Traumatisme crânien chez l'enfant

Protocole de soins partagés
18e journée du GFRUP (27-28 Sept 2018)

Anne-Laure HERISSE, CCA
Antoine TRAN, PH
Service: Urgences Pédiatriques
Site: Hôpitaux Pédiatriques de Nice CHU-Lenval

Fondation Lenval
pour les enfants, depuis 1888
Hôpitaux Pédiatriques de Nice CHU-LENVAL

Tableau I
Score de Glasgow en fonction de l'âge.

Échelle de Glasgow standard (> 5 ans)	Échelle de Glasgow de 2 à 5 ans	Échelle de Glasgow de 0 à 2 ans
Ouverture des yeux		
4 – Spontanément	4 – Spontanément	4 – Spontanément
3 – Aux stimuli verbaux	3 – Aux stimuli verbaux	3 – Aux stimuli verbaux
2 – Aux stimuli douloureux	2 – Aux stimuli douloureux	2 – Aux stimuli douloureux
1 – Aucune réponse	1 – Aucune réponse	1 – Aucune réponse
Réponse verbale		
5 – Est orienté et parle	5 – Mots appropriés, sourit, fixe, suit du regard	5 – Agit normalement
4 – Est désorienté et parle	4 – Mots appropriés, pleure, est consolable	4 – Pleure
3 – Paroles inappropriées	3 – Hurle, est inconsolable	3 – Hurlements inappropriés
2 – Sons Incompréhensibles	2 – Gémit aux stimuli douloureux	2 – Gémissements (*grunting*)
1 – Aucune réponse	1 – Aucune réponse	1 – Aucune réponse
Réponse motrice		
6 – Répond aux demandes	6 – Répond aux demandes	6 – Mouvements spontanés intentionnels
5 – Localise ta douleur	5–Localise la douleur	5 – Se relire au toucher
4 – Se retire à la douleur	4 – Se retire à la douleur	4 – Se retire à la douleur
3 – Flexion à la douleur (décérébration)	3 – Flexion à la douleur (décérébration)	3 – Flexion à la douleur (décortication)
2 – Extension à la douleur (décérébration)	2 – Extension à la douleur (décérébration)	2 – Extension à la douleur (décérébration)
1 – Aucune réponse	1 – Aucune réponse	1 – Aucune réponse

Lorton et al. Arch Pediar 2014

Classification des TC (Glasgow)

Critères OMS/CDC (2003):
-Confusion/ désorientation
-Perte de connaissance <30mn
-Amnésie du TC <24h
-Signes neuro/neuropsy (signes focaux, convulsions)
-enfant: irritabilité, léthargie, vomissement
-GCS = 13-15 dans les 30mn après TC

https://www.cdc.gov/traumaticbraininjury/pdf/mtbireport-a.pdf

CATEGORIE	CRITERES
Minimal	G = 15 No loss of consciousness (PDC) No amnesia
Mild	G= 14 ou G = 15 et : -PDC < 5 min -Ou tb de la vigilance ou de la mémoire
Moderate	G= 9-13 ou PDC ≥ 5 min ou déficit neurologique focal
Severe	G= 5-8
Critical	G=3-4

Finalement:

TC léger

TC modéré

TC sévère

Handbook of neurosurgery, Greenberg, sixth edition.

Kuppermann N et al. Lancet 2009,

Le TC, c'est:

- 200-600 blessés/100 0000 patient (tt âge confondu)/an

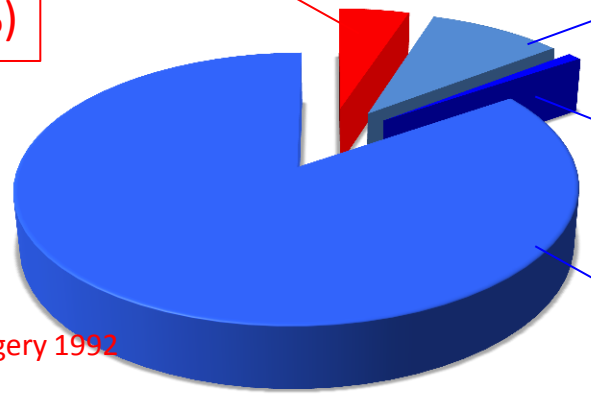
  (Rubiano et al. Nature 2015)

- 100-300 cs aux urg/100 000 (tt âge confondu)/an

  (Kraus et al. Neurol Clin 1996)

- trauma le + fréquent chez l'enfant

  (Segui-Gomez et al. Epidemiol Rev 2003)



TC grave (5%)

sous-estimée (décès avant l'arrivée à l'hôpital)

Levin HS et al. Neurosurgery 1992

TCL + lésion IC(<10%)

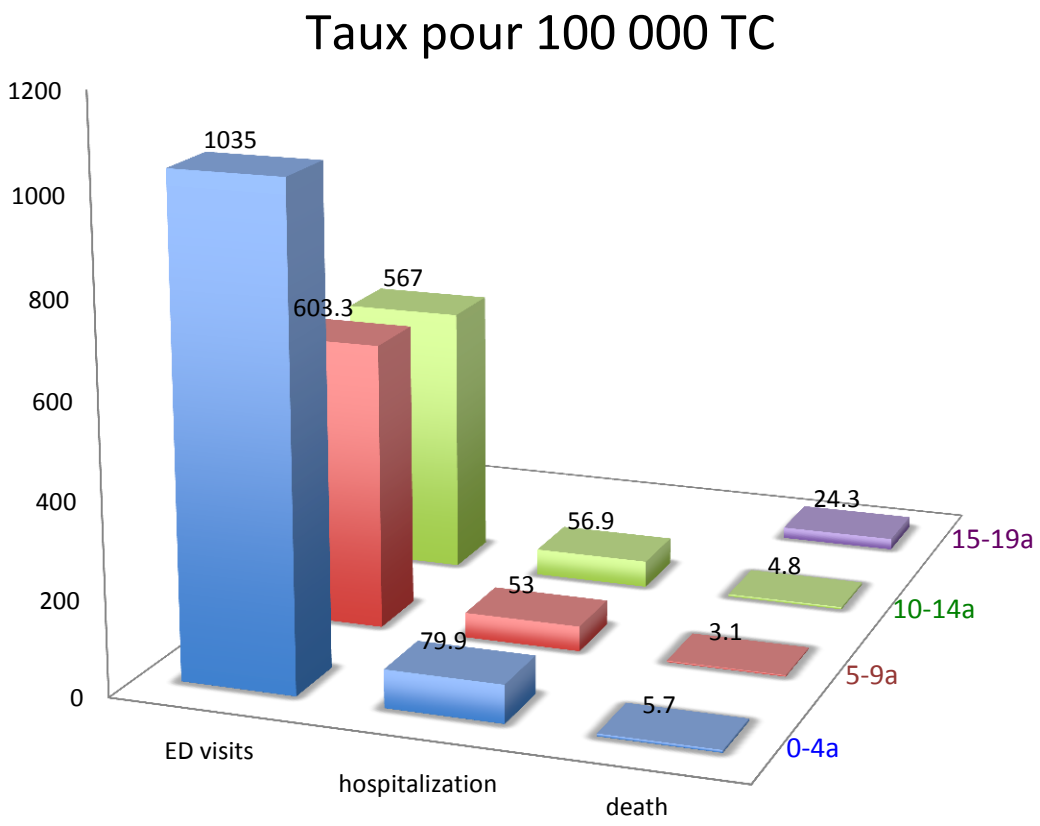
TCL + neurochir (<1%)

TCL ss lésion ni neurochir (<84%)

TC léger 95%

Dunning J et al. Arch Dis Child 2006,
Homer C.J et al. Pediatrics 1999,
Kuppermann N et al. Lancet 2009,
Pandor A et al . Health Technol Assess Winch Engl 2011

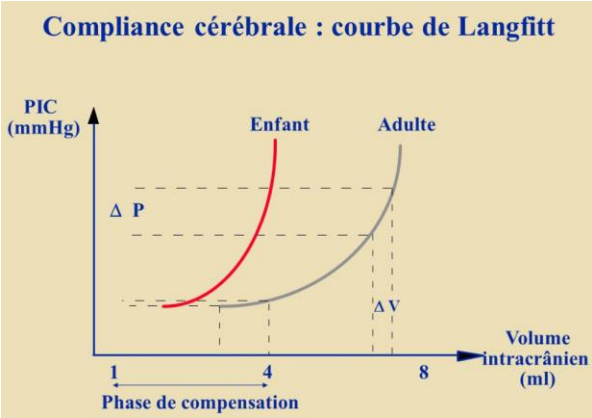
TC & morbi-mortalité



- 1ere cause de mortalité chez les >1an dans les pays dev (Segui-Gomez et al. Epidemiol Rev 2003)
- accidents de la voie publique sont les plus meurtriers chez les enfants
- lésions cérébrales sont le plus souvent diffuses
- déficiences multiples, notamment motrices, cognitives et comportementales (Giza CC et al. Curr Opin Crit Care 2007)

Langlois et al. J Head Trauma Rehabil 2005

TC chez l'enfant



Dure mère + fixée

Cerveau +riche en eau, moins myélinisé,

métabolisme intense, en développement = risque + important d' œdème cérébral

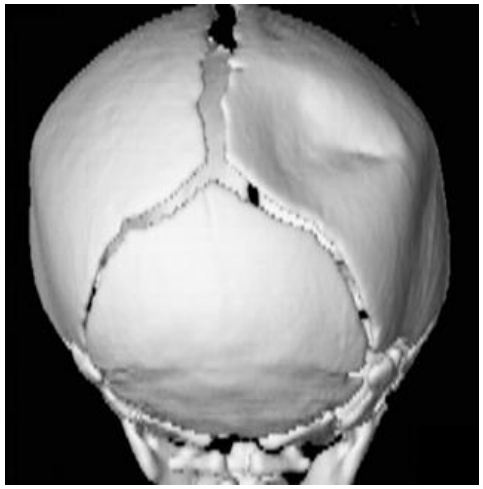
Boite crânienne élastique

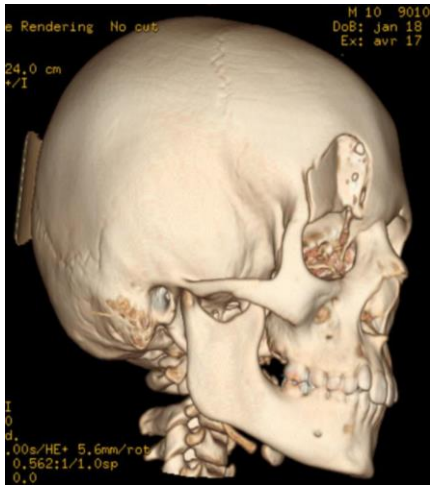
Tête + lourde

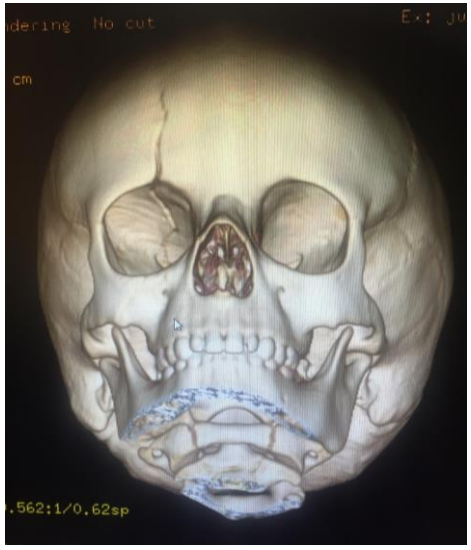
Extrémité céphalique + importante

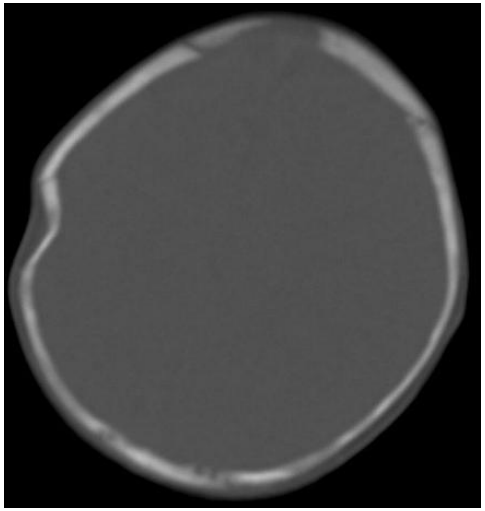
Cou moins musclé

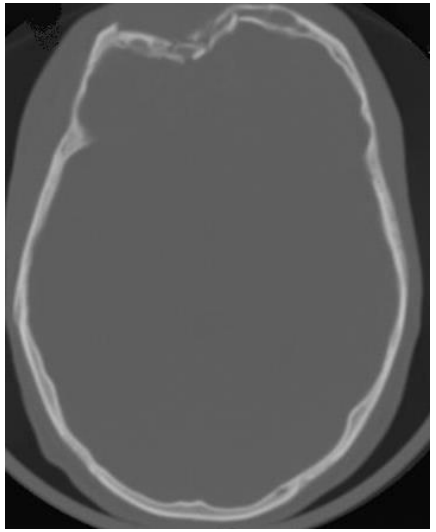
TC & fractures











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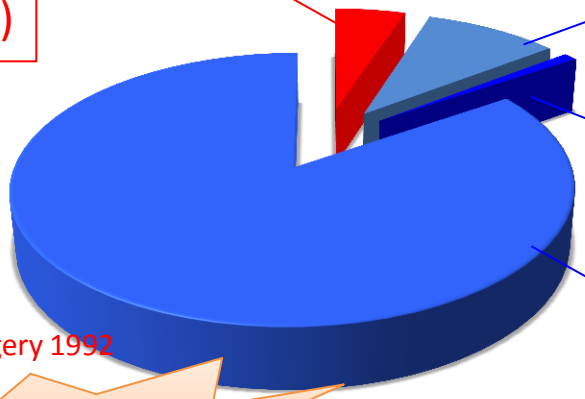


THERAPEUTIQUE

TCL + lésion IC(<10%)

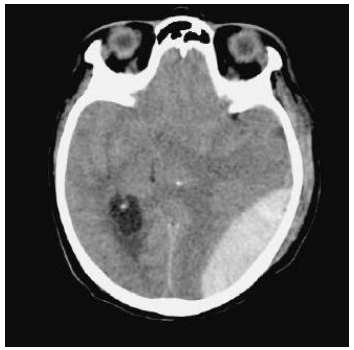
TCL + neurochir (<1%)

TCL ss lésion ni neurochir (<84%)

TC léger 95%

Dunning J et al. Arch Dis Child 2006,
Homer C.J et al. Pediatrics 1999,
Kuppermann N et al. Lancet 2009,
Pandor A et al . Health Technol Assess Winch Engl 2011

TC GRAVE

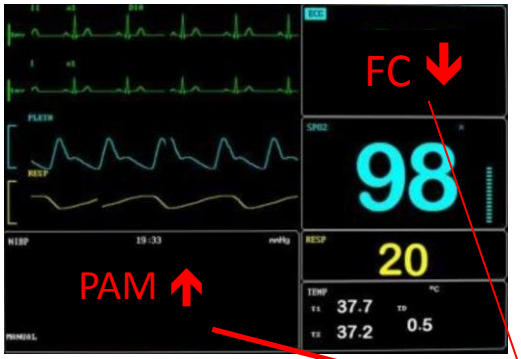


TC Grave & HTIC

Chez le NRS <1an

- fontanelle antérieure bombée
- distension des sutures

- Céphalées
- Altération de la conscience
- yeux en coucher de soleil
- Hoquet, bâillement
- Nausée, vomissements



Hémodynamique

Recommandations TCG en pédiatrie

- Guidelines for the acute medical management of severe traumatic brain injury in infants, children, and adolescents
  - Adelson PD et al. Pediatr Crit Care Med J 2003,
  - Kochanek PM et al. Pediatr Crit Care 2012,
  - Hardcastle N et al. Paediatr Anaesth 2014)

- Eviter l'apparition de lésions ischémiques secondaires sans favoriser la formation de l'œdème cérébral

- Recherche des meilleures pressions de perfusion cérébrale (PPC)

PPC = PAM – PIC

Chapter 8. Cerebral perfusion pressure
NRS: PPC > 40 mmHg
Enfant: PPC > 60 mmHg

Chapter 6. Threshold for treatment of intracranial hypertension
Traiter si PIC > 20mmHg

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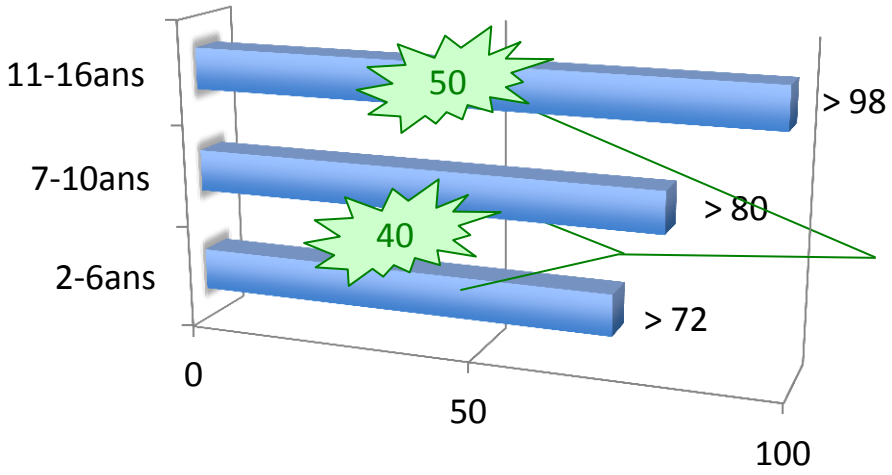
Traiter si PIC > 20mmHg

Bon pronostic pour des valeurs PPC en mmHg
(Chambers et al. J Neurosurg 2001)



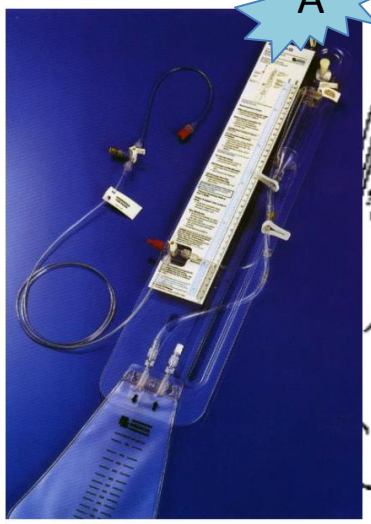
Seuil critiques mauvais
(pronostic neurologique)
(Javouhey et al. Ped crit care med 2009)

Monitorage de la PIC

Cathéter ventriculaire — A

- ✓ le + précis
- ✓ Fiable
- ✓ "Low cost"
- ✓ drainage LCR
- ✓ Gold standard PIC

- ✓ Hémorragie (17.6%)
- ✓ Infections (1.6%)
- ✓ Malposition (8.8%)



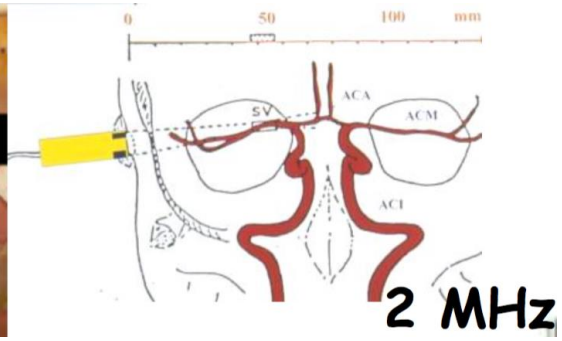
Cathéter parenchymateux — B

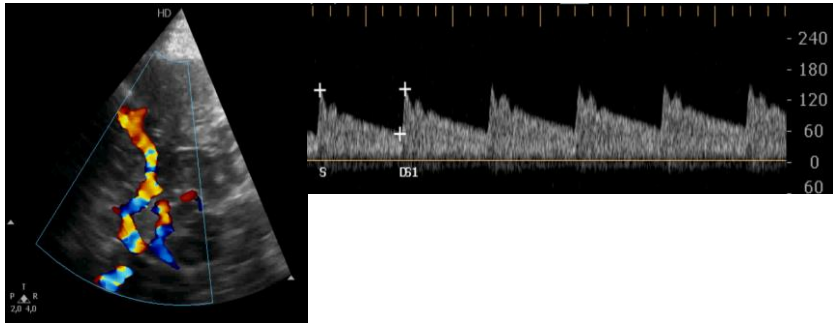
- ✓ Facile à insérer/utiliser
- ✓ Dérive de mesure

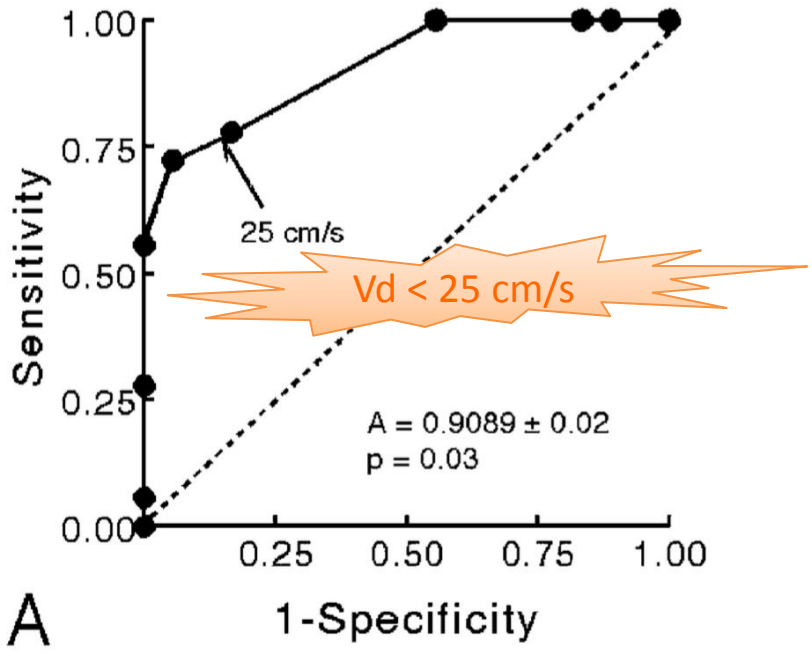
- ✓ moins fiable
- ✓ + cher

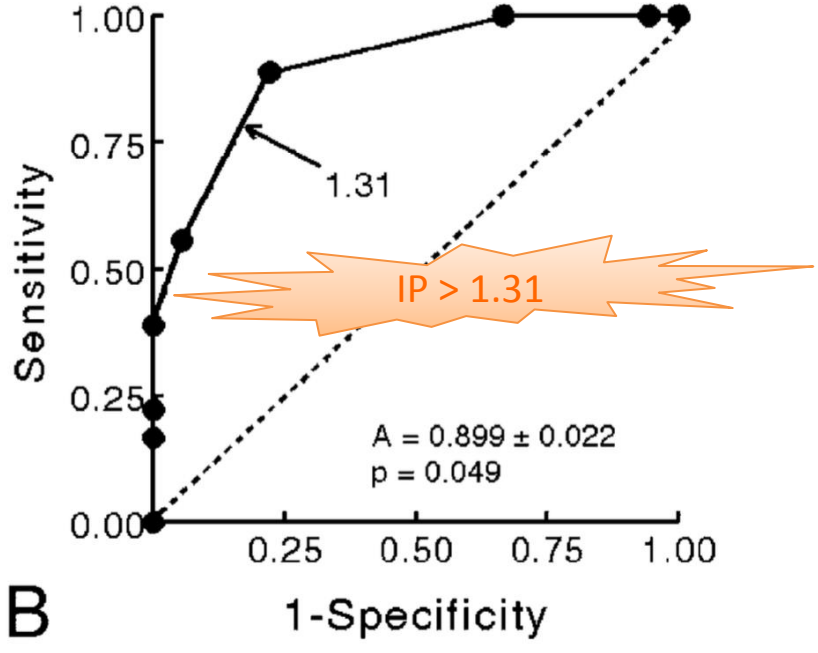
Richard et al. Neurosurg. 2004

TC & Doppler Transcrânien (DTC)



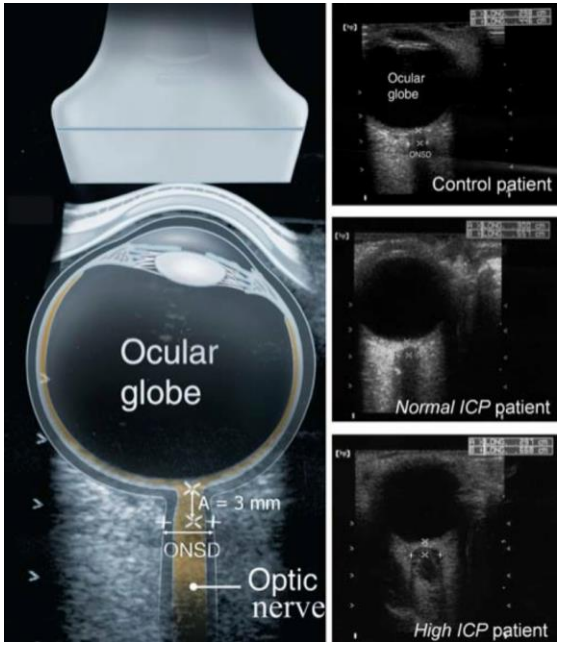






Trabold et al. Intensive Care Med 2004

TC & mesure échographique Trans orbitaire du diamètre de la gaine du nerf optique



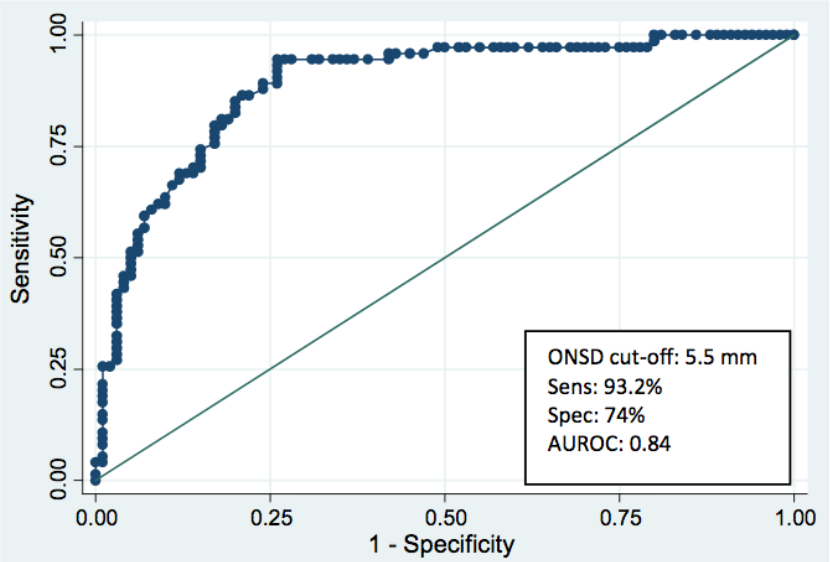


Fig. 3 AUROC for ONSD of 0.55 cm to detect ICP ≥ 20 mmHg

Table 6 Diagnostic accuracy of ONSD for detecting ICP ≥ 20 mmHg in different aetiological groups

Aetiology	ONSD cutoff value	Sensitivity% (95 % CI)	Specificity% (95 % CI)	PPV% (95 % CI)	NPV% (95 % CI)	AUROC (95 % CI)	OR (95%CI)
Hydrocephalus	5.50	91.9 (78.1–98.3)	83.6 (71.2–92.2)	79.1 (64–90)	93.9 (83.1–98.7)	0.88 (0.81–0.94)	57.90 (15.2–216)
TBI	5.79	80.0 (44.4–97.5)	65 (40.8–84.6)	53.3 (26.6–78.7)	86.7 (59.5–98.3)	0.73 (0.56–0.89)	7.43 (1.33–39.4)
Craniosynostosis	6.17	85.7 (42.1–99.6)	88.9 (51.8–99.7)	85.7 (42.1–99.6)	88.9 (51.8–99.7)	0.87 (0.7–1)	48.00 (3.09–100)
Intracranial cysts	4.50	50 (1.26–98.7)	20 (6.67–65.2)	12.5 (3.16–52.7)	75 (19.4–99.4)	0.4 (0–0.912)	0.43 (0–100)
Other	5.50	100 (15.8–100)	83.3 (35.9–99.6)	66.7 (9.43–99.2)	100 (47.8–100)	0.92 (0.75–1)	N/A

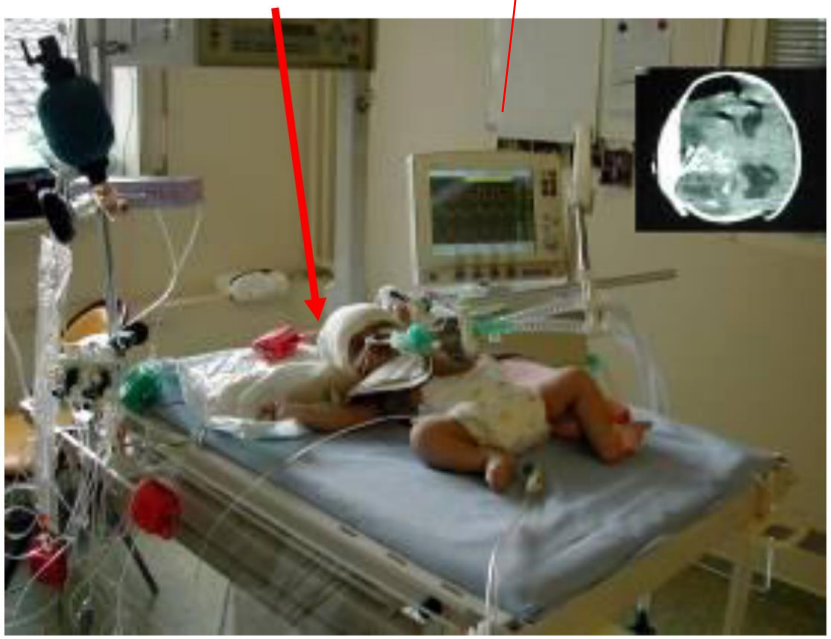
Padayachy et al. Childs Nerv Syst 2016

Traitement de l'HTIC
Maintien de la PPC = PAM - PIC

Mesures générales:
- Analgésie – sédation
- Tête en rectitude
- Eviter compression jugulaire
- Lutte Vs ACSOS

Hémodynamique:
Normovolémie
Vasopresseur = Noradrénaline
(début à 0.1-0.2 µg/kg/min

Traiter l'HIC patente:
- Hyperventilation
- Osmothérapie
- Neurochirurgie
  - Drainage LCR
  - Craniectomie
- Hypothermie
- Barbiturique



Chapter 12. Use of hyperventilation in the acute management of severe pediatric traumatic brain injury

(Adelson PD et al. Pediatr Crit Care Med 2003)

A. Standards. There are insufficient data to support a treatment standard for this topic.

B. Guidelines. There are insufficient data to support a treatment guideline for this topic.

C. Options. Mild or prophylactic hyperventilation ($Paco_2$ <35 mm Hg) in children should be avoided.

Mild hyperventilation ($Paco_2$ 30–35 mm Hg) may be considered for longer periods for intracranial hypertension refractory to sedation and analgesia, neuromuscular blockade, cerebrospinal fluid drainage, and hyperosmolar therapy.

Aggressive hyperventilation ($Paco_2$ <30 mm Hg) may be considered as a second tier option in the setting of refractory hypertension. Cerebral blood flow (CBF), jugular venous oxygen saturation, or brain tissue oxygen monitoring is suggested to help identify cerebral ischemia in this setting.

Niv de preuve: III

NORMOVENTILATION+++

Objectifs:

- 35 < EtCO2 < 38 mmHg
- PaO2 > 100 mmHg

- Eviter hyperventilation PaCO2<30 mmHg
- Si Hyperventilation nécessaire = neuromonitorage avancé

Chapter 11. Use of hyperosmolar therapy in the management of severe pediatric traumatic brain injury

(Adelson PD et al. Pediatr Crit Care Med 2003)

A. Standards. There are insufficient data to support a treatment standard for this topic.

B. Guidelines. There are insufficient data to support a treatment guideline for this topic.

C. Options. Hypertonic saline is effective for control of increased intracranial pressure (ICP) after severe head injury. Effective doses as a continuous infusion of 3% saline range between 0.1 and 1.0 mL/kg of body weight per hour, administered on a sliding scale. The minimum dose needed to maintain ICP <20 mm Hg should be used. Pending multiple-center confirmation of effectiveness and lack of toxicity, caution should be exercised in widespread adoption of this therapy.

Mannitol is effective for control of increased ICP after severe traumatic brain injury (TBI). Effective bolus doses range from 0.25 g/kg of body weight to 1 g/kg of body weight.

Euvolemia should be maintained by fluid replacement. A Foley catheter is recommended in these patients to avoid bladder rupture.

Serum osmolarity should be maintained below 320 mOsm/L with mannitol use, whereas a level of 360 mOsm/L appears to be tolerated with hypertonic saline, even when used in combination with mannitol.

Niv de preuve: III

Envisagez SSH 3% en cas d'HTIC

Bolus initial:

6.5-10 ml/kg

Perfusion d'entretien:

0.1-1 ml/kg/h

QSP PIC < 20mmHg

Osmolarité sérique <360 mOsm/L

Mannitol

Utilisation courante

Mais pas de données

Bolus 0.5-1 g/kg/4-6h

Osmolarité sérique <320 mOsm/L

Chapter 14. The role of temperature control following severe pediatric traumatic brain injury

(Adelson PD et al. Pediatr Crit Care Med 2003)

A. Standards. There are insufficient data to support a treatment standard for this topic.

B. Guidelines. There are insufficient data to support a treatment guideline for this topic.

C. Options. Extrapolated from the adult data, hyperthermia should be avoided in children with severe traumatic brain injury (TBI).

Despite the lack of clinical data in children, hypothermia may be considered in the setting of refractory intracranial hypertension.

Niv de preuve: III

L'hypothermie modérée (32-33°C) débutée tôt après TCG pour 24h doit être évitée

L'hypothermie modérée (32-33°C) débutée dans les 8h après TCG pour une durée <48H peut être envisagée pour réduire l'HTIC

Quelle que soit l'indication, réchauffement < 3°C/h

Chapter 13. The use of barbiturates in the control of intracranial hypertension in severe pediatric traumatic brain injury

(Adelson PD et al. Pediatr Crit Care Med 2003)

A. Standards. There are insufficient data to support a treatment standard for this topic.

B. Guidelines. There are insufficient data to support a treatment guideline for this topic.

C. Options. High-dose barbiturate therapy may be considered in hemodynamically stable patients with salvageable severe head injury and refractory intracranial hypertension.

If high-dose barbiturate therapy is used to treat refractory intracranial hypertension, then appropriate hemodynamic monitoring and cardiovascular support are essential.

Niv de preuve: III

Barbiturique fortes doses

- Chez des patients hémodynamiquement stables qui développent une HTIC réfractaire malgré un ttt maximal

- Un monitorage artériel continu et un support cardiovasculaire sont nécessaires pour maintenir une PPC adéquate

Pediatr Crit Care Med. 2003 Jul;4(3 Suppl):S56-9.

Guidelines for the acute medical management of severe traumatic brain injury in infants, children, and adolescents. Chapter 15. Surgical treatment of pediatric intracranial hypertension.

Adelson PD[1], Bratton SL, Carney NA, Chesnut RM, du Coudray HE, Goldstein B, Kochanek PM, Miller HC, Partington MD, Selden NR, Warden CR, Wright DW; American Association for Surgery of Trauma; Child Neurology Society; International Society for Pediatric Neurosurgery; International Trauma Anesthesia and Critical Care Society; Society of Critical Care Medicine; World Federation of Pediatric Intensive and Critical Care Societies.

Niv de preuve: ?

Practice guidelines for physicians who treat children with brain trauma are long overdue. A significant barrier to producing guidelines has been the lack of data from well-designed, controlled studies that address each specific juncture of the acute treatment phase. Our goal with this document was to assimilate the scarce data that exist and present it within an evi based framework in order to provide ment guidelines. With

Cependant…
Craniectomies décompressive

À envisager en cas de signes précoces détérioration ou d'engagement ou d'HTIC réfractaire au traitement médical

PHRC-N 2017
"RANDECPED"
Intérêt de la craniectomie décompressive dans le traumatisme crânien sévère de l'enfant avec hypertension intracrânienne réfractaire

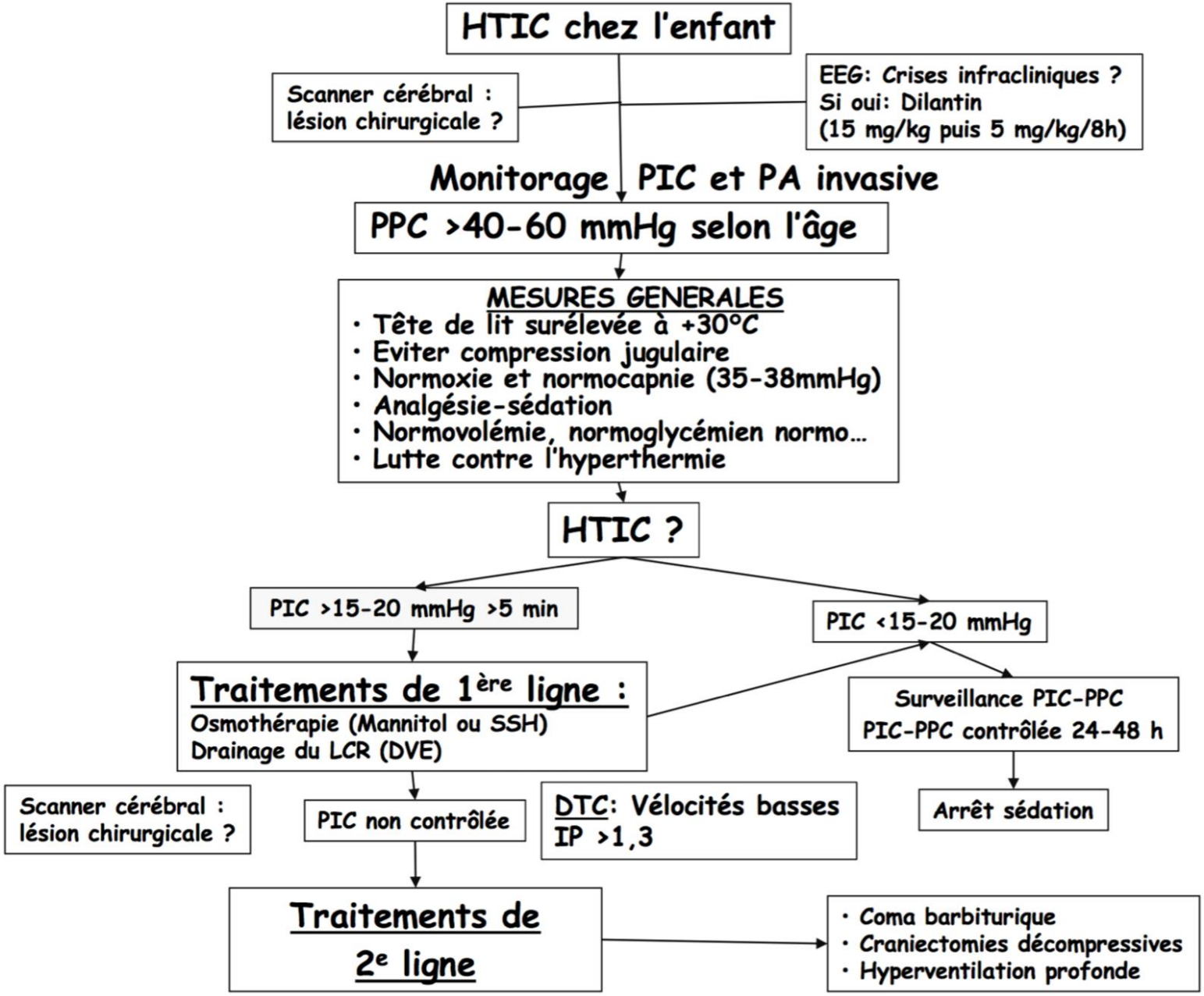
CHU-Lenval NICE
PI: Pr LONJON M

Table 1 Summary of the recommendation from the 2012 *Guidelines for the Acute Medical Management of Severe TBI in Infants, Children, and Adolescents*

Physiologic parameters	Recommendations	Level of evidence
Intracranial pressure	Consider ICP monitoring in infants and children with severe TBI	III
	Treatment of ICP may be considered at a threshold of 20 mmHg	III
Cerebral perfusion pressure[a]	A minimum CPP of 40 mm Hg may be considered in children with TBI	III
	A CPP threshold of 40–50 mmHg may be considered; there may be age-specific thresholds with infants at the lower end and adolescents at the upper end of this range	III
Brain oxygenation	If brain oxygen monitoring is used, maintenance of oxygen tension ≥10 mm Hg may be considered	III
Hyperosmolar therapy[a]	3% hypertonic saline (0.1 and 1 $ml \cdot kg^{-1}$ of body weight per hr) should be considered for the treatment of intracranial hypertension	III
	Footnote: no studies of mannitol met the inclusion criteria as evidence for this topic	
Hyperventilation[a]	Avoidance of prophylactic severe hyperventilation to a PaCO2 < 30 mm Hg may be considered in the initial 48 h after injury	III
	If hyperventilation is used in the management of refractory intracranial hypertension, advanced neuromonitoring for evaluation of cerebral ischemia may be considered	III
Temperature control[a]	Moderate hypothermia (32–33°C) beginning early after severe TBI for only 24-h duration should be avoided	II
	Moderate hypothermia (32–33°C) beginning within 8 hrs after severe TBI for up to 48-h duration should be considered to reduce intracranial hypertension	II
	If hypothermia is induced for any reason, rewarming at a rate of 0.5°C per h should be avoided	II
Cerebrospinal fluid drainage	CSF drainage through an external ventricular drain may be considered in the management of increased ICP	III
	The addition of a lumbar drain may be considered in the case of refractory intracranial hypertension with a functioning external ventricular drain, open basal cisterns, and no evidence of a mass lesion or shift on imaging studies	III
Barbiturates	High-dose barbiturate therapy may be considered in hemodynamically stable patients with refractory intracranial hypertension despite maximal medical and surgical management	III
	When high-dose barbiturate therapy is used to treat refractory intracranial hypertension, continuous arterial blood pressure monitoring and cardiovascular support to maintain adequate cerebral perfusion pressure are required	III
Corticosteroids[a]	The use of corticosteroids is not recommended to improve outcome or reduce ICP for children with severe TBI	II
Analgesics, sedatives, and neuromuscular blockade[a]	Etomidate may be considered to control severe intracranial hypertension; however, the risks resulting from adrenal suppression must be considered	III
	Thiopental may be considered to control intracranial hypertension	III
	Footnote: the specific indications, choice and dosing of analgesics, sedatives, and neuromuscular-blocking agents used in the management of infants and children with TBI should be left to the treating physician	
	As stated by the FDA, a continuous infusion of propofol for either sedation or the management of refractory intracranial hypertension in infants and children with severe TBI is not recommended	
Antiseizure prophylaxis[a]	Prophylactic use of antiseizure therapy is not recommended for children with severe TBI for preventing late posttraumatic seizures	III
	Prophylactic antiseizure therapy may be considered as a treatment option to prevent early posttraumatic seizures in young pediatric patients and infants at high risk of seizures after head injury	III
Nutrition[a]	Evidence does not support the use of immune-modulating diet to improve outcome	II
Decompressive craniectomy	Decompressive craniectomy with duraplasty may be considered for patients who are showing early signs of neurologic deterioration or herniation or are developing intracranial hypertension refractory to medical management during the early stages of their treatment	

CPP, cerebral perfusion pressure.
[a]Starred items were changes in recommendations from the first edition to the second edition.

Hardcastle et al. Paediatr Anaesth 2014



(Pr ORLIAGUET – Conf HTIC – DIU Urgences et Réanimation pédiatrique 2016)

TC GRAVE EN PRE-HOSPITALIER

First responder performance in pediatric trauma: A comparison with an adult cohort*

Bankole et al. Pediatr Crit Care Med 2011

Table 1. Adult vs. children: Interventions

	Adult	Children	*p*
Revised sample size	99 (49.3%)	102 (50.7%)	
Average age (yrs)	34.05	6.03	
Gender			
Female	23 (23.2%)	45 (44.1%)	
Male	76 (76.8%)	57 (55.9%)	
Head injury severity			
GCS–3–8	47 (47.5%)	39 (38.2%)	.202
GCS–9–11	13 (13.1%)	22 (21.6%)	.138
GCS–12–14	39 (39.4%)	41 (40.2%)	1.000
Mechanism of injury			
Assault	11 (11.1%)	3 (2.9%)	.027
Blunt trauma	2 (2.0%)	8 (7.8%)	.100
Fall	20 (20.2%)	28 (27.5%)	.250
Gun shot wound	2 (2.0%)	0 (0.0%)	.241
Motorcycle crash	1 (1.0%)	1 (1.0%)	1.000
Motor vehicle crash	56 (56.6%)	35 (34.3%)	.002
Pedestrian struck	6 (6.1%)	27 (26.5%)	<.001
Scene time (mins)	20.31	17.6	.208
Needed intubation at scene	52 (52.5%)	39 (38.2%)	.585
Received intubation	44 (84.6%)	31 (79.5%)	.048
Not intubated	8 (15.4%)	8 (20.5%)	.585
Problems with intubation	11 (21.2%)	27 (69.2%)	<.001
Peripheral IV (scene)	85 (85.9%)	67 (65.7%)	.001
Peripheral IV (trauma center)	63 (63.6%)	82 (80.4%)	.011
Fluid bolus (trauma center)	9 (9.1%)	26 (25.5%)	.003
Spine immobilization (scene)	98 (99.0%)	99 (97.1%)	.247
Method of transportation			
Air	38 (38.4%)	49 (48.0%)	.200
Ground	60 (60.6%)	53 (52.0%)	.256

GCS, Glasgow Coma Scale.

ECHEC IOT

Table 2. Problems with intubation

Problems With Intubation	Adult Sample Size	Adult (n = 11)	Children Sample Size	Children (n = 27)	*p*
No attempt (even though needed)	n = 52	8 (15.4%)	n = 39	8 (20.51%)	.585
Failed attempts (ambulance crew)	n = 44	1 (2.27%)	n = 31	9 (29.03%)	.001
Dislodgement	n = 44	1 (2.27%)	n = 31	5 (16.12%)	.075
Esophageal	n = 44	0 (0%)	n = 31	1 (3.23%)	.413
Wrong size	n = 44	0 (0%)	n = 31	2 (6.45%)	.168
Multiple attempts (>3)	n = 44	1 (2.27%)	n = 31	2 (6.45%)	.566

Complications of emergency tracheal intubation in severely head-injured children

Meyer P et al. Paed Anaesth 2000

Incidence of immediate complications during ETI

Incidents	*Prehospital ETI*	*ETI in emergency room*
Cough	19%	15%
Gastric content inhalation	2%	—
Spasm	3%	—
Vomiting	8%	9%
Haemodynamic variations	12%	5%

Incidence of immediate complications with different drugs regimens

Drugs used to facilitate ETI (% of the patients)	*Immediate complications (%)*	*No complications (%)*
No drugs used (12%)	67*	33
Hypnotics		
None (12%)	67*	33*
Yes (88%)	30	70
Opioids		
None (30%)	61.5*	39.5*
Fentanyl (70%)	18	82
Muscle relaxant		
None (70%)	53	47
Depolarizing (10%)	23	77
Nondepolarizing (20%)	5.5	94.5
Hypnotic and Opioid (68%)	10*	90

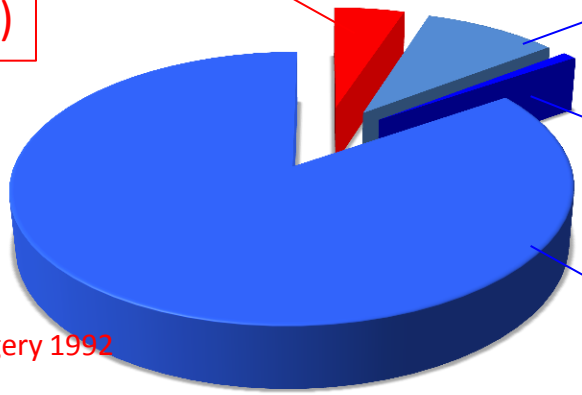
* Significant 95%.

Amélioration Protocole ISR et sédation

TC grave (5%)

sous-estimée (décès avant l'arrivée à l'hôpital)

Levin HS et al. Neurosurgery 1992



TCL + lésion IC(<10%)

TCL + neurochir (<1%)

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DIAGNOSTIC

Dunning J et al. Arch Dis Child 2006,
Homer C.J et al. Pediatrics 1999,
Kuppermann N et al. Lancet 2009,
Pandor A et al . Health Technol Assess Winch Engl 2011

TC LEGER

EXAMEN DE REFERENCE

- **TDM cérébral**
  - Sans injection de produit de contraste
  - Du trou occipital jusqu'à la voûte
  - Fenêtres osseuses et parenchymateuses

Risque de manquer une lésion intracrânienne
VS
Risque de radiation

Le risque de mortalité par cancer au cours de la vie attribuable à la dose de rayonnements ionisants provenant d'un seul scanner crânien:
1/1500 NRS 1an
1/5000 Enfant 10ans

Brenner DJ et al. AJR 2001

des doses, même faibles, de rayonnements ionisants dans le cerveau lors de la petite enfance influence les capacités cognitives à l'âge adulte

Hall P et al. BMJ 2004

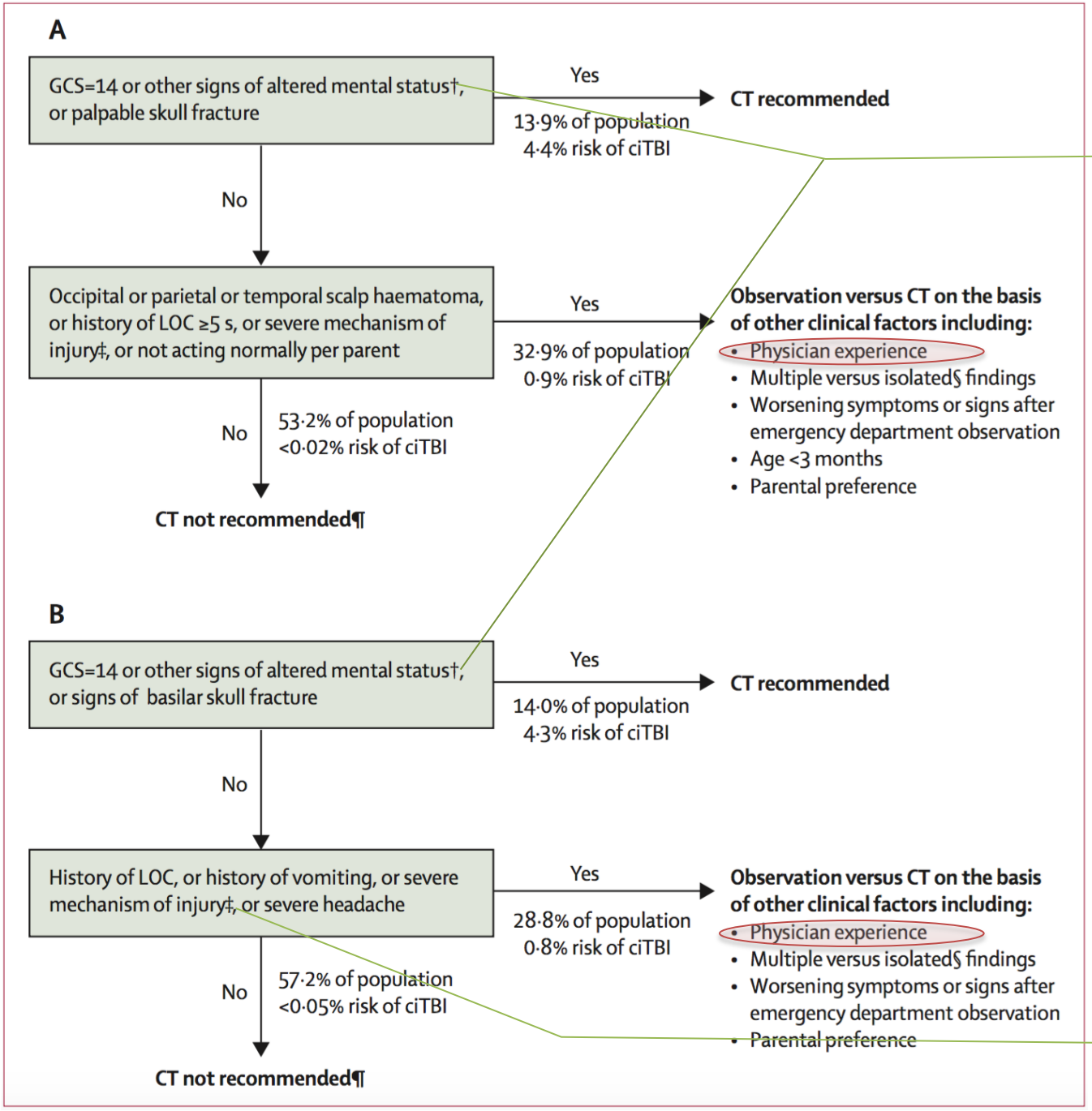
EXAMEN DE REFERENCE

- 3 règles cliniques publiées avec une qualité méthodologique élevée, études multicentriques, grande population:

- CATCH *(Canadian Assessment of Tomography for Childhood Head Injury)* :
  - 3866 enfants, seulement les TCL

- CHALICE *(Children's Head Injury Algorithm for the Prediction of Important Clinical Events)* :
  - 22 772 enfants, tout type de sévérité de TC

- PECARN *(Pediatric Emergency Care Applied Research Network)* :
  - 43 904 enfants, seulement les TCL

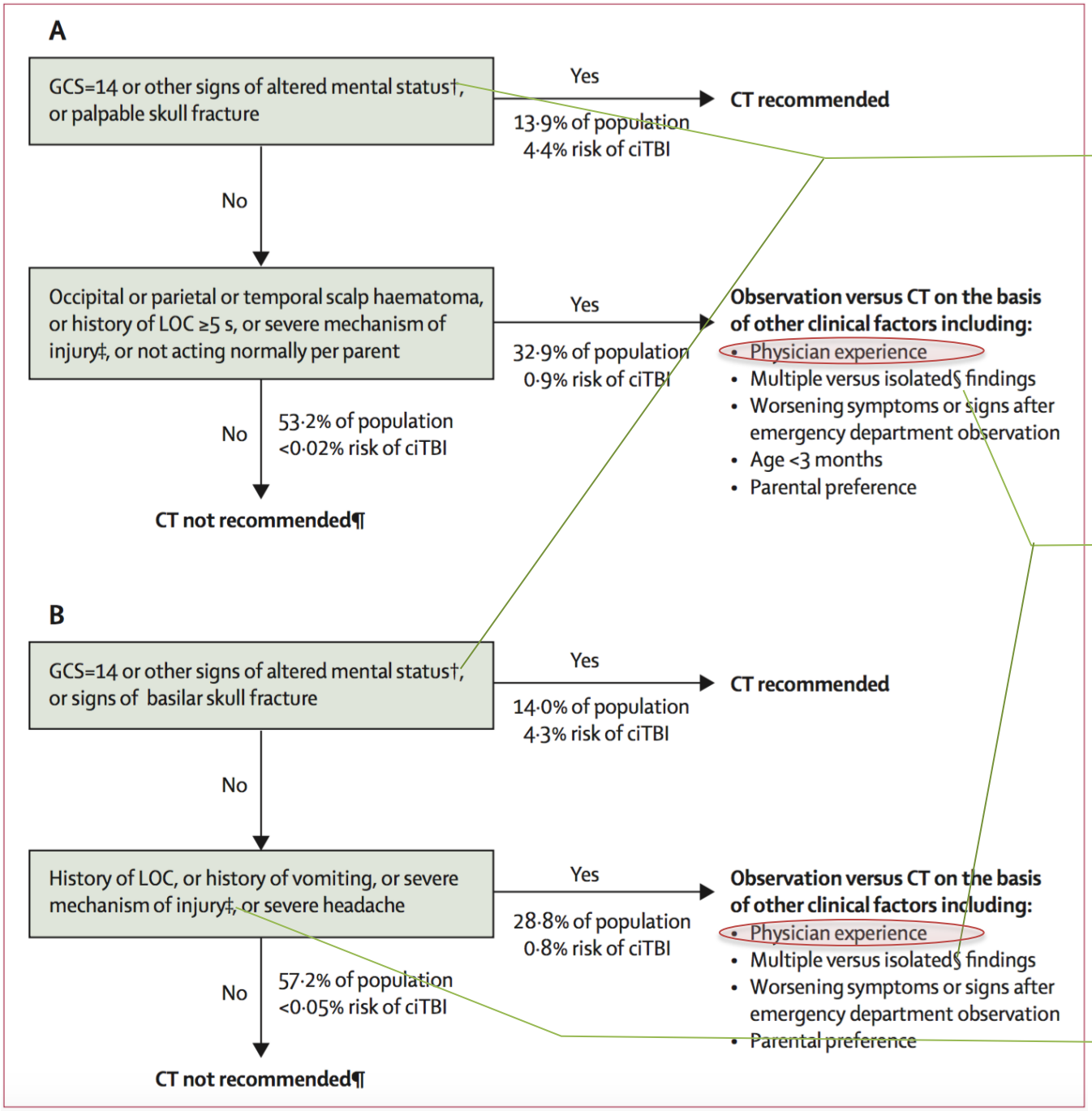


Kuppermann et al.
Lancet 2009

† Autres signes d'altération de la Cs: agitation, somnolence, répétition de questions, ou réponse verbale lente

‡Mécanisme sévère (haute cinétique):

- Patient éjecté de la voiture après un AVP,
- Mort d'un des passagers dans le crash;
- Piétons ou cycliste sans casque percuté par un véhicule motorisé;
- Chute d'une hauteur > 90 cm (panel A)ou >150 cm (panel B);
- TC sur projectile envoyé à haute cinétique.



Kuppermann et al.
Lancet 2009

† Autres signes d'altération de la Cs: agitation, somnolence, répétition de questions, ou réponse verbale lente

§Symptômes associés: pdc, céphalée isolée, vomissements isolés, certains types d'hématome de scalp chez le NRS < 3mois

‡Mécanisme sévère (haute cinétique):
- Patient éjecté de la voiture après un AVP,
- Mort d'un des passagers dans le crash;
- Piétons ou cycliste sans casque percuté par un véhicule motorisé;
- Chute d'une hauteur > 90 cm (panel A)ou >150 cm (panel B);
- TC sur projectile envoyé à haute cinétique.

Headache in Traumatic Brain Injuries From Blunt Head Trauma

Dayan et al. Pediatrics 2015

OBJECTIVE: To determine the risk of traumatic brain injuries (TBIs) in children with headaches after minor blunt head trauma, particularly when the headaches occur without other findings suggestive of TBIs (ie, isolated headaches).

METHODS: This was a secondary analysis of a prospective observational study of children 2 to 18 years with minor blunt head trauma (ie, Glasgow Coma Scale scores of 14–15). Clinicians assessed the history and characteristics of headaches at the time of initial evaluation, and documented findings onto case report forms. Our outcome measures were (1) clinically important TBI (ciTBI) and (2) TBI visible on computed tomography (CT).

RESULTS: Of 27 495 eligible patients, 12 675 (46.1%) had headaches. Of the 12 567 patients who had complete data, 2462 (19.6%) had isolated headaches. ciTBIs occurred in 0 of 2462 patients (0%; 95% confidence interval [CI]: 0%–0.1%) in the isolated headache group versus 162 of 10 105 patients (1.6%; 95% CI: 1.4%–1.9%) in the nonisolated headache group (risk difference, 1.6%; 95% CI: 1.3%–1.9%). TBIs on CT occurred in 3 of 456 patients (0.7%; 95% CI: 0.1%–1.9%) in the isolated headache group versus 271 of 6089 patients (4.5%; 95% CI: 3.9%–5.0%) in the nonisolated headache group (risk difference, 3.8%; 95% CI: 2.3%–4.5%). We found no significant independent associations between the risk of ciTBI or TBI on CT with either headache severity or location.

CONCLUSIONS: ciTBIs are rare and TBIs on CT are very uncommon in children with minor blunt head trauma when headaches are their only sign or symptom.

TABLE 6 Multivariable Regression Analysis Assessing Relationship Between Location and Severity of Headache, and TBI

	ciTBI Adjusted OR (95% CI), *N* = 12 587	TBI on CT Adjusted OR (95% CI), *N* = 6555
Severity of headache		
Mild/barely noticeable	Reference	Reference
Moderate/severe	1.55 (1.00–2.40)	0.97 (0.72–1.32)
Location of headache		
Diffuse	Reference	Reference
Localized	1.22 (0.82–1.80)	1.11 (0.82–1.50)

PHRC-N 2017 "PELICAN"

Evaluer la performance de la règle de décision PELICAN dédié aux enfants < 2ans pour identifier les LIC dans les suites d'un TCL

APHP, Necker
PI: Dr PATTEAU G

Fig 1. Clinical management strategy for the care of children < 2 years with apparently minor

- GCS 13 or less (at any time from initial assessment)
- GCS 14 and/or other signs of altered mental status [1], hypotonia or dizziness persist
  - 30 min after injury if age < 1y
  - 3h after injury if age > 1y, *with monitoring at ED ward and after oral analgesia +/- feeding* [2]
- Deterioration of mental status during ED ward monitoring [2]
- Focal neurological deficit [3]
- Bulging anterior fontanelle
- History of 2 episodes of vomiting (15 min apart) if age ≤ 3 mois
- Any post-traumatic seizure occurring more than 5 min after injury
- Signs of basilar skull fracture [4] , depressed skull fracture [5]

No

- Neonate (corrected age ≤ 28 days)

***Age (corrected): 29 days – <3 mo*:**

- Stigma of trauma on the scalp: erythema, abrasion, laceration, hematoma (any size)
- Transient signs of altered mental status [1] or hypotonia reported by parents
- History of vomiting (even a single one), immediate LOC (any duration) or impact seizure [6]

Age (chronological): ≥3 mo – <12 mo:

- Immediate LOC (any duration) or impact seizure [6]
- History of vomiting (even a single one)
- Scalp hematoma or swelling ≥ 5 cm

Age (chronological): ≥12 mo – <24 mo:

- Immediate LOC of a duration ≥ 5 min or impact seizure [6]
- Occurrence of more than 2 vomiting during the first hour after injury or at least one vomiting beyond the first hour after injury [7]
- Scalp hematoma or swelling ≥ 5 cm

Yes → **Clinical observation** [8]
(admission to short stay unit for a period of at least 6h)

Occurrence during the observation period of:

- Deterioration of mental status
- Bulging fontanelle/ Increased head circumference
- Focal neurological deficit
- Seizure
- An episode of vomiting beyond the sixth hour after injury [9]
- A second vomiting in the first 6 hours after injury if age < 3 mo

No → **Discharged home**
monitoring instructions in writing

No → **Discharged after resolution of symptoms** [11]
monitoring instructions in writing

Yes ← Normal CT or non neurosurgical TBI on CT [10]

Yes ← **CT scan**

GCS: Pediatric Glasgow coma scale score (James HE, 1986); LOC: Loss of consciousness; CT: cranial computed tomography; TBI: Traumatic brain injury

G Patteau, G Chéron. 2012 July

Critères d'hospitalisation TCL

✓Perte de connaissance

✓Mécanisme sévère du traumatisme

✓Signes cliniques suivants:

-GCS<15
-comportement anormal
-vomissements+++ > H12 TC
-céphalées+++ > H12 TC
-hématome sous-cutané ou céphalhématome
-raideur méningé
-signes embarrure, lésion base du crâne

✓Anomalies TDM récentes significatives:

Hémorragie ou contusion intracrânienne, œdème cérébral, lésions axonales diffuses, pneumencéphale, embarrure, diastasis des os du crâne

✓Autres facteurs de risques:

intoxication, drogues, alcool, suspicion de maltraitance

Sortie d'hospitalisation TCL

✓GCS = 15

✓Examen clinique normal

✓Absence d'autres facteurs pouvant justifier une hospitalisation

✓possibilité d'une surveillance adaptée

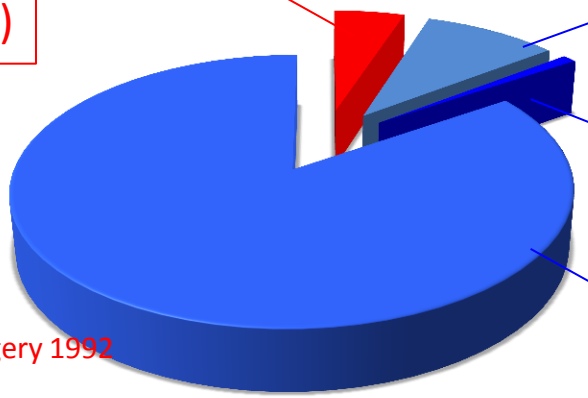
✓proche d'une structure de soins

✓Fiche conseil explicatif

Sortie d'hospitalisation TCL

✓Ce qui doit vous faire reconsulter:
[…]
✓Ce qui ne doit pas vous inquiéter:
[…]
✓Comment aider vos enfants à récupérer:
[…]
✓Comment surveiller votre enfant:
[…]
✓Problème à long terme:
[…]

Lorton et al. Arch Pediatr 2014



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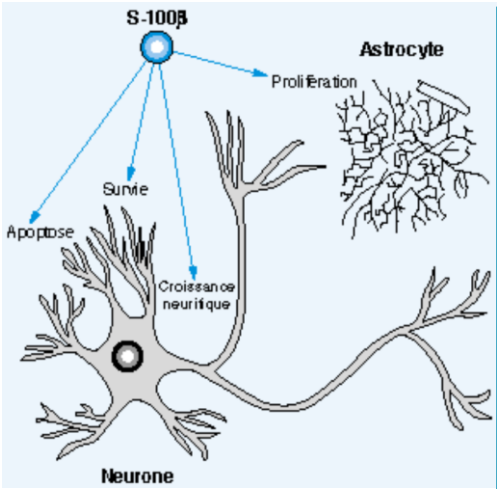
TCL & MESURES NON INVASIVES

TC & protéine S100B



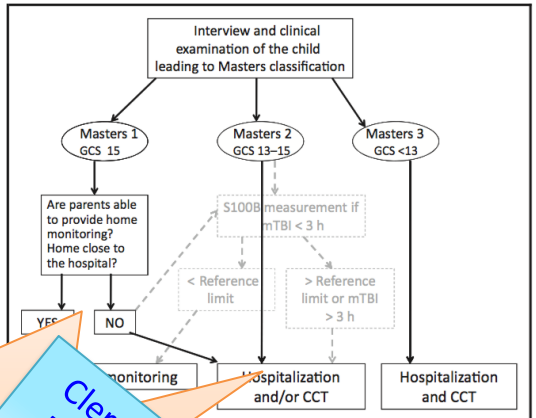
- Marqueur biologique de lésions intracrâniennes
- Ne passe la barrière hémato-méningée qu'en cas d'atteinte du tissu cérébral
- ↑S100B jusqu'à H6 du TC

Babcok et al, Brain inj 2012
Bechtel et al, Pediatrics 2009

Table 2. S100B concentration by CCT, clinical evolution, and management.[a]

	S100B+	S100B−	Sensitivity	Specificity	Positive predictive value	Negative predictive value
CCT+	23	0	100% (85.2%–100%)	33% (20%–50%)	45% (31%–60%)	100% (77%–100%)
CCT−	28	14				
Bad CE	21	0	100% (84%–100%)	36% (31%–41%)	8% (5%–11%)	100% (97%–100%)
Good CE	258	145				
Hospitalized	161	81				
Nonhospitalized	118	64				

[a] Patients exhibiting serum concentrations below the cutoff (0.35 μg/L for age 0–9 months; 0.23 μg/L for … 0.18 μ… counted as S100B−, and those above as S100B+. CCT−: mTBI patients with no signs of trauma-relevant … 1 pathophysiological trauma–relevant intracerebral lesion. The symptoms of … reflex disorder, seizure, progressive headache, or behavior change. Good CE was indica…



…(with use of …ecision algorithm for CCT or …in children under mTBI

…olid frames and arrows) …ents the curren… …of mTBI management. …y text (with dott… frames and arrows) repre-sents an alternative decisional algorithm including S100B measurement.

Bouvier et al. Clinical Chemistry 2…

PHRC-N 2015 "PROS100B"

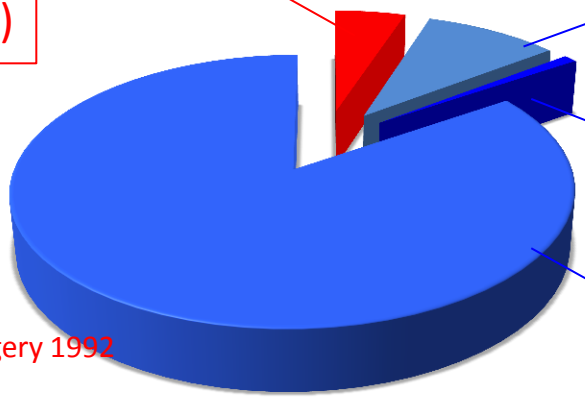
Evaluer l'utilité de la protéine S100B sur la diminution du nombre de TDM cérébral

Clermont-Ferrand
PI: Dr BOUVIER D

TC grave (5%)

sous-estimée (décès avant l'arrivée à l'hôpital)

Levin HS et al. Neurosurgery 1992



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Pandor A et al . Health Technol Assess Winch Engl 2011

TC "3 QUIZZ"

QUE FERIEZ-VOUS?

QUIZZ 1

Vous recevez aux urgences cet enfant de 4ans, amené par ses parents pour un traumatisme crânien suite à une chute de sa hauteur après avoir été bousculé dans la cours de l'école ce matin. Il aurait perdu connaissance durant 1mn avec un retour à la normale rapide. Les témoins de la scène ne décrivent pas de mouvements anormaux durant sa perte de connaissance, ni de changement de teint.
A l'interrogatoire, il vous dit ne pas se souvenir de la chute et ne se plaindrait que de sa bosse pariéto-occipitale droite.
Il est Glasgow 15 et votre examen physique ne retrouve aucune autre anomalie.
Vous relevez que 5heures se sont écoulées depuis son TC

TDM?

HOSPITALISATION?

QUIZZ 2

Vous recevez aux urgences cet enfant de 8 ans pour un traumatisme crânien sans perte de connaissance il y a 1 heure après une chute d'un toboggan dont la hauteur estimée serait d'environ 1m.
Hormis une bosse frontale, vous ne relevez aucune autre anomalie durant votre examen clinique. Il est Glasgow 15.
Cependant, Il est hémophile A sévère (fact8 < 1%) et ses parents ont pensés à apporter les facteurs.

TDM?

HOSPITALISATION?

QUIZZ 3

SMURiste dans l' âme, vous intervenez en équipe au domicile de cet enfant de 6ans, pour un traumatisme crânien sans perte de connaissance suite à une chute de sa hauteur contre le coin d'une table après avoir trébuché contre le tapis. 20mn se sont écoulées avant que vous n'arriviez.
A l'interrogatoire, il ne se plaindrait que de sa bosse frontal droite. Vous estimez son Glasgow à 14 (Y4V4M6) et votre examen physique ne retrouve aucune autre anomalie.
Il est Mercredi, 15h00 pile, et l'hôpital le plus proche est un hôpital général disposant d'un service d'urgence enfants-adultes à 30mn du domicile (sinon à 1h30 de l'hôpital pédiatrique)

TDM?

Quel hôpital?

Merci de votre attention

Protocole de soins partagés
18e journée du GFRUP (27-28 Sept 2018)

Anne-Laure HERISSE, CCA
Antoine TRAN, PH
Service: Urgences Pédiatriques
Site: Hôpitaux Pédiatriques de Nice CHU-Lenval

Fondation Lenval
pour les enfants, depuis 1888
Hôpitaux Pédiatriques de Nice CHU-LENVAL