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Il Trauma Cranico Lieve

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Trauma Cranico: sono problemi diversi con diversi percorsi di diagnosi e gestione

Trauma Lieve: (94%) una TC positiva 3-7%, necessitano di Intervento NCH. 0.5%, la mortalità <0.2% .

Trauma Moderato: (3-4%) una TC positiva 60% , Intervento NCH 15-20%, la mortalità 3-4% .

Trauma Severo: (1-2% dei casi) TC positiva >75% , intervento NCH in urgenza30%, la mortalità >20%

Trauma Pediatrico: un altro mondo, 0.5-2.0% delle prestazioni di PS, TC eseguite 10-20 % dei casi, TC positive 0.3%, interventi NCH <0.1%

Il Trauma Lieve

- Nell' adulto .. qualunque evento traumatico che interessa il distretto cranio-encefalico, con riscontro di traumatismo, in soggetti di età >14 anni con Glasgow Coma Scale 15-14.
- "13 is an unlucky number" (Stein, J.Trauma 2001)
- Le definizioni: Minore, Lieve, Minimo, Grado I, Classe I, Basso Rischio oggi raggruppate nel termine Lieve.
- Strategy shifted from "admit & observe to diagnose & decide".

Alcuni quesiti …

1. Chi deve fare la TC cranio-encefalo ?
2. Come interpretare la TC ?
3. Quale, come, dove, e quanto fare l'osservazione ?
4. La terapia con anticoagulanti ?
5. E gli antiaggreganti ?

1. Chi deve fare la TC cranio-encefalica ?

Nonostante >50% dei medici d' Urgenza sostengano la necessità di linee guida con SE 100% … le linee guida sono costruite con variabili cliniche..

Esclusa l' ipotesi di una TC "universale".. va tollerata una quota (anche 1:1000) di mancate diagnosi, al costo di moltissimi esami TC neg.

Emergency Department Computed Tomography Use Under Fire

Emergency Physicians Defend Imaging Practices

Accettable Risk but.. It may not be easy to write guidelines that reduce CT use, in part because it has become such a useful tool to reduce diagnostic uncertainty. Without it, physicians must live in the less comfortable space where uncertainty remains at a few percentage points, which is easier for policymakers to accept than for physicians and patients in the examination room, said Dr. Schneider. "The radiology and policy people are sitting on the other side of the equation and saying, 'There's only a 2% risk; what are you worried about?' And we're sitting with the patient
and saying, 'There's a 2% risk; are you willing to take it?'" Guidelines would be most useful, said Dr. Schuur, if they provided physicians with clear guidance on when a CT image is not necessary, thus providing cover from criticism and medicolegal risk for a missed diagnosis.

Ann Emerg Med 2012; 59 (5) May.

S-100B

- Most studied biomarker (and best)
- Rapid increase then decrease after head injury
  - 30 minutes after injury with T½ = 97 minutes
- Sensitive but not specific:
  - Biberthaler, *Shock* 2006; 25:446
  - Muller, *J Trauma* 2007; 62:1452
  - Geyer, *J Neurosurg Pediatr* 2009; 4:339 - ? In peds
- Recommendation: **Serum S-100B <0.1µg/L within 4 hours and no significant head trauma – no cranial CT**

Le variabili da considerate e le Linee Guida …

- Glasgow Coma Scale <15
- Frattura cranica (volta o base)
- Neuro-deficit e/o Convulsioni
- Sintomi: Amnesia, Perdita di conoscenza, Cefalea, Vomito ripetuto.
- Fattori di Rischio: Anticoagulanti, Alcol/Farmaci e/o Droghe d'abuso, Pregressi interventi NCH, Storia di Epilessia, Età avanzata (????), antiaggreganti, FANS (?), LMWH (?)
- Dinamica a rischio, segni di trauma sopra le clavicole .

Reliability of Clinical Guidelines in the Detection of Patients at Risk Following Mild Head Injury: Results of a Prospective Study

Auth, year	Sensitivity	Specificity	PPV	NPV	Accuracy	Pts. Lost
Stein, 1996	89.2	47.2	12.1	98.2	50.4	9 (3)
Tomei, 1996	92.8	35.9	10.5	98.4	40.1	6 (0)
Arienta, 1997	88.0	54.2	13.5	98.2	56.8	10 (2)
Lapierre, 1998	92.8	24.5	9.1	97.6	29.6	6 (0)
Murshid, 1998	60.2	81.1	20.7	96.2	79.6	33 (3)
Haydel, 2000	95.2	18.7	8.7	97.9	24.4	4 (0)
Ingebrigtsen, 2000	84.3	59.8	14.6	97.9	61.7	13 (2)
SIGN, 2000	65.1	74.5	17.2	96.3	73.8	29 (4)
Servadei, 2001	97.6	13.9	8.5	98.6	20.2	2 (0)
Stiell, 2001	85.5	50.4	12.3	97.7	53.0	12 (0)
Vos, 2002	96.4	27.7	9.8	98.9	32.9	3 (0)

*Ibanez J, **J Neurosurg** 2004*

A Critical Comparison of Clinical Decision Instruments for Computed Tomographic Scanning in Mild Closed Traumatic Brain Injury in Adolescents and Adults

Table 1. Findings used by 7 clinical decision rules for CT scanning in mild traumatic brain injury.

Clinical Finding	Canadian	NCWFNS	New Orleans	NEXUS-II	NICE	Scandinavian
GCS score	<15 At 2 h	<15	<15	Abnormal alertness, behavior	<15 At 2 h	<15
Amnesia	Retrograde >30 min*	Any	Antegrade	—	Retrograde >30 min	Any
Suspected fracture	Open, depressed, basal	Any	Any injury above clavicles	Any	Open, depressed, basal	Basal, depres confirmed
Vomiting	Recurrent	Any	Any	Recurrent	Recurrent	—
Age, y	≥65	—	>60	≥65	≥65[†]	—
Coagulopathy	—	Any	—	Any	Any[†]	Any
Focal deficit	—	Any	—	Any	Any	Any
Seizure	—	History	Any	—	Any	Any
LOC	If GCS=14	Any	—	—	—	Any
Visible trauma	—	—	Above clavicles	Scalp hematoma	—	Multiple injuri
Headache	—	Any	Severe	—	—	—
Injury mechanism	Dangerous*[‡]	—	—	—	Dangerous[†‡]	—
Intoxication	—	Abuse history	Drug, alcohol	—	—	—
Previous neurosurgery	—	Yes	—	—	—	Shunt

NCWFNS, Neurotraumatology Committee of the World Federation of Neurosurgical Societies; *NICE*, National Institute of Clinical Excellence; —, indicates the item not considered an indication for CT scanning by author(s) of the rule; *LOC*, loss of consciousness.

*Used to determine medium risk for the Canadian Rule.

†CT scan only if also loss of consciousness or any amnesia.

‡Dangerous injury mechanism=ejected from motor vehicle, pedestrian struck by motor vehicle, fall of >3 feet or 5 steps.

Stein S, ***Ann Emerg Med*** *2009*

Clinical Decision Rules for Adults With Minor Head Injury: A Systematic Review

Results: Twenty-two relevant studies were identified. Differences existed in patient selection, outcome definition, and reference standards used. Nine rules stratified patients into high- and moderate-risk categories (to identify neurosurgical or nonsurgical intracranial lesions). The Canadian Computed Tomography Head Rule (CCHR) high-risk criteria have sensitivity of 99% to 100% with specificity of 48% to 77% for injury requiring neurosurgical intervention. Other rules such as New Orleans criteria, National Emergency X-Radiography Utilization Study II, Neurotraumatology Committee of the World Federation of Neurosurgical Societies, Scandinavian, and Scottish Intercollegiate Guidelines Network produce similar sensitivities for injury requiring neurosurgical intervention but with lower and more variable specificity values.

Discussion: The most widely researched decision rule is the CCHR, which has consistently shown high sensitivity for identifying injury requiring neurosurgical intervention with an acceptable specificity to allow considered use of cranial computed tomography. No other decision rule has been as widely validated or demonstrated as acceptable results, but its exclusion criteria make it difficult to apply universally.

Harnan SE, ***J Trauma*** 2011

Prediction Value of the Canadian CT Head Rule and the New Orleans Criteria for Positive Head CT Scan and Acute Neurosurgical Procedures in Minor Head Trauma: A Multicenter External Validation Study

Editor's Capsule Summary

What is already known on this topic

Decisions rules have been derived and validated for patients with minor head injury.

What question this study addressed

Whether rules derived in North American are applicable in Tunisia and whether one performs better than the other.

What this study adds to our knowledge

For the prediction of neurosurgical intervention in 1,582 patients, the Canadian CT Head Rule had higher sensitivity (100% versus 82%) and specificity (60% versus 26%) than the New Orleans Criteria.

How this is relevant to clinical practice

This study suggests that not all clinical decision rules may have the same performance characteristics in all populations. It is worthwhile to evaluate new rules' performance before they are adopted in new populations.

Bouida Ann Emerg Med 2012; in press

Algoritmo per la Diagnosi e il Trattamento del Trauma Cranico Lieve dell'Adulto

Uno dei seguenti:
- GCS <14 in ogni momento
- GCS 14 a 2 ore dall'evento
- Ogni tipo di neuro-deficit
- Segni clinici di frattura della base cranica
- Convulsioni successive all'evento
- Vomito ripetuto (≥2 episodi)

Sì →
- TC <2 ore
- Osservazione prolungata (>6 ore)

No → Perdita Transitoria di Conoscenza e/o Amnesia Breve e/o Cefalea Diffusa

No → Coagulopatia

Sì →
- TC 2-6 ore
- Osservazione prolungata (>6 ore)

Sì → Uno dei seguenti:
- Dinamica a rischio
- Amnesia retrograda >30 min o dubbia / persistente
- Età ≥65 anni

Sì →
- TC 2-6 ore
- Osservazione prolungata (>6 ore)

No →
- Osservazione breve (3-6 ore)

No →
- Solo osservazione domiciliare

Blood Alcohol Concentration and Management of Road Trauma Patients in the Emergency Department

Table 6 Risk of Unsuspected Injuries, Diagnosed Only at Final Evaluation, in Trauma Patients after Road Crashes

	Odds Ratio	95% CI	*p* Value
Univariate analysis			
Gender (male subjects vs. female subjects)	1.28	0.97–1.69	0.087
Age[a]	1.08	1.00–1.17	0.054
Any comorbidity	3.95	2.91–5.36	<0.001
NISS[a]	2.72	2.41–3.06	<0.001
Crash-to-ED admission time[a]	0.64	0.51–0.79	<0.001
BAC positivity	4.96	3.75–6.58	<0.001
Multivariate analysis			
NISS[a]	2.62	2.30–2.98	<0.001
BAC positivity	4.98	3.62–6.87	<0.001
Any comorbidity	2.19	1.54–3.11	<0.001

CI, confidence interval.

[a] Odds ratio was calculated considering any increase by NISS classes, age by decades, and crash-to-ED admission time by hours.

Fabbri A. ***J Trauma*** 2002

The changing face of mild head injury: Temporal trends and patterns in adolescents and adults from 1997 to 2008

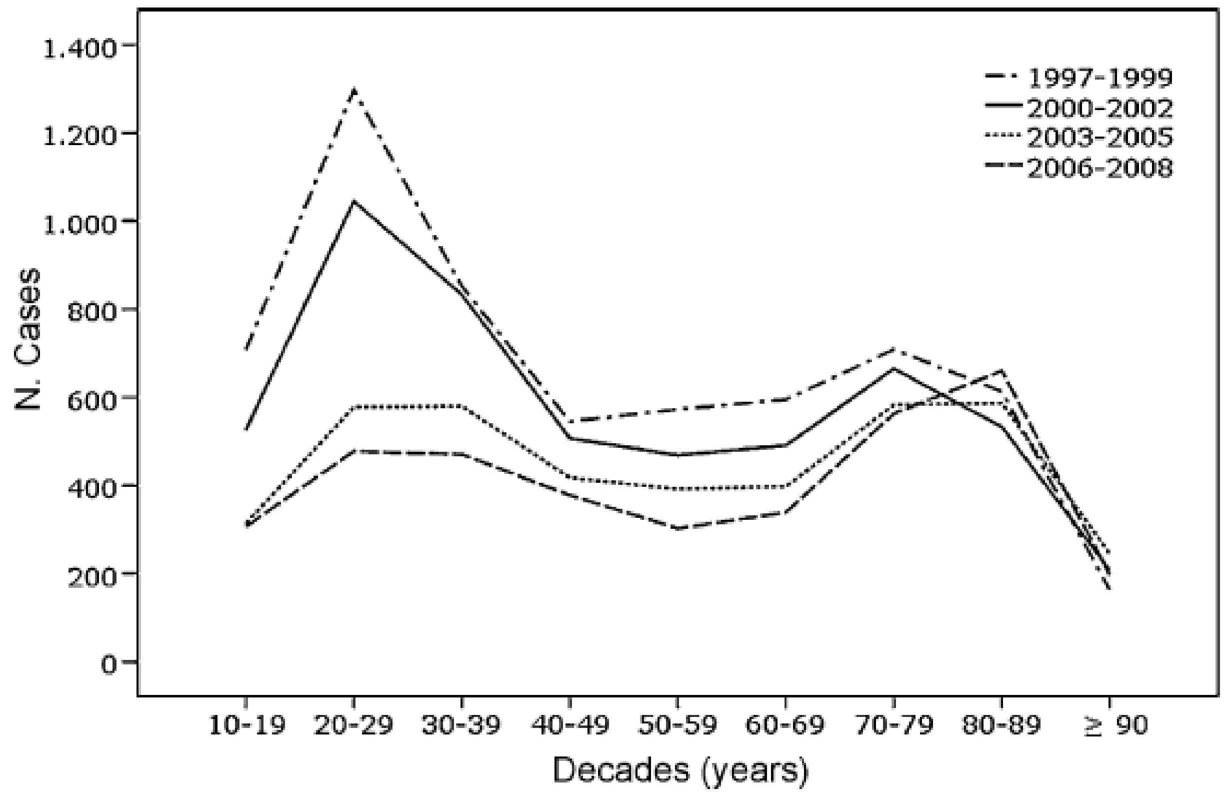


Fig. 1. Number of cases visited in the Emergency Department for mild head injury in four time periods, divided according to age-decades. Note the disappearance of the bimodal distribution of age along the years.

Fabbri A. ***Injury*** *2010*

I casi asintomatici con TC pos. devono ripeterla?

Routine Repeat Head CT for Minimal Head Injury is Unnecessary

Background: Patients with MHI and a positive head computed tomography (CT) scan frequently have a routine repeat head CT (RRHCT) to identify possible evolution of the head injury requiring intervention. RRHCT is ordered based on the premise that significant injury progression may take place in the absence of clinical deterioration.

Methods: In a Level I urban trauma center with a policy of RRHCT, we reviewed the records of 692 consecutive trauma patients with Glasgow Coma Scale scores of 13–15 and a head CT (October 2004 through October 2005). The need for medical or surgical neurologic intervention after RRHCT was recorded. Patients with a worse and unchanged RRHCT were compared, and independent predictors of a worse RRHCT were identified by stepwise logistic regression.

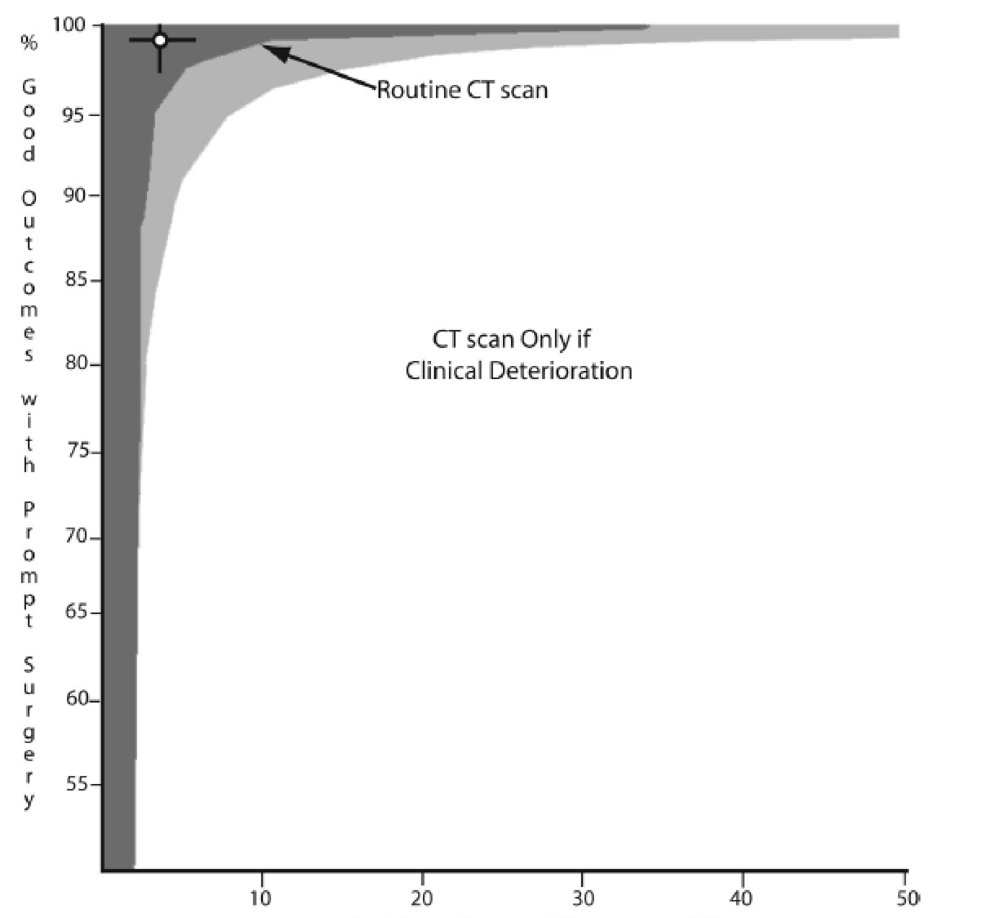
Results: There were 179 patients with MHI and RRHCT ordered. Of them, 37 (21%) showed signs of injury evolution on RRHCT and 7 (4%) required intervention. All 7 had clinical deterioration preceding RRHCT. In no patient without clinical deterioration did RRHCT prompt a change in management. A Glasgow Coma Scale score less than 15 (13 or 14), age higher than 65 years, multiple traumatic lesions found on first head CT, and interval shorter than 90 minutes from arrival to first head CT predicted independently a worse RRHCT.

Conclusions: RRHCT is unnecessary in patients with MHI. Clinical examination identifies accurately the few who will show significant evolution and require intervention.

Key Words: Head injury, Cat scan, Minimal, Glasgow Coma Scale, Repeat.

Velmahos GC: ***J Trauma*** 2006

Routine Serial Computed Tomographic Scans in Mild Traumatic Brain Injury: When are They Cost-Effective?

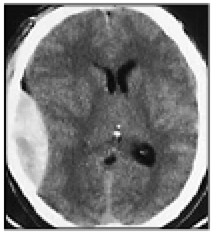


Stein S, ***J Trauma*** *2008*

2. Come interpretare il referto TC ?

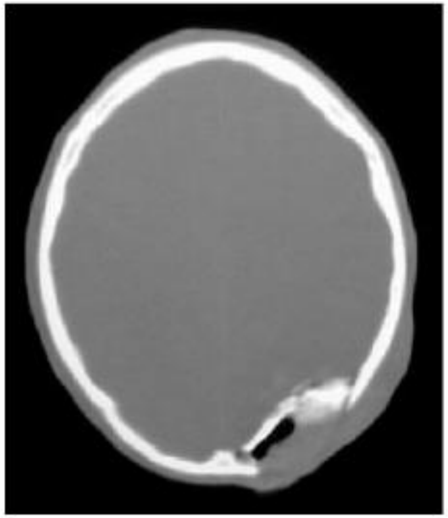
Head CT

- Most EM training programs have no formalized training process to meet this need.
- Many Emergency Physicians are uncomfortable interpreting CTs.
- Studies have shown that EPs have a significant "miss rate" on cranial CT interpretation.



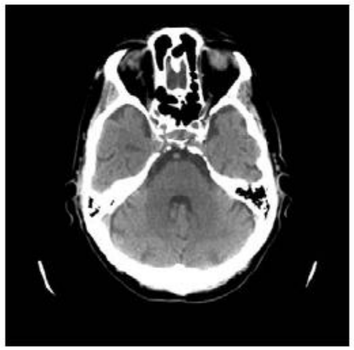
Blood **C**an **B**e **V**ery **B**ad

- Blood
- Cisterns
- Brain
- Ventricles
- **B**one



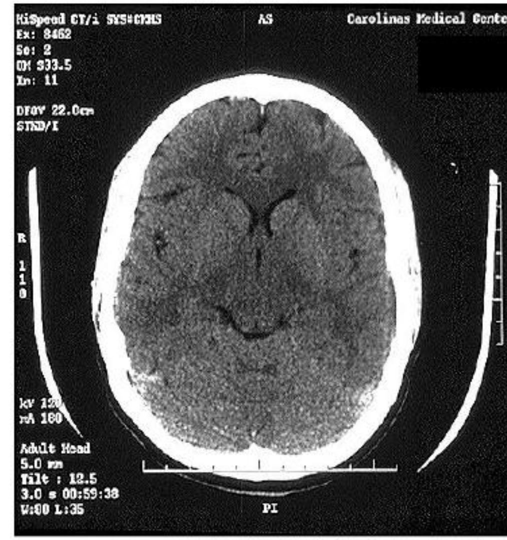
CT Scan Basics

- The denser the object, the whiter it is on CT
  - Bone is most dense = + 1000 Hounsfield U.
  - Air is the least dense = - 1000H Hounsfield U.
  - Water is in the middle = 0 Hounsfield U.

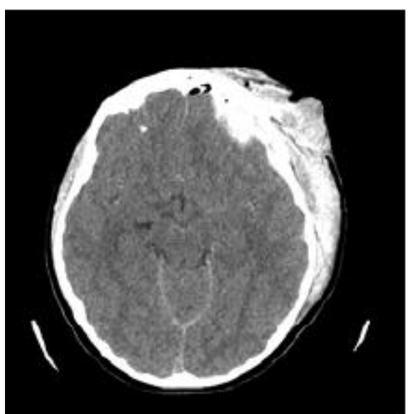


Symmetry &
Gray-White Differentiation

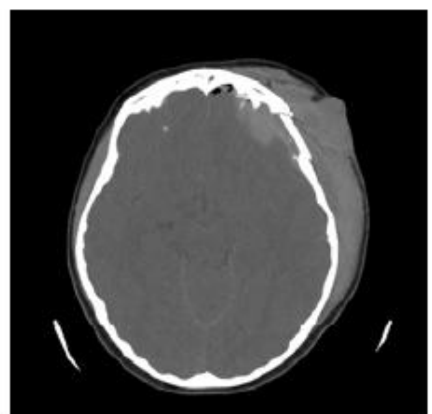
Normal Brain



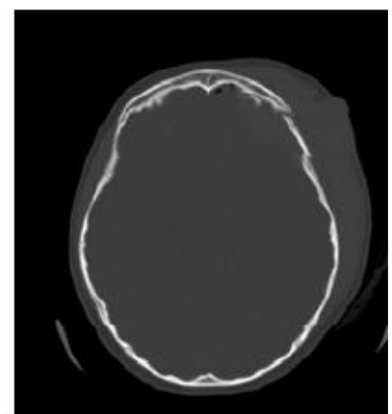
- Windowing



Brain



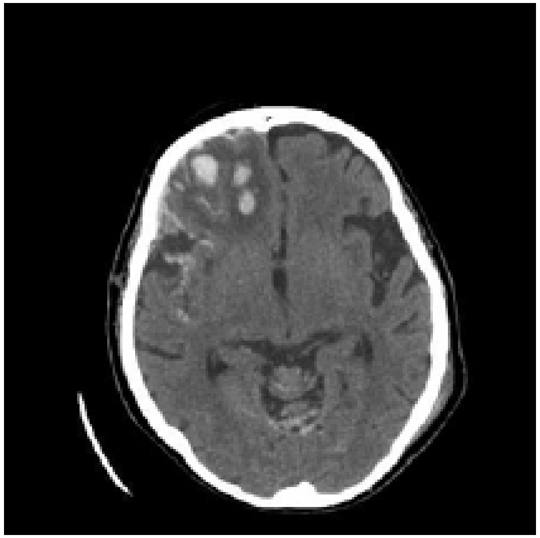
Blood

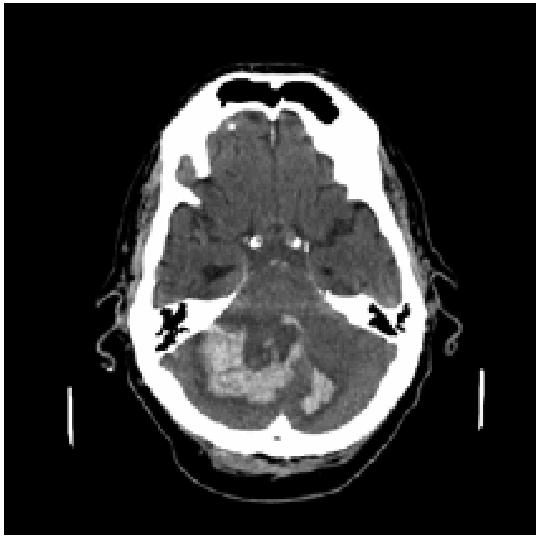


Bone

B is for Blood

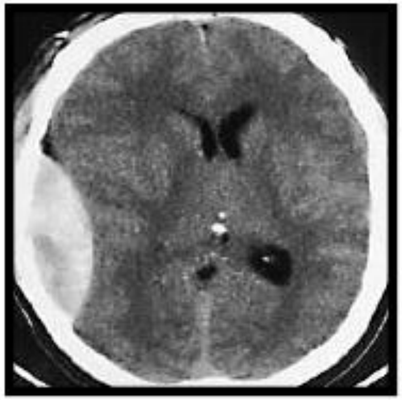
- 1^{st} decision: Is blood present?
- 2^{nd} decision: If so, where is it?
- 3^{rd} decision: If so, what effect is it having?

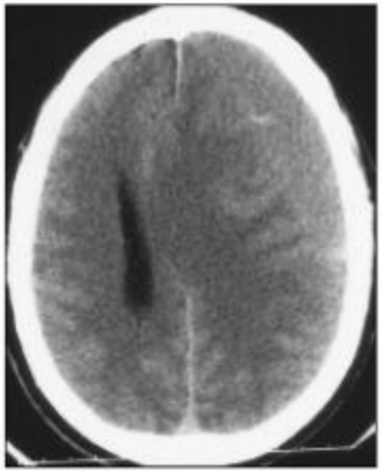




B is for Blood

- Acute blood is bright white on CT (once it clots).





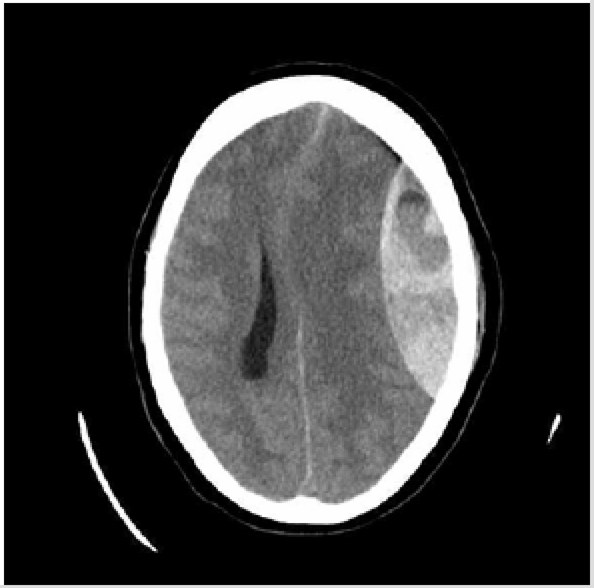
- Blood becomes isodense at approximately 1 week.

- Blood becomes hypodense at approximately 2 weeks.

- Top 5 things to worry about on a trauma head CT
  - Epidural Hematoma
  - Subdural Hematoma
  - Skull Fracture
  - Contusion
  - Pressure / Shift

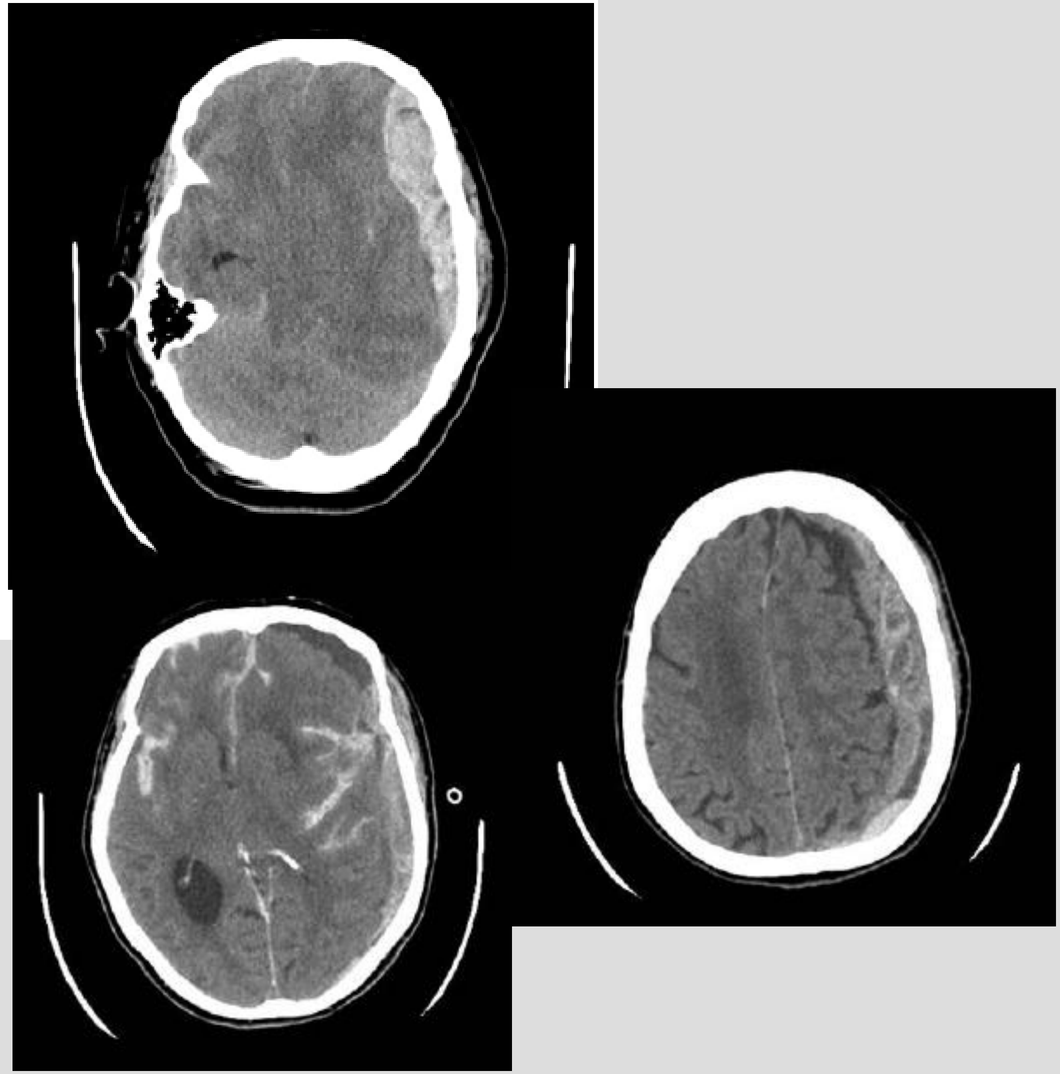
Epidural Hematoma

- Lens shaped
- Does not cross sutures
- Classically described with injury to middle meningeal artery
- Low mortality if treated prior to unconsciousness (< 20%)



Subdural Hematoma

- Typically falx or sickle-shaped.
- Crosses sutures, but does not cross midline.
- Acute subdural is a marker for severe head injury. (Mortality approaches 80%)
- Chronic subdural usually slow venous bleed and well tolerated.



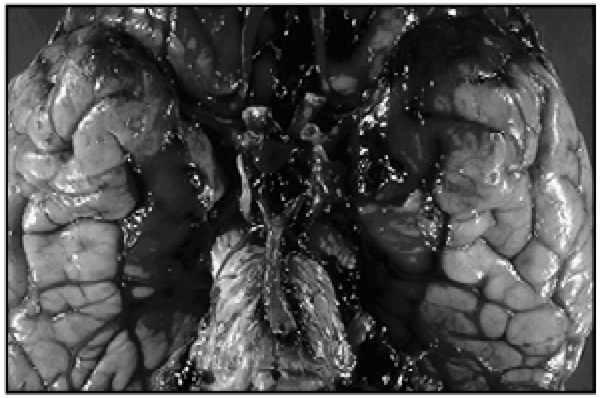
Subarachnoid Hemorrhage

- Blood in the cisterns/cortical gyral surface
  - Aneurysms responsible for 75-80% of SAH
  - AVM's responsible for 4-5%
  - Vasculitis accounts for small proportion (<1%)
  - No cause is found in 10-15%

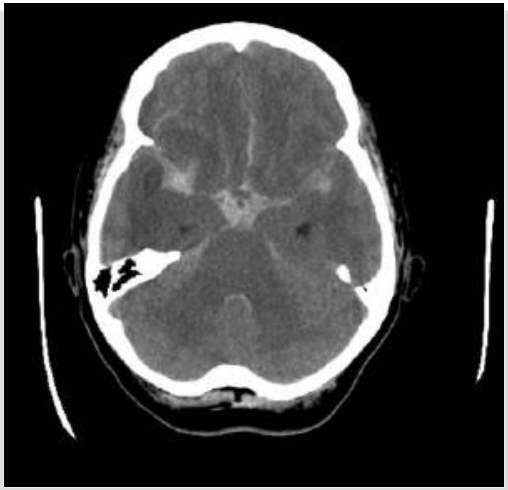
  - 20% will have associated acute hydrocephalus

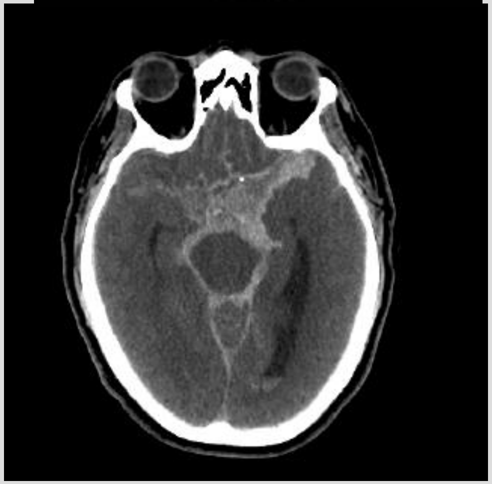
CT Scan Sensitivity for SAH

- 98-99% at 0-12 hours
- 90-95% at 24 hours
- 80% at 3 days
- 50% at 1 week
- 30% at 2 weeks

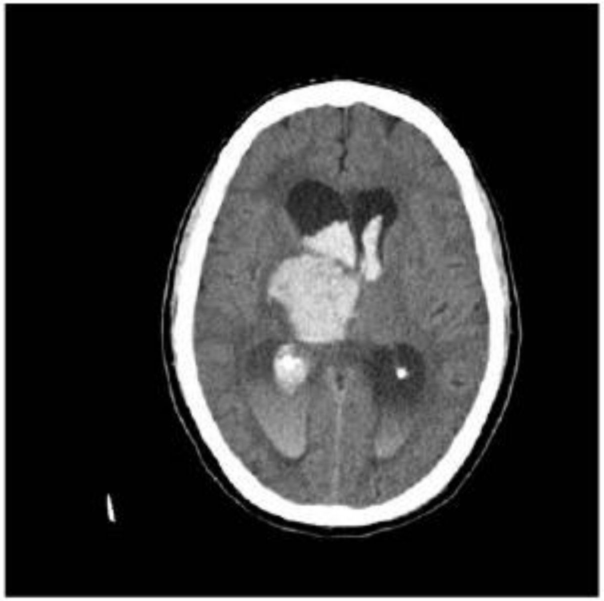


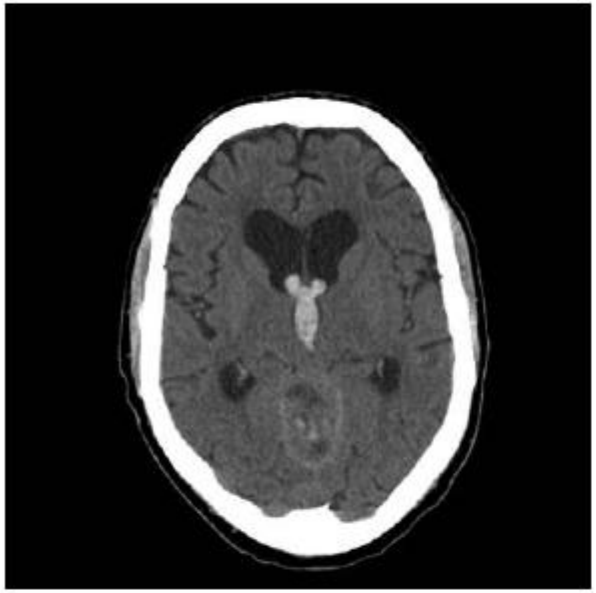
➢ Depends on <u>generation</u> of scanner and <u>who</u> is reading scan.





Intraventricular & Intraparenchymal Hemorrhage





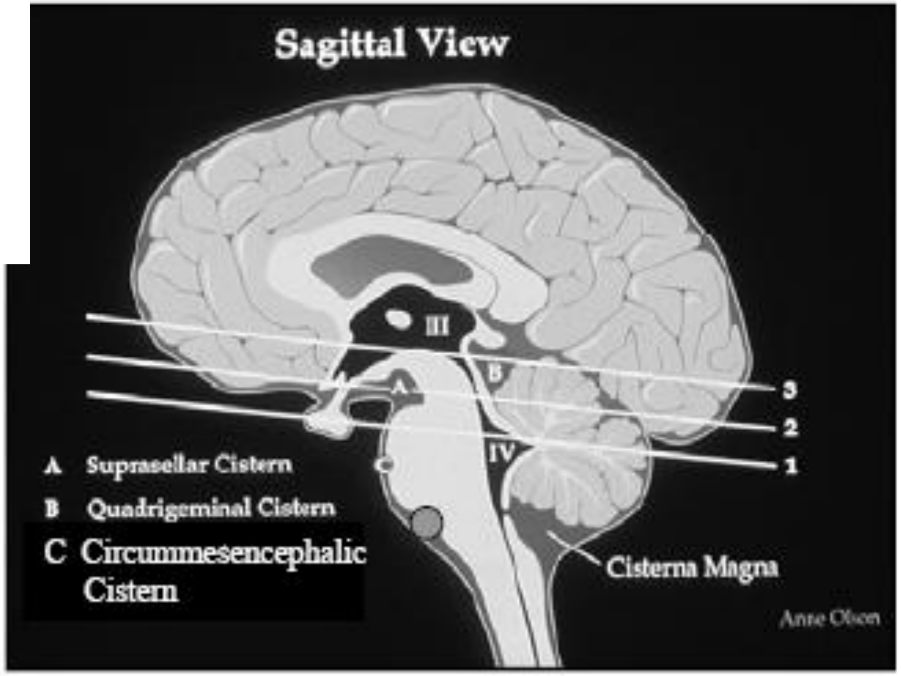
C is for CISTERNS
(Blood Can Be Very Bad)

- **4 Key Cisterns:**

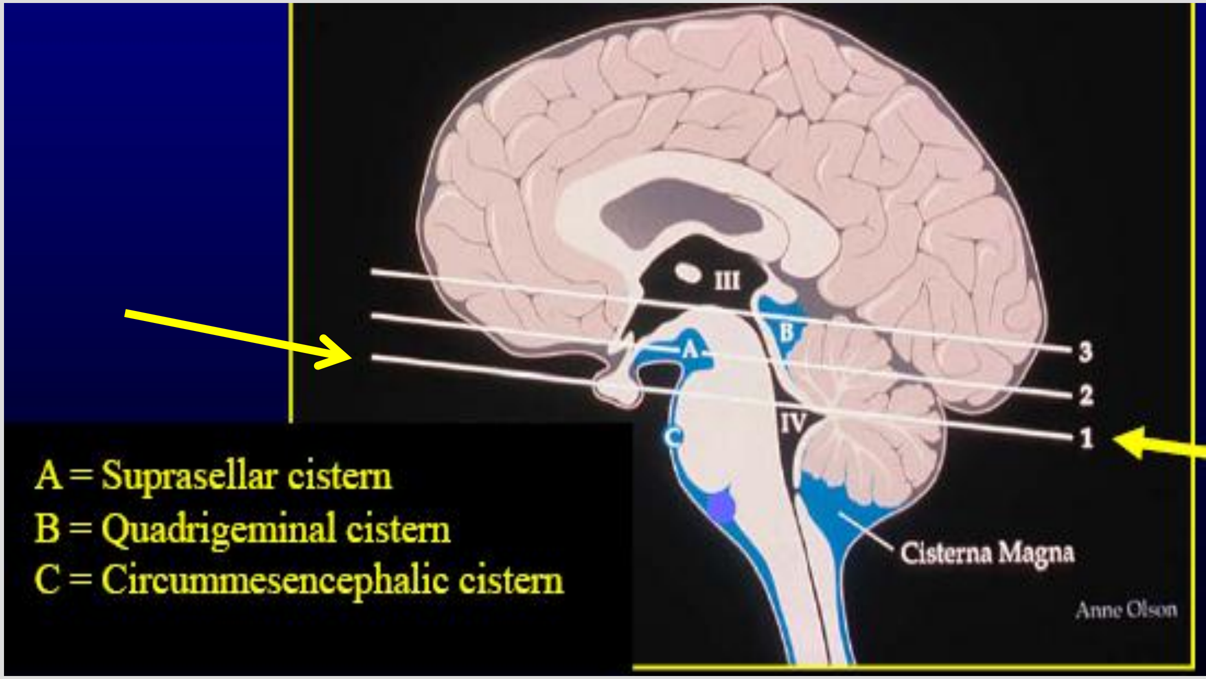
1. Circum-mesencephalic
2. Suprasellar
3. Quadrigeminal
4. Silvian

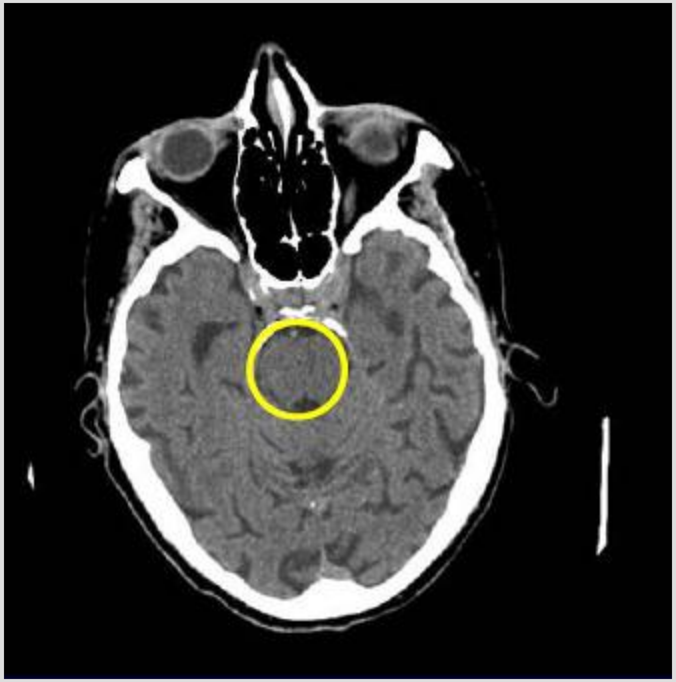
- **3 Levels:**

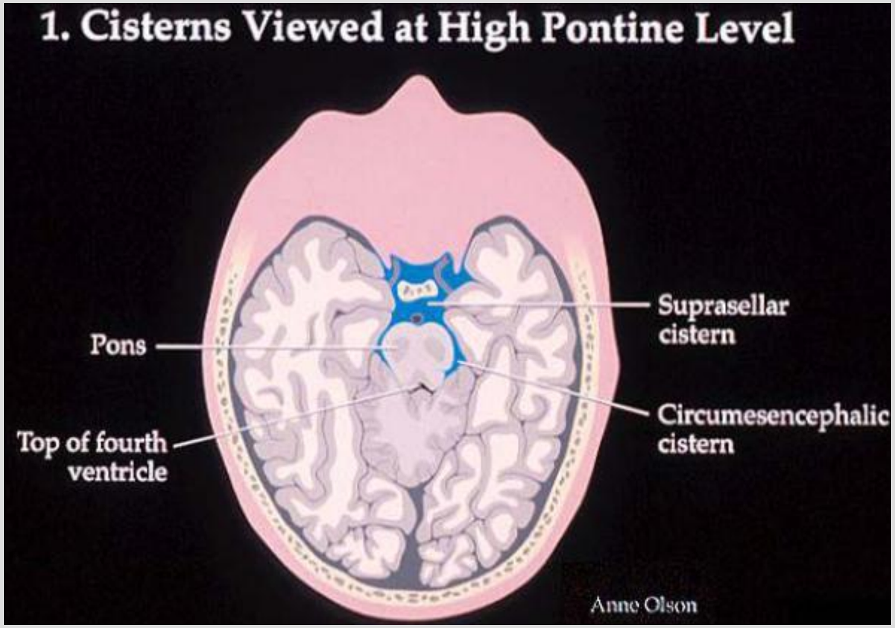
1. High Pontine level
2. Cerebral Peduncle level
3. Midbrain level



3. Mid-Brain level
2. Cerebral Peduncle Level
1. High-Pontine Level







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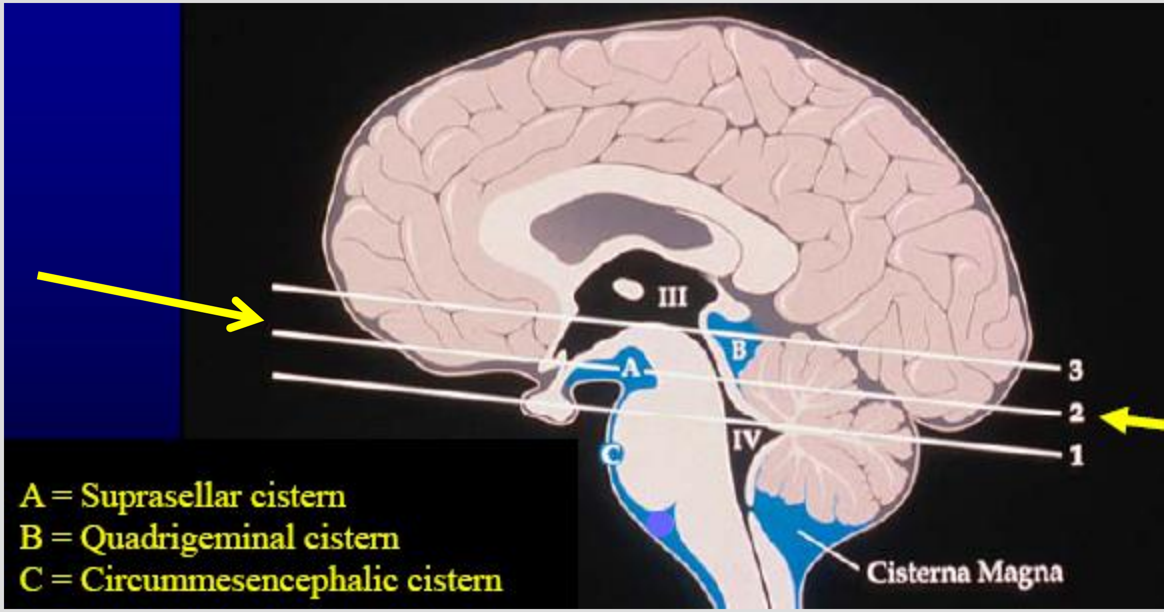

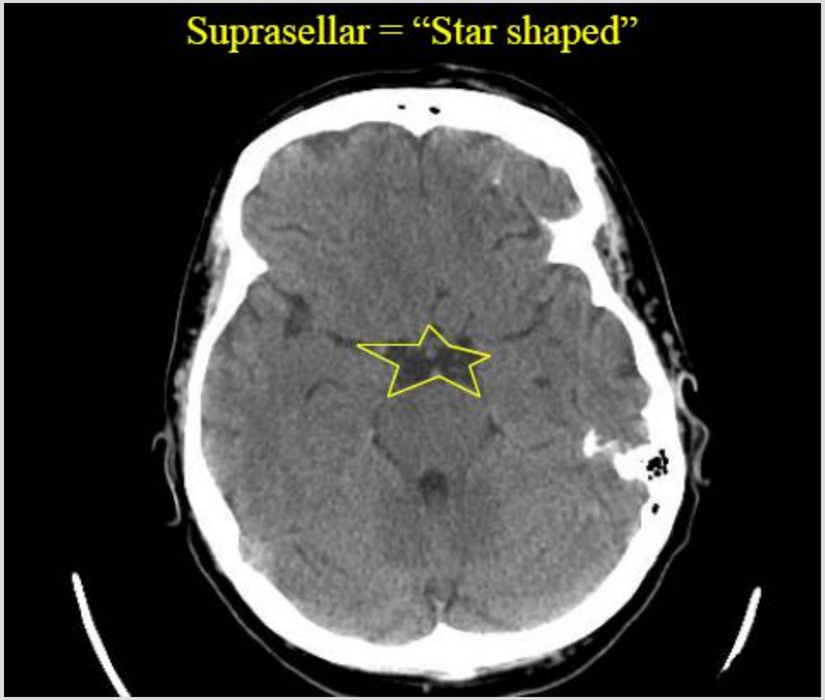

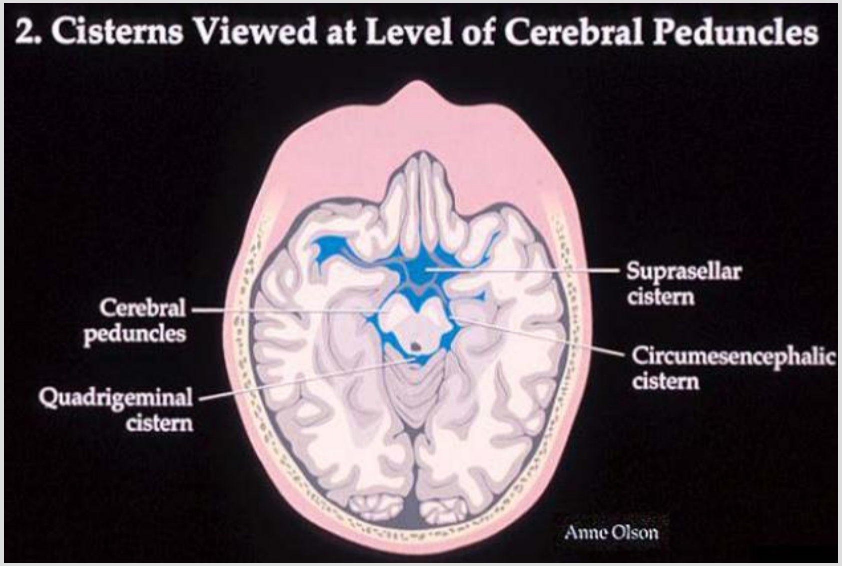

3. Mid-Brain level
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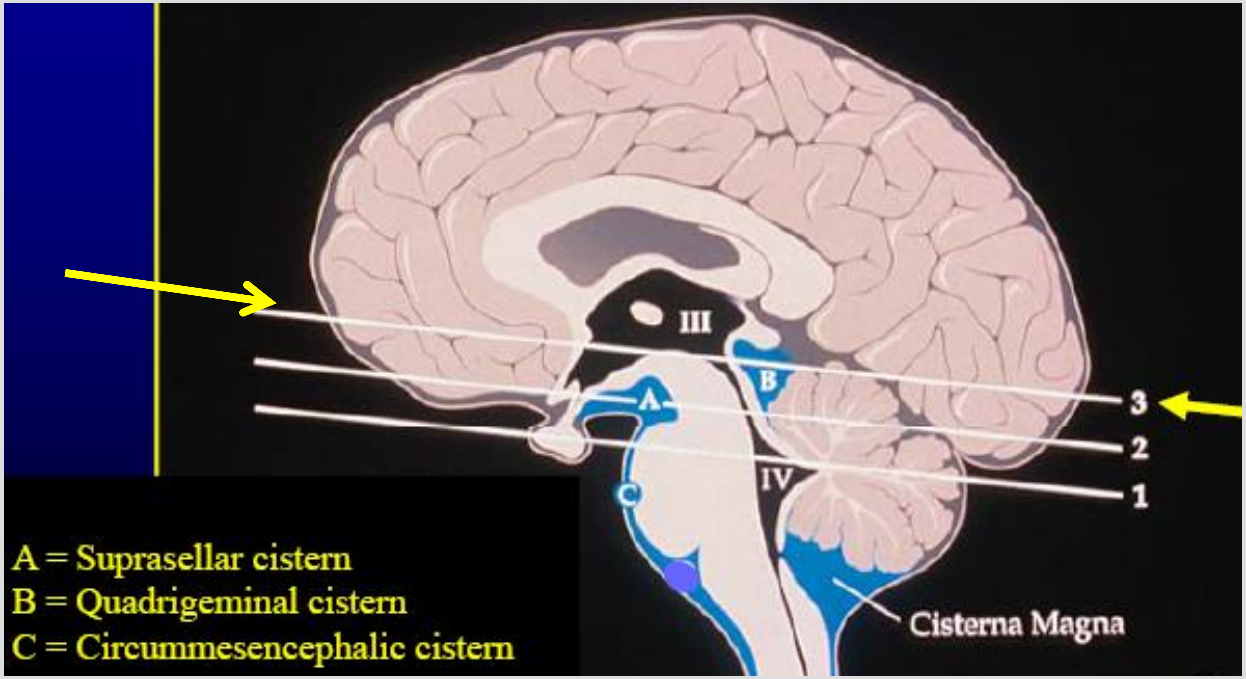
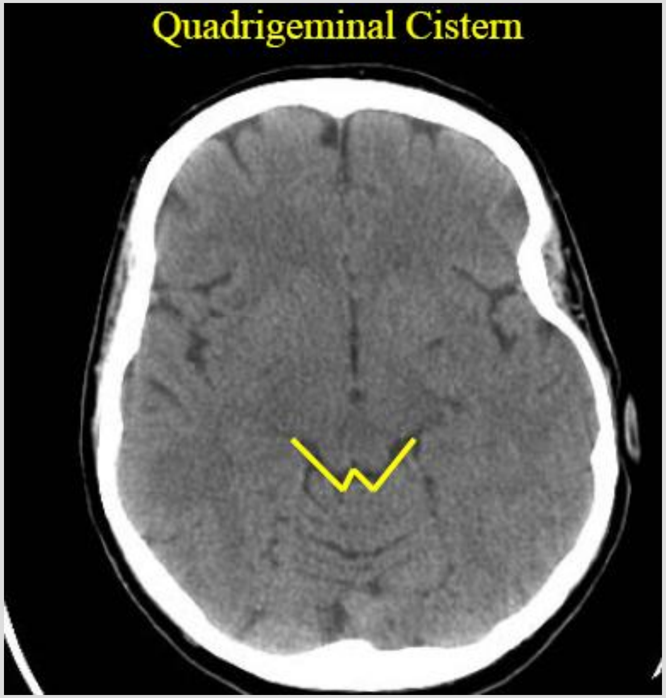
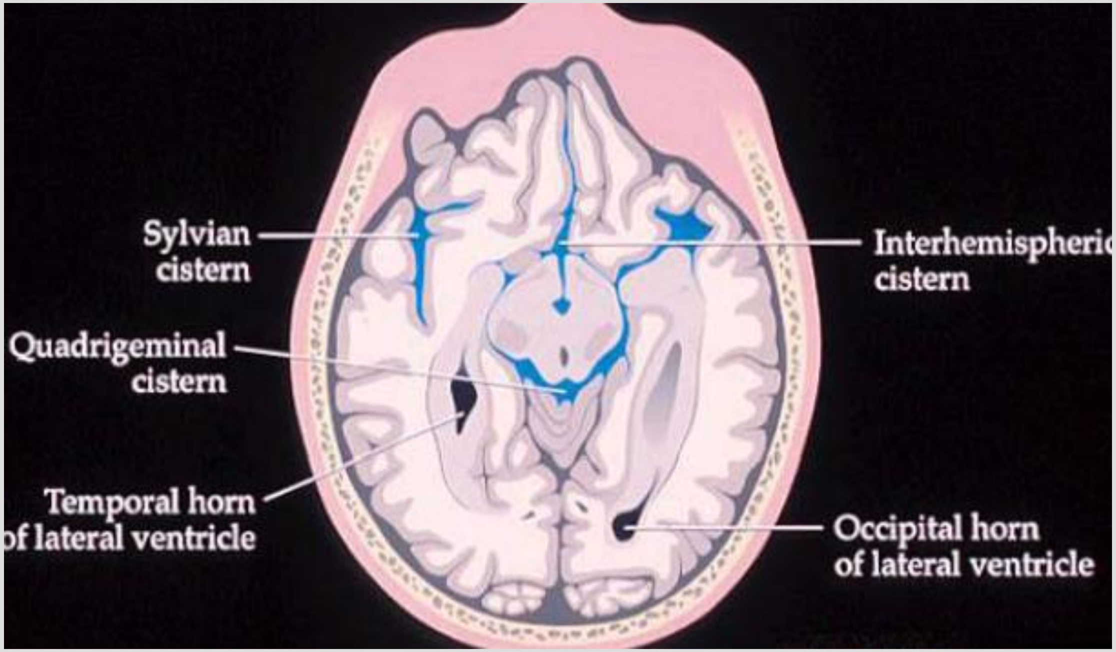






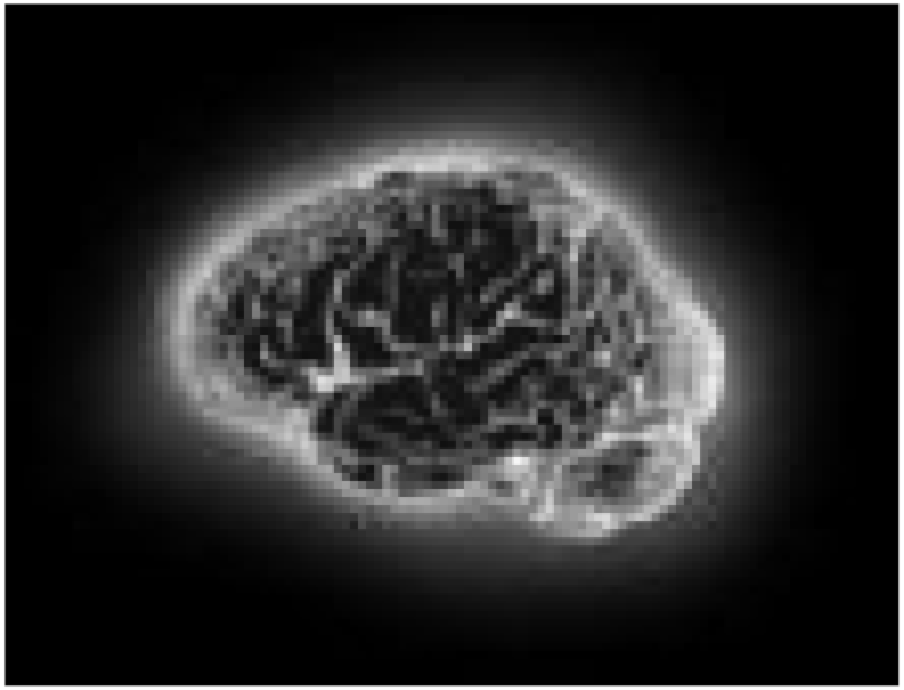
Marshall Classification

Tipo di lesione	Cisterne	Shift linea mediana	Volume della lesione
I: Normale	Normali	--	No lesioni
II: Diffuse Injury Lesione unica >1 se unilaterali Bilaterali	Normali	<5 mm	<25 mL
III: Diffuse Injury + Swelling	Compresse o assenti	<5 mm	<25 mL
IV: Diffuse Injury + Shift		> 5 mm	< 25 mL
V: Evacuated Mass lesion	Qualunque lesione che necessiti di intervento di evacuazione chirurgica in urgenza		
VI: Non Evacuated Mass Lesion	Lesioni di volume >25 mL non operabili		

società italiana medicina d'emergenza-urgenza

B is for BRAIN

(Blood Can Be Very Bad)

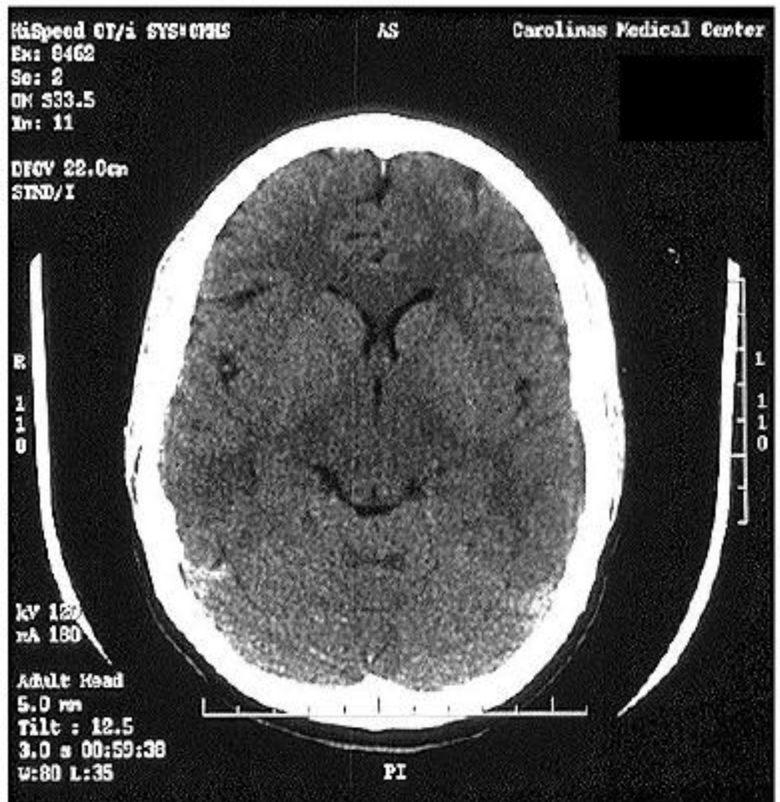


B is for **B**RAIN

(Blood Can Be Very Bad)

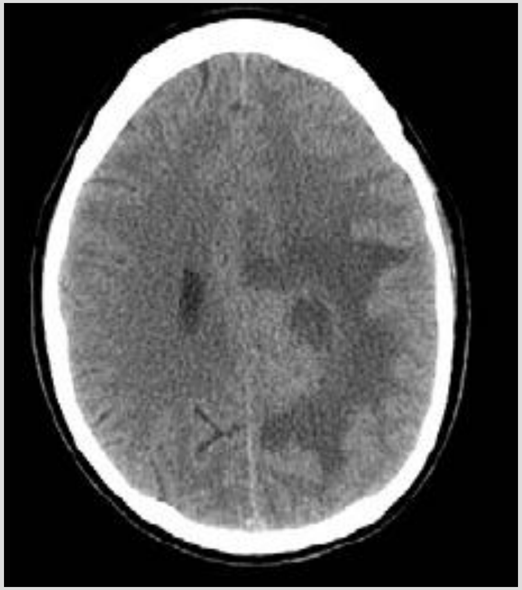
Symmetry &
Gray-White Differentiation

Normal Brain



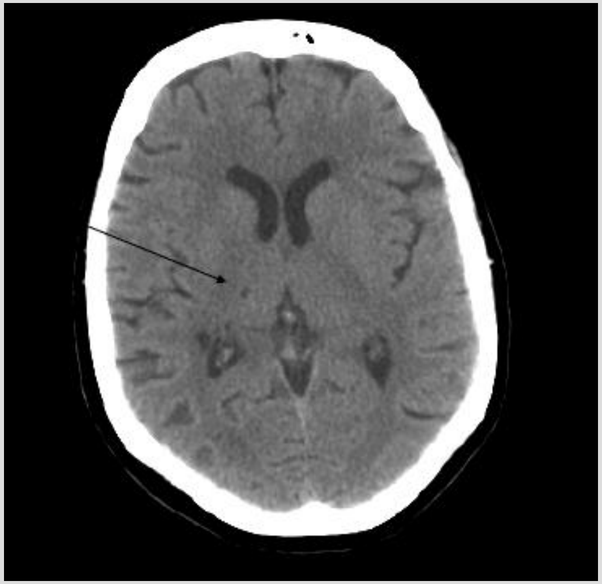
Considera le alternative …

Tumori ..



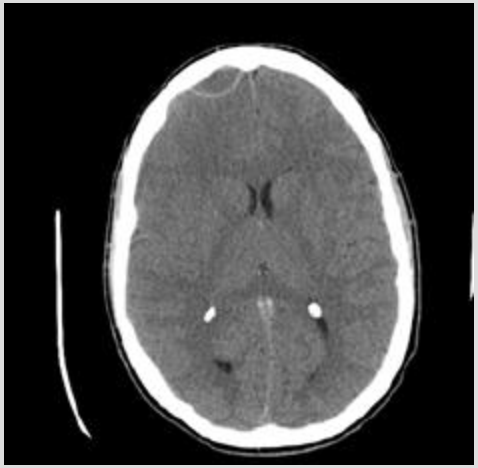
Ischemia

Ischemia lacunare

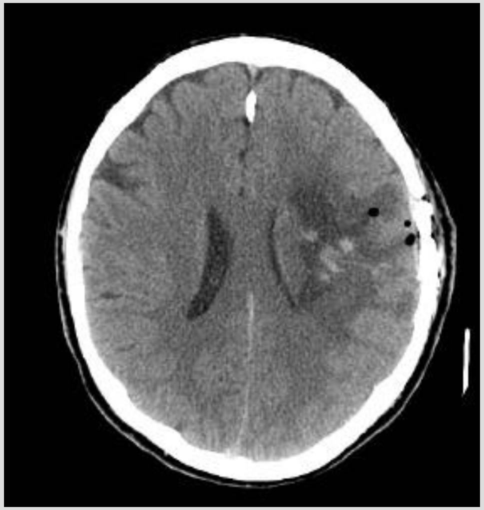


Atrofia ..

Ascessi ..



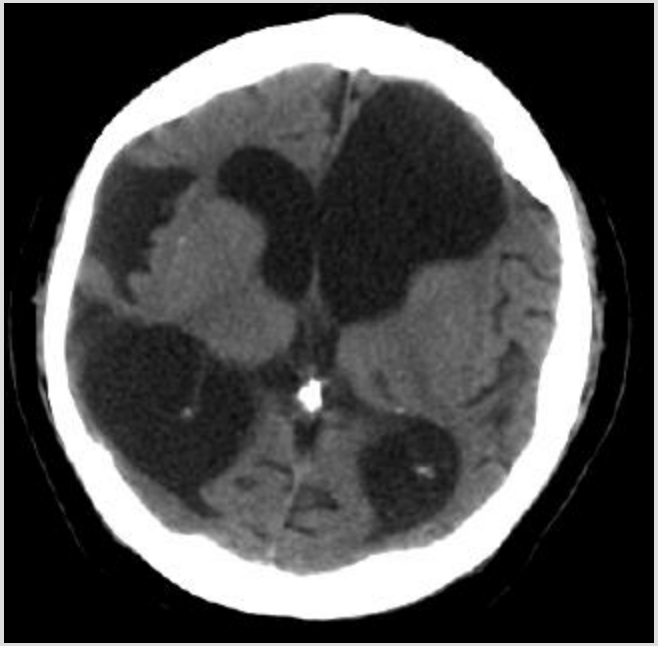
Aria ..



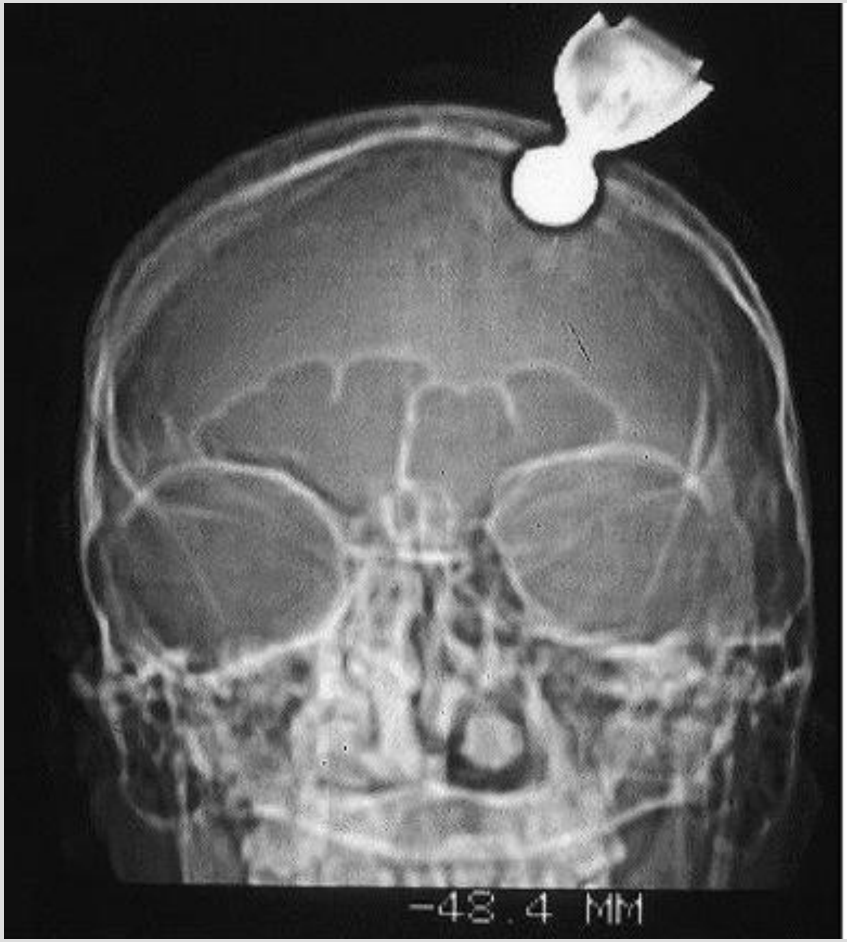
V is for VENTRICLES

(Blood Can Be Very Bad)

Ex vacuo ..



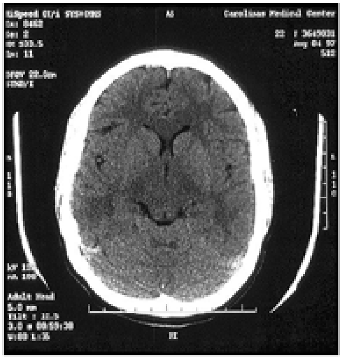
B is for Bone
(Blood Can Be Very Bad)



2. Come interpretare il referto TC ? .. Le conclusioni

Blood Can Be Very Bad

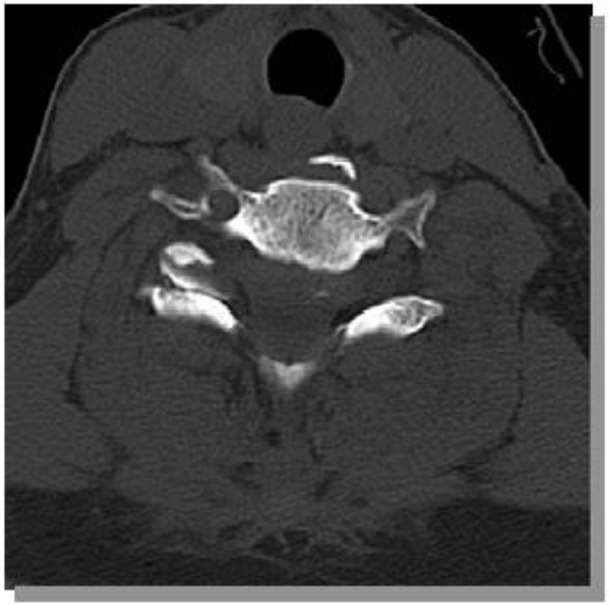
If no blood is seen, all cisterns are present and open, the brain is symmetric with normal gray-white differentiation, the ventricles are symmetric without dilation, and there is no fracture, then there is no emergent diagnosis from the CT scan.

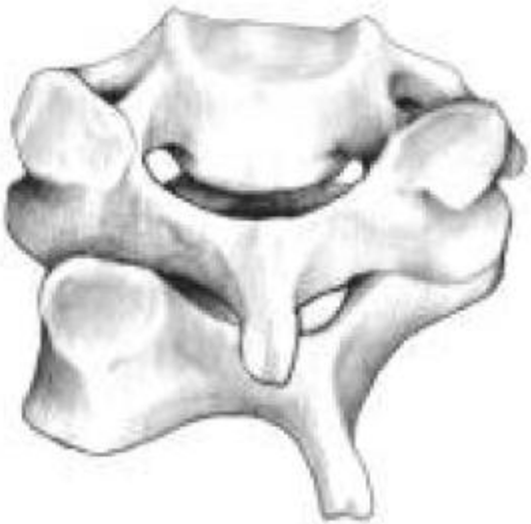


E il Rachide Cervicale ???

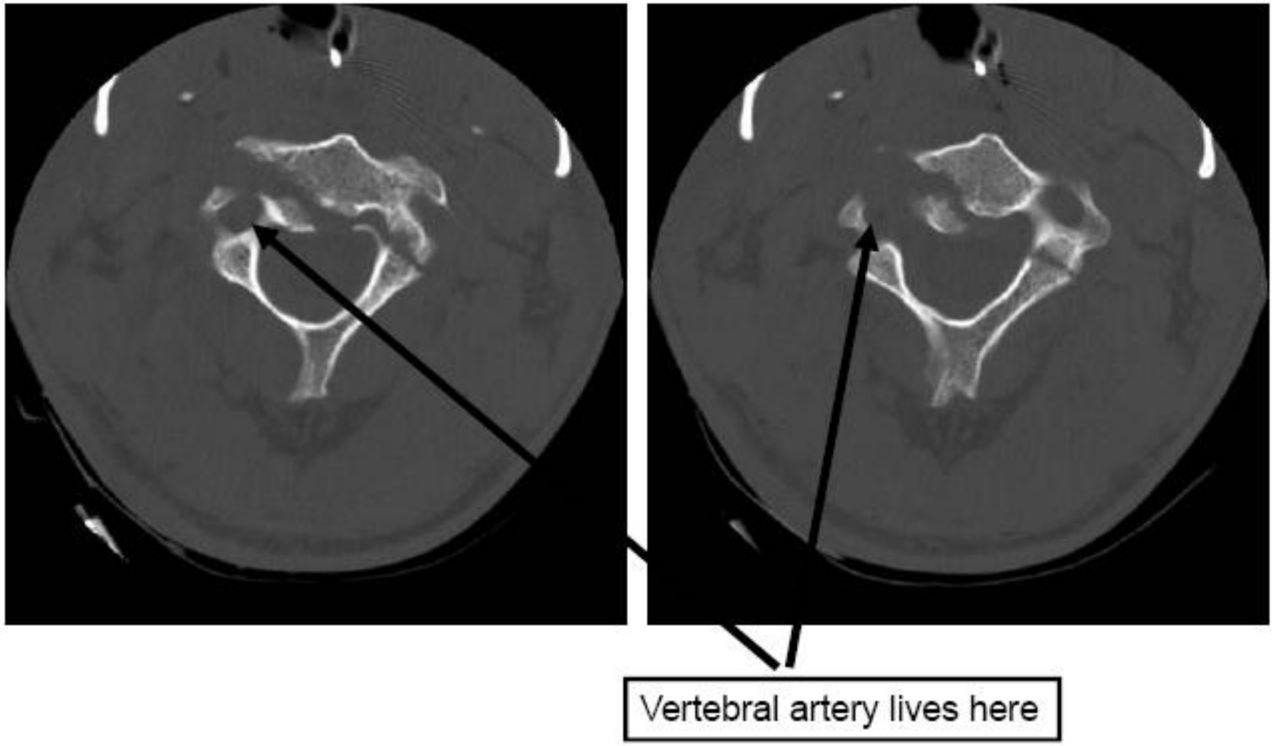
- Top 2 things to worry about on a trauma CT of the C-spine
  - Fracture (neck)
  - Dislocation (neck)

CT Neck: Unilateral Facet Dislocation

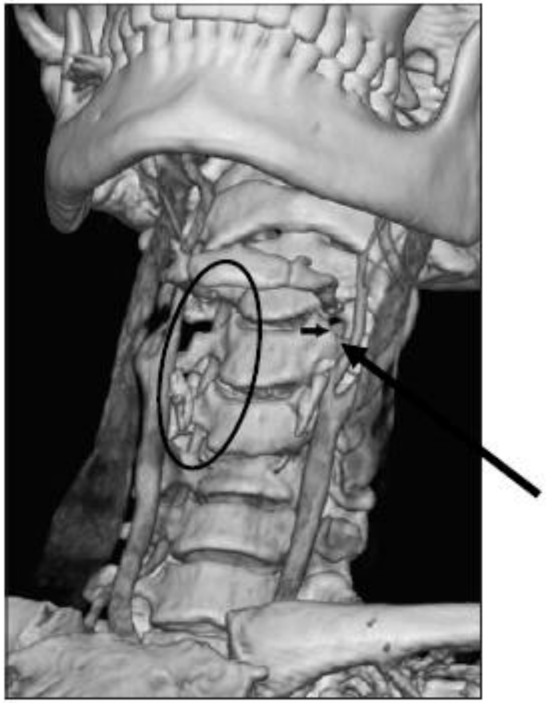




CT Neck: Vascular Injury



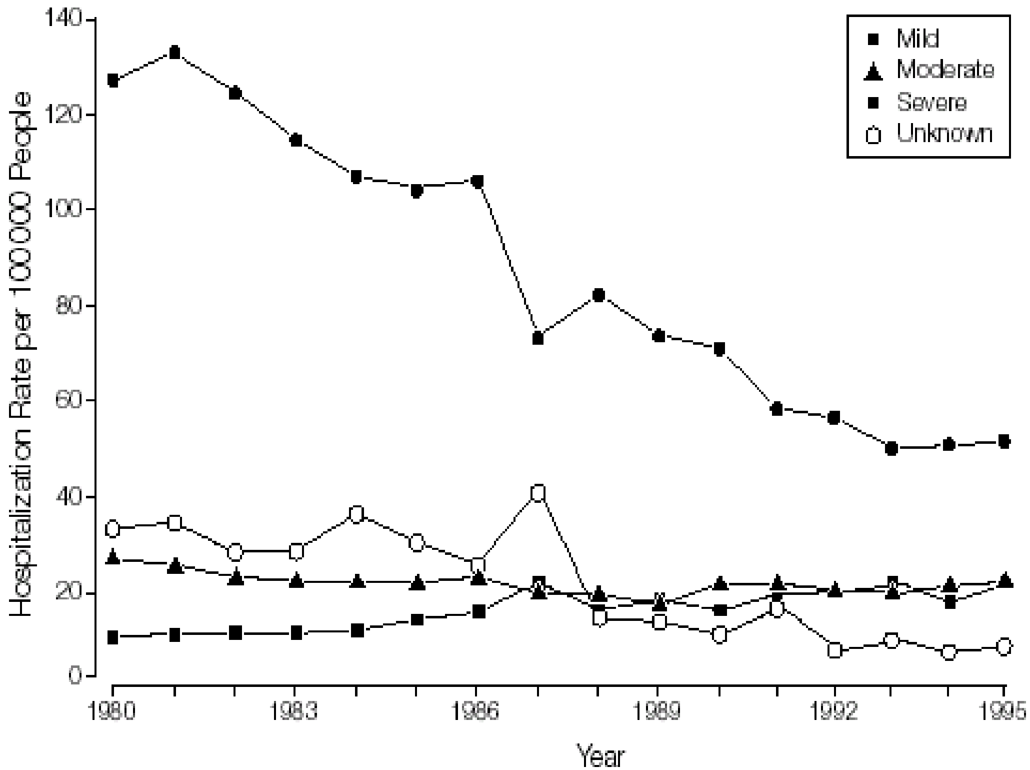
CT Neck: Vascular Injury



3. Quale, come e quanta osservazione fare ?

Trends in Hospitalization Associated With Traumatic Brain Injury

Figure 2. Incidence Rates of TBI-Related Hospitalization in the United States by Category of Severity, 1980-1995



Thurman D. ***JAMA*** 1999

Which type of observation for patients with high-risk mild head injury and negative computed tomography?

Table 2 Events in patients according to treatment protocol (number of cases and percentage)

	In-hospital observation ($N=646$)	Early home monitoring ($N=834$)	P value[a]
Patients with early evidence of post-traumatic injuries	9 (1.4%)[b]	6 (0.7%)	0.773
Deaths at 6 months	5 (0.8%)	8 (1.0%)	0.785
Injury-related deaths	0	2 (0.2%)	0.508
Moderate 6-month disability	2 (0.3%)	0	0.508

Fabbri A. ***Eur J Emerg Med*** *2004*

Good Practice in Observation

7.3.2 Frequency of observations

As the risk of an intracranial complication is highest in the first six hours after a head injury, observations should have greatest frequency in this period.[3]

Observations should be performed and recorded on a half-hourly basis until GCS equal to 15 has been achieved. The minimum frequency of observations for patients with GCS equal to 15 should be as follows, starting after the initial assessment in A&E:

- **half-hourly for two hours;**
- **then one hourly for four hours;**
- **then two hourly thereafter.**

Should the patient with GCS equal to 15 deteriorate at any time after the initial two-hour period, observations should revert to half-hourly and follow the original frequency schedule.

These recommendations are based on level five evidence and are considered to be grade D recommendations.

4. La terapia Anticoagulante ?

Intracranial Complications of Preinjury Anticoagulation in Trauma Patients with Head Injury

	Anticoagulated Patients (n = 37)	Control Patients (n = 37)	*p* Value
Age (yr)*	74 ± 11	75 ± 8	0.655
Male/Female ratio	21/16	22/15	
Anticoagulant			
Warfarin	12		
Aspirin	19		
Other	6		
INR*	2.37 ± 0.96†	1.16 ± 0.12	<0.001
Mechanism of injury	30 falls/7 MVCs	30 falls/7 MVCs	
Associated injuries (%)	12 (32)	17 (46)	0.341
ISS*	17.0 ± 7.8	19.8 ± 8.1	0.143
GCS score*	11.8 ± 4.0	12.5 ± 2.6	0.378
Length of stay (days)*	10 ± 11	11 ± 14	0.853
Mortality (%)	14 (38)	3 (8)	0.006

* Mean ± SD.
† Warfarin patients only.
MVC, motor vehicle collision.

*Mina AA, **J Trauma** 2002*

Coagulopathy and NICE recommendations for patients with mild head injury

Table 1 Characteristics of the 501 patients, submitted to early CT scan according to protocol, and not considered by NICE recommendations

	CT negative (n = 461)	CT positive (n = 40)	Odds ratio (95% CI)	p value*
Median (IQR) age, years	53 (29 to 77)	68 (46 to 78)	–	0.054
Median (IQR) INR†	2.3 (2.0 to 2.8)	2.2 (2.2 to 2.6)	–	0.464
Cause of injury				
Fall	204 (44.3%)	19 (47.5%)	1.14 (0.59 to 2.18)	0.741
Crash	179 (38.8%)	15 (37.5%)	0.94 (0.48 to 1.84)	1.000
Assault	15 (3.3%)	2 (5.0%)	1.56 (0.34 to 7.10)	0.637
Occupational	32 (6.9%)	2 (5.0%)	0.71 (0.16 to 3.06)	1.000
Risk factors				
Coagulopathy	50 (10.8%)	16 (40.0%)	5.48 (2.73 to 11.00)	<0.001
Dangerous mechanism	156 (33.8%)	16 (40.0%)	1.30 (0.67 to 2.53)	0.488
Age ≥65 years	191 (41.4%)	22 (55.0%)	1.73 (0.90 to 3.31)	0.133
History of epilepsy	20 (4.3%)	2 (5.0%)	1.16 (0.26 to 5.15)	0.692
Previous neurosurgery	26 (5.6%)	1 (2.5%)	0.43 (0.06 to 3.25)	0.713
Alcohol and/or drugs	51 (11.1%)	7 (17.5%)	1.71 (0.72 to 4.05)	0.205

Fabbri A, ***JNNP*** *2004*

Delayed Intracranial Hemorrhage After Blunt Trauma: Are Patients on Preinjury Anticoagulants and Prescription Antiplatelet Agents at Risk?

Kimberly A. Peck, MD, C. Beth Sise, JD, RN, MSN, Steven R. Shackford, MD, Michael J. Sise, MD, Richard Y. Calvo, MPH, Daniel I. Sack, BA, Sarah B. Walker, BA, and Mark S. Schechter, MD

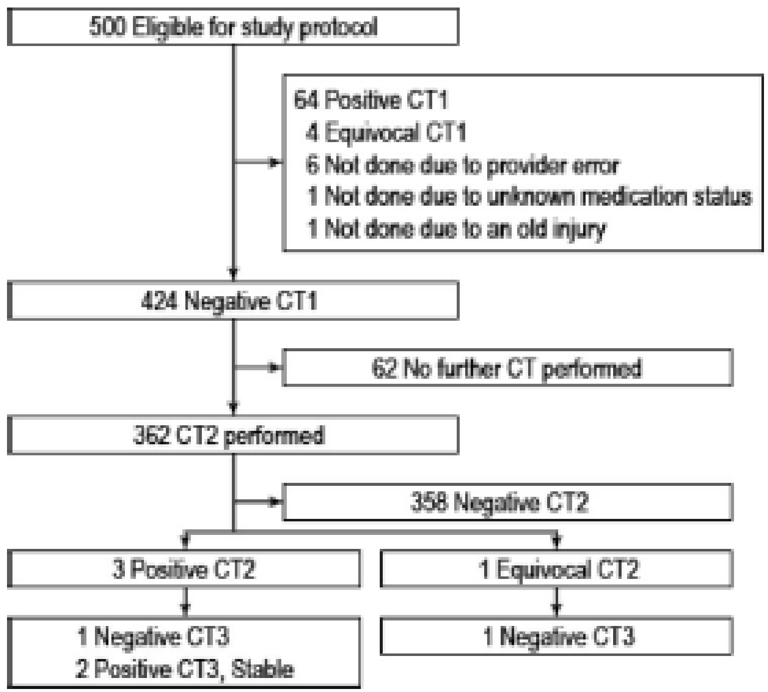


Figure 1. A flow diagram of 500 patients eligible for the head CT study protocol.

(*J Trauma*. 2011;71: 1600–1604)

Management of Minor Head Injury in Patients Receiving Oral Anticoagulant Therapy: A Prospective Study of a 24-Hour Observation Protocol

What is already known on this topic

Computed tomography (CT) scanning is typical for patients with minor head injury and receiving warfarin. Subsequent management, however, is controversial.

What question this study addressed

Does a protocol of 24-hour observation followed by a repeated head CT scan detect delayed bleeding?

What this study adds to our knowledge

Repeated CT scanning revealed new hemorrhages in 5 of 87 patients completing the protocol, with 1 undergoing craniotomy. Two patients discharged after the protocol (both with international normalized ratio>3.0) were later readmitted with bleeding, but neither required surgery.

How this is relevant to clinical practice

Delayed intracranial hemorrhage is common after minor head injury when patients are receiving warfarin. A minimum protocol of 24-hour observation followed by repeated scanning is necessary to detect most such occurrences.

Menditto VG, ***Ann Emerg Med*** 2012

5. E gli Antiaggreganti ?

Management of Prehospital Antiplatelet and Anticoagulant Therapy in Traumatic Head Injury: A Review

Wesley D. McMillian, PharmD,† and Frederick B. Rogers, MD, FACS†*

In summary, from these limited retrospective analyses, it seems that prehospital antiplatelet therapy in trauma patients is associated with increased morbidity and possibly increased risk of mortality when compared with those patients not treated before injury. Unfortunately, we cannot glean the relative contribution of the antiplatelet therapy to the severity of ICH based on GCS or ISS. It is plausible that preinjury antiplatelet therapy converts minor head trauma into a progressive ICH. Furthermore, these studies do not provide any guidance to clinicians on the use of platelets or other reversal agents in the patient with traumatic head injury on preinjury antiplatelet therapy.

J Trauma. 2009;66:942–950.

Predicting intracranial lesions by antiplatelet agents in subjects with mild head injury

Background The effect of pre-injury antiplatelet treatment in the risk of intracranial lesions in subjects after mild head injury (Glasgow Coma Scale (GCS) 14—15) is uncertain.

Methods The potential risk was determined, considering its increasing use in guidelines on cardiovascular disease prevention, and ageing of the trauma population in Europe.

Patients The interaction of antiplatelet therapy with the prediction variables of main decision aids was analysed in 14 288 consecutive adolescent and adult subjects with mild head injury.

Measurements Any intracranial lesion at CT scan was selected as an outcome measure in a multivariable logistic regression analysis.

Results Intracranial lesions were demonstrated in 880 cases (6.2%), with an unfavourable outcome at 6 months in 86 (0.6%). Antiplatelet drugs were recorded in 10% of the entire cohort (24.7% in the group over 65 years). They increased the risk of intracranial lesions in the univariate analysis (OR 2.6; 95% CI 2.2 to 3.1), interacting with age in the multivariate analysis (antiplatelet OR 2.7 (1.9 to 3.7); age ≥75 years 1.4 (1.0 to 1.9)). The inclusion of these two variables with those included in previous decision aids for CT scanning (GCS, neurodeficit, post-traumatic seizures, suspected skull fracture, vomiting, loss of consciousness, coagulopathy) predicted intracranial lesions with a sensitivity of 99.7% (95% CI 98.9 to 99.8) and a specificity of 54.0% (95% CI 53.1 to 54.8), with a CT ordering rate of 49.3% (undetermined events 0.2:1000).

Interpretation Antiplatelet drugs need to be considered in future prediction models on mild head injury, considering their increasing use and progressive ageing of the trauma population.

A.Fabbri, ***JNNP*** *2010*

A meta-analysis to determine **the effect on survival of platelet transfusions** in patients with either spontaneous or traumatic antiplatelet medication associated intracranial haemorrhage

Intracranial haemorrhage, platelet transfusion

Study name	OR	Lower limit	Upper limit	Z Value	p Value
Washington *et al*[10]	0.132	0.006	2.813	−1.298	0.194
Downey *et al*[11]	0.945	0.531	1.680	−0.193	0.847
Ivascu *et al*[14]	0.395	0.148	1.060	−1.844	0.065
Fortuna *et al*[15]	0.408	0.194	0.859	−2.359	0.018
	0.609	0.404	0.917	−2.376	0.018

OR and 95% CI

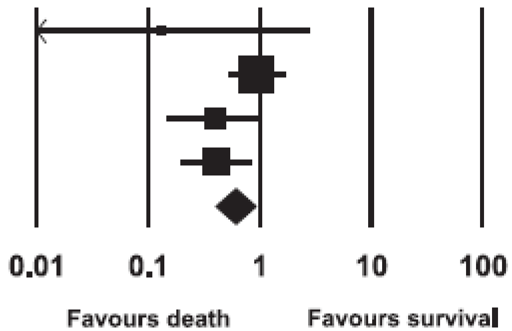


Figure 4 Forest plot for the four traumatic intracranial haemorrhage studies. Fixed effects model.

A meta-analysis to determine **the effect on survival of platelet transfusions** in patients with either spontaneous or traumatic antiplatelet medication associated **intracranial haemorrhage**

Batchelor JS, Grayson A. *BMJ Open* 2012;**2**:e000588. doi:10.1136/bmjopen-2011-000588

Key messages

- Six studies were found to be suitable for the meta-analysis (two studies for spontaneous ICH and the remaining four were traumatic intracranial haemorrhage).
- The pooled OR showed no benefit in survival following a platelet transfusion (OR=0.773, 95% CI 0.414 to 1.442).

Strengths and limitations of this study

- The studies were small, unpowered and not randomised.
- Mortality is a relatively crude marker of effect in the cohort of patients with either spontaneous or traumatic haemorrhage.
- Significant bias may have been introduced in view of the fact that in all but one study, the platelet transfusions were given at the discretion of the attending physician.

Clinical review: Traumatic brain injury in patients receiving antiplatelet medication

CRITICAL CARE

Christopher Beynon*, Daniel N Hertle, Andreas W Unterberg and Oliver W Sakowitz

Table 1. Overview of retrospective studies on the effects of antiplatelet medication in patients with traumatic brain injury

Study	Inclusion criteria	Antiplatelet therapy	Number of subjects	Mortality rate	Major findings
Mina *et al.* 2002 [20]	Posttraumatic ICH	Aspirin	19	47% aspirin group; 8% control group	Mortality significantly increased with aspirin therapy. No difference in mortality rates between aspirin and warfarin treated patients
Spektor *et al.* 2003 [23]	Mild and moderate TBI, age >60 years	Aspirin (100 mg/day)	110	NR	Aspirin therapy had no effect on incidence of posttraumatic ICH after mild to moderate TBI
Ohm *et al.* 2005 [21]	Posttraumatic ICH	Aspirin, clopidogrel	90	23% antiplatelet group; 8% control group	Mortality threefold increased with antiplatelet therapy. GCS <12 and age >76 years risk factors for death in patients on antiplatelet therapy
Jones *et al.* 2006 [24]	All TBI, age >50 years	Clopidogrel	43	7% clopidogrel group	Clopidogrel-treated patients have higher rates of cranial surgery and episodes of rebleeds. More blood products were transfused in clopidogrel-treated patients
Wong *et al.* 2008 [25]	All TBI	Aspirin, clopidogrel	111	14% clopidogrel group; 3% aspirin group	Clopidogrel-treated patients were more likely to be discharged to long-term inpatient facilities
Major *et al.* 2009 [22]	All TBI	Aspirin, clopidogrel	287	1.4% aspirin group	Mortality rate 21% in patients on aspirin with posttraumatic ICH. Three of the four patients who died in the aspirin group deteriorated with a significant delay
Bonville *et al.* 2011 [26]	All TBI	Aspirin, clopidogrel	271	12.3% aspirin group; 9.3% clopidogrel group	Use of antiplatelet agents did not affect mortality or length of hospital stay

GCS, Glasgow Coma Scale; ICH, intracranial haemorrhage; TBI, traumatic brain injury.

REVIEW

Clinical review: Traumatic brain injury in patients receiving antiplatelet medication

CRITICAL CARE

Christopher Beynon*, Daniel N Hertle, Andreas W Unterberg and Oliver W Sakowitz

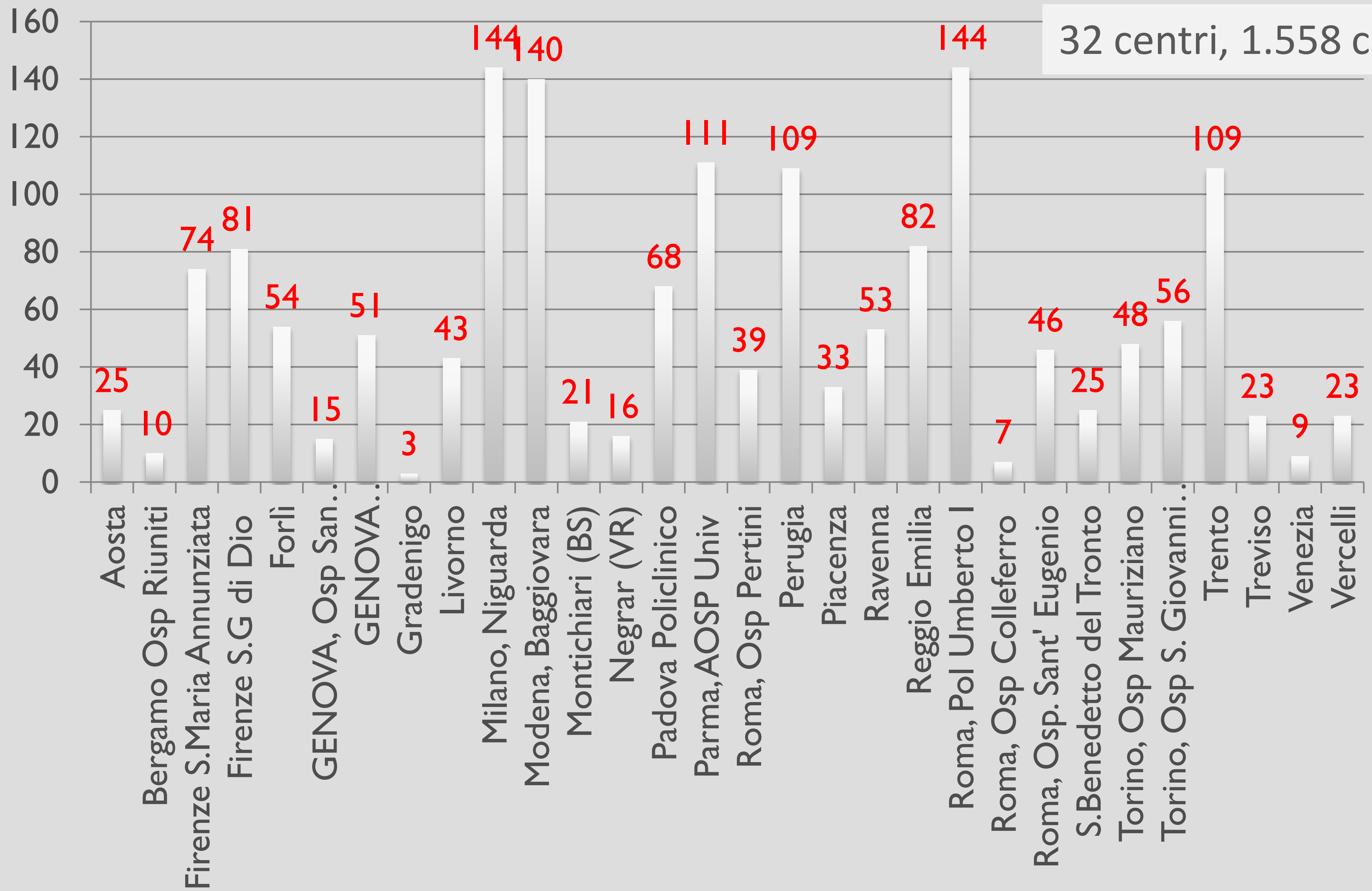
Conclusion

The use of antiplatelet agents in patients will increase as the population ages and because cardiovascular diseases have one of the highest incidence rates of all diseases in industrialized countries. TBI plays a major economic role in society since survivors often suffer serious neurologic sequelae resulting in high dependency. Available data from studies suggest that the pre-injury use of antiplatelet agents yields risks for TBI patients that may lead to an unfavourable outcome. Options to (partially) restore platelet activity include transfusion of platelets and application of haemostatic drugs such as desmopressin, TXA and FVIIa. Guidelines regarding their use are missing since these agents have not been subject to controlled trials in TBI so far. Withdrawal of antiplatelet agents may carry high risks for patients, so treatment has to consider co-morbidities and an interdisciplinary approach should be chosen. Further trials are needed to characterise the impact of pre-injury antiplatelet therapy on TBI victims and to establish protocols optimizing treatment

Antiplatelet Therapy and the Outcome of Subjects with Intracranial Injury: the Italian SIMEU Study

società italiana medicina d'emergenza-urgenza

32 centri, 1.558 casi



Antiplatelet Therapy and the Outcome of Subjects with Intracranial Injury: the Italian SIMEU Study

società italiana medicina d'emergenza-urgenza

KEY MESSAGES

1. 12.9% of subjects with head injury, positive head CT scan and indication to conservative treatment worsened by head CT scan comparison at 6-24 hours.
2. A group of 6/14 items (Glasgow coma scale, Marshall category, antiplatelet therapy, intraventricular or traumatic-subaracnoid haemorrhage, number of lesions) were independently associated with worsening.
3. Pre-injury antiplatelet therapy two-fold increased the risk of worsening.
4. The risk was particularly high in subjects on clopidogrel, independently of the association with other antiplatelet drugs.
5. At follow up, only 3/14 items (Marshall category, GCS score, age >75 years) were selected as predictors of unfavourable outcome. The risk of unfavourable outcome increased by 50% in the group of subjects treated with antiplatelet therapy.

Platelet Transfusion: An Unnecessary Risk for Mild Traumatic Brain Injury Patients on Antiplatelet Therapy

TABLE 4. Outcome Results Comparing Platelet Transfused and Nontransfused MTBI Patients Taking Antiplatelet Agents

	Platelet Transfusion		
	Mean ± SD or No. Patients (%)		
Antiplatelet Outcomes	**Yes (N = 44)**	**No (N = 64)**	***p***
Neurological decline	0	2 (3)	0.51*
Surgical intervention	2 (5)	0	0.16*
Medical decline	6 (14)	2 (3)	0.06*
Cardiac event	8 (18)	8 (12)	0.41*
Respiratory event	4 (9)	2 (3)	0.22*
Glasgow outcome			0.16†
1	2 (5)	0	
3	5 (11)	3 (5)	
4	7 (16)	11 (17)	
5	30 (68)	50 (78)	
HCT progression	5/41 (12)	4/58 (7)	0.48*

*Washington, **J Trauma** 2011*

2: Il Trauma Cranico Moderato ..

1. Quale inquadramento clinico iniziale?…
2. L’interpretazione della prima TC cerebrale?..
3. Gli indicatori precoci di evolutività e di prognosi sfavorevole ??….
4. La gestione dei casi senza indicazioni chirurgiche ?..

Trauma Cranico Moderato

- Gruppo eterogeneo (GSC 13-9) per l'estrema differenza in termini di severità, decorso e prognosi.
- Glasgow Coma Scale 10–9 (???)
- E' prova difficile per il medico d'urgenza …. decisioni difficili, coinvolgono altri specialisti…
- Importanza dell'interpretazioni del quadro clinico iniziale e della TC: condiziona la gestione e la prognosi
- I predittori dell'outcome non sono definiti.

L’Inquadramento Clinico Iniziale?

A. Protezione rachide cervicale e controllo vie aeree	• Garantire pervietà delle vie aeree e stabilità del rachide cervicale
B. Controllo ventilazione e ossigenazione per prevenzione danno secondario	• Identificare e trattare le cause di alterata ventilazione con obiettivo $satO^2 > 95\%$
C. Controllo circolazione per prevenzione danno secondario	• Controllo emorragie con obiettivo PA sistolica 110 mm/Hg
D. Valutazione stato neurologico	• Glasgow Coma Scale 13-9 dopo stabilizzazione (verifica alcolemia, farmaci e droghe d’abuso).
E. Svestizione	• Esame clinico generale, monitoraggio e protezione termica

Rx rachide C 2p*, Torace, Bacino, Eco-addome, TC cerebrale entro 2 ore + TC C0-C2, C7-T1. *Rx rachide in toto se dinamica alta energia.

(TC total body)

↓ TC cerebrale **negativa**

↓ TC cerebrale **positiva**

Interpretazione della prima TC?

TC Negativa

- **Percorso di Osservazione: possibile in Ospedale Senza Neurochirurgia** (Telemedicina e Trasferimento in 30-60 min)

- **Ripetizione TC:**

  1. Immediata se deterioramento clinico
  2. A 6 ore dalla prima TC se Ipotensione, deficit coagulazione, frattura del cranio
  3. A 24 dalla prima TC in tutti i casi eccetto quelli senza N-Deficit e GCS 15

Interpretazione della prima TC cerebrale?

Tipo di Lesione	Cisterne Base	Shift Linea Mediana	Volume della Lesione
I – Normale	Normali	--	No lesioni
II - Diffuse Injury *a) lesione unica, b) ≥ 2 se unilaterali, c) bilaterali*	Presenti normali	<5 mm	<25 mL (anche se frammenti ossei)
III - Diffuse Injury + Swelling	Compresse o assenti	<5 mm	<25 mL
IV - Diffuse Injury + Shift	Compresse o assenti	>5 mm	<25 mL
V - Evacuated Mass lesion	Lesione massa: qualunque lesione che necessiti di intervento di evacuazione chirurgica in urgenza. *a) EDH, b) SDH c) ICH d) Lesioni multiple.*		
VI - Non Evacuated Mass Lesion	Lesione massa non operata >25 mL. *a) EDH, b) SDH c) ICH, d) Lesioni multiple*		

Interpretazione della prima TC Cerebrale ?

TC Positiva

Diffuse Injury II

Osservazione in:

1) Osp periferico + Teleconsulto,
2) Neurochirurgia se deterioramento

Ripetizione TC:

1. Immediata se deterioramento clinico,
2. A 6 ore dalla precedente se prima TC <2 ore dal trauma. Possibile ripetere entro12 ore se GCS 15 e assenza di N-deficit.,
3. Entro 12 ore dalla precedente se prima TC dopo 2 ore e in tutti gli altri casi

Diffuse Injury III + Swelling
Diffuse Injury IV + Shift
Evacuated Mass Lesion V
Non Evacuated Mass lesion VI

Trattamento in:

- **Neurochirurgia** per intervento/osservazione
- **Rianimazione** per monitoraggio PIC

Quali gli Indicatori Precoci di Outcome ?..

Early predictors of unfavourable outcome in subjects with moderate head injury in the emergency department

A Fabbri, F Servadei, G Marchesini, S C Stein and A Vandelli

JNNP ONLINE

Table 5 Risk of unfavourable outcome in patients after moderate head injury predicted by variables included in the local database

Multivariable analysis	Odds ratio	95% CI	p Value
Basal skull fracture	8.89	2.53–31.26	<0.001
Subarachnoid haemorrhage	4.50	1.73–11.73	0.002
Coagulopathy	4.48	1.35–14.88	0.014
Subdural haematoma	3.04	1.07–8.61	0.037
Marshall category	1.82	1.33–2.50	<0.001
Glasgow Coma Scale	0.59	0.42–0.83	0.002

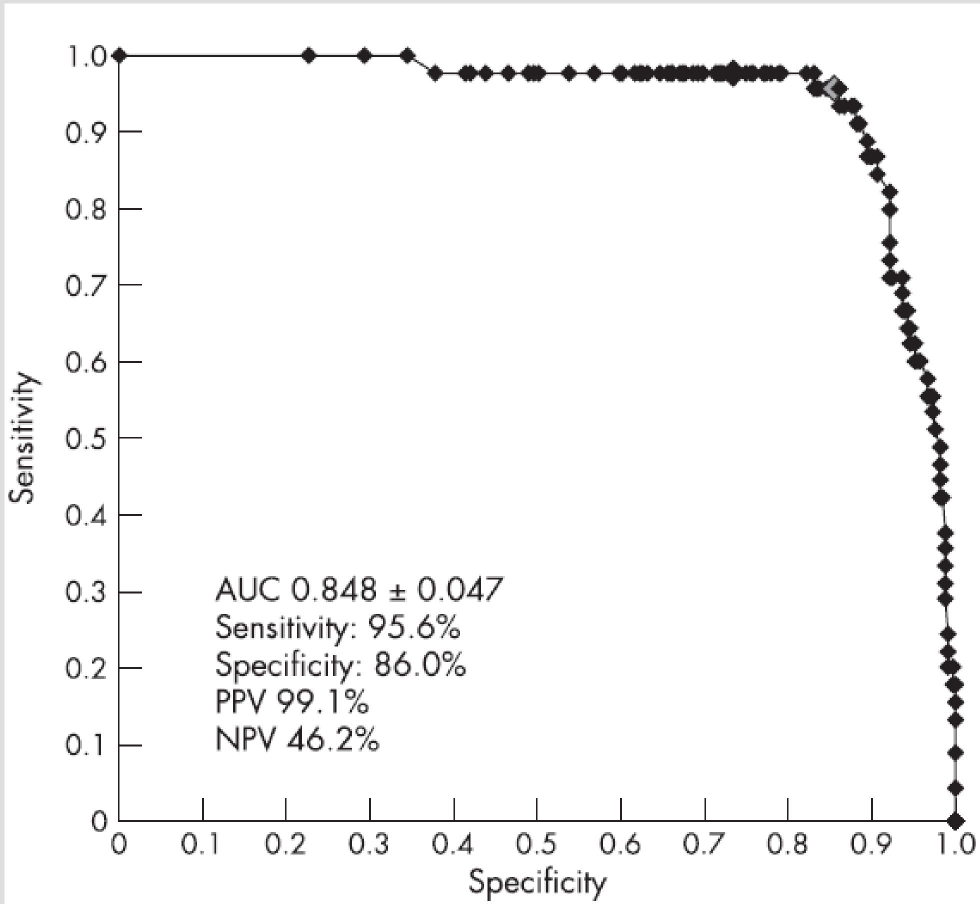
Variables not included in the multivariable analysis: depressed skull fracture, intracerebral haematoma/contusion, epidural haematoma, intraventricular haematoma, Injury Severity Score >15, age, co-morbidity, alcohol and/or drugs of abuse intoxication, high-risk characteristics of injury, male sex, hypoxia, hypotension, CT scan deterioration during clinical course.
Marshall category and Glasgow Coma Scale were considered to be continuous variables; basal skull fracture, subarachnoid haemorrhage, subdural haematoma and coagulopathy were considered to be dichotomised variables.

*A. Fabbri **JNNP** 2008*

JNNP ONLINE

Early predictors of unfavourable outcome in subjects with moderate head injury in the emergency department

A Fabbri, F Servadei, G Marchesini, S C Stein and A Vandelli



*A. Fabbri **JNNP** 2008;79: 567-573*

Quale tipo di osservazione ?...

	Neurosurgical Unit (N = 152)	Periferal Hospital (N = 713)
Males	120 (78.9%)	450 (63.3%)
Age (median: IQR)	44 (30 – 66)	59 (35 – 79)
Charlson Score	1 (0 – 2)	0 (0 – 1)
INR > 2.0	16 (10.5%)	49 (6.9%)
Coma Scale		
15 – 14	109 (71.7%)	591 (82.9%)
13 – 11	36 (23.7%)	85 (11.0%)
10 – 9	23 (15.1%)	37 (5.2%)
Injury Severity Score	17 (17 – 19)	16 (11 – 18)
Marshall Category		
Category 2	62 (40.8%)	557 (78.1%)
Category 3	69 (45.4%)	127 (17.8%)
Category 4	21 (13.8%)	30 (4.2%)
Basal Skull Fracture	24 (15.8%)	60 (8.4%)
Epidural Haemorrhage	26 (17.1%)	13 (1.8%)
Subdural Haematoma	100 (65.8%)	258 (36.2%)
Intracerebral Haematoma / Contusion	64 (42.1%)	475 (66.6%)

*A.Fabbri **JNNP** 2008;79:1180-1185*

JNNP ONLINE

Observational approach to subjects with mild-to-moderate head injury and initial non-neurosurgical lesions

A Fabbri, F Servadei, G Marchesini, S C Stein and A Vandelli

Table 2 Multivariate logistic regression model of main variables considered for admission for observation to a neurosurgical unit versus a peripheral hospital in patients with intracranial injury after mild-to-moderate head injury

Covariates	Odds Ratio (95% CI)	p Value
Age	0.98 (0.97–0.99)	<0.001
Charlson Score	0.93 (0.80–1.09)	0.375
INR	1.47 (0.95–2.28)	0.081
Injury Severity Score	0.95 (0.91–0.99)	0.022
GCS	0.88 (0.77–1.01)	0.078
BSF	1.04 (0.55–1.97)	0.909
Marshall Category	3.07 (2.19–4.29)	<0.001
SDH	5.32 (2.86–9.87)	<0.001
EDH	21.89 (8.12–59.04)	<0.001
ICH	0.93 (0.54–1.60)	0.796

Age, Charlson score, INR, Marshall category and GCS were considered as continuous variables; BSF, SDH, EDH and ICH were considered as dichotomized variables.
BSF, basal skull fracture; EDH, epidural haemorrhage; GCS, Glasgow Coma Scale; ICH, intracerebral haematoma/contusion; INR, Injury Severity Score; SDH, subdural haematoma.

*A.Fabbri **JNNP** 2008;79:1180-1185*

Observational approach to subjects with mild-to-moderate head injury and initial non-neurosurgical lesions

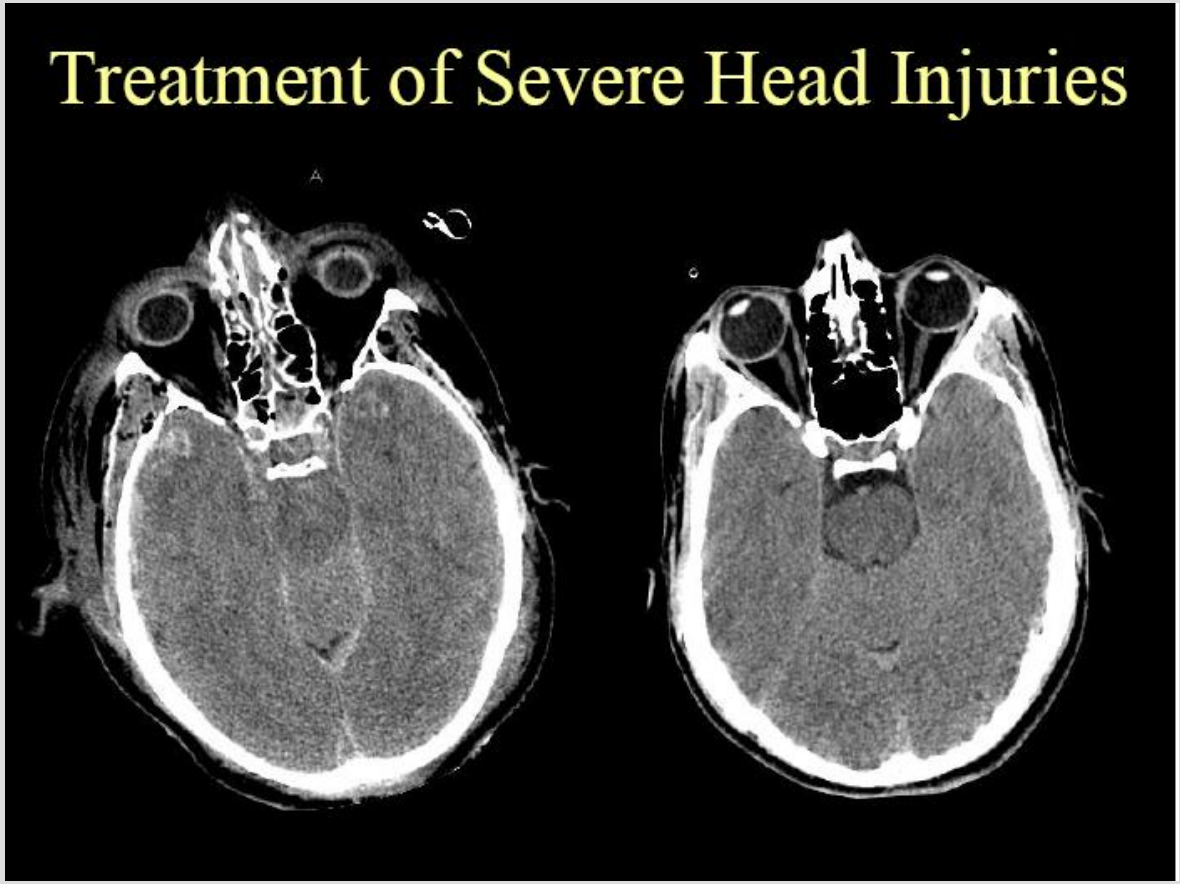
A Fabbri, F Servadei, G Marchesini, S C Stein and A Vandelli

JNNP ONLINE

Strata	Propensity Score	NSU Disposition	PH Disposition	Odds Ratio	95% CI	P value
1	0.0124 – 0.0694	8	280	0.00	0.00 -	0.999
2	0.0694 – 0.1529	31	258	2.28	0.67 – 7.74	0.185
3	0.1544 – 0.9949	113	175	0.76	0.37 – 1.58	0.470
All cases		152	713	0.92	0.49 – 1.75	0.810

Interpretation: A model of care based on observation in PH with neurosurgical consult by teleradiology system, repeat CT scanning and transfer time 30–60 min to a NSU is not detrimental for subjects with initial non-neurosurgical lesions after mild-to-moderate head injury.

A.Fabbri ***JNNP*** *2008;79:1180-1185*



GCS 8 – 3: (GCS 9-10 ??) stato di coma, non risponde agli stimoli dolorosi se non con flessione o estensione abnorme.

Priorità Gestione

A	B	C

TC cerebrale, V_NCH / Neuro_Intesivista con ricovero in ICU.
Esame neurologico (GCS e segni di lato) ogni 60 min (se sedazione finestra ogni 8 hr)

Pathophysiology of brain injury

- Primary insult:
  - Direct tissue damage at the time of impact
  - Treatment goal: injury prevention
- Secondary insult:
  - Tissue injury occurring after the initial injury due to multiple causes
  - Treatment goal: prevent these types of insults with appropriate treatment

JOURNAL OF NEUROTRAUMA 27:1233–1241 (July 2010)

DOI: 10.1089/neu.2009.1216

Inappropriate Prehospital Ventilation in Severe Traumatic Brain Injury Increases In-Hospital Mortality

Travis M. Dumont,[1] Agostino J. Visioni,[1] Anand I. Rughani,[1] Bruce I. Tranmer,[1] and Bruce Crookes[2]

Patients are not intubated by first responders or during transport at our hospital, thus no patients in this group were intubated prior to arrival at the hospital. Patients receive manual bag-mask breaths throughout transport to the trauma center. Routine trauma protocol is for arterial blood gas to be

Our findings indicate: (1) hypocarbia/hyperventilation and hypercarbia/hypoventilation following TBI increases the risk of in-hospital mortality; and (2) normocarbia following TBI decreases the risk of in-hospital mortality.

Prehospital Intubation in Head Injured Patients: ↑ Risk of Death

- ↑ mortality with hypocapnia ($pC0_2$ <27mm Hg)
  - Odds ratio = 3.4 (Davis, J Trauma 2004; 57:1)
- ↑ mortality with one episode of hypoxia
  - Odds ratio = 2.66 (Chi, J Trauma 2006; 61:1134)
- ↑ mortality with hyperventilation (77%) or hypoventilation (61%) compared to normal ventilated patients (15%) (Dumont, J Neurotrauma 2010)
- ↑ mortality with abnormal ventilation as compared to burn patients – Peng, Ann Emerg Med, 2009; 54:S139

Opening Questions …

- Querelle sulla intubazione
- Esiste l’ipossia e l’ipercapnia
- Esiste un effetto della $paCO_2$ sul volume ematico cerebrale che può essere rilevante
- Esiste un effetto cardiodepressore della iperventilazione e della ipocapnia che può essere rilevante
- Esistono limiti tecnologici e culturali sull’ approccio ventilatorio

polmonite

GOS 6 mesi

intubazione

ipotensione

ipossia

Pressione intratoracica

shivering

fighting

ventilazione

Pressione di Perfusione

M

paCO2

Volume Ematico Cerebrale

O

Cerebral
Blood Flow

ICP

Cerebral
Vascular
Resistance

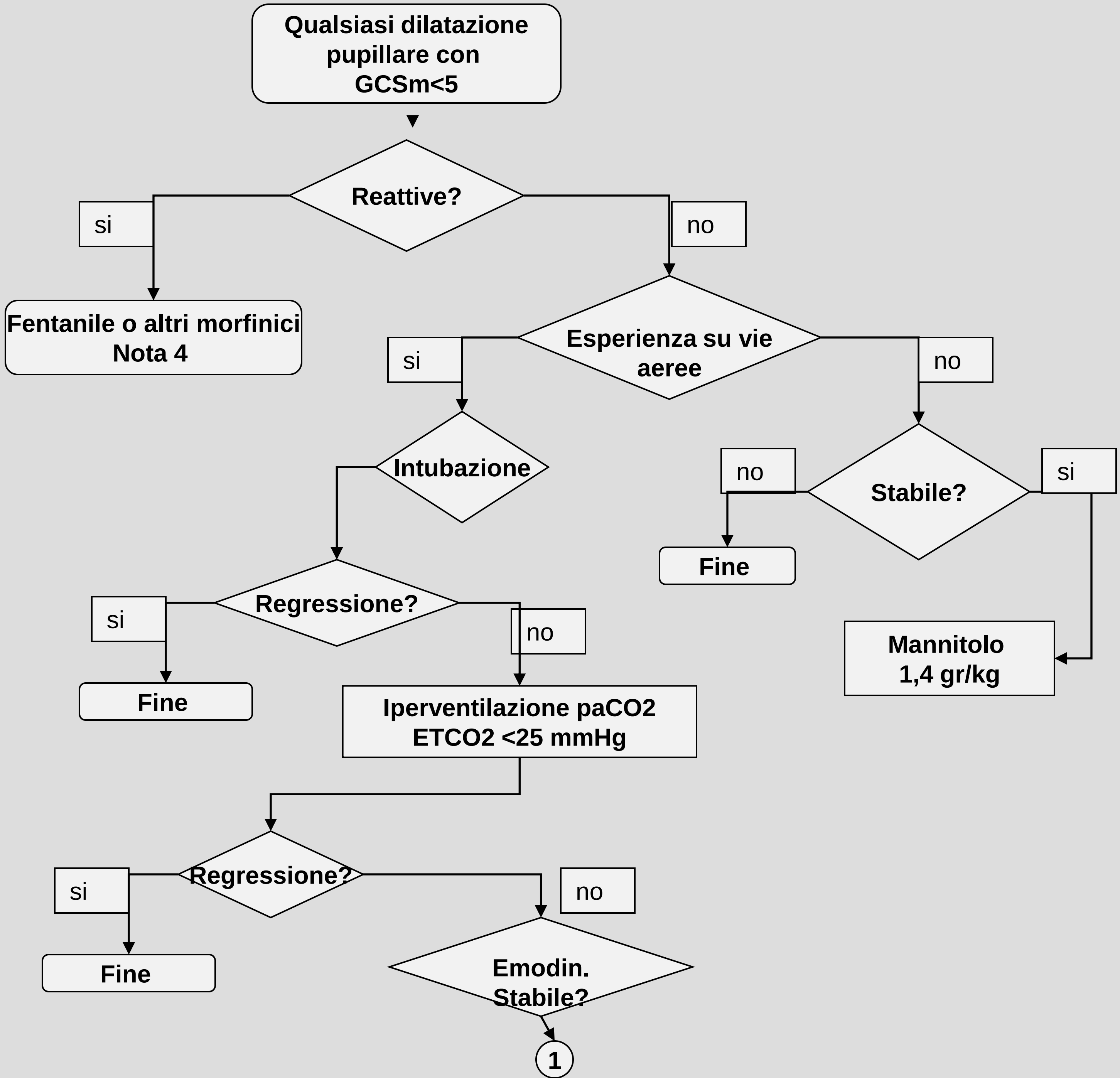
R

Cerebral Metabolic
Rate O2

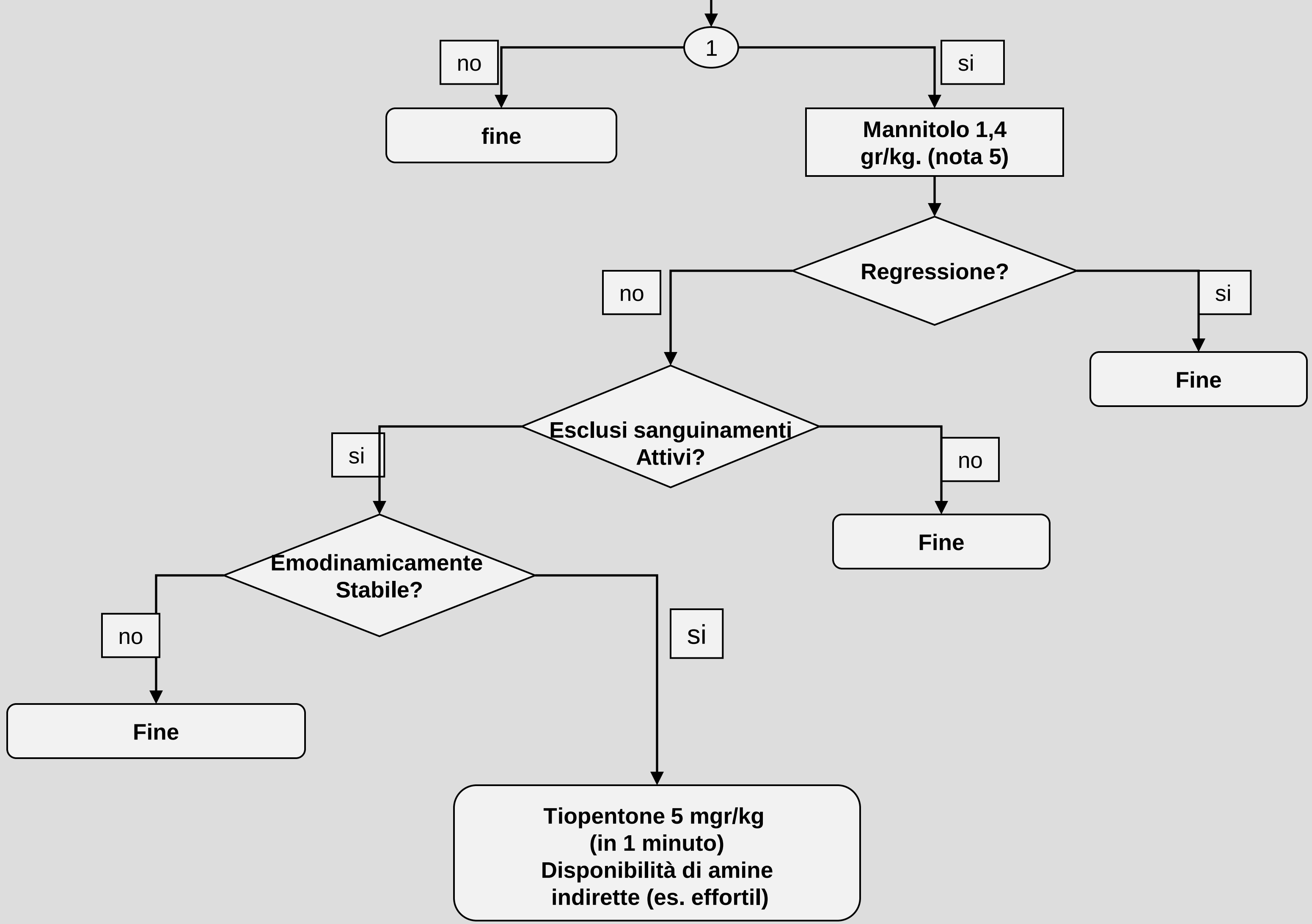
pupille

T

LITA' intraospedaliera



Qualsiasi dilatazione pupillare con GCSm<5
Reattive?
si
no
Fentanile o altri morfinici
Nota 4
Esperienza su vie aeree
si
no
Intubazione
Stabile?
no
si
Fine
Mannitolo 1,4 gr/kg
Regressione?
si
no
Fine
Iperventilazione paCO2 ETCO2 <25 mmHg
Regressione?
si
no
Fine
Emodin. Stabile?
1


1
no
si
fine
Mannitolo 1,4 gr/kg. (nota 5)
Regressione?
no
si
Fine
Esclusi sanguinamenti Attivi?
si
no
Fine
Emodinamicamente Stabile?
no
si
Fine
Tiopentone 5 mgr/kg (in 1 minuto) Disponibilità di amine indirette (es. effortil)

Trauma Pediatrico: un altro mondo, 0.5% delle prestazioni di PS, TC eseguite 10-20 % dei casi, TC positive 0.3%, interventi NCH <0.1%

	1	2	3	4	5	6
Eyes	Does not open eyes	Opens eyes in response to painful stimuli	Opens eyes in response to speech	Opens eyes spontaneously	N/A	N/A
Verbal	No verbal response	Inconsolable, agitated	Inconsistently inconsolable, moaning	Cries but consolable, inappropriate interactions	Smiles, orients to sounds, follows objects, interacts	N/A
Motor	No motor response	Extension to pain (decerebrate response)	Abnormal flexion to pain for an infant (decorticate response)	Infant withdraws from pain	Infant withdraws from touch	Infant moves spontaneously or purposefully

Performance of a Decision Rule to Predict Need for Computed Tomography Among Children With Blunt Head Trauma

Jennifer A. Oman, MD[a], Richelle J. Cooper MD, MSHS[b], James F. Holmes, MD[c], Peter Viccellio, MD[d], Andrew Nyce, MD[e], Steven E. Ross, MD[f], Jerome R. Hoffman, MD[b], William R. Mower, MD, PhD[b], for the NEXUS II Investigators

RESULTS. NEXUS II enrolled 1666 children, 138 (8.3%) of whom had clinically important ICI. The decision instrument correctly identified 136 of the 138 cases and classified 230 as low risk. A total of 309 children were younger than 3 years, among whom 25 had ICI. The decision instrument identified all 25 cases of clinically important ICI in this subgroup.

CONCLUSIONS. The decision instrument derived in the large NEXUS II cohort performed with similarly high sensitivity among the subgroup of children who were included in this study. Clinically important ICI were rare in children who did not exhibit at least 1 of the NEXUS II risk criteria.

Oman JA et al. ***Pediatrics*** 2007

Pediatric traumatic brain injury: an update of research to understand and improve outcomes

Recent findings

Advances have been made in defining the critical Glasgow Coma Score for predicting poor outcome and in developing the Relative Head Injury Severity Score, which can assess severity of traumatic brain injury from administrative datasets. More information regarding the radiation risks of head computed tomography imaging and guidelines for the appropriate use of imaging have recently been evaluated. Important steps have also been taken to reduce secondary brain injury through the use of hypertonic saline and induced hypothermia. There continues to be long-term neurodevelopmental deficits among survivors and new tools to assess these deficits have been developed and tested. Finally, increased investigation into understanding the impact of minority race and socioeconomic status has on outcome following traumatic brain injury has determined the existence of disturbing disparities.

Summary

Traumatic brain injury is the leading cause of mortality and is a major public health issue in the pediatric population. There have been many recent contributions in the diagnosis, treatment, and long-term morbidity of traumatic brain injury. Ongoing work is needed to improve outcomes of traumatic brain injury equitably for all patients.

Martin C ***Curr Op Pediatr.*** 2008

CATCH: a clinical decision rule for the use of computed tomography in children with minor head injury

Martin H. Osmond MD CM, Terry P. Klassen MD, George A. Wells PhD, Rhonda Correll RN, Anna Jarvis MD, Gary Joubert MD, Benoit Bailey MD, Laurel Chauvin-Kimoff MD CM, Martin Pusic MD, Don McConnell MD, Cheri Nijssen-Jordan MD, Norm Silver MD, Brett Taylor MD, Ian G. Stiell MD; for the Pediatric Emergency Research Canada (PERC) Head Injury Study Group

Box 1: Canadian Assessment of Tomography for Childhood Head injury: the CATCH rule

CT of the head is required only for children with minor head injury* and any one of the following findings:

High risk (need for neurologic intervention)

1. Glasgow Coma Scale score < 15 at two hours after injury
2. Suspected open or depressed skull fracture
3. History of worsening headache
4. Irritability on examination

Medium risk (brain injury on CT scan)

5. Any sign of basal skull fracture (e.g., hemotympanum, "raccoon" eyes, otorrhea or rhinorrhea of the cerebrospinal fluid, Battle's sign)
6. Large, boggy hematoma of the scalp
7. Dangerous mechanism of injury (e.g., motor vehicle crash, fall from elevation ≥ 3 ft [≥ 91 cm] or 5 stairs, fall from bicycle with no helmet)

Note: CT = computed tomography.
*Minor head injury is defined as injury within the past 24 hours associated with witnessed loss of consciousness, definite amnesia, witnessed disorientation, persistent vomiting (more than one episode) or persistent irritability (in a child under two years of age) in a patient with a Glasgow Coma Scale score of 13–15.

CMAJ 2010. DOI:10.1503/cmaj.091421

Trauma Update Bologna 17 Febbraio 2012: expert opinion

3.TRAUMA CRANICO MINORE: DIAGNOSTICA E CRITERI

La letteratura è molto ricca e numerosi sono gli algoritmi proposti per dare indicazioni all'esecuzione della TAC encefalo.
Ogni ospedale deve fare la sua scelta.

3.1. Per le indicazioni alla TAC encefalo:

- **Il panel consiglia: l' utilizzo di algoritmi decisionali sul trauma cranico lieve;** (riducono il ricorso ad esami radiologici che usano radiazioni ionizzanti [11,13], permettono di individuare i pazienti a maggior rischio di patologie intracraniche significative [1,2,3,4,5,6,7,8,14] , danno omogeneità al lavoro di gruppo, consentono di utilizzare linguaggi chiari e condivisi.
- **Il Panel consiglia: Per semplicità, applicabilità, metodologia dello studio, distinzione fra età > o < di 2 anni molti centri utilizzano l' algoritmo PECARN [6].**

PECARN BHT Study

- N=43,995 children,
- 57,158 eligible (77% enrolled)
- MOI: falls (48.1%), occupant in MVC (9.1%), ran into stationary objects (8.5%), object struck head (8.4%), sports (7.3%), assaults (7.3%), pedestrians (3.3%) or bicyclists (1.2%) struck by automobiles, and bicycle crashes (3.5%).

PECARN BHT

- 96.8% had GCS of 14 (3.1%) or 15 (93.7%).
- CTs were obtained in 36.8% (site-specific range: 9.7% - 71.1%), and were positive in 11.2% (30% of these were isolated skull fractures).
- Neurosurgery was performed on 0.5%, and 0.1% died from TBI.

PECARN Prediction Rules

Age younger than 2 years

- GCS < 15 or abnormal mental status
- Temporal/parietal/occipital scalp hematoma
- LOC > 5 seconds
- Severe mechanism of injury
- Palpable/suspected skull fracture
- Acting abnormal per parent

Kuppermann/Holmes/Dayan/Hoyle/Atabaki et al 2009

PECARN Prediction Rules

Age 2 years and older

- *GCS < 15 or abnormal mental status*
- *LOC*
- *History of emesis*
- *Severe mechanism of injury*
- *Signs of basilar skull fracture*
- *Severe headache*

Kuppermann/Holmes/Dayan/Hoyle/Atabaki et al 2009

Results: ciTBI

ciTBI = 62	Patients ≥ 2 years (n=6311)	
	Prediction rule	Clinician suspicion ≥1%
Sensitivity (95% CI)	96.8% (88.8%, 99.6%)	64.5% (51.3%, 76.3%)
Specificity (95% CI)	59.8% (58.5%, 61.0%)	90.6% (89.8%, 91.3%)

Results: ciTBI

ciTBI = 25	Patients < 2 years (n=2185)	
	Prediction rule	Clinician suspicion ≥1%
Sensitivity (95% CI)	100% (86.3%, 100%)	60.0% (38.7%, 78.9%)
Specificity (95% CI)	53.7% (51.5%, 55.8%)	92.4% (91.2%, 93.5%)

Applicability of the CATCH, CHALICE and PECARN paediatric head injury clinical decision rules: Pilot data from a single centre

Mark D Lyttle

John A Cheek, Carol Blackburn, Ed Oakley,

Brenton Ward, Amanda Fry, Kim Jachno, Franz E Babl

Emergency Department, Royal Children's Hospital, Melbourne

Paediatric Research in Emergency Departments International Collaborative (PREDICT)

Results

Overall applicability of clinical decision rules

Clinical decision rule	Potential number (n)	Applicable to (n)	Applicable to (%, 95% CIs)
CATCH	*949*	*250*	*26.3 (23.6-29.3)*
CHALICE	*949*	*922*	*97.2 (95.9-98.1)*
PECARN <2 years old	*203*	*155*	*76.4 (69.9-82.0)*
PECARN 2-<18 years old	*746*	*552*	*74.0 (70.7-77.1)*

The Effect of Observation on Cranial Computed Tomography Utilization for Children After Blunt Head Trauma

WHAT'S KNOWN ON THIS SUBJECT: Emergency-department observation of children with minor blunt head trauma for symptom progression before making a decision regarding computed tomography may decrease computed tomography use. The actual impact of this strategy on computed tomography use and clinical outcomes, however, is unknown.

WHAT THIS STUDY ADDS: Clinicians currently observe some children with head trauma before deciding whether to obtain a cranial computed tomography scan. Patients who were observed had a significantly lower rate of overall cranial computed tomography use after adjusting for markers of head injury severity.

Nigrovic LE, ***Pediatrics*** 2011

ORIGINAL ARTICLES

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Computed Tomography for Minor Head Injury: Variation and Trends in Major United States Pediatric Emergency Departments

Rebekah Mannix, MD, MPH[1], William P. Meehan, MD[1,2], Michael C. Monuteaux, ScD[1], and Richard G. Bachur, MD[1]

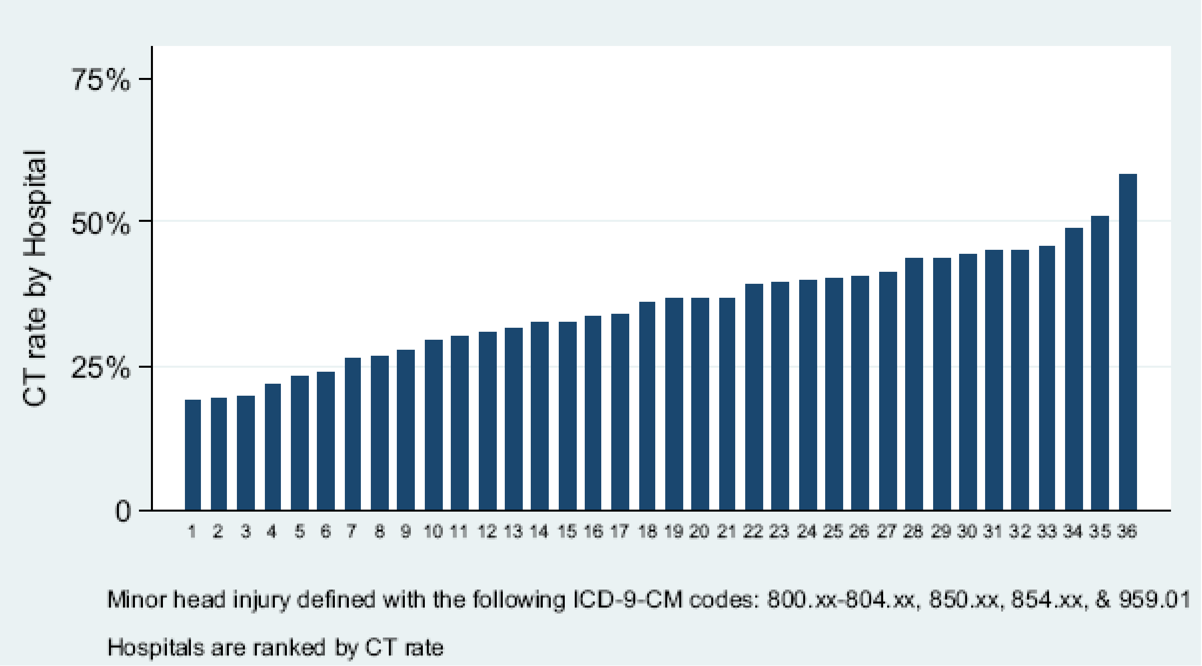

Figure 1. Rates of CT in pediatric patients with minor head injury discharged from the ED (n = 161 319) across a sample of pediatric hospitals in the US from 2005 to 2009.

Mannix R, *J. Pediatr* 2012