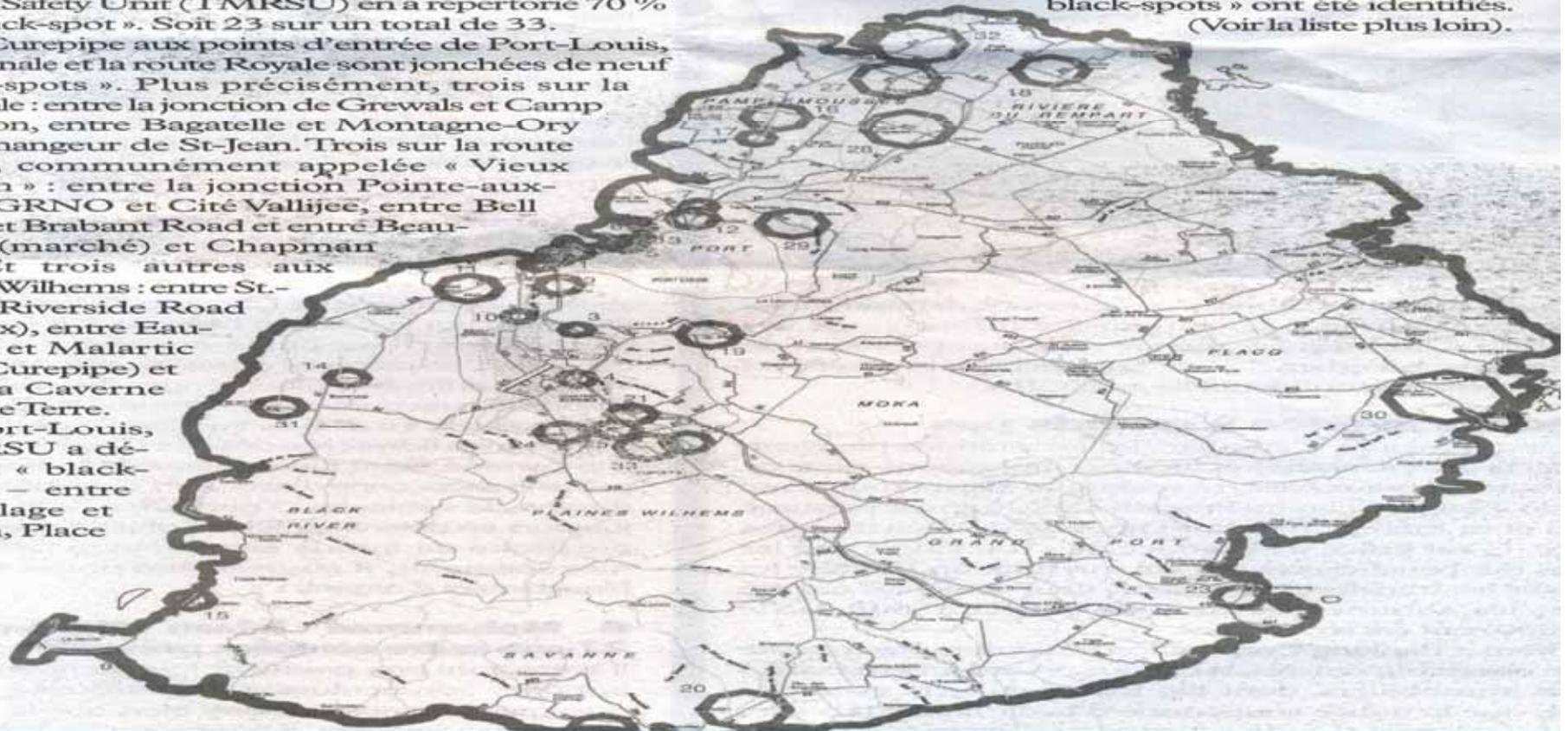
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# Black-spot

Une route est décrétée « black-spot » à la suite d'un constat sur six ans. Elle est placée sur la liste noire si, durant cette période, le nombre d'accidents fatals et ceux causant des blessés graves dépasse 100 points. Un accident fatal comporte 12 points et un accident faisant des blessés équivaut à 8 points.

## La liste noire

Autoroute M1 : Port-Louis – Plaisance

1. Bell Village - Caudan
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13. Abercombie – Route Nicolay

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14. Bambous – Jonction Route Médine
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23. Beau Vallon – Mahébourg

Route B3 : Candos - Vacoas

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Route B4 : St-Paul

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31. Médine Branch Road – Anna Branch Road

Route B45 : Chemin Vingt-Pieds

32. Sotisse – Plaine des Papayes

Route B63 : Sivananda Road

33. Curepipe – Jonction Floréal

## STATISTICS

# Road Traffic Accidents in Mauritius

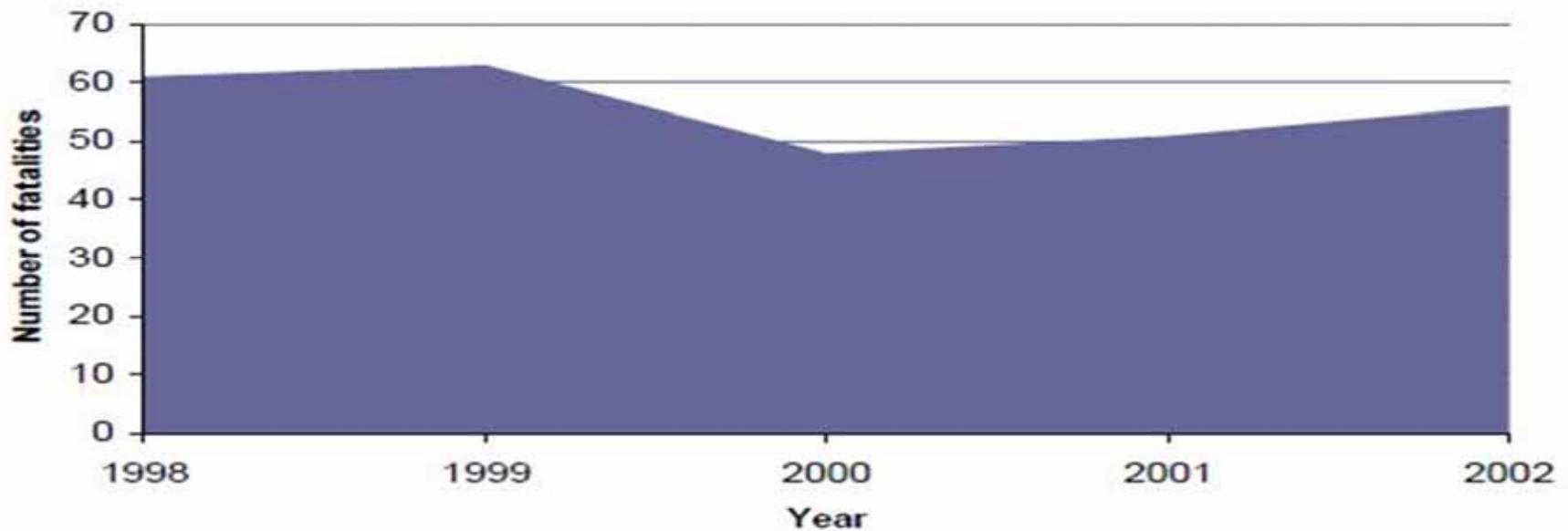
## STATISTICS

**Table 2:**  
Proportion of pedestrians killed for each year - 1998 to 2002

<u>Fatalities</u>	Number					
	<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>1998-2002</u>
a: Pedestrians	61*	63	57	47	51	279
b: All	162	170	163	126	158	779
<i>a as % of b</i>	<b>36</b>	<b>37</b>	<b>34</b>	<b>38</b>	<b>32</b>	<b>36</b>

\*In 1998, there were two accidents in which two pedestrians were killed in each crash

**Chart 01: Number of pedestrians killed in Mauritius, 1998 -2002**

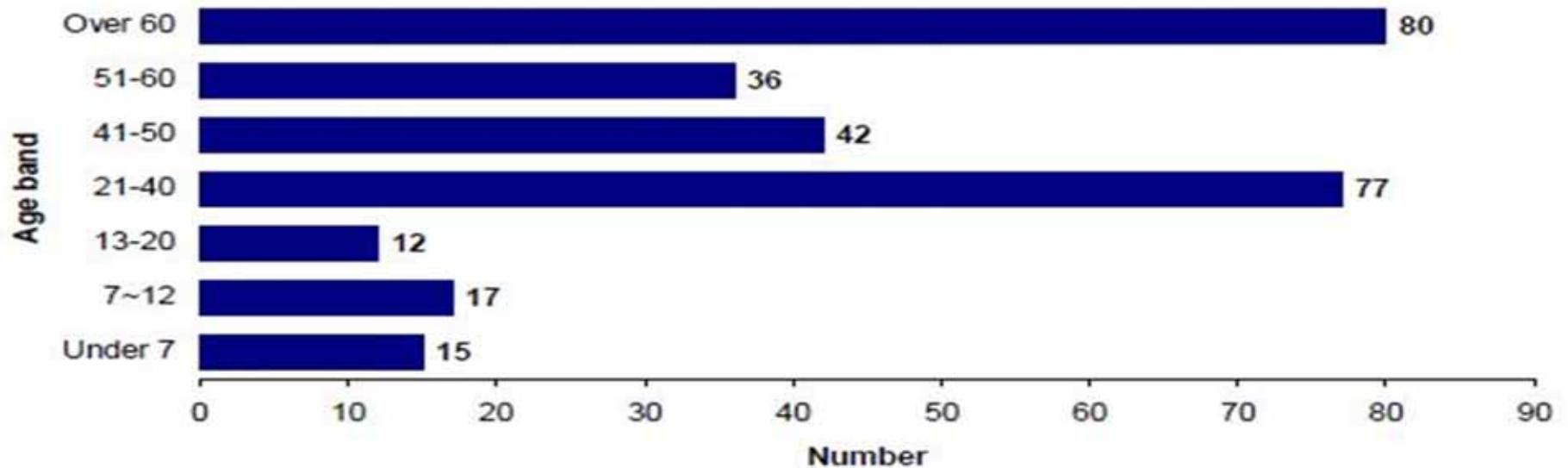


**Table 4:  
Pedestrian fatalities by age groups - 1998 to 2002**

**STATISTICS**

<u>Age band</u>	Number					<u>1998-2002</u>
	<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>	<u>2002</u>	
Under 7	02	01	07	01	04	<b>15</b>
7-12	03	04	02	05	03	<b>17</b>
13-20	02	02	05	NIL	03	<b>12</b>
21-40	22	16	17	11	11	<b>77</b>
41-50	10	08	05	11	08	<b>42</b>
51-60	05	08	10	05	08	<b>36</b>
Over 60	17	24	10	15	14	<b>80</b>

**Chart 02: Pedestrian fatalities by age group, 1998-2002**



TBI\_Mauritius

# PEDESTRIANS

## Mauritius

- **27 % of total road casualties**
- **36 % of death toll (1 in 3)**
- **Pedestrians' behavior**
- **Drivers' behavior**
- UK = 25 %
- France = 10 %
- Reunion = 28 %

TBI\_ Mauritius

# PEDESTRIANS

- Male = 78 %
- Female = 22 %
- Elderly 60 yrs
- 48 % during night time

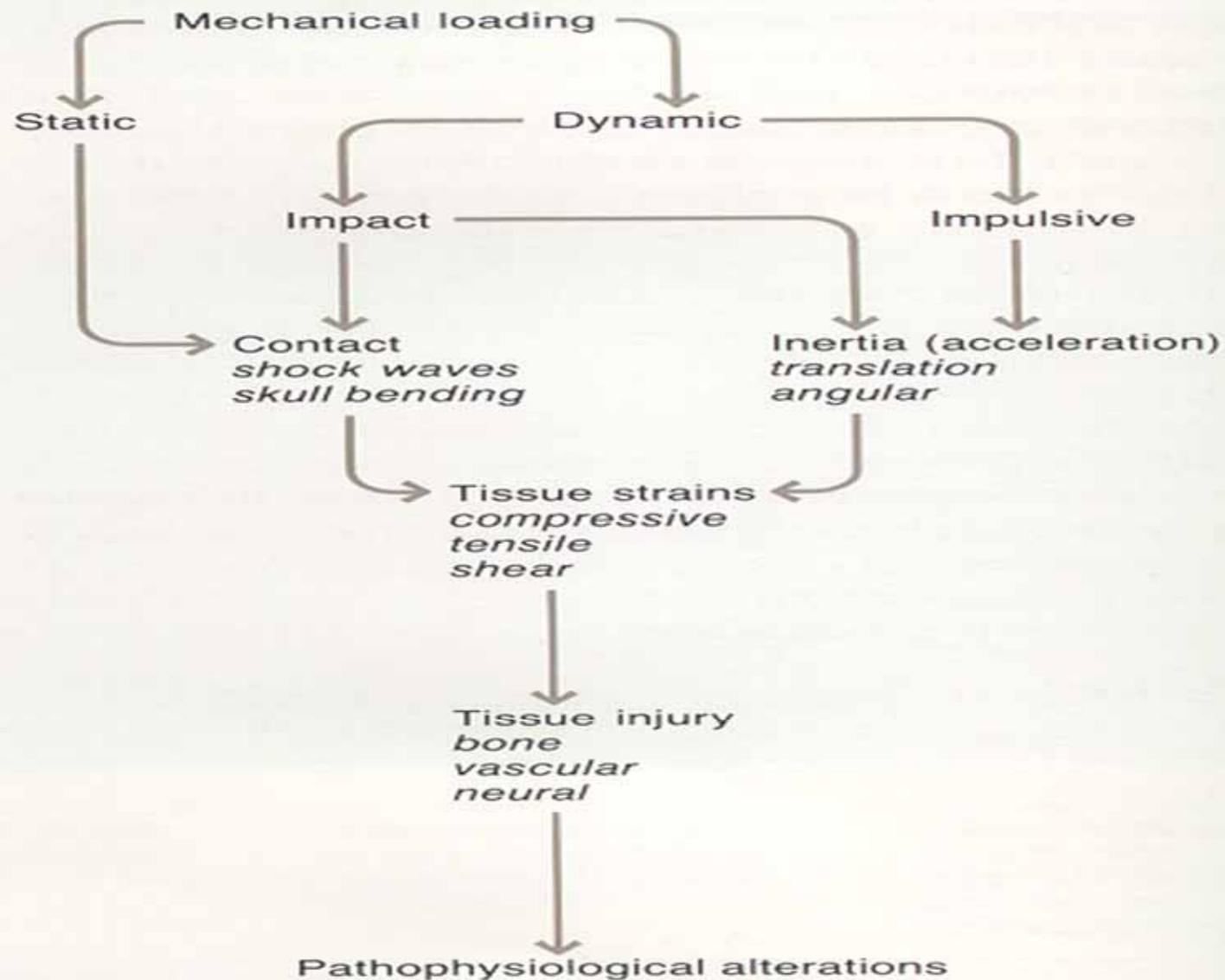
# CONCEPT OF PRIMARY & SECONDARY INJURY

- All head injuries do not occur at the moment of impact (**primary injury**) but rather evolves over the ensuing minutes, hours and days (**secondary injury**)
- This secondary injury can result in increased **mortality** and **morbidity**

# MECHANISMS OF INJURY

- **Forces -** static  
dynamic
- **Injury -** primary  
secondary
- **Effects on -** skull  
vascular  
cerebral tissue  
cerebro-spinal fluid

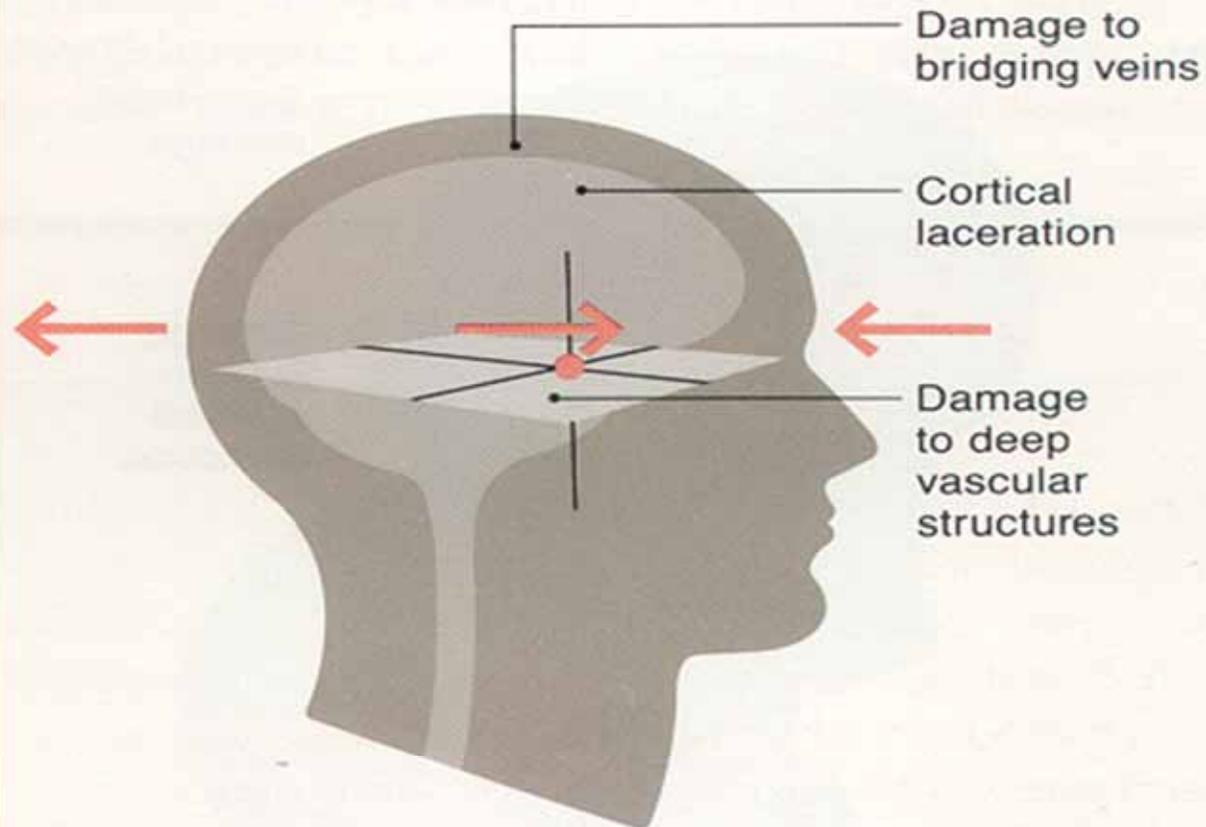
## Mechanisms by which mechanical energy can injure the head



Adapted with permission from Gennarelli TA, Thibault LE: Biological models of head injury, in Becker DP, Povlishock JT (eds): *Central Nervous System Trauma Report (1985)*. Bethesda, MD, National Institute of Neurological and Communicative Disorders and Stroke, National Institutes of Health, 1985, chap 25.

## Damage resulting from translational forces

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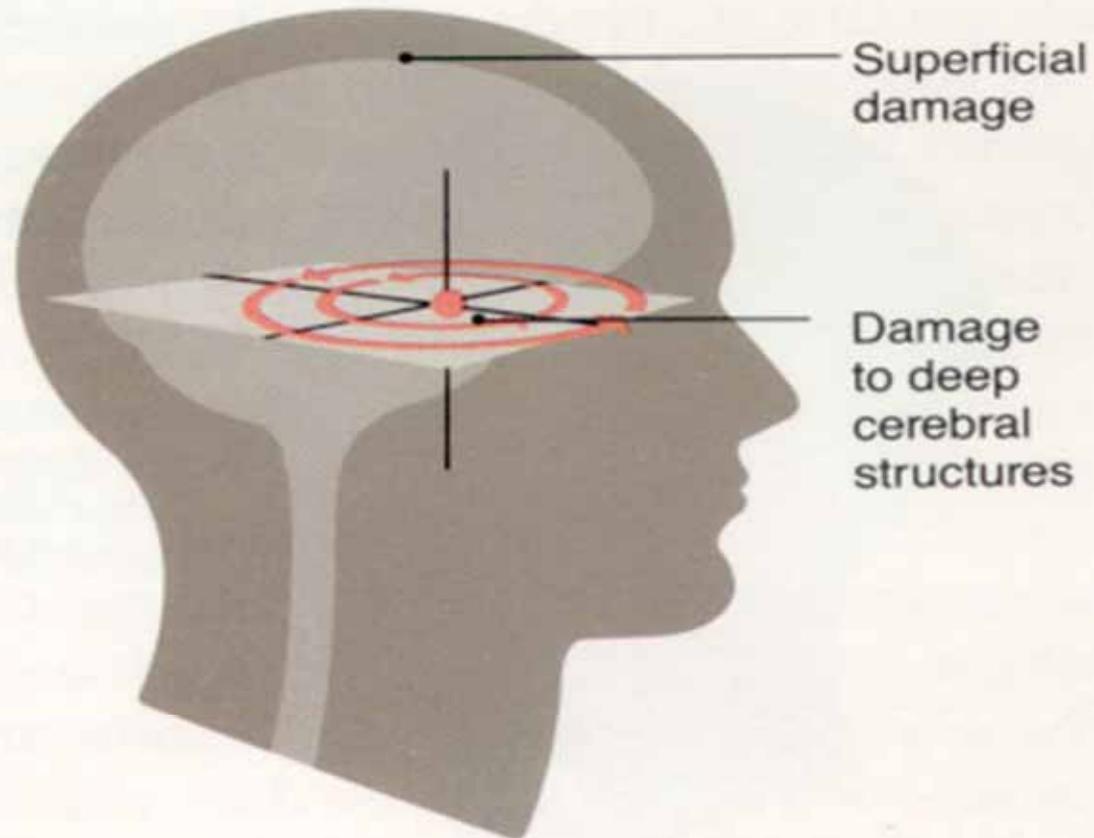


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Translational forces occur along main axes and do not have a rotational component. As the magnitude increases, the superficial cerebral damage becomes more severe and, eventually, deeper structures are damaged as well.

## Damage resulting from rotational forces

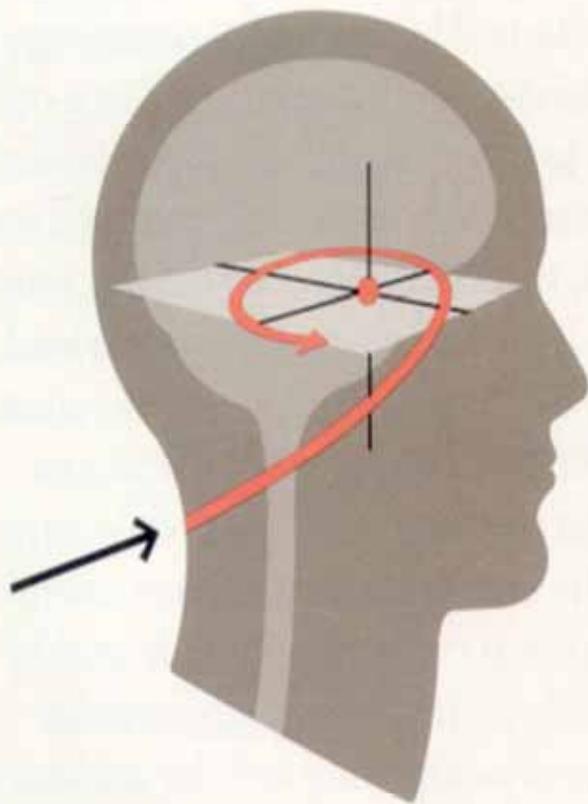
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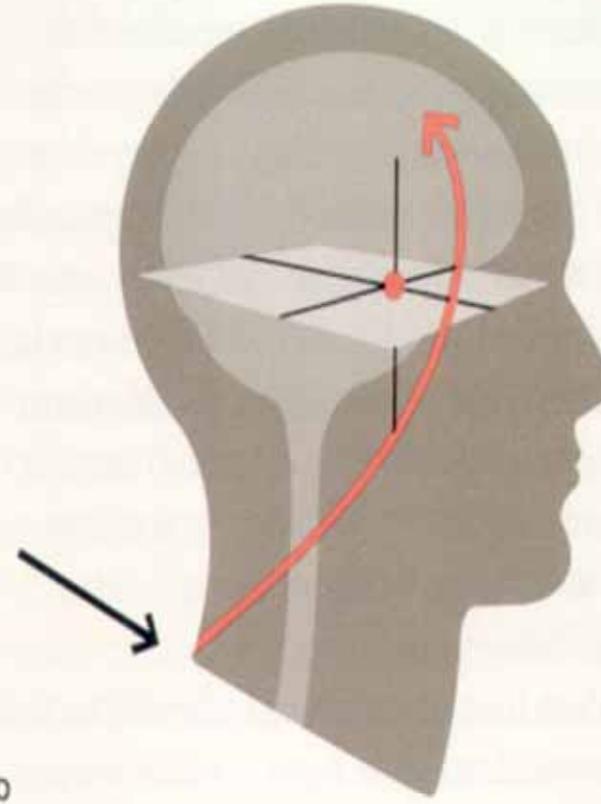
The effects of pure rotational forces are not seen clinically but have been observed experimentally: Increasing magnitude leads to deeper damage.

## Damage resulting from angular forces



a

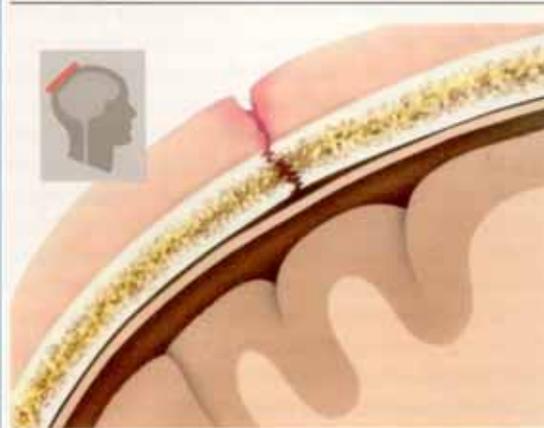
a When an angular force pivots through the upper cervical area, a greater rotational element results.



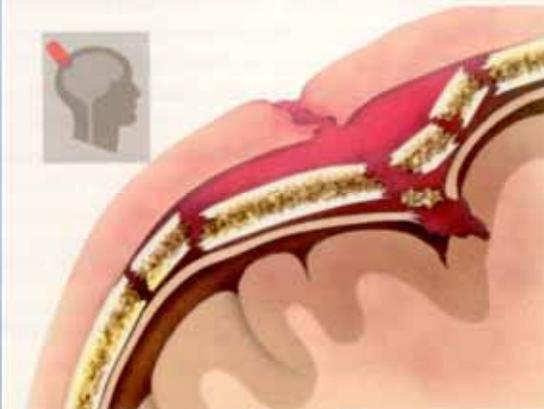
b

b In contradistinction, a low cervical pivotal point creates a greater translation element. The depth of injury resulting from an angular force will depend on the magnitude of the force.

Mechanisms of skull fracture



Effect of flat instrument (Linear)



Effect of blunt instrument (Depressed)

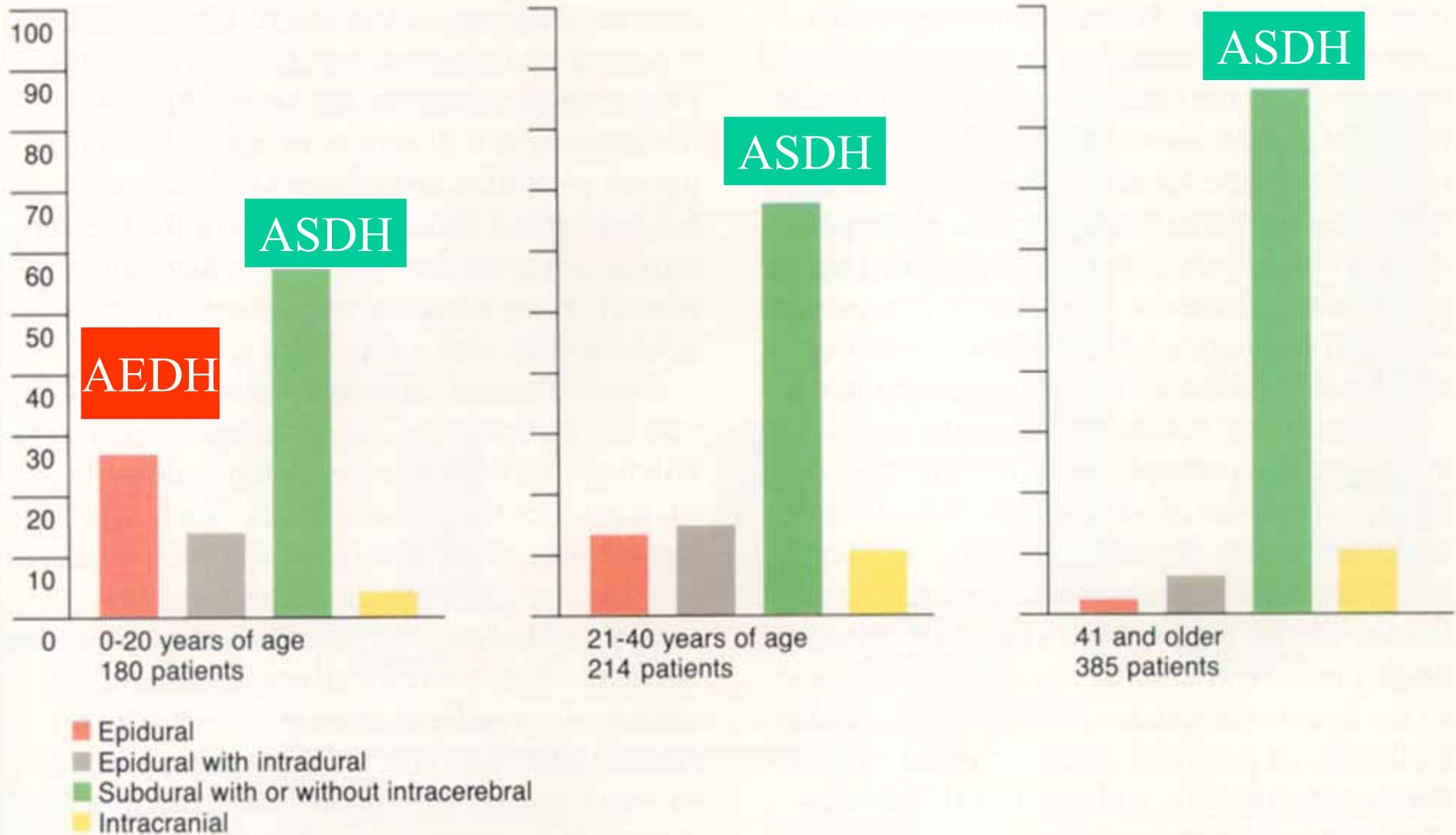


Effect of sharp instrument (Perforating)

## Prevalence of types of hematomas among patients of various age ranges

# Hematomas

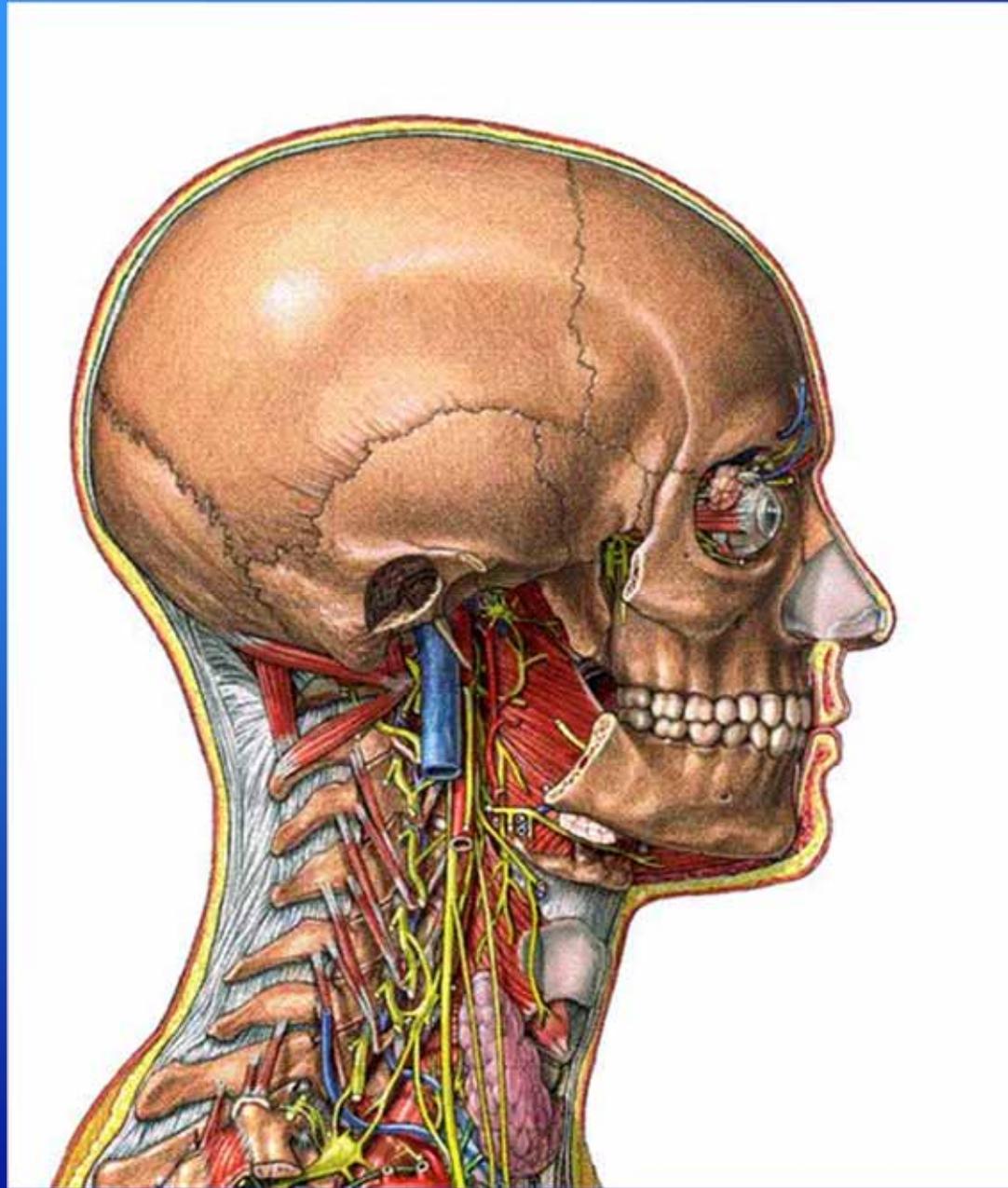
Percent of  
hematoma patients

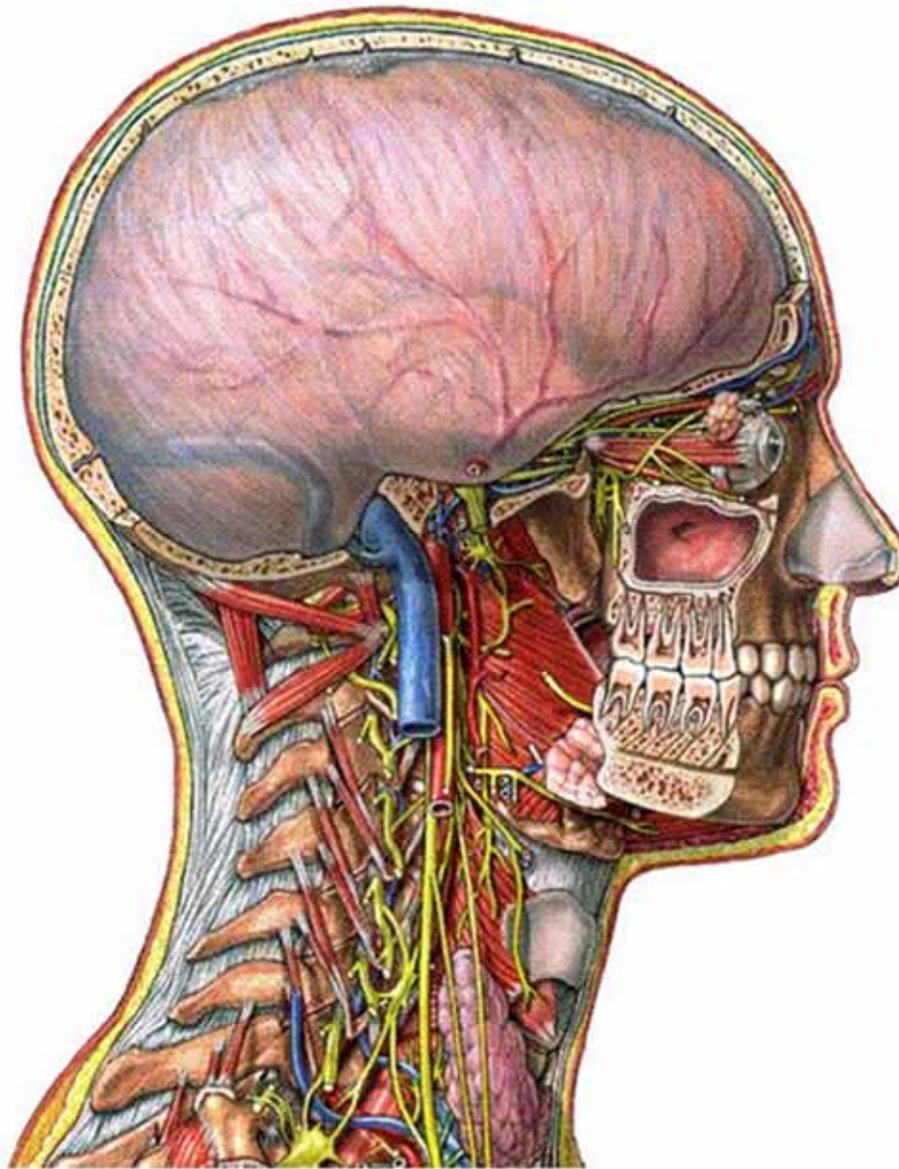


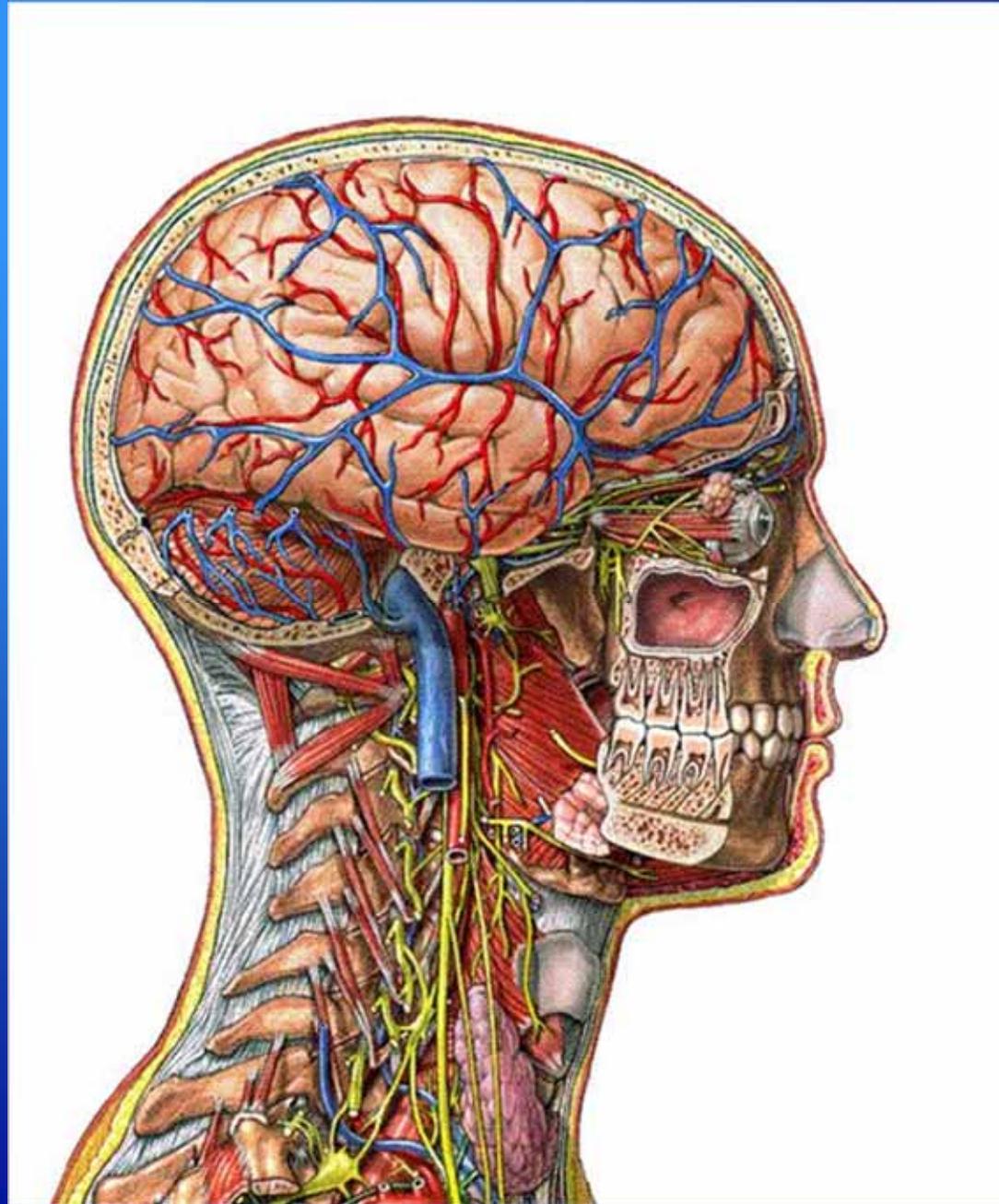
Adapted with permission from Jennett B, Teasdale G: *Management of Head Injuries*. Philadelphia, F A Davis Co, 1981.

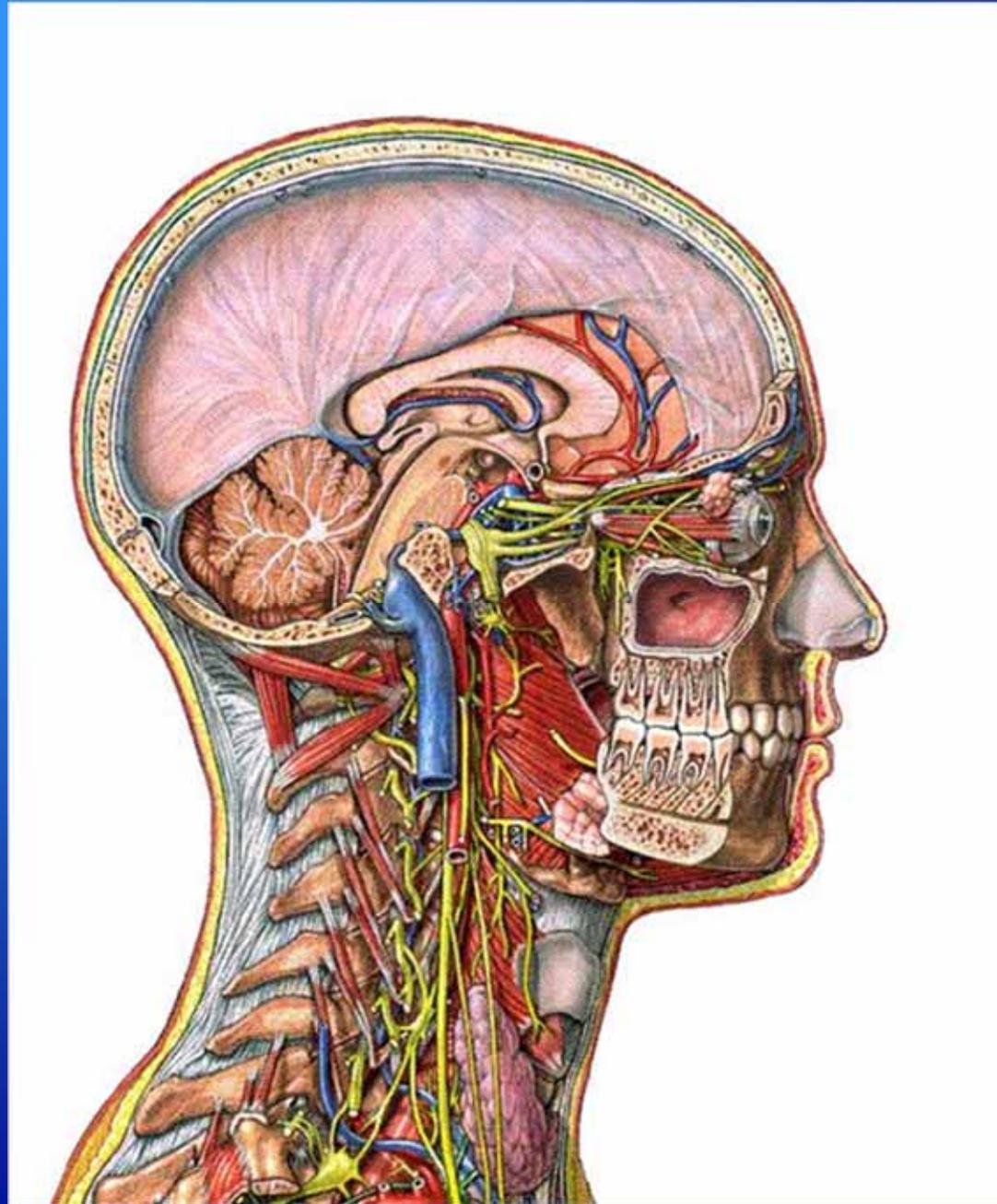
# UNDERSTANDING THE PATHOPHYSIOLOGY

- **Anatomy**
- **Monro-Kellie Doctrine**
- **Langfitt curve**
- **Cerebral perfusion**
- **Intracranial pressure**
- **Cerebral herniation**



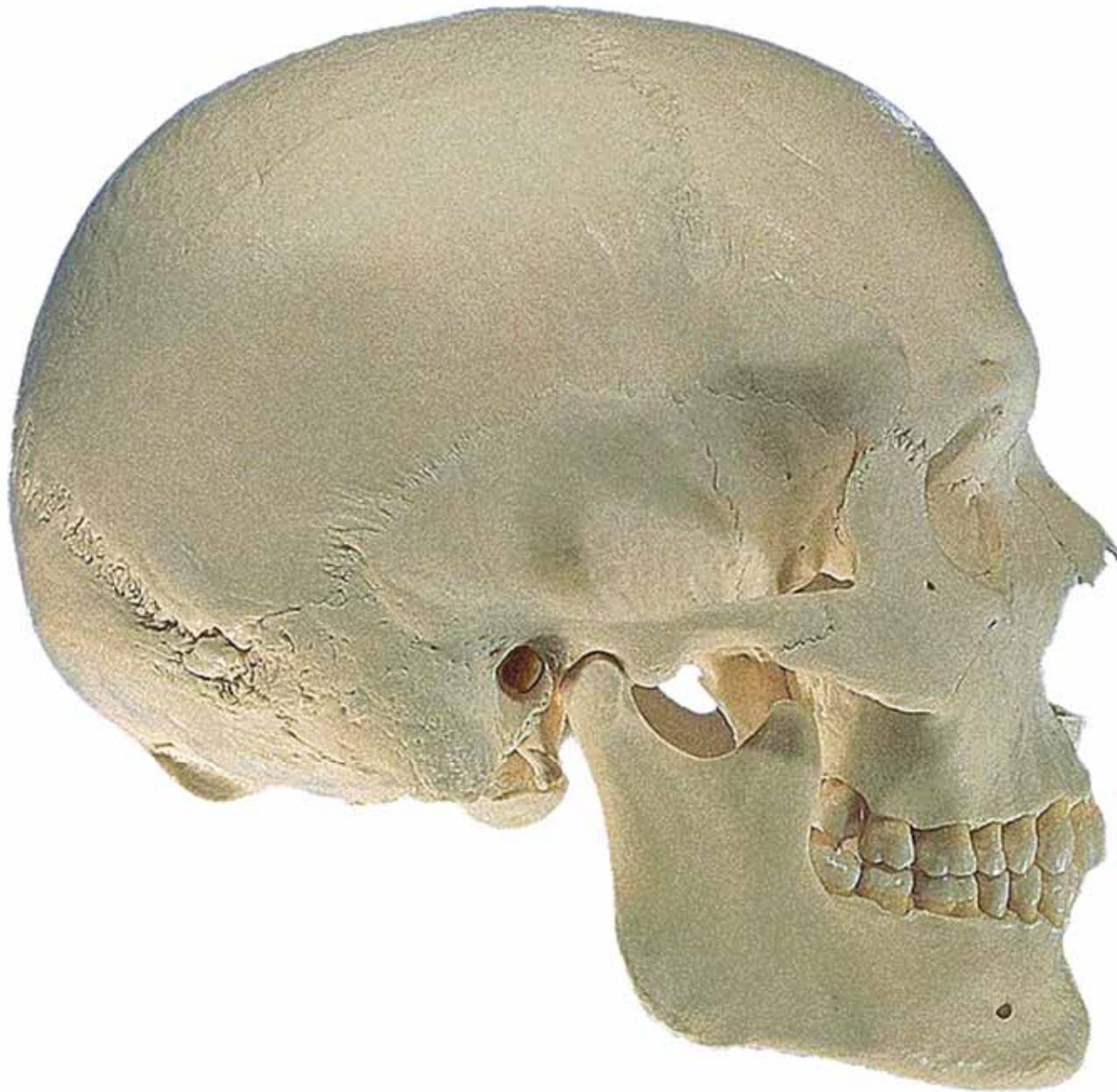






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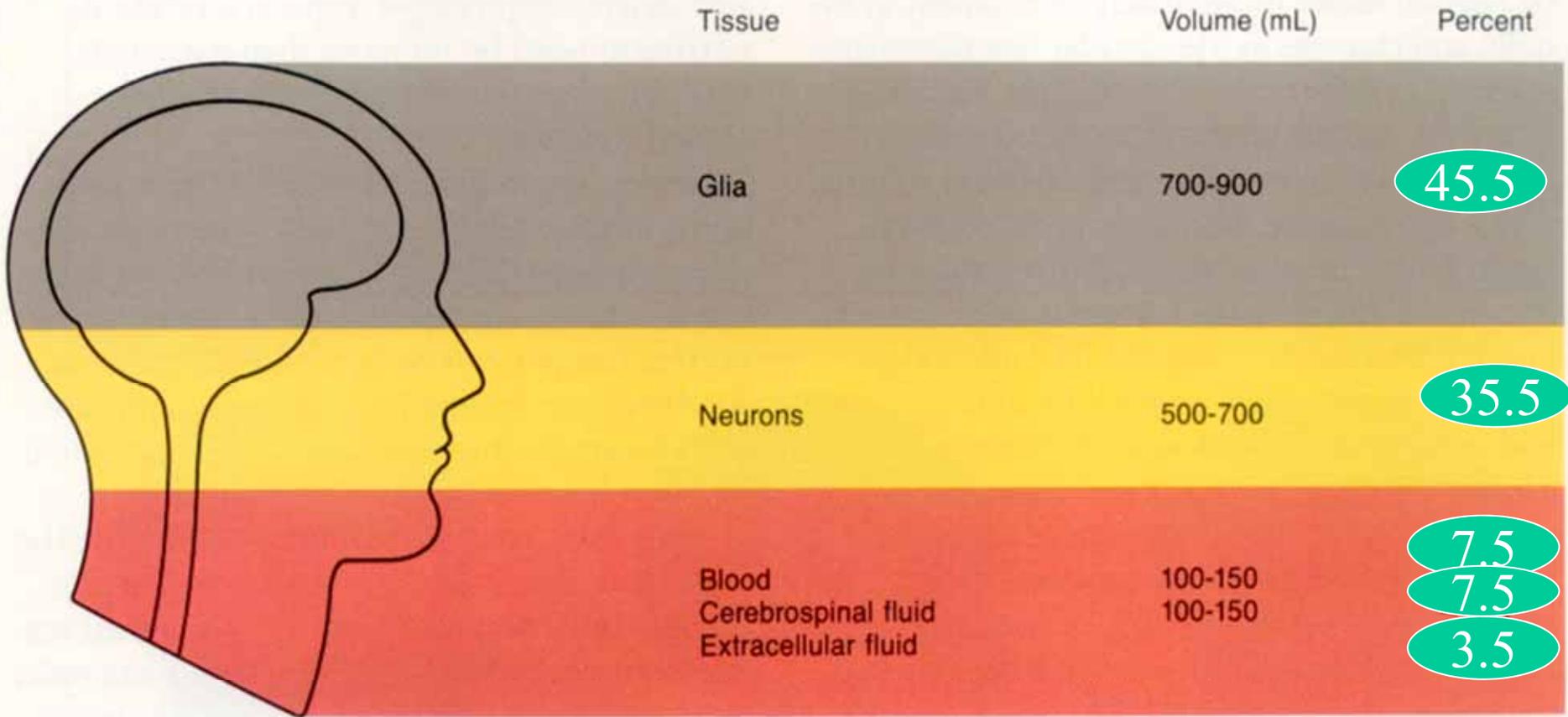


# RAISED INTRACRANIAL PRESSURE

- **Monro-Kellie Doctrine :**

$$V \text{ total } (\kappa) = V \text{ blood} + V \text{ csf} + V \text{ brain}$$

## Relative volumes in the normal brain



$$V \text{ constant} = V \text{ brain tissue} + V \text{ cerebrospinal fluid} + V \text{ blood}$$

The relative volume of the blood (arterial and venous), the cerebrospinal fluid, and the extracellular space are extremely small compared to the total volume and to the volume of the cerebral tissue. All these are important factors

in compensation for increases in volume of intracranial tissue components. It can be seen that potential volume compensation is limited.

# UNDERSTANDING THE PATHOPHYSIOLOGY

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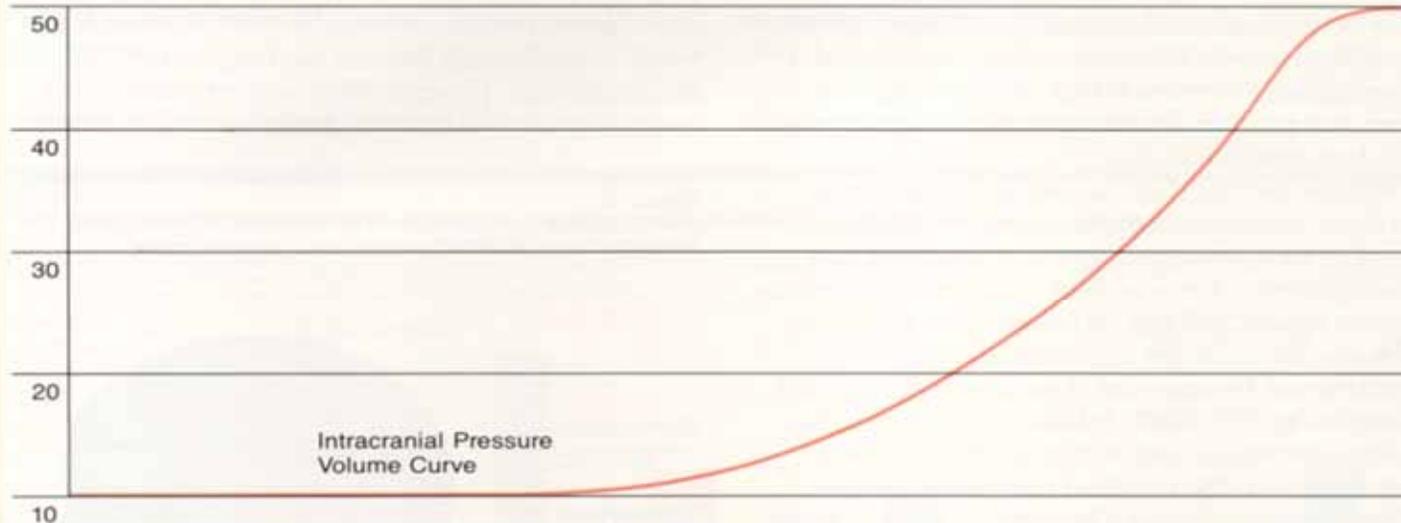
# RAISED INTRACRANIAL PRESSURE

- **Langfitt Curve**

**Volume / Pressure Curve**

The pressure-volume curve: Compensation by intracranial components to expanding mass lesion

Pressure (mm Hg)



Equilibrium state



To spinal theca

Compensated state



To spinal theca

Uncompensated state



To spinal theca

- Brain volume
- Arterial volume
- Venous volume
- CSF volume

- Volume of mass lesion

Adapted with permission from Ward JD, Becker DP, Mickell J, Keenan R: Intracranial pressure, head injuries, subarachnoid hemorrhage, non-surgical coma and brain tumors, in Shoemaker WC, Thompson WL

(eds): *Critical Care, State of the Art*, vol 2R. Fullerton, CA, The Society of Critical Care Medicine, 1981, chap 1.

## Compensatory maintenance of intracerebral pressure: Potential contribution by anatomic compartment

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Supratentorial  
compartment **50 %**

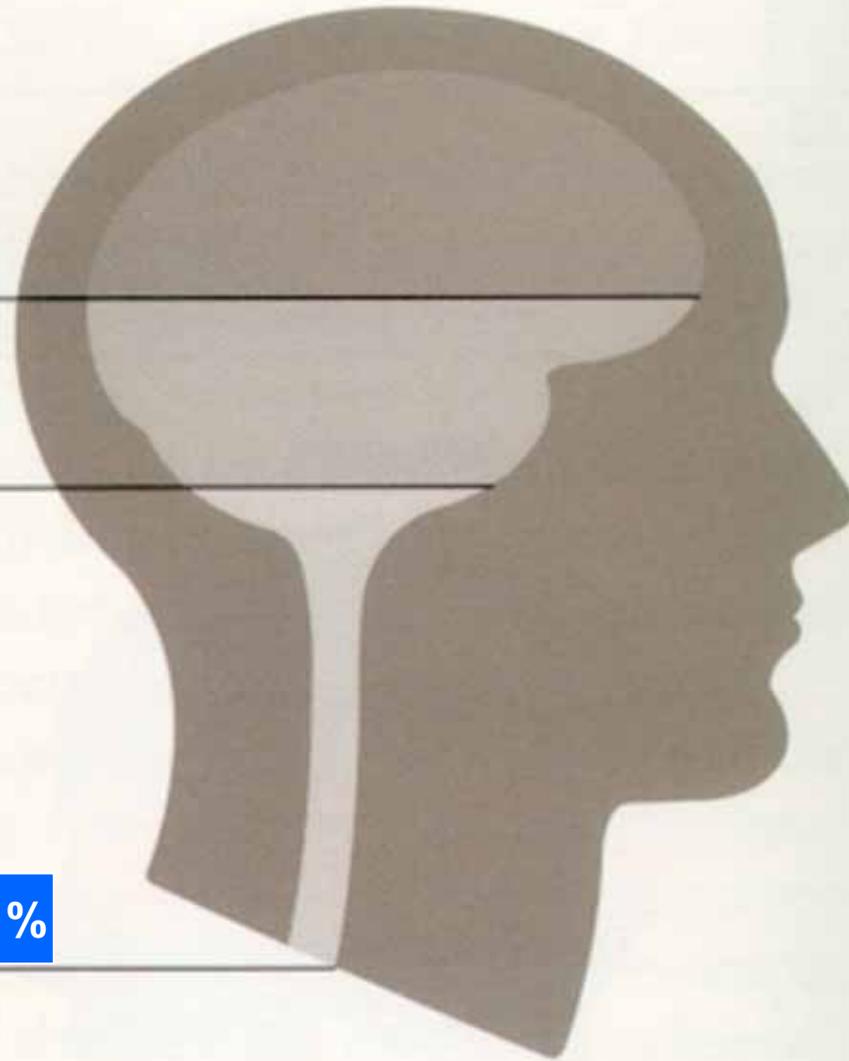
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Infratentorial  
compartment **30 %**

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Spinal thecal sac **20 %**

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*Autum dry leaves*  
Oil on canvas. Size-  
1994  
73 x 107 cm

# RAISED INTRACRANIAL PRESSURE

- RATE?

**Time frames re. V/P curve**

**acute vs. subacute vs. chronic**

# UNDERSTANDING THE PATHOPHYSIOLOGY

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# CONSEQUENCE OF RICP

- **CPP = MAP - ICP**
- **MAP related to flow in a tube -**  
$$Q = \kappa \times P \times r^4 / 8 L \times \mu$$
- **Q = 50 ml/100 g brain tissue/min**

# ICP TREATMENT THRESHOLD

- ICP treatment at  $> 20\text{mmHg}$  (adult)
- Infant  $\sim 10\text{mmHg}$
- Child  $\sim 15\text{mmHg}$
- Interpretation and treatment based on frequent clinical exam

# Cerebral Perfusion Pressure

## CPP Treatment Threshold

$$\text{MAP} - \text{ICP} = \text{CPP}$$

- Maintain CPP
- > 55 (infant)
- > 60 (1-5yrs)
- > 65 (5-12 yrs)
- > 60 mmHg (>12 yrs) 2003 revision

# MANNITOL

- **20% solution in boluses (0.25 - 1.0 g/kg)**
- **ICP falls within 5-10 minutes**
- **Maximum effect +/-60 minutes**
- **Total effect lasts 3-4 hours**

- **Osmotic diuretic**
- **Plasma expansion → decreased blood viscosity → RHEOLOGY**
- **Reduces RBC rigidity**
- **Free radical scavenger**
- **May reduce CSF production**

- **Dehydration and hypotension**
- **Expansion of an intracranial haemorrhage**
- **Electrolyte disorders → hyperkalaemia**
- **Hyperosmotic pre-renal renal failure**

# Hypertonic saline

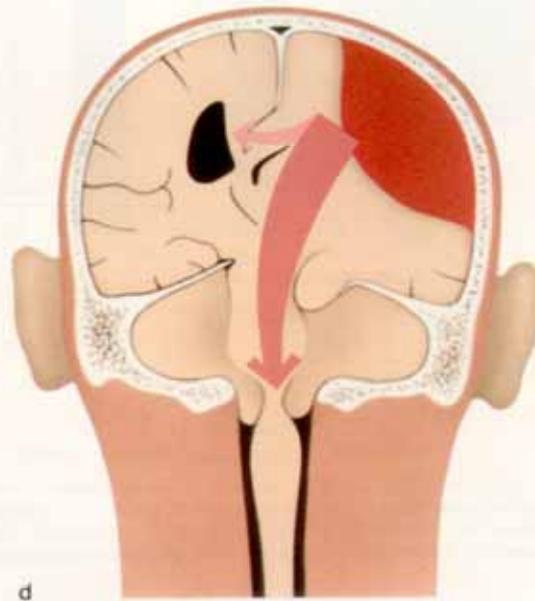
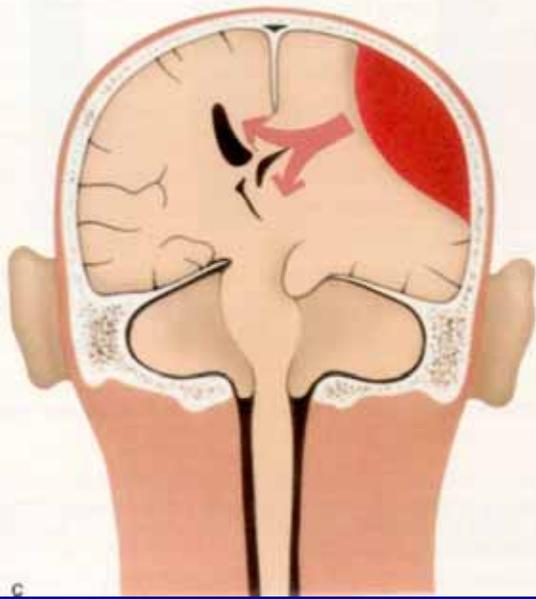
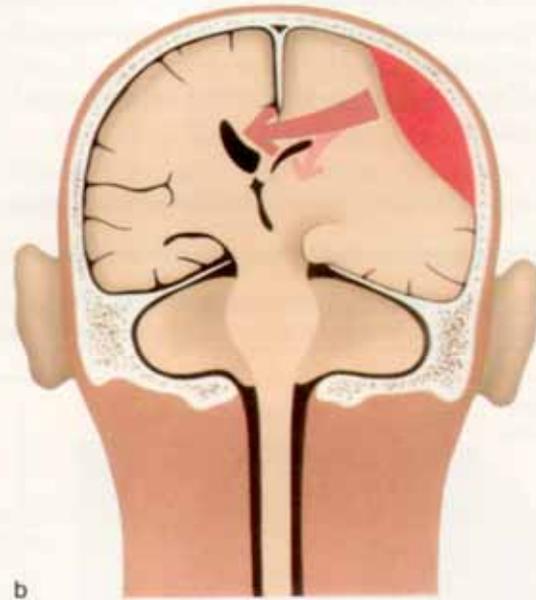
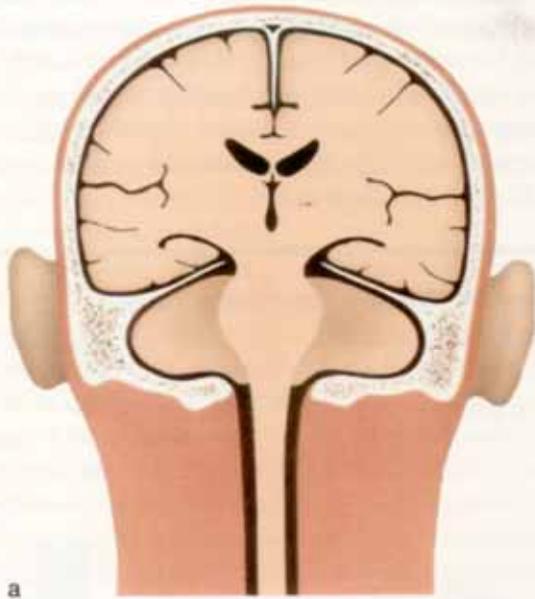
- Increasingly used as alternative to mannitol
- Conc. Varies 1.7 % - 29.2 %
- ↓ cerebral oedema
- ↑ CBF (↓ endothelial cell volume)
- ↓ RBC size, ↑ capillary lumen
- ↓ ICP in patients refractory to mannitol
- 1-2 ml/kg/hr (2, 3 & 7.5 % solutions)

*Shackford et al, J Neurosurg 1992; 76 : 91-8*

# VENTILATION

- **SpO<sub>2</sub> < 90%, or < 7.9 kPa (60 mm Hg) → poor outcome**
- PaCO<sub>2</sub> → cerebral vessel caliber
- 1<sup>st</sup> 24 hours after TBI : ↓ CBF
- Aggressive ↓ PaCO<sub>2</sub> can worsen ischaemia
- **HYPERVENTILATION : ICU - BASED . PaCO<sub>2</sub> 4.5 – 5 kPa**

# Herniation syndrome



# Raised intracranial pressure

- **Cerebral herniation syndromes**

**sub falcine  
tentorial  
foraminal**

# SIGNS OF CEREBRAL HERNIATION

- Fixed dilated pupils
- Asymmetric pupils
- Extensor posturing
- ↓ GCS

# MEDICAL & SURGICAL MANAGEMENT

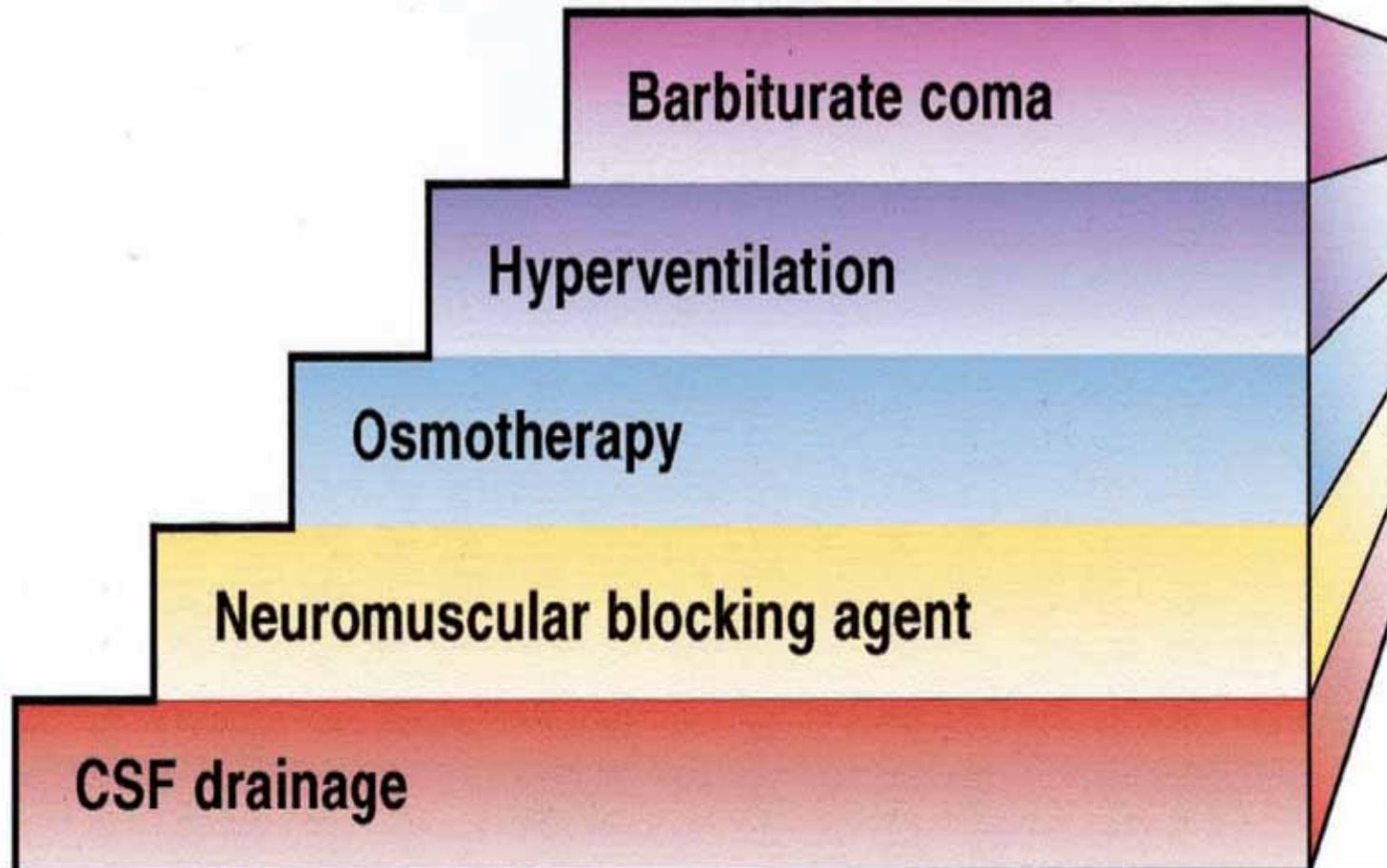
- **Step ladder treatment**

mannitol, ventilation, ICP monitoring,  
EVD (CSF diversion), hypothermia  
(barbiturate coma), antiepileptics, steroids

## Surgery

Burrhole, Craniectomy, Craniotomy,  
decompressive craniotomy

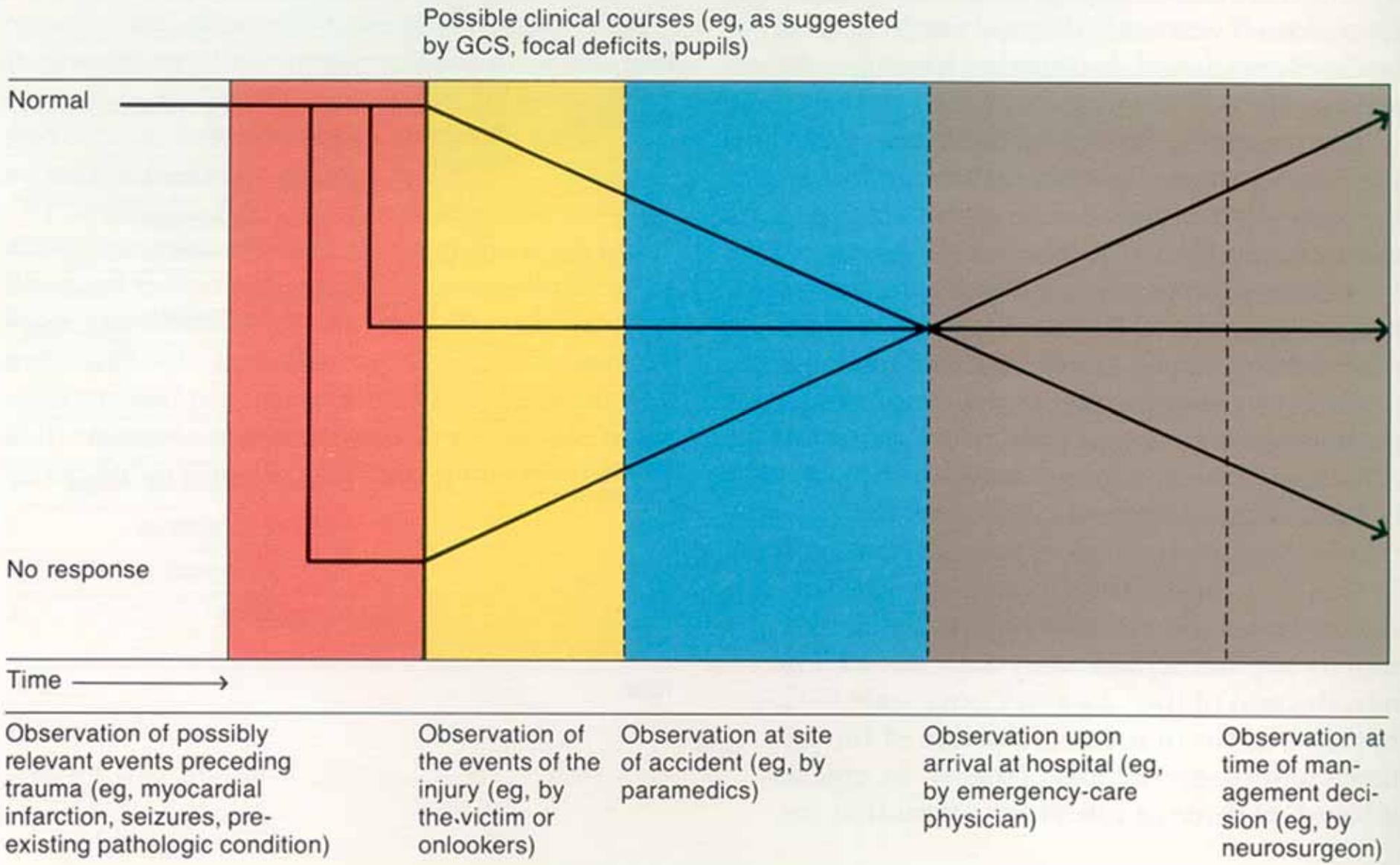
## A. Traditional ICP-directed management strategy



# OBSERVATIONS

- **GCS and variants**
  - pros**
  - cons**
- **Time relationships**
- **Lateralisation**
- **Focal**
- **Non-specific**
- **BP**
- **Arterial oxygenation**

**A schematic representation of possibly relevant events before or after a traumatic incident, highlighting the importance of documentation**



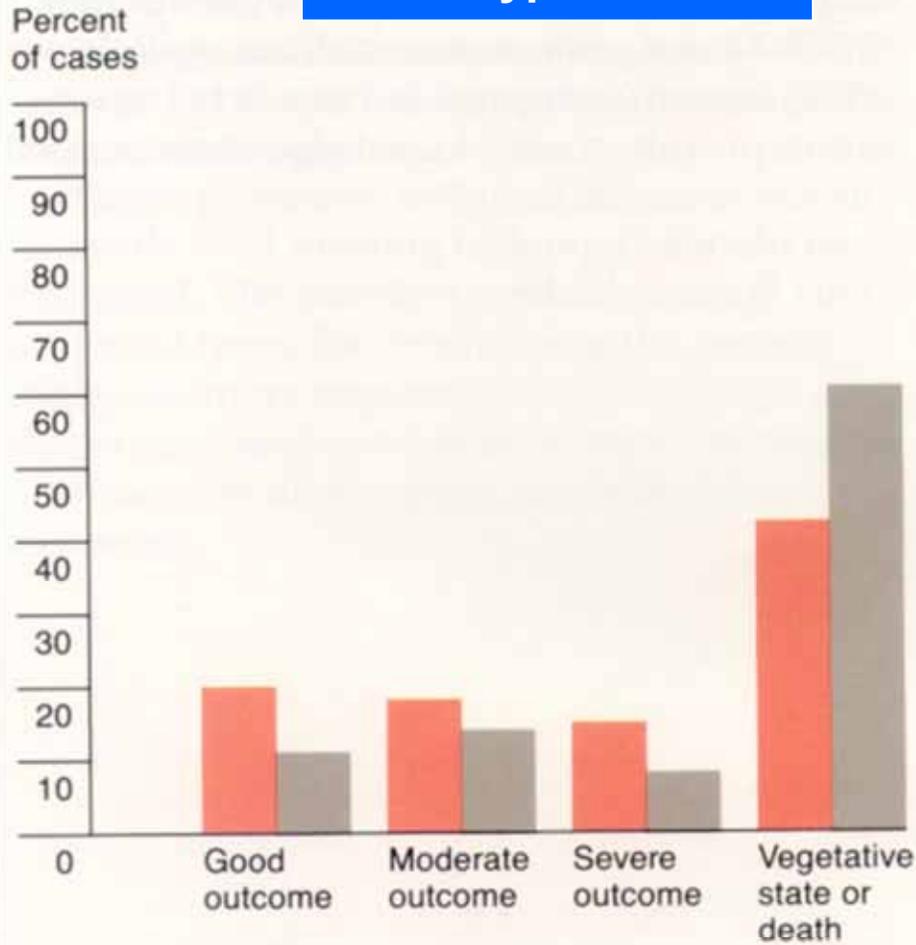
The shaded areas represent potential losses of information by inadequate documentation.

## Secondary injury may be due to

- ↑ ICP
- hypotension
- hypoxia
- hyperpyrexia
- hypocapnoea
- hypoglycaemia

The interrelations between hypoxia and outcome and between shock and outcome

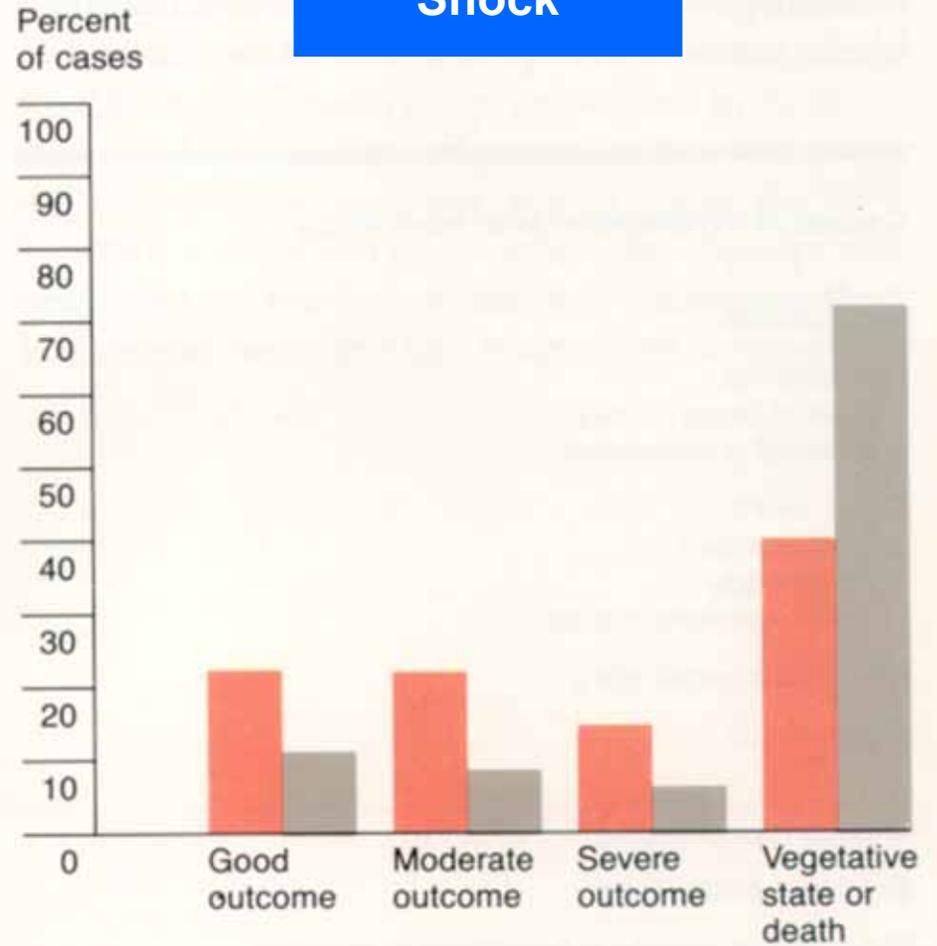
Hypoxia



■ No hypoxia      n = 517  
■ Hypoxia      p < 0.01

Hypoxia  $X^2 = 14.62$ , df = 3

Shock



■ No shock      n = 549  
■ Shock      p < 0.001

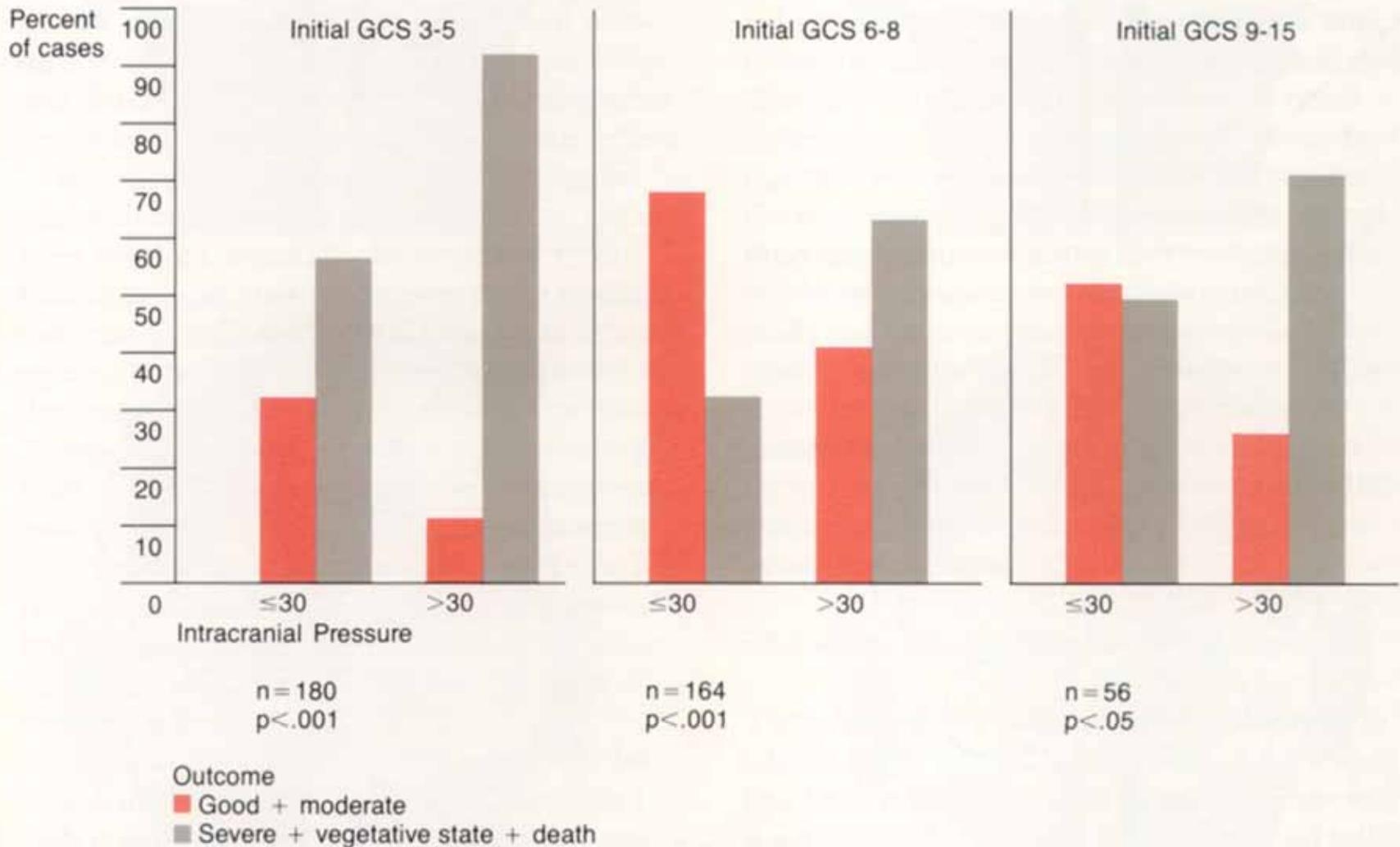
Shock  $X^2 = 47.31$ , df = 3

Adapted with permission from Eisenberg HM, Cayard C, Papanicolaou AC, Weiner RL, Franklin D, Jane J, Grossman R, Tabaddor K, Becker DP, Marshall LF, Kunitz S: The effects of three potentially preventable

complications of outcome after severe closed head injury, in Ishii S, Nagai H, Brock M (eds): *Intracranial Pressure*. New York, Springer-Verlag, 1983, vol 5, pp 549-553.

The relation between intracranial pressure and outcome at three values on the Glasgow Coma Scale

**ICP and GOS**

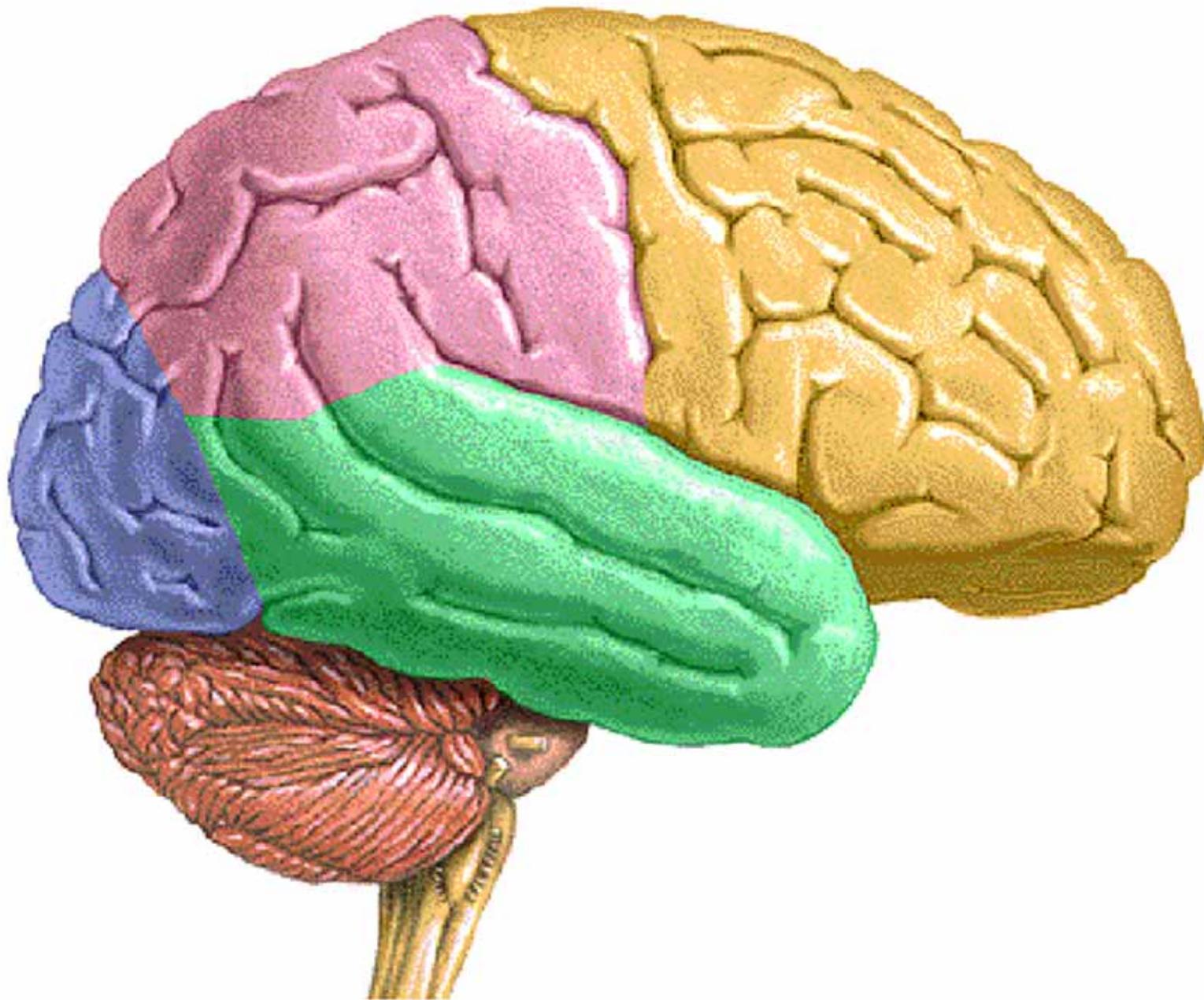


Adapted with permission from Eisenberg HM, Cayard C, Papanicolaou AC, Weiner RL, Franklin D, Jane J, Grossman R, Tabaddor K, Becker DP, Marshall LF, Kunitz S: The effects of three potentially preventable

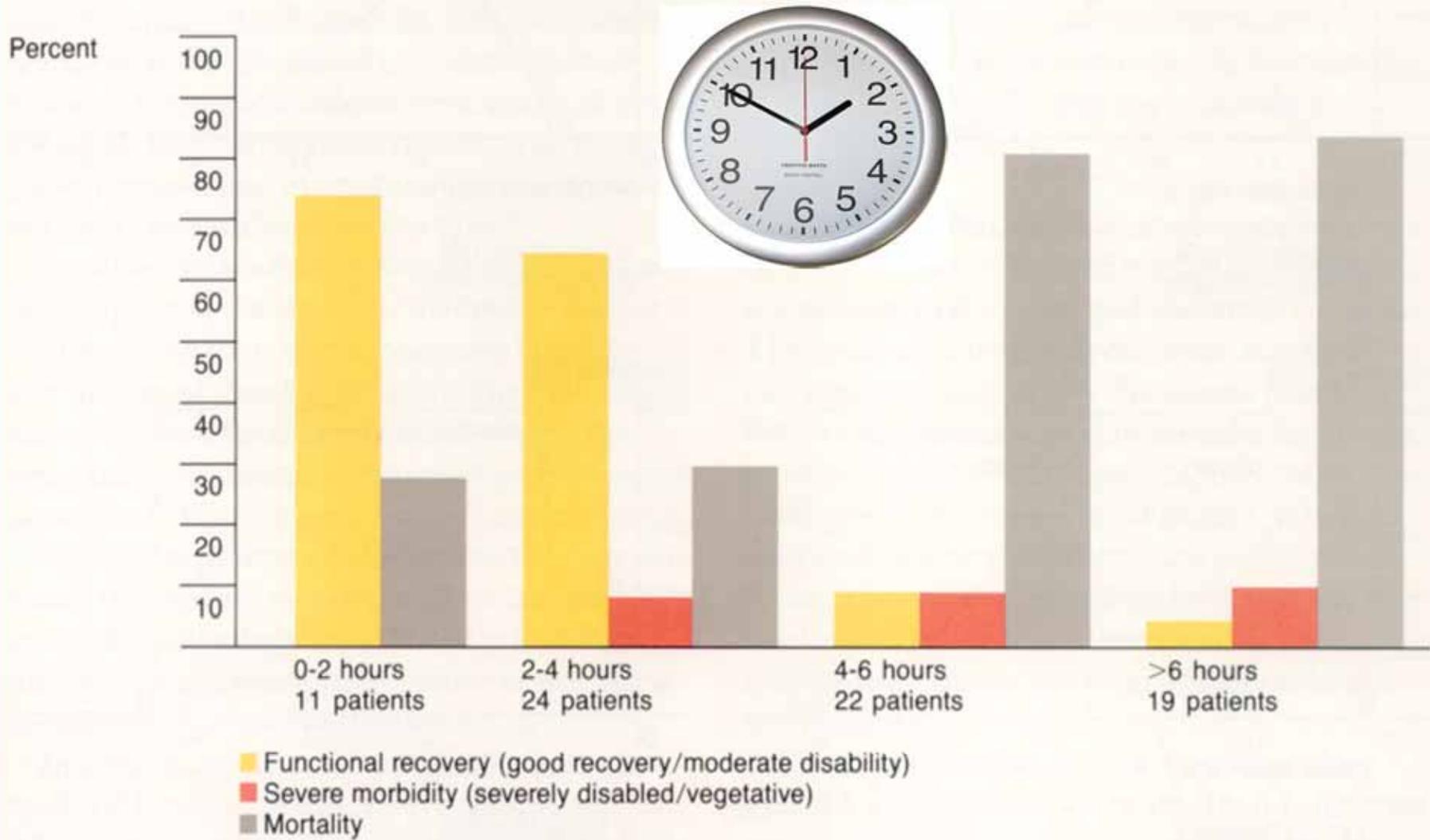
complications of outcome after severe closed head injury, in Ishii S, Nagai H, Brock M (eds): *Intracranial Pressure*. New York, Springer-Verlag, 1983, vol 5, pp 549-553.



*Sunset*  
oil colour  
1999  
30 x 50 cm



# Influence of time delay from injury to surgical intervention on outcome in 76 patients with acute subdural hematoma



Mortality increased significantly when the delay exceeded four hours ( $p < 0.0001$ ). The range of time delay in the group who underwent surgery more than six hours after injury was 6.2 to 18.3 hours.

Reprinted, by permission of the New England Journal of Medicine, from Seelig JM, Becker DP, Miller JD, Greenberg RP, Ward JD, Choi SC: Traumatic acute subdural hematoma. *New Engl J Med* 1981;304:1511-1518.

# CONCEPT OF GOLDEN HOUR



- Roadside to A/E dept

Emergency response time- 15-22 mins (SAMU)

A/E to Operation room

?

# BTF GUIDELINES

## AEDH GUIDELINES :

VOLUME > 30 CC  
MIDLINE SHIFT > 5 MM  
THICKNESS > 15 MM

**REQUIRE CRANIOTOMY +  
EVACUATION OF HAEMATOMA**

## ICH / CONTUSION GUIDELINES :

GCS 6-8, frontal/temporal lesions > 20 cc+ mls  
≥ 5 mm  
AND/OR cisternal compression

GCS 6-8 , lesion > 50 cc

smaller lesions, dropping GCS, refractory ICP

**NEED CRANIOTOMY**

## ASDH

THICKNESS > 10 MM  
MIDLINE SHIFT > 5 MM  
DROP IN GCS BY 2 POINTS OR MORE  
ICP > 20 mm Hg  
PUPIL DILATES

**REQUIRE CRANIOTOMY**

if gcs < 9, icp monitor placed

# RESUSCITATION OF THE BRAIN

- Preservation of **cerebral Perfusion** and **Oxygenation**  
are the first priorities in managing patients with Traumatic Brain Injuries

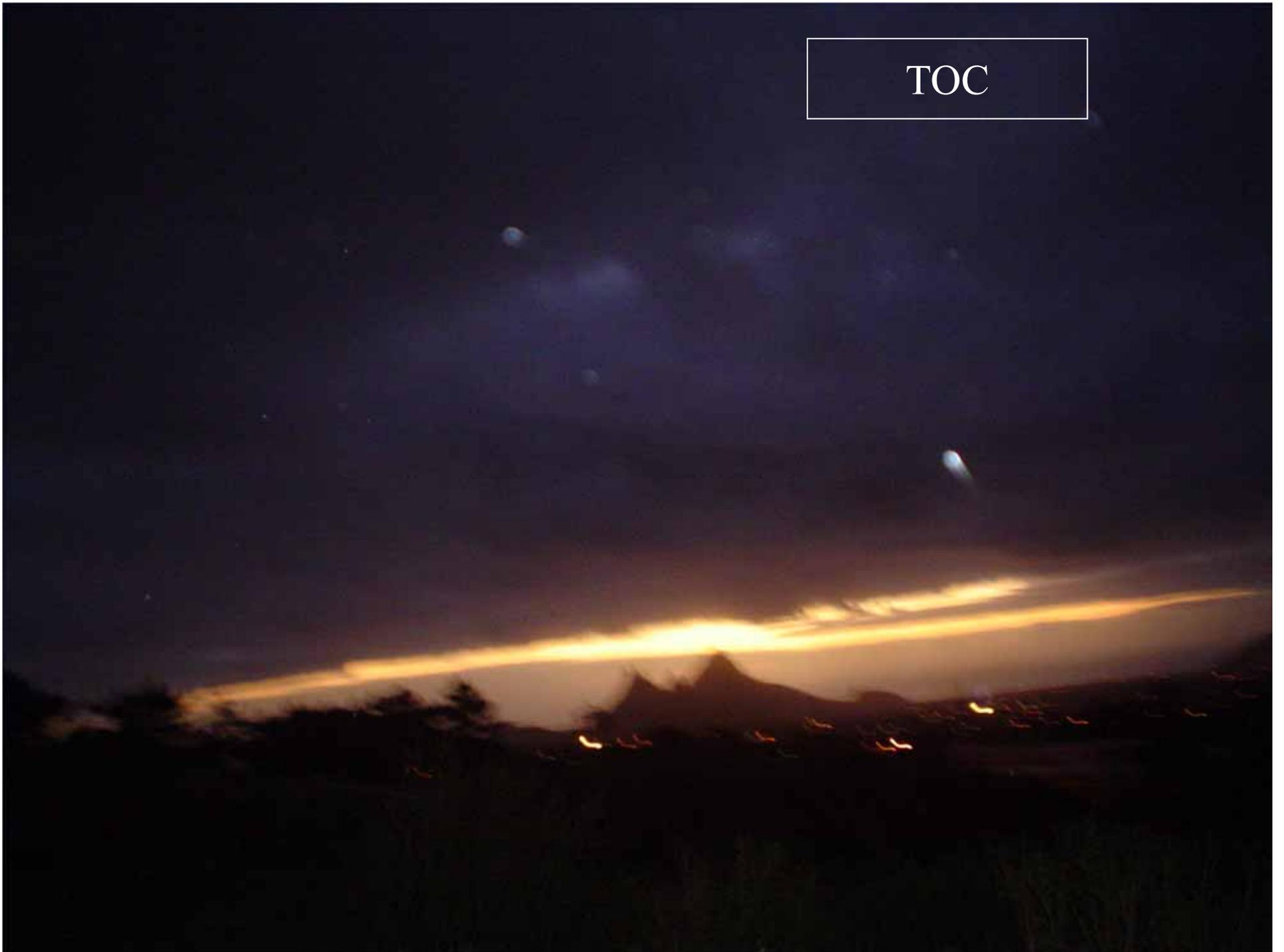
## The two H

**Hypoxemia**  $O_2$  Saturation  $< 90\%$

– Cyanosis, apnea,  $Pa O_2 < 60$  mm Hg

**Hypotension** Systolic  $< 90$  mm Hg

TOC



# TRAUMATIC BRAIN INJURY



**SAMU** EMERGENCY RESPONSE  
VICTORIA HOSPITAL

## ON THE SCENE

- **Remove** the patient from a hazardous situation
- **Airway care with c-spine immobilisation**
- **Breathing , Circulation**



- EMS staff : **continuously** assess & aggressively treat **hypotension & hypoxia**
- **Secure airway in GCS  $\leq$  8**
- Routine hyperventilation : to be avoided  
Use if signs of **cerebral herniation** :
  - dilating pupil,
  - extensor posturing

# SAMU CONTROL ROOM

## VICTORIA HOSPITAL



# SAMU CONTROL ROOM VICTORIA HOSPITAL



# Accident/Emergency dept -Victoria Hospital(Resuscitation)

- Casualty medical officer
- Surgical Resident Medical Officer
- General surgeon
- Neurosurgeon

# ACCIDENT EMERGENCY THEATRE

## VICTORIA HOSPITAL



# REANIMATION ROOM

## VICTORIA HOSPITAL



# REANIMATION ROOM

VICTORIA HOSPITAL

• REANIMATION ROOM •

65J



# Intensive Care Unit (VH)

- ICP (Intra-cranial pressure monitoring)
- Ventilation
- Neurological observations
- Neurosurgical personnel
- ICU residents

# GENERAL ICU VICTORIA HOSPITAL





# Investigations

- X Rays
- CT scan
- MRI

Transportation of patient (intubation, monitoring)

Secondary head injury (hypoxia, hypotension)

# CT SCAN VH



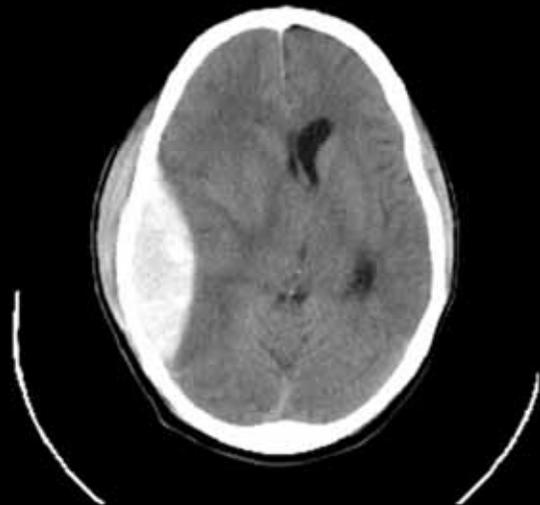
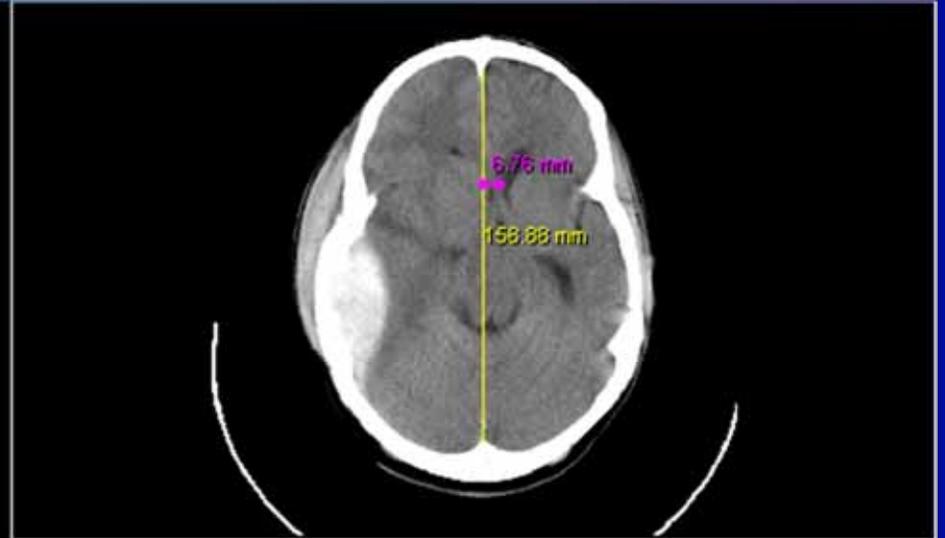
# MRI VH



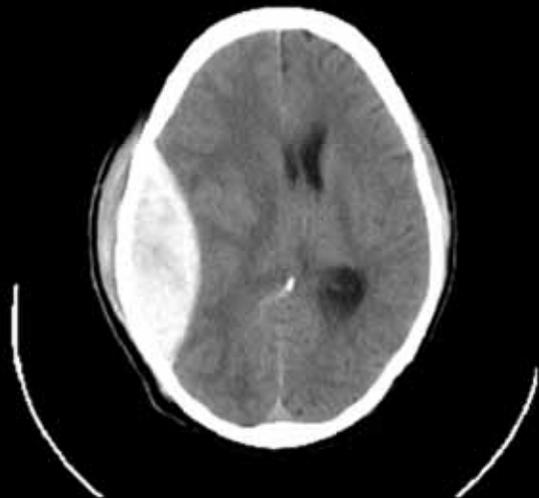
- **The examination and imaging will tell you where it is ;**

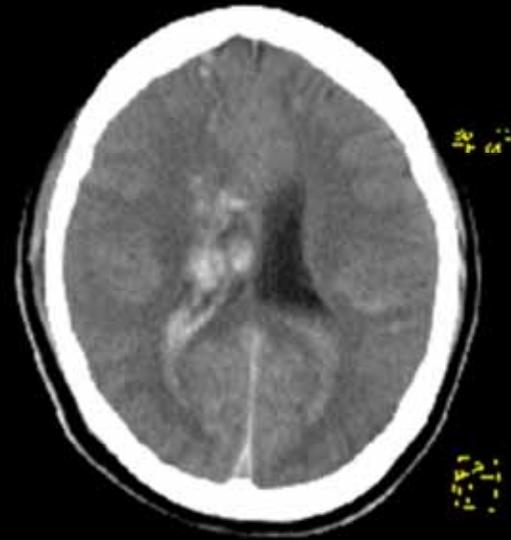
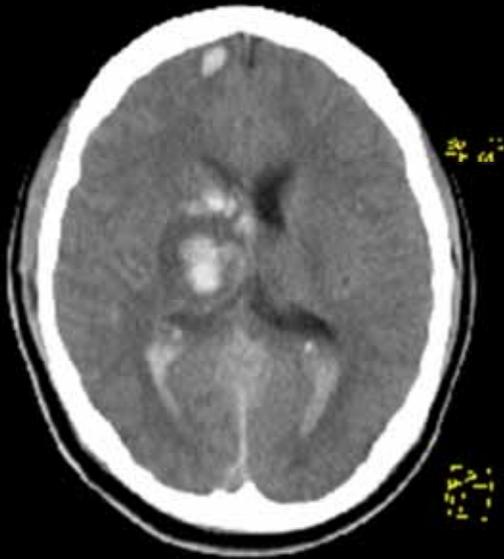
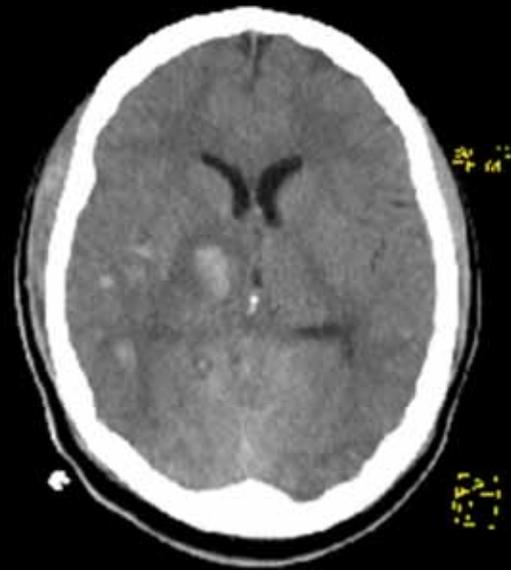
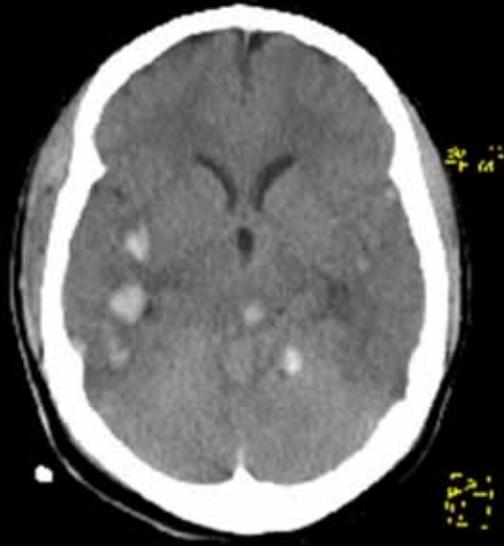
**but,**

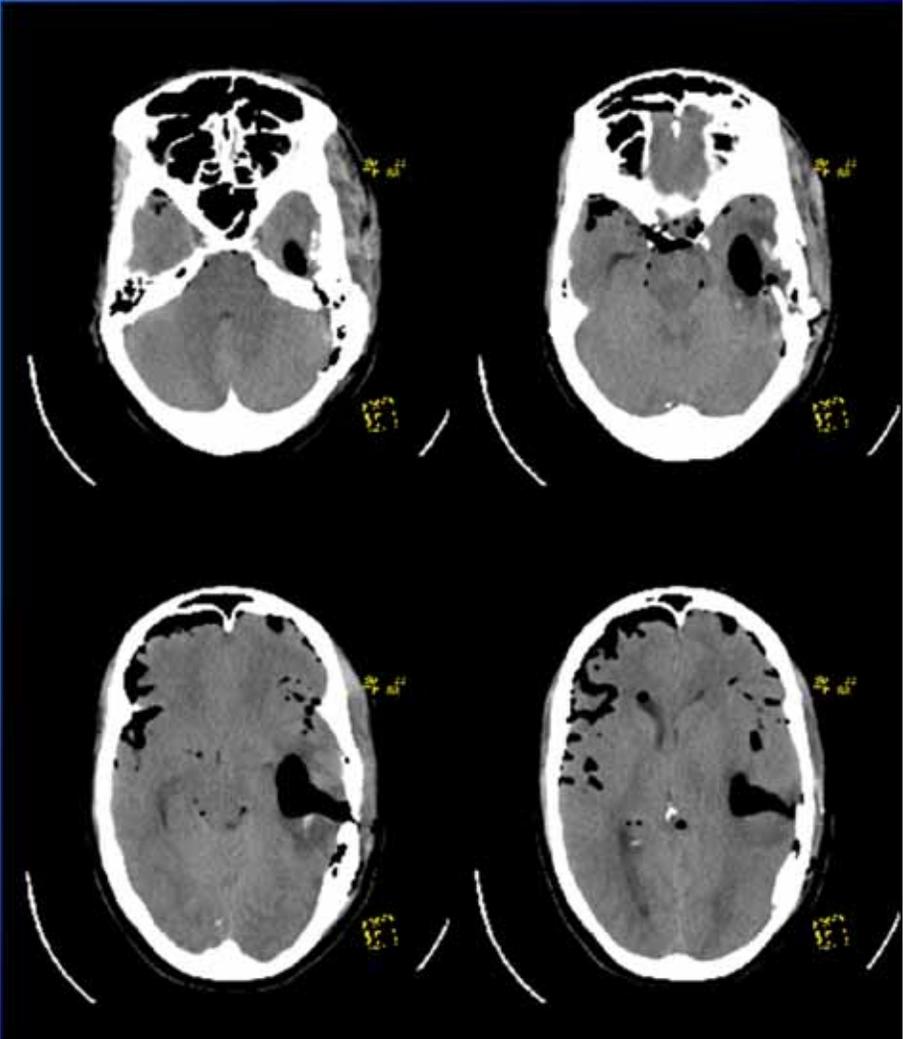
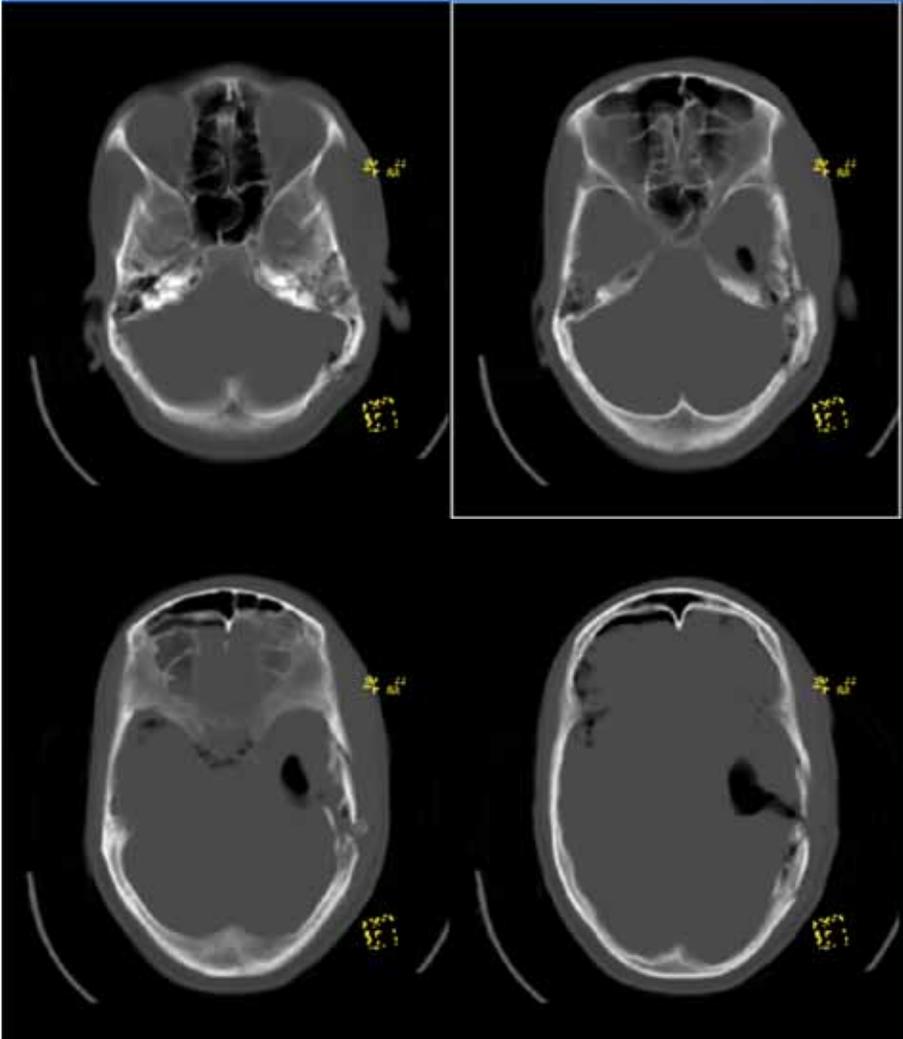
- **The history will tell you what it is .**



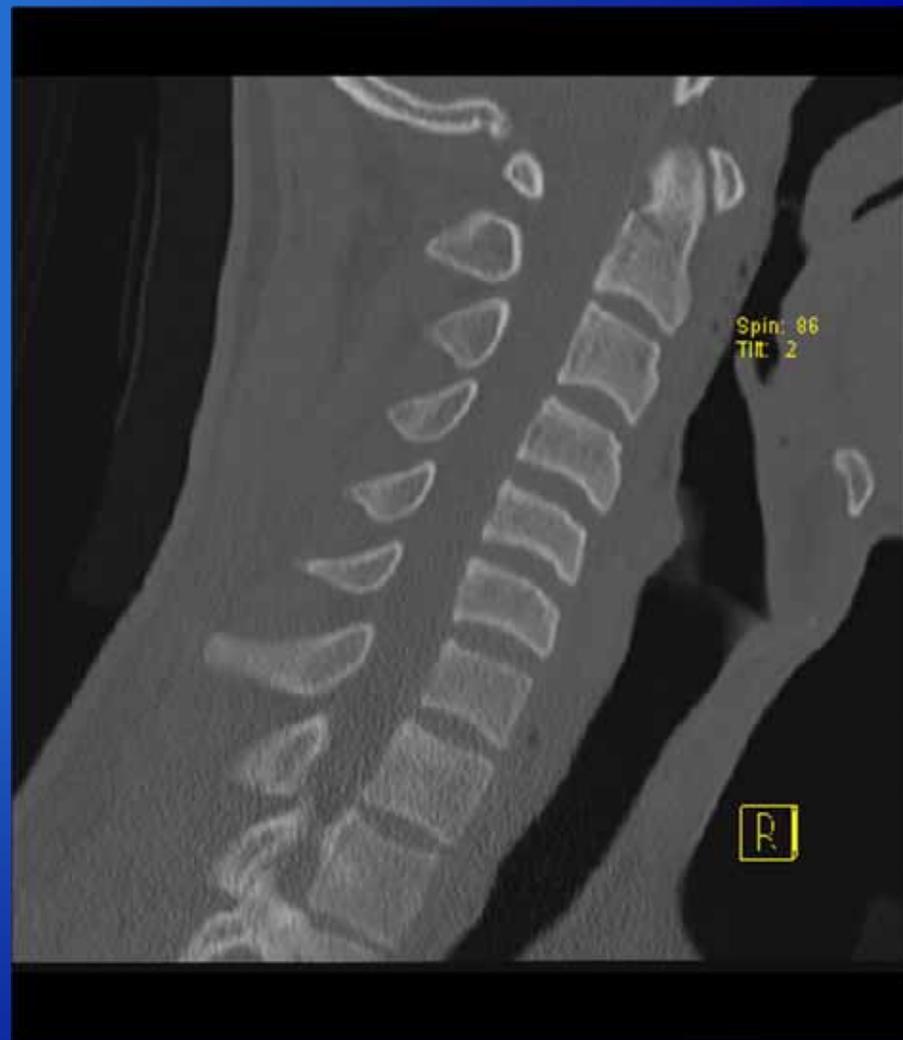
AEDH

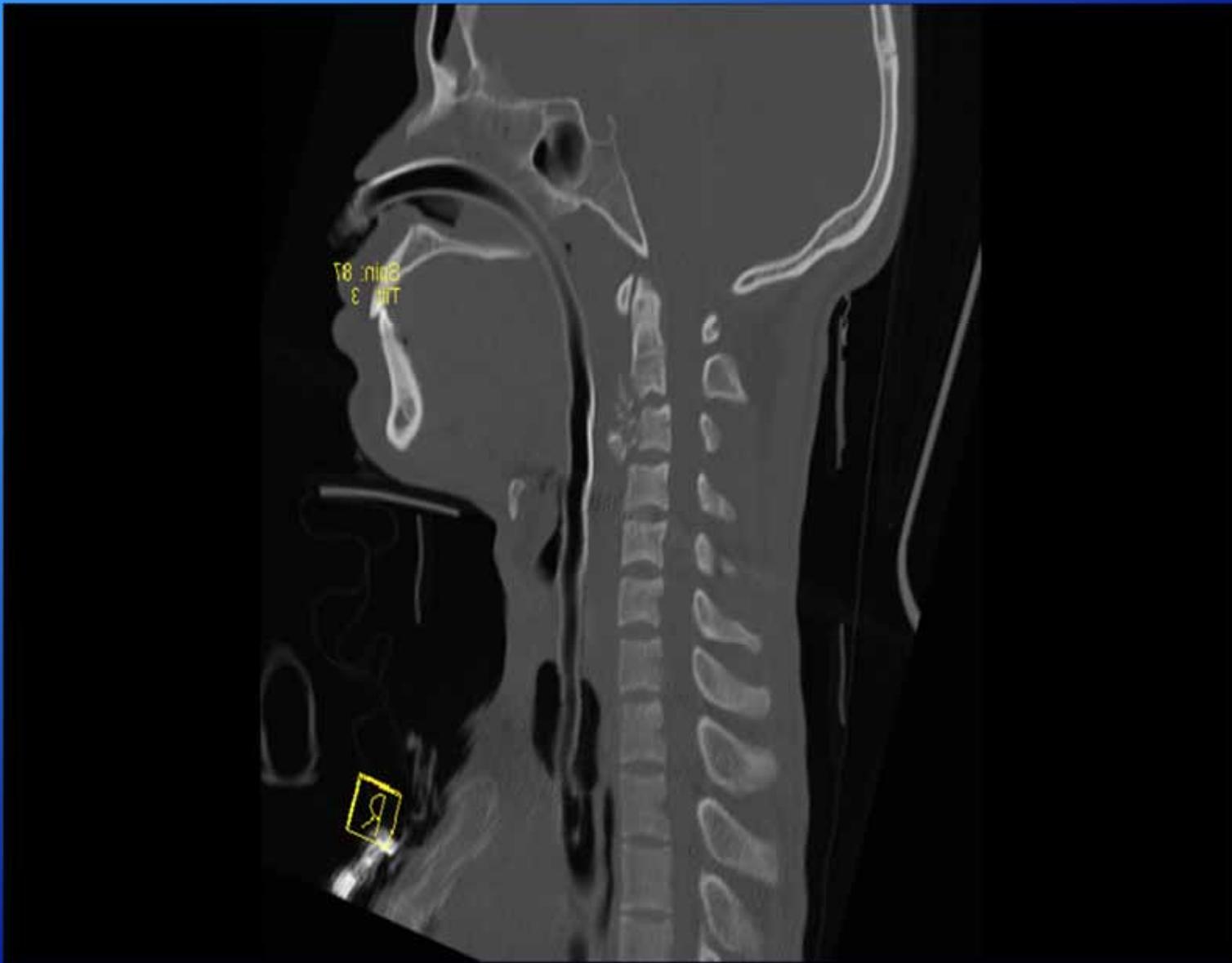






# ABC-CSPINE







OPERATING THEATRE  
VICTORIA HOSPITAL

# ICP monitoring

- Detect evolving SOL
- ICP an independent predictor of outcome
- ICP monitoring use :  $\uparrow$  32 % in 1995  
78 % in 2005

## Increased ICP

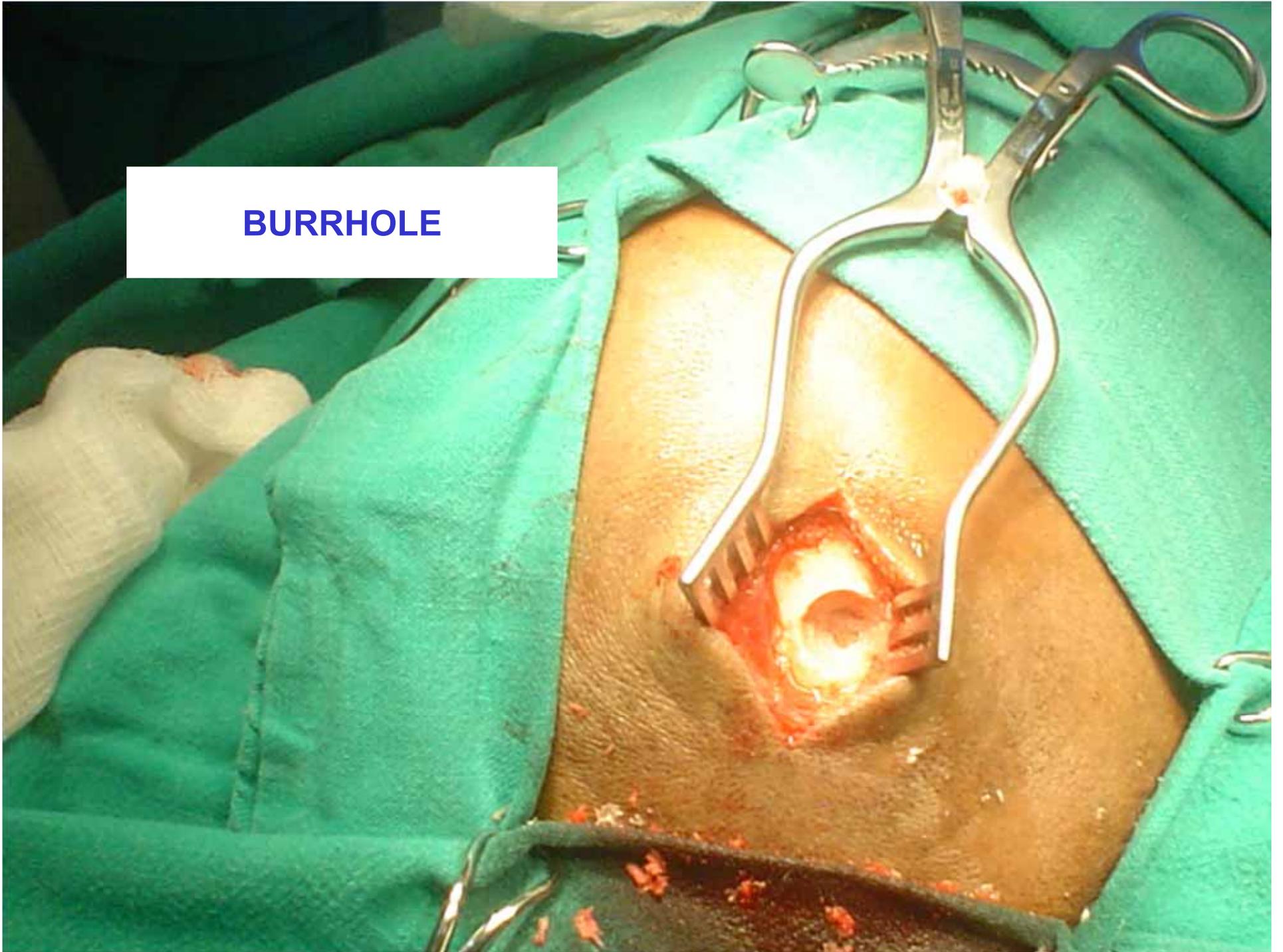
- Normal <15 mmHg
- Elevated >20 mmHg
- Severe >40 mmHg

# SCALP INCISION

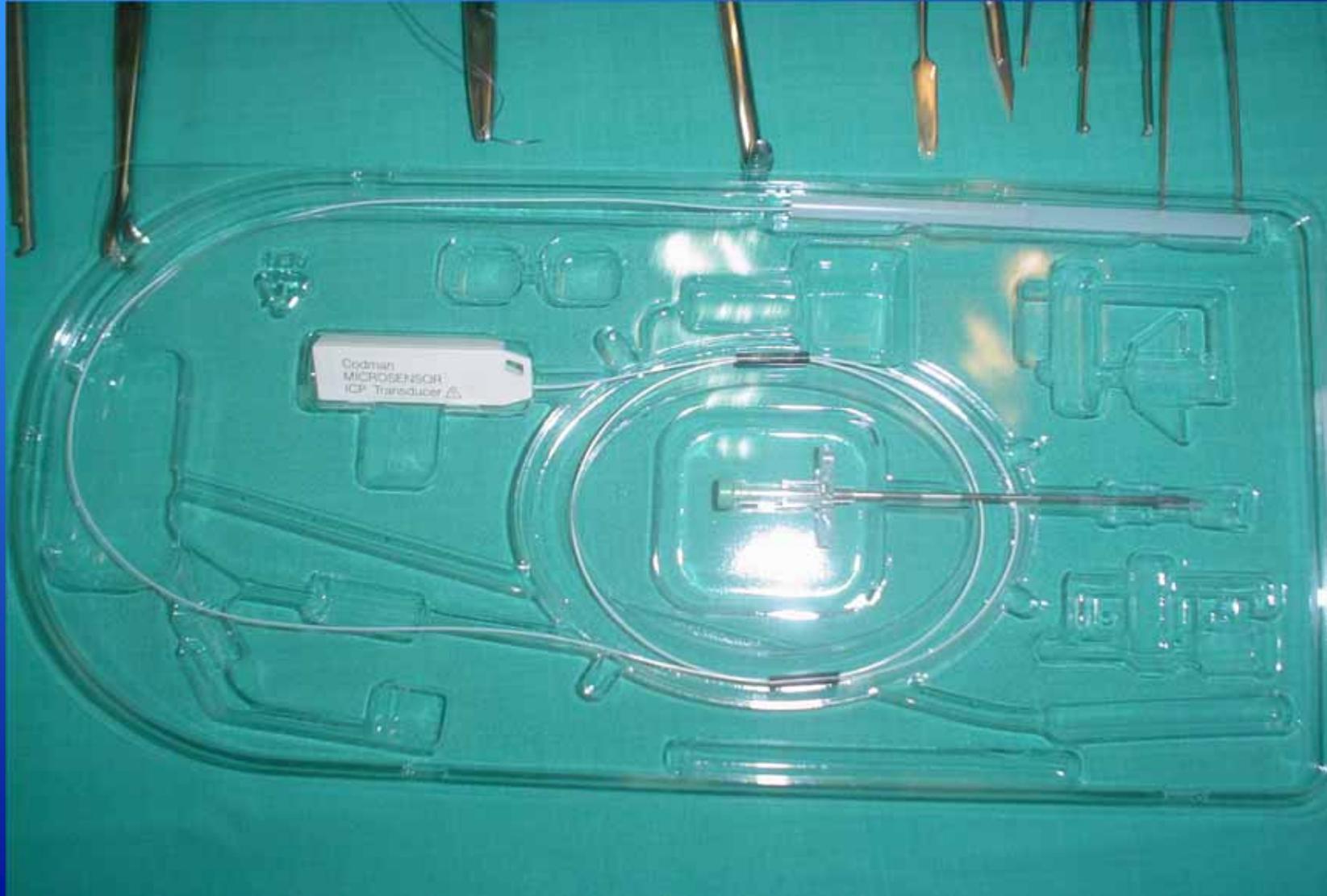


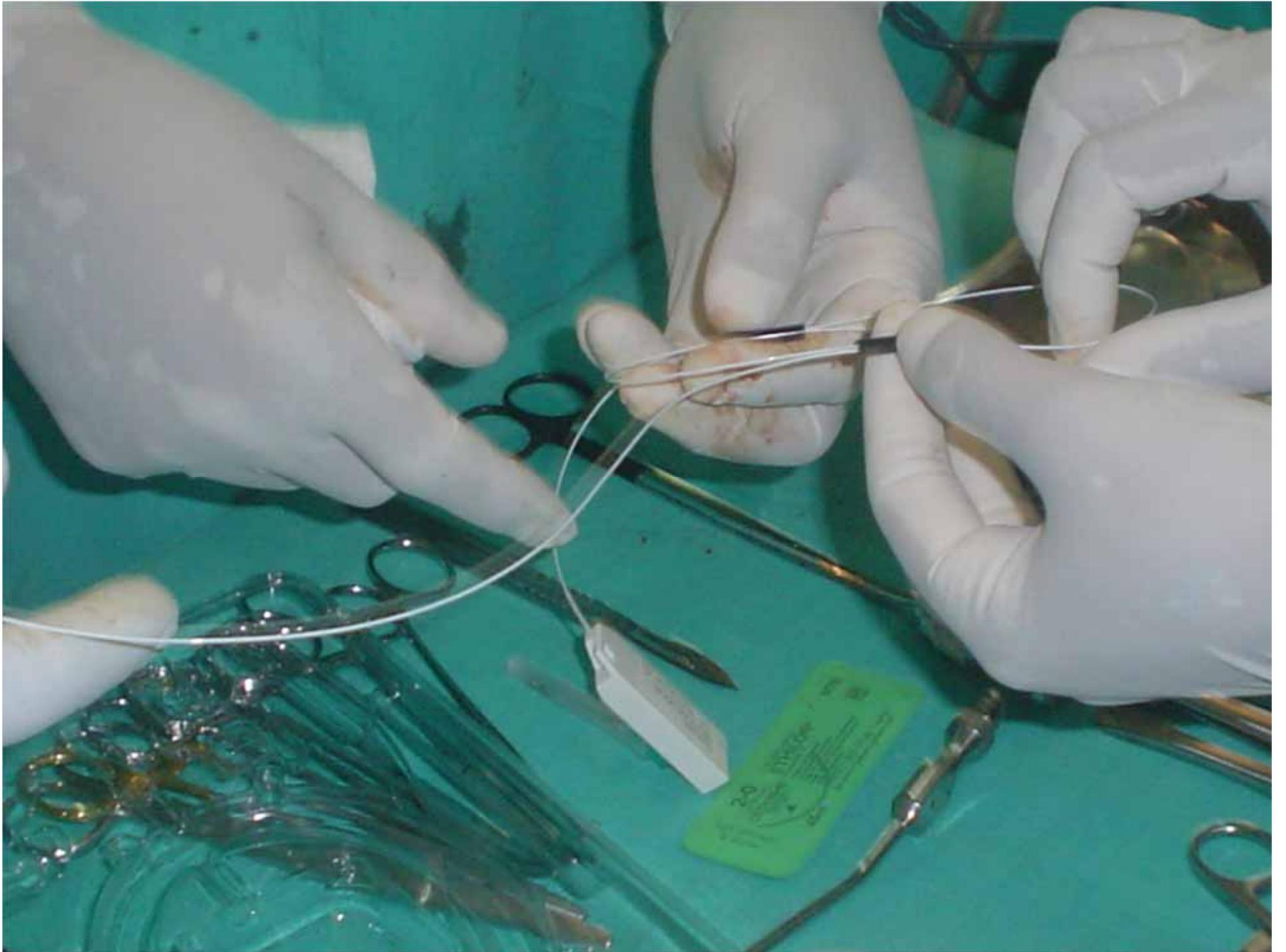


**BURRHOLE**



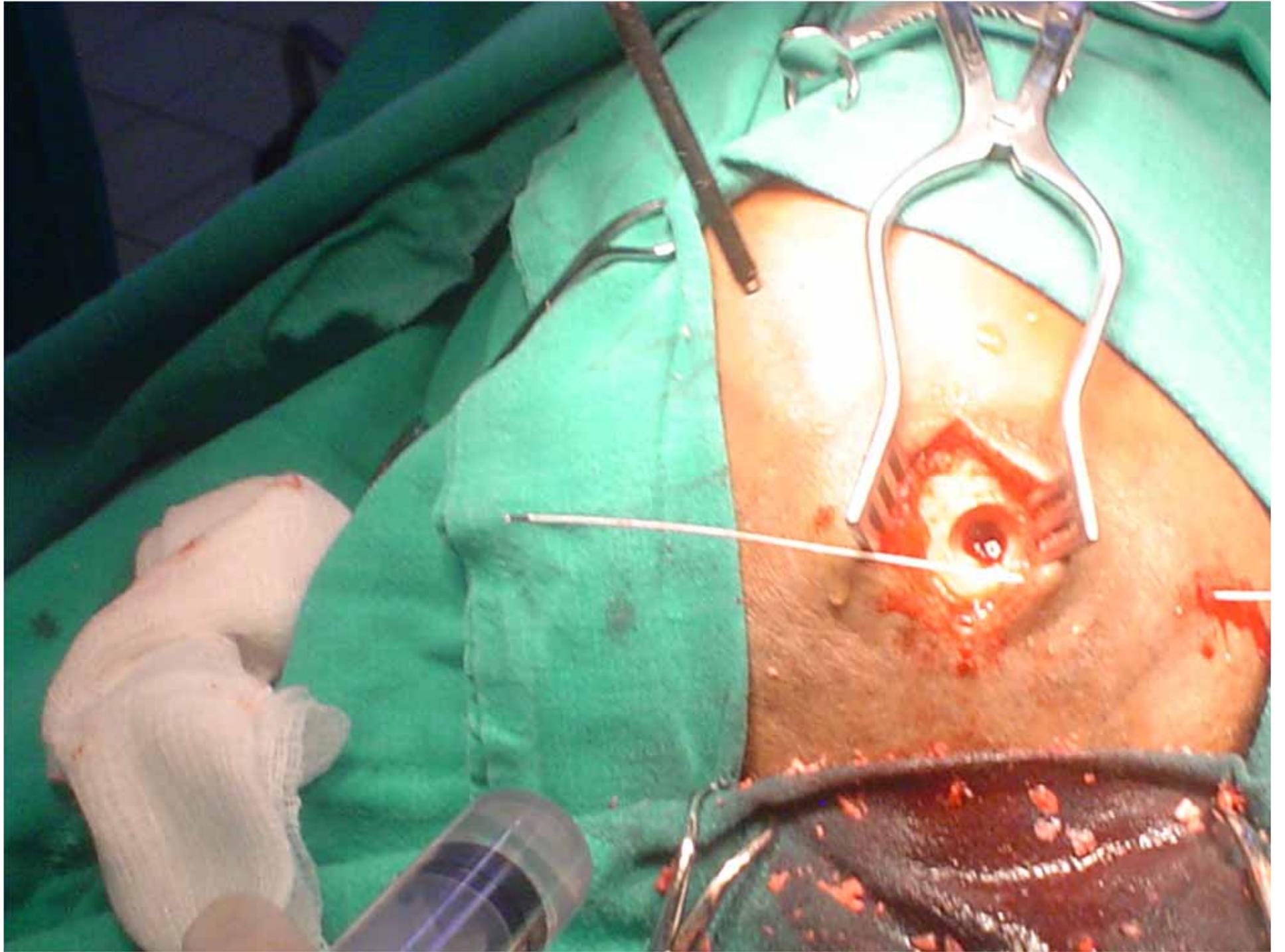
# ICP CATHETER

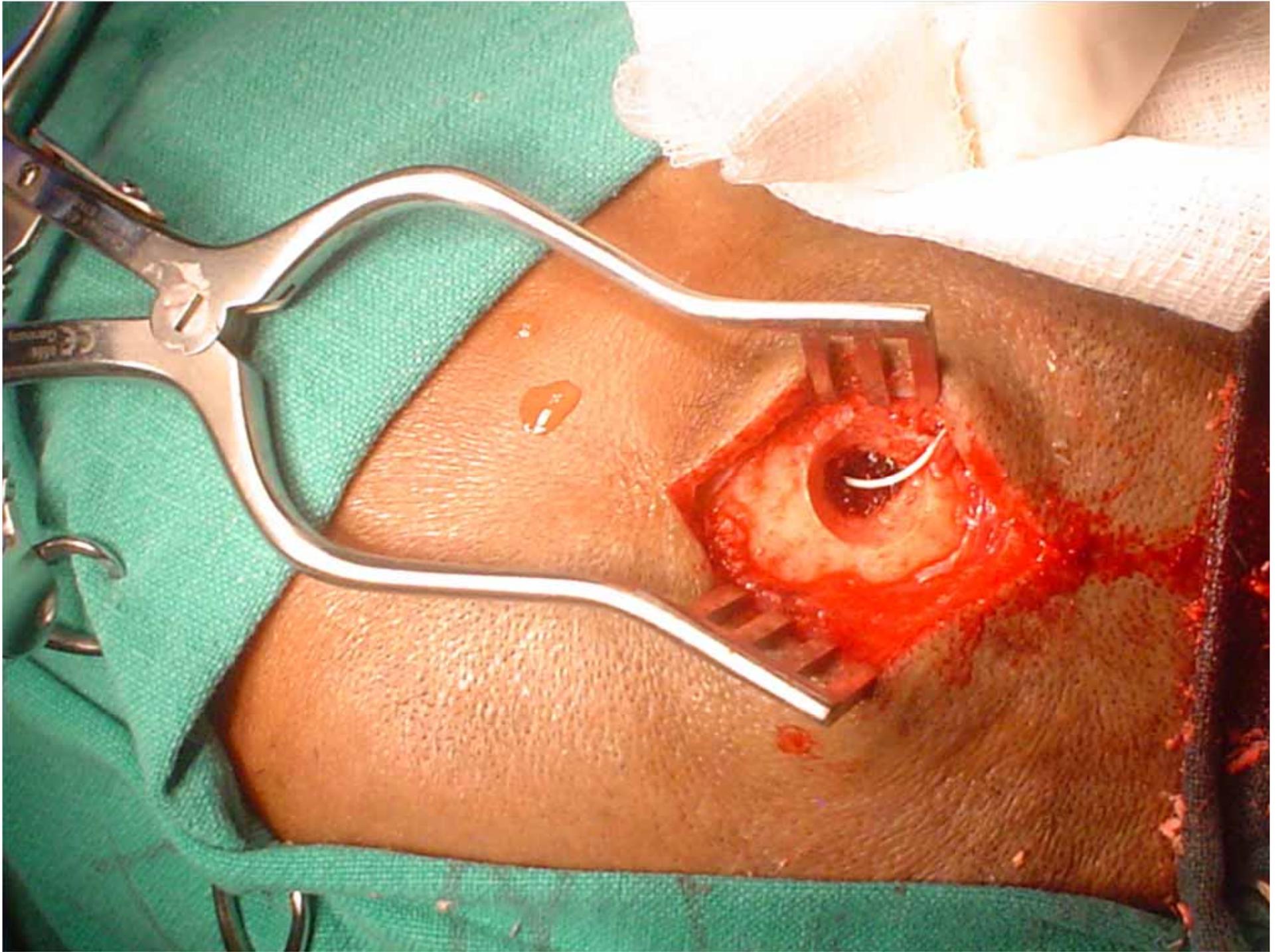
















Codman



ICP Express™



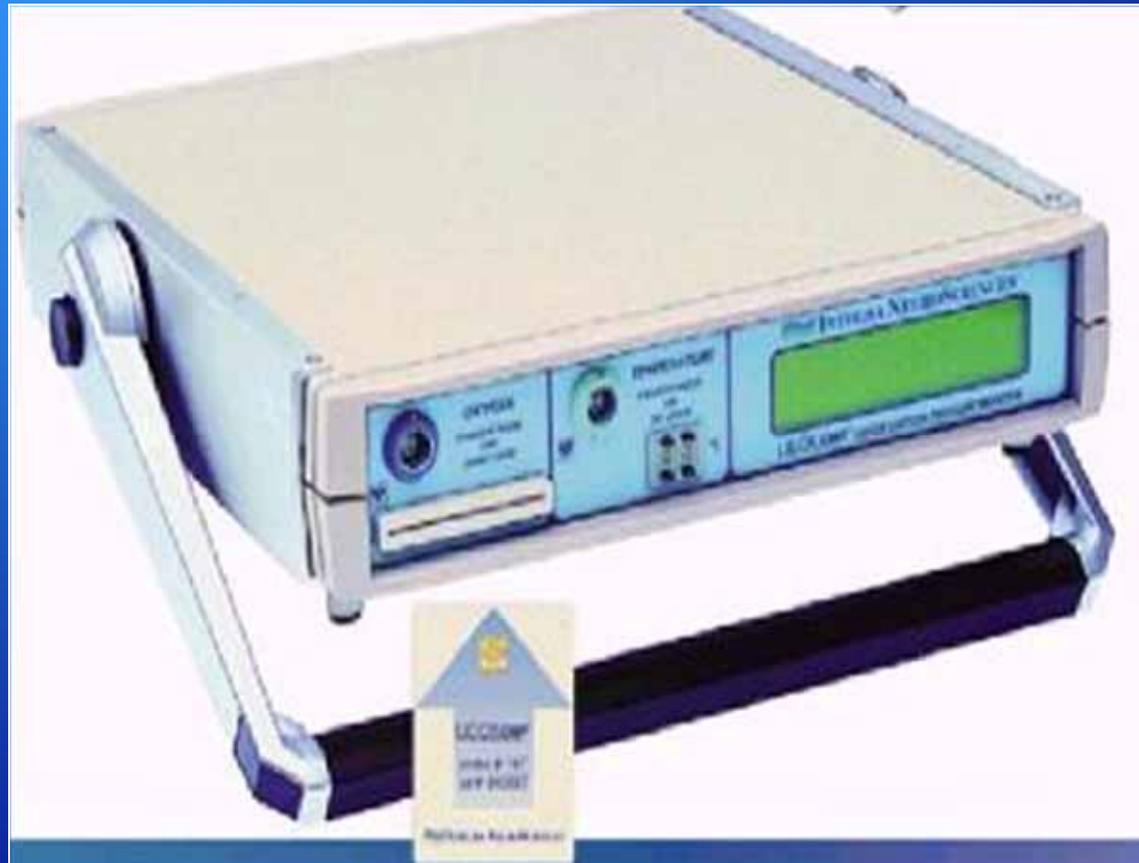
MENU



0



# LICOX



## Licox®

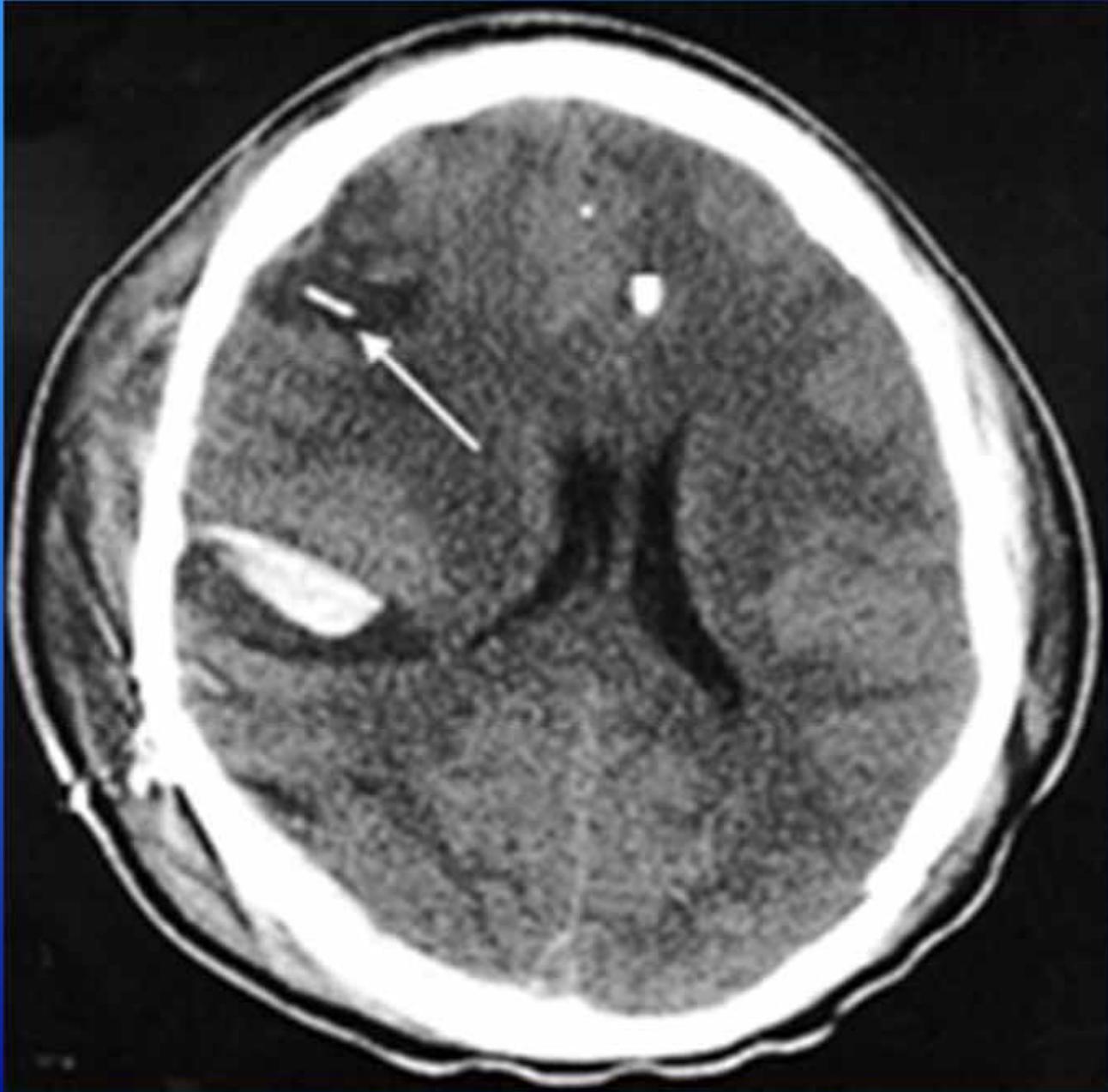
- Is a form of multi-modality monitoring.
  - 3 parameters are measured through one burr hole
    - ICP
    - Temperature
    - O<sub>2</sub> – parenchymal brain tissue oxygenation (PbtO<sub>2</sub>)

# LICOX

## Brain Tissue Oxygen ( $P_{bt}O_2$ )

- Normal: 20-35 mm Hg
- Risk of death increases
  - < 15 mm Hg for 30 minutes
  - < 10 mm Hg for 10 minutes
- $P_{bt}O_2 < 5$  mm Hg
  - high mortality
- $P_{bt}O_2 \leq 2$  mm Hg
  - neuronal death

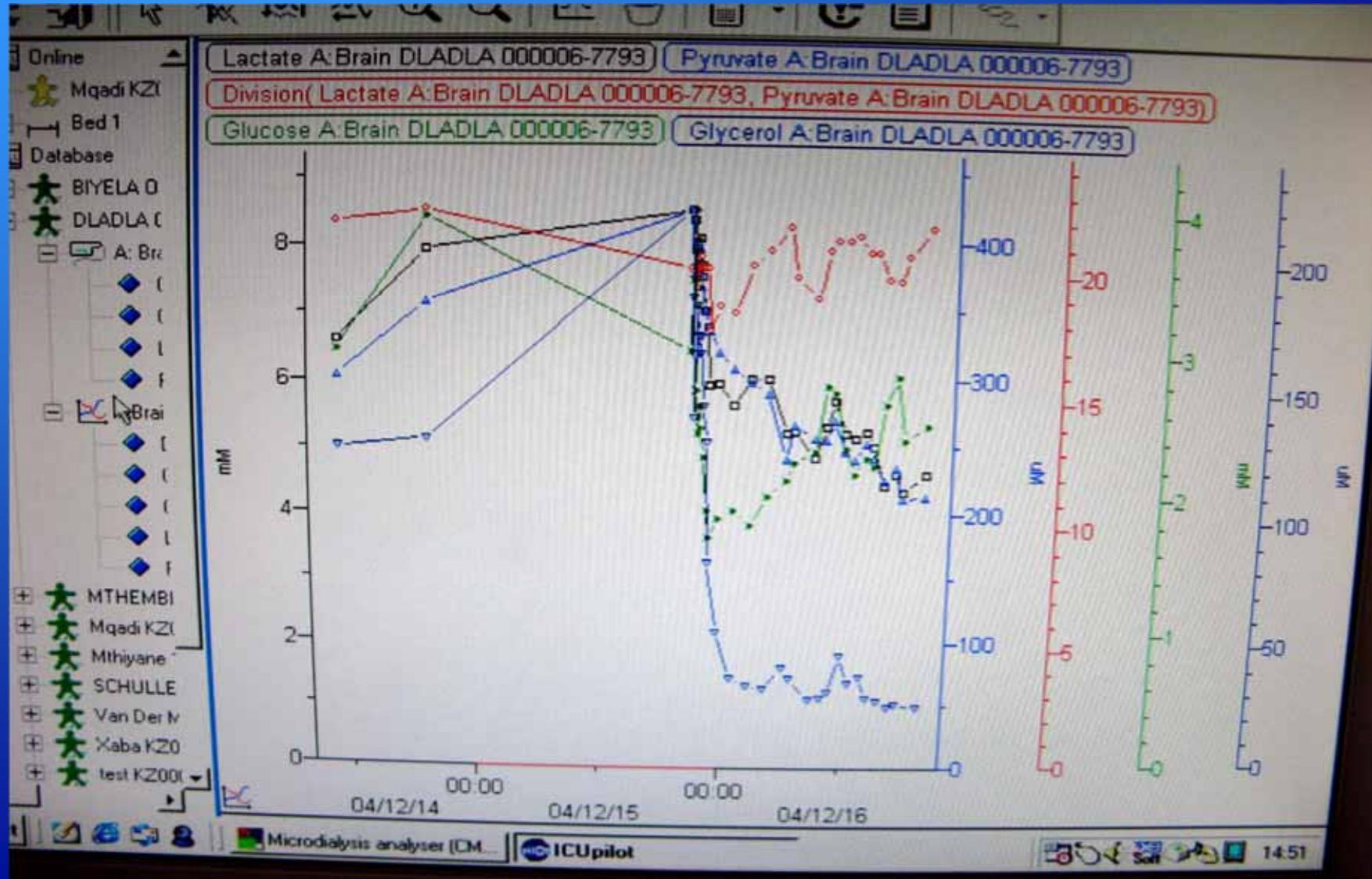
**Recent studies have shown reduced mortality rate in patients with severe traumatic brain injury treated with brain tissue oxygen monitoring.**



# MICRODIALYSIS

- **Principle of microdialysis**
  - glucose
  - lactate
  - pyruvate
  - glycerol
  - lactate/pyruvate ratio

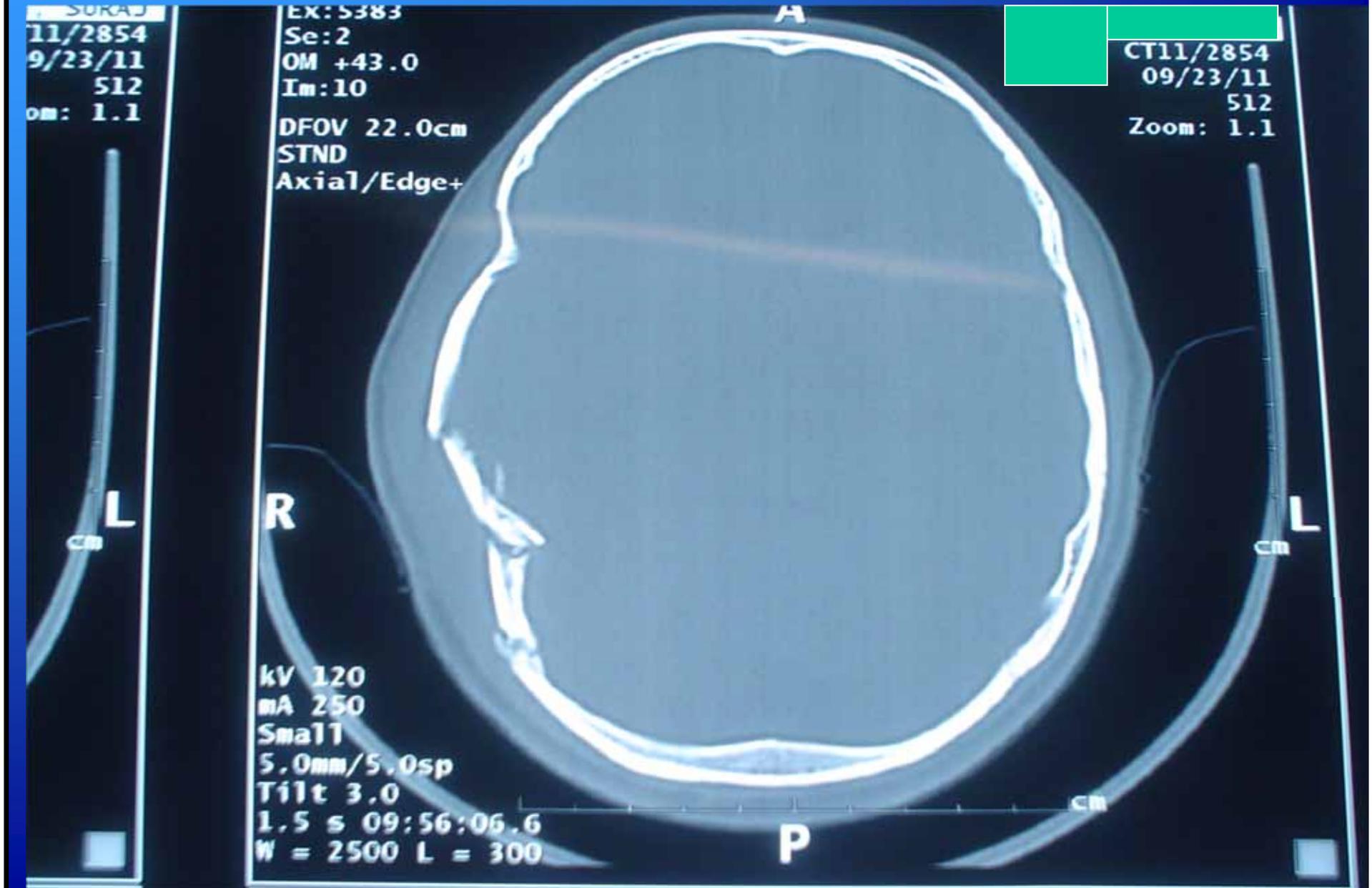
# Microdialysis





# TRAUMATIC BRAIN INJURY

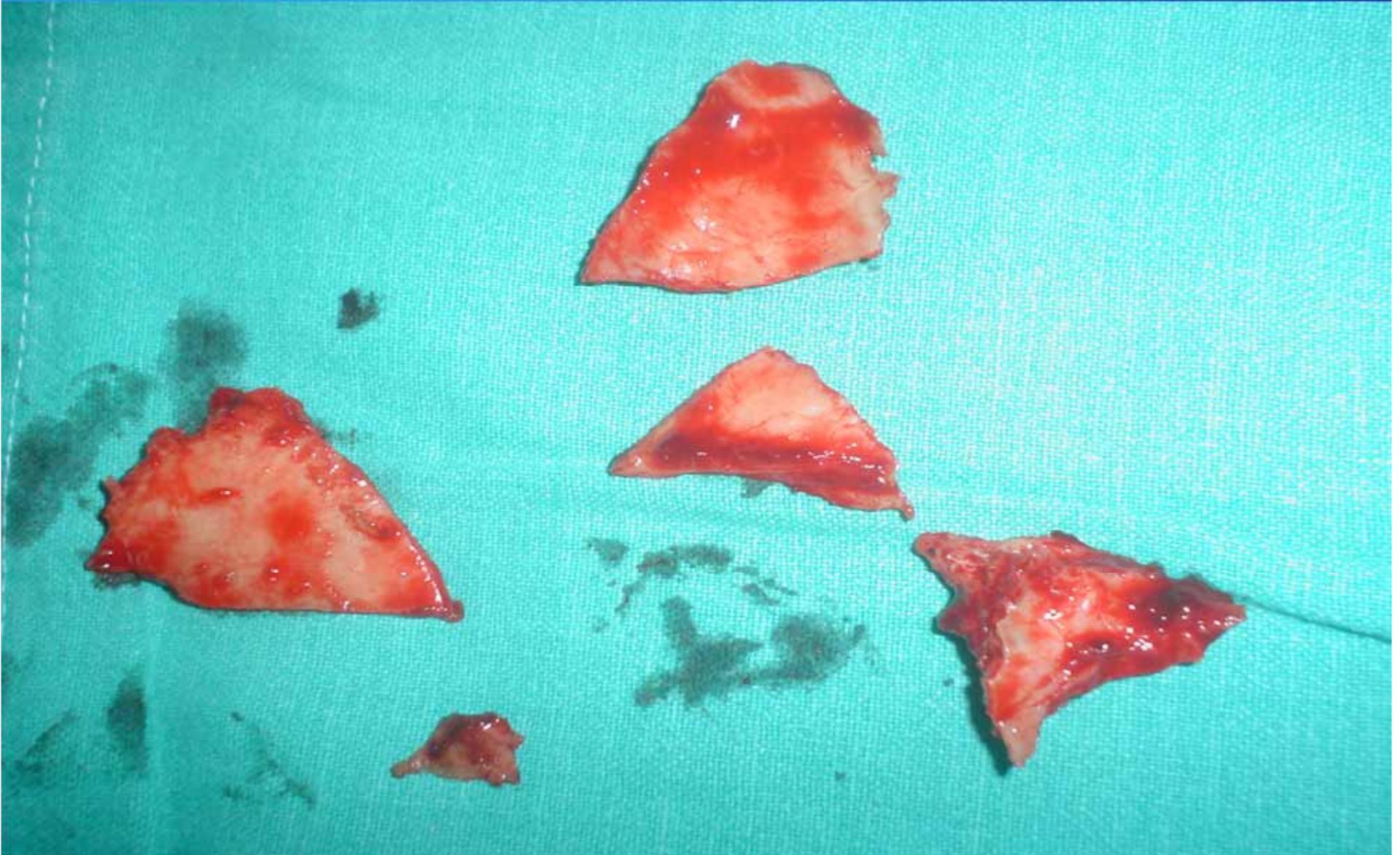
## COMMUNUITED SKULL FRACTURE



TRAUMATIC  
BRAIN INJURY  
DEPRESSED  
COMMUNUITED  
SKULL BONE  
FRACTURE WITH  
UNDERLYING  
BRAIN  
CONTUSION

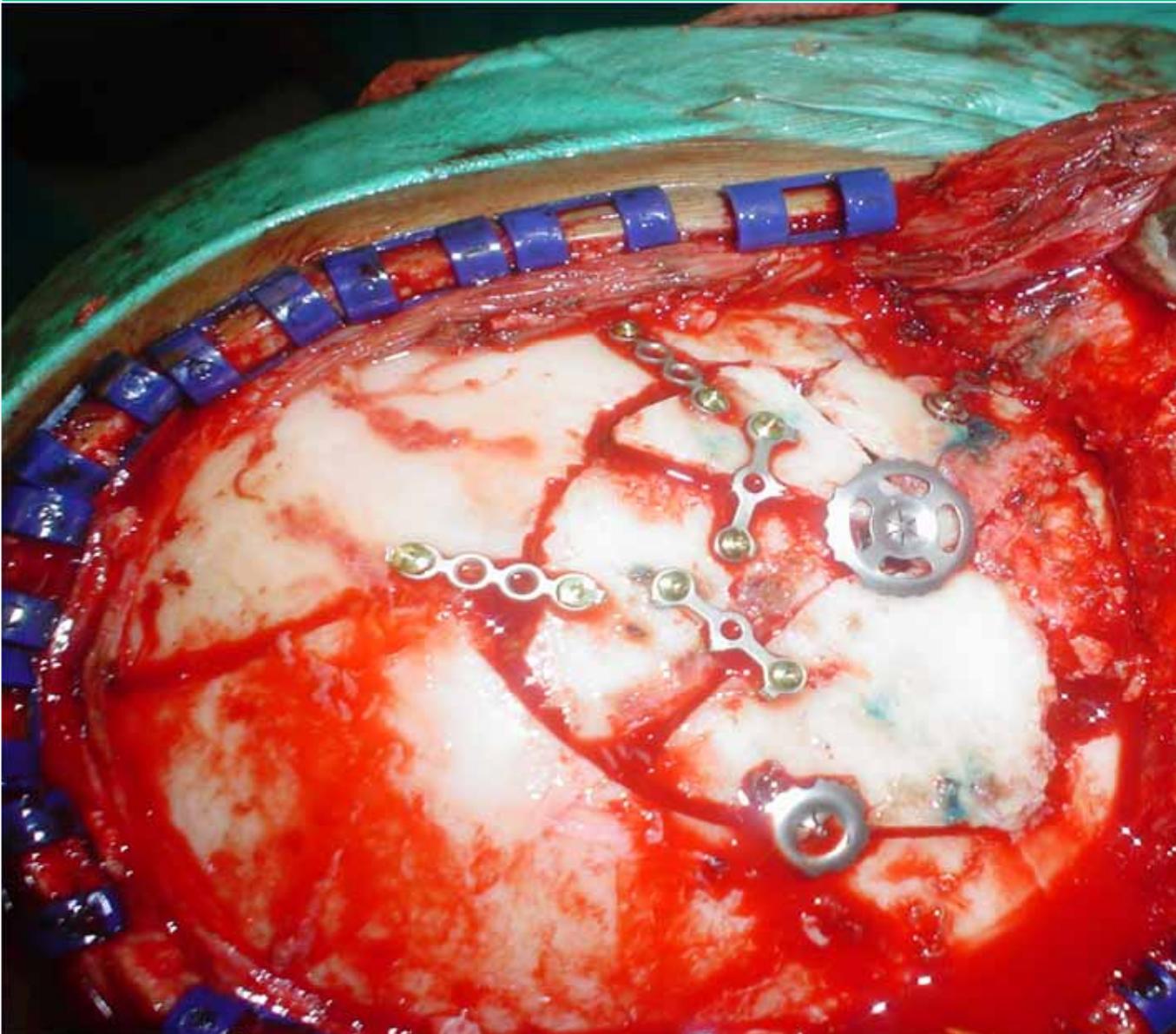


# TRAUMATIC BRAIN INJURY COMMUNUITED SKULL FRACTURE



## TRAUMATIC BRAIN INJURY

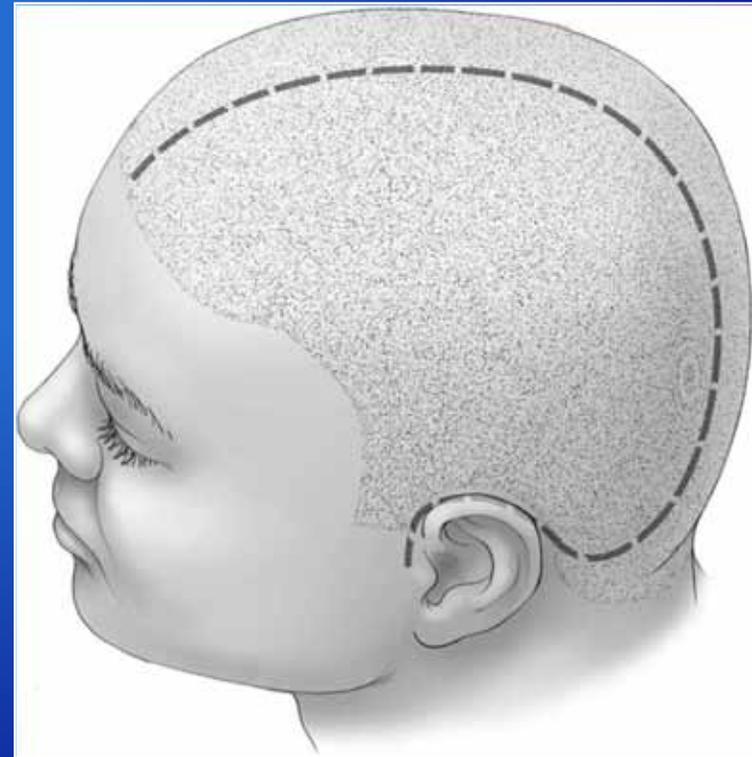
22 yr old male patient fell from a height



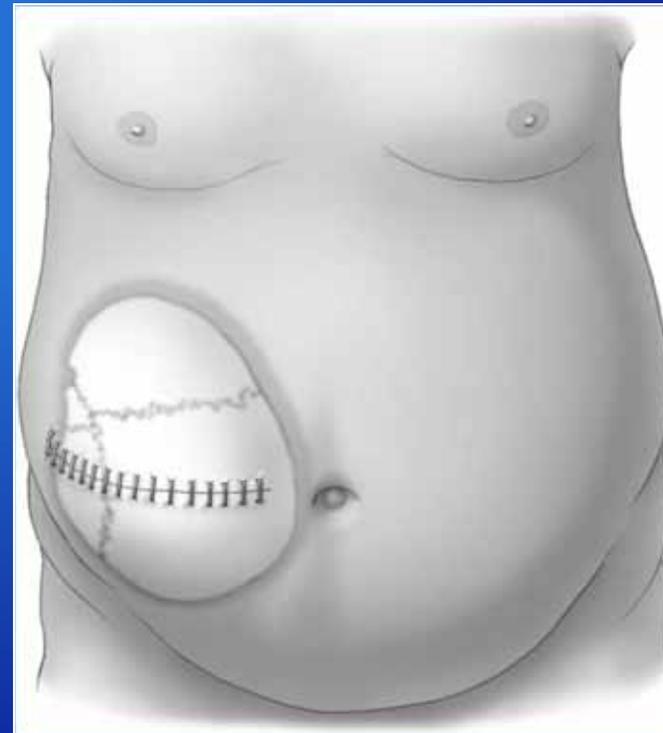
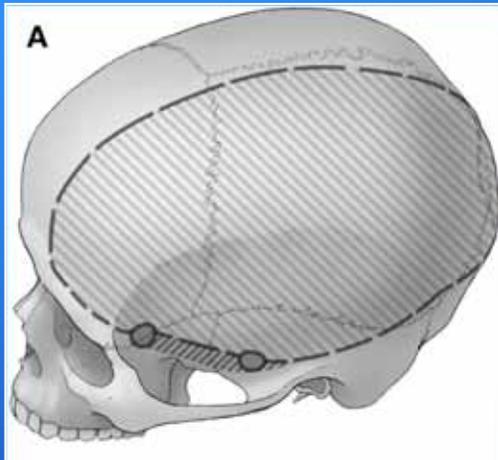
Elevation of depressed  
Fractures &  
Cranioplasty

VH SEPT 2011

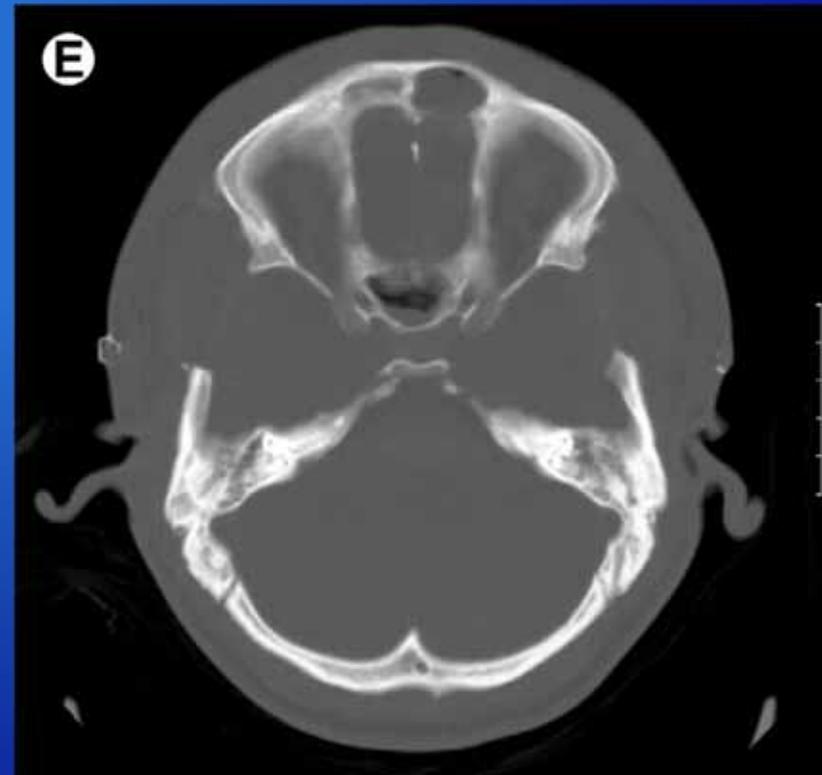
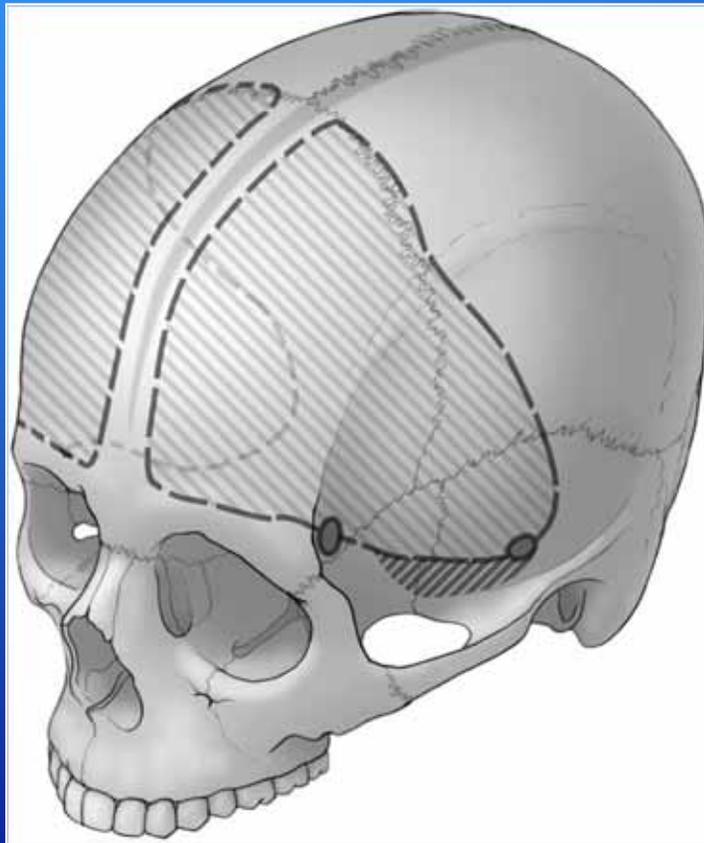
# THE ROLE OF DECOMPRESSIVE CRANIECTOMIES



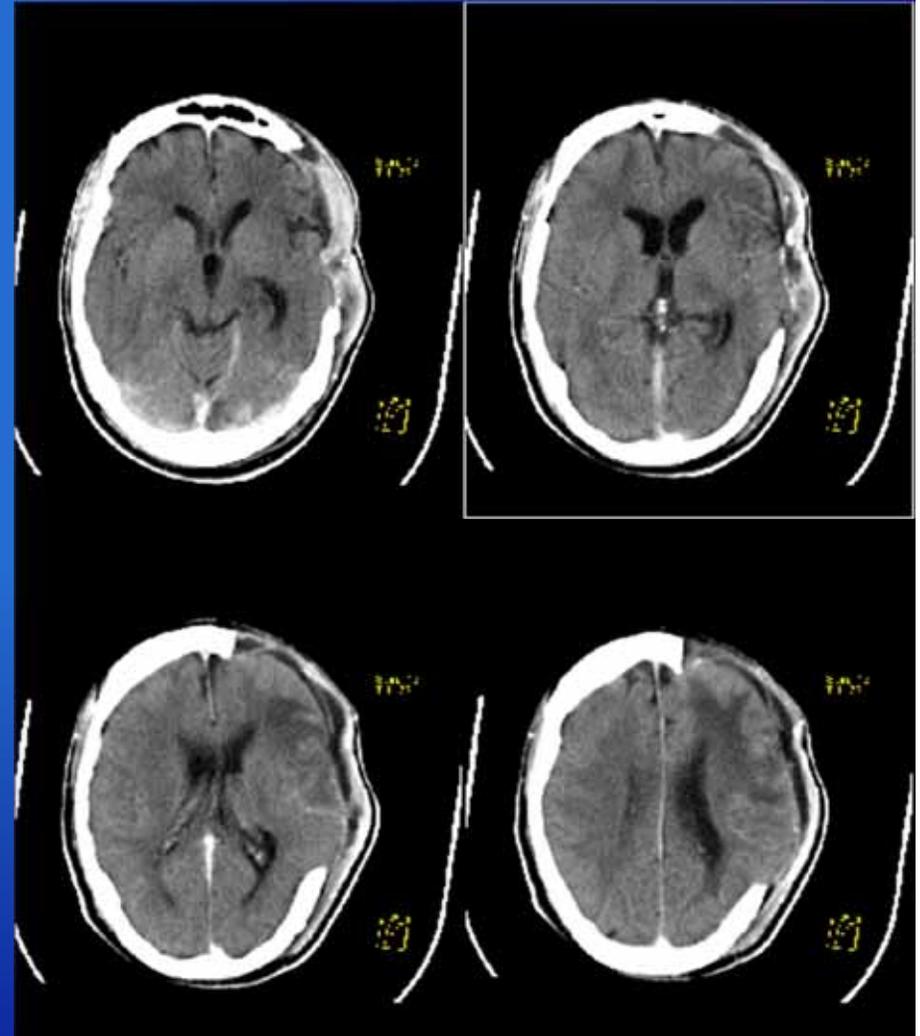
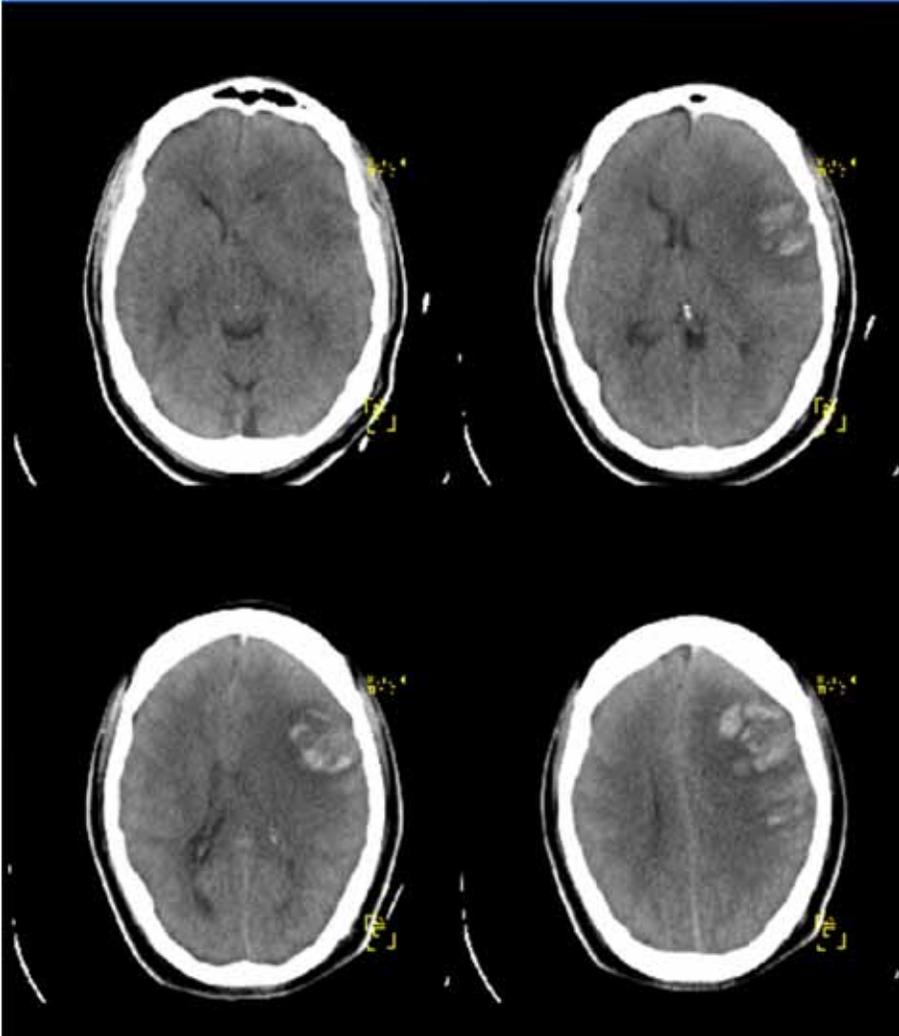
# THE ROLE OF DECOMPRESSIVE CRANIECTOMIES



# THE ROLE OF DECOMPRESSIVE CRANIECTOMIES

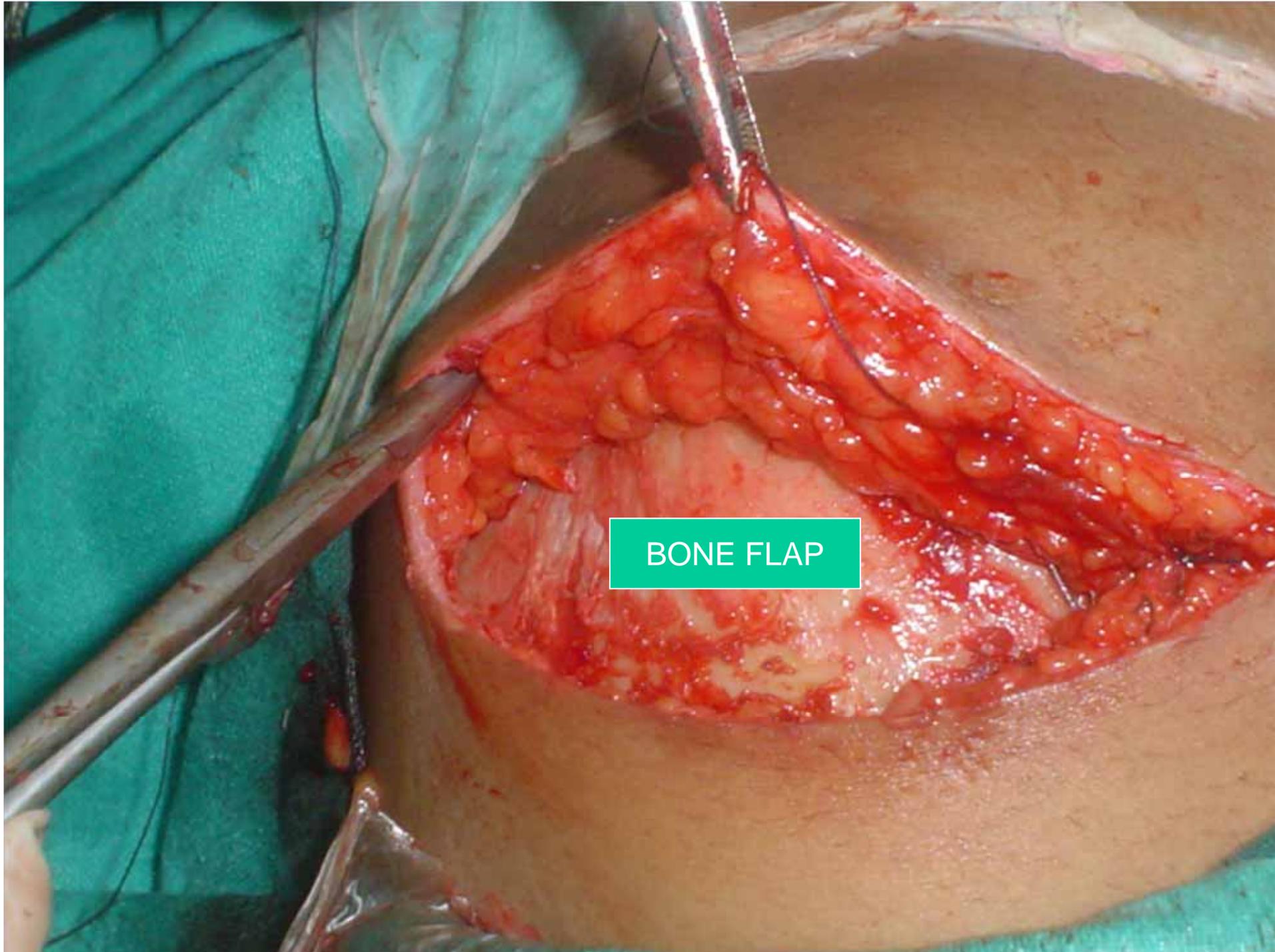


## DECOMPRESSIVE CRANIECTOMIES



# Abdominal wall



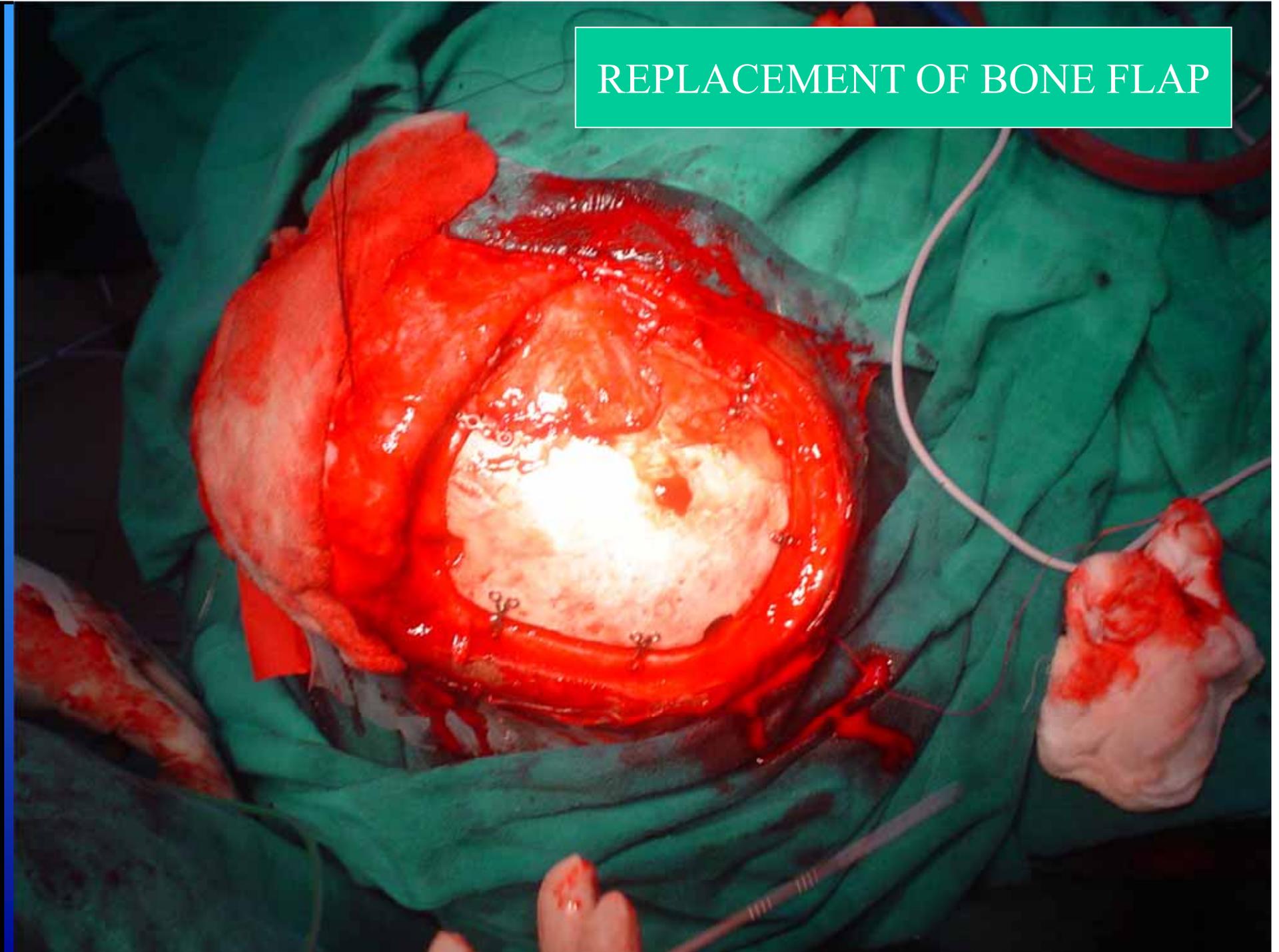


BONE FLAP

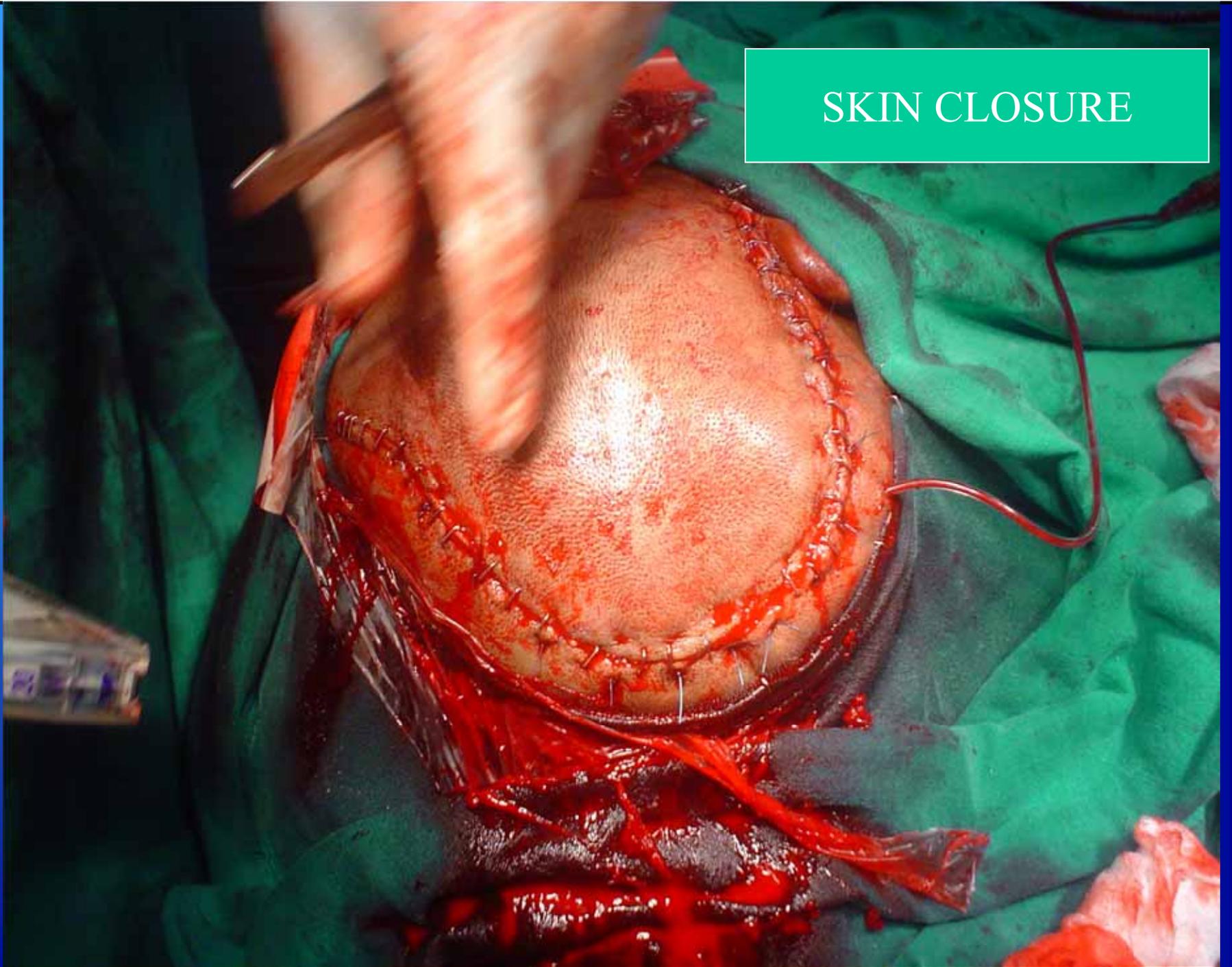
# BONE STORED IN ABDOMINAL WALL



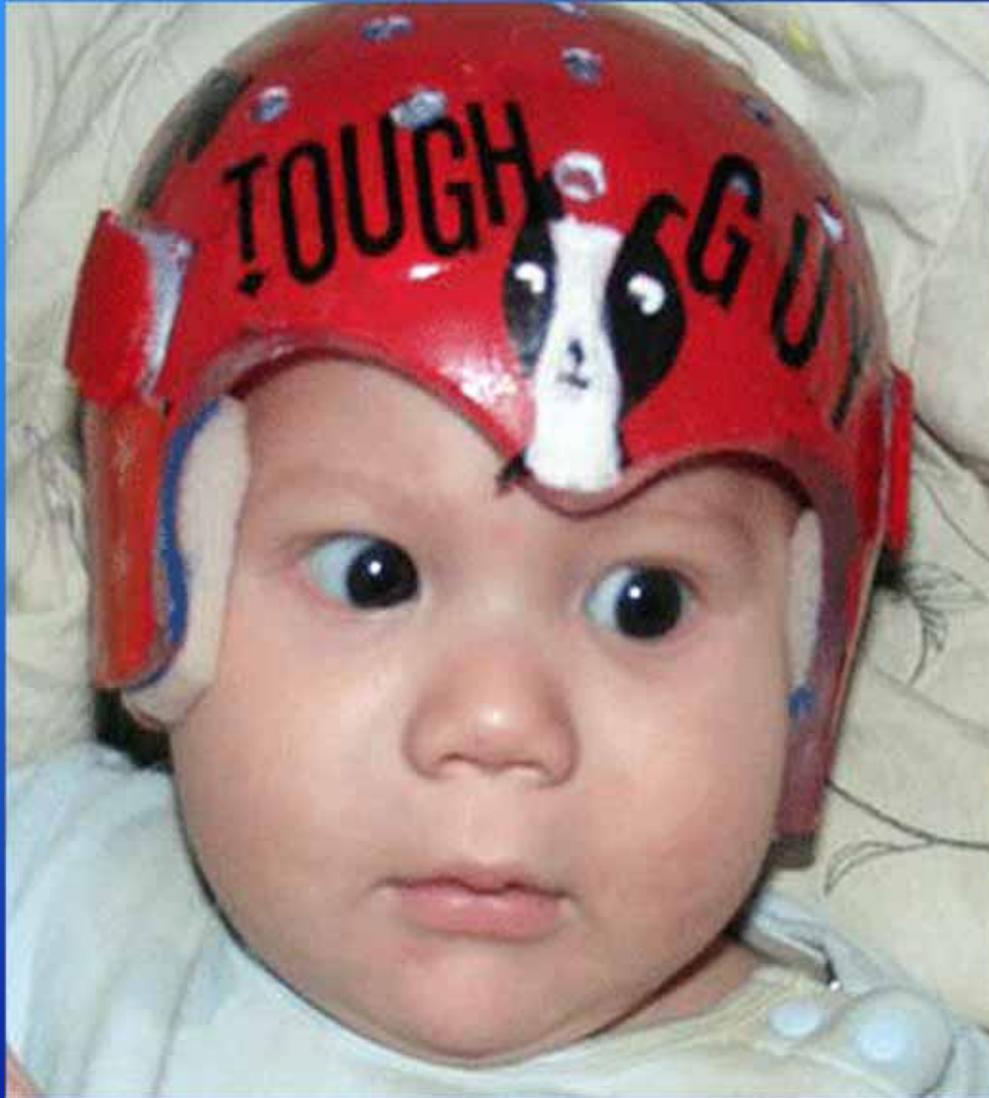
# REPLACEMENT OF BONE FLAP



# SKIN CLOSURE



## HEAD PROTECTION





OR-VICTORIA HOSPITAL

# 11 MORTS ET 4 BLESSÉS À ST-JULIEN



Plusieurs causes évoquées par les enquêteurs  
Trois des quatre rescapés dans un état critique  
Une collecte nationale annoncée

## Accidents de la route



**L'hécatombe  
continue :  
6 morts  
cette semaine**

**105 victimes depuis début janvier**

- Une moyenne d'un accident de la route chaque **demi-heure**
- Deux morts sur cinq causés par la **vitesse excessive**



Photo source: Lexpress

**Update 08:40** – 11 person confirmed dead from the accident and 4 seriously injured.

**Update 08:45** – The passengers of the van were foreign workers most probably from Bangladesh.

# WHO CARES?

HEAD INJURY IS PREVENTABLE!





FIRST COME FIRST SERVED

TRAUMATIC BRAIN  
INJURY  
IS LARGELY  
PREVENTABLE



# TRAUMATIC BRAIN INJURY IS LARGELY PREVENTABLE





*Thank you*