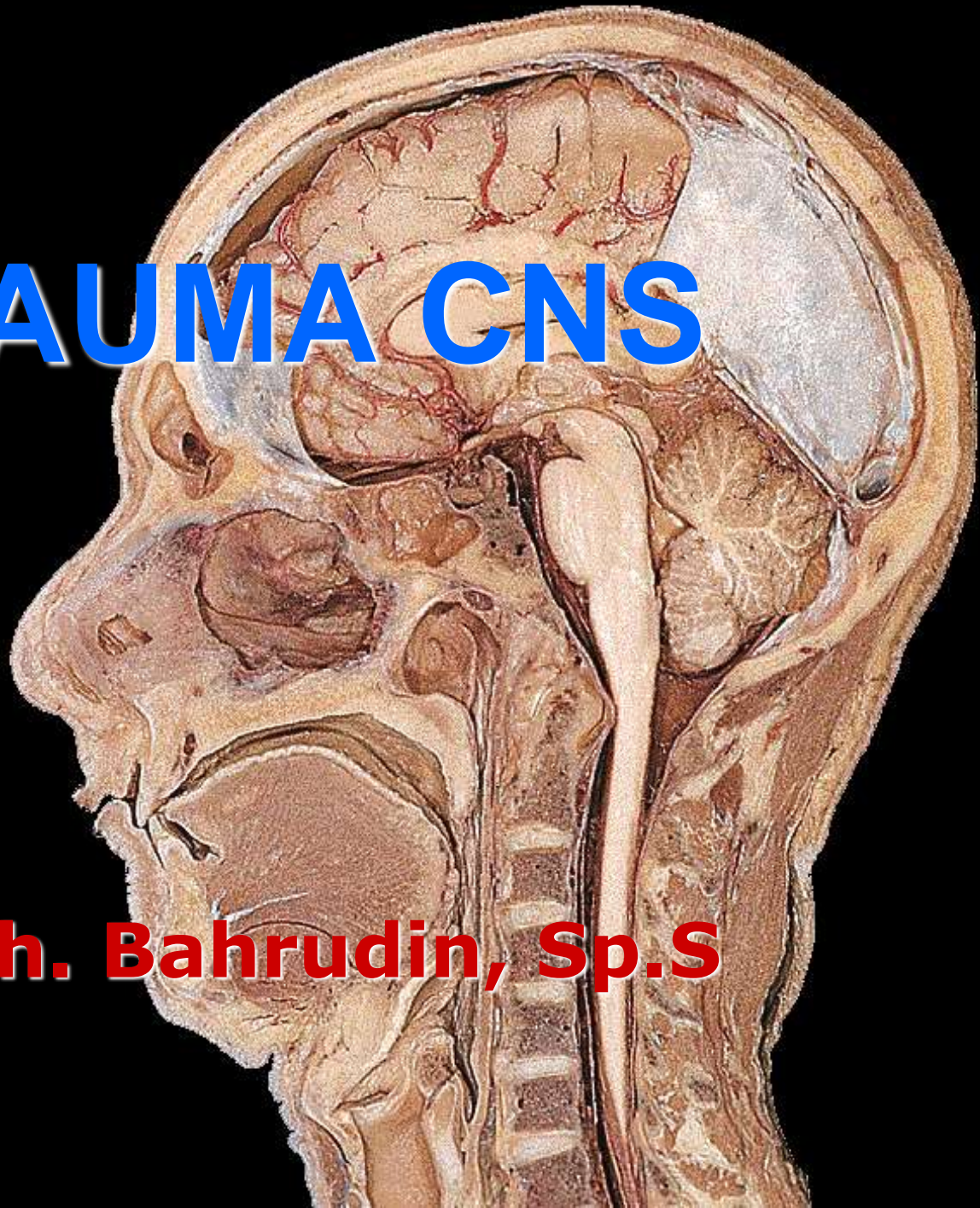


# TRAUMA CNS

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**Dr. Moch. Bahrudin, Sp.S**

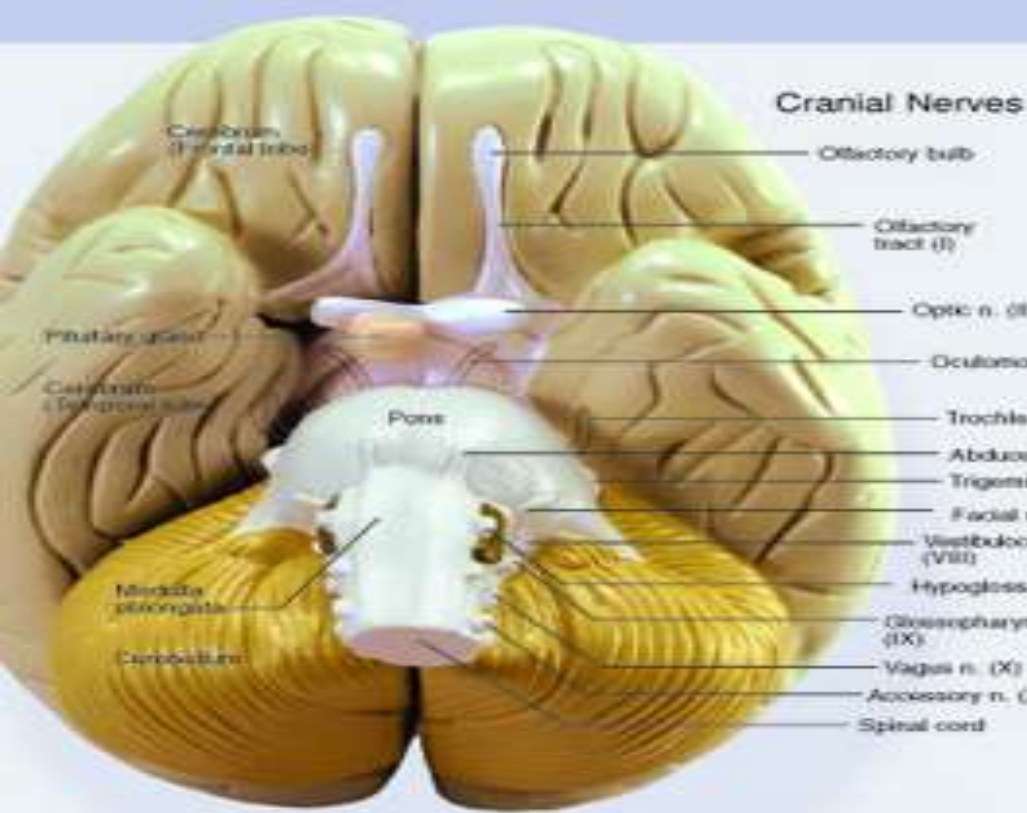




# TRAUMA KEPALA

---

- TOPIK
- EPIDEMIOLOGI
- FISIOPATOLOGI
- KLASIFIKASI
- TRAUMA KEPALA
- PENATALAKSANAAN



- Lateral View**
1. Frontal lobe
  2. Precentral gyrus
  3. Postcentral gyrus
  4. Frontal lobe
  5. Central sulcus
  6. Occipital lobe
  7. Temporal lobe
  8. Cerebellum
  9. Brainstem



- Sagittal Section**
1. Corpus callosum
  2. Body of fornix
  3. Anterior commissure
  4. Optic chiasm
  5. Pons
  6. Medulla oblongata
  7. Thalamus
  8. Septum pellucidum
  9. Interthalamic adhesion
  10. Chiasm plexus
  11. Cerebrum
  12. Cerebellum

**Brain Stem and Cerebellum**

1. Medial geniculate body
2. Lateral geniculate body
3. Corpus callosum
4. Lentiform nucleus
5. Optic tract
6. Optic nerve
7. Pituitary gland
8. Pons
9. Cerebellum
10. Cerebral peduncle
11. Olive



**Somatic Nervous System**

The somatic nervous system controls the skeletal muscles and external sensory receptors. The somatic sensory system helps you to have sensations of touch, pain, and temperature. The somatic motor system innervates only the skeletal muscle, causing voluntary and reflexive movements.



- Anterior View**
1. Cerebral cortex (gray matter)
  2. White matter
  3. Lentiform nucleus
  4. Caudate nucleus
  5. Frontal lobe
  6. Temporal lobe
  7. Pituitary gland
  8. Optic nerve
  9. Cerebellum



- Superior View**
1. Left cerebral hemisphere
  2. Right cerebral hemisphere
  3. Frontal lobe
  4. Precentral gyrus
  5. Postcentral gyrus
  6. Parietal lobe
  7. Temporal lobe
  8. Occipital lobe



# Epidemiologi

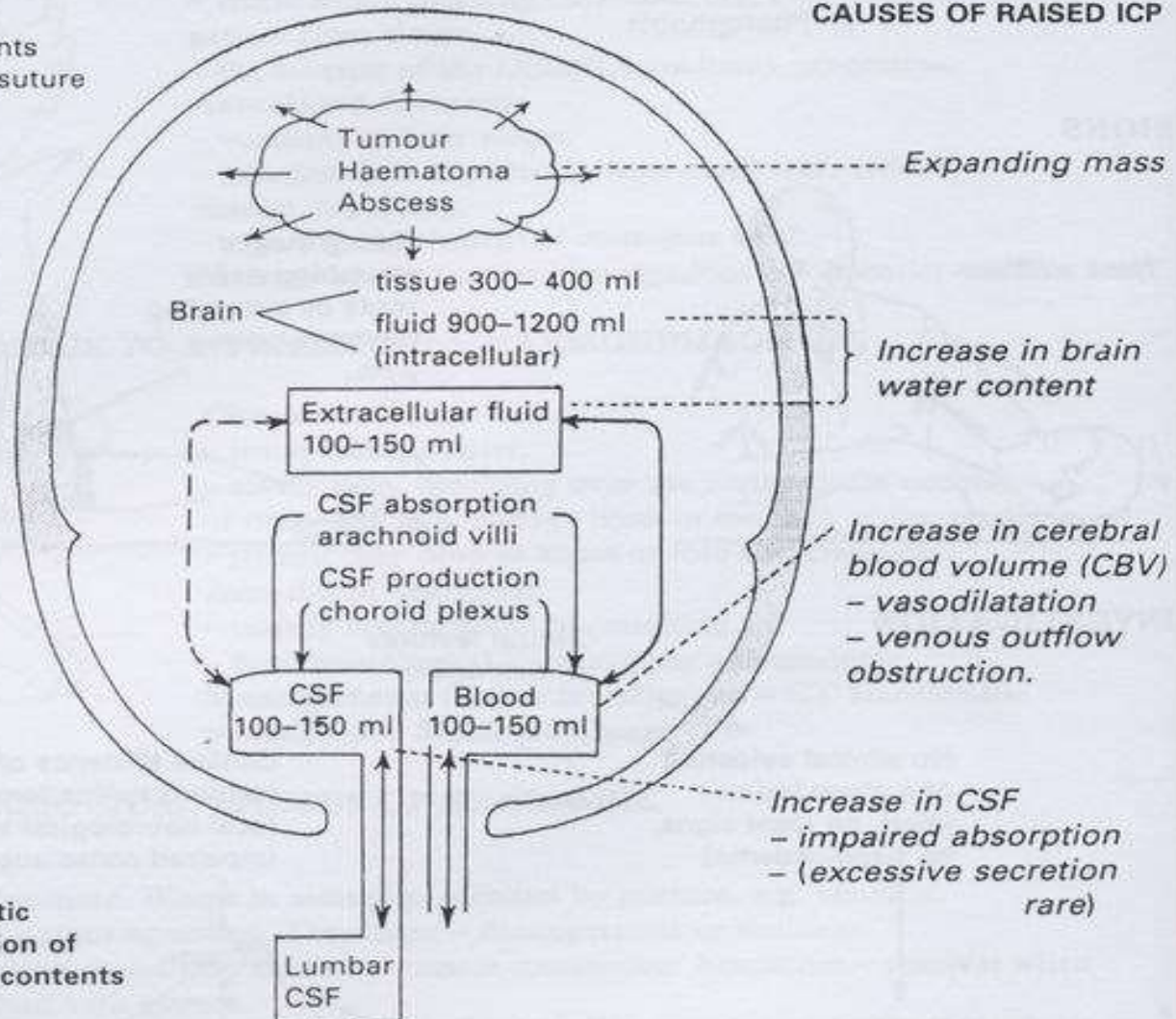
---

- penyebab kematian dan kecacatan pada anak dan dewasa pada usia produktif
- Amerika Serikat 1,6 juta orang pertahunnya
- 250.000 orang berobat ke rumah sakit
- 60.000 orang meninggal
- 70.000 sampai 90.000 orang mengalami cacat neurologis permanen
- Kerugian finansial karena kehilangan produktifitas dan biaya perawatan medis sekitar 100 milyar dolar Amerika

# FISIOPATOLOGI

Skull – rigid  
(except in infants  
– ↑ICP causes suture  
diastasis)

## CAUSES OF RAISED ICP



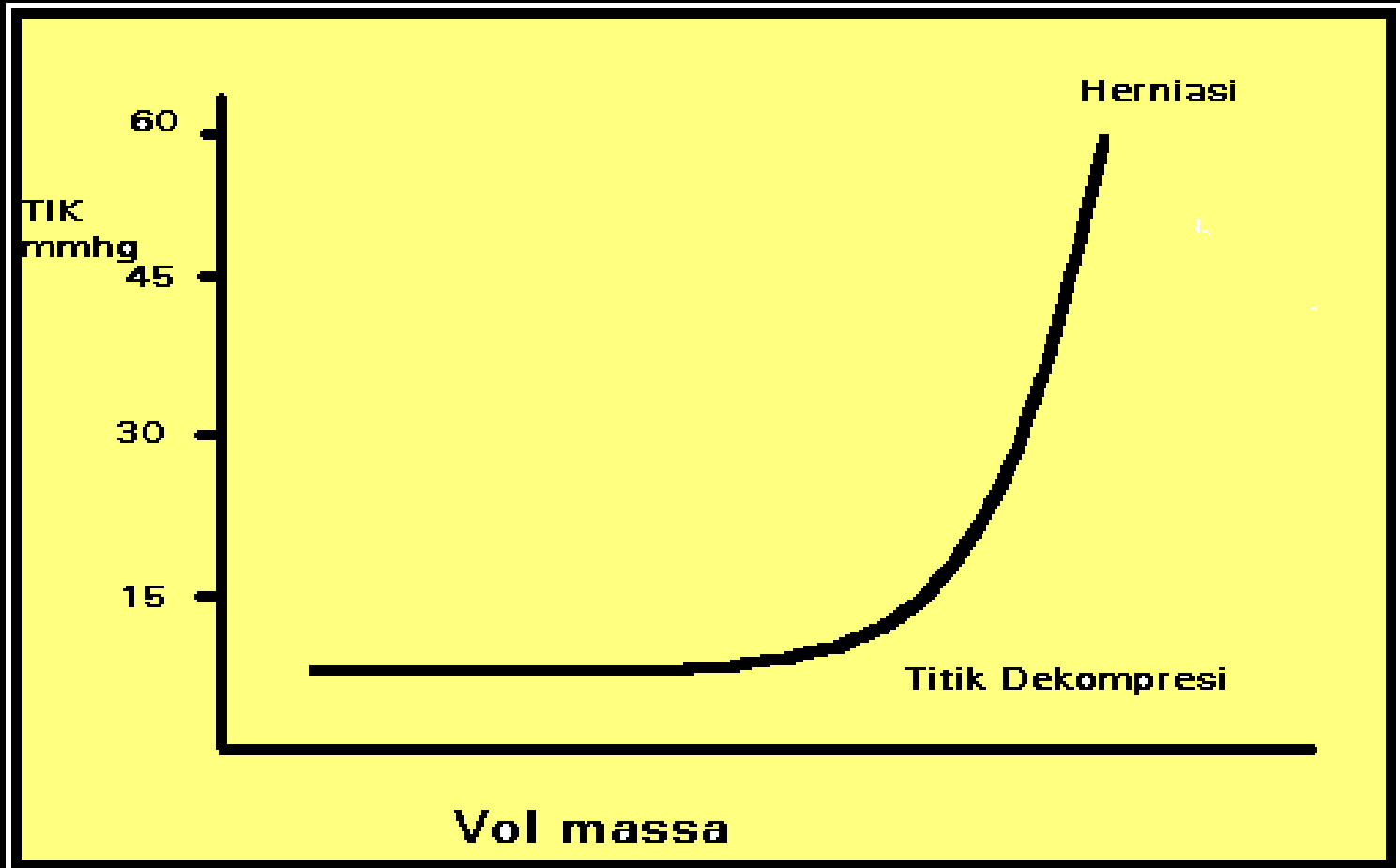
Diagrammatic  
representation of  
intracranial contents

# Doktrin monro kellie



KOMPENSASI INTRAKRANIAL TERHADAP MASA YANG EKSPANSI

# Kurva volume tekanan



# Tekanan Perfusi Otak

---

$$\text{TPO} = \text{TAR} - \text{TIK}$$

TAR = Tekanan arteri rata-rata


## Aliran Darah ke Otak ( ADO)

ADO N = 50 ml / 100 gr / menit

20 – 25 ml / 100 gr / menit    aktifitas EEG hilang

ADO < 5 ml / 100 gr / menit    mati



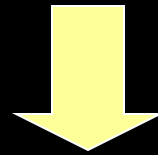


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TAR : 50 – 160 mmhg

< 50 mmhg → aliran ADO ↓

> 160 mmhg → dilatasi pasif  
pd otak ADO ↑



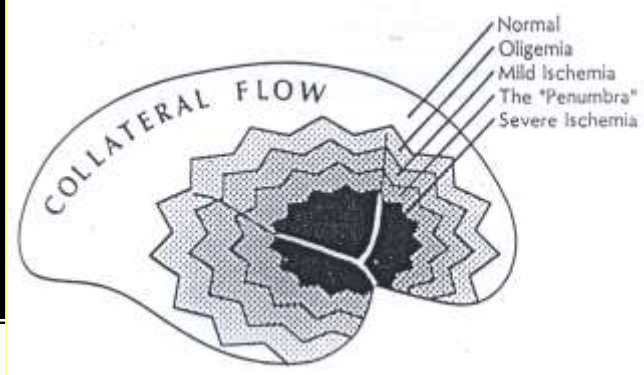
**Autoregulasi !!**

**Cedera otak**



**Autoregulasi ter gg**

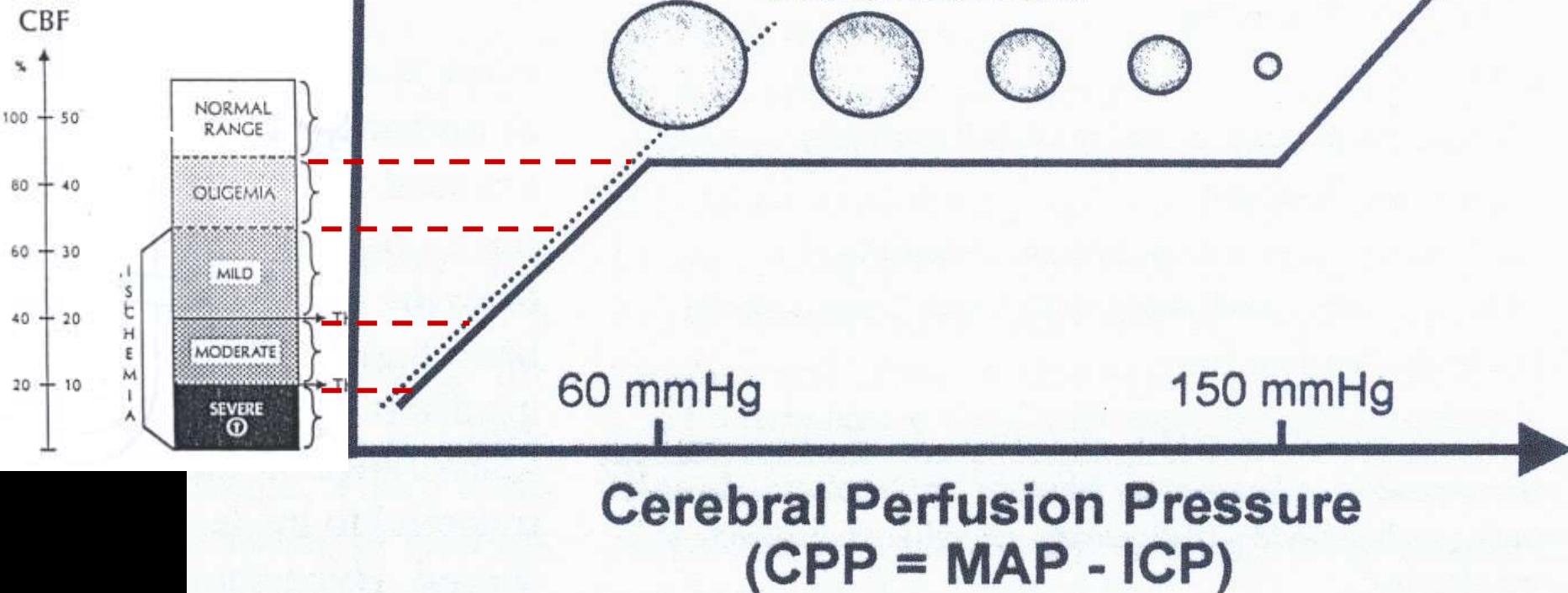
# AUTO REGULASI CBF



## Cerebral Blood Flow (CBF)

Loss of autoregulation

Vessel diameter



# Klasifikasi cedera kranioserebral

---

berdasarkan neuropatofisiologi :

## 1. Komosio serebri

tidak ada jaringan otak yang rusak tapi hanya kehilangan fungsi otak sesaat, berupa pingsan kurang dari 10 menit atau amnesia paska cedera kranioserebral.

## 2. Kontusio serebri

kerusakan jaringan otak dengan defisit neurologik yang timbul setara dengan kerusakan otak tersebut, minimal pingsan lebih dari 10 menit atau ada lesi neurologik yang jelas.

## 3. Lacerasi otak

kerusakan jaringan otak yang luas dan jaringan otak robek yang umumnya disertai fraktur tengkorak terbuka.

# Klasifikasi Cedera Kepala

Mekanisme	<ul style="list-style-type: none"><li>• Tumpul</li><li>• Tembus</li></ul>	<ul style="list-style-type: none"><li>• Kecepatan tinggi ( tabrakan mobil)</li><li>• Kecepatan rendah (jatuh dipukul)</li><li>• Cedera peluru</li><li>• Cedera tembus lain</li></ul>
Beratnya	<ul style="list-style-type: none"><li>• Ringan</li><li>• Sedang</li><li>• Berat</li></ul>	<ul style="list-style-type: none"><li>• GCS 14-15</li><li>• GCS 9-13</li><li>• GCS 3- 8</li></ul>
Morfologi	<ul style="list-style-type: none"><li>• Fraktur tengkorak</li><li>• Lesi intrakranial</li></ul>	<ul style="list-style-type: none"><li>• Kalvaria</li><li>• Dasar tengkorak</li><li>• Garis – bintang</li><li>• Depresi – non depresi</li><li>• Terbuka – tertutup</li><li>• Dg / tanpa kebocoran CSS</li><li>• Dg / tanpa parese n VII</li><li>• Epidural</li><li>• Subdural</li><li>• Intracerebral</li><li>• Komosio ringan</li><li>• Komosio klasik</li><li>• Cedera akson difus</li></ul>

## **KLASIFIKASI TRAUMA KAPITIS :**

### **Cedera kepala ringan (risiko rendah)**

GCS 15 (alert, attentive, % terorientasi)

Tdk ada pe↓ kesadaran

Tdk ditemukan tanda intoksikasi obat atau alkohol

Subyektif : sakit kepala & pusing

Obyektif : luka abrasi di kepala, laserasi atau hematoma

Tdk ditemukan kriteria cedera kepala ringan atau berat

### **Cedera kepala sedang (risiko sedang)**

#### **GCS 9 – 14 ( confused, lethargic, atau stupor)**

Concussion

Amnesia posttrauma

Muntah

Tanda mungkin fx tengkorak (Battle's sign, raccoon eyes, hemotympanum, keluar CSF dari hidung atau telinga)

Kejang

### **Cedera kepala berat (risiko tinggi)**

#### **GCS 3 – 8 (koma)**

Penurunan kesadaran progresif

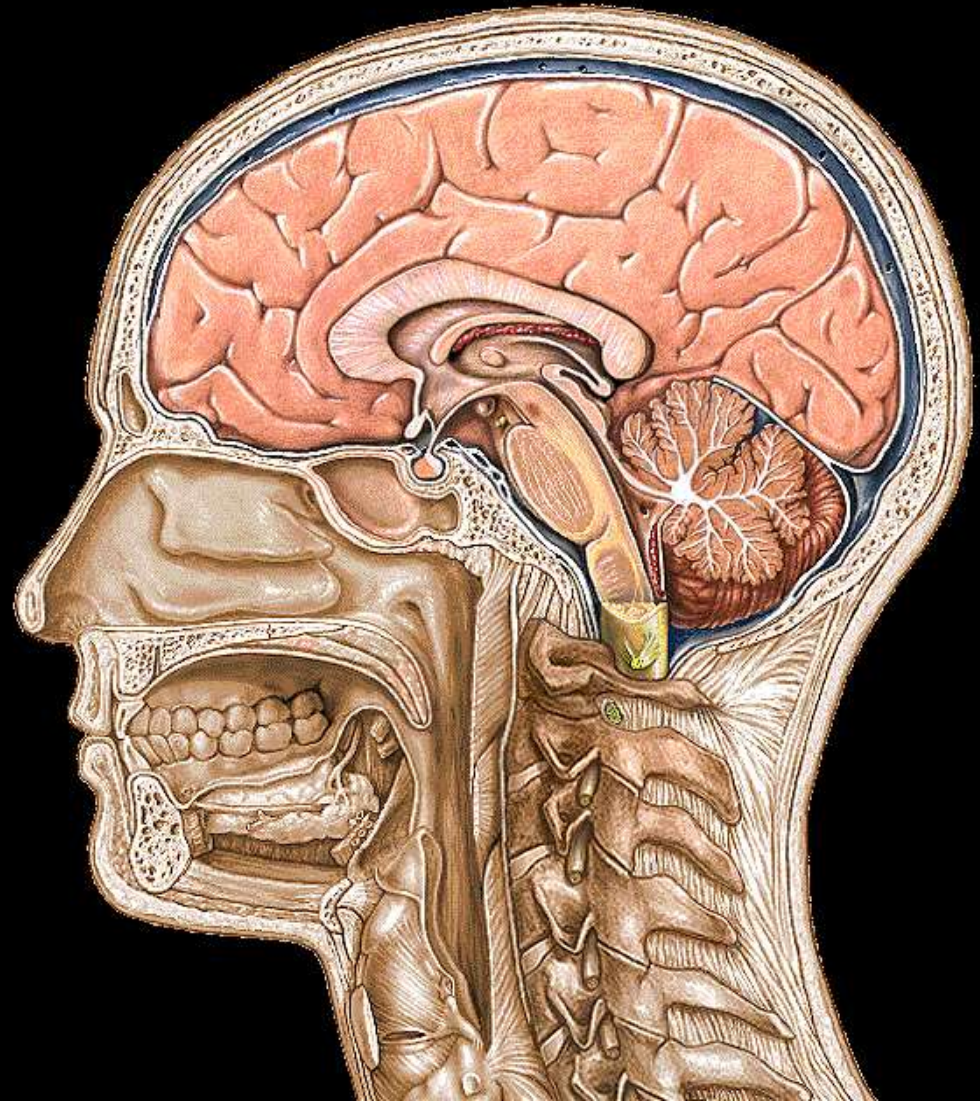
Tanda defisit neurologis fokal

*Penetrating skull injury* atau teraba fx depresi

# Trauma kepala

---

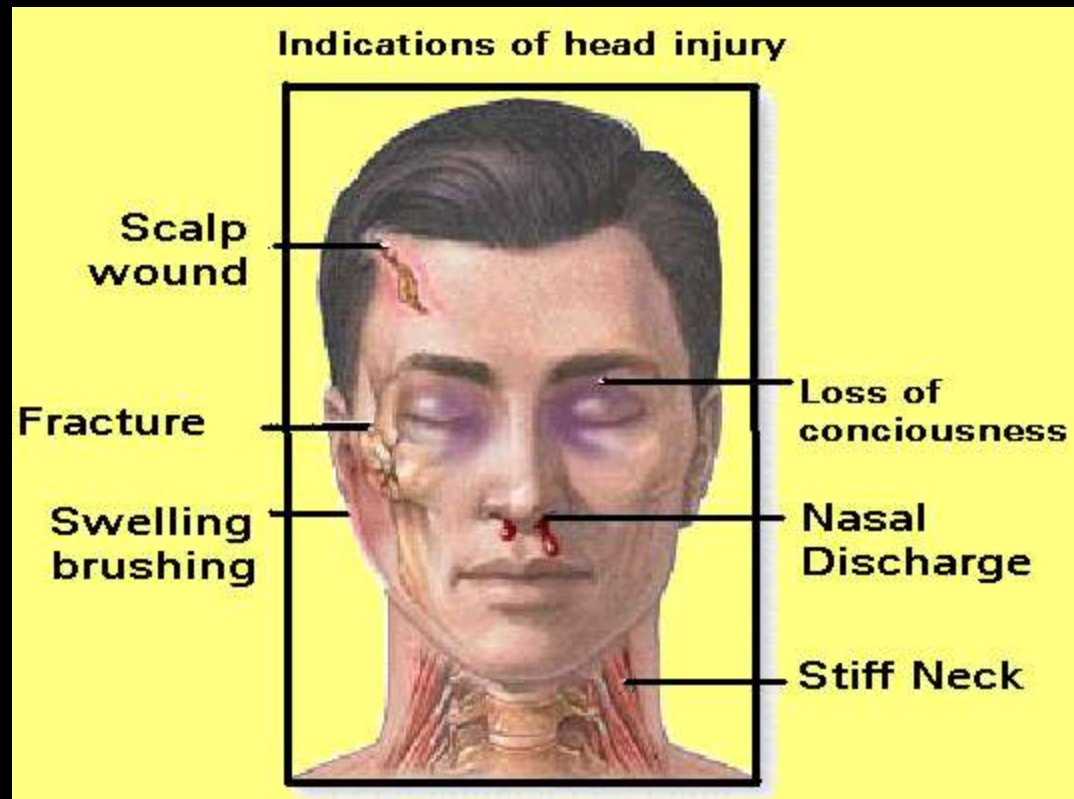
- 1. Kulit dan jaringan subcutan**
- 2. TI tengkorak**
- 3. Saraf otak**
- 4. Pembuluh darah**



# 1. Kulit dan jaringan subcutan

---

Tidak bahaya → menakutkan



## 2. Tulang tengkorak

Fraktur + → otak - → tdk bahaya

1. **Fraktur linear**

Temporal → perdarahan epidural

2. **Fr. Basis Kranii**

**Ekimosis periorbital**

Battle Sign → meningitis  
rhinorrhea dan otorrhea





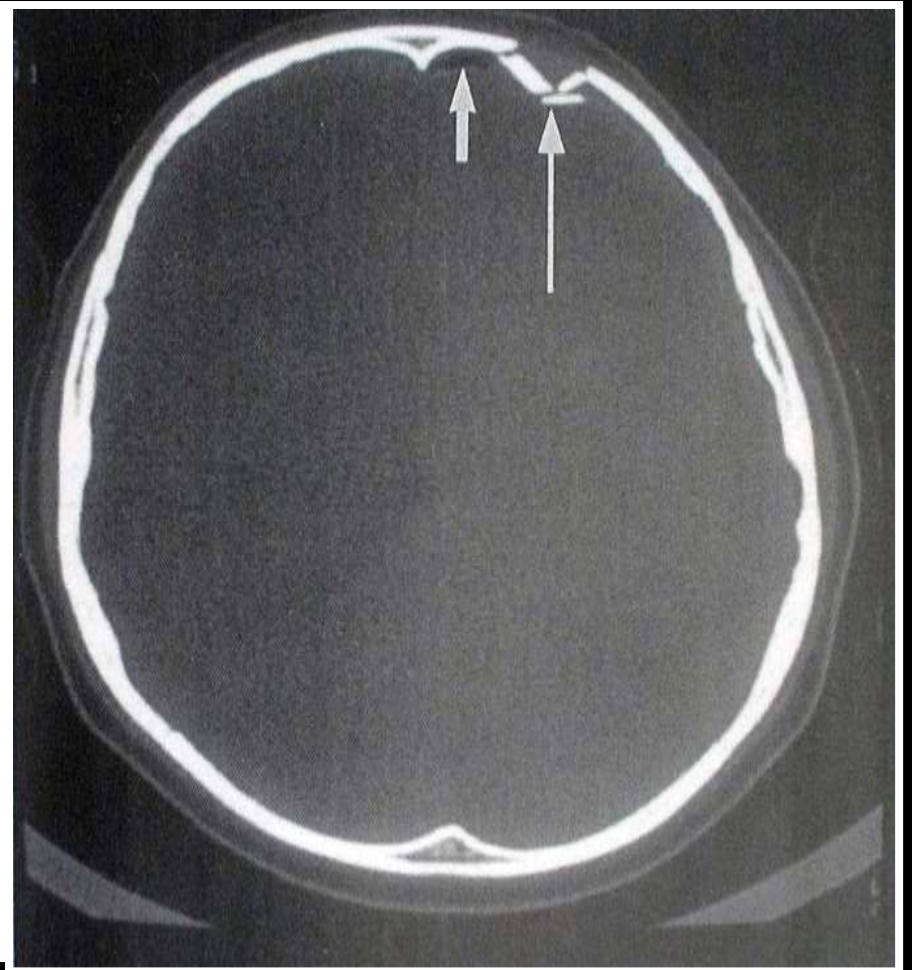
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### 3. Fr. Impresi

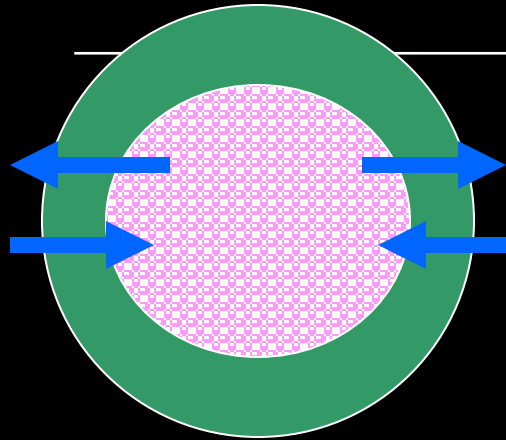
> 1/2 tl tengkorak → bahaya

- Epilepsi pos trauma
- Meningitis
- Kelumpuhan

# Impressi fraktur



# Jaringan otak



Batang otak >>

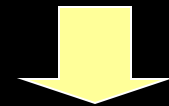
Rotasi



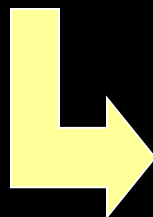
•Otak  
•tulang



Konsistensi  
beda



shearing



Perdarahan  
(lobus frontalis, temporalis dan oksipitalis)



# Akibat TK secara klinis

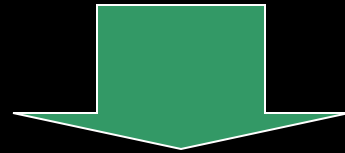
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- A. Komosio serebri
- B. Kontusio serebri

# Komosisio serebri

---

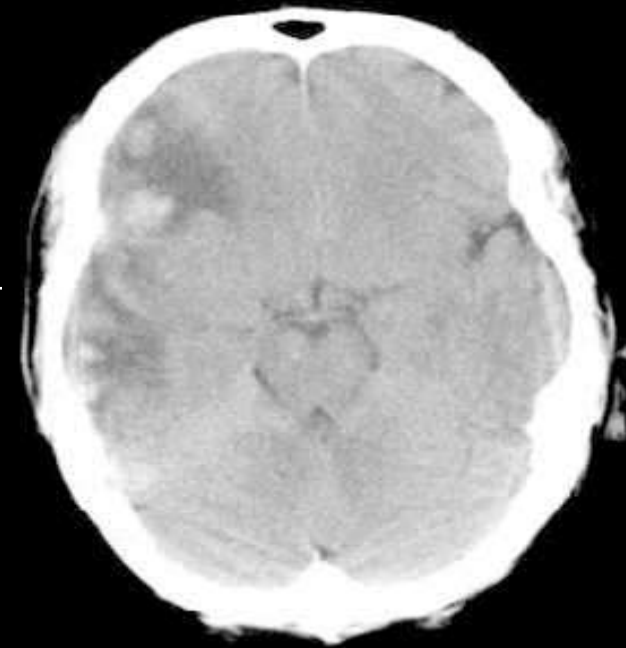
- Kesadaran ↓ < 15 "
- Amnesia retrograd
- Gejala autonom (Vegetatif)
- Gejala neurologis / psikis –



Sembuh sempurna

# Kontusio serebri

- Kesadaran ↓ > 15 " jam hari  
mngg dst
- Amnesia Retrograd +
- Amnesia post trauma
- Prognosis < 7 hr 90 %  
> 28 hr 10 %
- Gg. Psikis → lobus  
temporalis
- Gg. Neurologis
- CT scan per drh an kecil





- Subgaleal hematom
- Impressi fraktur
- Contusio serebri

## 4. Saraf otak

---

N. I → Sering terganggu

N. II → Sekitar orbita

N. III. IV. V Jarang terkena

N. VI → Sering terganggu

**Diplopia** → segera → prognosa buruk  
Bbrp hr → prog. buruk





---

n. VII dan VIII

- Sering → trauma langsung edema

N . IX, X, XI, XII

- Jarang
- Kena → prog jelek

# 5. Pembuluh darah

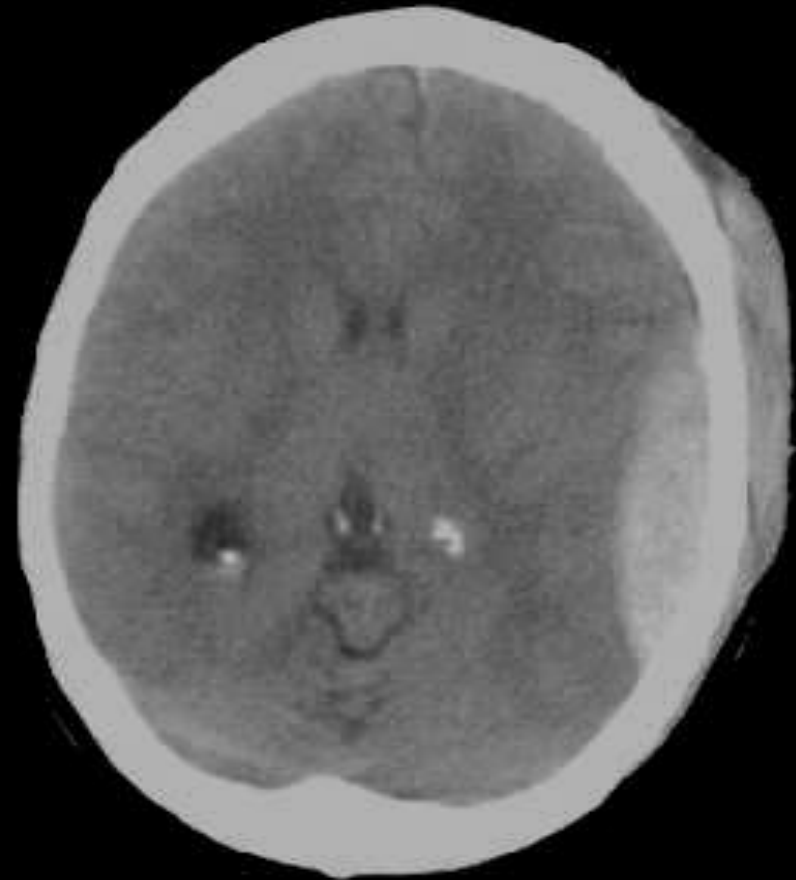
---

a. meningeal media / cabang



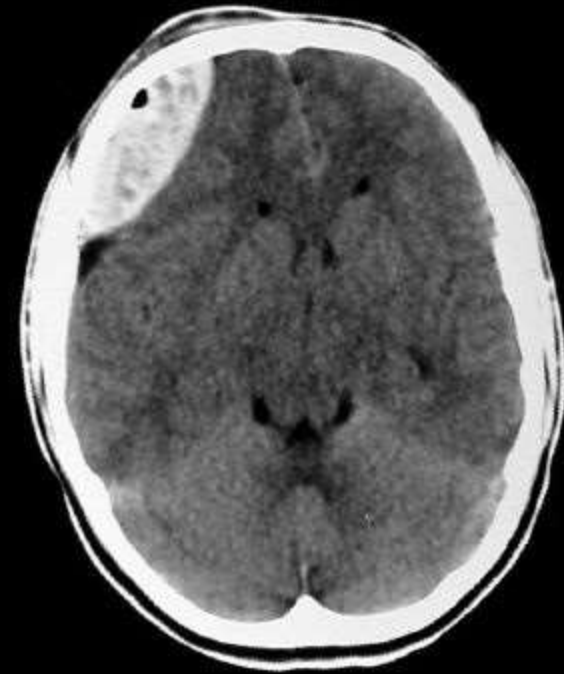
## Perdarahan Epidural

- setiap trauma kapitis harus dibuat x-foto kepala, apakah ada fraktur linier pada os temporal, & observasi teliti perdarahan epidural.
- Pada CT scan  $\Rightarrow$  gambaran clot berbentuk bikonveks seperti lensa (*lens-shaped clot*),



# Epidural Hemorrhage

---





## Gambaran klinis

---

1. Free interval period (FIP)
2. Gg. N. III
3. Hemiparesis
4. Gg. Pernafasan

**Tx: Operatif Burrhole**

# Perdarahan subdural

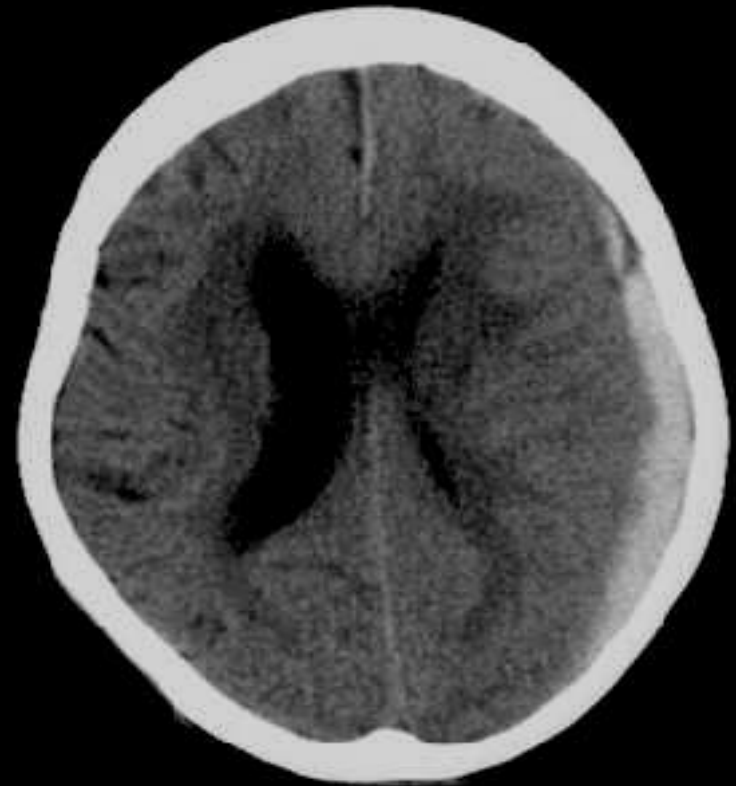
---

- Perdrhan vena : Bridging veins  
Vena yang menyeberang dari jar. Duramater ke otak

## Gg. Klinis

- Gg. Kesadaran (Floating consciousness)
- Papiledema
- Hemiparese
- CT scan → clot spt bln sabit (half moon / cresentic)

**Tx : Operatif**



# SUBDURAL HEMATOM AKUT

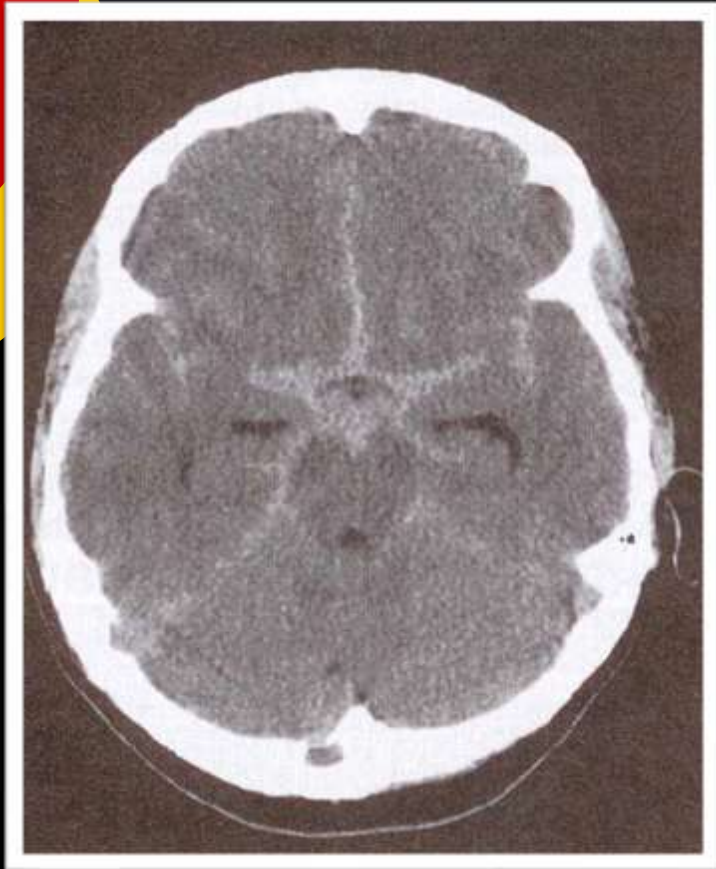
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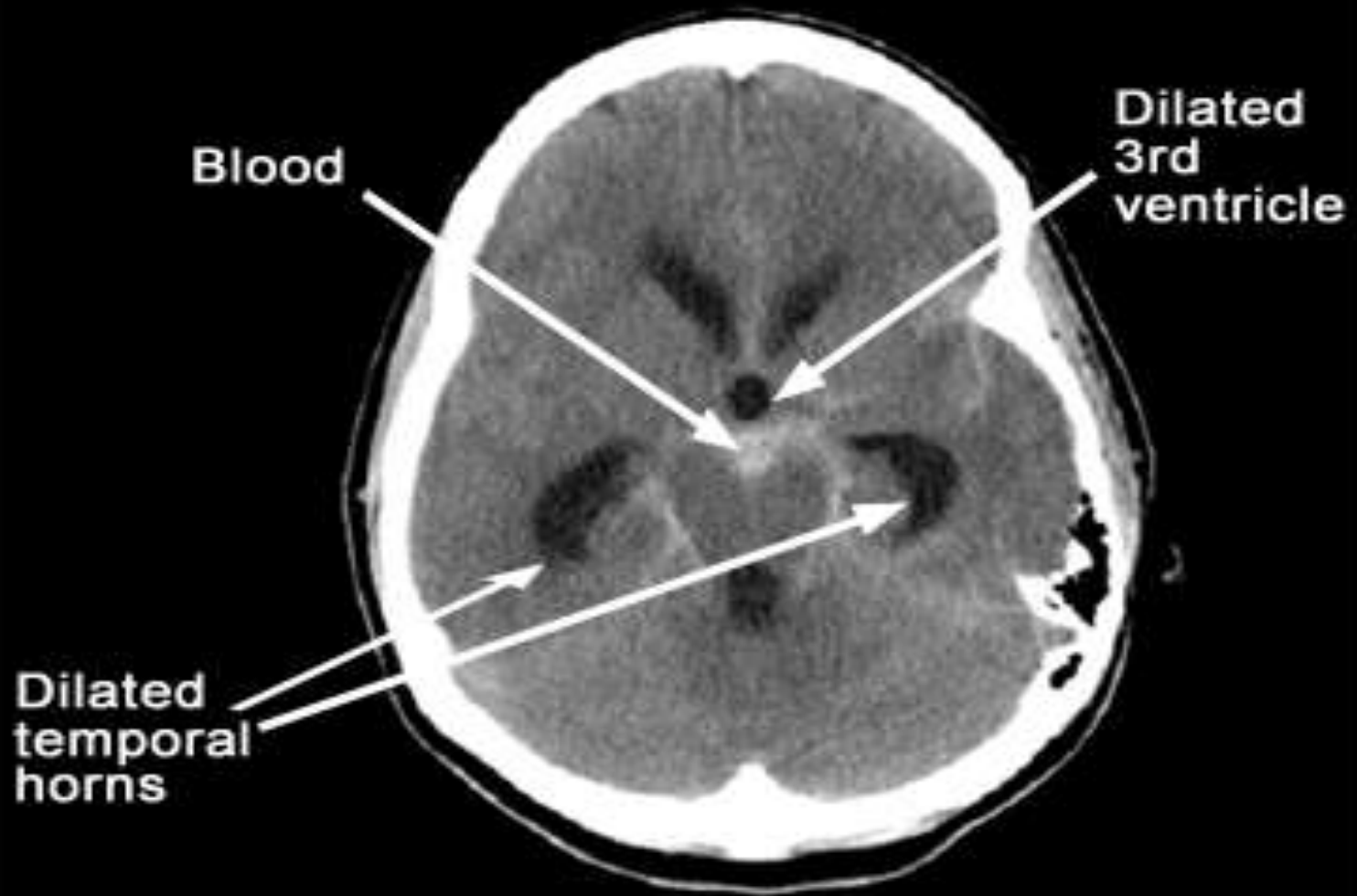
daerah hiperdens  
kresentik  
ekstraaksial koleksi  
dengan efek massa  
(pendataran sulkus)  
dan midline shift kiri  
ke kanan

# PERDARAHAN SUBARAKHNOID

---



- CT scan menunjukkan perdarahan subarakhnoid difus di sisterna basal, sisterna interhemisfer, fissura sylvia bilateral.
- Tanduk ventrikel temporal keduanya melebar abnormal
- Curiga ada hidrosefalus







# Komplikasi

---

- Epilepsi traumatik (16 % - 48 %)
- Meningitis pasca trauma
- Abses
- Hydrosephalus
- Dimensia pasca trauma
- Fistula carotiko- kavernosus

# PENATALAKSANAAN

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konsep sentral :

- kerusakan neurologis tidak hanya terjadi pada saat terjadinya trauma melainkan berkembang pada jam-jam dan hari-hari berikutnya serta dipengaruhi juga oleh kerentanan pasien terhadap trauma
- Metode penanganan yang komprehensif, cepat, tepat, monitoring yang benar serta penemuan obat-obat baru, metode neurorestorasi dan rehabilitasi bertujuan meningkatkan keluaran dari pasien neurotrauma



## **KRITERIA TRAUMA KAPITIS YANG MEMERLUKAN RAWAT INAP DI RS :**

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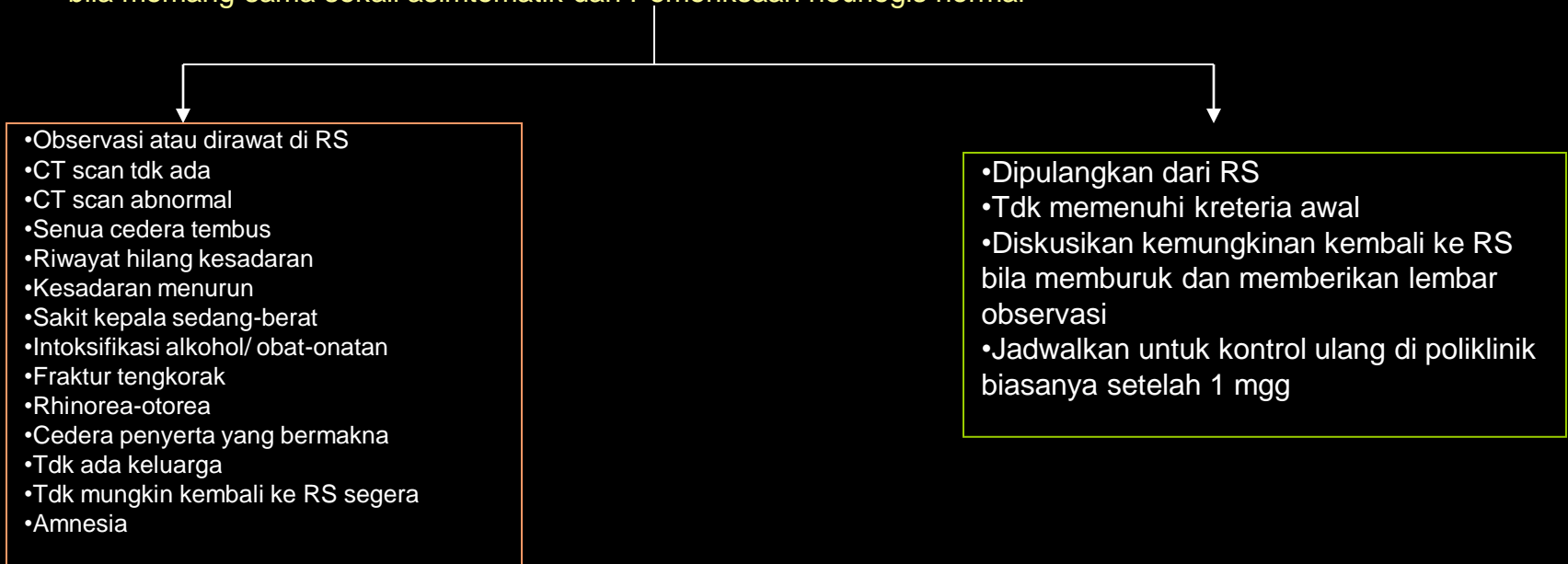
1. CT-scan kepala  $\Rightarrow$  perdarahan intrakranial atau fx
2. Confusion, gelisah, atau penurunan kesadaran
3. Gx atau tanda defisit neurologis fokal
4. Intoksikasi obat atau alkohol
5. Disertai penyakit lain yang tampak signifikan
6. Kehilangan mengenali sekitar selama observasi

# Penatalaksanaan cedera kepala ringan

Defenisi : Penderita sadar dan beorientasi (GCS 14-15)

Riwayat :

- Nama, umur, jenis kelamin, ras, pekerjaan
  - Mekanisme cedera
  - Waktu cedera
  - Tidak sadar segera setelah cedera
  - Tingkat kewaspadaan
  - Amnesia : Retrograde, Amegrade
  - Sakit kepala : ringan, sedang, berat
  - Kejang
- 
- Pemeriksaan umum untuk menyingkirkan cedera sistemik
  - Pemeriksaan neurologis terbatas
  - Pemeriksaan ronsen vertebra servikal dan lainnya sesuai indikasi
  - Pemeriksaan kadar alkohol darah dan zat toksik dalam urine
  - Pemeriksaan CT scan kepala sangat ideal pada penderita cedera kepala ringan, kecuali bila memang sama sekali asimtomatik dan Pemeriksaan neurlogis normal



# Penatalaksanaan Cedera Kepala Sedang

Defenisi : Penderita biasanya tampak bingung atau mengantuk, namun masih mampu menuruti perintah sederhana ( GCS : 9 – 13)

Pemeriksaan awal :

Sama dg untuk cedera kepala ringan ditambah pemeriksaan darah sederhana

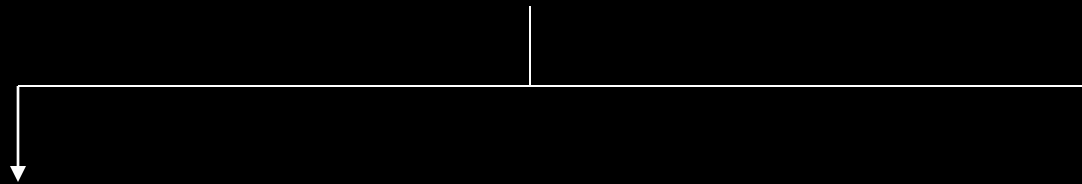
Pemeriksaan CT scan kepala

Dirawat untuk observasi

Setelah dirawat

Pemeriksaan neurologis periodik

Pemeriksaan CT scan ulang bila kondisi penderita memburuk atau bila penderita akan dipulangkan



**Bila kondisi membaik (90%)**

- Pulang
- Kontrol di poliklinik

- Bila kondisi memburuk (10 %)
- Bila penderita tdk mampu melakukan perintah lagi, segera lakukan pemeriksaan CT scan ulang dan penatalaksanaan sesuai protokol cedera kepala berat

# Penatalaksanaan Awal Cedera Kepala Berat

---

Defenisi : Penderita Tdk mampu melakukan perintah sederhana karena kesadaran yang menurun (GCS 3-8)

---

Pemeriksaan dan penatalaksanaan :

- ABCDE
  - Primary survey dan resusitasi
  - Secondary survey
- 
- Reevaluasi neurologis
    - Respon buka mata
    - Respon motorik
    - Respon verbal
    - Reaksi cahaya pupil
    - Refleks okulo sefalik (doll's eyes)
    - Refleks okulovestibuler (test Kalori)
- 
- Obat-obatan
    - Manitol
    - Hyperventilan sedang
    - Antikonvulsan
- 
- Test diagnosis sesuai urutan
    - CT scan (senua penderita)
    - Ventrikulografi udara
    - Angiogram
-

# ABC Assessment

A : Airway : suction to free pharynx from blood and other material; intubate after cervical spine evaluation

B : Breathing : evaluate rate, rhythm and breath sounds; ventilate to rise PaO<sub>2</sub> and reduce PaCO<sub>2</sub> (to lower ICP) monitor ABG levels

C : Circulatory status : start IV infusion of lactated Ringer's or normal saline solution followed by blood, if indicated; obtain immediate laboratory work and x ray; administer steroid and diphenhydramine, plus pressor agent, if required (shock rarely due to head injury alone search for cause)



## Acute Intracranial Hematoma



A. Sutures for skull bones extended and joined, turning flap of skin and fascia, which is turned down (drapes removed to demonstrate location).

B. Skull opened by connecting  
skull bones with osteotome



C. Bone flap turned down by cracking about segment of length, exposing epidural hematoma, which is removed by suction, aspirator or Peffer's dissector.





# CIDERA MEDULA SPINALIS

Mechanism of Spinal Injuries





# CEDERA MEDULA SPINALIS

---

- TOPIK
- EPIDEMIOLOGI
- ANATOMI
- MEKANISME Cedera Medula Spinalis
- TANDA DAN GEJALA
- PENATALAKSANAAN

# Pendahuluan

---

- Cedera Medula Spinalis :

Kerusakan pada medula spinalis karena pergeseran atau kompresi tulang yang mengakibatkan gangguan baik secara komplit atau parsial, merupakan keadaan darurat neurologi yg perlu tindakan cepat, tepat dan cermat untuk mengurangi kecacatan

- Prognosis tergantung dari 2 faktor :

- beratnya defisit neurologis yg timbul
- lamanya defisit neurologis sebelum dilakukan tindakan dekompresi.



# Epidemiologi

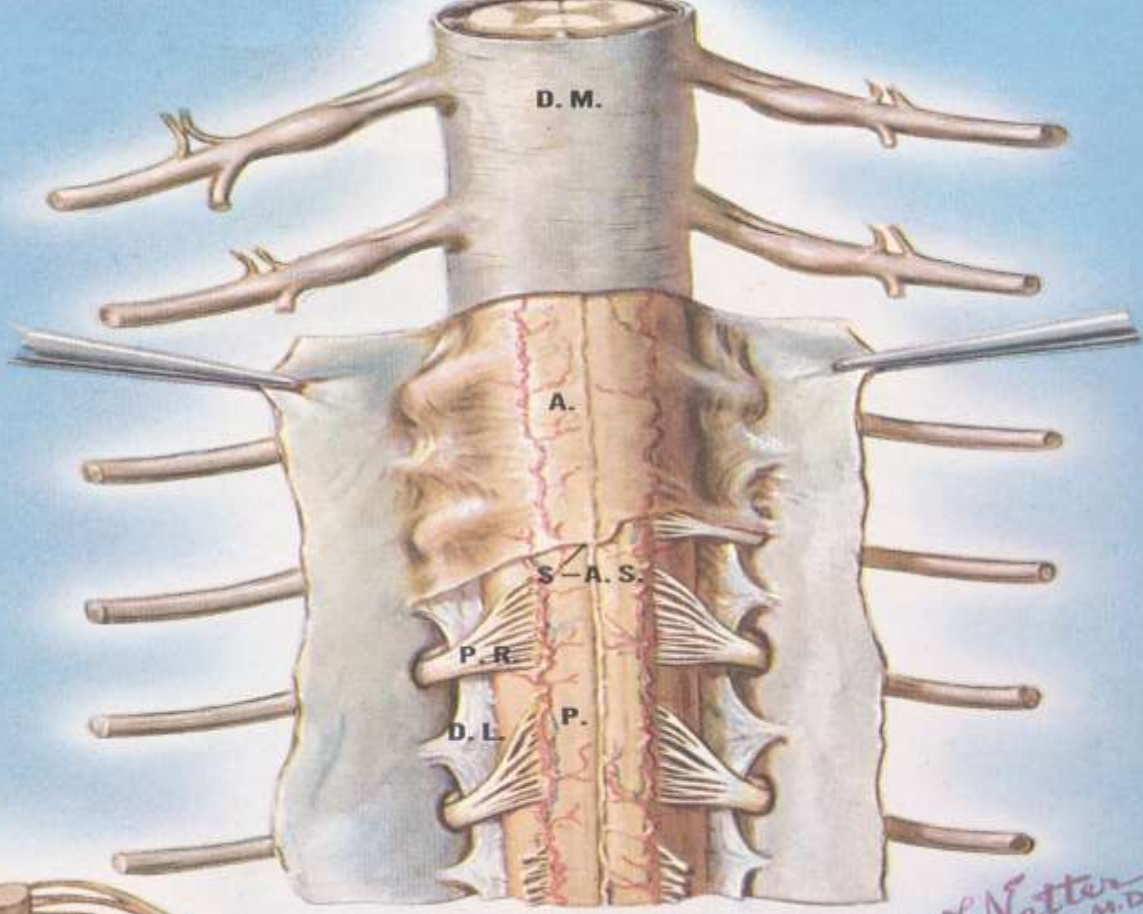
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- Pria lebih sering terkena (80%)
- Sering pada dewasa muda (15-30 tahun)
- Pada orang tua sering karena kecelakaan kendaraan bermotor
- Penyebab tersering:
  - Olah raga "Full Contact" (Rugby, American wrestling)
  - Olah raga "High speed" (Skii, Skate, surfing)
  - Olah raga "melompat" (trampoline, berkuda)
  - Menyelam

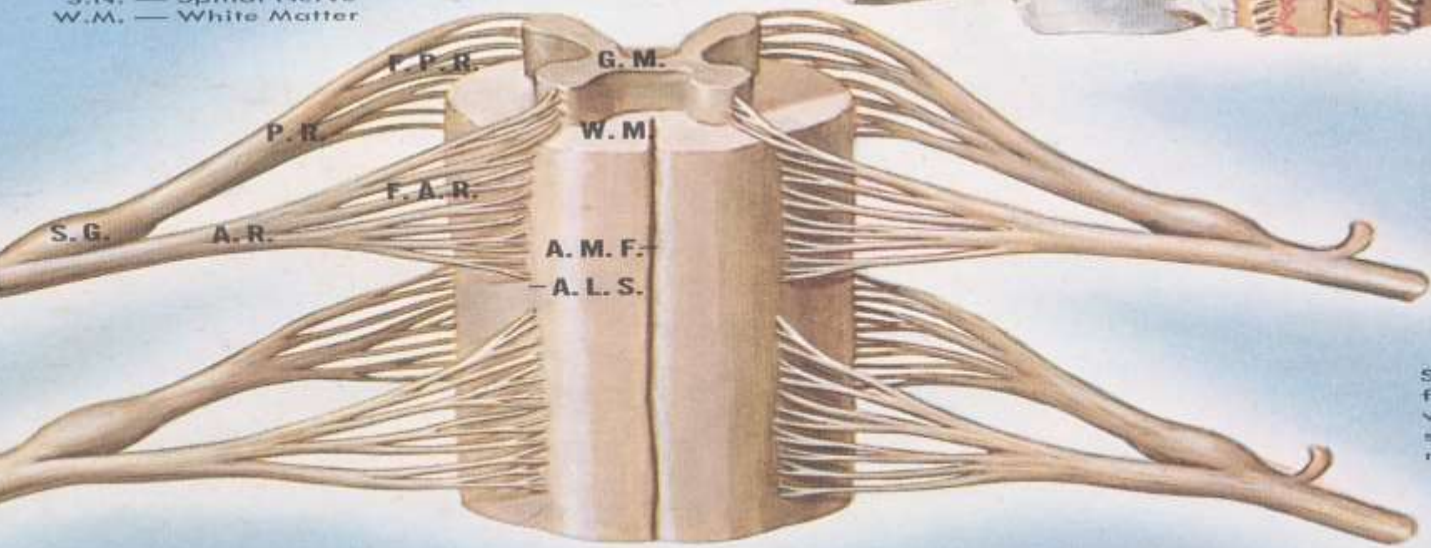
<b>Road traffic accidents</b>	<b>45%</b>	<b>Domestic and industrial accidents</b>	<b>34%</b>
Car, van, coach, lorry	16.5%	Domestic—e.g. falls down stairs or from trees	
Motorcycle	20%	or ladders	22%
Cycle	5.5%	Accidents at work—e.g. falls from scaffolding or ladders, crush injuries	12%
Pedestrian	1.5%		
Aeroplane, helicopter	1.5%		
<b>Self harm and criminal assault</b>	<b>6%</b>	<b>Injuries at sport</b>	<b>15%</b>
Self harm	5%	Diving into shallow water	4%
Criminal assault	1%	Rugby	1%
		Horse riding	3%
		Miscellaneous—e.g. gymnastics, motocross, skiing, etc,	7%

Segment of spinal cord viewed from behind, with portions of dura mater and arachnoid removed.

- A. — Arachnoid
- D.L. — Dentate Ligament
- D.M. — Dura Mater
- P. — Pia Mater Overlying Spinal Cord
- P.R. — Posterior Root
- S-A.S. — Subarachnoid Septum



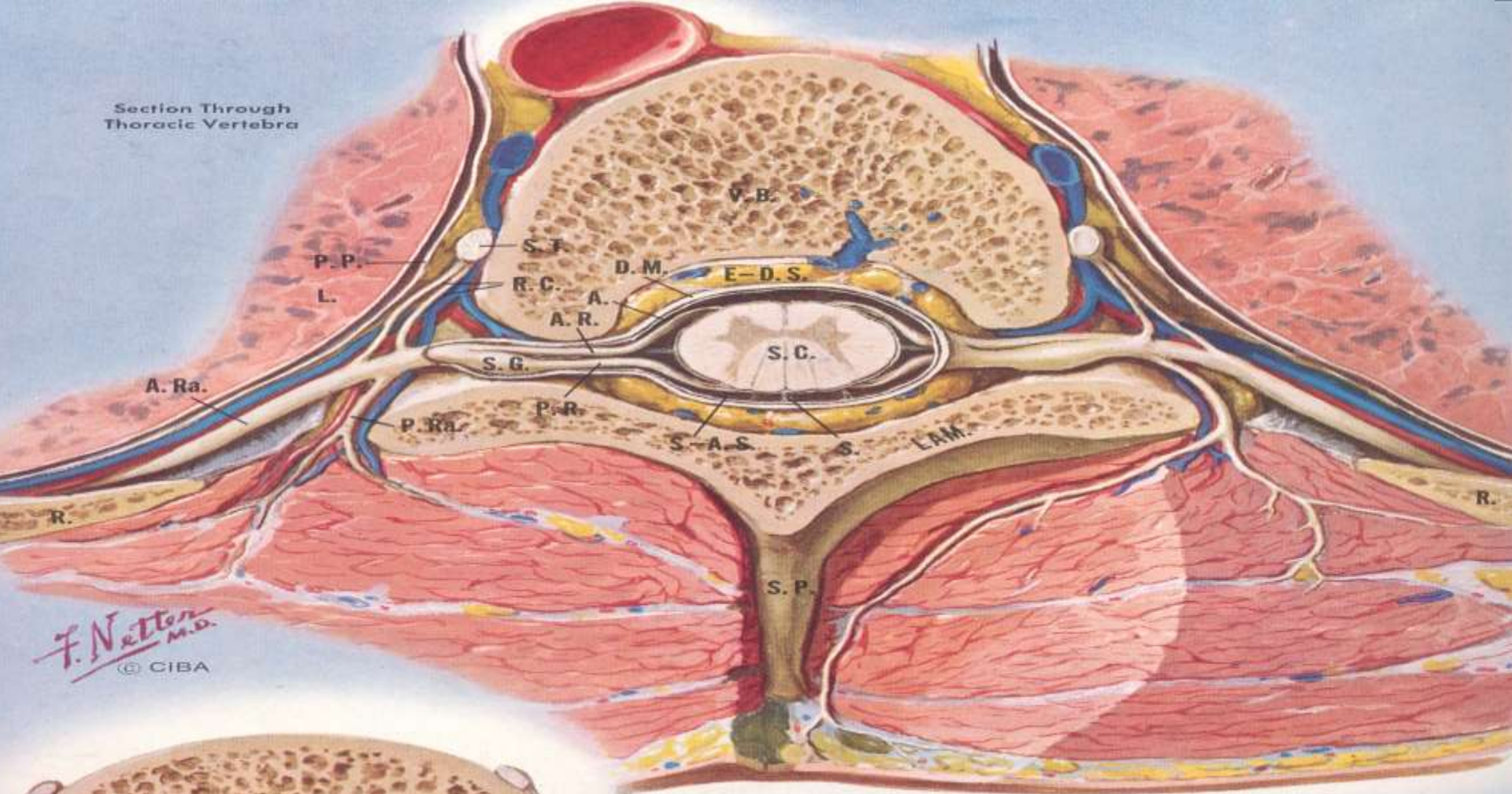
- A.L.S. — Anterior Lateral Sulcus
- A.M.F. — Anterior Median Fissure
- A.R. — Anterior Root
- F.A.R. — Fila of Anterior Root
- F.P.R. — Fila of Posterior Root
- G.M. — Gray Matter
- S.G. — Spinal Ganglion
- S.N. — Spinal Nerve
- W.M. — White Matter



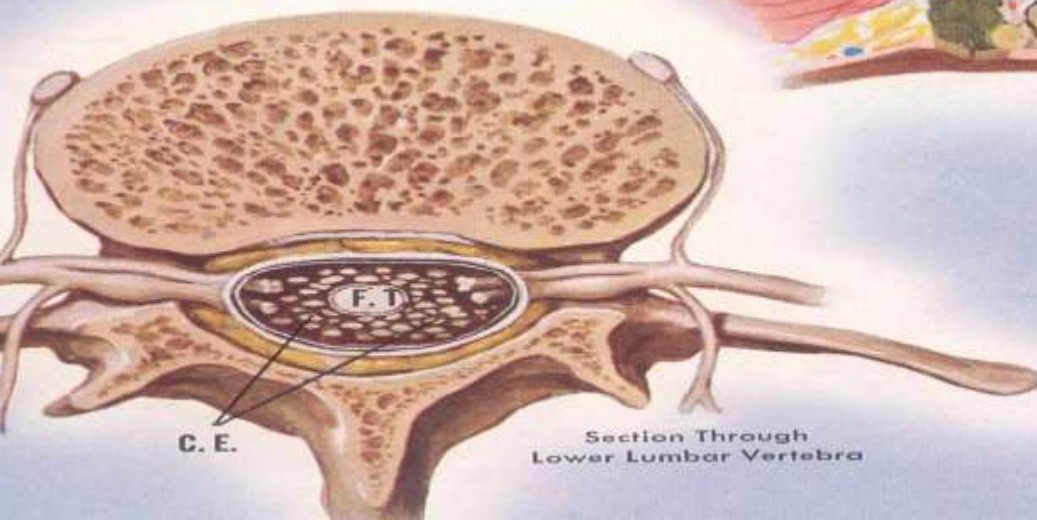
*F. Netter*  
M.D.  
© CIBA

Segment of spinal cord, viewed from in front with portion of white matter removed and showing origin of spinal nerves.

Section Through  
Thoracic Vertebra



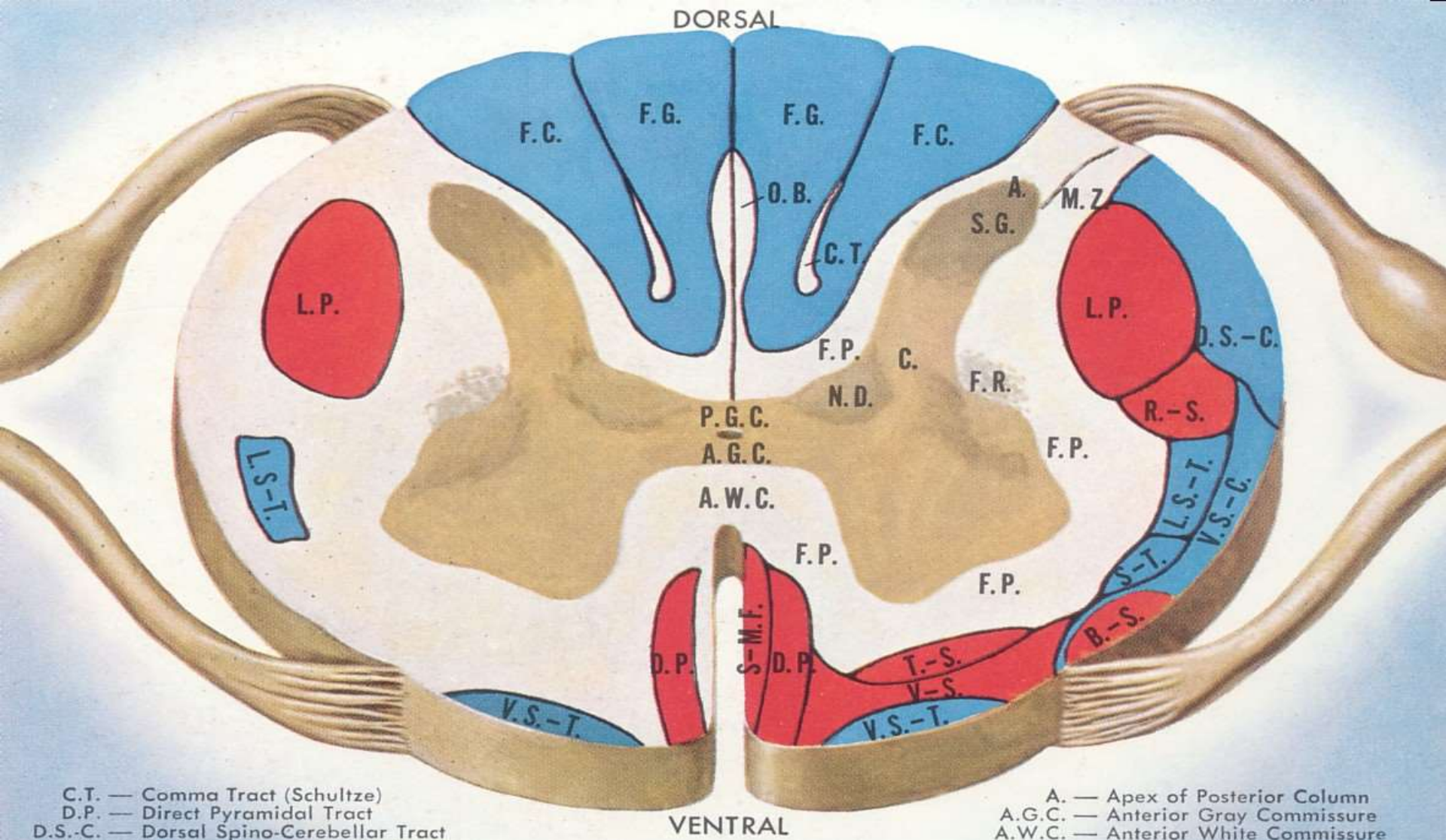
*F. Netter M.D.*  
© CIBA



Section Through  
Lower Lumbar Vertebra

- A. — Arachnoid
- A.R. — Anterior Root of Spinal Nerve
- A.Ra. — Anterior Ramus of Thoracic Nerve (Intercostal Nerve)
- C.E. — Cauda Equina
- D.M. — Dura Mater
- E-D.S. — Epidural Space
- F.T. — Filum Terminale
- LAM. — Lamina
- L. — Lung
- P.P. — Parietal Pleura
- P.Ra. — Posterior Ramus of Thoracic Nerve
- P.R. — Posterior Root of Spinal Nerve
- R. — Rib
- R.C. — Rami Communicantes
- S. — Subarachnoid Septum
- S-A.S. — Subarachnoid Space
- S.C. — Spinal Cord
- S.G. — Spinal Ganglion
- S.P. — Spinous Process
- S.T. — Sympathetic Trunk
- V.B. — Vertebral Body





- C.T. — Comma Tract (Schultze)
- D.P. — Direct Pyramidal Tract
- D.S.-C. — Dorsal Spino-Cerebellar Tract
- F.C. — Funiculus Cuneatus (Burdach)
- F.G. — Funiculus Gracilis (Goll)
- L.P. — Lateral Pyramidal Tract
- L.S.-T. — Lateral Spino-Thalamic Tract
- O.B. — Oval Bundle
- R.S. — Rubro-Spinal Tract
- S.T. — Spino-Tectal Tract
- T.S. — Tecto-Spinal Tract
- V.S.-C. — Ventral Spino-Cerebellar Tract (Gower)
- V.S.-T. — Ventral Spino-Thalamic Tract







Schematic section through spinal cord, showing on left the tracts of greatest clinical importance and, on right, other tracts and landmarks as well.

(RED indicates tracts from brain to cord; BLUE, from cord to brain.)

- A. — Apex of Posterior Column
- A.G.C. — Anterior Gray Commissure
- A.W.C. — Anterior White Commissure
- B.S. — Bulbo-Spinal Tract (Helwig's Bundle)
- C. — Cervix of Posterior Column
- F.P. — Fasciculus Proprius
- F.R. — Formatio Reticularis
- M.Z. — Marginal Zone
- N.D. — Nucleus Dorsalis
- P.G.C. — Posterior Gray Commissure
- S.G. — Substantia Gelatinosa
- S-M.F. — Sulca-Marginal Fasciculus
- V.S. — Vestibulo-Spinal Tract

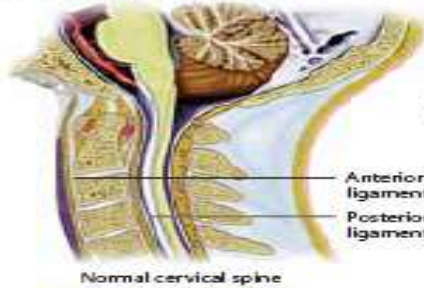
# Mekanisme Cedera Medula Spinalis

- Hyperextension
- Hyperflexion
- Compression
- Rotation
- Lateral Stress
- Distraction

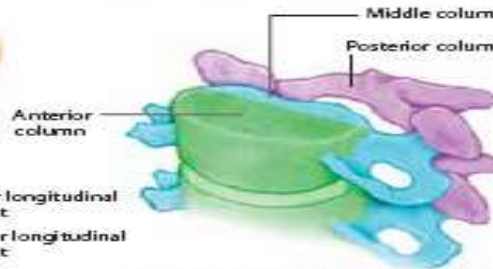
DESCRIPTION	DIAGRAM	EXAMPLES
<b>Hyperextension</b> Excessive posterior movement of head or neck		Face into windshield in MVC Elderly person falling to the floor Football tackler Dive into shallow water
<b>Hyperflexion</b> Excessive anterior movement of head onto chest		Rider thrown off of horse or motorcycle Dive into shallow water
<b>Compression</b> Weight of head or pelvis driven into stationary neck or torso		Dive into shallow water Fall of greater than 10 to 20 feet onto head or legs
<b>Rotation</b> Excessive rotation of the torso head and neck, moving one side of the spinal column against the other		Rollover MVC Motorcycle accident
<b>Lateral Stress</b> Direct lateral force on spinal column, typically shearing one level of cord from another		"T-bone" MVC Fall
<b>Distraction</b> Excessive stretching of column and cord		Hanging Child inappropriately wearing shoulder belt around neck Snowmobile or motorcycle under rope or wire



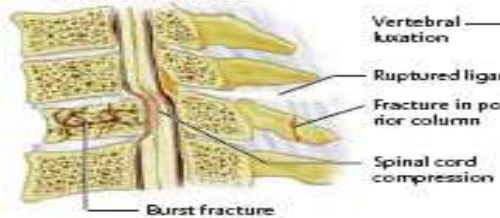
Whiplash injury of cervical spine (traumatic cervical distortion)



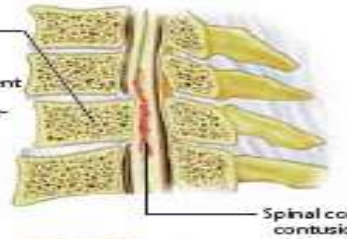
Normal cervical spine



Three-column model of spinal stability



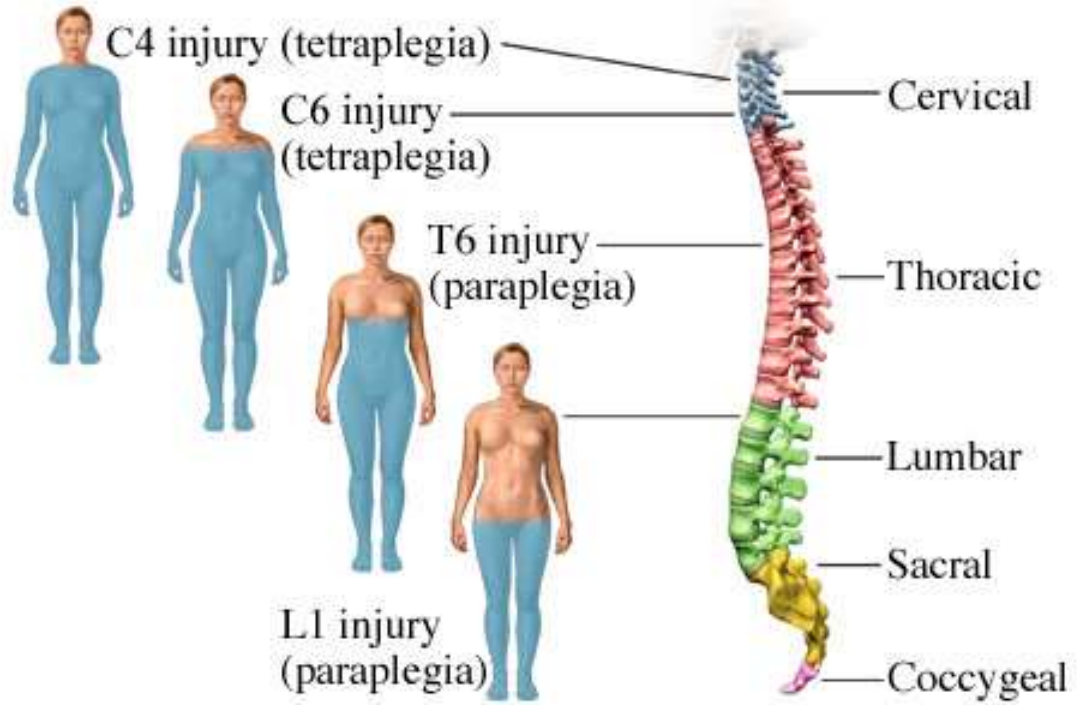
Burst fracture



Spinal cord contusion



Syringomyelia (posttraumatic)  
Gunshot wound



# Cedera Cervical

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## Curiga bila :

- **Ada cedera kepala / atas clavícula**
- **Pernafasan paradoksal (diafragma)**
- **Kelumpuhan tangan / kaki**
- **Refleks lutut (-) → periksa sphinkter ani**
- **Hipotensi (+ bradikardia)**

# CEDERA MEDULA SPINALIS

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Efek trauma terhadap tulang belakang :

- Fraktur – Dislokasi
- Dislokasi
- Fraktur
- Fraktur tdk mempunyai predileksi
- Dislokasi C<sub>1-2</sub>, C<sub>5-6</sub>, T<sub>11-12</sub>
- Tanpa kerusakan nyata pada tulang belakang, kerusakan MS bisa berat

# Tanda dan Gejala Cedera Medula Spinalis

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- Nyeri leher atau punggung
- Jejas pada leher
- Trauma Clavicula
- Multipel trauma pada pasien yang tidak sadar
- Tetra/Para/Monoparesis
- Tetra/Para/Monohipestesi
- Inkontinensia

Level <sup>1</sup>	Motor Deficit	Sensory Deficit <sup>2</sup>	Autonomic Deficit <sup>3</sup>
C1–C3 <sup>4</sup>	Quadriplegia, neck muscle paresis, spasticity, respiratory paralysis	Sensory level at back of head/edge of lower jaw; pain in back of head, neck, and shoulders	Voluntary control of bladder, bowel, and sexual function replaced by reflex control; Horner syndrome
C4–C5	Quadriplegia, diaphragmatic breathing	Sensory level at clavicle/shoulder	Same as above
C6–C8 <sup>5</sup>	Quadriplegia, spasticity, flaccid arm paresis, diaphragmatic breathing	Sensory level at upper chest wall/back; arms involved, shoulders spared	Same as above
T1–T5	Paraplegia, diminished respiratory volume	Sensory loss from inner surface of lower arm, upper chest wall, back region downward	Voluntary control of bladder, bowel, and sexual function replaced by reflex control
T5–T10	Paraplegia, spasticity	Sensory level on chest wall and back corresponding to level of spinal cord injury	Same as above
T11–L3	Flaccid paraplegia	Sensory loss from groin/ventral thigh downward, depending on level of injury	Same as above
L4–S2 <sup>6</sup>	Distal flaccid paraplegia	Sensory loss at shin/dorsum of foot/posterior thigh downward, depending on level of injury	Flaccid paralysis of bladder and bowel, loss of erectile function
S3–S5 <sup>7</sup>	No motor deficit	Sensory loss in perianal region and inner thigh	Flaccid paralysis of bladder and bowel, loss of erectile function



# KOMOSIO

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- Fungsi MS hilang sementara sembuh sempurna bbrp menit, (48 jam)/hari tanpa gejala sisa
- Edema, perdarahan perivaskuler kecil-kecil, infark disekitar pembuluh darah
- Makro = utuh





# KONTUSIO

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Kerusakan makro :

- Edema, perdarahan, reaksi peradangan, degenerasi wallerian, kerusakan neuroncornu ant.

# LASERASI

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- Kerusakan berat → diskontinuitas MS
- Jenis trauma :  
Tembak, bacok / tusuk  
fraktur dislokasi



# PERDARAHAN

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- Epidural
- Subdural
- Hematomielia

Perdarahan Epidural & Subdural

Akibat :  
- Trauma  
- Anestesi Epidural  
- Sepsis



# Hematomielia

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- Perdarahan dlm substansia grisea medulla spinalis
- Akibat : fraktur-dislokasi Whiplash
  - akibat gaya eksplosif : jatuh pada posisi berdiri, duduk.

# GEJALA KLINIS

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## Komplit :

### Lesi setinggi Cervical

- Tetraplegi
- Inkontinensia
- Paralisis otot pernafasan

### Lesi di bawah Thorakal 1

- Inkontinensia
- Paraplegi



# Inkomplit

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**Anterior Cord Syndrome**

**Central Cord Syndrome**

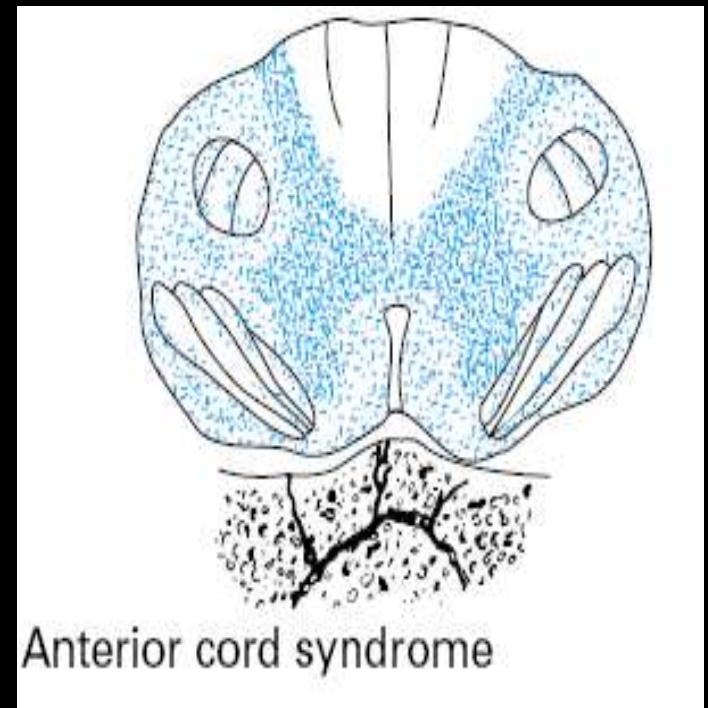
**Posterior Cord Syndrome**

**Brown-Sequard's Syndrome**

**Cauda equina**

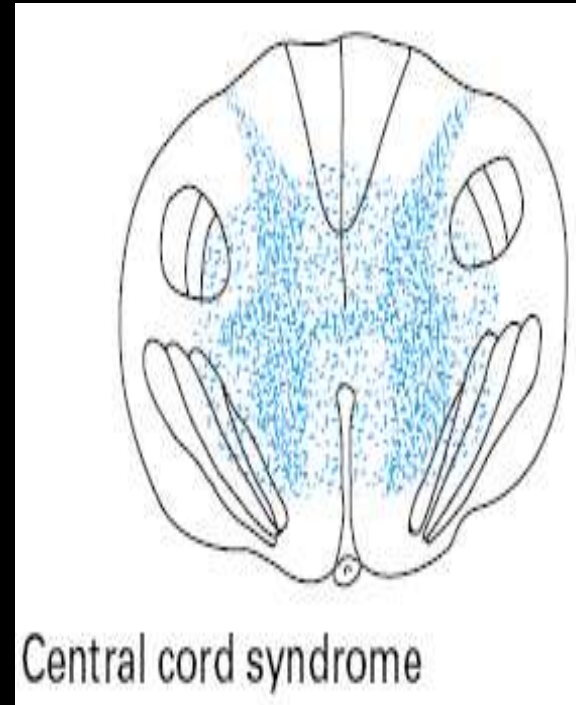
## Anterior Cord Syndrome

- ❑ Sering mengenai A Spinalis anterior
- ❑ Kehilangan fungsi motorik dan sensasi terhadap pain, light touch & temperatur
- ❑ Sensasi posisi dan vibrasi utuh



## Central Cord Syndrome

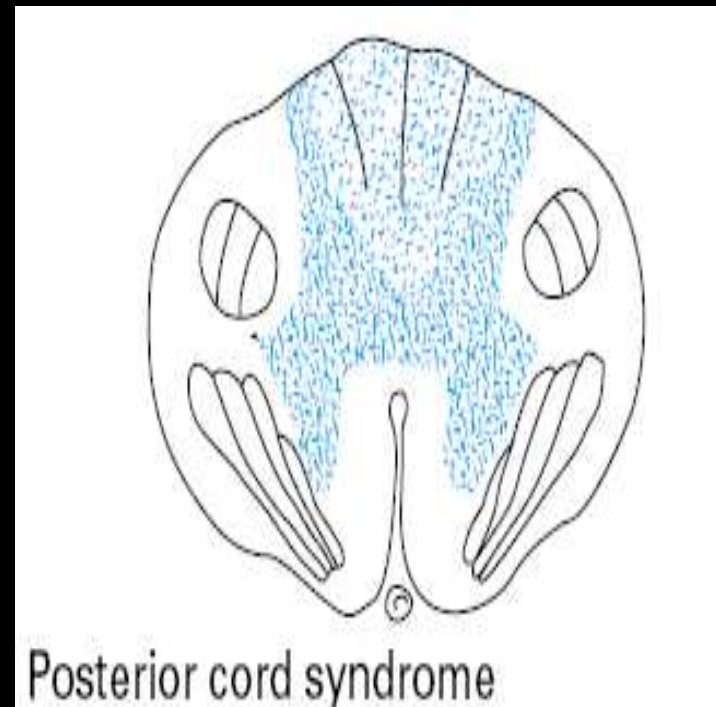
- ❑ Hyperextensi cervical spine
- ❑ Kelemahan terutama pada ekstremitas atas (tipe flasid) dengan ekstremitas bawah yang relatif masih kuat (spastis)
- ❑ Sensasi perineal, fungsi BAB & BAK kadang masih terdapat





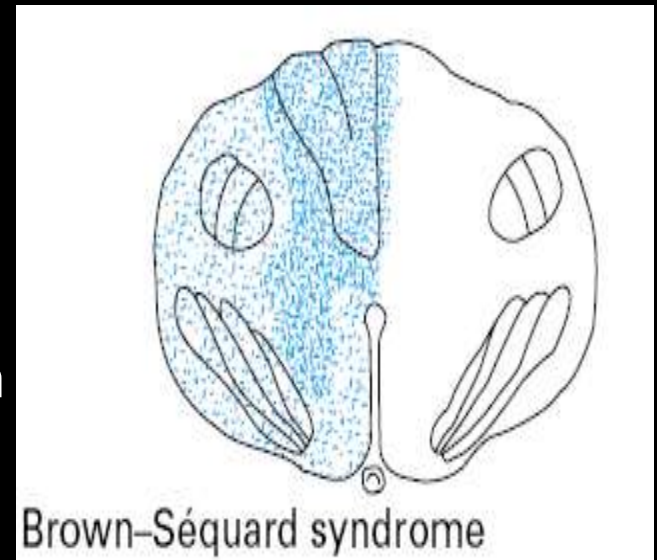
## Posterior Cord Syndrome

- ❑ Sering akibat hiperekstensi, fraktur pada bagian posterior vertebrae
- ❑ Kekuatan baik, sensasi terhadap pain dan temperatur baik
- ❑ Gangguan proprioseptif, terdapat ataksia, sehingga sulit berjalan



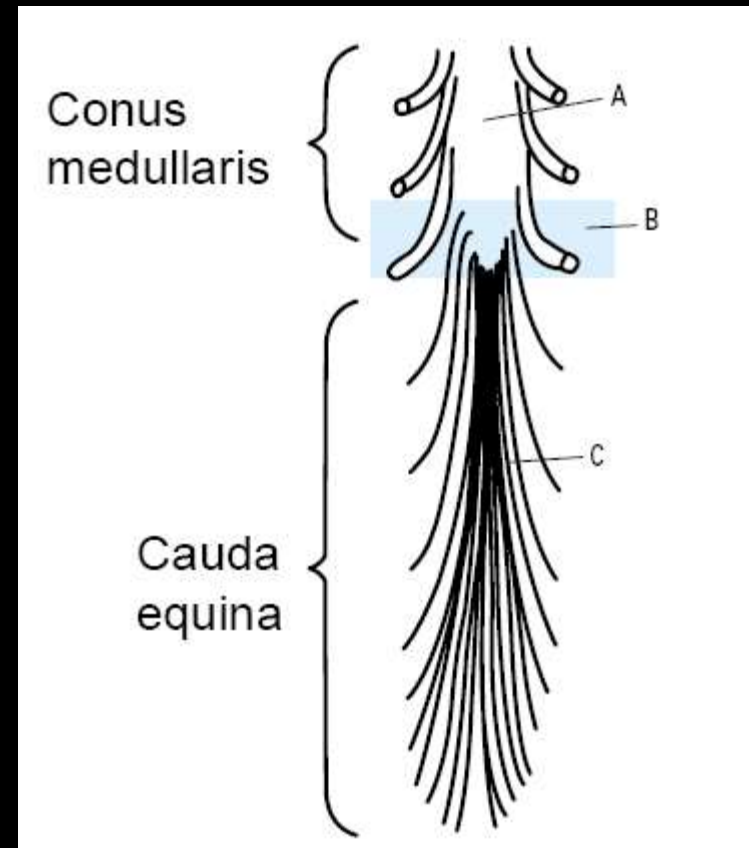
## **Brown-Sequard's Syndrome**

- ❑ Penetrating injury yang mengenai salah satu sisi medula spinalis
- ❑ Kelemahan dan gangguan sensorisensorik Ipsilateral
- ❑ Gangguan sensorik pain dan temperatur kontralateral



# Cauda equina

- ❑ Gangguan motorik atau sensori ringan pada tungkai
- ❑ Gangguan sensorik pada regio perineal (saddle anesthesia)
- ❑ Gangguan BAB & BAK
- ❑ Disfungsi Ereksi pada pria & gangguan respon seksual pada wanita
- ❑ Tonus spinkter anal terganggu, reflek bulbocavernosus dan anal terganggu



# Penatalaksanaan

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- Tujuan :
  - Pemulihan maksimal defisit neurologi
  - Medula spinalis stabil
  - Mobilisasi dan rehabilitasi
- Penatalaksanaan :
  - Prehospital
  - Hospital atau UGD

# Penatalaksanaan Prehospital

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## Umum

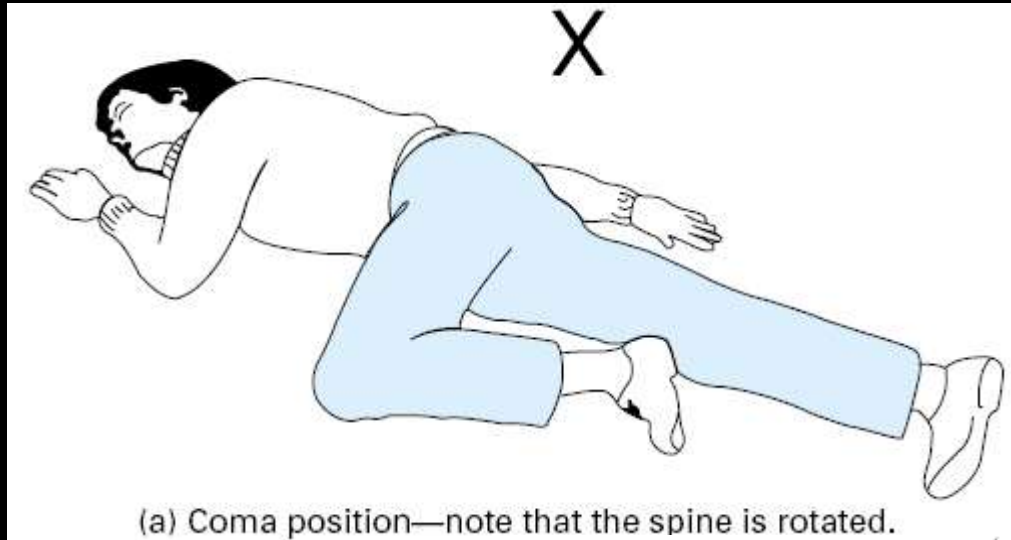
- ✓ 10-25% defisit neurologis karena tindakan pre hospital tidak adekuat.
- ✓ jika ada fraktur / dislokasi vertebra servikalis fiksasi leher pasang collar, kepala dan leher jangan digerakkan.
- ✓ cek ABC --> RJP
- ✓ jika ada fraktur vertebra torakal atau lumbal, fiksasi torakal dengan korset.

# Neck Collar / Collar Brace

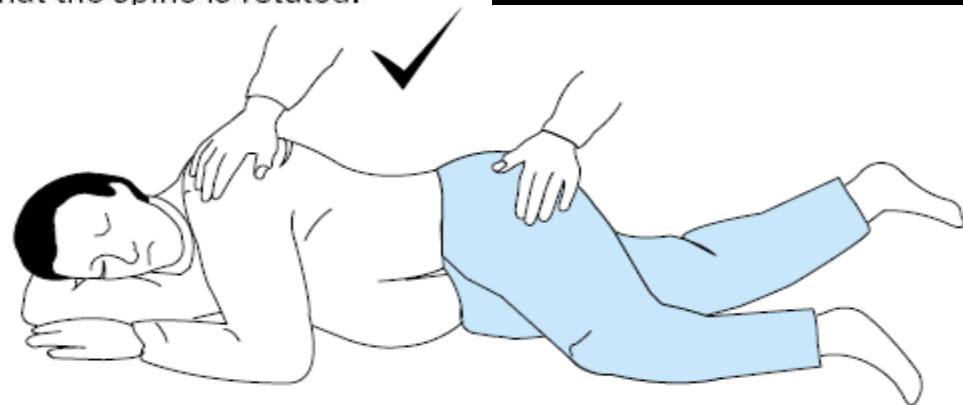
**Servikal difiksasi pada posisi netral/ekstensi ringan pasang cervical collar tanpa menggerakkan leher (terlalu banyak), kepala harus dipegang “in-line” fiksasi dibantu sandbags (bantalan pasir)**



# Tatalaksana

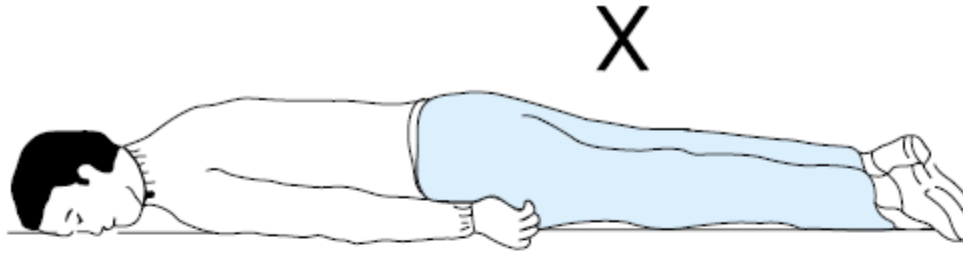


(a) Coma position—note that the spine is rotated.

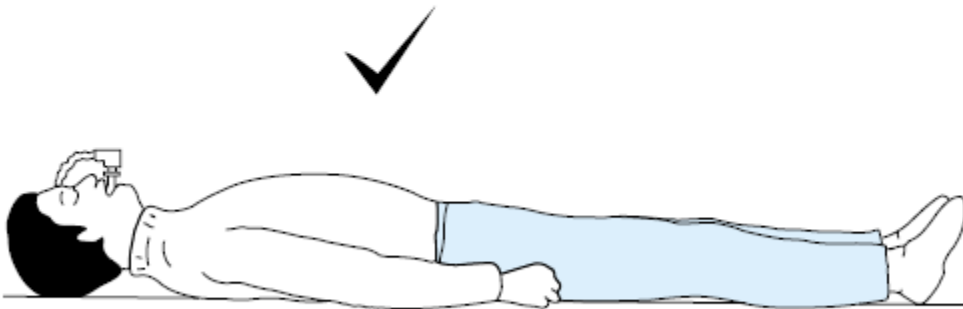


(b) Lateral position—two hands from a rescuer stabilise the shoulder and left upper thigh to prevent the patient from falling forwards or backwards.

# Tatalaksana

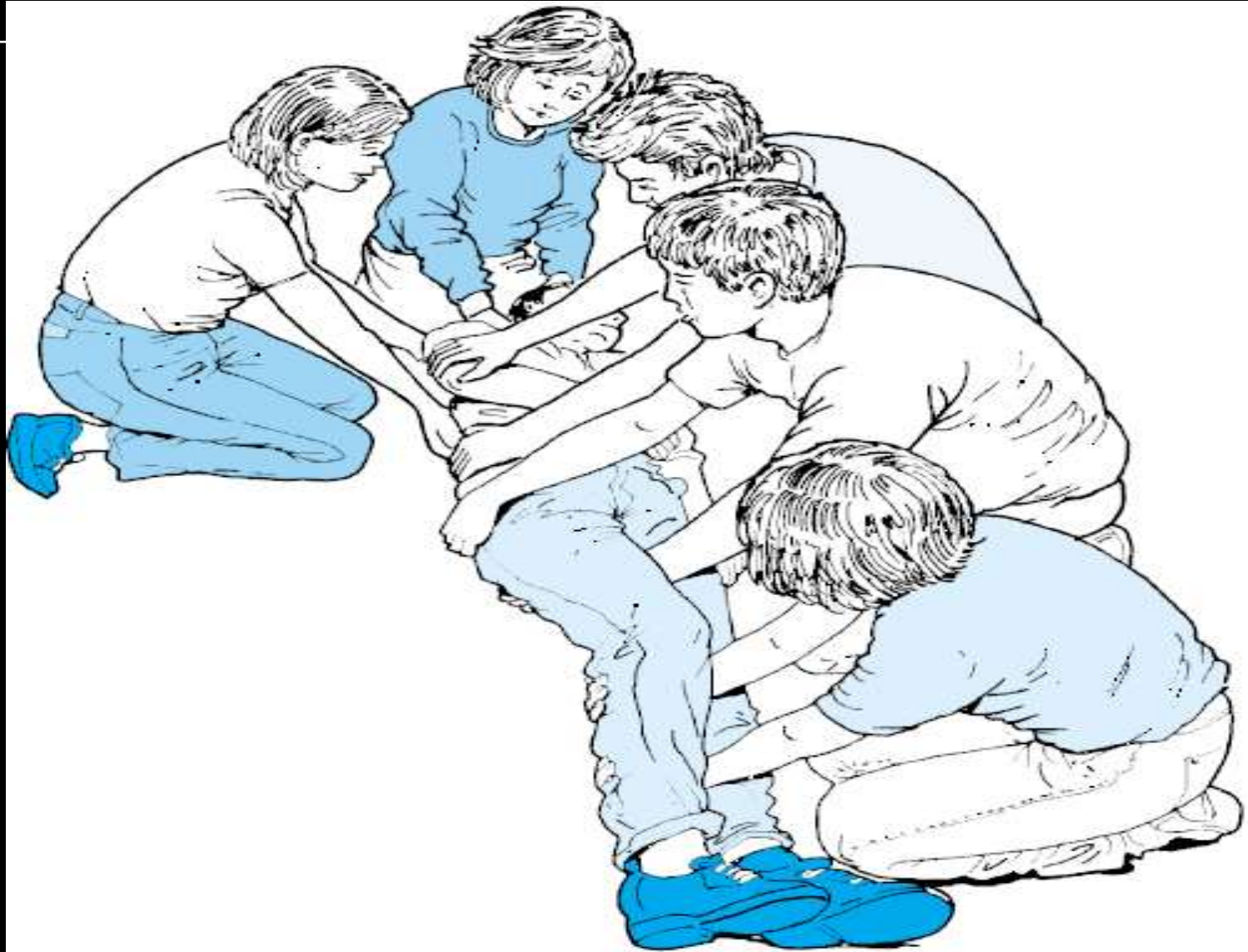


(c) Prone position—compromises respiration.



(d) Supine position—if patient is supine the airway must be secure, and if consciousness is impaired, the patient should be intubated.









Penatalaksanaan  
Cedera Med Spin

Cegah Trauma  
Sekunder

Resusitasi cairan  
monitoring

Steroid

CVP

Kateter  
Urine

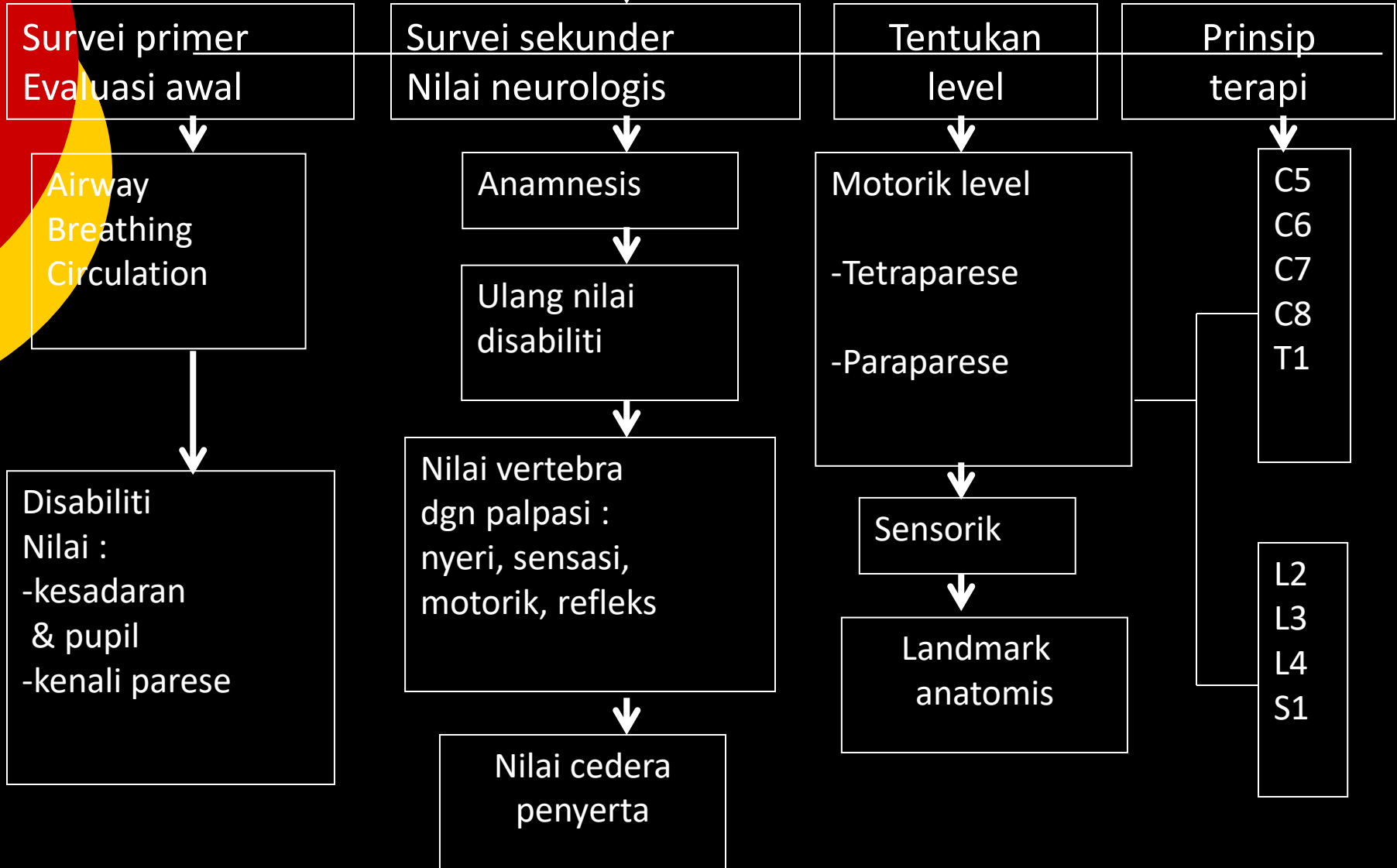
Kateter  
Lambung

Desifit neuro  
< 8 jam

30mg/Kgbb 10 – 15'

5,4mg/Kgbb/jam – 23jam

# Manajemen cedera spinal



# Terapi

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methyprednisolone :

30 mg/kg IV lalu dilanjutkan dengan drip 5.4 mg/kg/jam untuk 23 jam berikutnya

(jika < 3 jam, jika antara 3-8 jam drip dilanjutkan sampai 48 jam)

