TRAUMI CRANICI E MIDOLLARI

Il Neurologo

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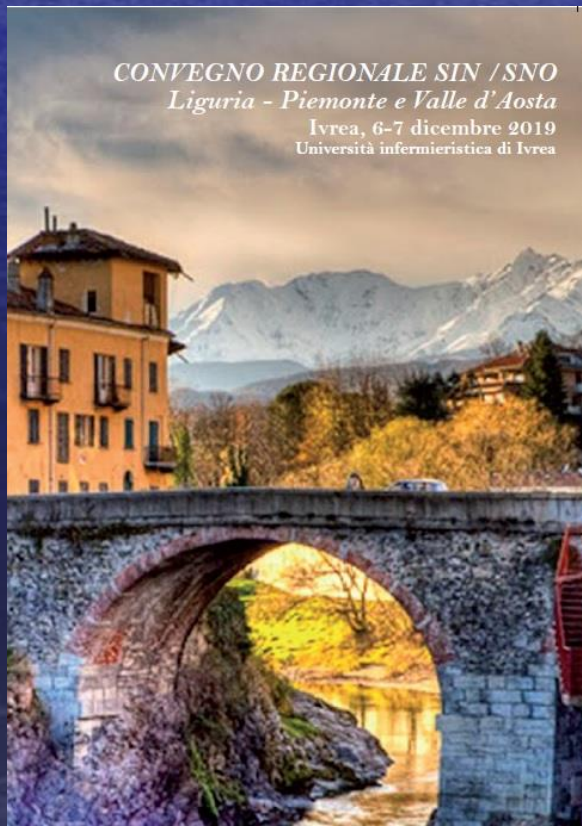
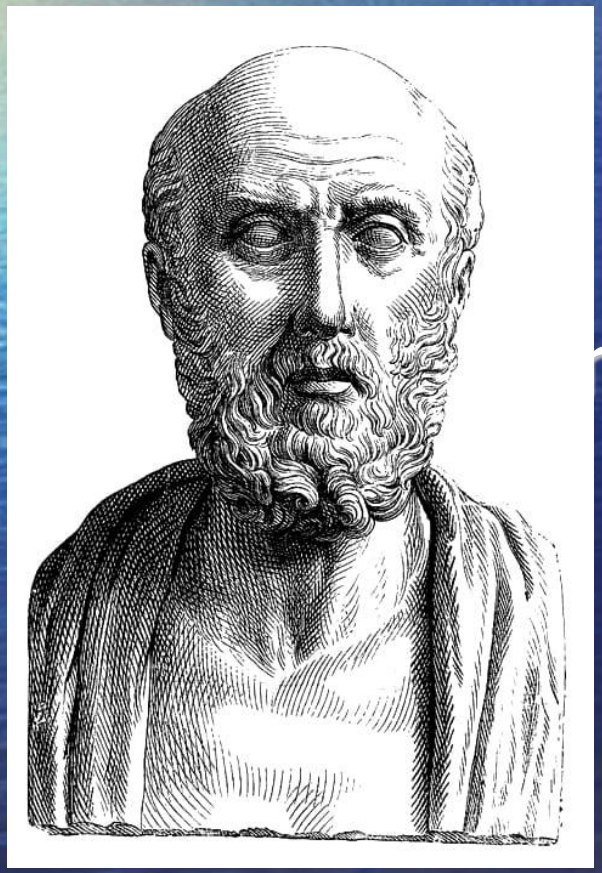


Nessun trauma cranico è troppo insignificante per essere ignorato



r aggiungere del testo

Ippocrate, 460 – 377 a.C.

TRAUMA CRANICO

- Incidenza annuale: 250 – 600/100.000
- Mortalità: 17/100.000
- Negli USA è la prima causa di morte nella popolazione tra 0 – 44 anni
- Nel 38% dei casi sono bambini ed anziani

- Eziologia:
  - Abuso in infanzia
  - Attività sportiva in adolescenti e giovani adulti
  - Incidenti stradali (16%) in giovani adulti
  - Cadute accidentali in anziani
  - Corpi contundenti (20 %)
  - Incidenti sul lavoro
  - Aggressioni (11%)
  - Attività di combattimento

TRAUMA CRANICO

- CLASSIFICAZIONE (secondo modalità)
  - Chiuso
  - Penentrante
  - Da esplosione

  - Senza frattura strutture ossee
  - Con frattura strutture ossee
    - Volta cranica
    - Base cranica (attenzione! Occhi di procione; segno di Battle; rinoliquorrea; nervi cranici)

TRAUMA CRANICO

- CLASSIFICAZIONE (secondo gravità)
  - Lieve → GCS 13 – 15 (80% dei casi)
  - Moderato → GCS 9 – 12 (10% dei casi)
  - Severo → GCS <8 (10% dei casi)

Table 2. Diagnostic criteria[a] for determination of traumatic brain injury severity among military service members

	Severity		
Diagnostic Criteria	**Mild**	**Moderate**	**Severe**
Neuroimaging	Normal	Normal or abnormal	Normal or abnormal
Loss of consciousness	<30 min	30 min to 24 h	≥24 h
Alteration of consciousness	<24 h	≥24 h[b]	≥24 h[b]
Posttraumatic amnesia	<24 h	24 h to 7 d	≥7 d
Glasgow Coma Scale[c] score	13-15	9-12	3-8

[a]Source: US Department of Veterans Affairs and US Department of Defense.[1]
[b]If alteration of consciousness persists for >24 hours, severity is determined by neuroimaging, loss of consciousness, posttraumatic amnesia, and Glasgow Coma Scale score.
[c]The highest Glasgow Coma Scale score captured within the first 24 hours after injury is used, and scores range from 3 (coma or death) to 15 (healthy).

Public Health Reports, 2017

TRAUMA CRANICO

- CLASSIFICAZIONE DANNO CEREBRALE
  - Primario: danno che si genera nell'impatto
  - Secondario: danno che subentra successivamente all'impatto (edema, ernia, ischemia, trombosi venosa, infezione, idrocefalo, perdita di liquor) (è quello su cui si può agire!!!)

FATTORI PROGNOSTICI

Table 3. Evidence-based negatively and positively correlated prognostic criteria after traumatic brain injury

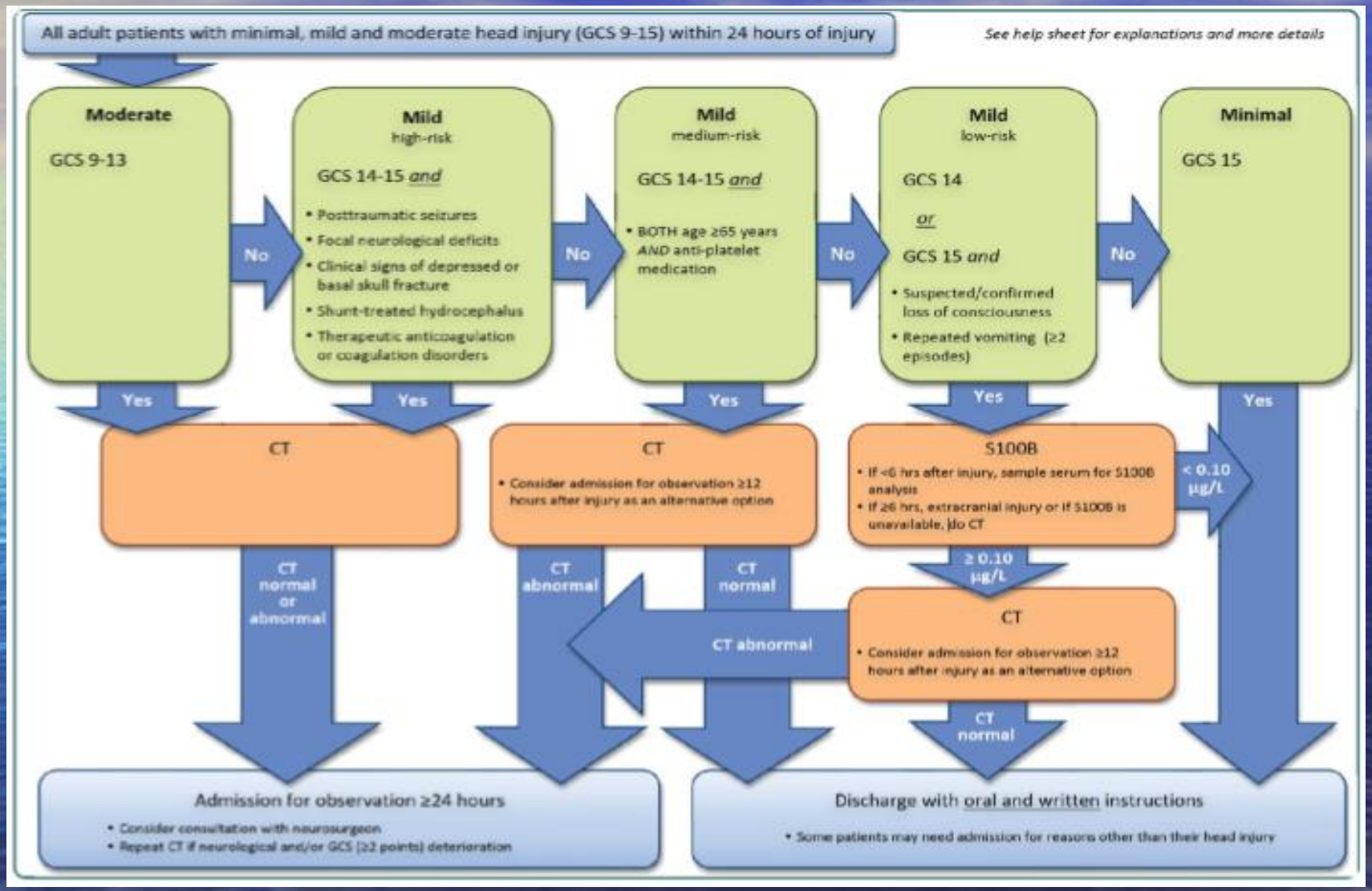
Prognostic Category	Negatively Correlated Criteria	Positively Correlated Criteria
Age[33-37]	≥65 y	<65 y
Sex[33,36,37]	Male	Female
Education level[33,34]	Lower	Higher
Abbreviated Injury Scale or Trauma and Injury Severity Scale[33-35,37]	Higher scores	Lower scores
Brain midline shift on first postinjury head computerized tomography scan[34]	≥15 mm	<15 mm

Public Health Reports, 2017

TRAUMA CRANICO: danni strutturali

- Rinoliquorrea → rischio infezioni e pneumencefalo
- Fistola carotido-cavernosa → esoftalmo pulsante + nervi oculomotori
- Contusione corticale (emorragica nelle prime 6-9 ore; colpo e contraccolpo; picco edema 48-96 ore)
- Ematoma epidurale (rottura dell'arteria meningea media)
- Ematoma subdurale (rottura delle vene a ponte)
- Danno assonale diffuso (petecchie e microemorragie)

TRAUMA CRANICO: diagnostica



Trauma cranico e terapia anticoagulante

- Tutti i pazienti con trauma cranico lieve che assumono anticoagulanti devono essere sottoposti a TAC cranio ed osservazione di 24 ore
- Solo VKA sono correlati ad aumentata mortalità da trauma cranico
- Sanguinamento tardivo in 0,2-6% dei pazienti con VKA o clopidogrel
- Se trauma cranico e INR > 2 odds ratio di emorragia intracranica 2,59

Trauma cranico e terapia anticoagulante

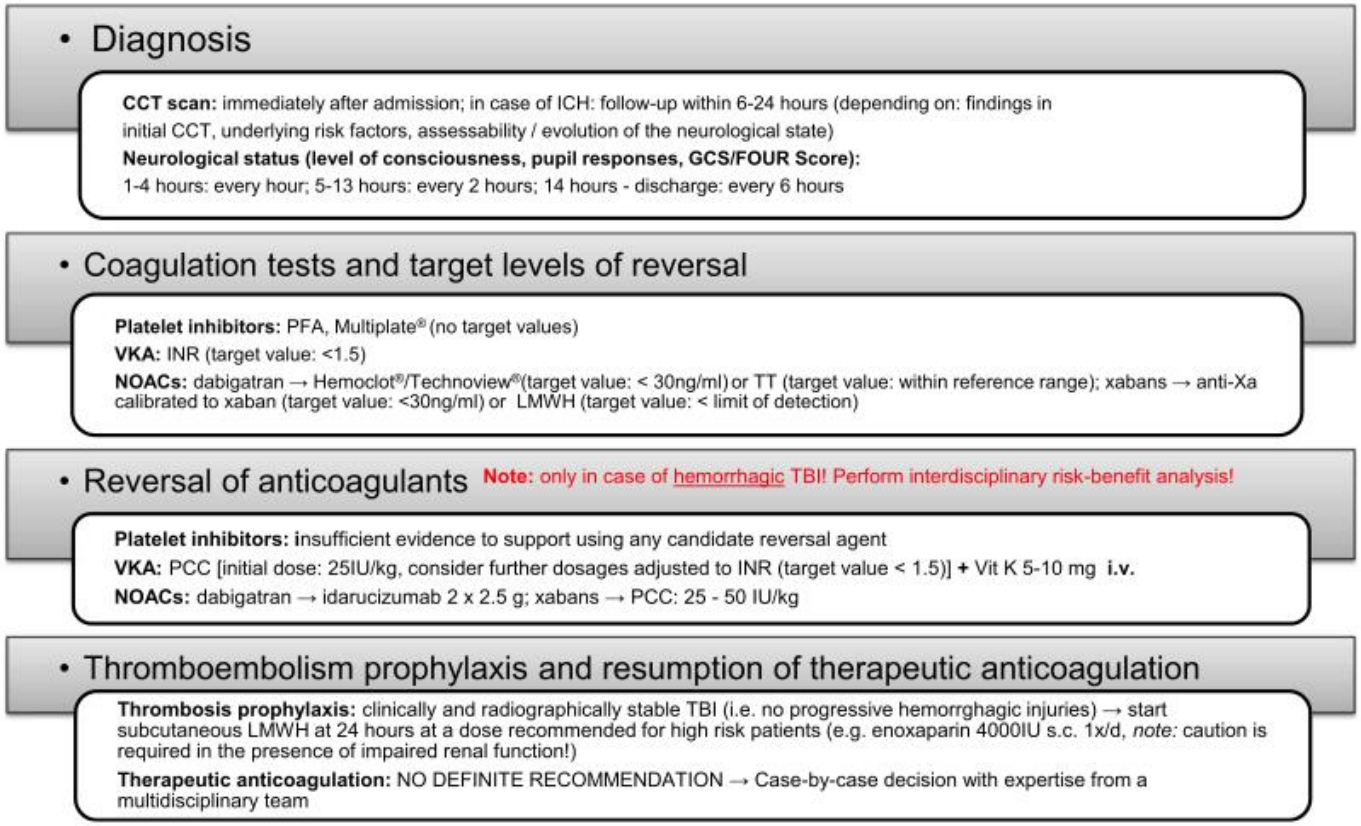


Fig. 1 Best practice recommendations for the diagnosis and treatment of adult patients experiencing traumatic brain injury during treatment with oral anticoagulants

TRAUMA CRANICO: scala FOUR

FOUR - Full Outline of UnResponsiveness[1]

Points	Eye response	Motor response	Brainstem reflexes	Respiration
4	Eyelids open or opened, tracking, or blinking to command	Thumbs-up, fist, or peace sign	Pupil and corneal reflexes present	Not intubated, regular breathing pattern
3	Eyelids open but not tracking	Localizing to pain	One pupil wide and fixed	Not intubated, Cheyne–Stokes breathing pattern
2	Eyelids closed but open to loud voice	Flexion response to pain	Pupil or corneal reflexes absent	Not intubated, irregular breathing
1	Eyelids closed but open to pain	Extension response to pain	Pupil and corneal reflexes absent	Breathes above ventilator rate
0	Eyelids remain closed with pain	No response to pain or generalized myoclonus status	Absent pupil, corneal, and cough reflex	Breathes at ventilator rate or apnea

TRAUMA CRANICO: rischio tromboembolico

Table 1 Indications for oral anticoagulation in patients at risk of venous thromboembolism (modified from Watzke et al. 2013) [134]

Low thromboembolic risk	High thromboembolic risk
Platelet inhibitors	Platelet inhibitors
• CHD or other cardiovascular diseases (cerebrovascular disease, PAD) without complications	• CHD or other cardiovascular diseases with complications or additional risk factors (ischemic cardiomyopathy, St.p. cardiac decompensation, diabetes mellitus, cerebrovascular disease, PAD, renal impairment)
• Diabetes mellitus with increased cardiovascular risk	• St.p. surgical or interventional procedures in patients with CHD, PAD, or cerebrovascular disease within the last year (e.g., coronary stent)
	• Acute coronary syndrome or myocardial infarction during the last year
VKAs and NOACs	VKAs and NOACs
• Non-valvular atrial fibrillation and CHADS2 score or CHADS2-VA2SC score ≤ 3 without stroke	• Non-valvular atrial fibrillation and CHADS2 score or CHADS2-VA2SC score > 3 or St.p. stroke
• Previous venous thromboembolism (> 3 months ago)	• Atrial fibrillation
• Mechanical aortic valve prosthesis without other risk factors (atrial fibrillation, cardiomyopathy, CHD, PAD, diabetes mellitus, age > 75 years, stroke)	• Mechanical mitral valve prosthesis or other mechanical valve prostheses with additional risk factors, particularly atrial fibrillation or St.p. stroke
	• Venous thromboembolism during the last 3 months

CHD coronary heart disease, *NOACs* non-vitamin K antagonist oral anticoagulants, *PAD* peripheral arterial disease, *VKAs* vitamin K antagonists

TRAUMA CRANICO: quando riprendere anticoagulante

- Dopo 10 – 14 giorni
  - in pazienti stabili
  - Ad alto rischio di embolia cerebrale
- Dopo 4 – 8 settimane
  - In pazienti con rischio di embolia cerebrale medio-basso (CHADS2VASc < 4)

Guidelines for the Management of Severe Traumatic Brain Injury, Fourth Edition

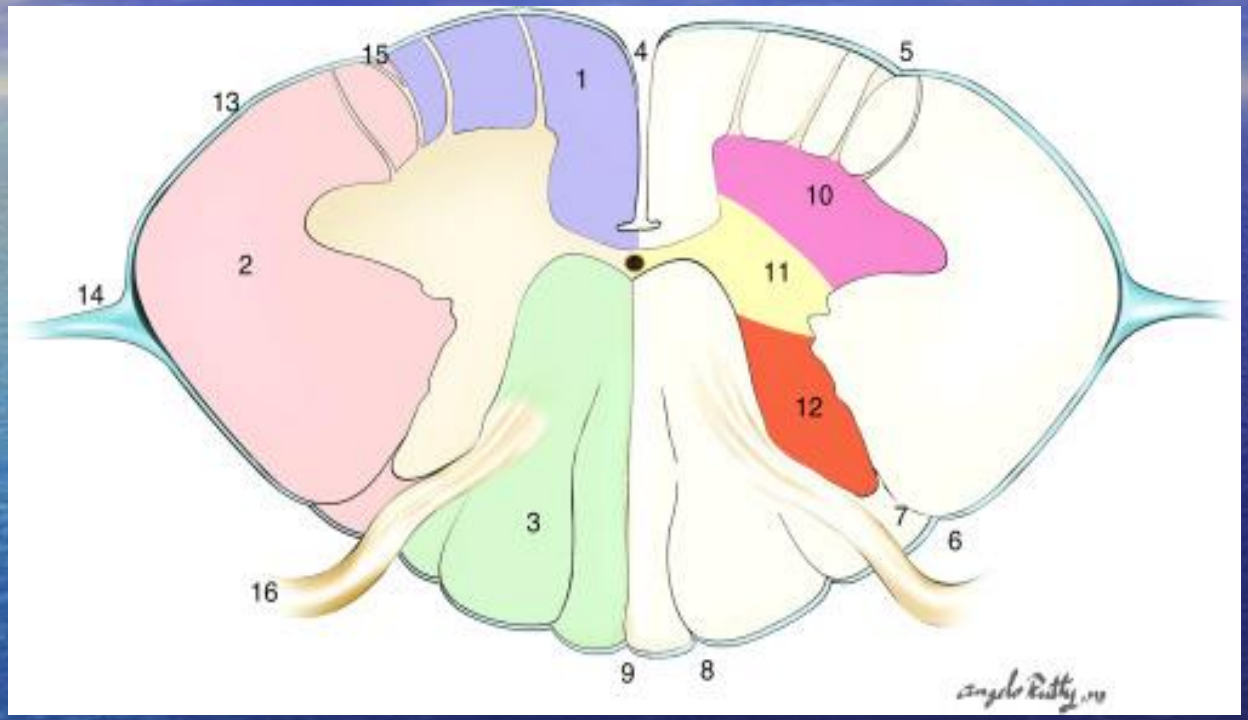
Neurosurgery 80:6–15, 2017 DOI:10.1227/NEU.0000000000001432 www.neurosurgery-online.com

Steroids	Level I
	• The use of steroids is not recommended for improving outcome or reducing ICP. In patients with severe TBI, high-dose methylprednisolone was associated with increased mortality and is contraindicated.
Hyperosmolar therapy	Recommendations from the prior (Third) Edition not supported by evidence meeting current standards.
	Mannitol is effective for control of raised ICP at doses of 0.25 to 1 g/kg body weight. Arterial hypotension (systolic blood pressure <90 mm Hg) should be avoided.
Deep vein thrombosis Prophylaxis	Level III
	• LMWH or low-dose unfractioned heparin may be used in combination with mechanical prophylaxis. However, there is an increased risk for expansion of intracranial hemorrhage.
	• In addition to compression stockings, pharmacologic prophylaxis may be considered if the brain injury is stable and the benefit is considered to outweigh the risk of increased intracranial hemorrhage.
	• There is insufficient evidence to support recommendations regarding the preferred agent, dose, or timing of pharmacologic prophylaxis for deep vein thrombosis.
Seizure prophylaxis	Level IIA
	• Prophylactic use of phenytoin or valproate is not recommended for preventing late PTS.
	• Phenytoin is recommended to decrease the incidence of early PTS (within 7 d of injury), when the overall benefit is thought to outweigh the complications associated with such treatment. However, early PTS have not been associated with worse outcomes.
	• **At the present time there is insufficient evidence to recommend levetiracetam compared with phenytoin regarding efficacy in preventing early post-traumatic seizures and toxicity.**
Decompressive craniectomy	Level IIA
	• **Bifrontal DC is not recommended to improve outcomes as measured by the GOS-E score at 6 mo post-injury in severe TBI patients with diffuse injury (without mass lesions), and with ICP elevation to values >20 mm Hg for more than 15 min within a 1-h period that are refractory to first-tier therapies. However, this procedure has been demonstrated to reduce ICP and to minimize days in the ICU.**
	• **A large frontotemporoparietal DC (not less than 12 x 15 cm or 15 cm diameter) is recommended over a small frontotemporoparietal DC for reduced mortality and improved neurologic outcomes in patients with severe TBI.**
	*The committee is aware that the results of the RESCUEicp trial[2] were released soon after the completion of these Guidelines. The results of this trial may affect these recommendations and may need to be considered by treating physicians and other users of these Guidelines. We intend to update these recommendations if needed. Updates will be available at https://braintrauma.org/coma/guidelines.

TRAUMA MIDOLLARE

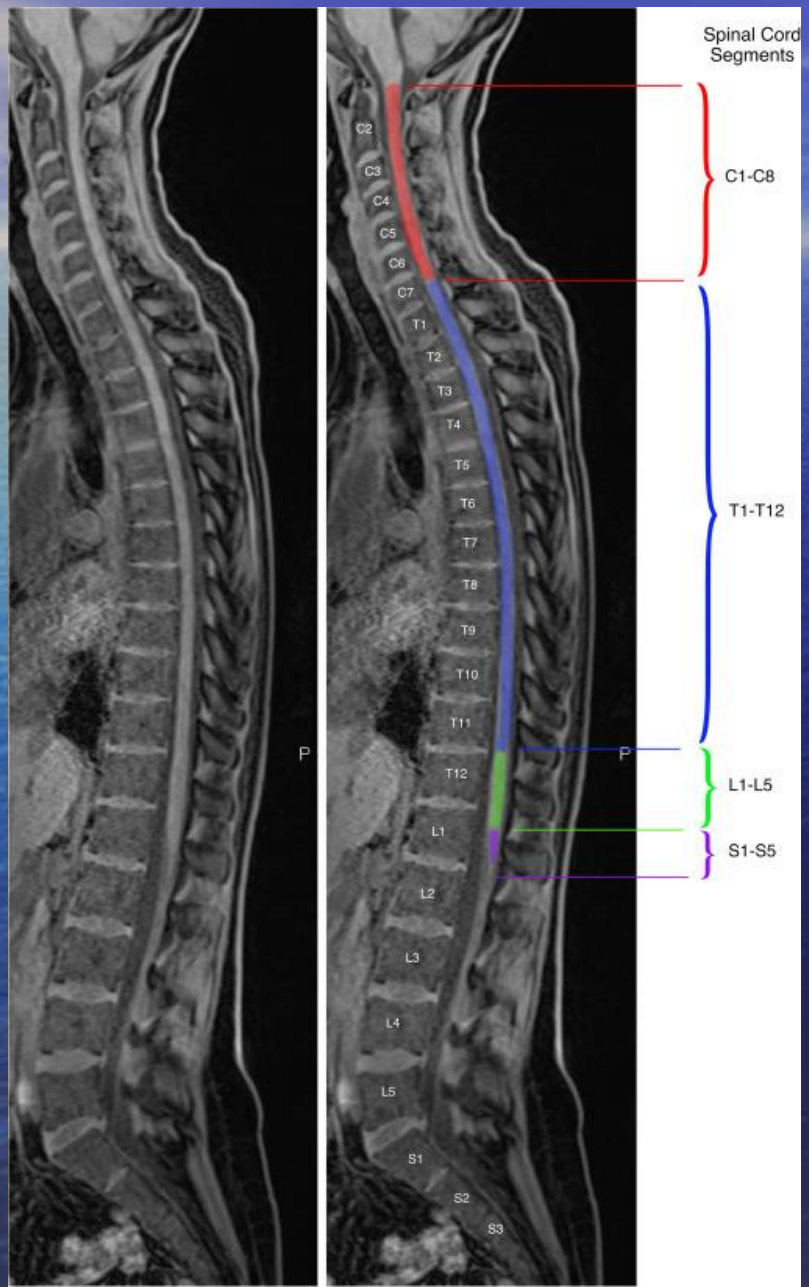
- Circa 16% dei pazienti con trauma cranico subiscono anche un trauma vertebrale
- Incidenza negli USA: 17.000/anno
- Circa 70% dei casi in corso di politrauma
- In circa 20% dei casi lesione a più livelli
- Segmento cervicale più vulnerabile

TRAUMA MIDOLLARE: richiami di anatomia



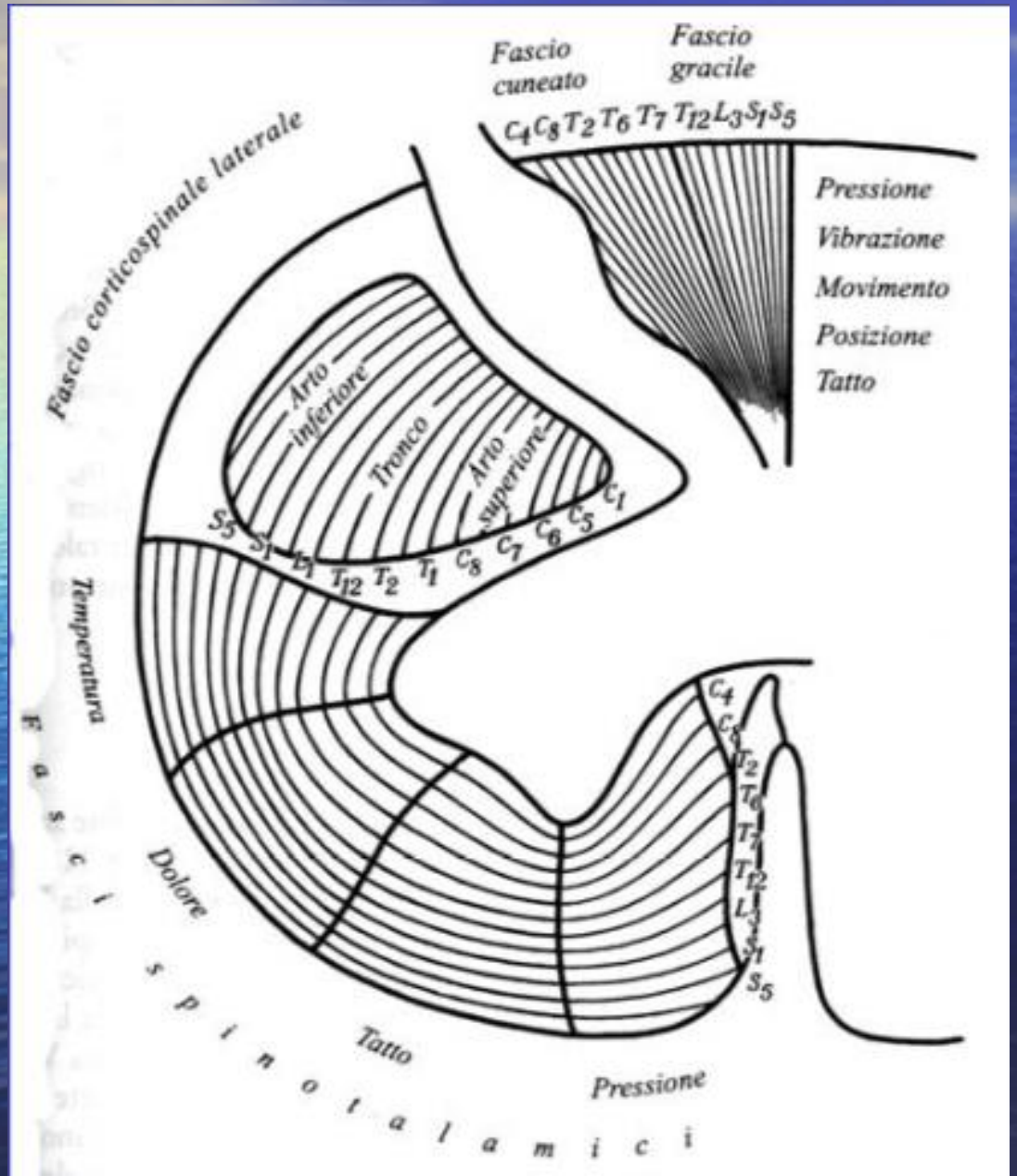
1. FASCICOLO ANTERIORE
2. FASCICOLO LATERALE
3. FASCICOLO POSTERIORE
10. CORNO ANTERIORE
11. ZONA GRIGIA INTERMEDIA
12. CORNO POSTERIORE

Richiami di anatomia



MANCATA CORRISPONDENZA TRA MIELOMERI E VERTEBRE

Richiami di anatomia



DISTRIBUZIONE SOMATOTOPICA
FIBRE ASCENDENTI
FIBRE DISCENDENTI

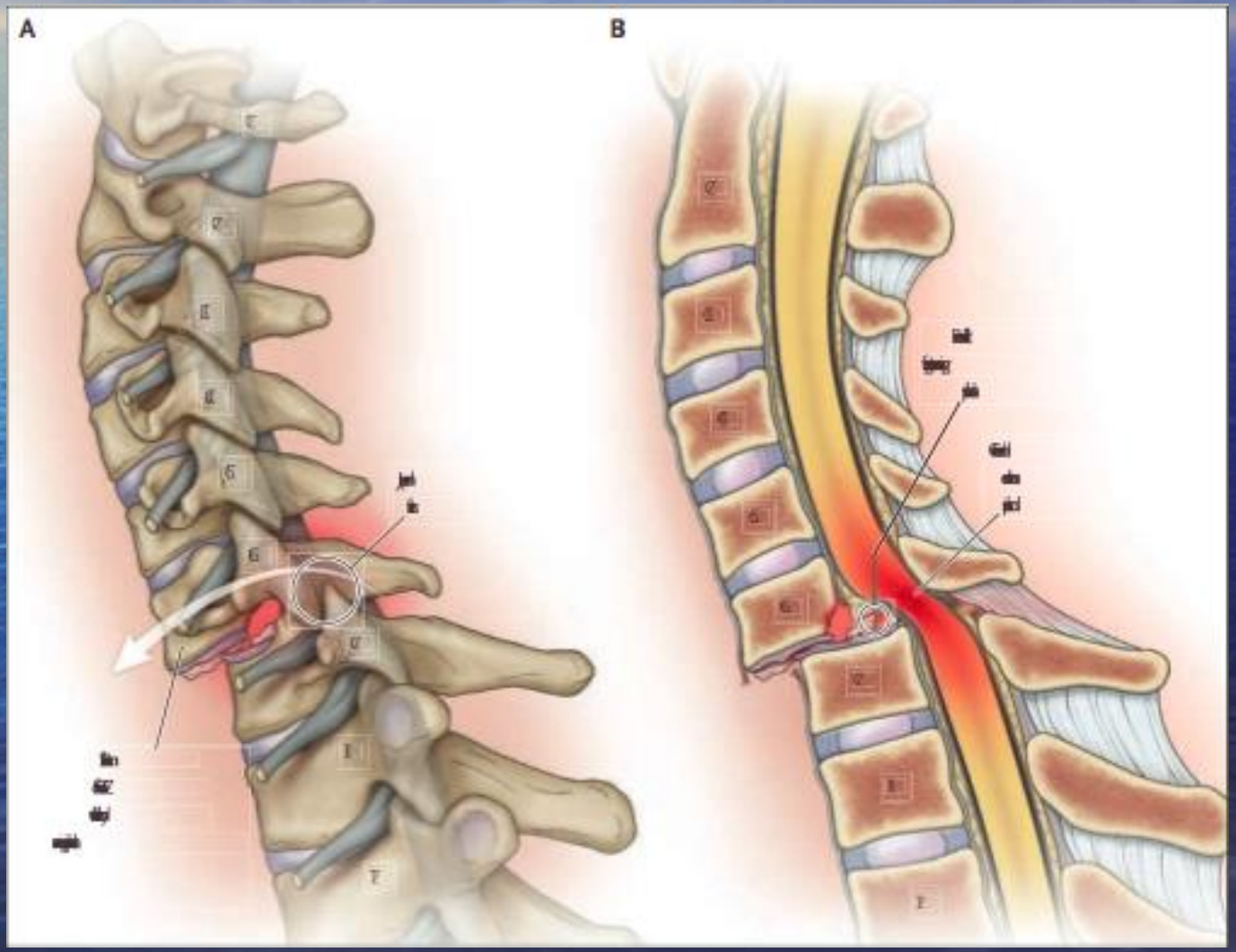
DISTRIBUZIONE FUNZIONALE
FIBRE ASCENDENTI

Fibre spino-talamiche incrociano nel midollo
Fibre cordoni posteriori incrociano nei lemnischi

Table 3. Main Clinical and Imaging Characteristics of Acute Spinal Cord Compression and Treatment Options.*

Variable	Traumatic Cord Compression
Characteristics	
Temporal evolution	Sudden (at time of injury)
Predisposing factors	High-velocity trauma, narrowed spinal canal (congenital or degenerative)
Typical symptoms and signs	Paraplegia or tetraplegia, sensory level, central cord syndrome, focal spinal pain
Laboratory abnormalities	Resulting from trauma to other organs
CT findings	Fracture of elements of spinal column, subluxation of vertebral bodies
MRI findings	High STIR signal in ligaments, cord edema and hemorrhage, subluxation
Treatment options	
Medical treatment	Maintenance of mean arterial blood pressure at 85 to 90 mm Hg, bladder catheterization
Surgical treatment	Decompression of spinal cord, restoration of alignment, internal fixation and fusion

TRAUMA MIDOLLARE: meccanismi



TRAUMA MIDOLLARE: sindromi cliniche

Table 1. Clinical Syndromes of Acute Spinal Cord Compression.

Complete transverse myelopathy (lesion affecting both sides and anterior and posterior spinal cord at one or more segments)
Bilateral paralysis below lowest affected segment of spinal cord
Loss or reduction of all sensation below affected level of spinal cord (sensory level)
Sphincter dysfunction with urinary or bowel urgency, retention, or incontinence
Segmental loss of reflexes at affected level
Hyperreflexia and Babinski signs
Spinal shock (acute destruction of spinal cord at one or more cervical or upper thoracic segments)
Paralysis of limbs below the affected segment of the spinal cord
Hypotonia and areflexia of limbs below the level of the lesion
No Babinski signs
Loss of sphincter function
Reduced autonomic function below affected level
Systemic hypotension
Central cord syndrome (predominant gray-matter damage, typically involving cervical spine, from trauma)
Weakness and reflex loss in arms; less severe weakness or no weakness in legs
Reduced pain and thermal sense in arms, typically with hyperesthesia, sparing sensation of vibration and proprioception in arms and legs
Variable hyperreflexia in legs

TRAUMA MIDOLLARE: sindromi cliniche

- Hemicord (Brown–Séquard) syndrome
  - Paralysis, hyperreflexia, and reduced sensation of vibration on one side of body
  - Babinski sign on paralyzed side
  - Loss of pain and thermal sense on opposite side
- Conus medullaris syndrome (cord compression at the level of L1–L2 vertebral bodies)
  - Weakness of feet and legs
  - Variable reflexes in legs
  - Early loss of sphincter function
  - Loss of sensation at sacral and lower lumbar (perineal) dermatomes; sensory level at or below waist
  - Variable Babinski signs
- Cauda equina syndrome (compression between L2 and S1 vertebral bodies)
  - Sciatic or other radicular pain
  - Areflexic weakness of feet and legs, depending on level of compression
  - Sphincter dysfunction
  - Reduced sensation from saddle region and legs up to groin

TRAUMA MIDOLLARE: livelli lesionali

Sede della lesione*	Possibili effetti†
A livello C5 o superiore	Paralisi respiratoria e tetraplegia
Tra C5 e C6	Paralisi degli arti inferiori, dei polsi e delle mani; indebolimento dell'abduzione della spalla e della flessione del gomito; perdita del riflesso brachioradiale
Tra C6 e C7	Paralisi degli arti inferiori, polsi e mani, ma i movimenti della spalla e la flessione del gomito sono di solito possibili; perdita del riflesso bicipitale
Tra C7 e C8	Paralisi delle gambe e delle mani
Tra C8 e D1	Con lesioni midollari trasversali, sindrome di Horner (ptosi, pupille miotiche, anidrosi facciale), paralisi degli arti inferiori
Tra T11 e T12	Paralisi dei muscoli degli arti inferiori sopra e sotto il ginocchio
A livello T12-L1	Paralisi al di sotto del ginocchio
Cauda equina	Paresi ipo o areflessica degli arti inferiori, di solito dolore e ipersensibilità nel territorio di distribuzione delle radici nervose interessate e perdita del controllo sfinterico intestinale e vescicale
A livello S3-S5 o del cono midollare a L1	Perdita completa del controllo della vescica e dell'intestino

SCALA GRAVITA' (ASIA)

Table 2. ASIA Impairment Scale for Traumatic Spinal Cord Injury.*

Grade	Impairment
A	Complete: no sensory or motor function is preserved in segments S4–S5.
B	Sensory incomplete: sensory but not motor function is preserved below the neurologic level of injury and includes the S4–S5 segments; no motor function is preserved more than three levels below the motor level on either side of the body.
C	Motor incomplete: motor function is preserved at the most caudal sacral segments for voluntary anal contraction, or sensory function is preserved at the most caudal sacral segments (S4–S5), with some sparing of motor function more than three levels below the motor level on either side of the body.
D	Motor incomplete: motor function is incomplete as defined above, with muscle power ≥3 for at least half the key muscle functions below the neurologic level of injury.†
E	Normal: sensory and motor function are normal.

STANDARD NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY

MOTOR

	R	L	KEY MUSCLES
C2			
C3			
C4			
C5			Elbow flexors
C6			Wrist extensors
C7			Elbow extensors
C8			Finger flexors (distal phalanx of middle finger)
T1			Finger abductors (little finger)
T2			
T3			
T4			
T5			
T6			
T7			
T8			
T9			
T10			
T11			
T12			
L1			
L2			Hip flexors
L3			Knee extensors
L4			Ankle dorsiflexors
L5			Long toe extensors
S1			Ankle plantar flexors
S2			
S3			
S4-5			Voluntary anal contraction (Yes/No)

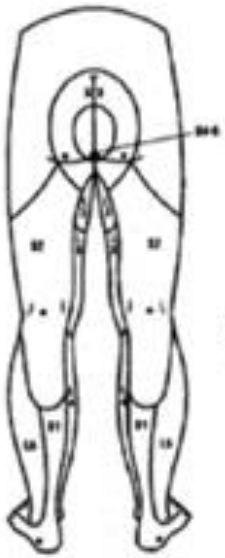
0 = total paralysis
1 = palpable or visible contraction
2 = active movement, gravity eliminated
3 = active movement, against gravity
4 = active movement, against some resistance
5 = active movement, against full resistance
NT = not testable

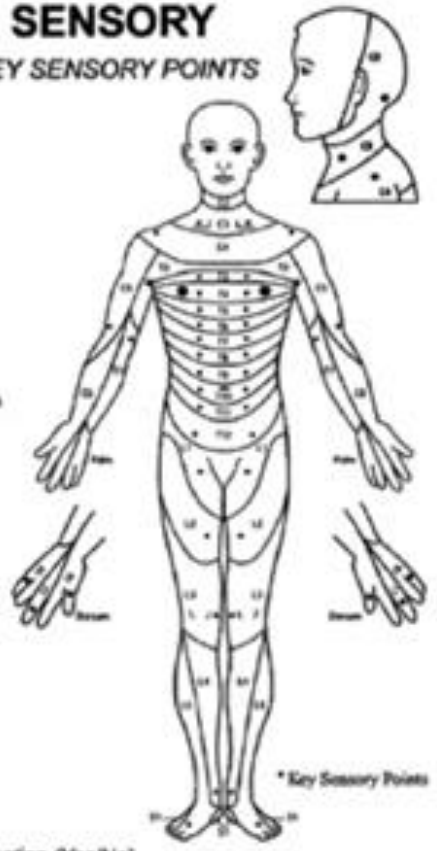
TOTALS (MAXIMUM) (50) + (50) = (100) **MOTOR SCORE**

SENSORY

	LIGHT TOUCH R	LIGHT TOUCH L	PIN PRICK R	PIN PRICK L
C2				
C3				
C4				
C5				
C6				
C7				
C8				
T1				
T2				
T3				
T4				
T5				
T6				
T7				
T8				
T9				
T10				
T11				
T12				
L1				
L2				
L3				
L4				
L5				
S1				
S2				
S3				
S4-5				

0 = absent
1 = impaired
2 = normal
NT = not testable





* Key Sensory Points

Any anal sensation (Yes/No)

TOTALS (MAXIMUM) (56) (56) (56) (56) = **PIN PRICK SCORE*** (max: 112)

= **LIGHT TOUCH SCORE** (max: 112)

NEUROLOGICAL LEVEL
The most caudal segment with normal function

SENSORY R L
MOTOR R L

COMPLETE OR INCOMPLETE?
Incomplete = Any sensory or motor function in S4-S5

ASIA IMPAIRMENT SCALE

ZONE OF PARTIAL PRESERVATION
Caudal extent of partially innervated segments

SENSORY R L
MOTOR R L

TRATTAMENTO

- Immobilizzazione della colonna
- Necessario ridurre la compressione midollare il prima possibile
- Corticosteroidi ad alte dosi in traumatismi non più consigliati nelle linee guida
- Evitare ipotensione arteriosa (attenzione shock neurogeno con ipotensione, bradicardia ed arti inferiori caldi)
- Sondino naso-gastrico (ileo paralitico)
- Prevenzione delle trombosi venose profonde ed embolia polmonare (LMWH+ compressione pneumatica)

Leonessa morente 650 A.C. Ninive