
HEAD INJURIES
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- Pathophysiology
- Local effects on brain tissue
- Systemic effects of TBI
- Management protocols
- Patient triage and classification
- mechanism
- Types of head injuries

Triage: the following criteria suggest severe injury and urgency in care

Revised Trauma Score[1]	Injury Pattern	Injury Mechanism
Glasgow Coma Score <13	Penetrating injury to head, neck chest, abdomen or groin	Fall >6 metres (c. 20 feet)
Systolic Blood Pressure (sBP) <90 mmHg	Two or more proximal long bone fractures	Ejection of patient from a vehicle
Respiratory Rate (RR) <12 or >29 bpm	Flail chest	Roll-over of vehicle
	Burn >15% TBSA* or facial, airway or chest involvement	Death of occupant in same car
	Victim = pedestrian or motorcyclist	Rearward displacement of front axle
	History of ingestion of alcohol or drugs	Passenger compartment intrusion

- The Primary Survey and Resuscitation
- proceed in parallel
- A — Clear the Airway. Use chin-lift or jaw-thrust. Immobilize the cervical spine with collars, bags and tape until cleared.
- B — Check Ventilation. Administer oxygen at 15 litres per minute with tight-fitting mask with reservoir or use bag, valve and mask.
- C — Check for pulses, skin perfusion and consciousness. Identify obvious sources of blood loss;
- D — Assess the level of consciousness with A.V.P.U.:
- A (alert); V (responds to verbal communication);
- P (responds only to pain); U (unconscious);
- E — Expose and examine the patient thoroughly.

Search for Life-Threatening Injuries and Treat Them Urgently

Airway	Breathing	Circulation	Disability	Exposure
Is the airway compromised? Consider oro-pharyngeal or naso-pharyngeal airway. If ineffective, intubate with endotracheal or naso-tracheal technique. If unable, consider crico-thyroidotomy.	Ventilate by bag and mask or tube, with oxygen. Perform a needle thoracostomy (2nd L. ICS-MCL)* for a tension pneumothorax. Seal open pneumothorax. Identify flail chest. Insert chest drain for massive haemo-pneumo-thorax. The oximetry reading should be 95% or greater, on supplemental oxygen.	Arrest obvious bleeding. Pre-empt shock with 2 large bore i.v. cannulae. Infuse 2000 mls (20ml/kg in children) of crystalloid before transfusion of warmed blood (O-neg., type-specific or fully cross-matched). Drain any significant haemo-pericardium. Use cutdown or intraosseous lines if necessary.	Assess level of consciousness with AVPU (see D. above) Look at the pupils. Can the patient move all 4 limbs? Is there evidence of peripheral nerve disruption or upper motor neurone/intra-cranial injury (e.g. asymmetry of movement or up going plantar – Babinski or thumb – Hoffman -reflexes).	Undress completely. Avoid hypothermia. Attach ECG monitor. Insert NG tube and urinary catheter. Beware of contra-indications! Blood specimens: plasma chemistry, arterial blood gases, FBC, and cross-match. Get a urine sample (for urinalysis and toxicology etc).

- The Secondary Survey
- Recheck A, B, C and D. Proceed to next stage if the patient is stable and analgesia has been effective. The secondary survey is a head-to-toe examination of the patient's body.
- A.M.P.L.E. - a simple mnemonic for key
- information
- A: allergies (e.g. penicillin or aspirin)
- M: medication (e.g. a beta-blocker or warfarin)
- P: previous medical history (e.g. previous surgery or anaesthetic mishap)
- L: last mealtime (i.e. drink versus major meal)
- E: events surrounding the incident (e.g. fell 5 metres with immediate loss of consciousness)

Examine each body region meticulously

Head	Face	Neck	Chest
Assess for wounds and fractures. Examine the eyes, and check for basal skull fracture.	Examine the mouth, mandible, zygoma, nose and ears. Exclude mid-facial fracture or airway obstruction.	Assume initially that a fracture – dislocation exists. Use collar – tape – sandbag neck immobilisation and palpate the spine. Wounds deeper than the platysma need formal surgical exploration.	Look, listen and feel: inspect the chest X-ray. Exclude lung and cardiac contusion, aortic rupture, diaphragmatic hernia, tracheal, bronchial or oesophageal injury. Look for haemo-pneumothorax.

Neurological	Abdomen	Orthopaedic
Estimate GCS* repeatedly (e.g. every 15 minutes). Perform a full CNS examination, in the co-operative patient. Evidence of paralysis or sensory deficit requires full spinal immobilisation. Falling GCS levels require urgent CT scan and neurosurgical consultation.	Peritoneal and retro-peritoneal injuries may present with normal signs. Rectal and perineal examination is essential. CT, ultrasonsography or occasionally diagnostic peritoneal lavage may help in excluding abdominal injury.	Check for limb or spinal malalignment, crepitus, and tenderness. Examine the back. Assess neuro-vascular and tendon function. Logroll the patient to assess thoraco-lumbar injury. Search for minor fractures, dislocations, glass or other foreign bodies.

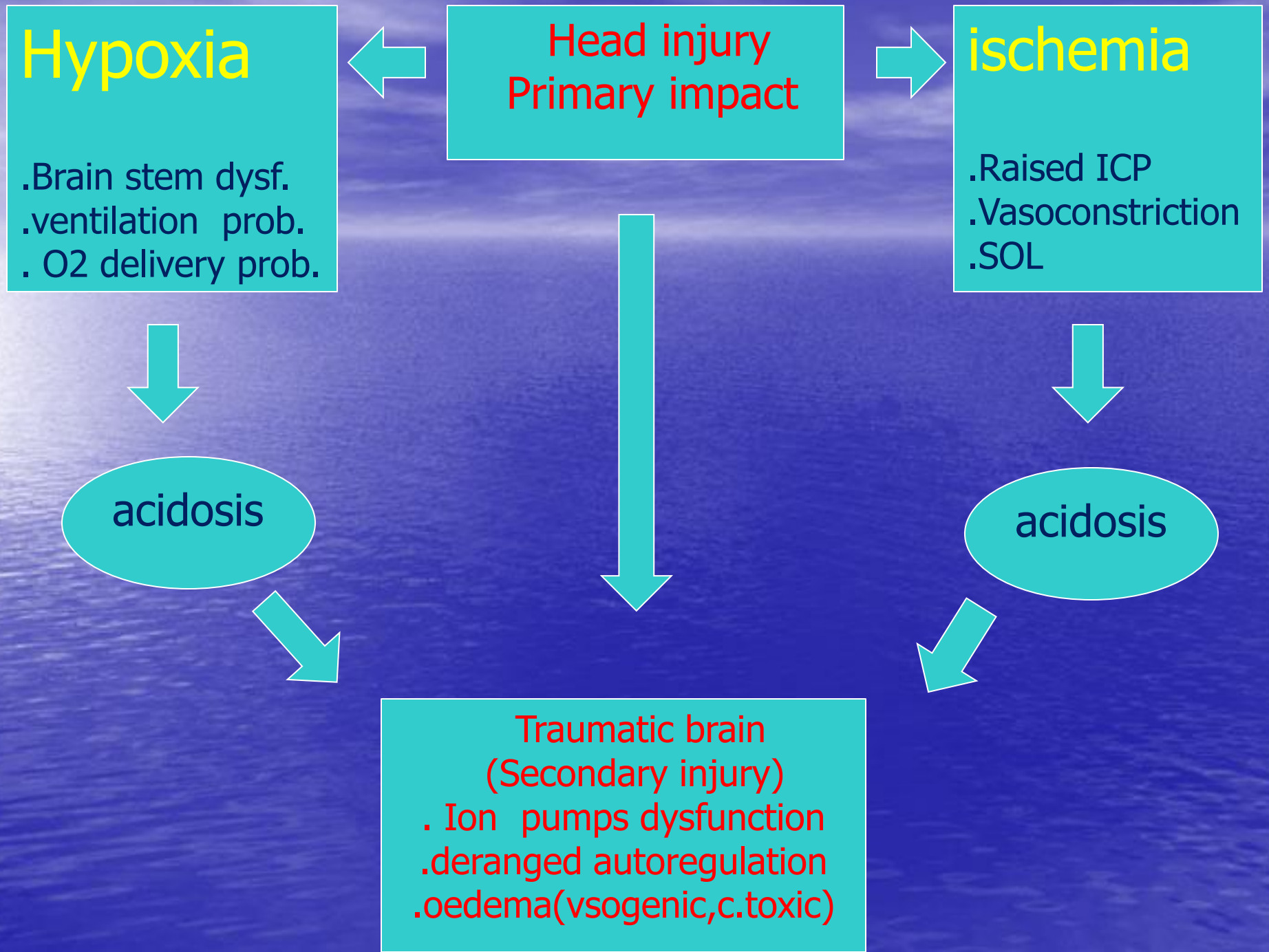
- INITIAL MANAGEMENT OF SEVERE TRAUMA
- Most widely accepted system is that recommended in the American College of Surgeons' Advanced Trauma Life Support (ATLS) course. The key elements of this approach are the primary survey/resuscitation phase, the secondary survey and the rapid implementation of definitive treatment, which may involve early surgery. The objective is to detect life-threatening conditions as quickly as possible, to stabilise the patient and to start definitive treatment as early as possible, in a prioritised fashion.

Intensive management of traumatic brain injury (roles and objectives)

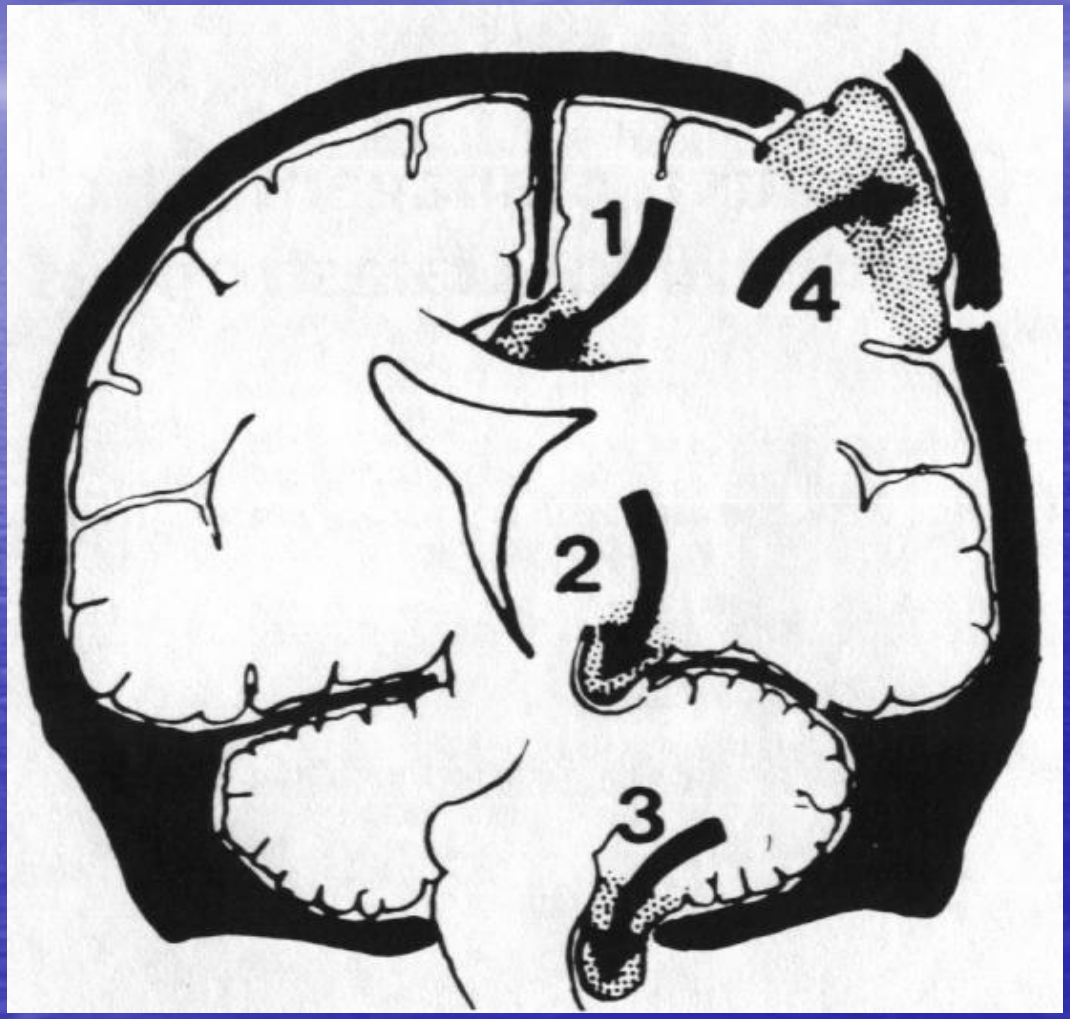
- *The primary focus of intensive management is directed towards patients suffering severe head injury (GCS of 8)following initial resuscitation and to prevent those suffering moderate injuries from deteriorating into unresponsive coma*

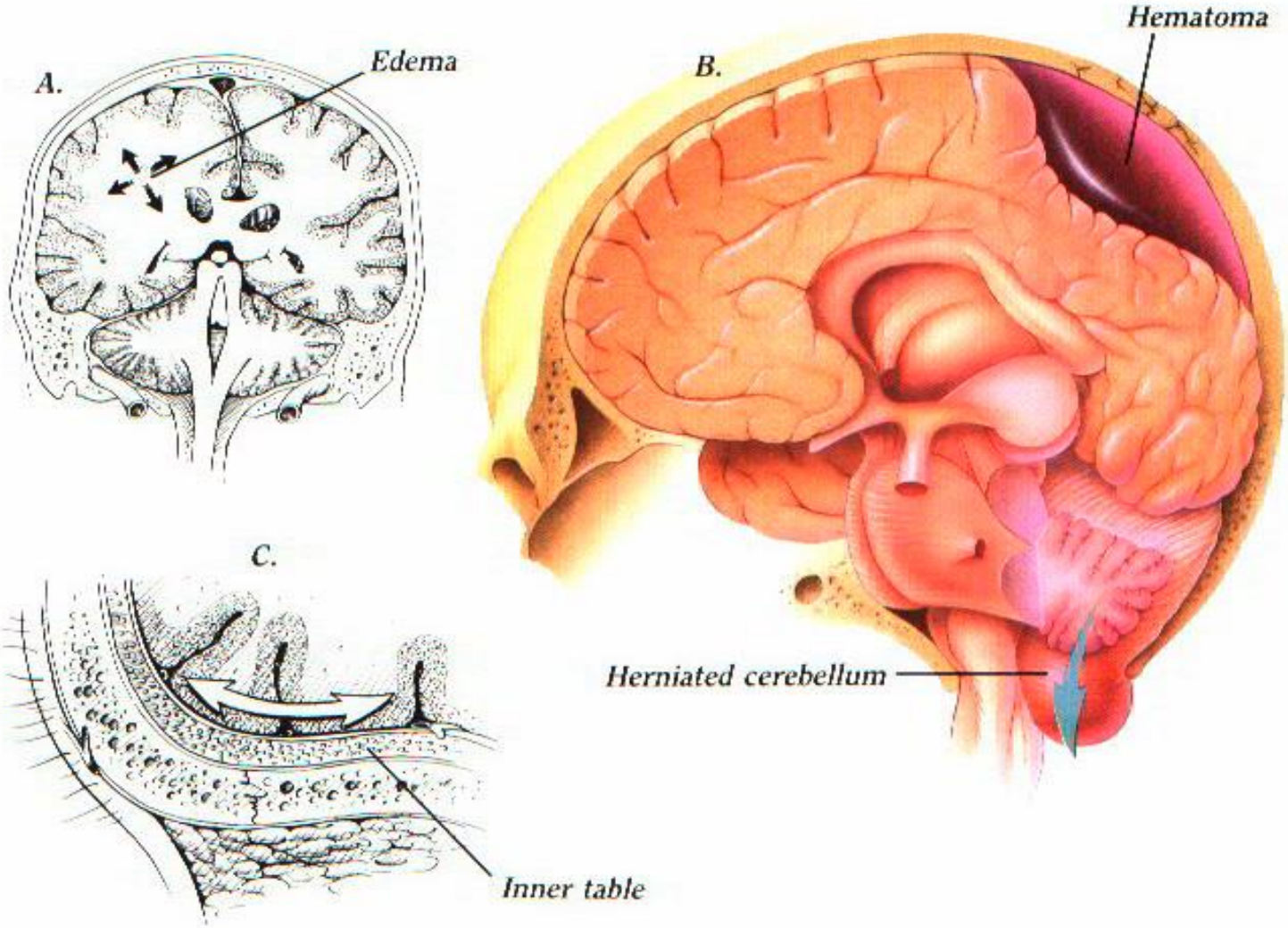
- *It is universally agreed that a population of neurons is irreversibly damaged at initial impact but neuronal demise continues unchecked until brain resuscitation is initiated*

- *It is also agreed that primary brain injury initiates a cascade of metabolic derangement affecting the cerebral vascular system, glial supporting cells, and neurons, which leaves brain vulnerable to secondary injury*


Hypoxia
.Brain stem dysf.
.ventilation prob.
. O2 delivery prob.
Head injury
Primary impact
ischemia
.Raised ICP
.Vasoconstriction
.SOL
acidosis
acidosis
Traumatic brain
(Secondary injury)
. Ion pumps dysfunction
.deranged autoregulation
.oedema(vsogenic,c.toxic)

Herniation syndromes




A.
Edema
B.
Hematoma
Herniated cerebellum
C.
Inner table

Systemic effect of T.B.I

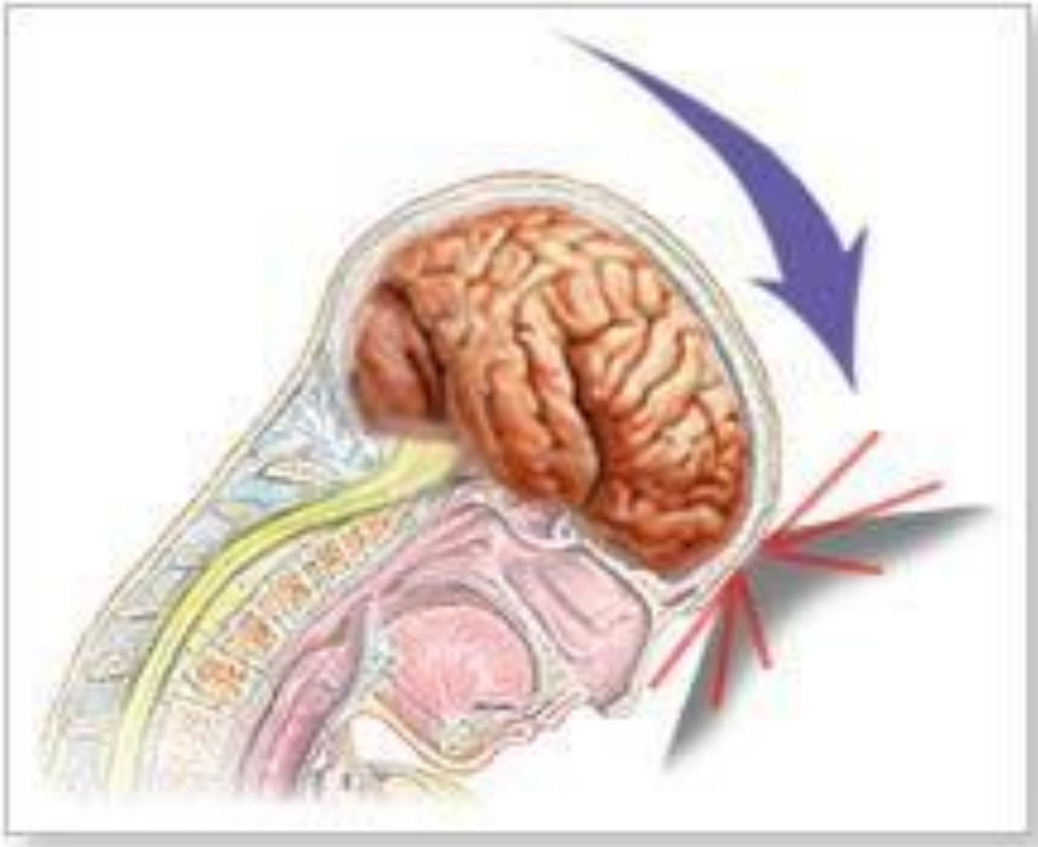
Cholinergic dysfunction	Adrenal hyperactivity	Hypothalamic dysfunction	Brain stem dysfunction
.bradyrrhythmia. hypotension	.MI .neurogenic pulmonary edema	.DI .SIADH .CSWS .hypersecretion of ACTH ,GH prolactin	.apnoea, .hypoventilation .Bradycardia .hypotention .hypertention, .decrease COP .arrhythmias

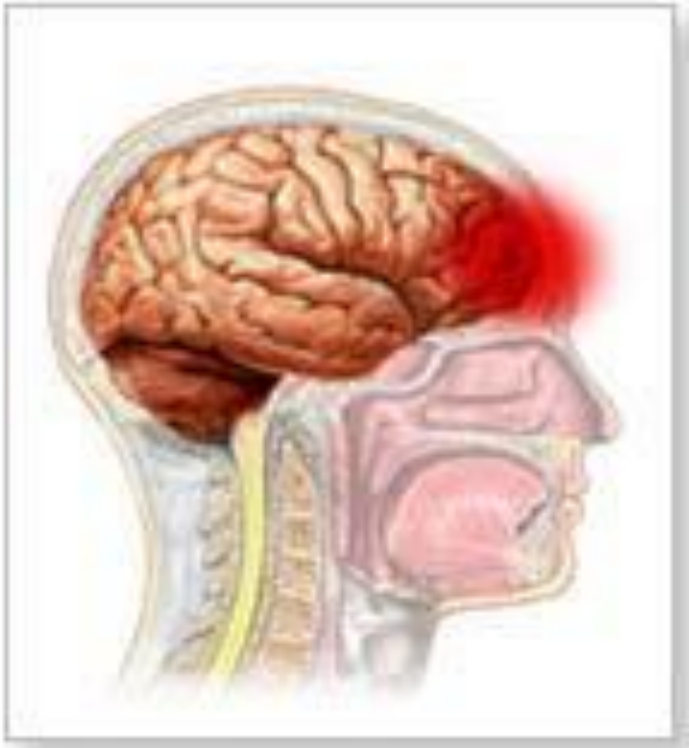
increased secretion of catecholamines and enkephaline, cytokines leading to hypermetabolism, hyperglycemia hypercatabolism and organ dysfunction (lung, liver, heart, gut) through lactic acidosis

MECHANISMS OF INJURY

- inertial or contact mechanisms
- Inertial injuries are commonly called "acceleration" or "deceleration" injuries
- Contact injuries are commonly called coup & contercoup injuries.

A concussion is a violent jarring or shaking that results in a disturbance of brain function





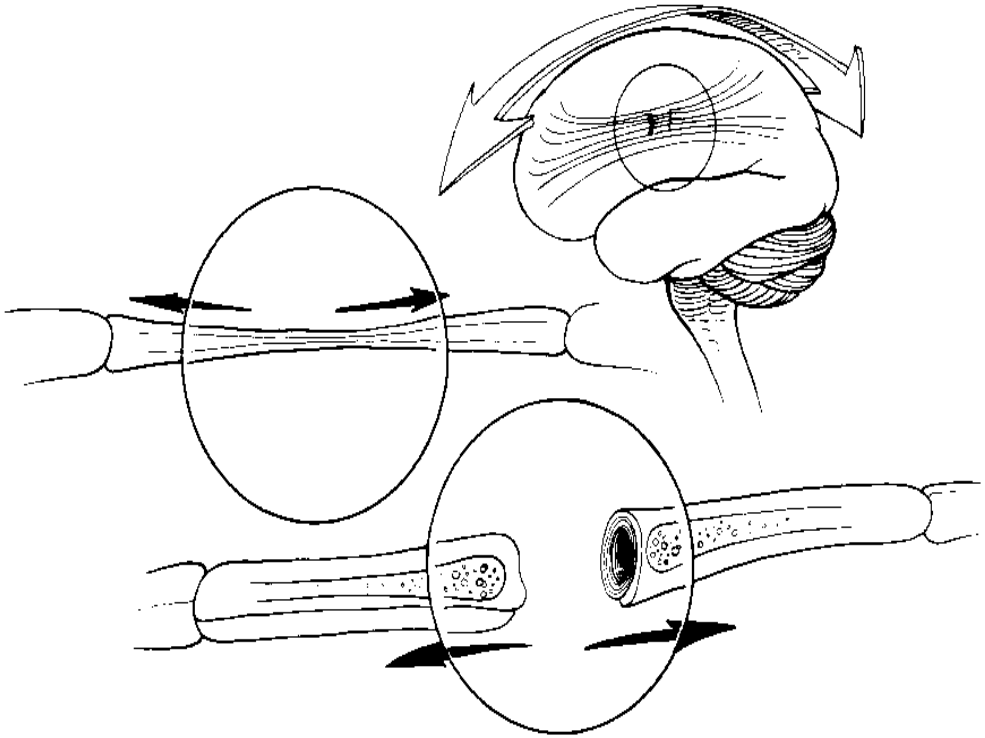
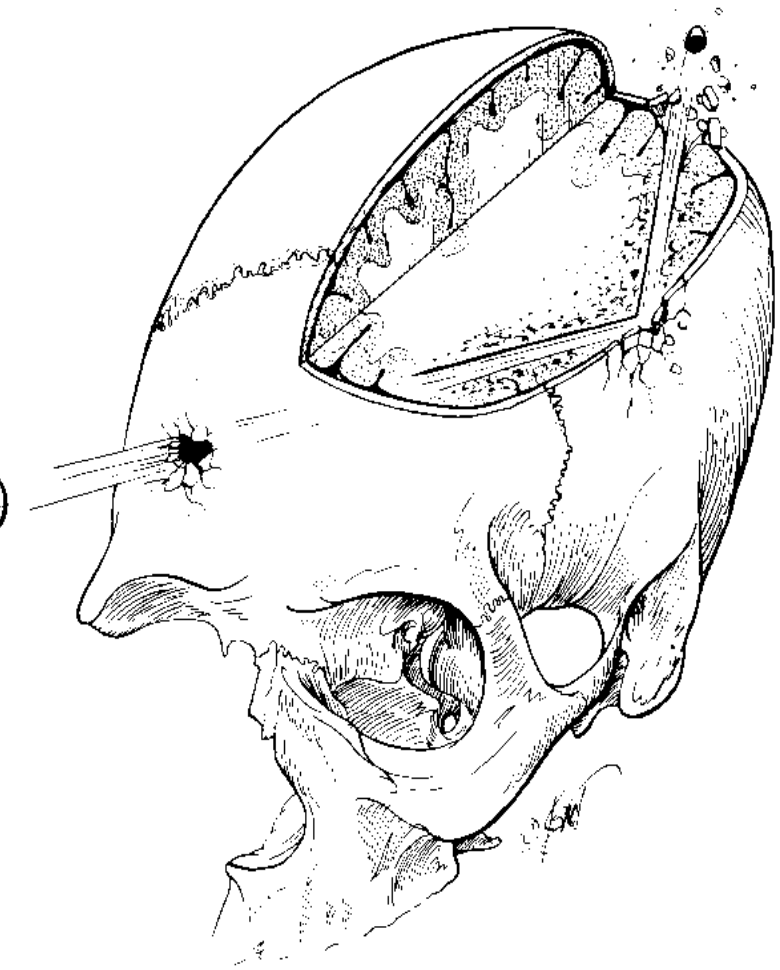
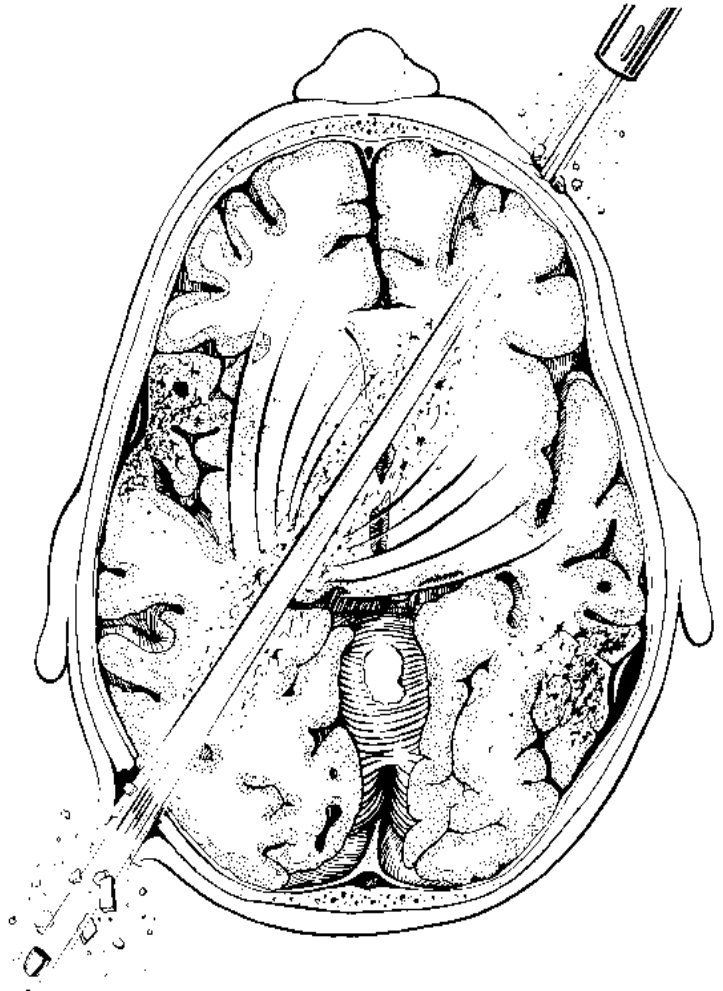
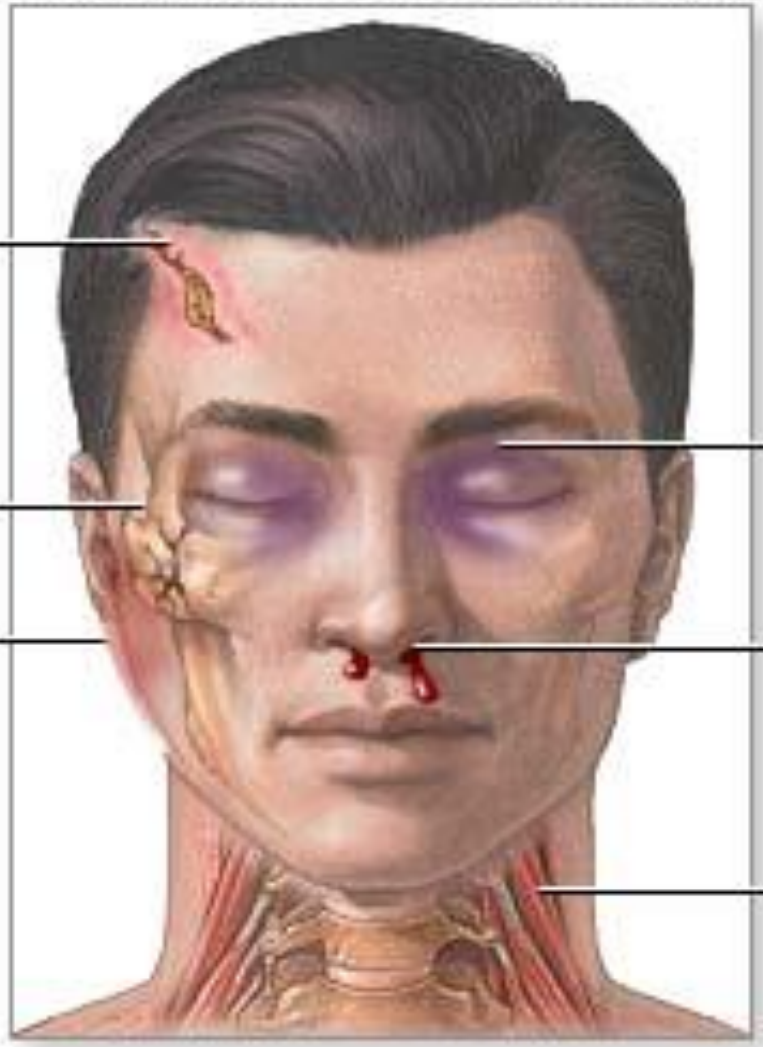


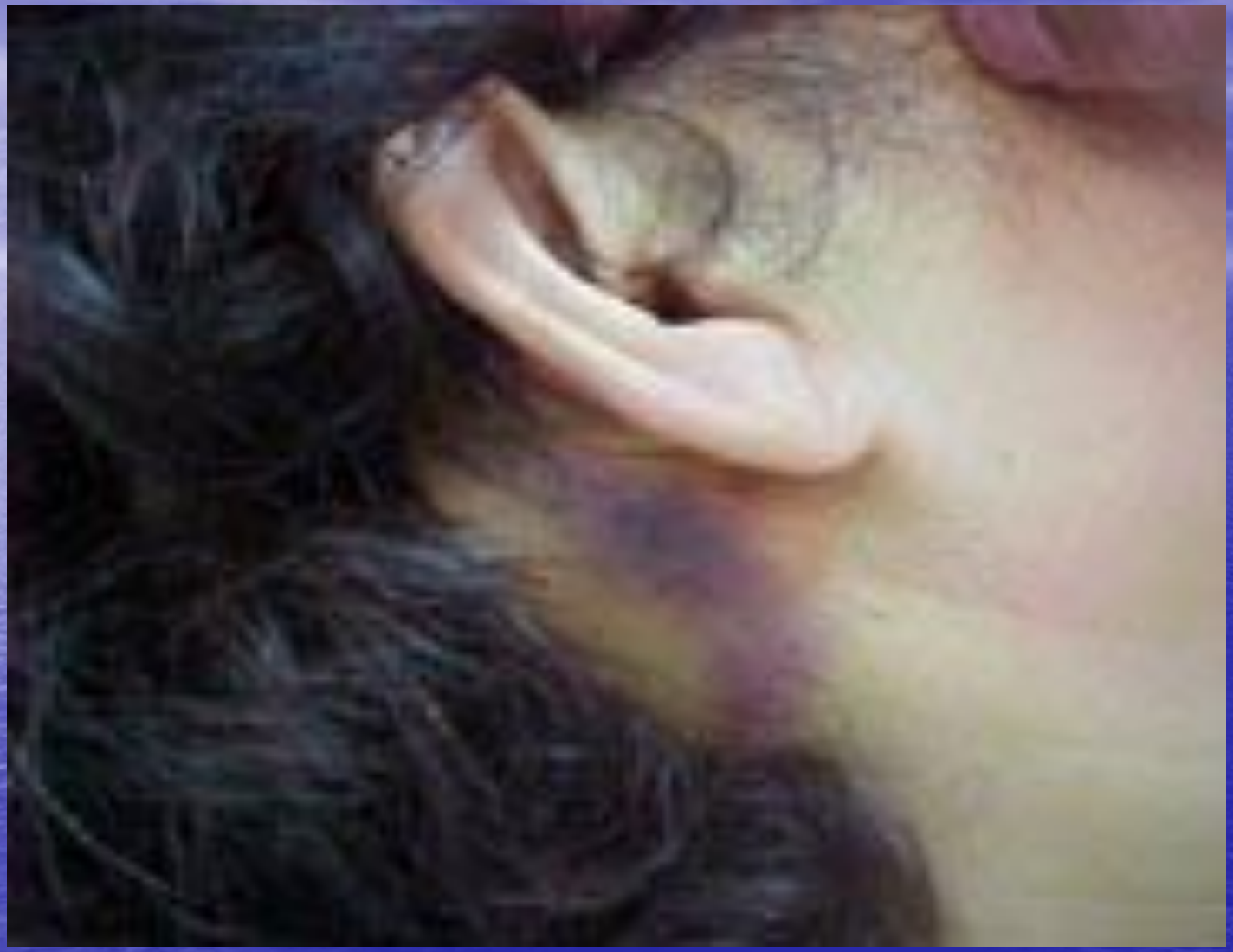
Figure 1-16. Axonal shearing may occur in acceleration as well as deceleration injuries. The nerve fiber may be stretched or completely severed, producing the manifestations of diffuse head injury.

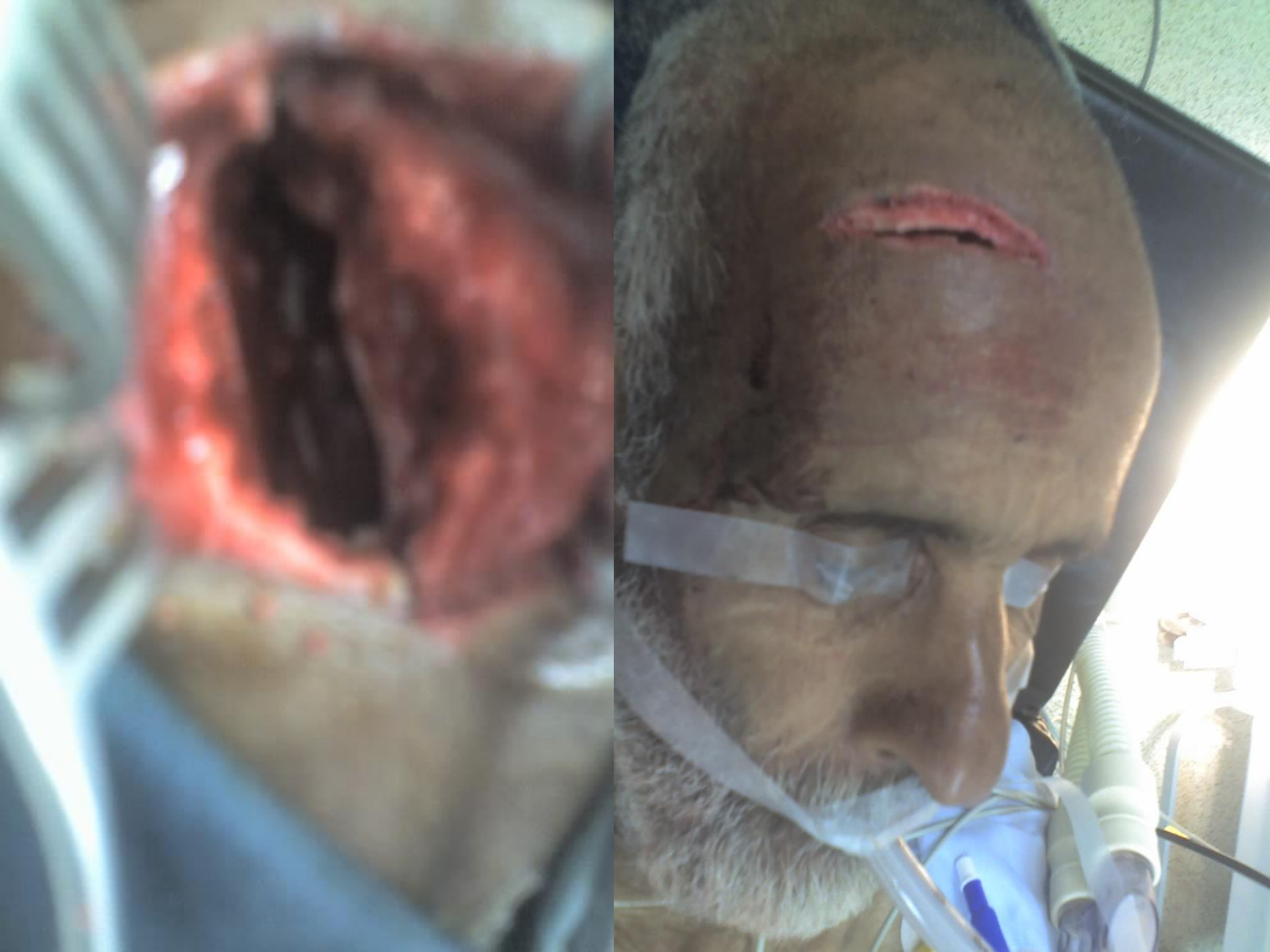


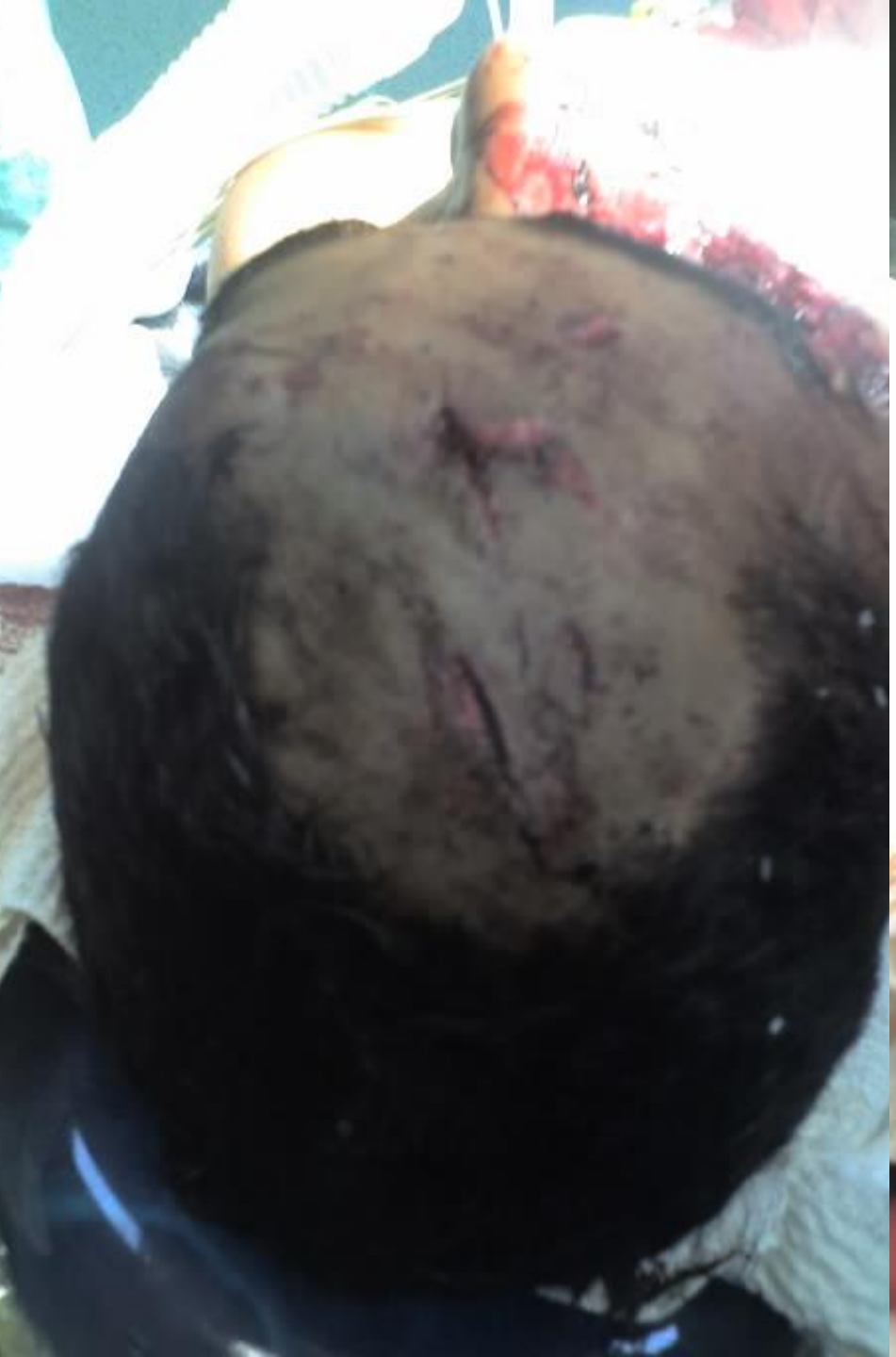


Indications of a head injury










Initial management of acute closed head injury

at accident site

Triage, resuscitation of ABCD (35% incidence of hypoxia (Apnea > 10 min carries high mortality)

Controlled ventilation to maintain paco2 30-35mmhg GCS less than 8 needs intubation and MVA

Crystaloid solution infusion and treatment of hypotesion (15% incidence of hypotension) presence of one episode of shock > 3 min(mostly hypovolemic) increases mortality by up to 50%

minimum of syst bp of 100mmhg to maintain adequate cerebral perfusion

emergency room

Systemic approach

GCS and B S reflexes

Management protocols

Immediate intubation and CT brain ,lateral cervical xray, Cxr. us abd, pelvic xr. DPL for all severe injured

Surgery if CT shows a midline shift(Manitol if FND before CT)

Ur cath, NG , laboratory tests

in the ICU

.cardio-respir. Parameters monitoring
.Controlled ventilation
.PEEP
.hyperventilation
.Tracheostomy
.Chest toilet , physiotherapy
.Neuromuscular paralysis
.sedation
.B gasses ,electrolytes monitoring
.Antiepileptics
.Raised intracranial pressure treatment

GCS	6	5	4	3	2	1
Best motor response	Obey command	Localize the pain	Withdrawal to pain	Flexion to pain	Extention to pain	none
Verbal response		oriented	confused	Inappropriate word	Incomprehensible sound	none
Eye opening			Spontaneous	To verbal	To pain	none

Low risk group	*Moderate risk group*	*High risk group*
Asymptomatic Head ache Dizziness Scalp hematoma Scalp laceration Absence of moderate or high risk criteria	History of change of consciousness History of progressive headache Alcohol or drug intoxication Unreliable or inadequate history Age less than 2 years Post traumatic seizure or vomiting or amnesia Multiple trauma Serious facial injury Signs of basal fracture Possible skull penetration Depressed fracture Child abuse	Depressed level of consciousnesss not due to drugs or other causes Focal signs Decreasing LOC Penetrating skull injury Palpable depressed fracture
Observation alone	Observation for high risk signs Consider CT Neurosurgical consultation	Consider urgent CT & Neurosurgical consultation& examination

Scalp Injuries

1.Injuries severe enough to damage scalp may also damage the underlying skull

2.Acomplete examination of the whole patient is mandatory

layers of scalp are

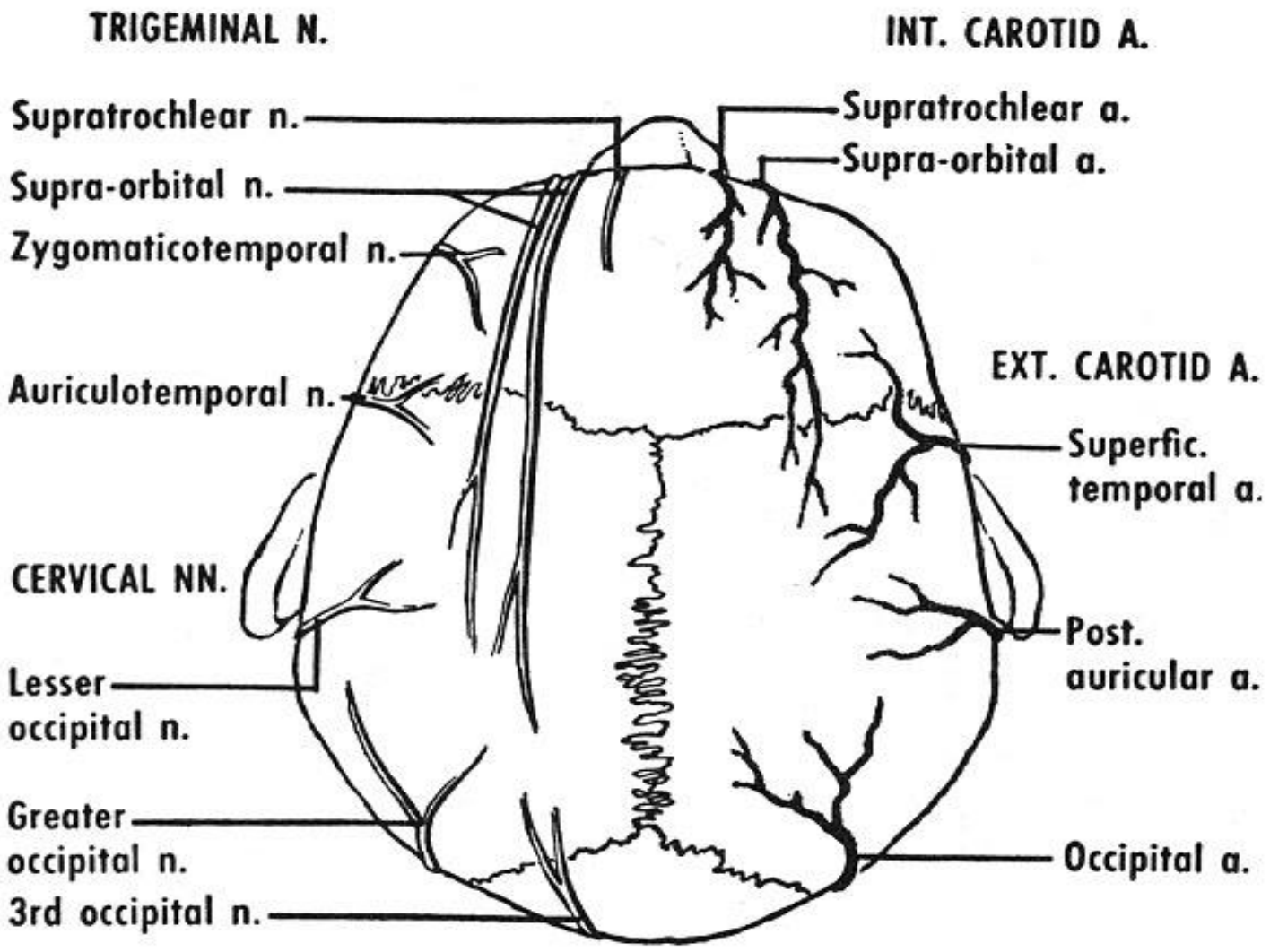
S **Skin**

C **C.T**

A **Aponeurotic (Galia)**

L **Areolar tissue**

P **Periosteum**


TRIGEMINAL N.
INT. CAROTID A.
Supratrochlear n.
Supra-orbital n.
Zygomaticotemporal n.
Auriculotemporal n.
CERVICAL NN.
Lesser occipital n.
Greater occipital n.
3rd occipital n.
Supratrochlear a.
Supra-orbital a.
EXT. CAROTID A.
Superfic. temporal a.
Post. auricular a.
Occipital a.

Types

- Lacerations
- Avulsions
- Physical injuries
- Chemical injuries

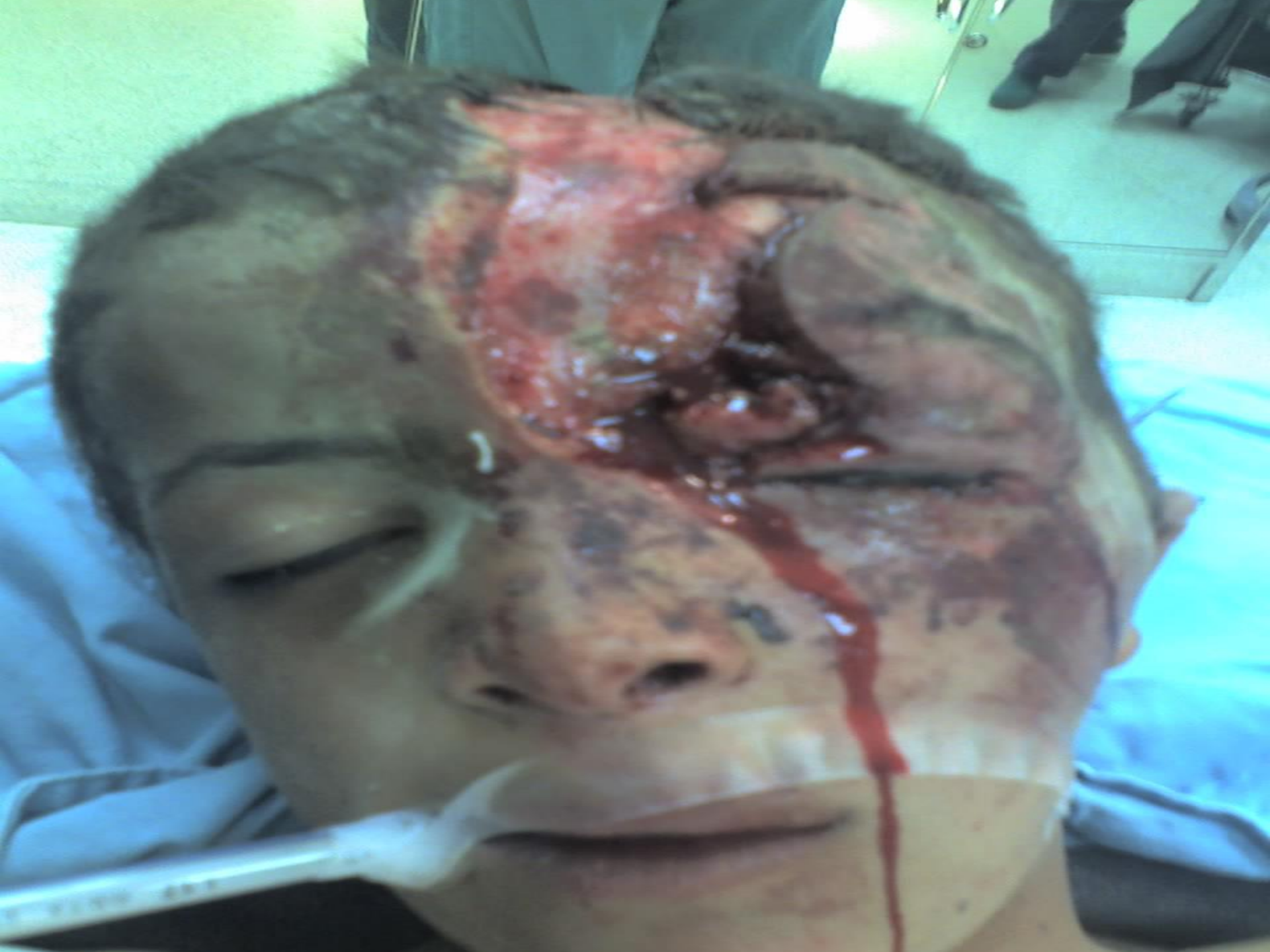
Scalp Lacerations

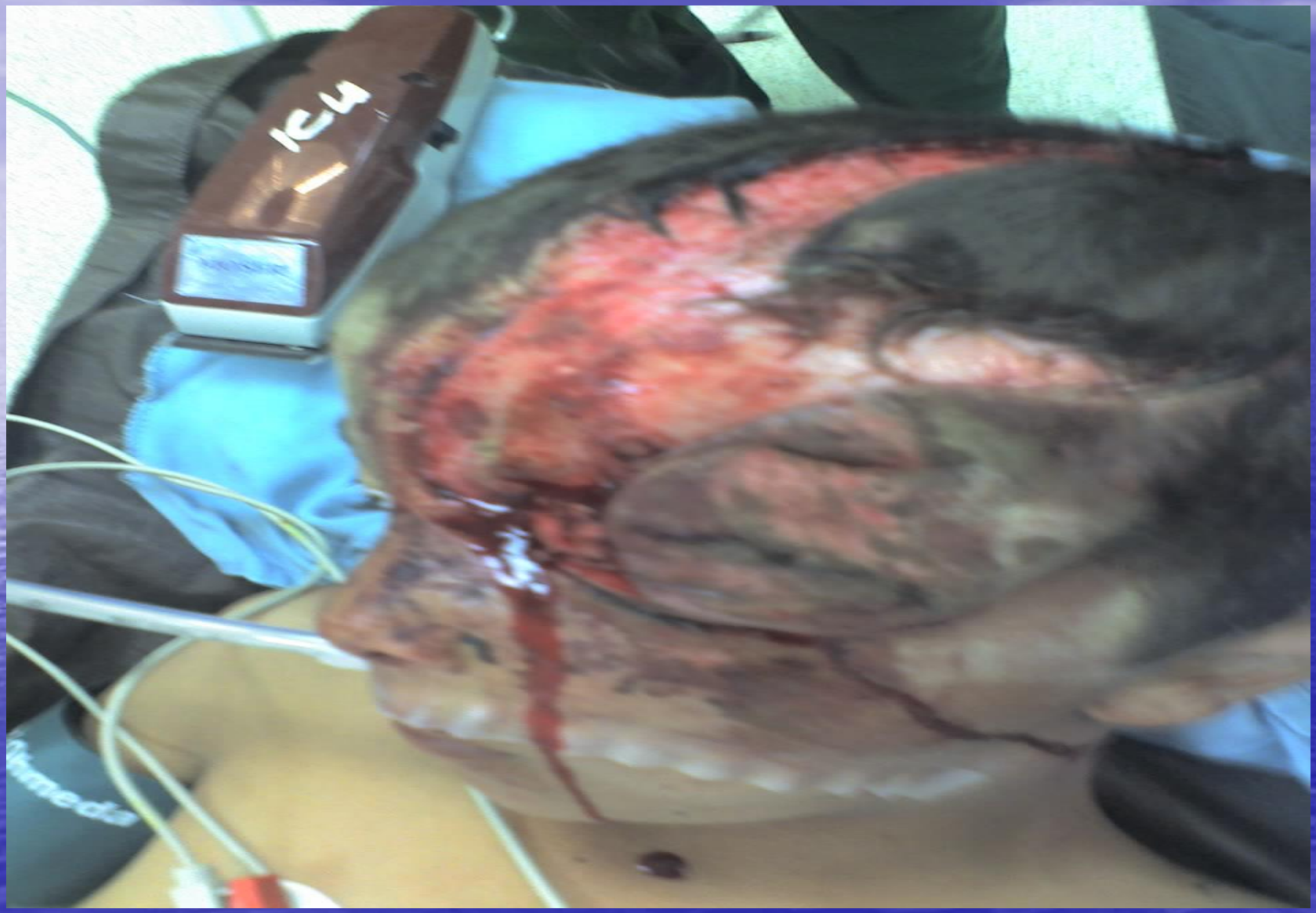
- Small and linear either superficial one (bleeder) or deep one (less beeder) mostly closed under L.A in 2 layers (Galia and skin)

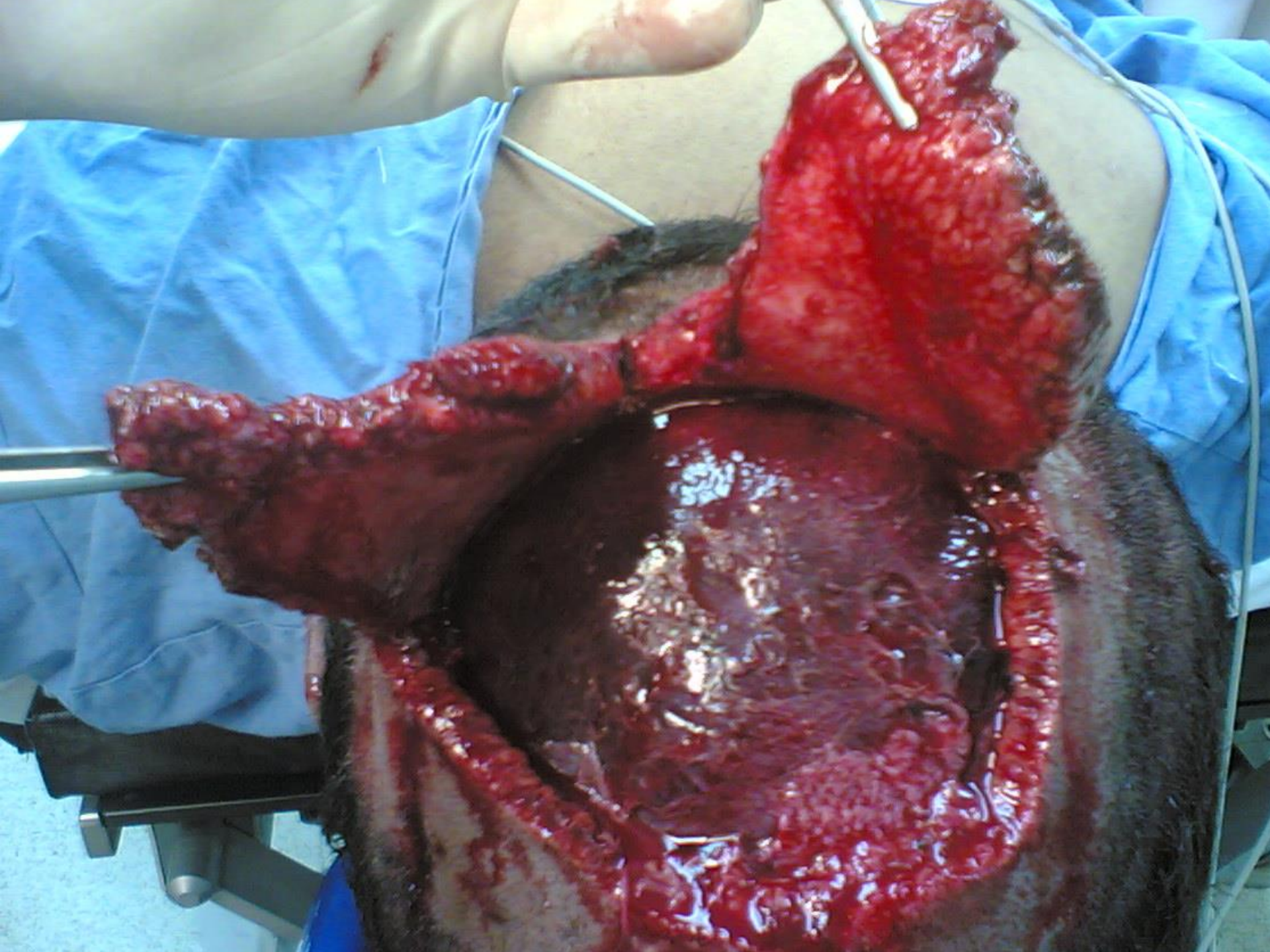
- Stellated and large either superficial one (bleeder) or deep one (less beeder) mostly closed under G.A especially in children, extensive debridement is unnecessary, all devitalised tissue should be derbided.

Reconstruction ladder

1. primary suturing in simple lacerations ,sharp, without tissue loss and gross contamination
2. secondary intention in wounds with minimum tissue loss
3. debridement and a split thickness graft in wounds with extensive tissue loss and intact pericranium
4. local flaps in wounds with extensive tissue loss and stripped pericranium and a split thickness graft for donor area (if a defect is left)
5. Pedicular flaps can be used if local flaps are not sufficient especially for occipital areas and small defects
6. Free tissue transplant is used for anterior and large areas





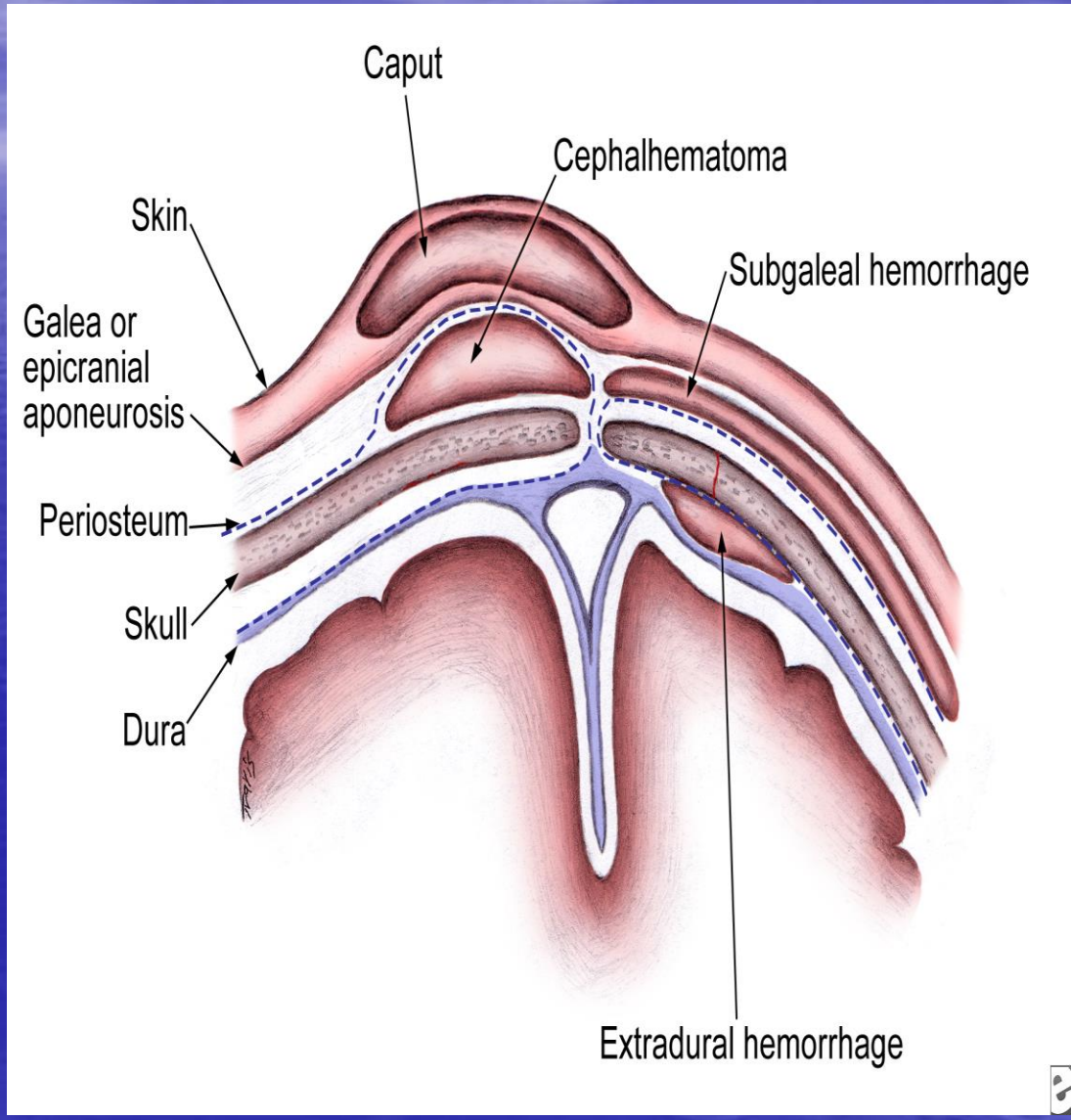


Scalp swelling and hematomas

1. Caput succedaneum

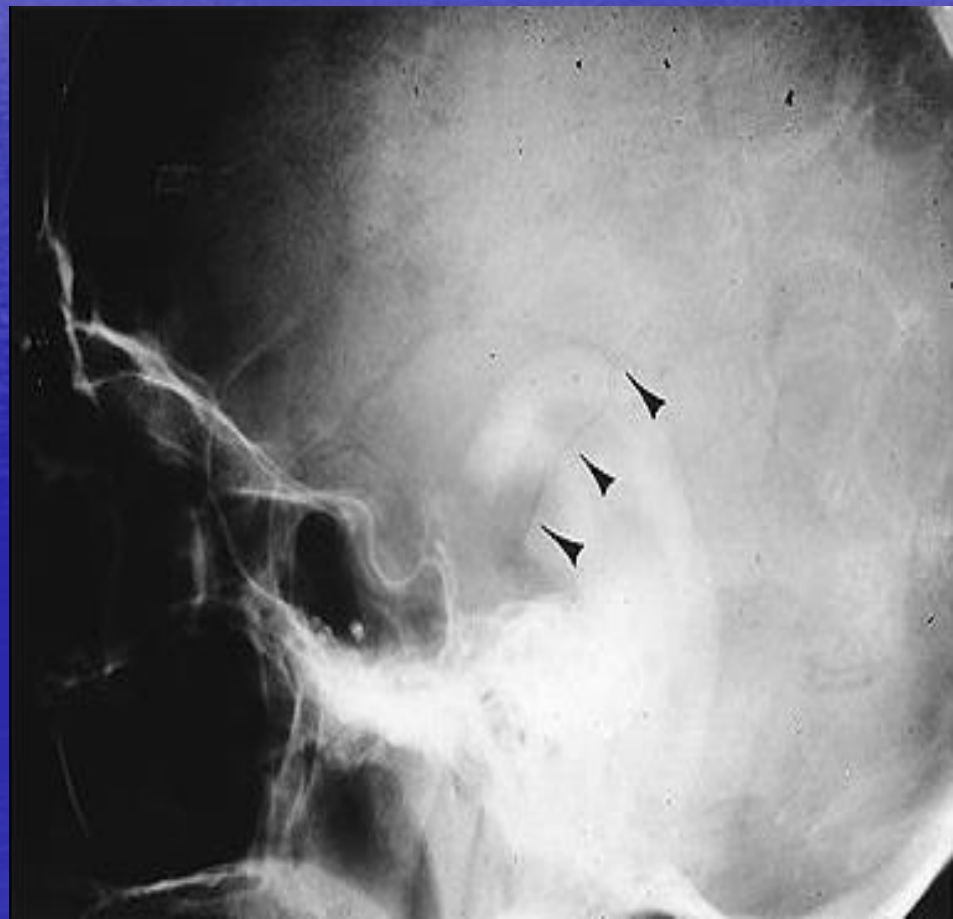
2. Cephal hematoma

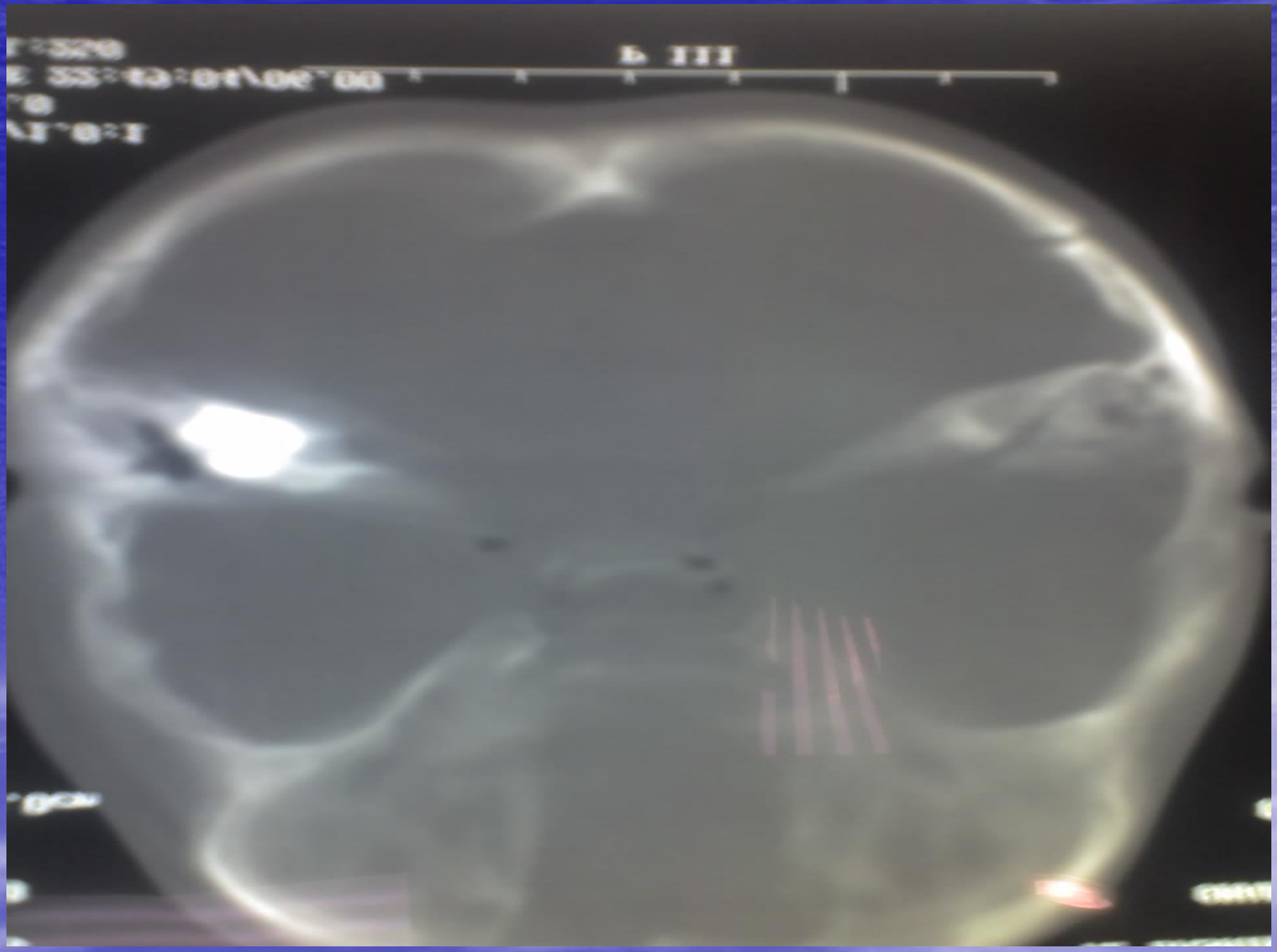
3. Subglial hematomas

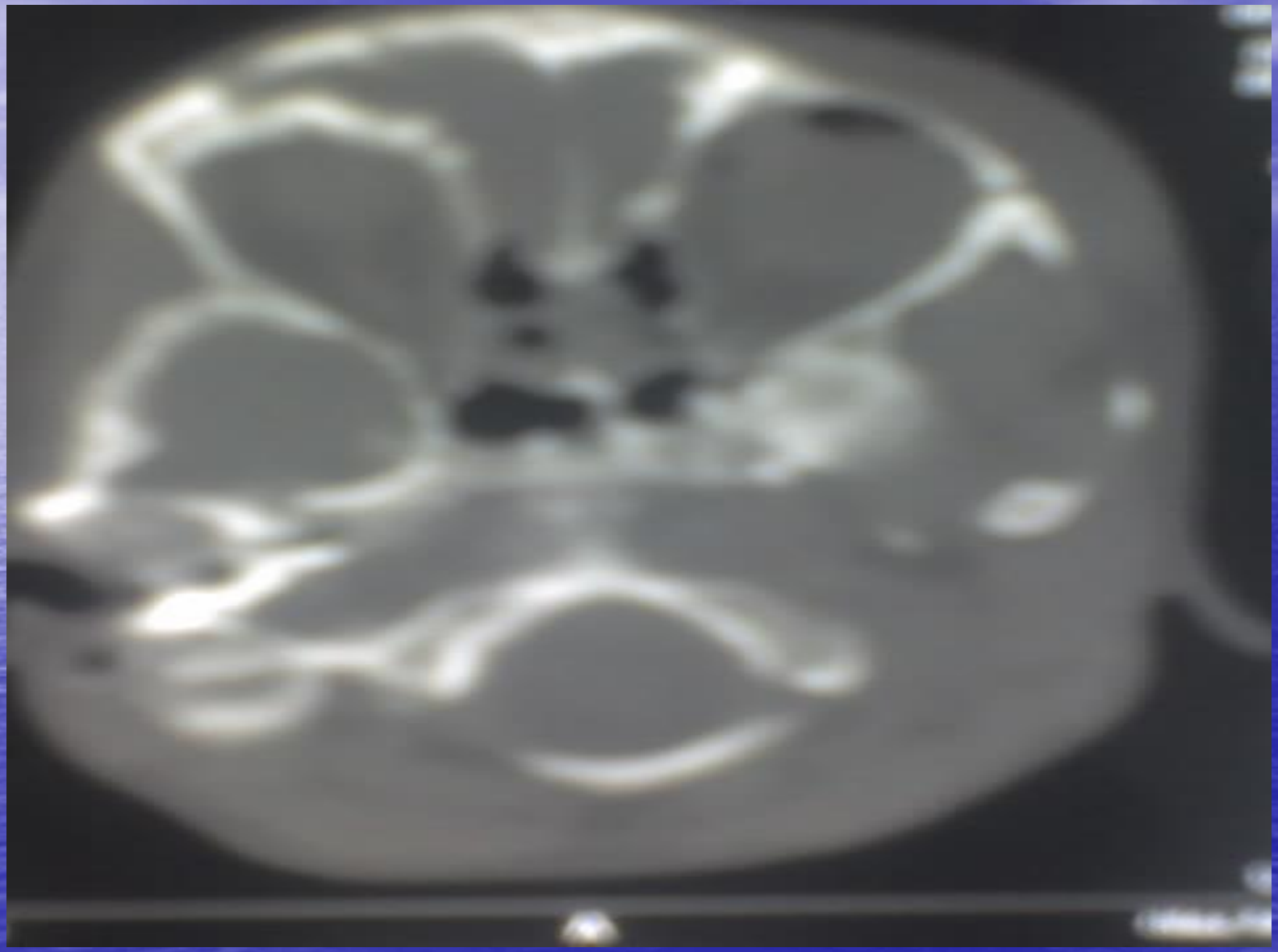


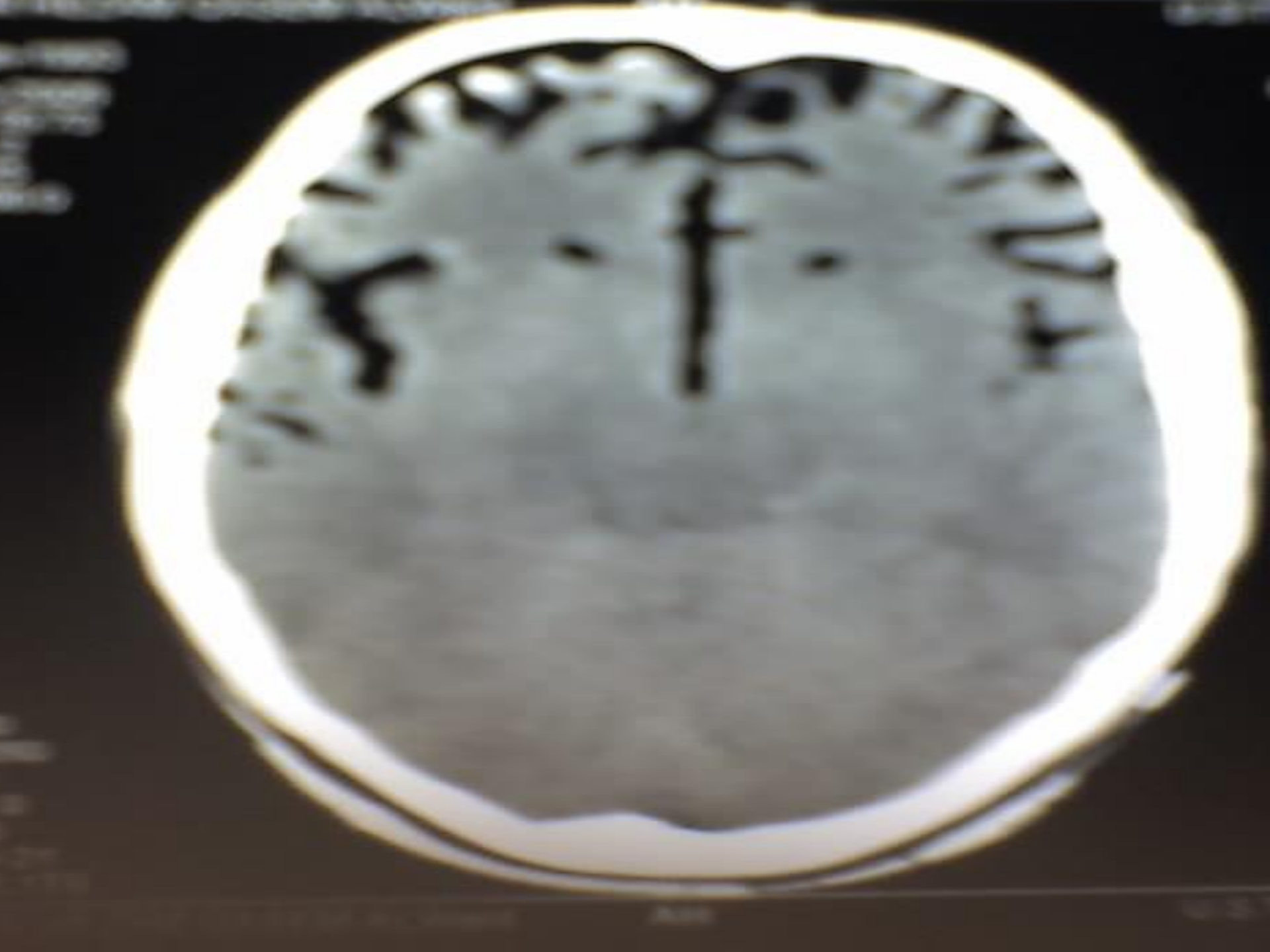
Skull fractures classification

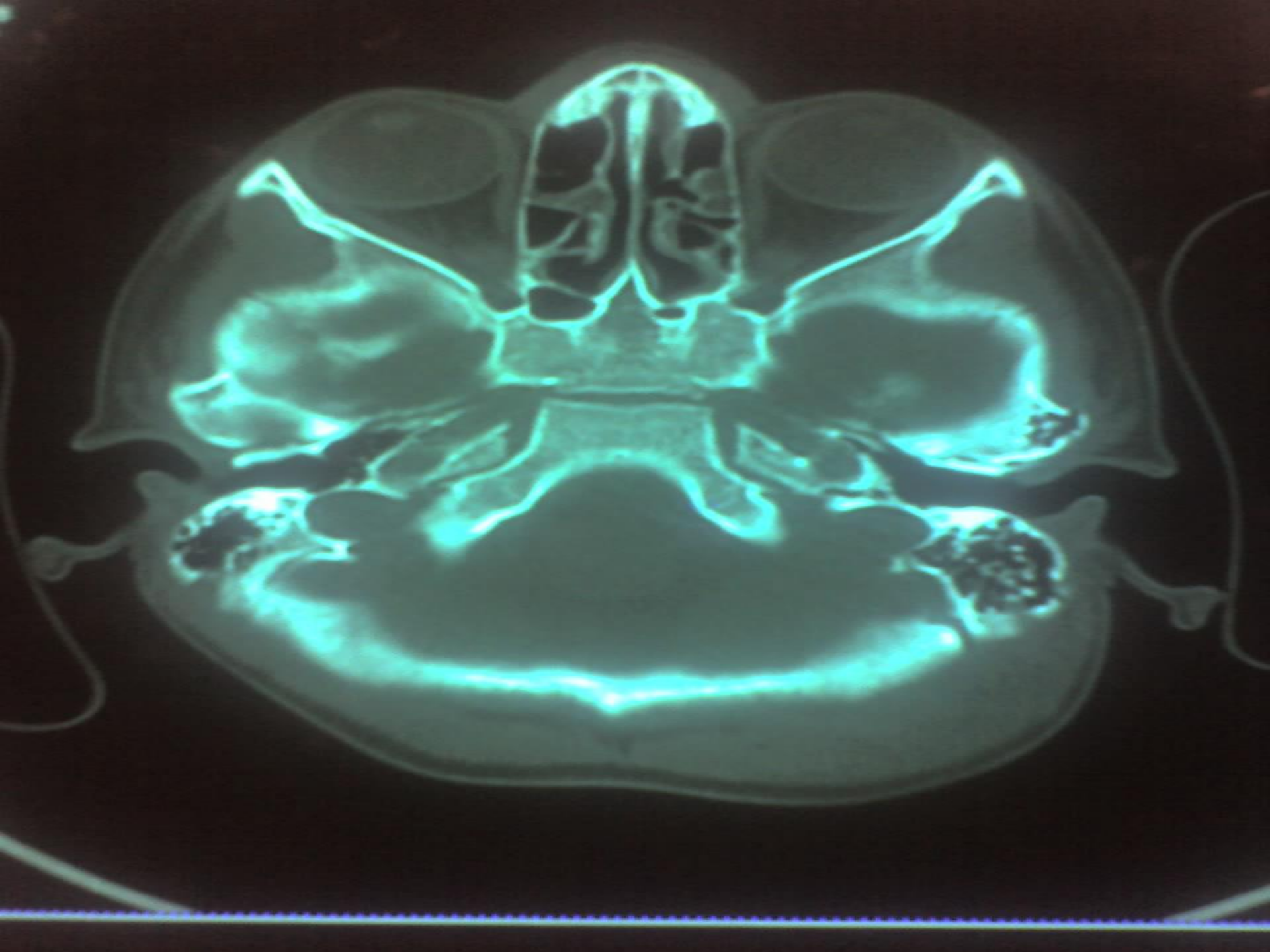
- *1.by pattern (according to amount of energy,ratio of impact force to surface area)*
  - Comminuted
  - Depressed
  - Linear
  - Diastatic
  - Basal fractures
  - Growing
- *2.by type*
  - Opened
  - Closed
- *3.by anatomic location*
  - Basal
  - convexity

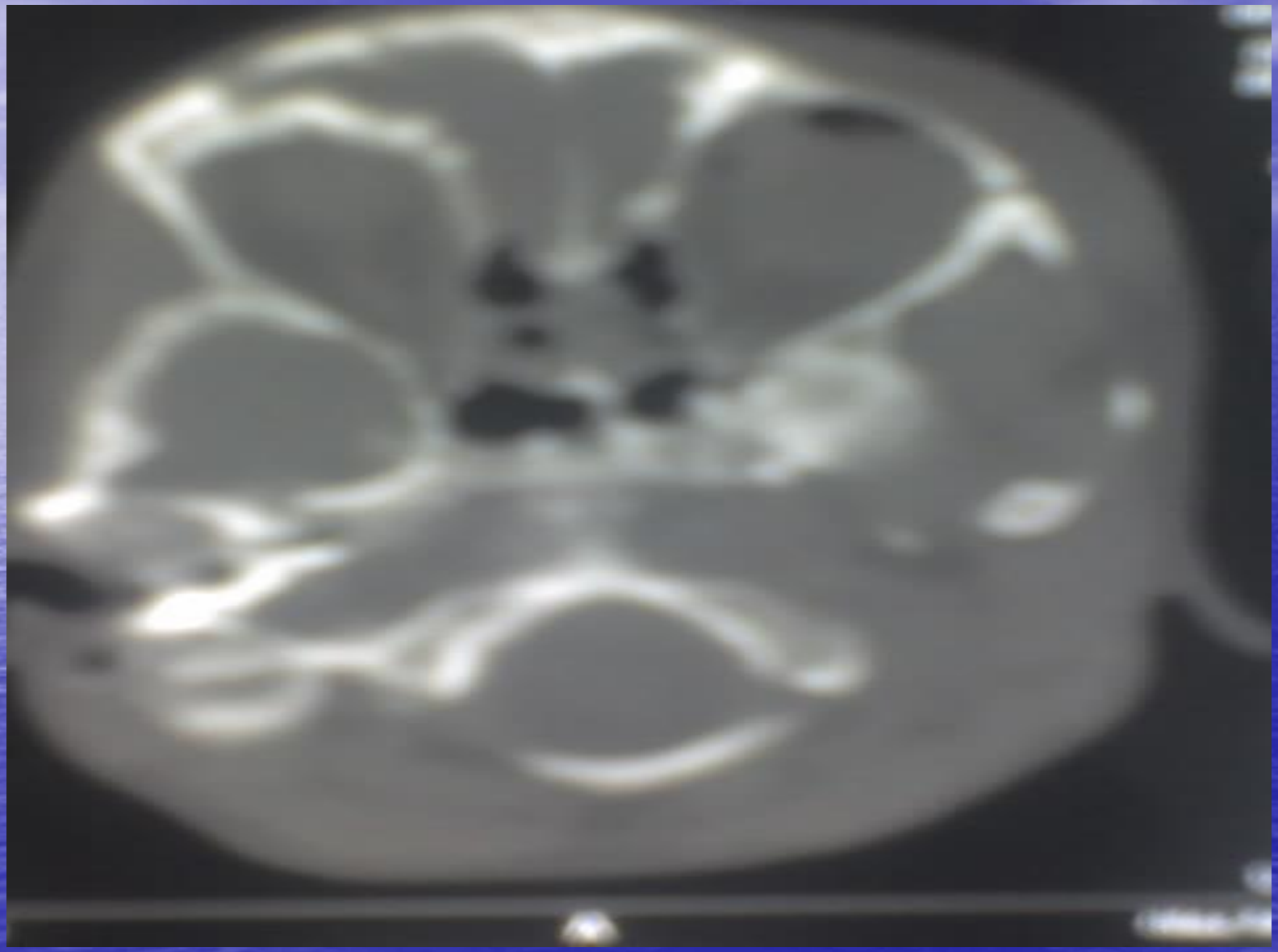


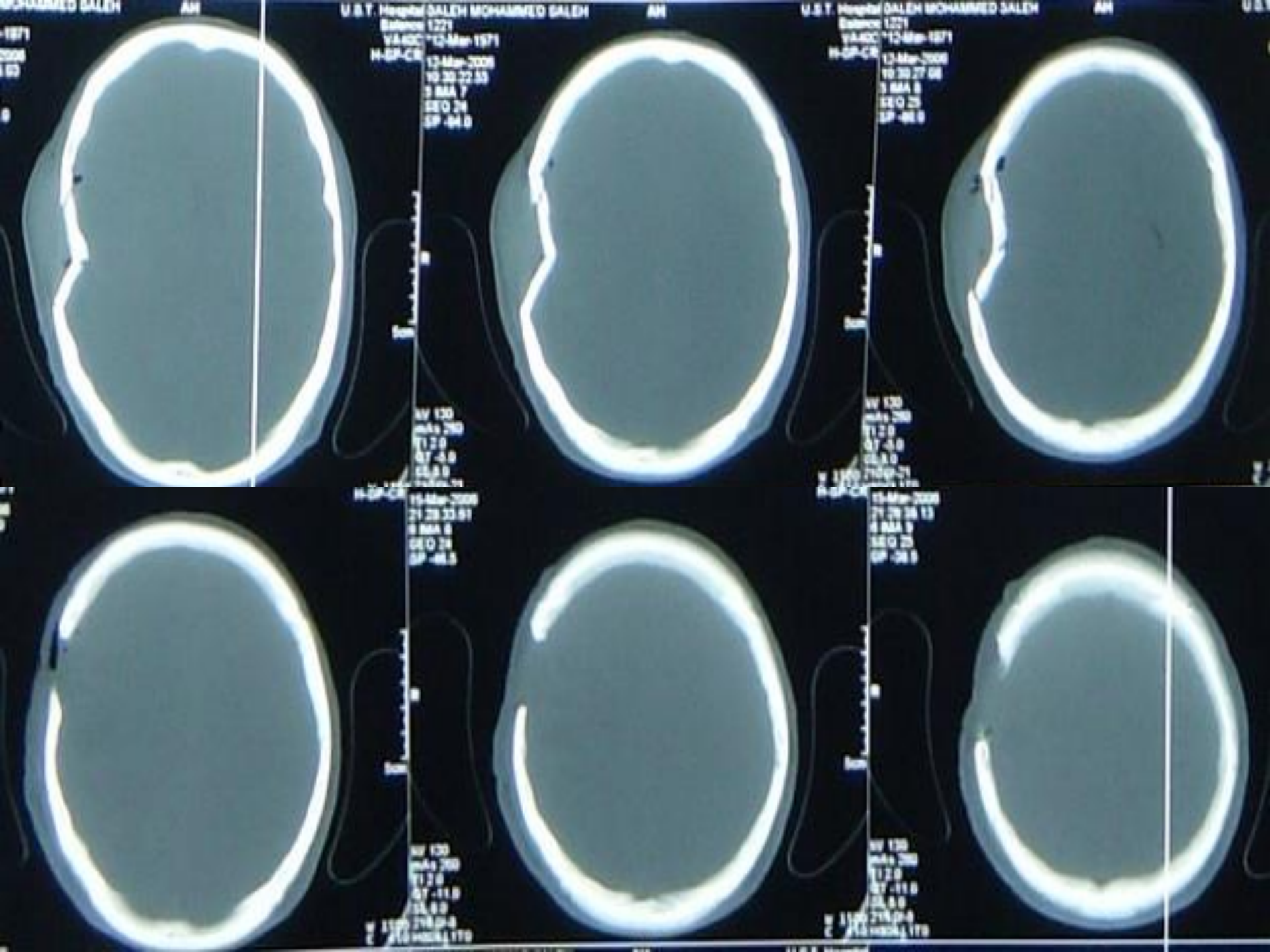


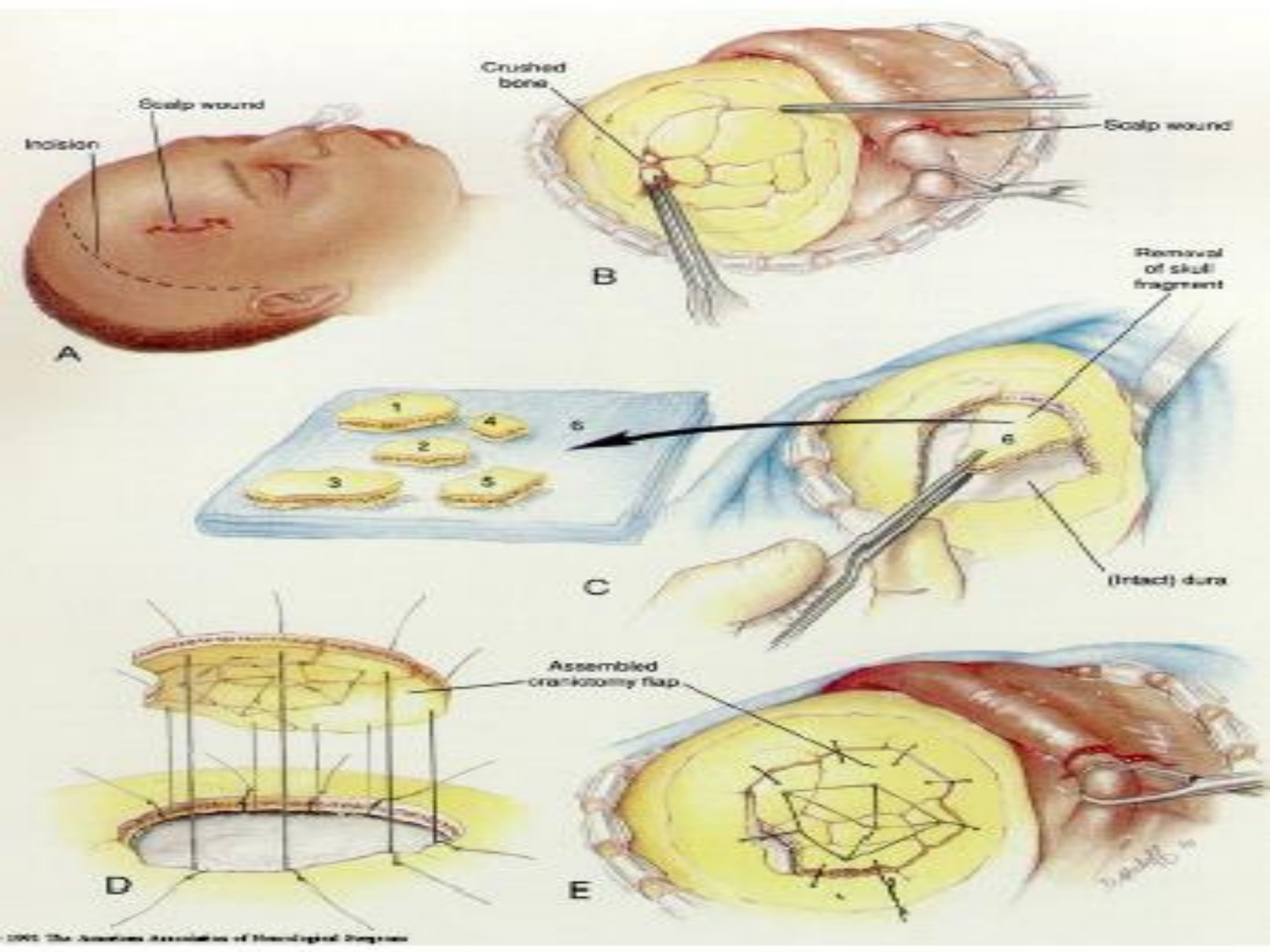


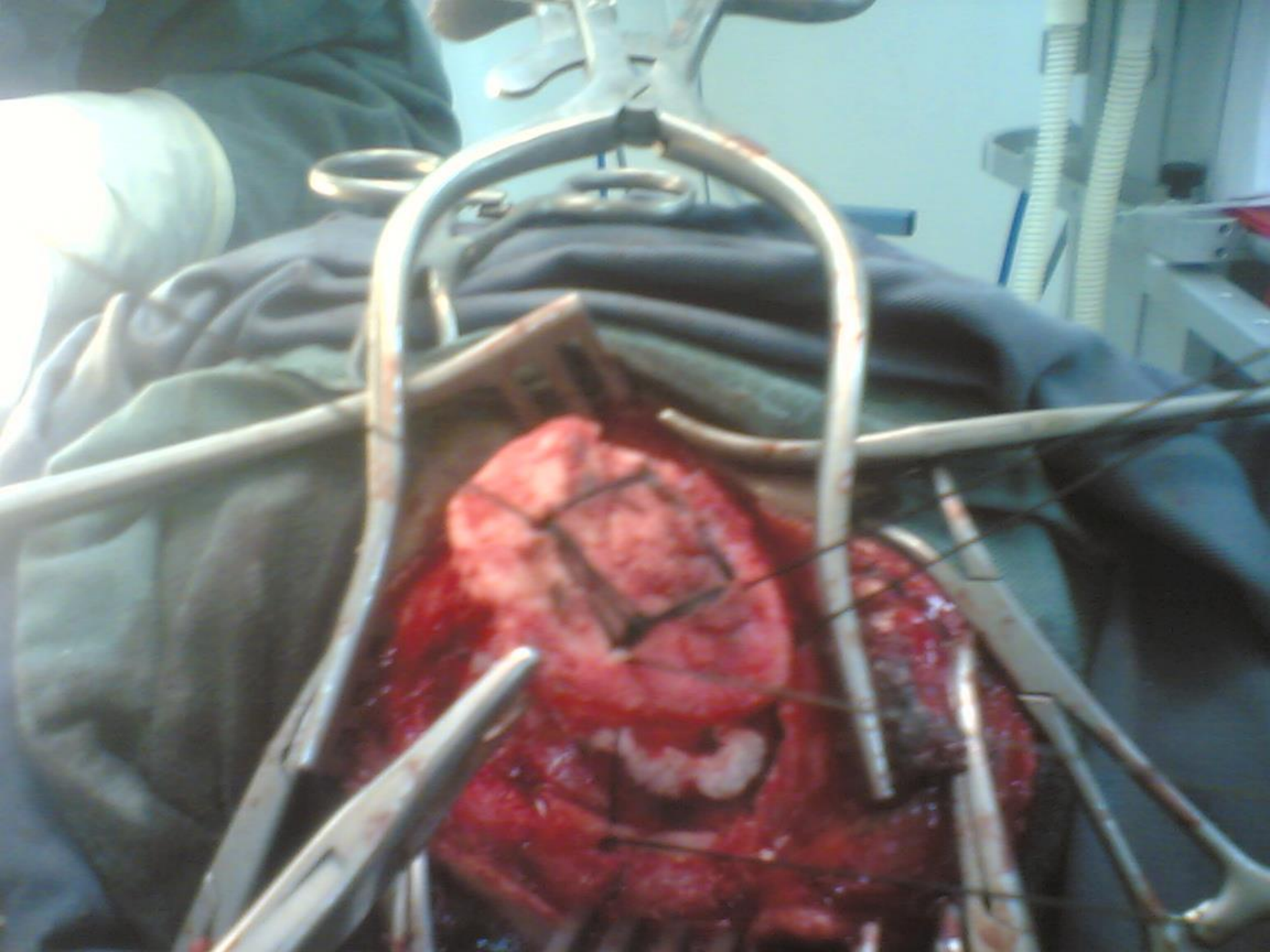


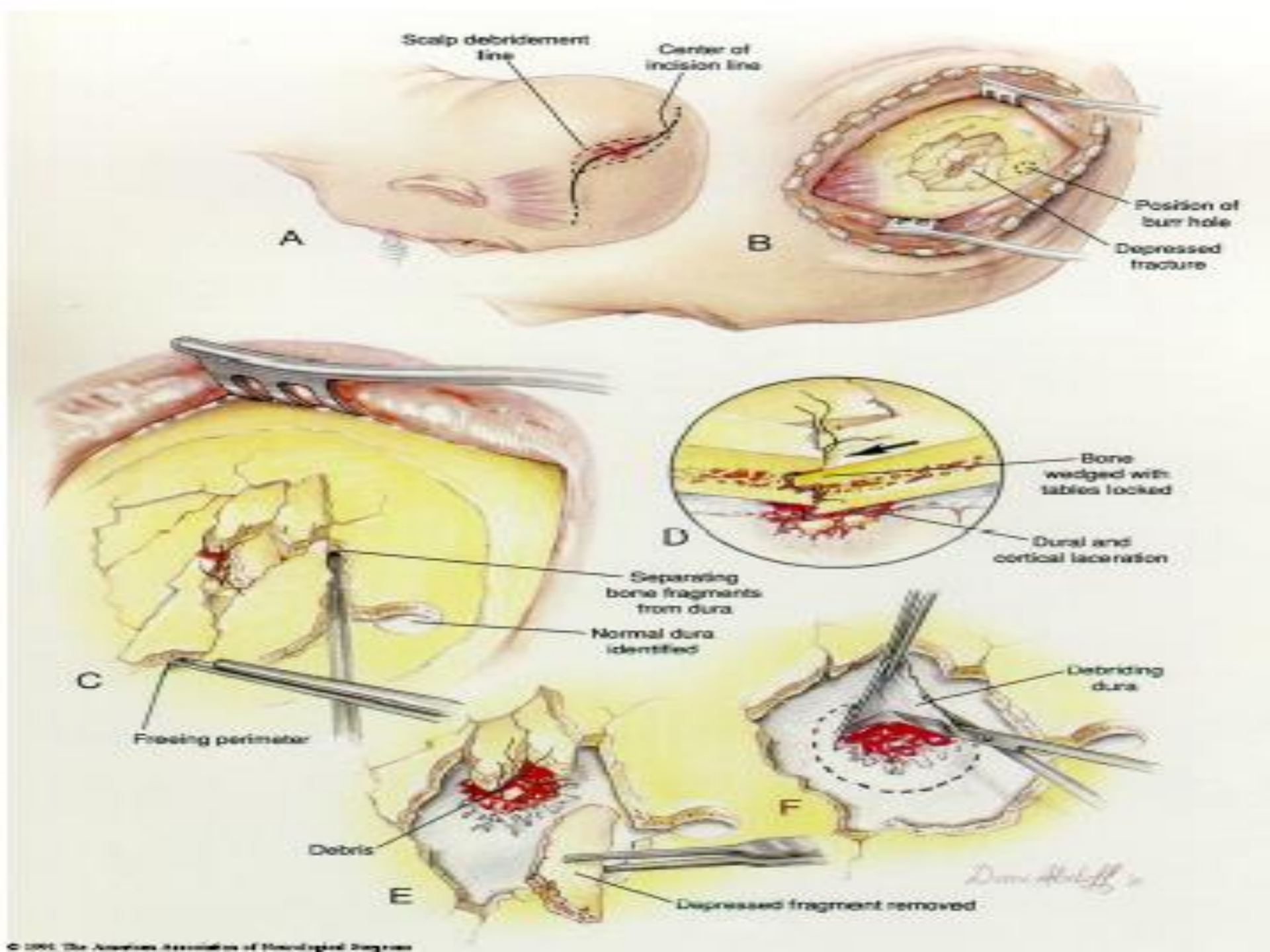


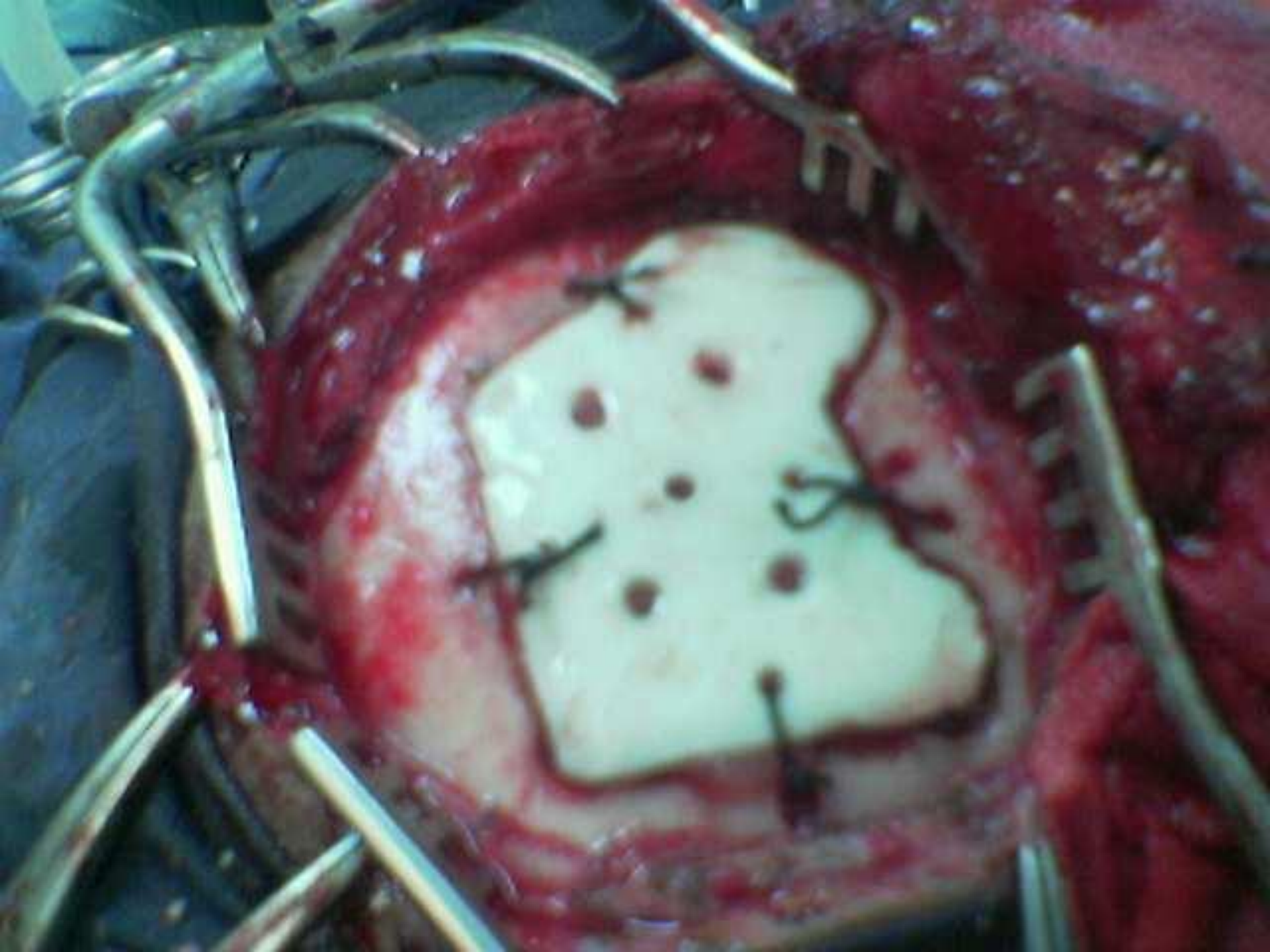


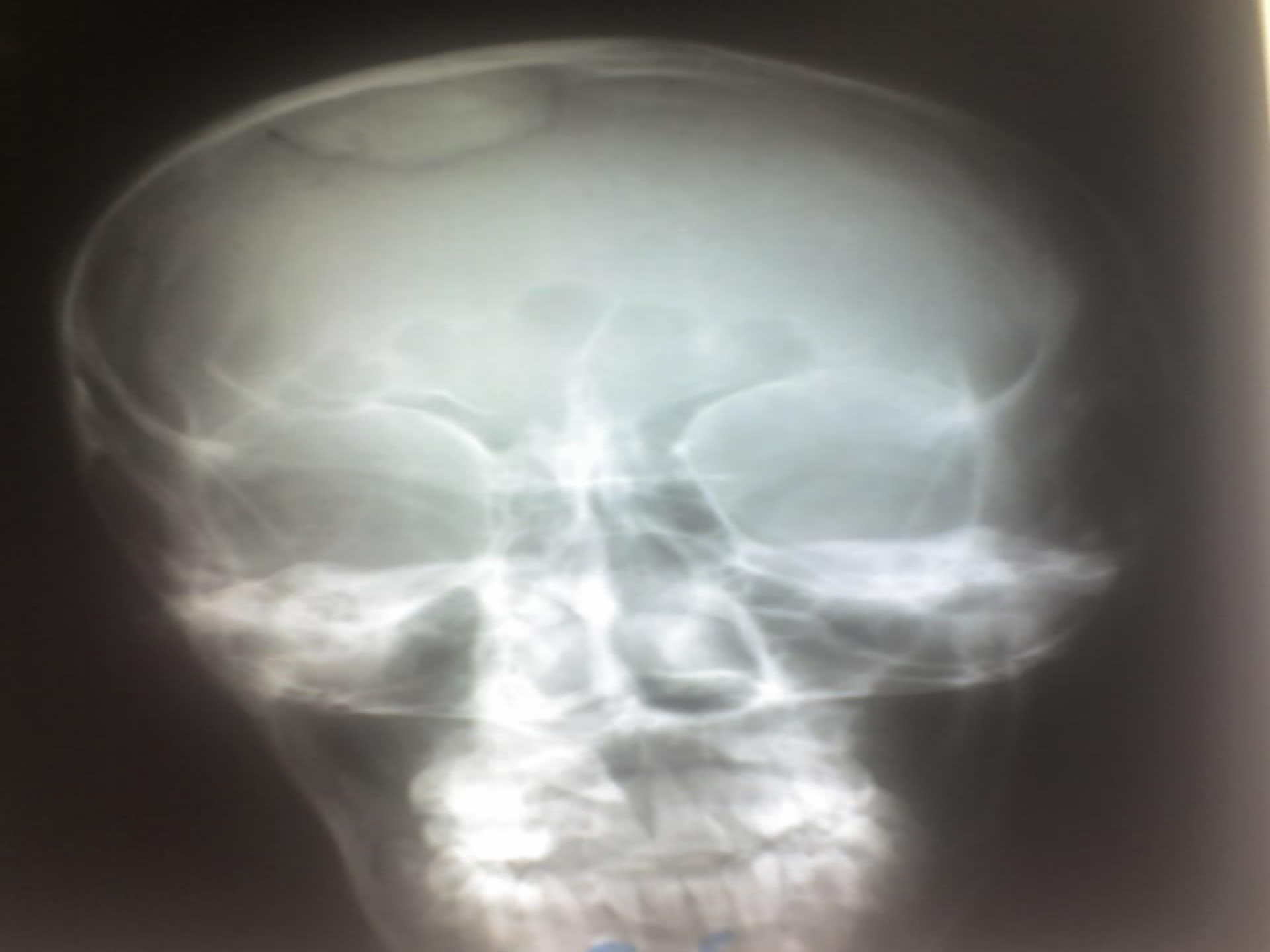

SALEH MOHAMMED SALEH
AH
SALEH MOHAMMED SALEH
AH


Scalp wound
Incision
A
Crushed bone
Scalp wound
B
Removal of skull fragment
1
4
6
2
3
5
6
C
(Intact) dura
Assembled craniotomy flap
D
E




Scalp debridement line
Center of incision line
A
B
Position of burr hole
Depressed fracture
C
Separating bone fragments from dura
Normal dura identified
Freeing perimeter
D
Bone wedged with tables locked
Dural and cortical laceration
E
Debris
Depressed fragment removed
F
Debriding dura





Treatment roles

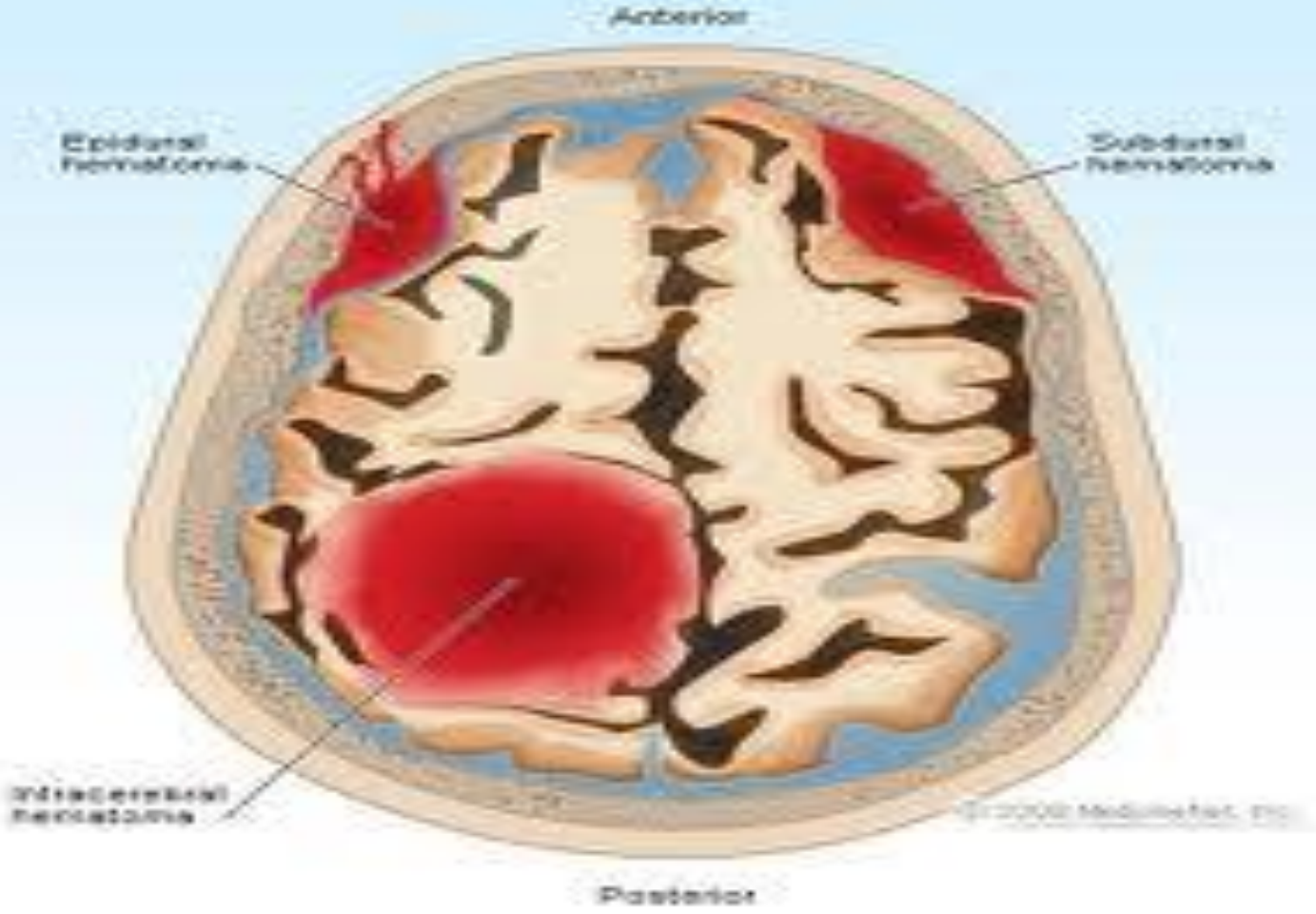
- Comminuted (replacement as a cranioplasty if not infected with treatment of other associated injuries)
- Linear fractures (no treatment but observation if closed, debridement if infected and compound)
- Depressed(replacement as a cranioplasty if not infected, otherwise good debridement and craniectomy)
- Basilar skull fracture (observation for two days, avoid irrigation of the nose or ear, avoid probing, detailed auditory and vestibular examination is performed at6 weeks interval)
- Frontal sinus fracture (if in the posterior wall cranialization is necessary)

Types of traumatic intracranial leasions

- *Focal(epidural hematoma-subdural hematoma-brain contussion-intracerebral hematomas-focal subarachnoid hematoma)*

- *Diffused(subarachnoid hemorhage-diffused axonal injury-concussion)*

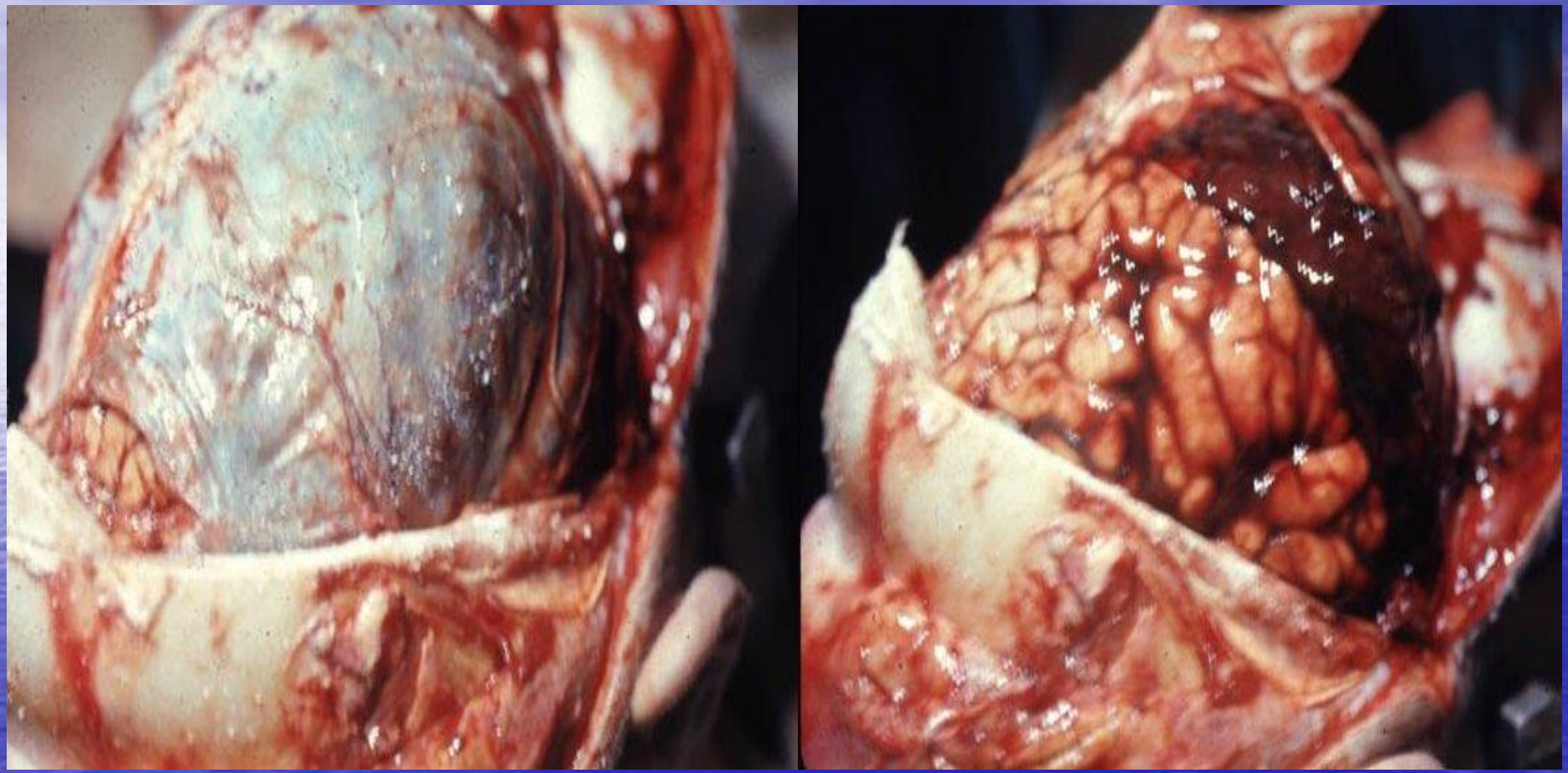
Brain Hematoma



Traumatic intracranial hematomas

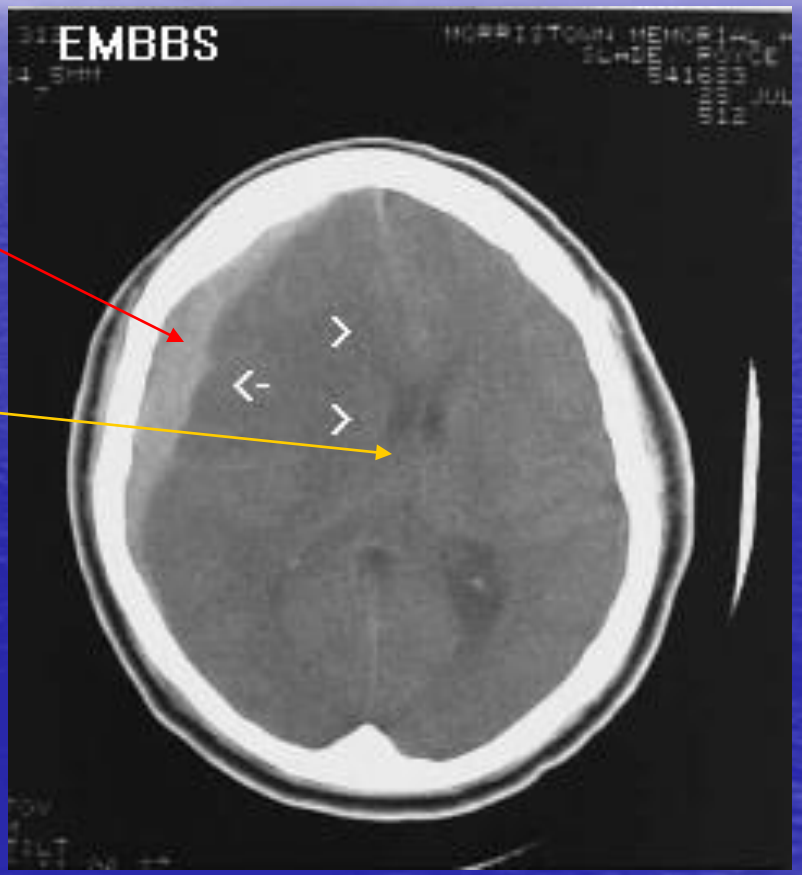
• *Acute subdural*

- accelerate high speed impact
- tearing of bridging veins
- bleeding from cortical vessels, venous sinuses
- acute brain trauma may coexist
- altered level of consciousness and focal neurological deficit are common
- CT and rapid evaluation are necessary
- If no signs of rapid deterioration or progressive neurological deficit ,no mass effect so observation and control of intracranial p. is necessary, otherwise surgery is the role)



Acute Subdural Hematoma

Another example of acute subdural hematoma with a midline shift (noncontrast CT)

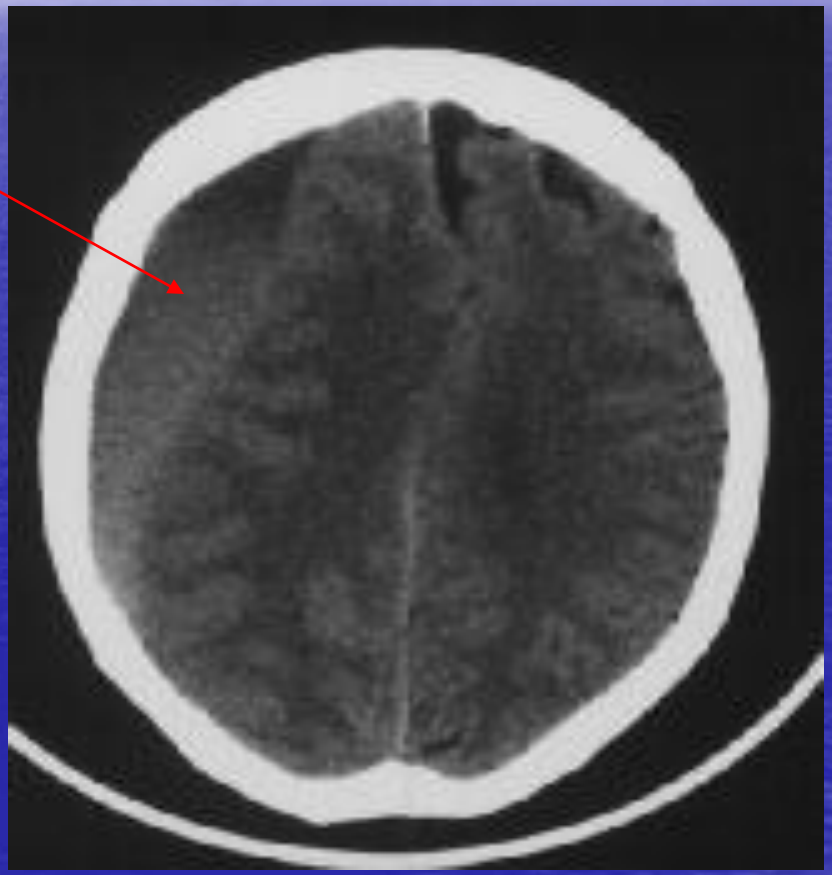


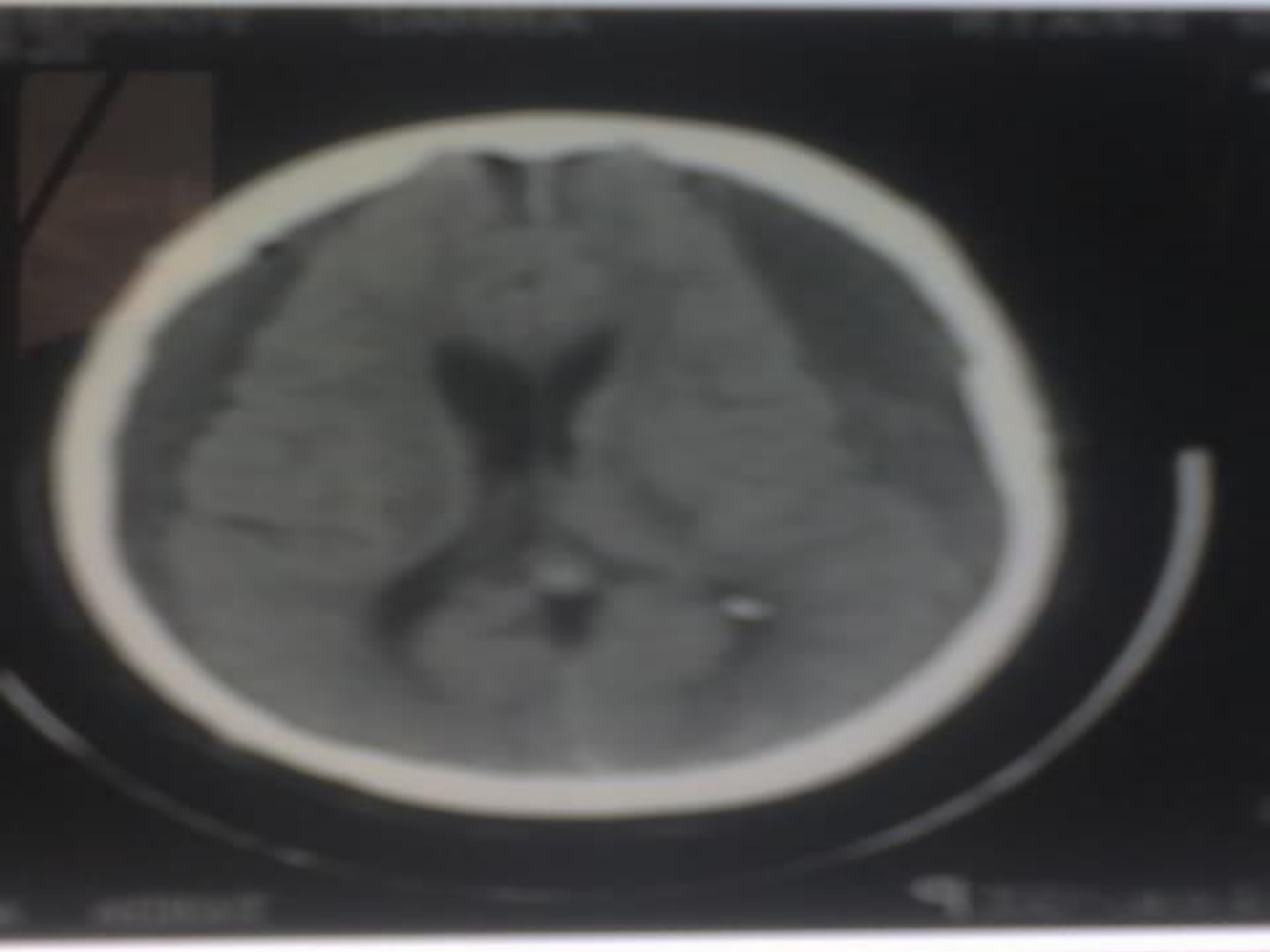
Chronic subdural

- Mostly in those over 50 years old
- ½ of patients have got no history of trauma
- If there is any history of trauma , it is trivial
- Alcoholism, epilepsy, coagulopathy are common
- Dementia is common presentation
- In minimal neuological deficit ,medical management is the role
- If not successful, deterioration of neurological picture so surgery usually by burr hole evacuation.

Subacute Subdural Hematoma

Noncontrast CT—note the clot appears less dense in this subacute subdural hematoma.



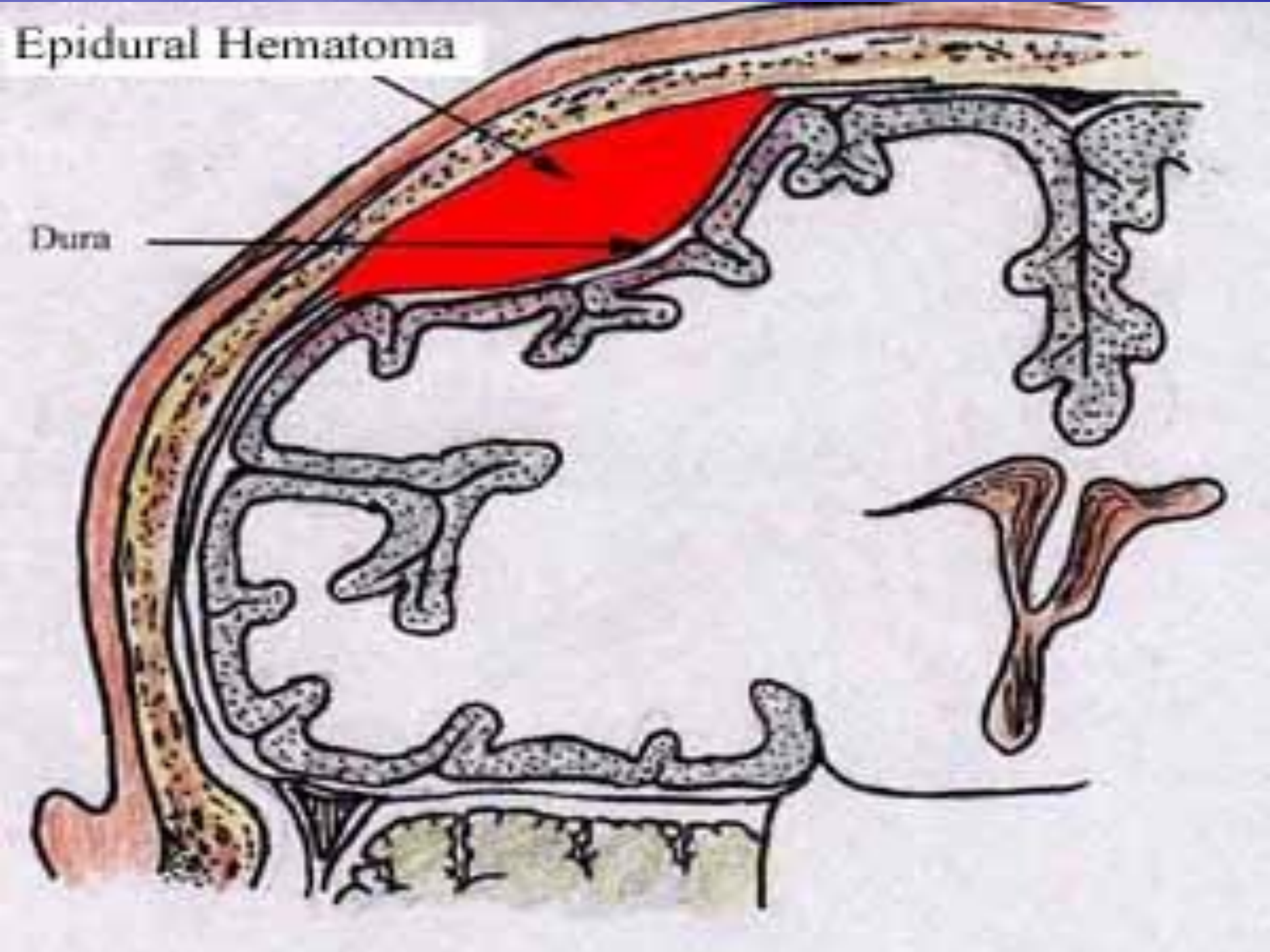


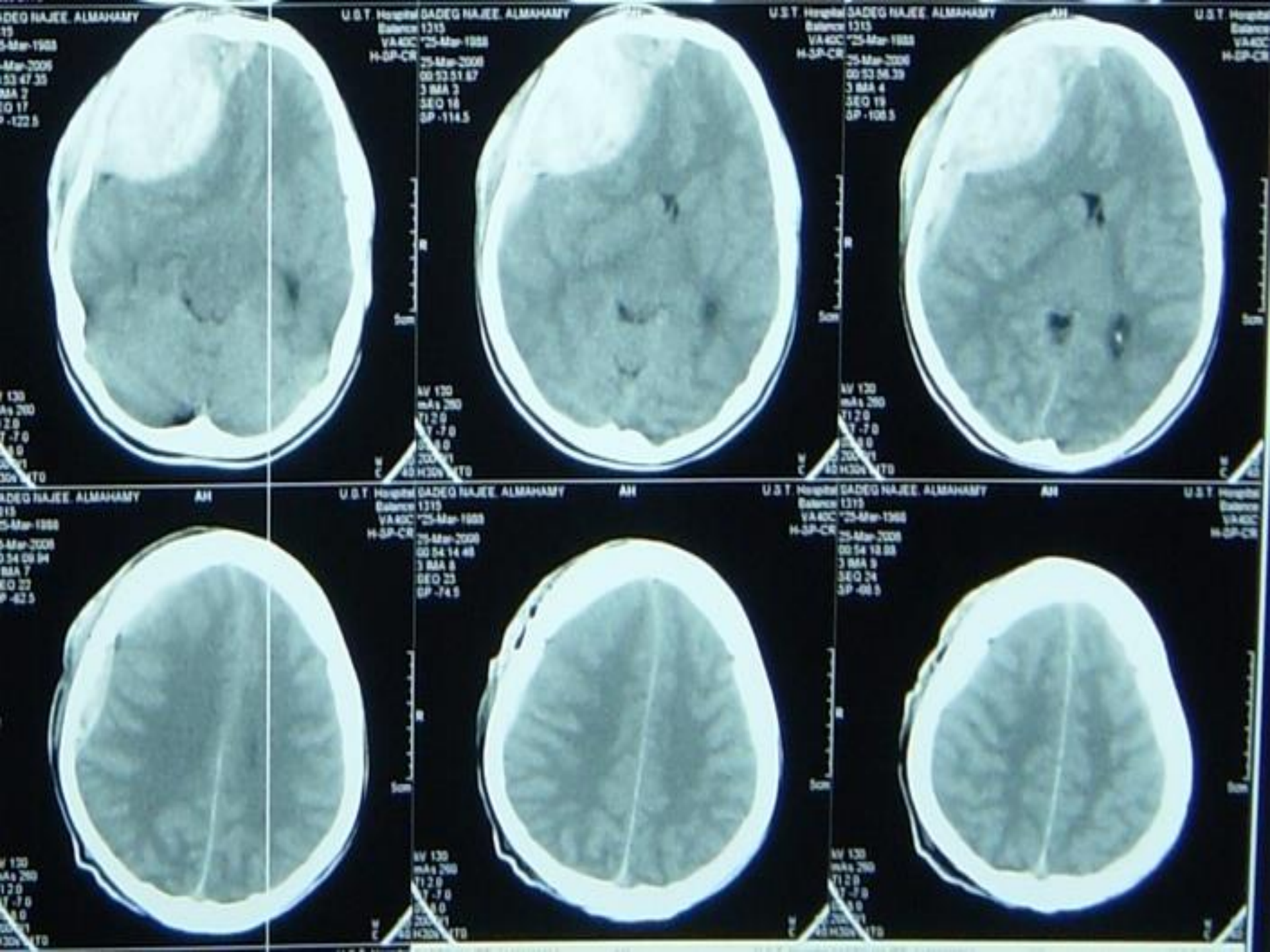
Subdural Hematoma

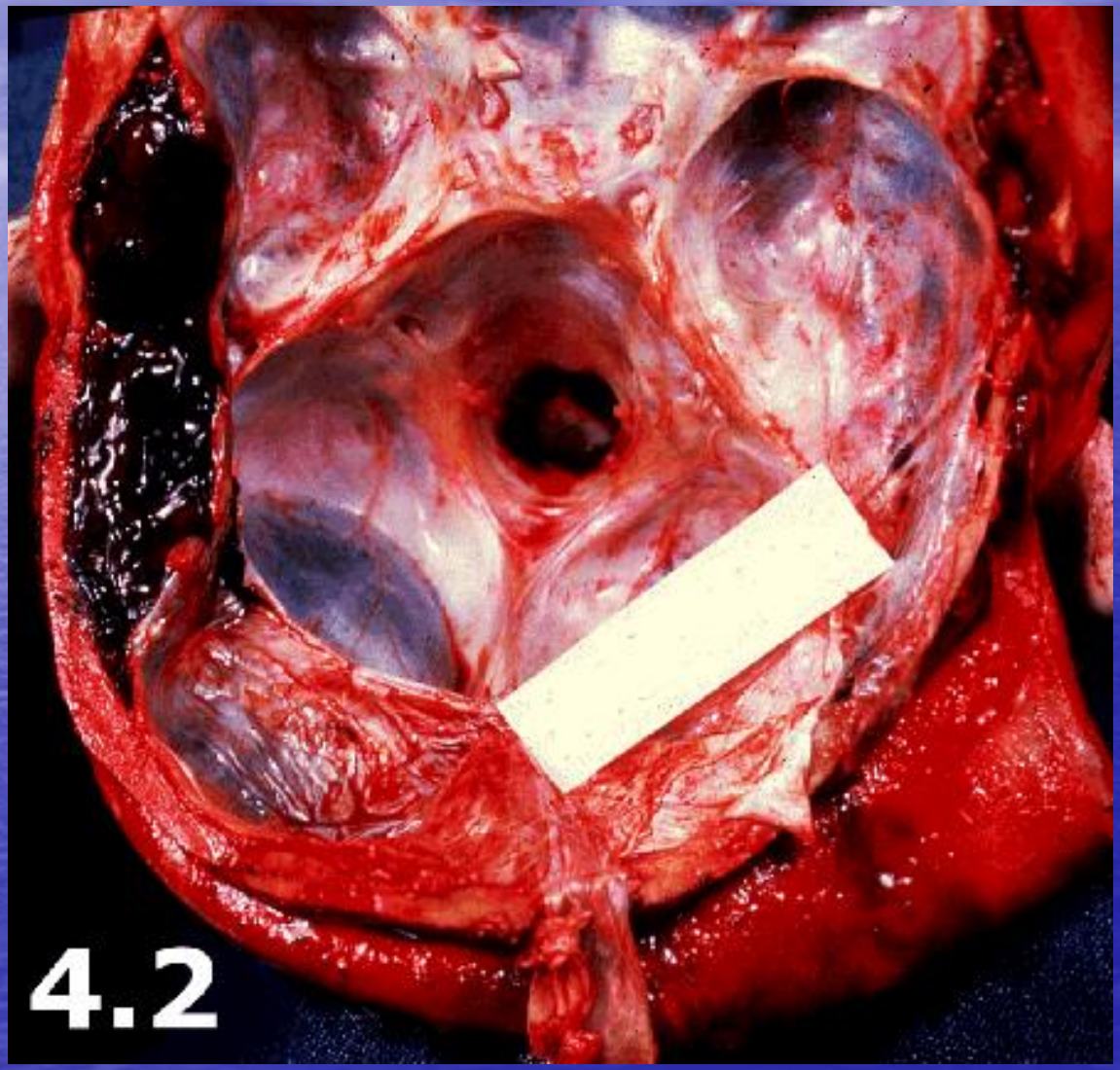
Axial section of skull and brain

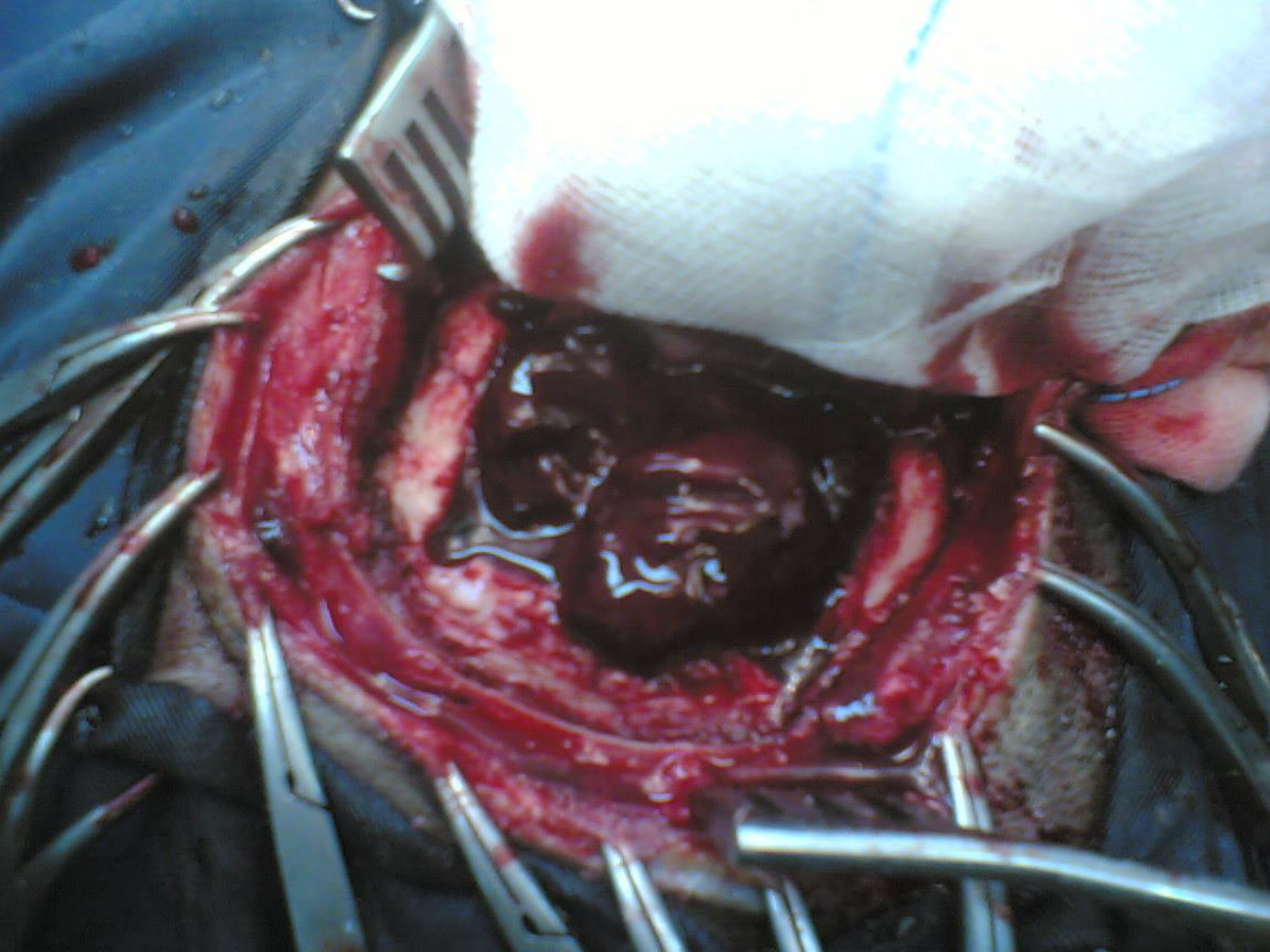
Extradural hematomas

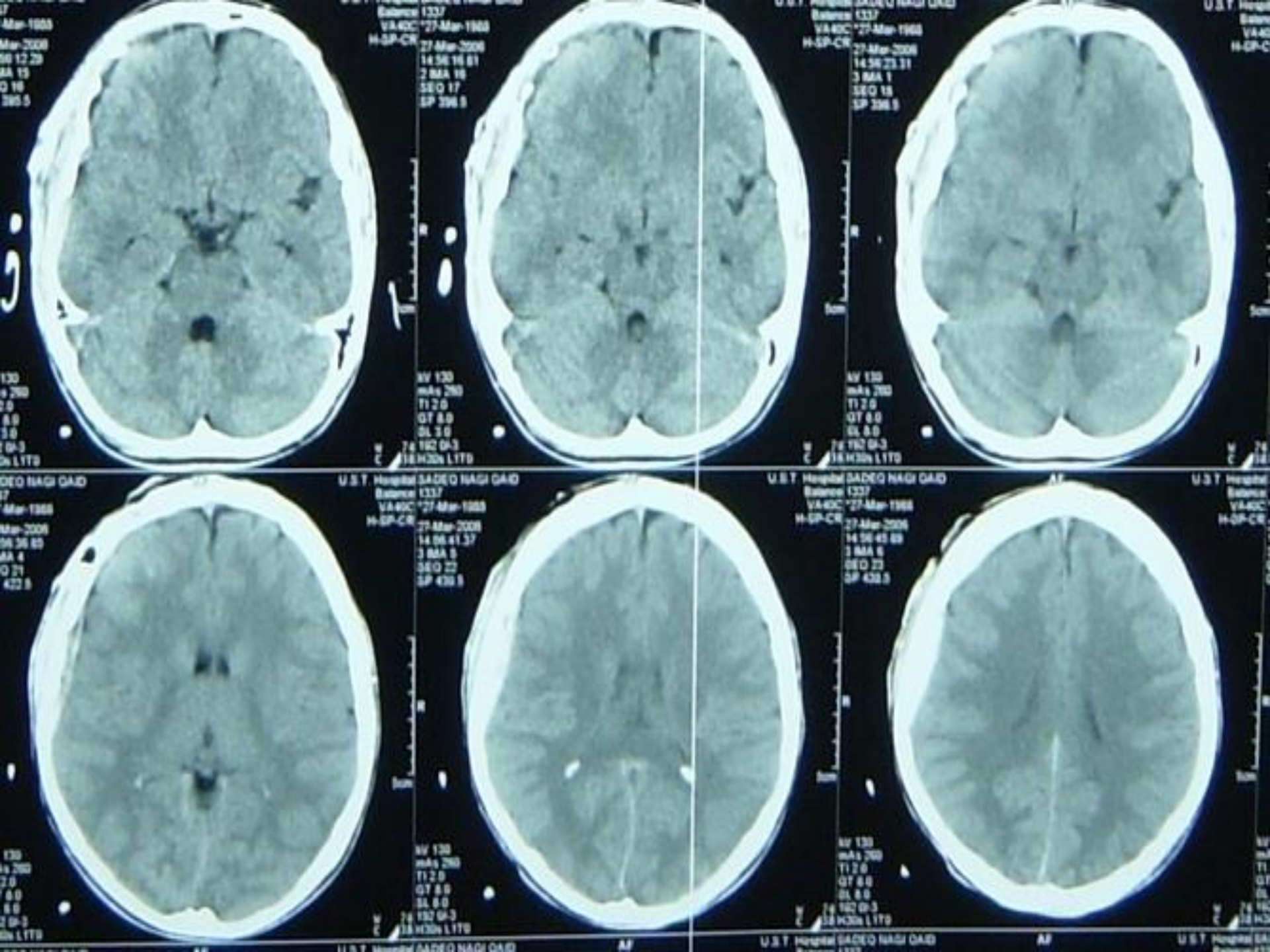
- Mostly resulting from meningial vessel tear (arteries > Veins > sinuses)
- Fractures are common associated injury
- Severe associated brain injury is rare
- Level of consciousness is variable
- If with mass effect must be evacuated within ½ hour
- if small follow up is recommended
- Prognosis depends on level of consciousness at time of presentation

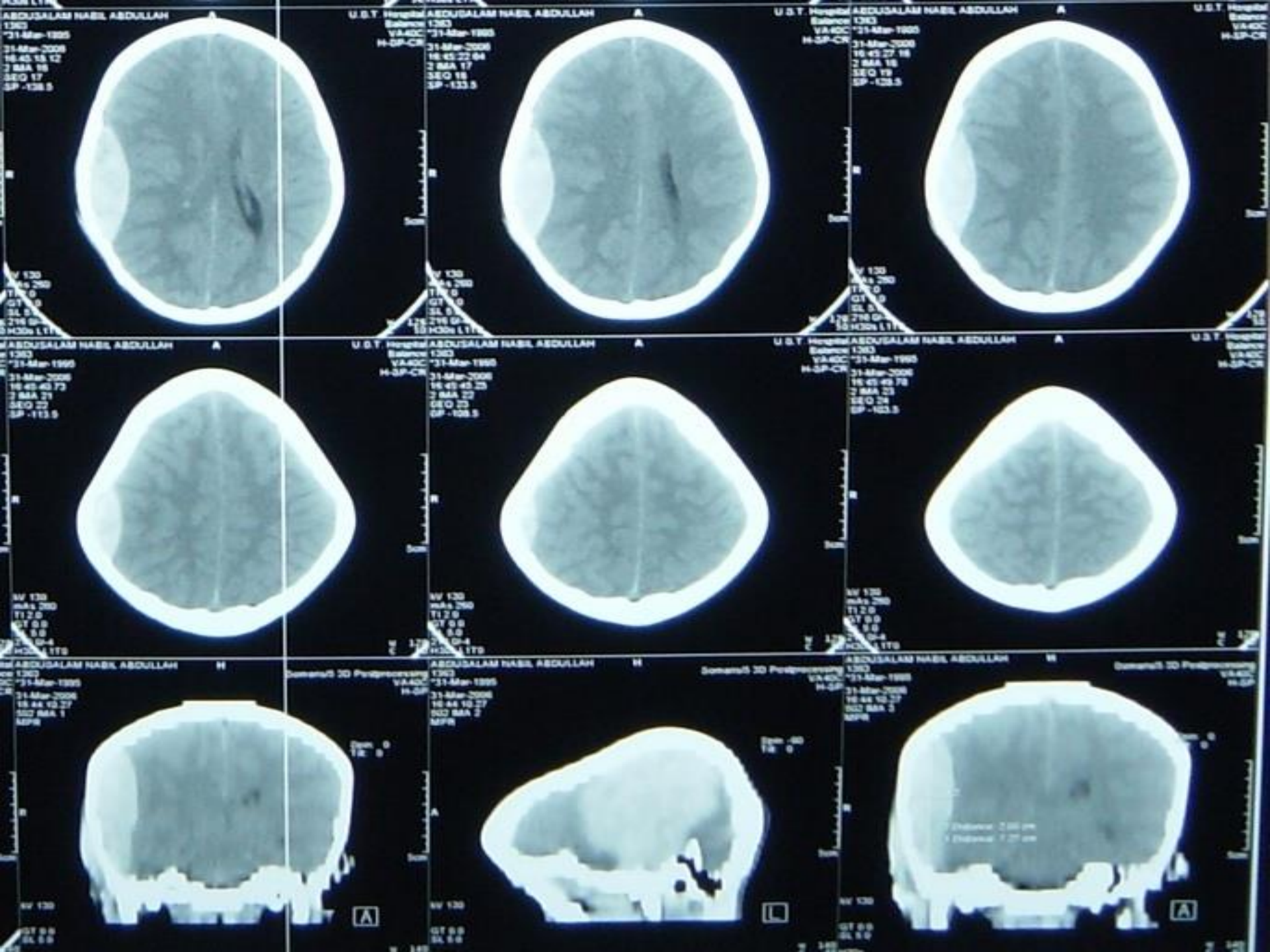

Epidural Hematoma
Dura

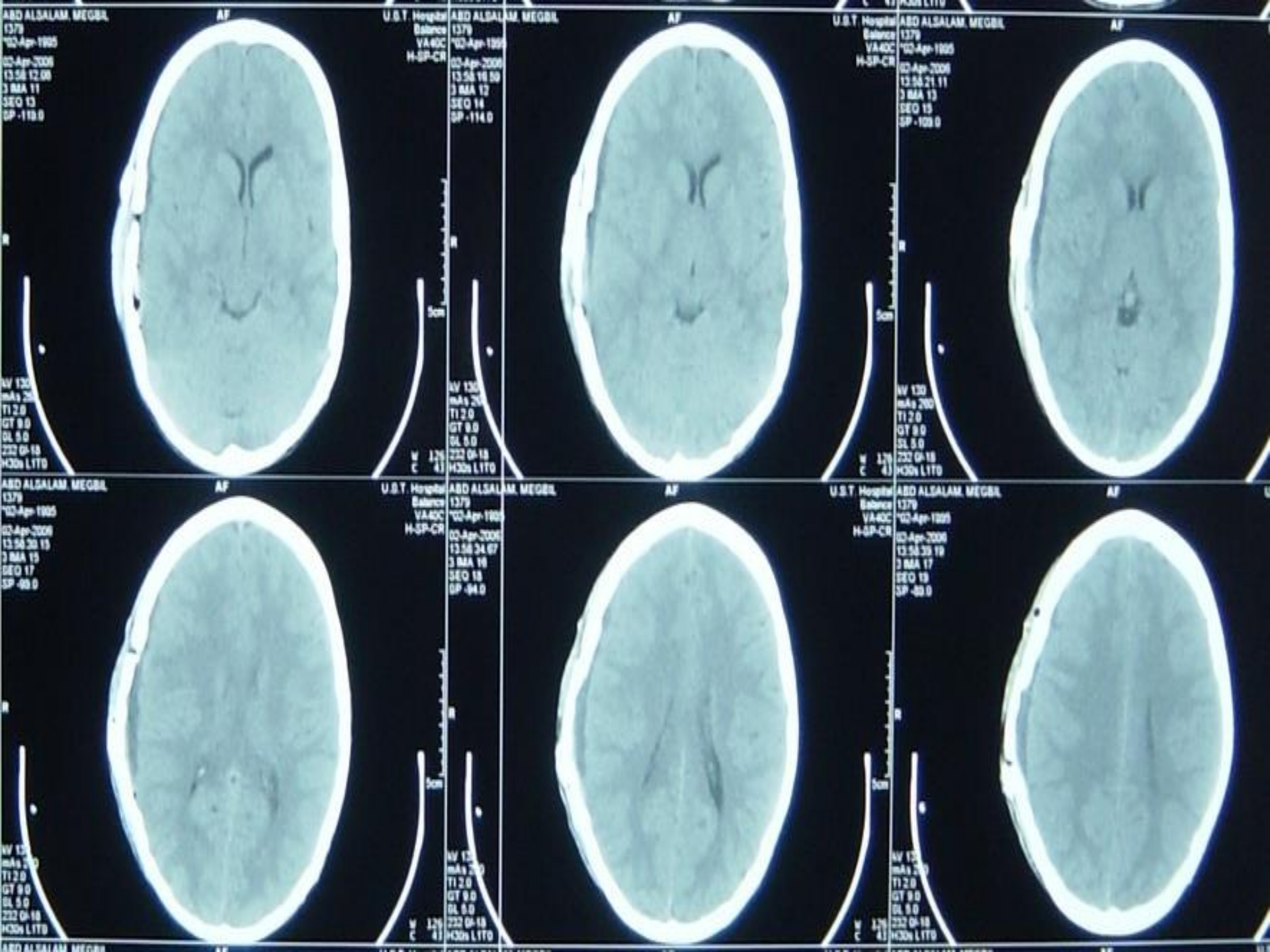

SADEG NAJEE. ALMAHAMY
U.S.T. Hospital
AH


4.2



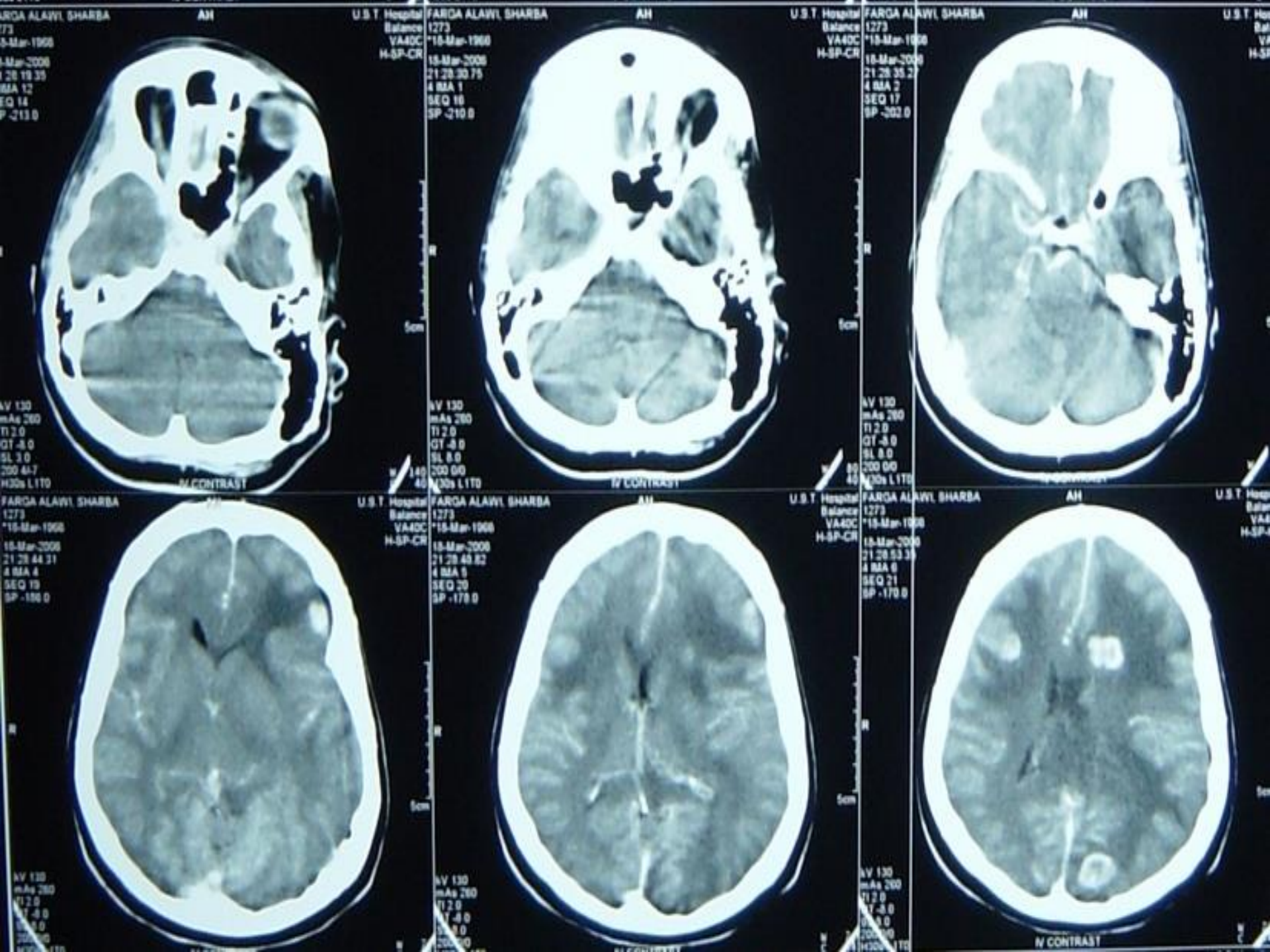


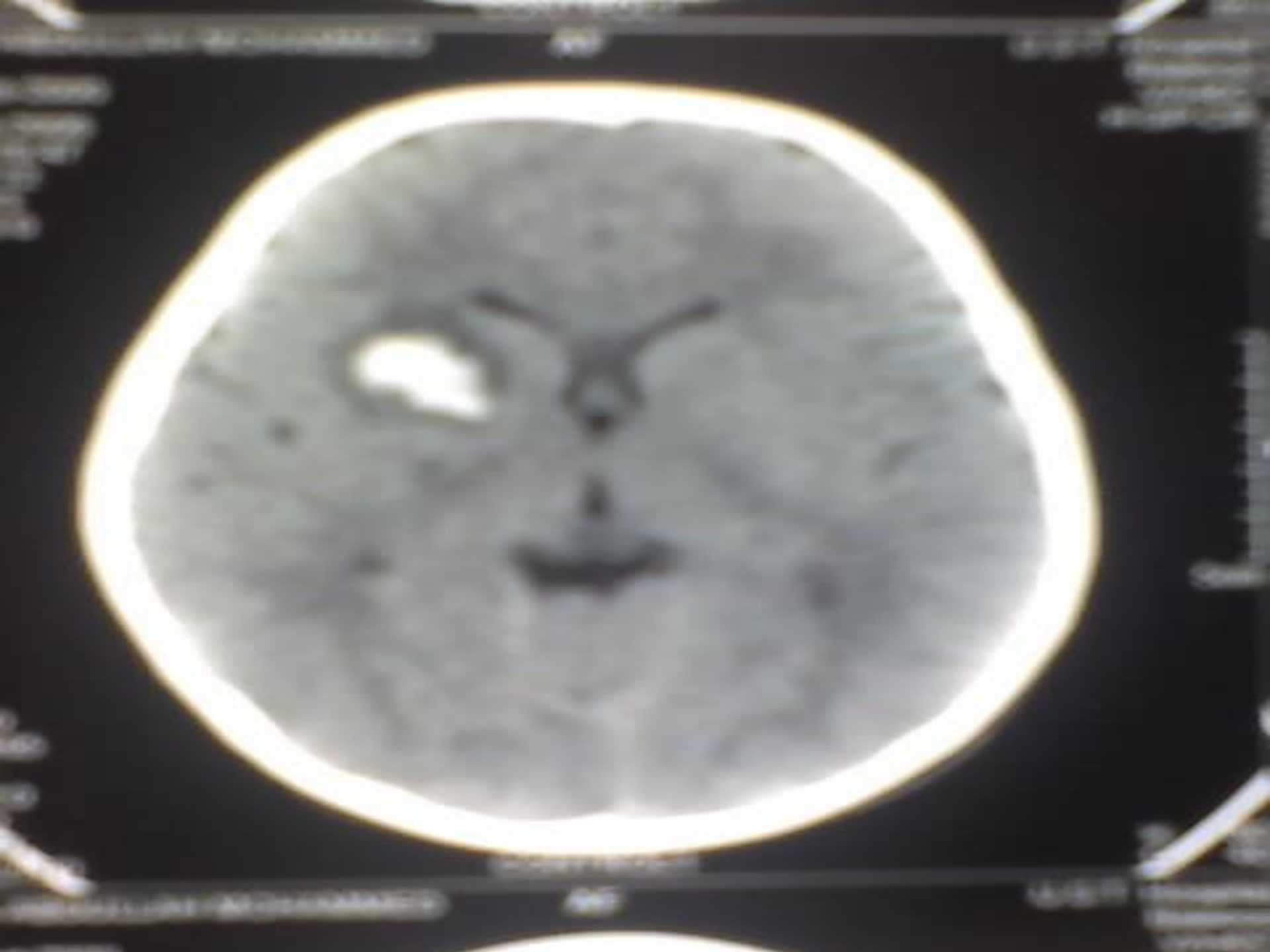


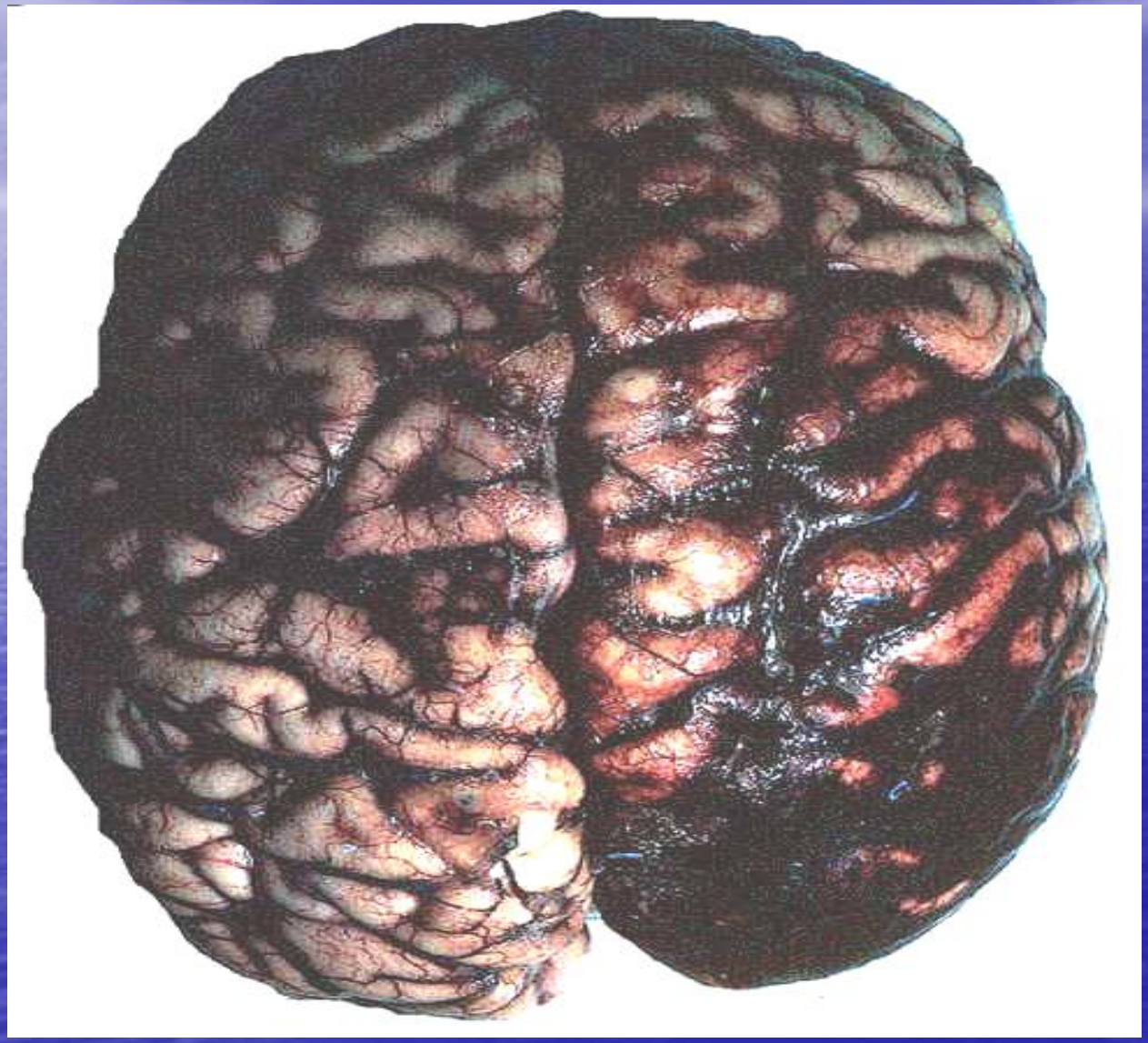

ABD ALSALAM, MEGBIL
AF
U.S.T. Hospital
Balance
VA40C
H-SP-CR
5cm

Cerebral contusions

- Small and deep one needs follow up
- Large and with mass effect needs lobectomy
- Large one may herniate as late as 9 days post trauma
- Level of consciousness depends on size of contusion and location

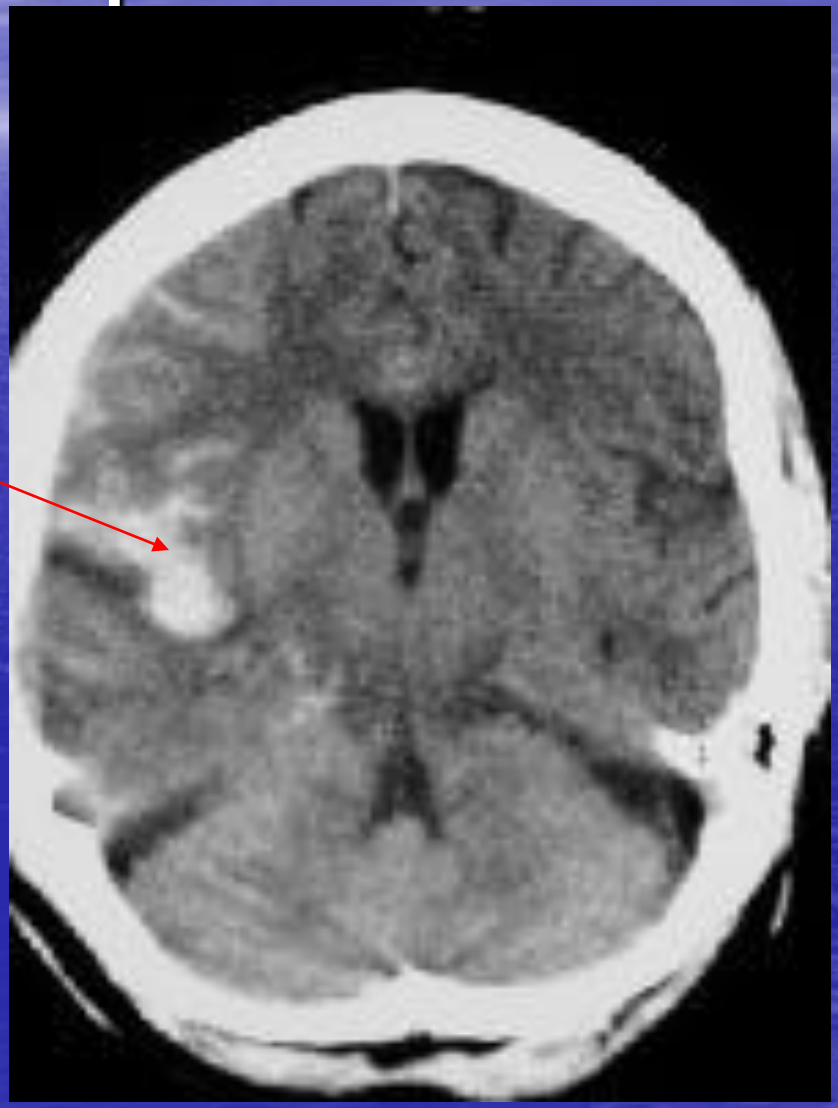

FARGA ALAWI, SHARBA
AH
U.S.T. Hospital
Balance
VA40C
H-SP-CR
IV CONTRAST



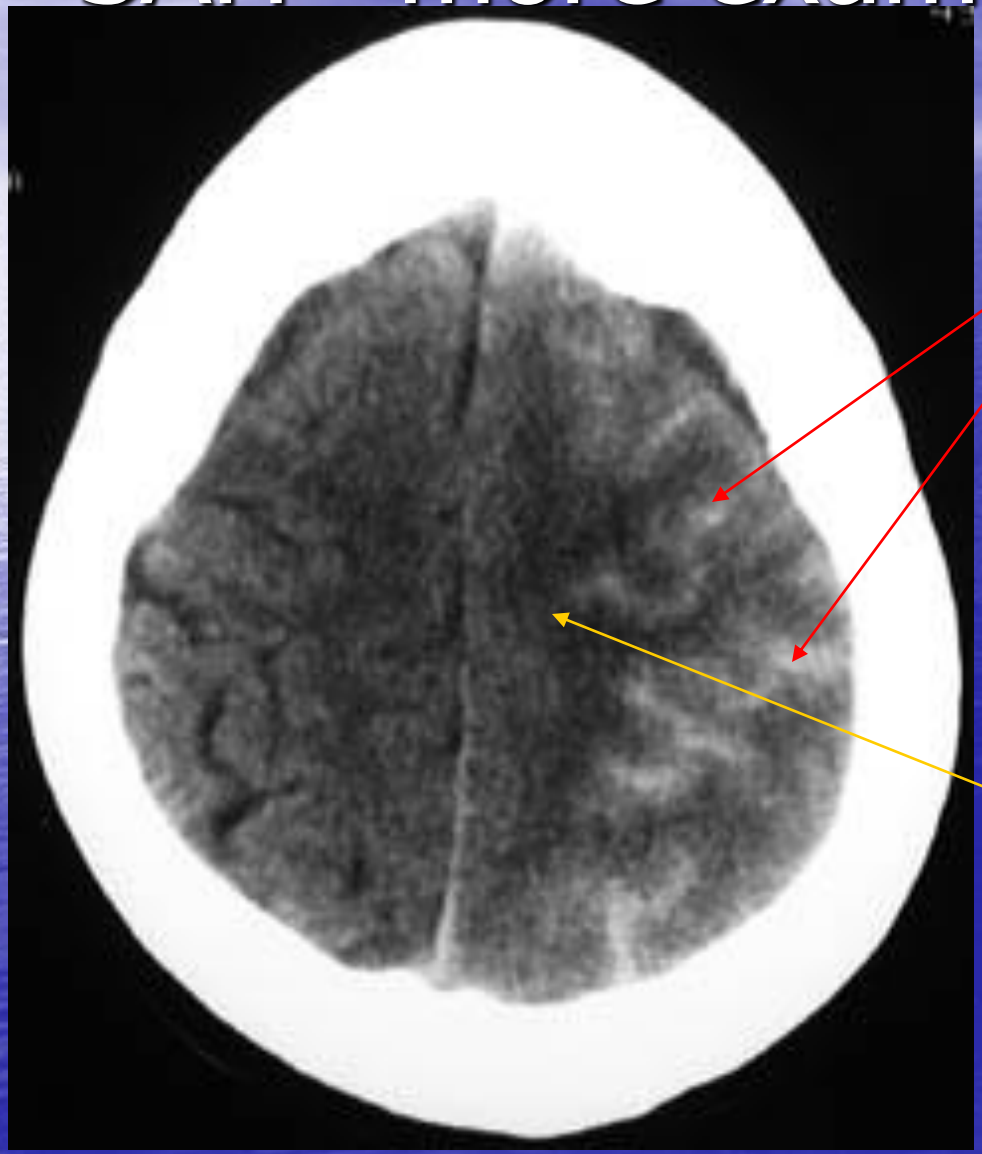


SAH—more examples

- Subarachnoid hemorrhage in the right sylvian fissure



SAH—more examples



Blood in the sulci

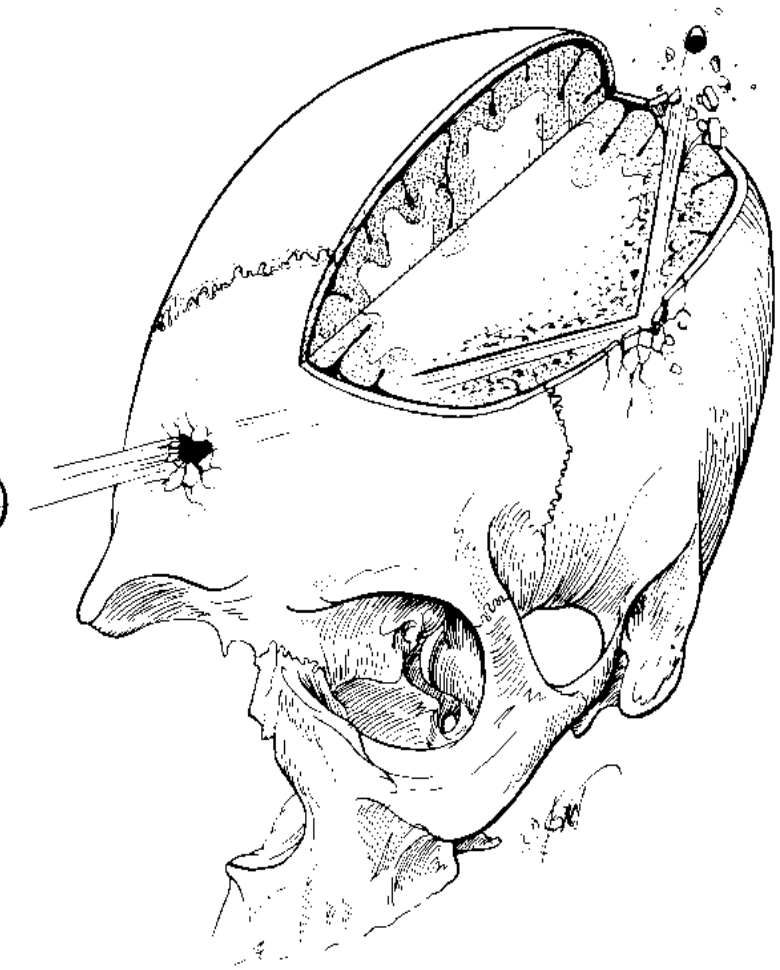
Edema causing a midline shift

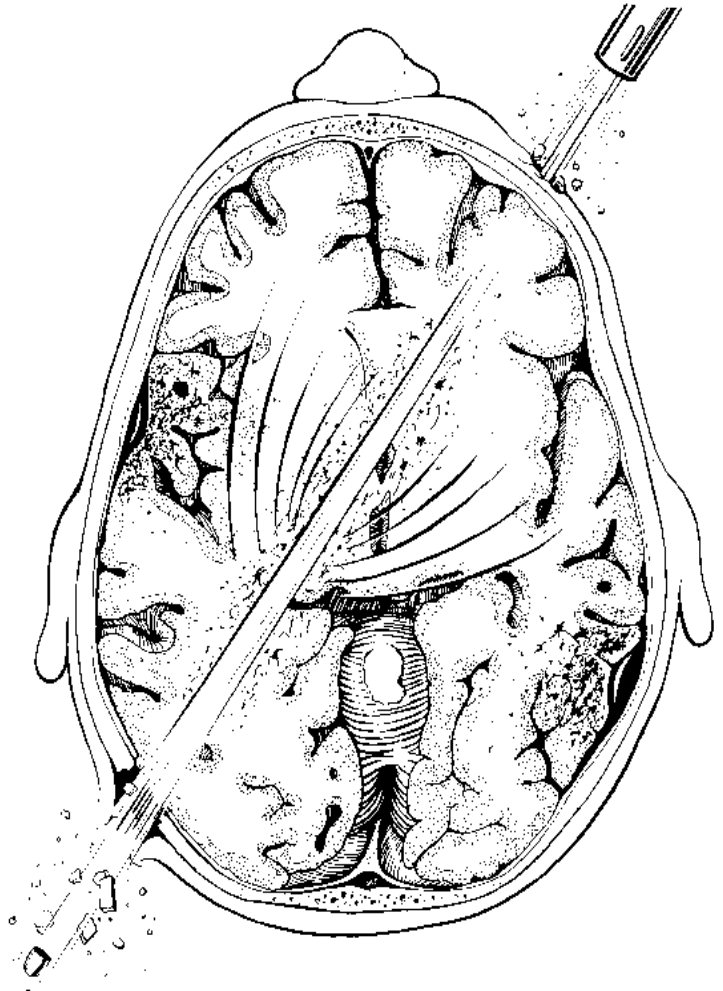
Posterior fossa hematomas

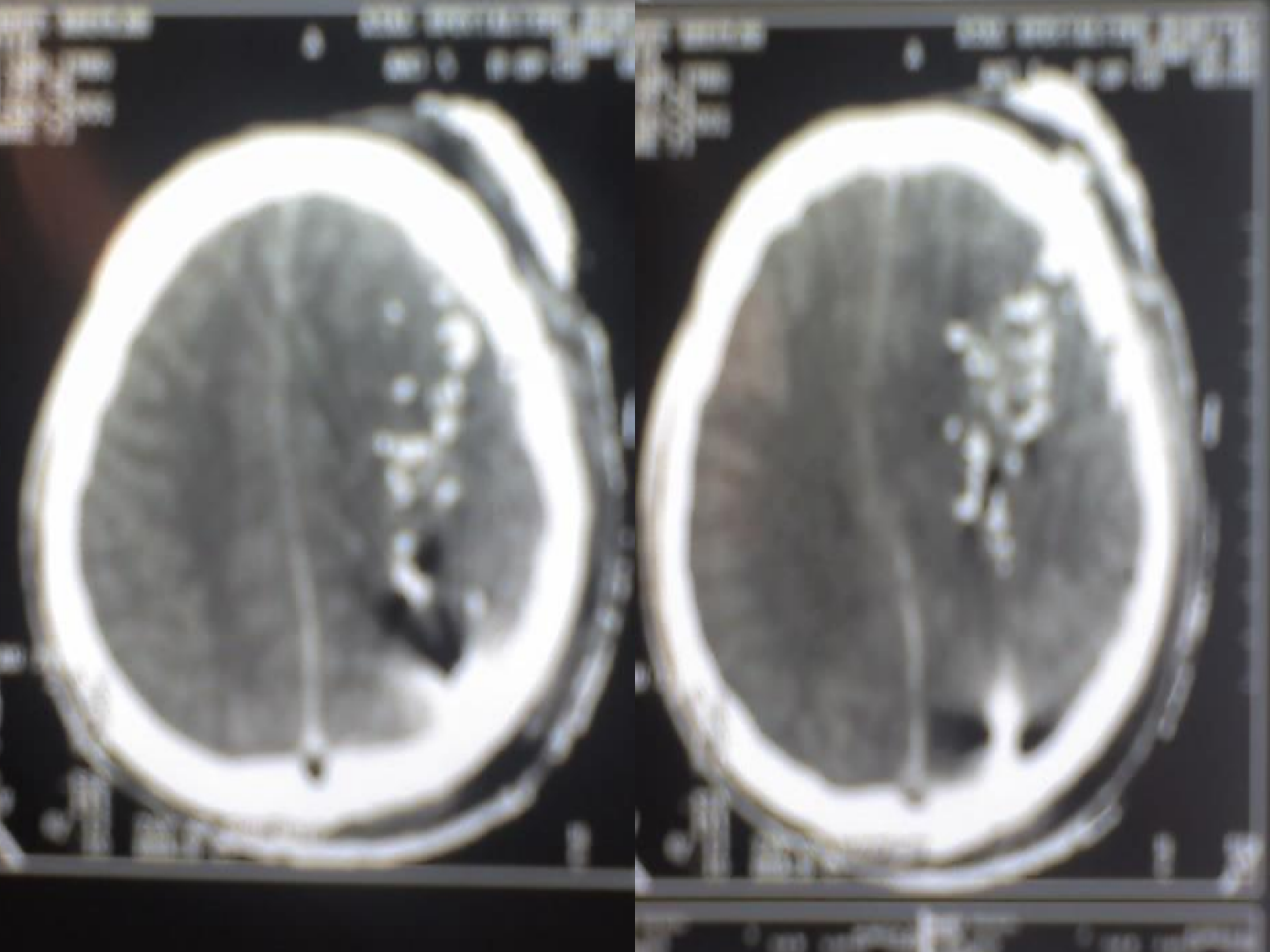
- Usually arise from venous sinuses hemorhage
- Deterioration in level of consciousness is rappid and signs of brain stem and long tract compression are common innitial finding
- Urgent evacuation is the role

Penetrating head injuries

- Sonic waves and cavitations and decavitation and secondary insults are the injurious mechanisms
- Infection rates are high
- Injury far away from site of entrance and exit is common
- Control of homodynamic state is the initial management
- Surgical interventions are limited to debridement and removal of mass hematomas and for selected cases
- Prognosis is usually bad







Questions

- What are the types of skull fractures
- What are the parameters of GCS
- Enumerate the types of traumatic scalp swellings
- Enumerate the signs and symptoms of raised intracranisl pressure
- What are the types of traumatic intracranial hemorrhages
- Right about types of mechanisms of head injury
- What is the pathophysiology of head injury

THANK YOU