

EmCC



Acute Neuro Traumatic Brain Injury (TBI)

- TBI merupakan penyebab utama mortalitas dan morbiditas pada pasien dalam rentang usia 18 – 45 tahun.
- *Guidelines The Brain Trauma Foundation (2016)* merupakan strategi manajemen yang berbasis protokol yang bertujuan untuk memberikan perawatan yang berkualitas tinggi dan perbaikan outcome pasien yang dirawat dengan TBI.

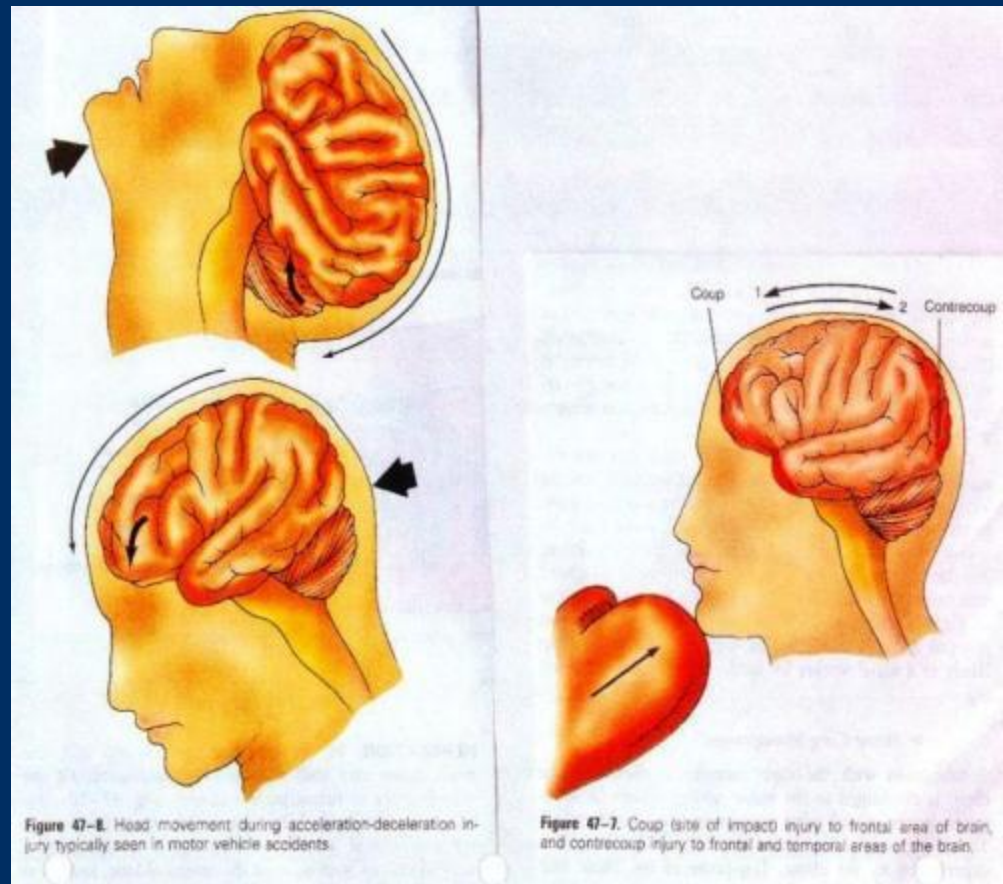
Traumatic Brain Injury (TBI)

- Types
 - Primary
 - Secondary
- Pathophysiology
 - ✓ Tahap inisial
 - ✓ Tahap lanjut



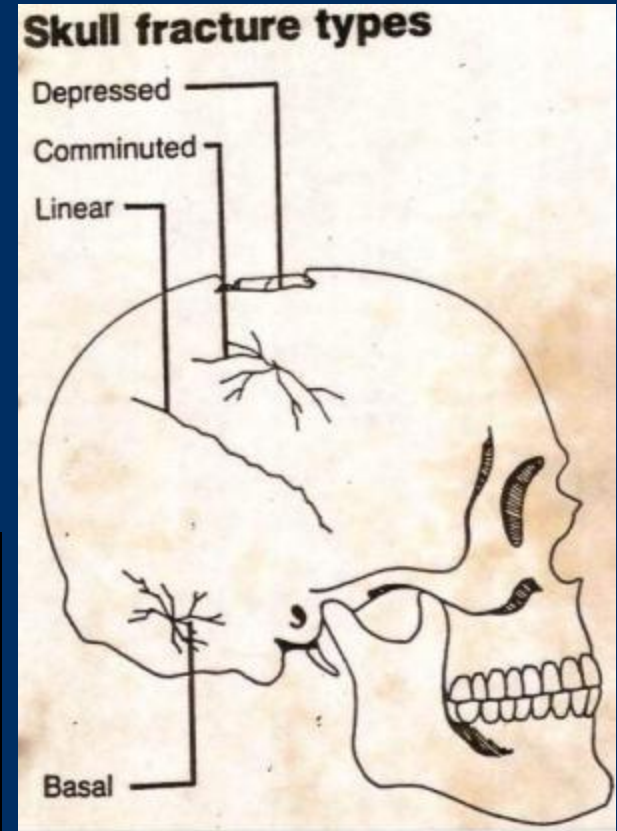
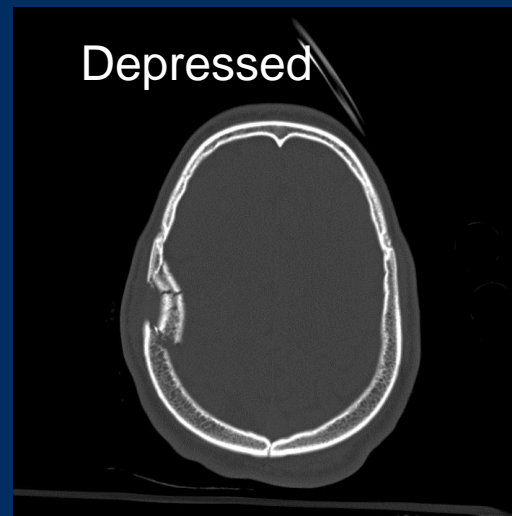
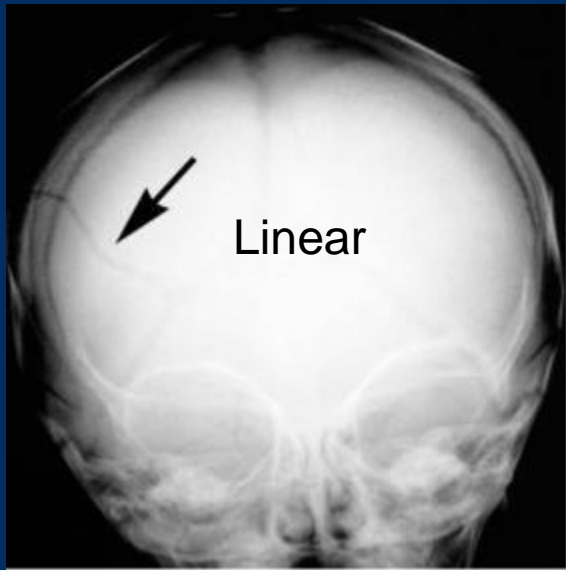
Traumatic Brain Injury

- Contact (Blunt) Injuries
- Coup-contrecoup
- Penetrating Injuries (missile injury)
- Scalp Injuries



Traumatic Brain Injury

- Skull fractures
 - Linear fracture
 - Depressed fracture
 - Basilar fracture



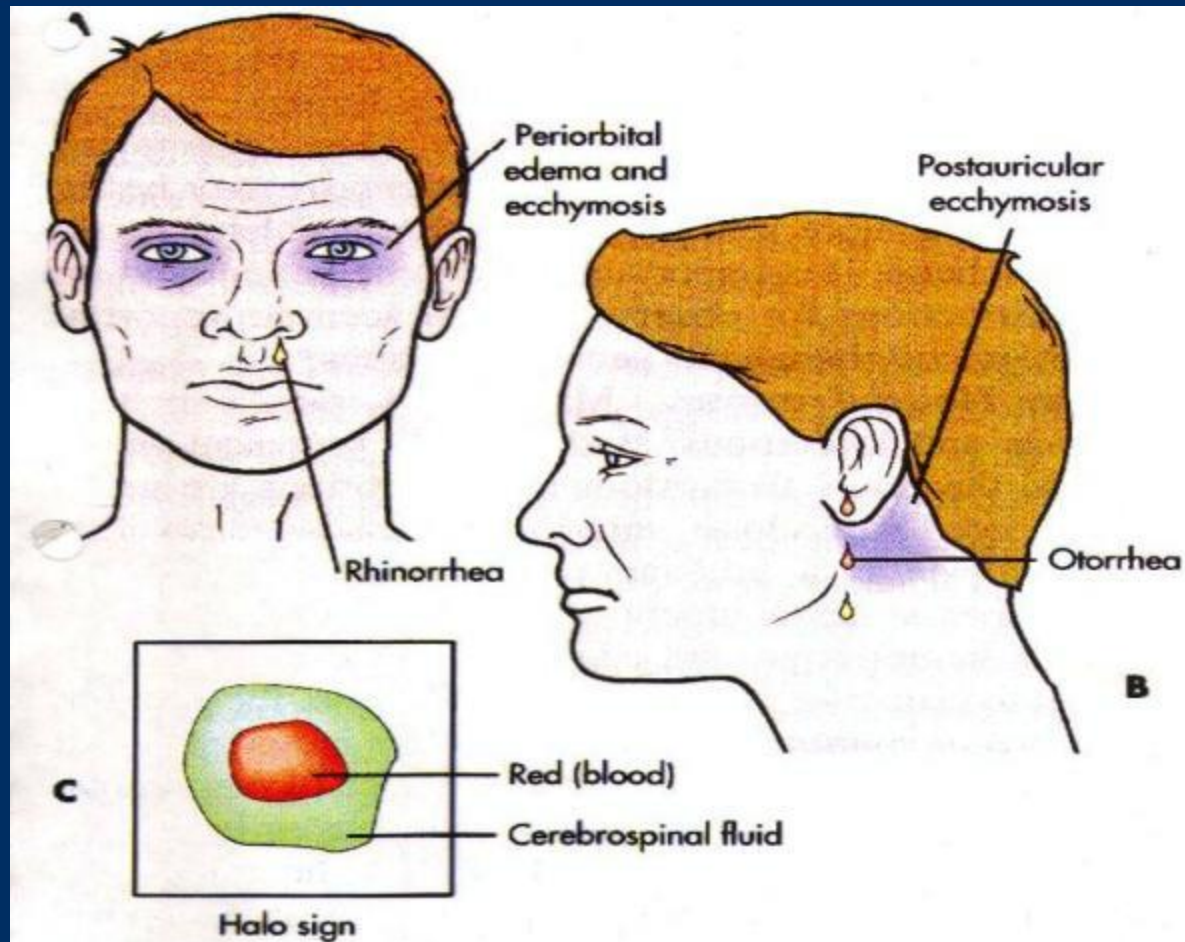
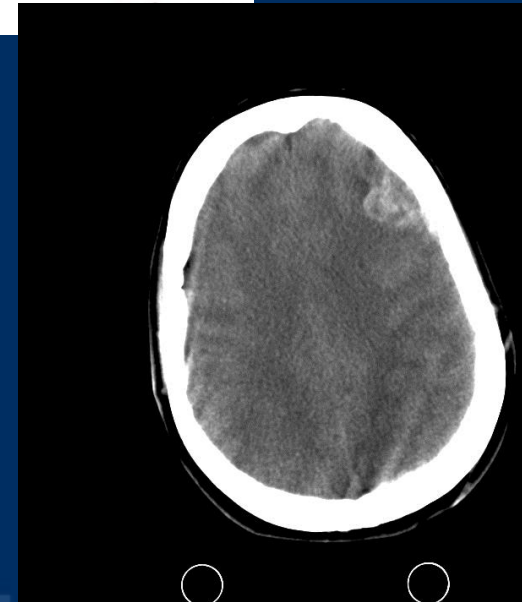
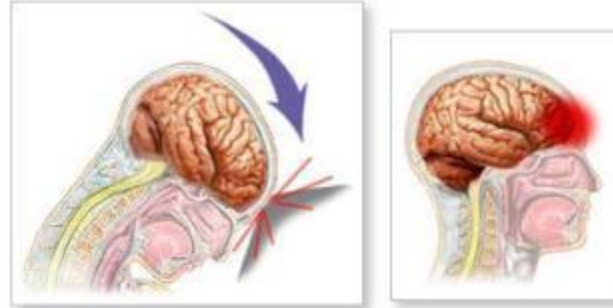


Fig. 54-11 **A**, Raccoon eyes and rhinorrhea. **B**, Battle's sign (postauricular ecchymosis) with otorrhea. **C**, Halo or ring sign (see text).

Cerebral Injury

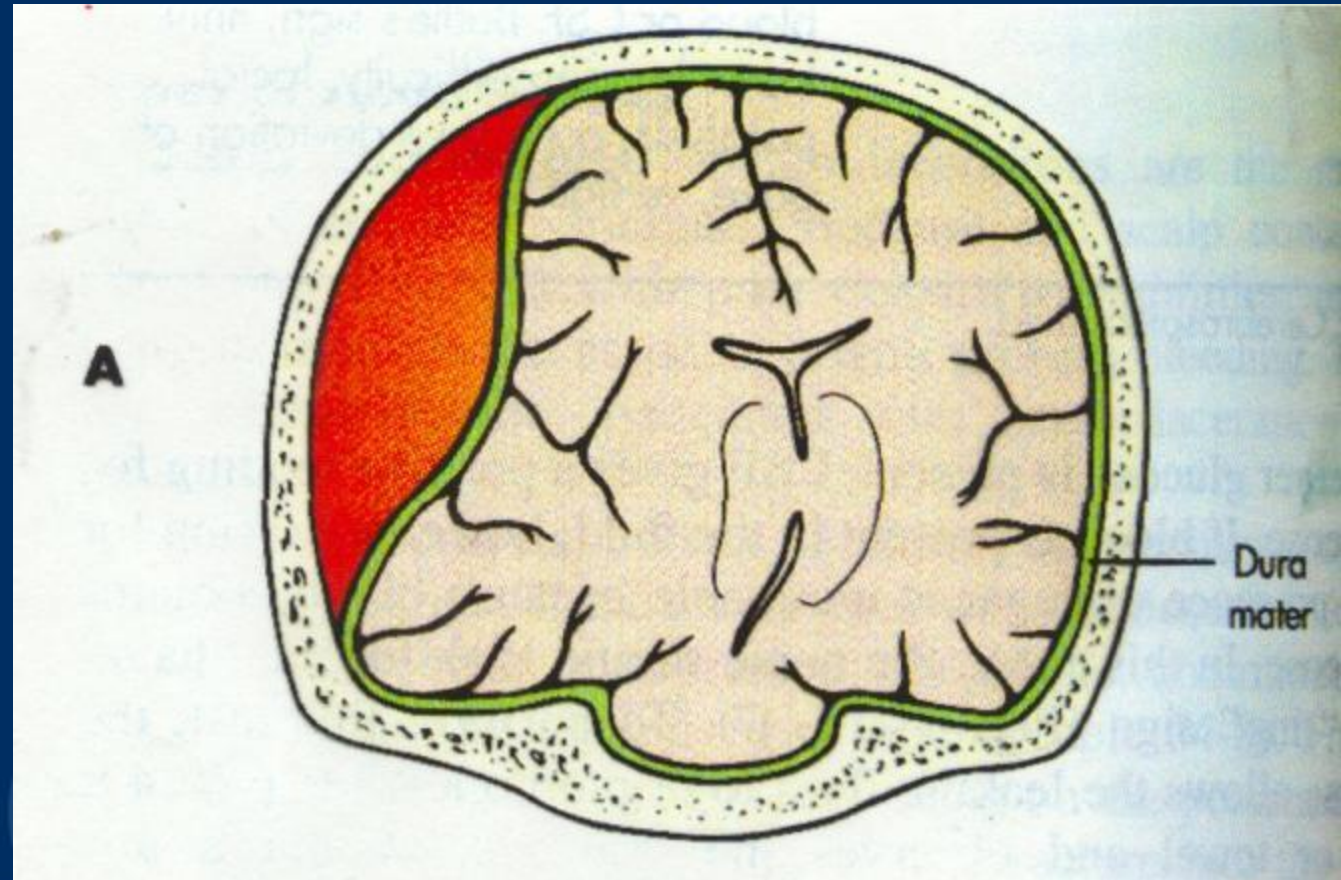
- Concussion
 - Postconcussive syndrome
- Contusion
- Diffuse Axonal Injury
 - Mild
 - Moderate
 - Severe

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



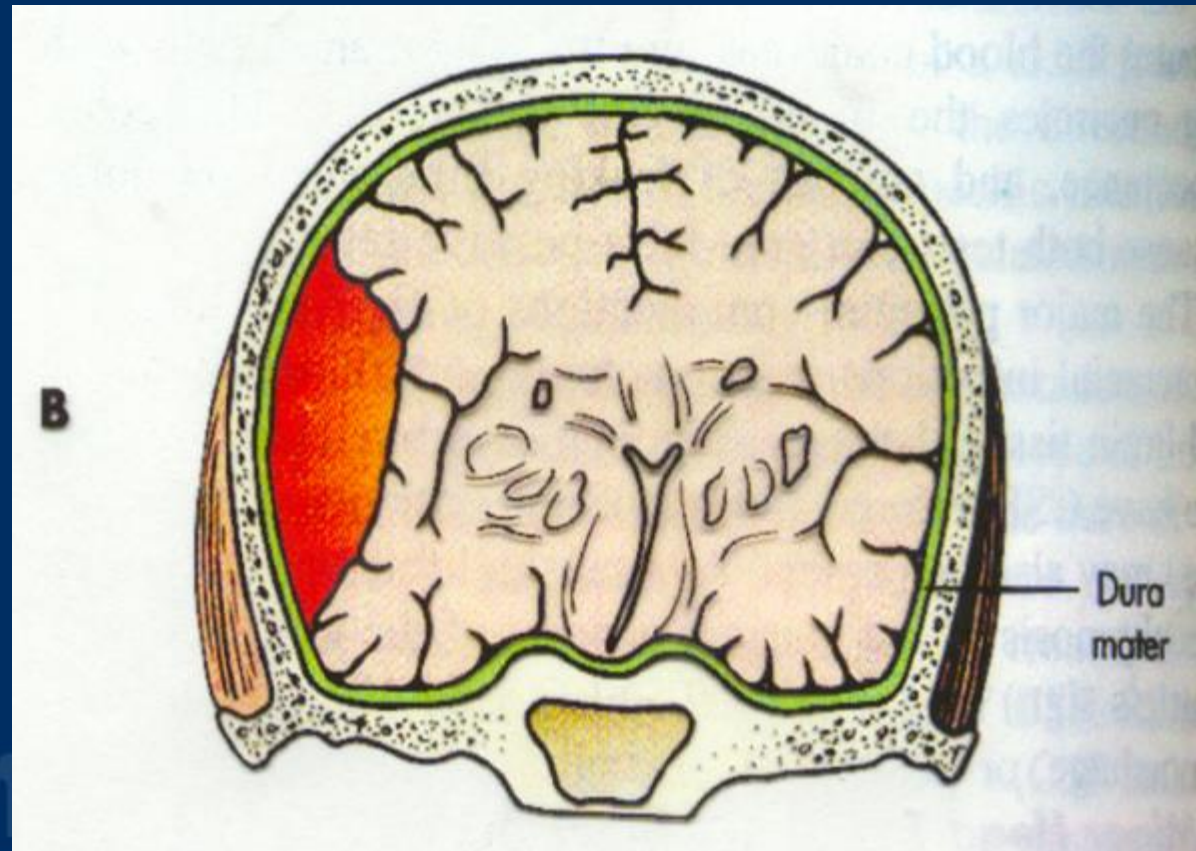
Focal Cerebral Injuries

- Epidural hematoma



Focal Cerebral Injuries

- Subdural Hematoma



Focal Cerebral Injuries

- Intracerebral hematoma



- Dimulai pada area terjadinya injuri
- Tujuan:
 - mengamankan ABC pasien
- TBI sedang dan berat harus dirujuk ke RS dengan fasilitas neurosurgical sesegera mungkin
- Tujuan manajemen primer:
 - mencegah hipoksia dan hipotensi

- Neurological Assessment: GCS
- Airway control & ventilation
- Blood pressure & cerebral perfusion pressure (CPP)
- Fluid management
- Sedation & Analgesia
- ICP monitoring & Management
- Osmotherapy

Manajemen TBI:

- Multimodal Neuromonitoring
- Antikonvulsant Therapy
- Temperature Management
- Glycemic Control
- Decompressive Craniectomy
- Nutrition
- Antibiotic Therapy

1. Neurological Assessment: Adult Glasgow Coma Scale

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

Pediatric Glasgow Coma Scale

PEDIATRIC GLASGOW COMA SCALE (PGCS)				
	> 1 Year	< 1 Year	Score	
EYE OPENING	Spontaneously	Spontaneously	4	
	To verbal command	To shout	3	
	To pain	To pain	2	
	No response	No response	1	
MOTOR RESPONSE	Obeys	Spontaneous	6	
	Localizes pain	Localizes pain	5	
	Flexion-withdrawal	Flexion-withdrawal	4	
	Flexion-abnormal (decorticate rigidity)	Flexion-abnormal (decorticate rigidity)	3	
	Extension (decerebrate rigidity)	Extension (decerebrate rigidity)	2	
	No response	No response	1	
	> 5 Years	2-5 Years	0-23 months	
VERBAL RESPONSE	Oriented	Appropriate words/phrases	Smiles/coos appropriately	5
	Disoriented/confused	Inappropriate words	Cries and is consolable	4
	Inappropriate words	Persistent cries and screams	Persistent inappropriate crying and/or screaming	3
	Incomprehensible sounds	Grunts	Grunts, agitated, and restless	2
	No response	No response	No response	1
TOTAL PEDIATRIC GLASGOW COMA SCORE (3-15):				

2. Airway Control & Ventilation

- Harus dilakukan pencegahan, identifikasi dan penanganan hipoksia (saturasi oksigen $<90\%$ dan atau siamosis)
- Berikan high-flow O₂ untuk semua kasus yang berpotensi terjadinya TBI
- Lakukan manuver airway repositioning
- Ventilasi menggunakan Bag-Valve Mask (BVM) dengan oroparingeal airway
- Intubasi endotrakeal dilakukan oleh tenaga yang berpengalaman jika ada

3. Tekanan darah dan CPP

- Pertahankan SBP ≥ 100 mmHg pada pasien 50 – 69 tahun; ≥ 110 mmHg pada pasien 15 – 49 tahun
- Target CPP diantara 60 -70 mmHg untuk menurunkan risiko iskemia pada jaringan otak
- CPP adalah parameter untuk memonitor keadekuatan aliran darah ke otak.
- $CPP = MAP - ICP$

4. Fluid management

- Pada pasien TBI yang mengalami hipotensi, hipovolemia biasanya diakibatkan dari perdarahan ekstrakranial, tetapi bisa juga terjadi karena kebocoran trans-kapiler
- Pemberian kristaloid: RL dan Saline

5. Sedasi dan analgesia

- Komponen penting dalam manajemen TBI adalah: mengurangi stres dan respons adrenokortikal
- Pasien yang tidak sadar juga bisa mengalami peningkatan TD dan ICP karena respon stres
- Sedasi: menurunkan stres metabolik dengan menurunkan metabolisme serebral dan konsumsi O₂, sehingga juga menurunkan aliran darah ke otak dan bisa mengurangi TIK
- Obat: high dose barbiturates

6. ICP monitoring & management



- Monroe-Kellie Hypothesis
- The cranial vault is a fixed space consisting of 3 compartments:
 - Brain tissue (80-84%)
 - CSF (10-12%)
 - Blood (4-10%)
- Therefore, expansion of one compartment results in a compensatory decrease in another in order to maintain ICP

Intracranial Pressure

- Normal: 0-10 mmHg
- Pressure > 20 mmHg is elevated
- Cerebral Perfusion Pressure
 - $CPP = MAP - ICP$
 - Normal: 60-100 mmHg
 - $CPP > 150$, disrupts blood-brain barrier and causes hyperperfusion and increased cerebral edema
 - $CPP < 50$ causes hypoperfusion and cerebral ischemia

- Increased brain volume : cerebral edema, trauma, surgery, stroke, tumor
- Increased blood volume : hematomas, AV malformations, aneurysm, stroke, \uparrow PCO₂
- Increased CSF volume : \downarrow CSF reabsorption, congenital hydrocephalus
- Lesions : tumors, abscesses

- Position of neck, head and hips
- CV instability
- ↑ Intrathoracic pressure
- ↑ Abdominal distension
- Decerebrate posturing and agitation
- Metabolic abnormality
- Non-therapeutic touch & painful procedures
- Suctioning
- Emotionally conversations

Increased ICP

- Early signs and symptoms:

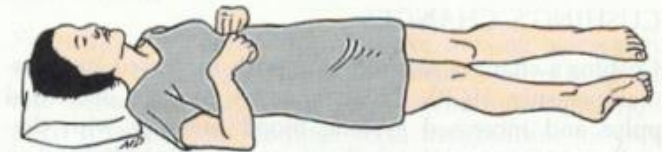
Penurunan kesadaran, gelisah, sakit kepala, perubahan pupil, hilangnya sensori dan motorik kontralateral, muntah dan muntah

- Late signs and symptoms

Penurunan kesadaran, Peningkatan TD sistolik dan penurunan TD diastolik, *widened pulse pressure*, bradikardi, respiratory dysrhythmias, muntah, papiledema



A. Extension posturing (decerebrate rigidity)



B. Abnormal flexion (decorticate rigidity)

Figure 13-3

A and B, Pathologic posturing in clients with severe brain injury.

Treatment of increased ICP

- Non-surgical
 - Respiratory support
 - Cerebral oxygenation: PaO₂ antara 90 – 100 mmHg
 - Temperature control karena suhu meningkat akan meningkatkan pula rate metabolik
 - Nutrition: monitor glukosa darah karena glukosa adalah sumber utama untuk otak
 - Control of Activity: leher dijaga sejajar dengan tubuh untuk meningkatkan drainase vena
 - Head of bed ditinggikan
 - Cegah batuk

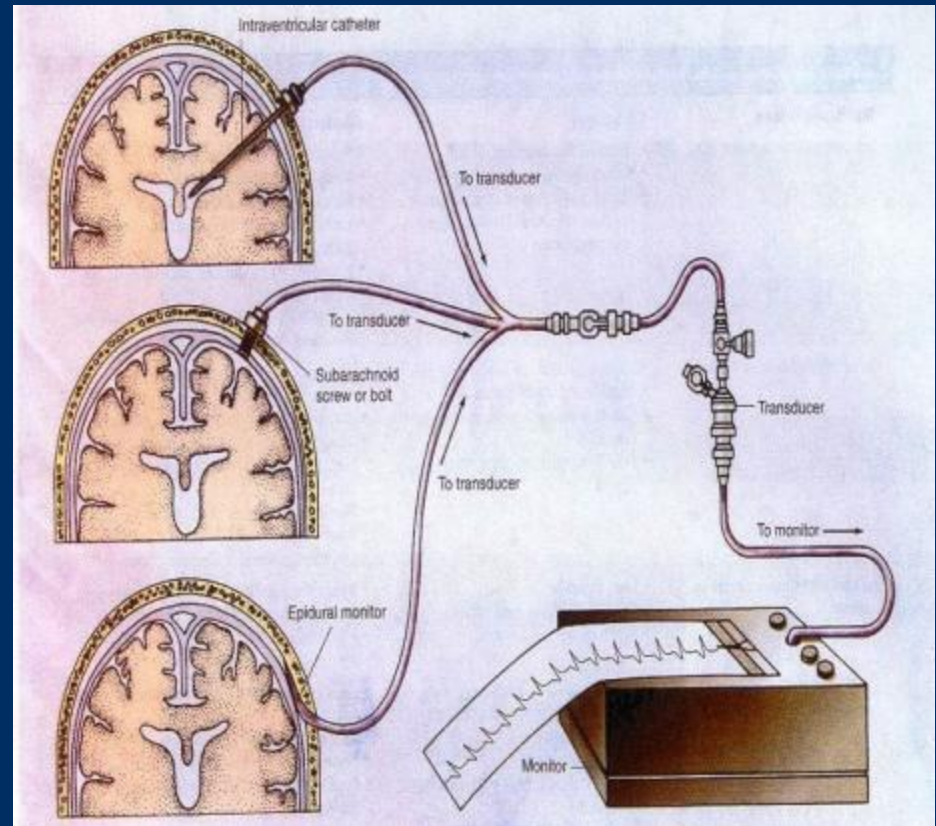
Treatment of increased ICP

- Pharmacotherapy
 - Osmotic diuretics
 - Mannitol
 - Corticosteroids
 - Blood pressure control
 - Muscle relaxants, muscle paralysis, sedation
 - Antibiotics
 - Seizure control
 - Barbiturate coma

- Surgical Interventions
 - Decompressive surgery
 - Craniotomy
 - Ventricular catheter: Drain Cerebral Spinal Fluid (CSF)

ICP Monitoring

- Ventriculostomy
- Subarachnoid Bolt
- Epidural Probe
- Fiberoptic transducer

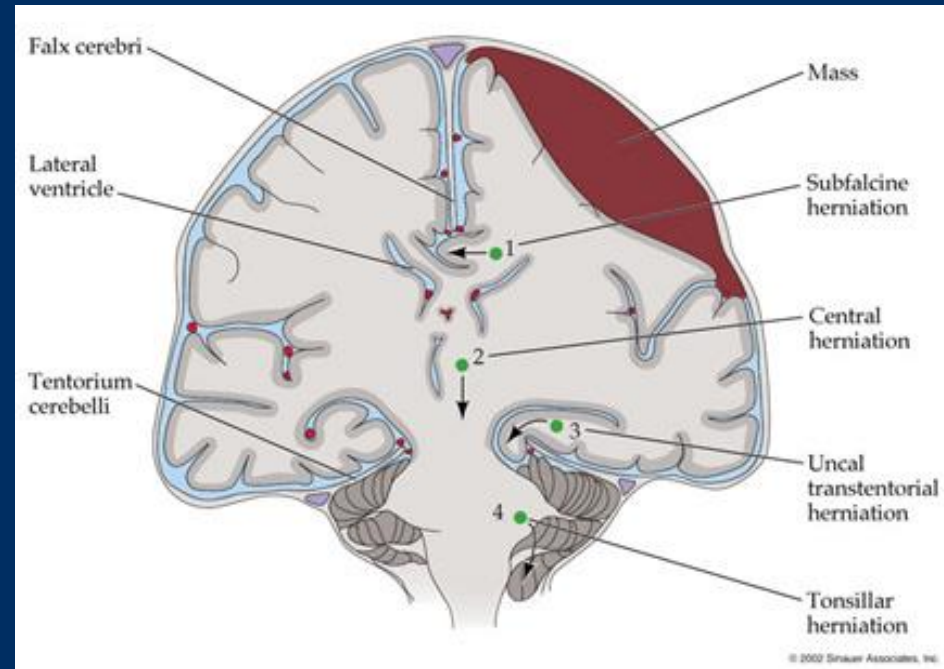


Herniation Syndromes

Biasanya terjadi pada peningkatan TIK, saat tubuh berupaya untuk mengembalikan volume dan tekanan otak .

Karena ada penekanan pada pons dan medulla, TD akan berubah, terjadi bradikardi dan asistol.

Saat terjadi hipotensi, maka bisa mengakibatkan ekmatian



Treatment: Neurosurgical repair and procedures

- Burr holes

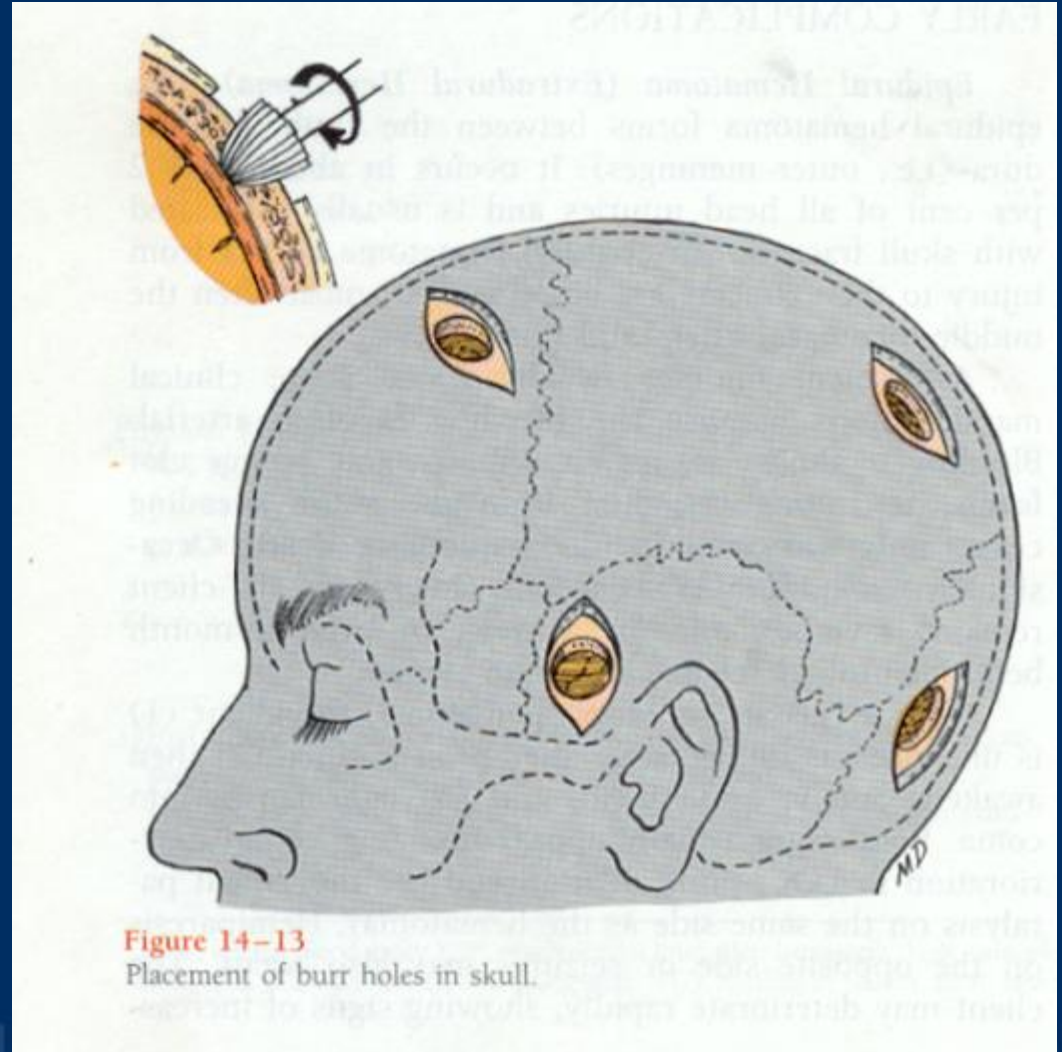
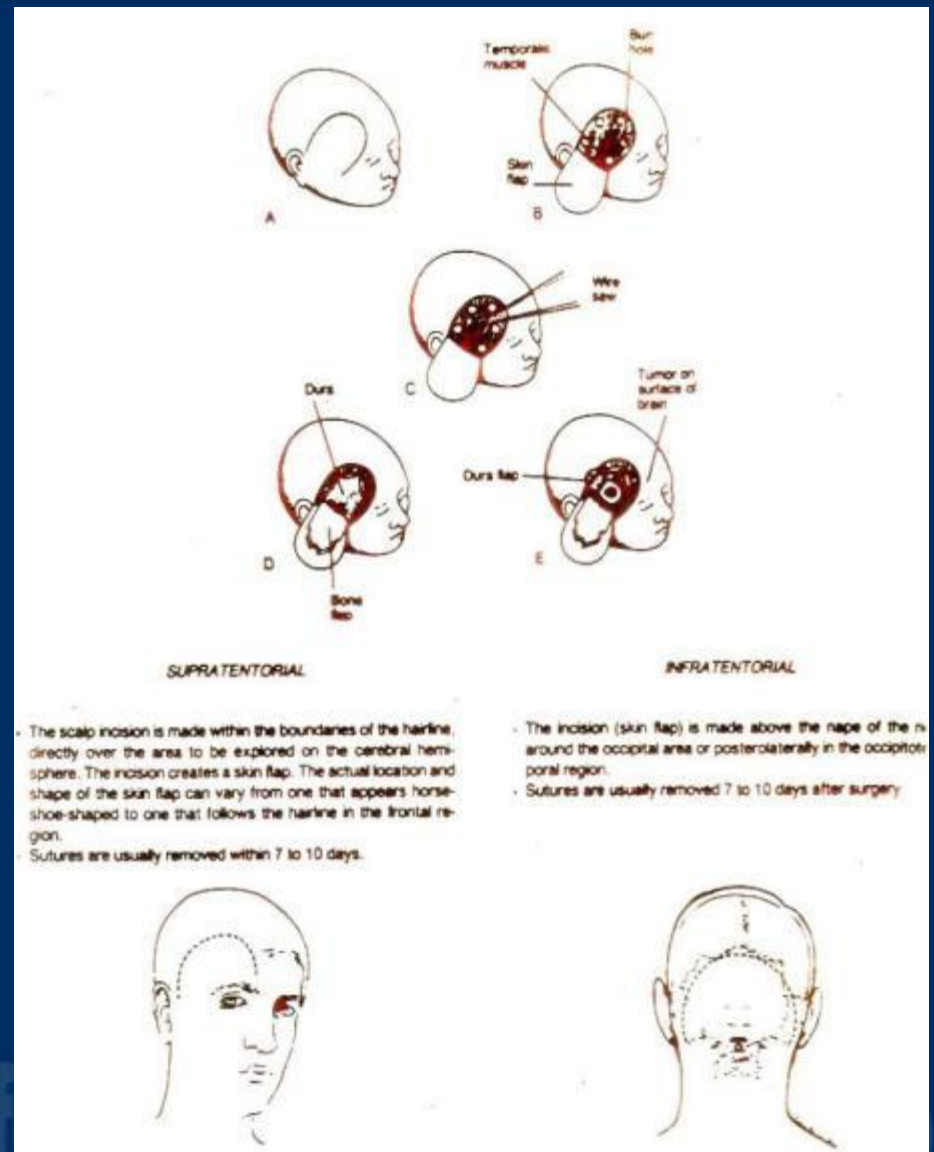


Figure 14-13
Placement of burr holes in skull.

Treatment: Neurosurgical repair and procedures

- Craniotomy
- Craniectomy
- Cranioplasty



References

- Emergency Nurses Association (2007). *Trauma Nursing Core Curriculum., 6th Edition.* Des Plaines, IL: Emergency Nurses Association.
- Dash, hari H., and Siddharth C. (2018). Management of traumatic brain injury patients. *Korean Journal of Anesthesiology.* February 71 (1): 12-21