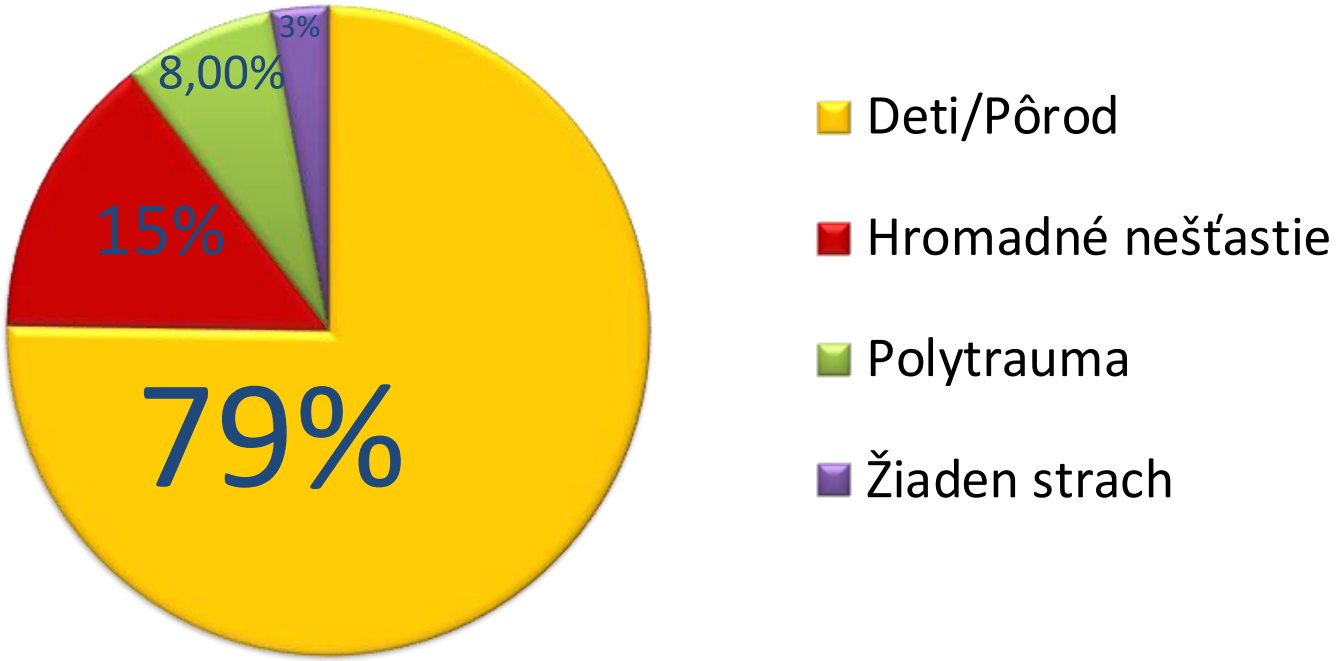
Kraniocerebrálne poranenie dieťaťa v prednemocničnej starostlivosti

OA Dr. Branislav Podhoransky, OA Dr. Daniel Csomor

Abteilung für Anästhesie, Notfall- und Allgemeine Intensivmedizin

Vorstand: Prim.Dr.Helmut Trimmel, MSc.

Z čoho majú lekári RLP **strach**



B

Deti a KCP

- **Úrazy**
  - hlavná príčina úmrtí u detí **> 1 rok** v tzv. rozvinutých krajinách
- **85%** zranených detí
  - izolované **KCP** alebo spolu s extrakraniálnym poranením
- Mortalita pri ťažkej KCP cca **15% – 35%**
- Mortalita vyššia v skupine detí mladších ako **4 roky**
- **Invalidizácia**
- Viac chlapcov 2:1 až 4:1

Deti a KCP

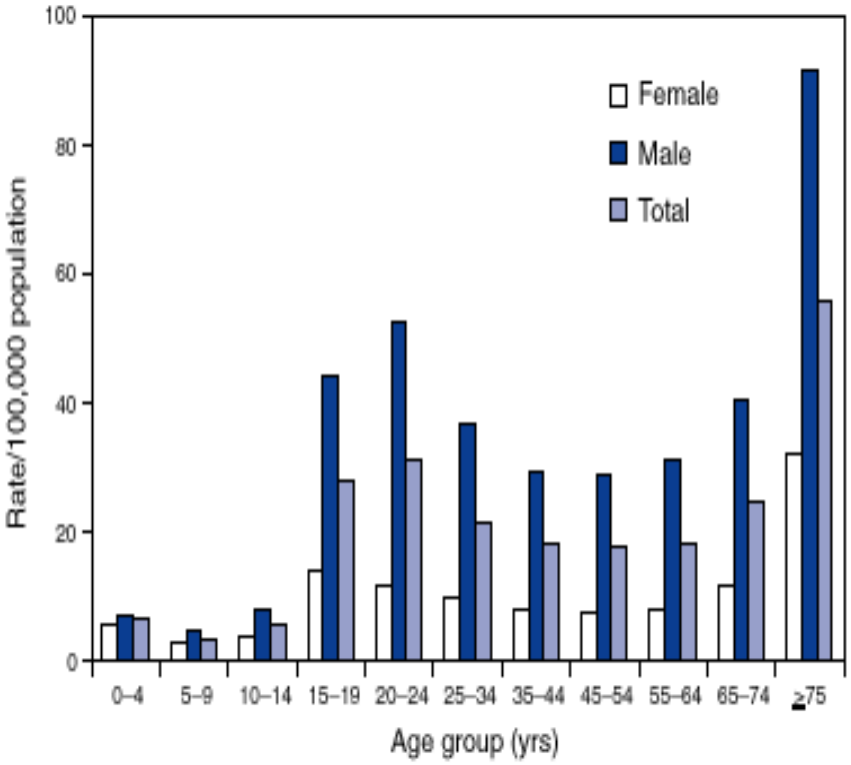
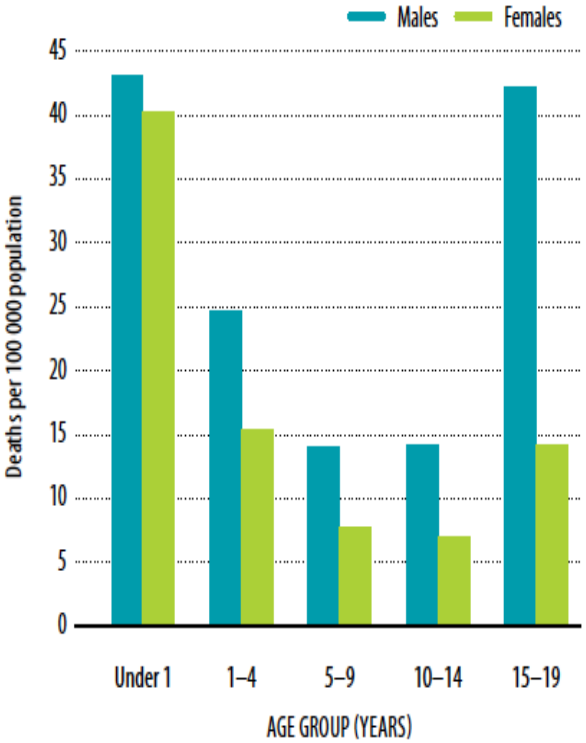


Fig. 2.3
Age- and sex-specific death rates for all unintentional child injuries in the WHO European Region



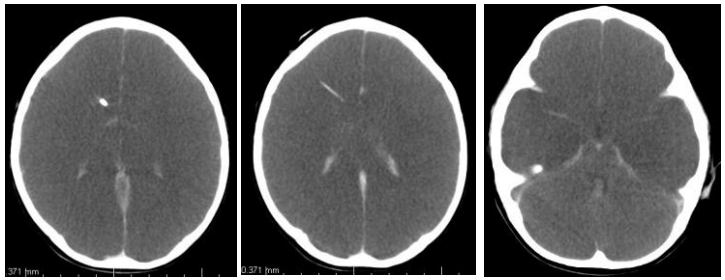
Source: The global burden of disease: 2004 update *(1)*.

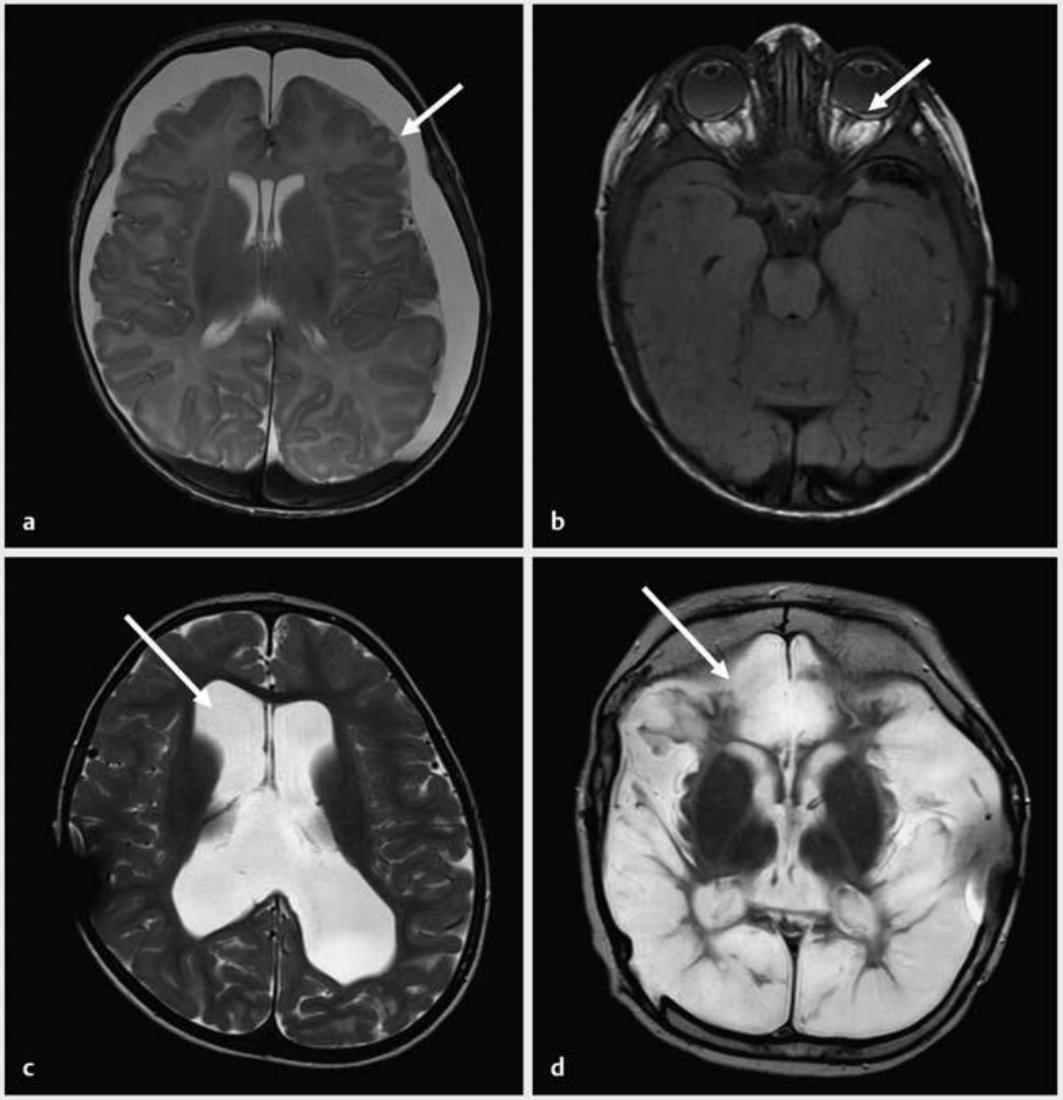
- Najčastejšie príčiny:

1. **dopravné úrazy** – staršie deti
2. **pády** – hlavne deti do 4 rokov [redacted]
3. **týrané deti – deti mladšie ako 2 roky**

Týrané dieťa - AHT (Abusive Head Trauma)

- Najťažšie KCP u detí **mladších ako 1 rok**
  - Mortalita do **30%**
- **10 % poranení u detí pod 5 rokov**
  - iná ako úrazová príčina (non – accidental cause)
- **Akútny SDH** – suspektný
  - často na podklade hypoxicko-ischemickej encefalopatie
- Zakrvácanie do retiny – **bilaterálne**
- **Epidurálny hematóm** – menej častý





▸ **Abb. 3** Fallbeispiel Schütteltrauma: 1,5 Monate alter männlicher Säugling mit V. a. Schütteltrauma. Nachweis ausgedehnter bilateraler Subduralhämatome (MRT T2ax, **a**), sowie retinaler Blutungen bds. (MRT T1ax, **b**). Im Langzeitverlauf Entwicklung eines posthämorrhagischen Hydrozephalus (MRT T2ax, **c**). Langzeitfolgen eines schweren Schütteltraumas mit ausgedehnten Parenchymdefekten des Großhirns (MRT T2ax, **d**). Quelle: Mit freundlicher Genehmigung des Instituts für Klinische Radiologie der Medizinischen Fakultät und des Universitätsklinikums Münster (Direktor: Univ.-Prof. Dr. med. Walter Heindel).

- **Krajiny s nižším a stredným príjmom**
  - Dominujú **dopravné úrazy**
    - Dopravný boom predbieha prevenciu
      - 310 detí účastníkmi dopravných nehôd
      - 29 detí (13,6%) – zabezpečené
  - **Horší outcome**

BMJ Open A retrospective review of paediatric head injuries in Asia – a Pan Asian Trauma Outcomes Study (PATOS) collaboration

Shu-Ling Chong,[1,2] Uzma Rahim Khan,[3] Indumathy Santhanam,[4] Jun Seok Seo,[5] Quan Wang,[6] Sabariah Faizah Jamaluddin,[7] Quoc Ai Hoang Trong,[8] Su Yah Chew,[9,10] Marcus Eng Hock Ong[11,12]

Table 3 Mechanism of injury, CT use, severe and secondary outcomes by Gross National Income (GNI)

Primary Mechanism of injury	Lower Middle-Income, n (%)	Upper Middle-Income, n (%)	High-Income, n (%)	Total, n (%)	p value
Total	230	208	1000	1438	
Fall	122 (53.0)	90 (43.3)	745 (74.5)	957 (66.6)	<0.001
Traffic Injury	94 (40.9)	107 (51.4)	109 (10.9)	310 (21.6)	
Struck by Person or Object	5 (2.2)	8 (3.8)	104 (10.4)	117 (8.1)	
Sports Injury	2 (0.9)	1 (0.5)	22 (2.2)	25 (1.7)	
Stab or Cut	0 (0.0)	0 (0.0)	4 (0.4)	4 (0.3)	
Gun Shot	2 (0.9)	0 (0.0)	0 (0.0)	2 (0.1)	
Others*	5 (2.2)	2 (1.0)	16 (1.6)	23 (1.6)	
CT Use					
CT Use	214 (93.0)	208 (100.0)	426 (42.6)	848 (59.0)	<0.001
Severe Outcomes					
Endotracheal Intubation	49 (21.4)	97 (46.6)	23 (2.3)	169 (11.8)	<0.001
Neurosurgical Intervention	20 (10.4)	71 (34.1)	24 (2.4)	115 (8.2)	<0.001
Death	13 (5.7)	35 (16.8)	7 (0.7)	55 (3.8)	<0.001
Secondary Outcomes					
Admitted to Hospital	187 (81.3)	188 (90.4)	788 (78.8)	1163 (80.9)	<0.001
Hospital Length of Stay, median (IQR)	3.0 (2.0–6.0)	5.0 (2.0–13.0)	1.0 (1.0–2.0)	1.0 (1.0–3.0)	<0.001

*'Others' mechanism comprised primarily of cases where the mechanism of injuries could not be obtained or categorised from retrospective chart review.

- **Primárne poranenie**

- **Sekundárne poranenie**

Primárne poranenie

- **Bezprostredný následok** mechanického inzultu v prvých momentoch poranenia
- **Priame poškodenie** kostných štruktúr,mozgových obalov, mozgového tkaniva
- Poškodenie s ktorým postihnutý **už prichádza** a nemáme na neho priamy vplyv
- Rozsah primárneho poškodenia **je definitívny**

Primárne poranenie

- **Zlomeniny lebky**
  - zlomeniny kalvy
  - zlomeniny bázy

- **Fokálne poranenia mozgu**
  - Kontúzia mozgu
  - Intracerebrálny hematóm
  - Subdurálny hematóm
  - Epidurály hematóm

- **Difúzne poranenia mozgu**
  - Komócia
  - Difúzne axonálne poškodenie

Primárne poranenie - Deti

- **Lebka dojčaťa**
  - menej pevná, otvorené švy ktoré umožňujú minimalny pohyb kostí – **pôrod**
  - parenchým a cievy - strihové a ťahové sily
- **Frontálna časť lebky** presahuje tvárovú oblasť
  - traumatická sila pôsobí priamo na neurokránium a mozog
- **Pomerne väčšia a ťažšia hlava**, **slabšie krčné svaly** – akcelerácia
  - dojča 1:3
  - dospelý 1:30
- **Slabšia muskulatúra krku**
- **Rozdielny stupeň myelinizácie** v závisloti od veku
  - Kranio – kaudalne, postero - anteriórne

Primárne poranenie - Deti

- **Koža hlavy** - dobre vaskularizovaná a prekrvená
  - Straty krvi
- **Celkový objem krvi** u malých detí – **podcenenie**
- Malé deti – veľké straty do epidurálneho a subgaleálneho priestoru
- **Do 18 mesiacov** – intrakraniálne krvácanie alebo edém pred neurologickou symptomatológiou
- **Dojča s napätou fontanelou**, s rozostupom švov – ťažká kraniotrauma

Primárne poranenie - Deti

- **Izolované nálezy:**
  - u detí častejšie zlomeniny lebky
  - epiduralny hematóm
- **Viac ako jedna lézia:**
  - kombinácia zlomenina lebky + epidurálny hematóm
- **Traumatické SAK** – u detí pomerne častá
- **SDH** – vysoko suspektné ako týrané dieťa

Sekundárne poranenie

- Vzniká **dôsledkom primárneho poškodenia**
  - Prim. pošk. spúšťa univerzálne autodeštrukčné pochody
  - Poškodenie neurónov, podporného nervového tkaniva, hematoencefalickej bariery, poruchy prietoku krvi
  - Môže sa zhoršovať vplyvom intrakraniálnych alebo extrakraniálych príčin
- **Môžeme ho liečbou ovplyvniť**
- **Cieľom našej liečby je predísť sekundárnemu poškodeniu!!!!**

Sekundárne poranenie - Deti

- **CBF**
  - **Dospelý:**
    - 50 ml/100 g /min
  - **Deti:**
    - 100 ml/100 g/min
    - dosahuje hodnoty dospelých počas puberty
  - **KCP:**
    - **< 25 ml/100 g/min**

Cerebrovascular Pathophysiology in Pediatric Traumatic Brain Injury

Shaji Philip, MD, Yuthana Udomphorn, MD, Fenella J. Kirkham, MB, BChir, FRCPCH, and Monica S. Vavilala, MD, FAAP

(*J Trauma*. 2009;67: S128–S134)

Pediatric neurocritical care in the 21st century: from empiricism to evidence

Mark S. Wainwright[a,b,c], Gregory Hansen[d], and Juan Piantino[e]

- **CMRO2**
  - nižší u novorodencov
  - **maximum** u detí medzi **3.- 4.** rokom
  - po 9 roku klesá na úroveň dospelých

- **CO2 vazoreaktivita**
  - je vyššia u detí ako u dopelých
  - oslabená pri **hypotenzii**
  - oslabená pri ťažkej **hypoxii**

Cerebrovascular Pathophysiology in Pediatric Traumatic Brain Injury

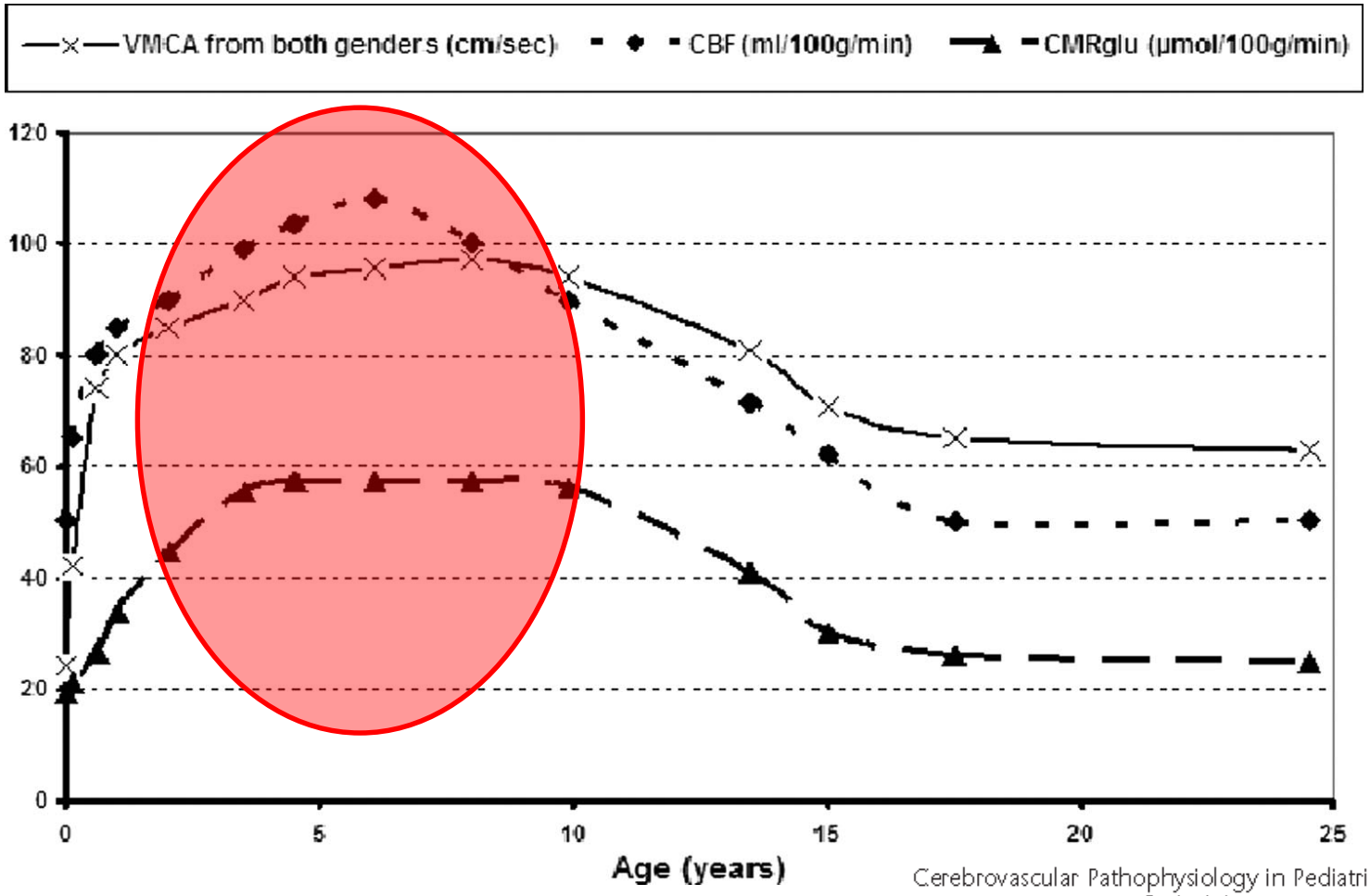
Shaji Philip, MD, Yuthana Udomphorn, MD, Fenella J. Kirkham, MB, BChir, FRCPCH, and Monica S. Vavilala, MD, FAAP

(*J Trauma*. 2009;67: S128–S134)

Pediatric neurocritical care in the 21st century: from empiricism to evidence

Mark S. Wainwright[a,b,c], Gregory Hansen[d], and Juan Piantino[e]

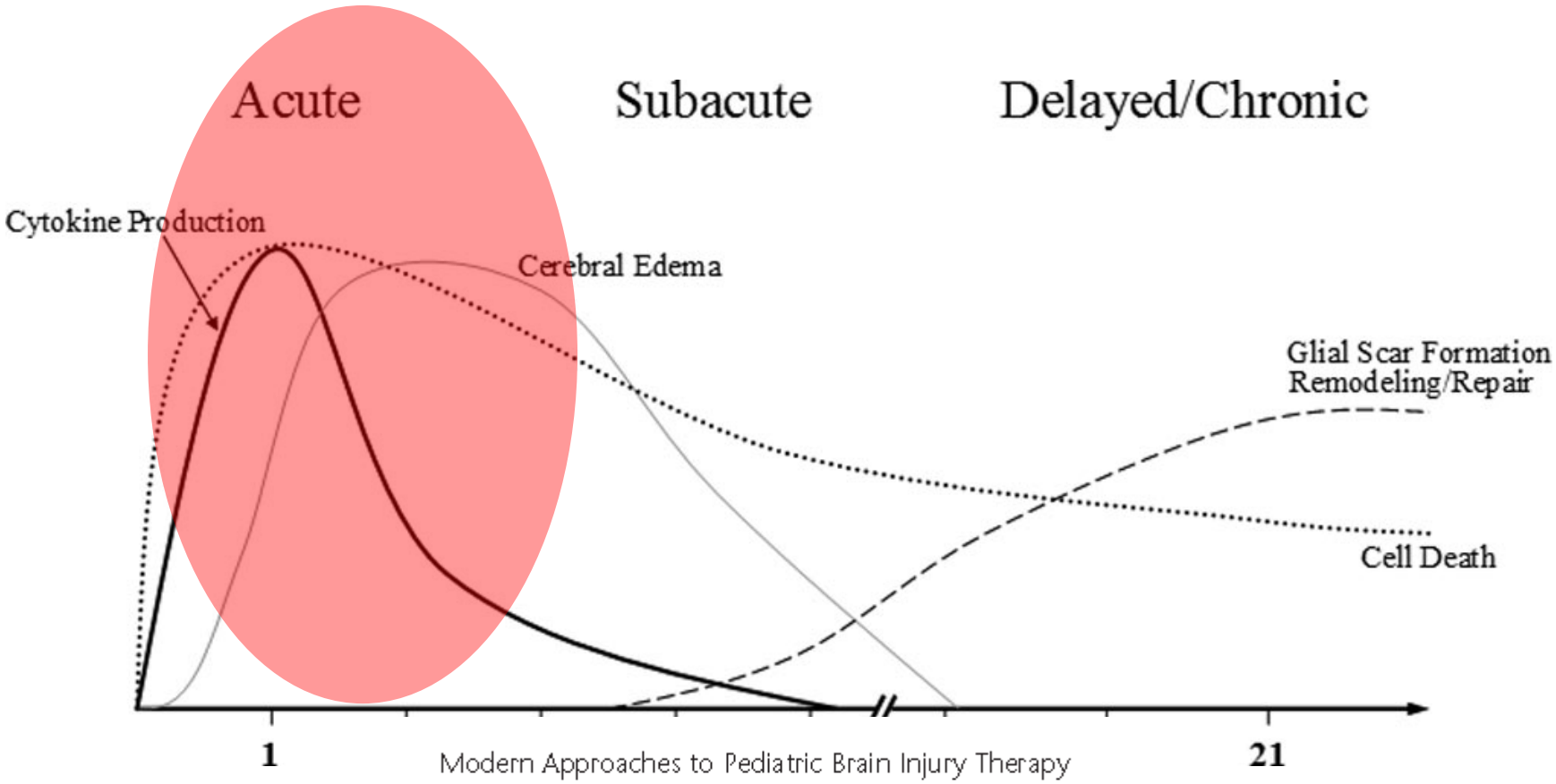
KCP a deti



Cerebrovascular Pathophysiology in Pediatric Traumatic Brain Injury

Shaji Philip, MD, Yuthana Udomphorn, MD, Fenella J. Kirkham, MB, BChir, FRCPCH, and Monica S. Vavilala, MD, FAAP

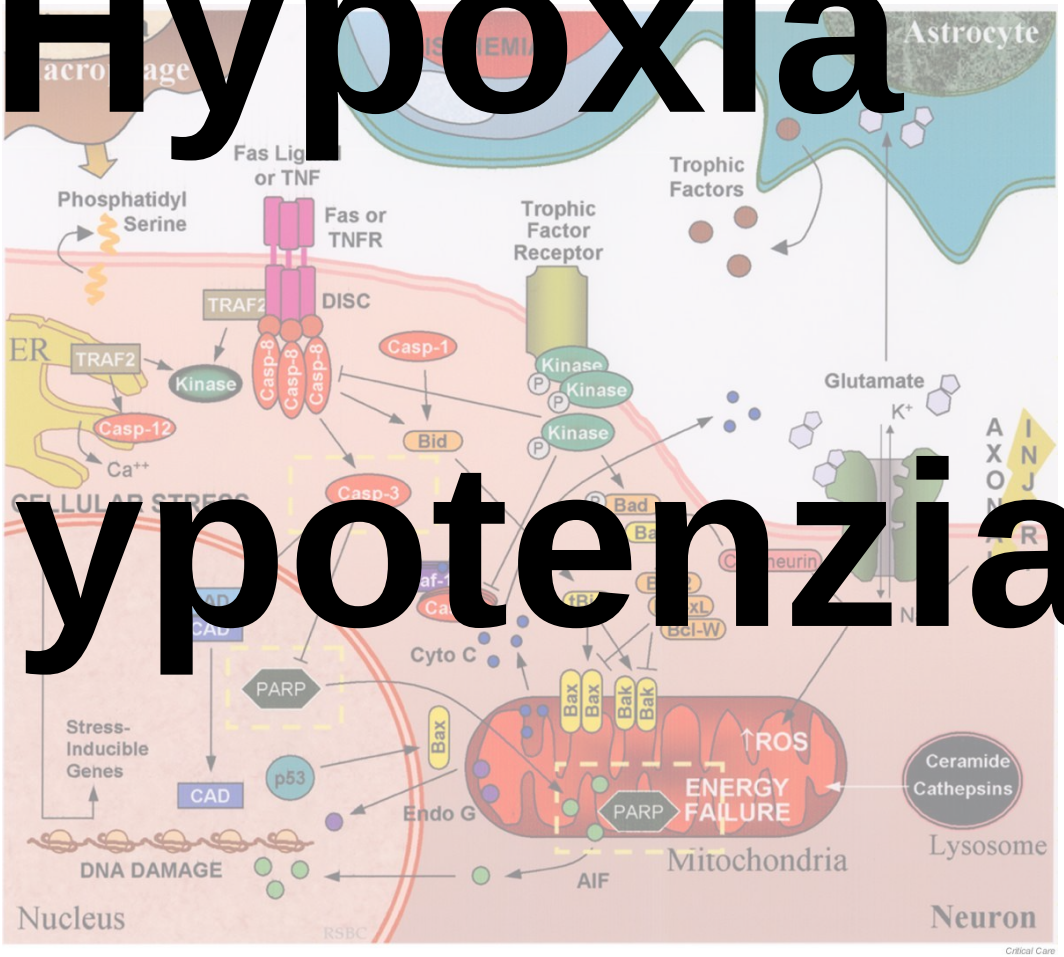
Sekundárne poranenie - Deti



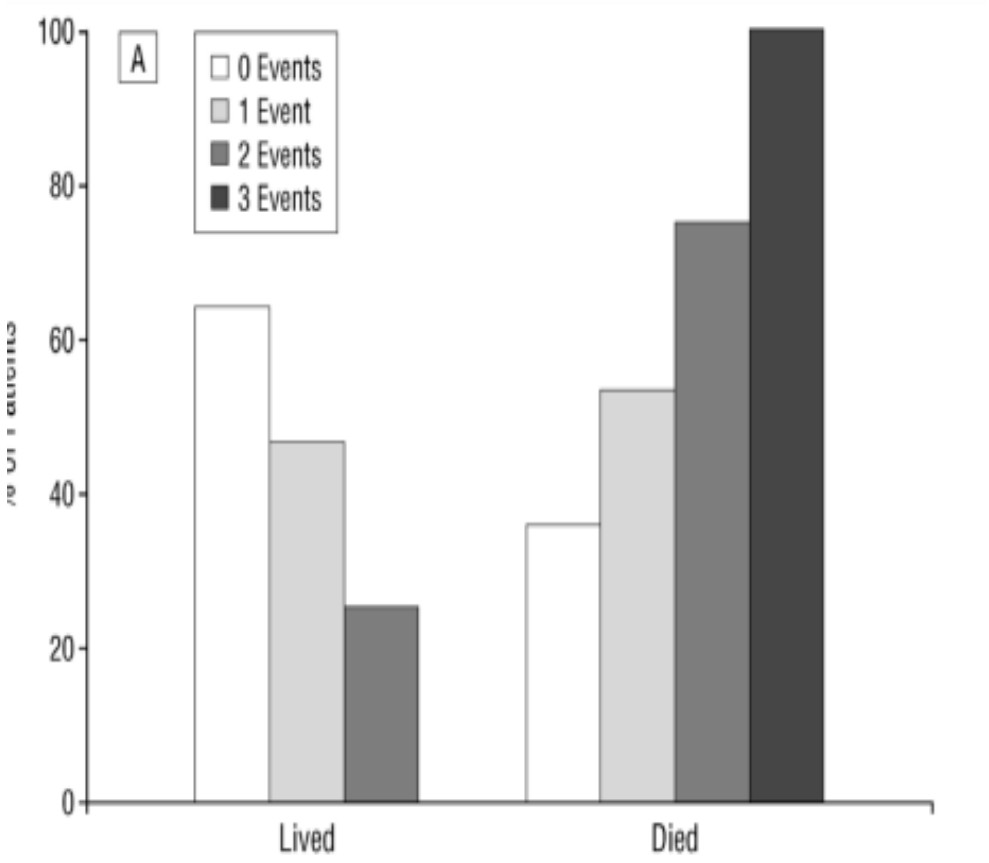
Peter A. Walker, MD, Matthew T. Harting, MD, James E. Baumgartner, MD, Stephen Fletcher, DO, Nathan Strobel, MD, and Charles S. Cox, Jr., MD

Hypoxia

Hypotenzia



Hypotenzia, Hypoxia



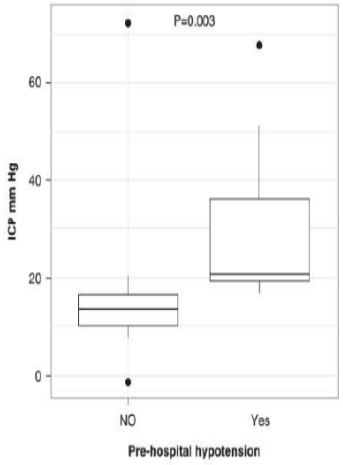
Hypotenzia

Pre-hospital Predictors of Impaired ICP Trends in Continuous Monitoring of Paediatric Traumatic Brain Injury Patients

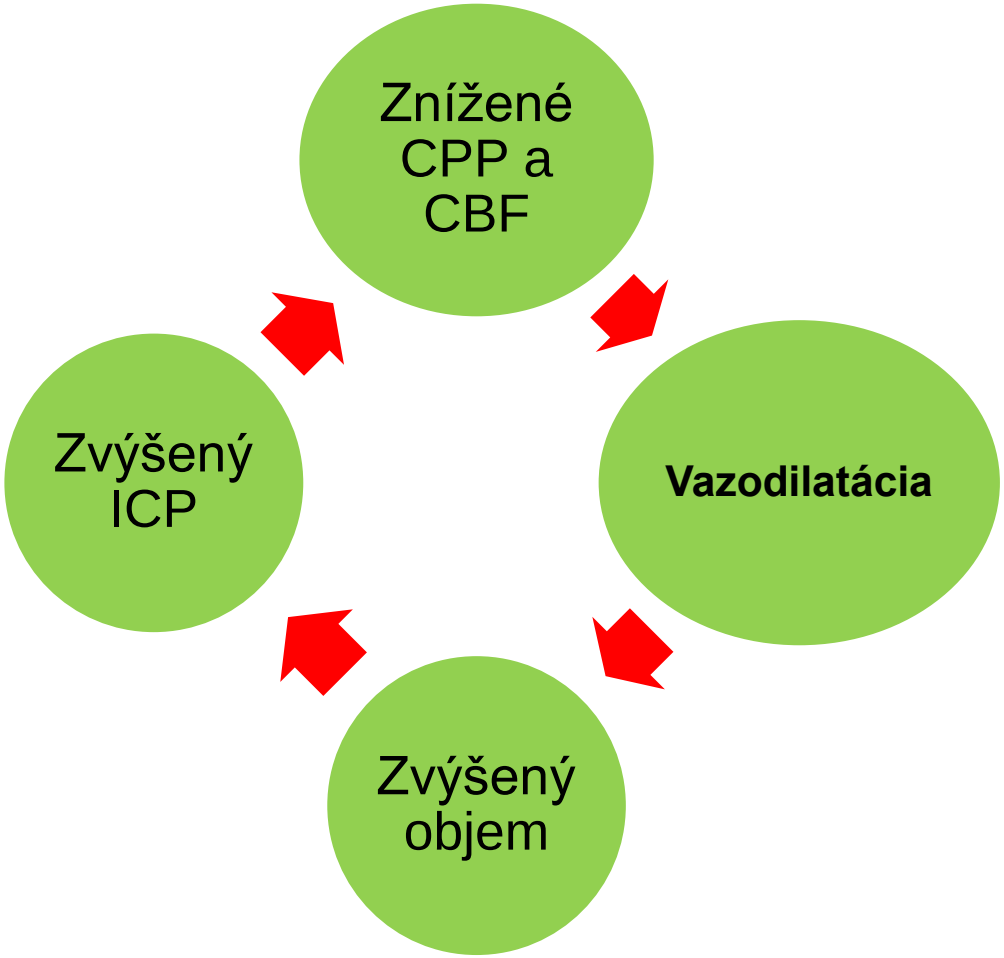
Adam M.H. Young[†], Joseph Donnelly[†], Xiuyun Liu, Mathew R. Guilfoyle, Melvin Carew, Manuel Cabeleira, Danilo Cardim, Matthew R. Garnett, Helen M. Fernandes, Christina Haubrich, Peter Smielewski, Marek Czosnyka, Peter J. Hutchinson, and Shruti Agrawal

T. Heldt (ed.), *Intracranial Pressure & Neuromonitoring XVI*, Acta Neurochirurgica Supplement, Vol. 126, https://doi.org/10.1007/978-3-319-65798-1_2, © Springer International Publishing AG 2018

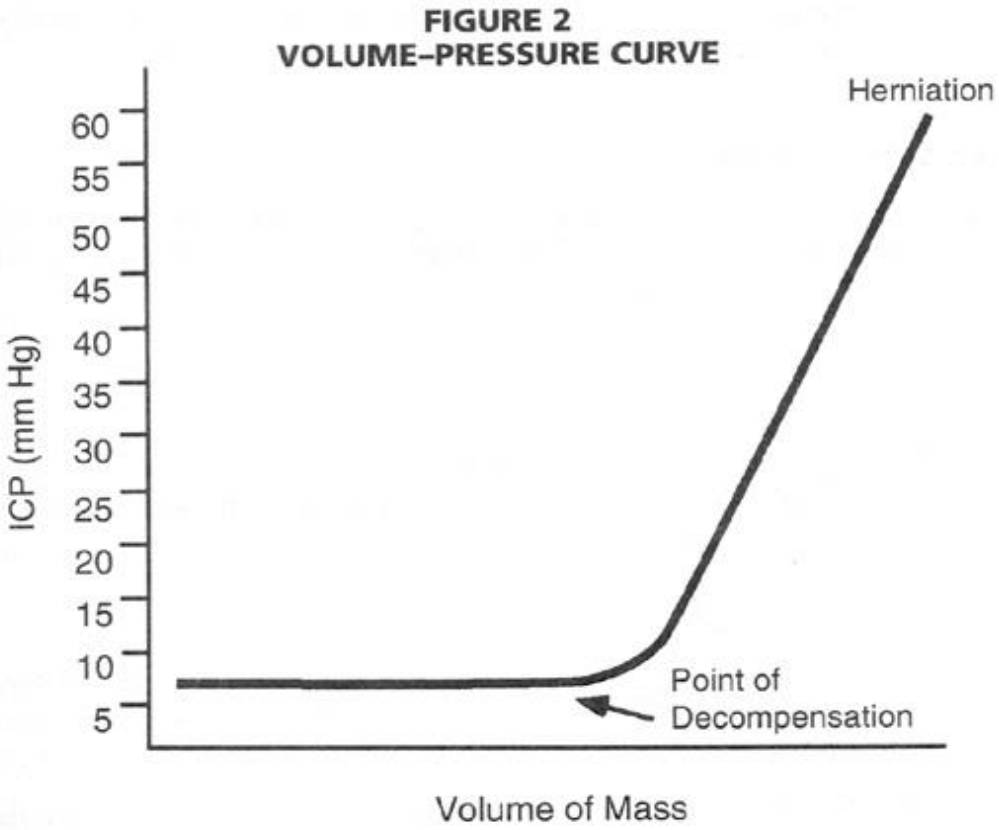
Conclusion: In paediatric TBI, pre-hospital hypotension is associated with increased ICP in the intensive care unit.



Deti a KCP



Intrakranialna hypertenzia



Intrakranialna hypertenzia

- **32%** detí prvé hodnoty **ICP > 20 mmHg**
- **50% ICP > 20 mmHg** počas liečby na ICU
- **ICP > 20 mmHg** - horší outcome
- Odporúčania: ICP < 20 mmHg
- **Malé deti, dočatá ?**

CPP

- Je CPP vekovo špecifický?
- Odporúčania: **40 and 50 mm Hg**
- Dojčatá pravdepodobne na dolnej hranici, adolescenti vyššie hodnoty

KCP – závažnosť

- **Ľahké**
  - GCS 14-15
- **Stredne ťažké**
  - GCS 9-13
- **Ťažké**
  - GCS ≤ 8

AVPU

- **A – ALERT** – pri vedomí
- **V – VOICE** – reaguje na oslovenie
- **P – PAI**N – reaguje na bolesť
  - **GCS 8 bb**
- **U – UNRESPONSIVE** - nereaguje

Outcome

- Charakter primárneho poranenia

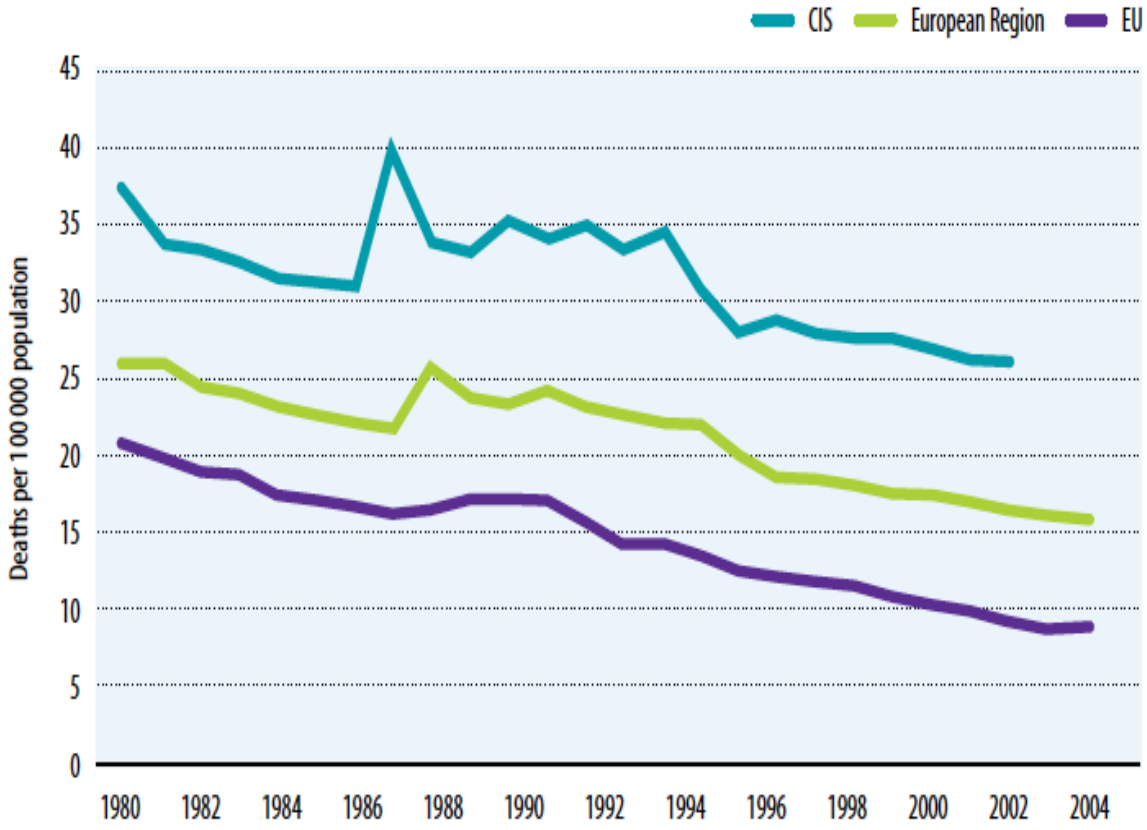
- **Efektivita liečby zameranej na prevenciu sekundárneho poranenia**

- **Prevencia**
  - bezpečnostná helma
  - bezpečnostné pásy
  - detské sedačky – pripútané dieťa
    - redukcia fatálnych zranení o 71% u dojčiat, 54% u väčších detí

Prevencia

Fig. 1.1

Trends in standardized mortality rates for unintentional injury in children aged 1–19 years in the WHO European Region



Source: Mortality by 67 causes of death, age and sex *(15)*.

- **Guidelines for the acute medical management of severe traumatic brain injury in infants, children, and adolescents**

Pediatr Crit Care Med 2003 Vol. 4, No. 3 (Suppl.)

- **Prvé postupy** – snaha o **EVB** liečbu
- Stav literatrúry **nedostatočný**

Guidelines for the Acute Medical Management
of Severe Traumatic Brain Injury in Infants, Children, and Adolescents-Second Edition

Pediatr Crit Care Med 2012 Vol. 13, No. 1 (Suppl.)

Guidelines for the Management of Pediatric Severe Traumatic Brain Injury, Third Edition: Update of the Brain Trauma Foundation Guidelines

March 2019 • Volume 20 (Suppl) • Number 3

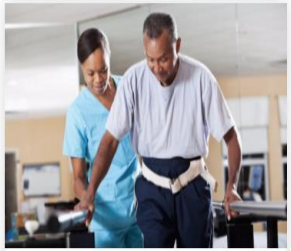
https://www.braintrauma.org

View recommendations or download a PDF of a complete Guidelines document below. PDF includes the complete evidence synthesis and references in addition to the recommendations.

Guidelines for the Management of Severe TBI, 4th Ed.

Guidelines for Prehospital Management of TBI, 2nd Ed.

Guidelines for Severe TBI in Infants, Children, & Adolescents, 2nd Ed.



Early Indicators of Prognosis in Severe TBI

Guidelines for Field Management of Combat-Related Head Trauma

Guidelines

RESEARCH ARTICLE

PLOS ONE | https://doi.org/10.1371/journal.pone.0201550 August 2, 2018

A systematic review and quality analysis of pediatric traumatic brain injury clinical practice guidelines

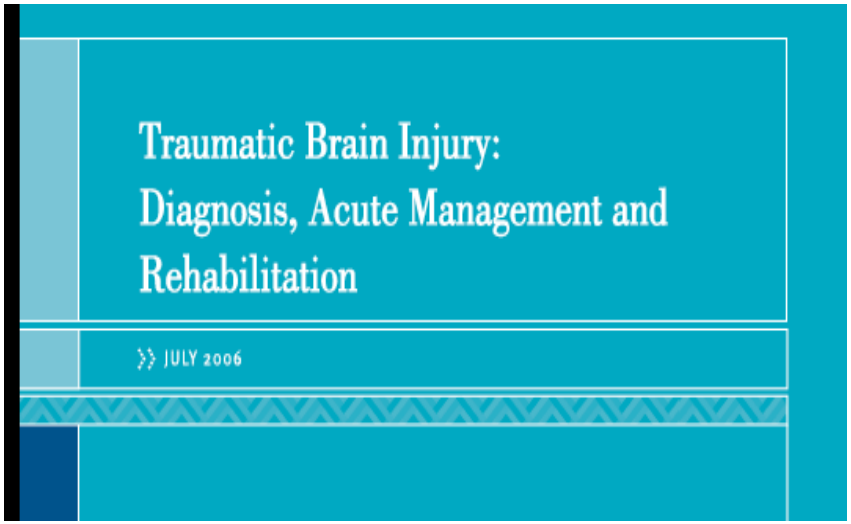
Roselyn Appenteng[1], Taylor Nelp[2], Jihad Abdelgadir[3], Nelly Weledji[4], Michael Haglund[3,5], Emily Smith[3,5], Oscar Obiga[5,6], Francis M. Sakita[7], Edson A. Miguel[8], Carolina M. Vissoci[9], Henry Rice[10], Joao Ricardo Nickenig Vissoci[2,3], Catherine Staton[2,3,5]*

- **New Zealand's** Traumatic Brain Injury: Diagnosis, Acute Management and Rehabilitation (NZGG, 2006)
- **The Scandinavian** guidelines for initial management of minor and moderate head trauma in children (SNC 2016)
- **Guidelines for the acute medical management of severe traumatic brain injury in infants, children, and adolescents-second edition** (BTF 2012)

Guidelines

Chapter 10:
Māori and traumatic brain injury

Chapter 11:
Pacific peoples and traumatic brain injury



New Zealand
GUIDELINES GROUP
Te Rōpū Rorangi Tohutohu

- Väčšina dôkazov na **úrovni III**

- Len niekoľko dôkazov dosahuje **úroveň II**
  1. **Kortikoidy**
  2. **Hypotermia prvých 24 hod po úraze**
  3. **Imunomodulačná výživa**
  4. **HTS ako osmotická terapia ICP**

- **Climbing the Mountain With No Top**

Factors that may improve outcomes of early traumatic brain injury care: prospective multicenter study in Austria

Alexandra Brazinova[1,2*], Marek Majdan[1,2], Johannes Leitgeb[3], Helmut Trimmel[4], Walter Mauritz[1,5] and Austrian Working Group on Improvement of Early TBI Care

Brazinova *et al. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine* (2015) 23:53
DOI 10.1186/s13049-015-0133-z

Table 3 Recommended treatment options

	Phase 1		Phase 2		Total		*p*-value*
Transport	**n**	**%**	**n**	**%**	**n**	**%**	
Direct	317	78	282	87	599	82	<0.01
Secondary	70	17	32	10	102	14	
Unknown	21	5	11	3	32	4	
Total	408	100	325	100	733	100	
Time intervals	**n**	**%**	**n**	**%**	**n**	**%**	
EMS arrival - hospital admission <60 min	167	41	197	61	364	50	<0.01
Hospital admission - CT scan <60 min	269	66	242	74	511	70	0.854
Hospital admission - OR <120	131	32	118	36	249	34	0.995
Prehospital monitoring	**n**	**%**	**n**	**%**	**n**	**%**	
Pulse oximetry used	298	73	284	87	582	79	0.969
Blood pressure monitoring used	291	71	267	82	558	76	0.966
Capnography in ventilated patients	123	57	131	78	254	35	0.121
Prehospital ventilation	**n**	**%**	**n**	**%**	**n**	**%**	
Hyperventilation (pCO2 < 35 mmHg)	81	20	47	14	128	17	0.083
Normoventialtion (pCO2 35–42 mmHg)	64	16	59	18	123	17	
Hypoventilation (pCO2 > 42 mmHg)	10	2	13	4	23	3	
Unknown	253	62	206	63	459	63	
Total	408	100	325	100	733	100	
Prehospital fluid resuscitation	**n**	**%**	**n**	**%**	**n**	**%**	
Ringer's lactate	109	27	65	20	174	24	0.096
Ringer's solution	102	25	110	34	212	29	0.148
Other electrolyte solution	71	17	74	23	145	20	0.283
Colloids	105	26	59	18	164	22	<0.05
Hypertonic saline	22	5	15	5	37	5	0.665
Other treatment options	**n**	**%**	**n**	**%**	**n**	**%**	
Trombelastometry done	99	24	129	40	228	31	0.212
Corticosteroids given	15	4	3	1	18	2	0.045

Legend: *CT* Computed Tomography, *OR* Operation Room, *EMS* Emergency Medical Service, *pCO2* Partial Pressure of Carbon Dioxide
*The tests were applied only on known values

Table 4 Outcomes at hospital discharge and 6 months after trauma

	Phase 1		Phase 2		Total		*p*-value*
ICU deaths	106	26	67	21	173	24	<0.001
Hospital deaths	118	29	72	22	190	26	<0.001
6 m deaths	127	31	72	22	199	27	<0.001
Unknown at 6 m	179	44	39	12	218	30	
Total	408	100	325	100	733	100	
Unfavorable	154	38	105	32	259	35	
Unknown	179	44	39	12	218	30	
Grand Total	408	100	325	100	733	100	

Table 5 Comparison of expected and observed outcomes at hospital discharge and 6 months after trauma

	Phase 1	Phase 2
Observed deaths (n)	118	72
Observed mortality (mean%)	31	23
OE ratio	0,91	0,69
Unexpected survivors (n)	12	33
6 month total (Outcome known) (n)	229	286
Observed Unfavorable (n)	154	105
Observed Unfavorable (mean%)	67	37
OE ratio	1,12	0,68
Unexpected favorable (n)	-16	49

Legend: *OE* observed/expected; 6 month outcome was measured by GOSE (Glasgow Outcome Scale extended) and dichotomized into favorable (GOSE score 7–8) and unfavorable (GOSE score 1–6) outcomes, *OE* Observed versus Expected

Zníženie nemocničnej mortality z 31 % na 23 %.

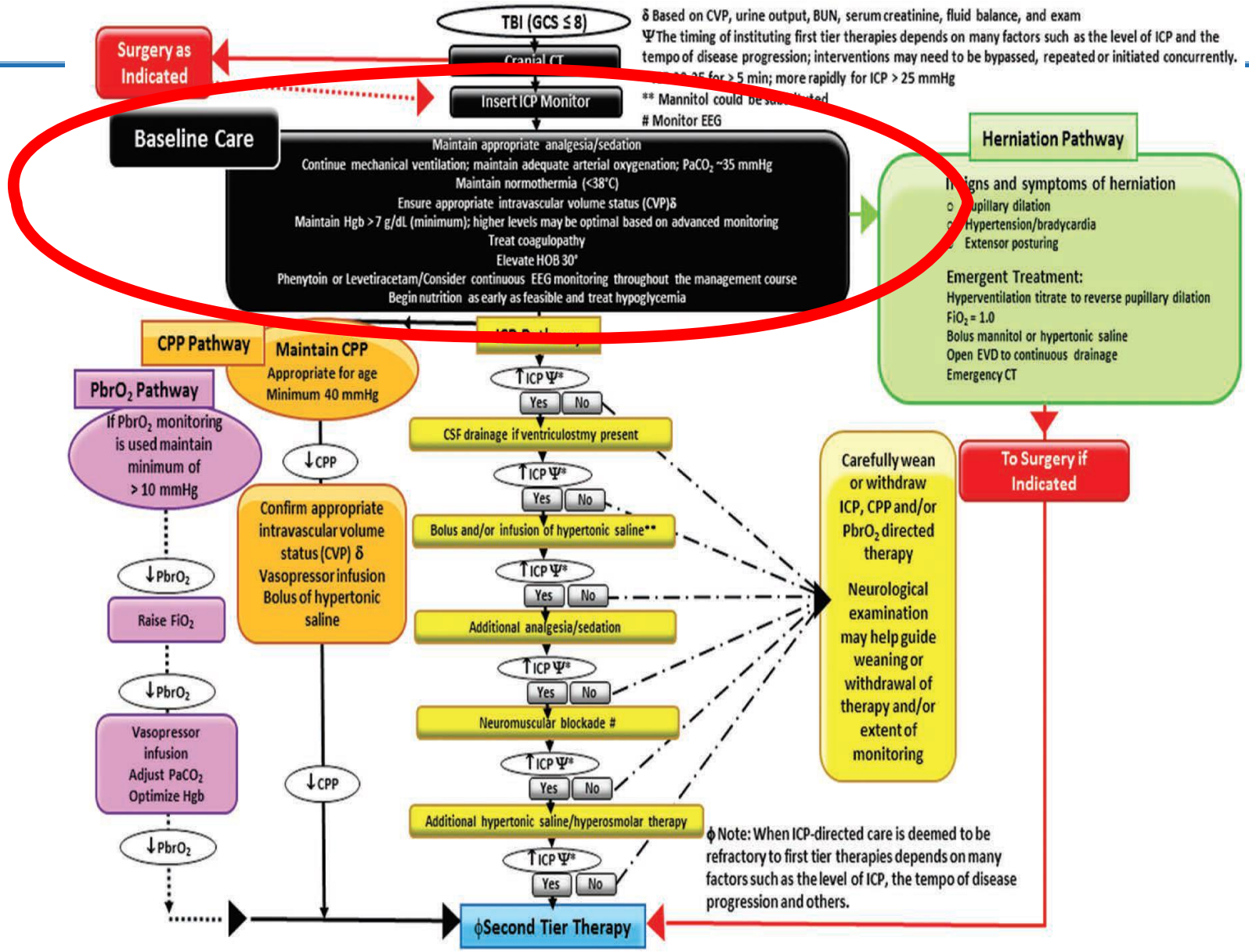
Uspokojivý outcome po 6 mesiacoch z 18 % na 56 %

- Recentné multicentrické štúdie u detí
  - **6% zvýšenie prežívania na každý percetnuálny bod -** increase in adherence rate to the guidelines

CURRENT OPINION

Pediatric neurocritical care in the 21st century: from empiricism to evidence

Mark S. Wainwright[a,b,c], *Gregory Hansen*[d], *and Juan Piantino*[e]


TBI (GCS ≤ 8)
Cranial CT
Insert ICP Monitor
Surgery as Indicated
δ Based on CVP, urine output, BUN, serum creatinine, fluid balance, and exam
Ψ The timing of instituting first tier therapies depends on many factors such as the level of ICP and the tempo of disease progression; interventions may need to be bypassed, repeated or initiated concurrently.
for > 5 min; more rapidly for ICP > 25 mmHg
** Mannitol could be substituted
# Monitor EEG
Baseline Care
Maintain appropriate analgesia/sedation
Continue mechanical ventilation; maintain adequate arterial oxygenation; PaCO2 ~35 mmHg
Maintain normothermia (<38°C)
Ensure appropriate intravascular volume status (CVP)δ
Maintain Hgb >7 g/dL (minimum); higher levels may be optimal based on advanced monitoring
Treat coagulopathy
Elevate HOB 30°
Phenytoin or Levetiracetam/Consider continuous EEG monitoring throughout the management course
Begin nutrition as early as feasible and treat hypoglycemia
Herniation Pathway
Signs and symptoms of herniation
Pupillary dilation
Hypertension/bradycardia
Extensor posturing
Emergent Treatment:
Hyperventilation titrate to reverse pupillary dilation
FiO2 = 1.0
Bolus mannitol or hypertonic saline
Open EVD to continuous drainage
Emergency CT
To Surgery if Indicated
CPP Pathway
Maintain CPP
Appropriate for age
Minimum 40 mmHg
PbrO2 Pathway
If PbrO2 monitoring is used maintain minimum of > 10 mmHg
↓CPP
Confirm appropriate intravascular volume status (CVP) δ
Vasopressor infusion
Bolus of hypertonic saline
↓PbrO2
Raise FiO2
↓PbrO2
Vasopressor infusion
Adjust PaCO2
Optimize Hgb
↓PbrO2
↑ICP Ψ*
Yes
No
CSF drainage if ventriculostmy present
Bolus and/or infusion of hypertonic saline**
Additional analgesia/sedation
Neuromuscular blockade #
Additional hypertonic saline/hyperosmolar therapy
Carefully wean or withdraw ICP, CPP and/or PbrO2 directed therapy
Neurological examination may help guide weaning or withdrawal of therapy and/or extent of monitoring
ϕ Note: When ICP-directed care is deemed to be refractory to first tier therapies depends on many factors such as the level of ICP, the tempo of disease progression and others.
ϕSecond Tier Therapy

- **Treat first what kills first**

  - A
  - B
  - C

Stabilizácia pacienta

- **A**
- **Intubácia GCS ≤ 8**
- Adekvátna veľkosť ETK
  - Balóniková
  - vek/4 + 3,5, malíček
- RSI
- Pri intubácii tlmený aj pacient v bezvedomí
- Stabilizácia krčnej chrbtice, **schantzov golier**

Intubácia

Pediatric Emergency Care:
September 2013 - Volume 29 - Issue 9 - p 963–968
doi: 10.1097/PEC.0b013e3182a219ea
Original Articles

Two Hundred Sixty Pediatric Emergency Airway Encounters by Air Transport Personnel: A Report of the Air Transport Emergency Airway Management (NEAR VI: "A-TEAM") Project

Tollefsen, William Wallace MD[*†‡]; Brown, Calvin A. III MD[*§]; Cox, Kelly L. MD[‖]; Walls, Ron M. MD[*§]

Results: Two hundred sixty pediatric intubations were performed consisting of 88 medical (33.8%) and 172 trauma (66.2%) cases; 98.8% (n = 257) underwent an orotracheal intubation attempt as the first method. First-pass intubation success was 78.6% (n = 202), and intubation was ultimately successful in 95.7% (n = 246) of cases. Medical and trauma intubations had similar success rates (98% vs 95%, Fisher exact test $P = 0.3412$). There was no difference in intubation success between age groups ($\chi^2 = 0.26$, $P = 0.88$). Three patients were managed primarily with an extraglottic device. Rescue techniques were used in 11 encounters (4.2%), all of which were successful. Cricothyrotomy was performed twice, both successful.

JSR Journal of Surgical Research

Intubácia

Article in Press

Prehospital care and transportation of pediatric trauma patients

Casey J. Allen, MD, Laura F. Teisch, BS, Jonathan P. Meizoso, MD, Juliet J. Ray, MD, Carl I. Schulman, MD, PhD, Nicholas Namias, MD, Juan E. Sola, MD, Kenneth G. Proctor, PhD
Division of Trauma and Surgical Critical Care, Dewitt-Daughtry Family Department of Surgery, University of Miami Miller School of Medicine, Miami, Florida

Received: December 15, 2014; Received in revised form: January 29, 2015; Accepted: March 4, 2015; Published Online: March 10, 2015

Conclusions

PHIs did not delay transportation times or worsen outcomes in pediatric trauma patients. Although mortally injured children more often required PHIs, this did not delay transportation to the trauma center.

Intubácia

An observational study of paediatric pre-hospital intubation and anaesthesia in 1933 children attended by a physician-led, pre-hospital trauma service.

Nevin DG[1], Green SJ[2], Weaver AE[3], Lockey DJ[4].

Resuscitation. 2014 Feb;85(2):189-95. doi: 10.1016/j.resuscitation.2013.10.006. Epub 2013 Oct 19.

- Obdobie 2000 – 2011
- 1933 detí mladších ako 16 rokov
- 315 prednemocničných intubácii
- len 3 pacienti mladší ako 1 rok
- **99,7% úspešnosť intubácií**

Efficacy of pre-hospital rapid sequence intubation in paediatric traumatic brain injury: A 9-year observational study

Stefan Heschl[a,b,*], Ben Meadley[b,c], Emily Andrew[b,c], Warwick Butt[d], Stephen Bernard[b,c,e], Karen Smith[b,c,f]

Discussion: Prehospital RSI in paediatric patients with TBI can safely be performed by highly trained paramedics. Overall, we observed more favourable long-term outcomes in patients who received prehospital intubation than those who did not, however our study is not powered to detect a significant difference. Intubation prior to transport might be beneficial for major trauma patients.

Please cite this article in press as: S. Heschl, et al., Efficacy of pre-hospital rapid sequence intubation in paediatric traumatic brain injury: A 9-year observational study, Injury (2018), https://doi.org/10.1016/j.injury.2018.02.013

Prehospital on-scene anaesthetist treating severe traumatic brain injury patients is associated with lower mortality and better neurological outcome

Pakkanen *et al. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine* (2019) 27:9
https://doi.org/10.1186/s13049-019-0590-x

Toni Pakkanen[1,2*], Jouni Nurmi[3], Heini Huhtala[4] and Tom Silfvast[5]

Conclusion: Prehospital on-scene anaesthetist treating severe TBI patients is associated with lower mortality and better neurological outcome.

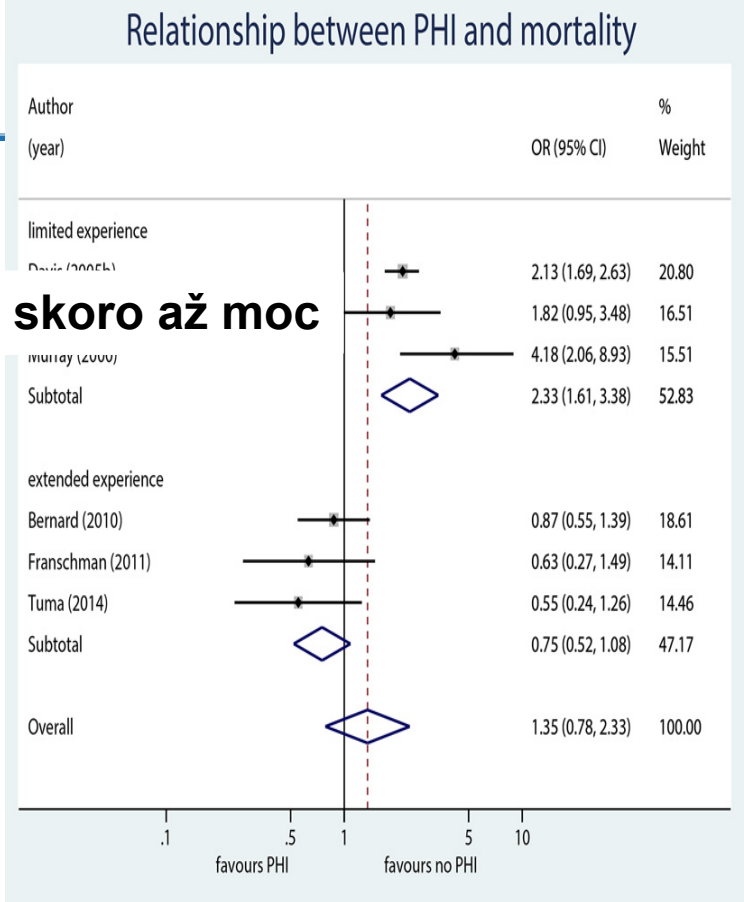
RESEARCH ARTICLE

Experience in Prehospital Endotracheal Intubation Significantly Influences Mortality of Patients with Severe Traumatic Brain Injury: A Syste Analysis

Myslím, že si dostatočne hlboko, skoro až moc

Sebastiaan M. Bossers[1], Lothar A. Schwarte[1,2], Stephan A. Loer[1], Jos W. R. Twisk[3], Christa Boer[1,4], Patrick Schober[1,2]*

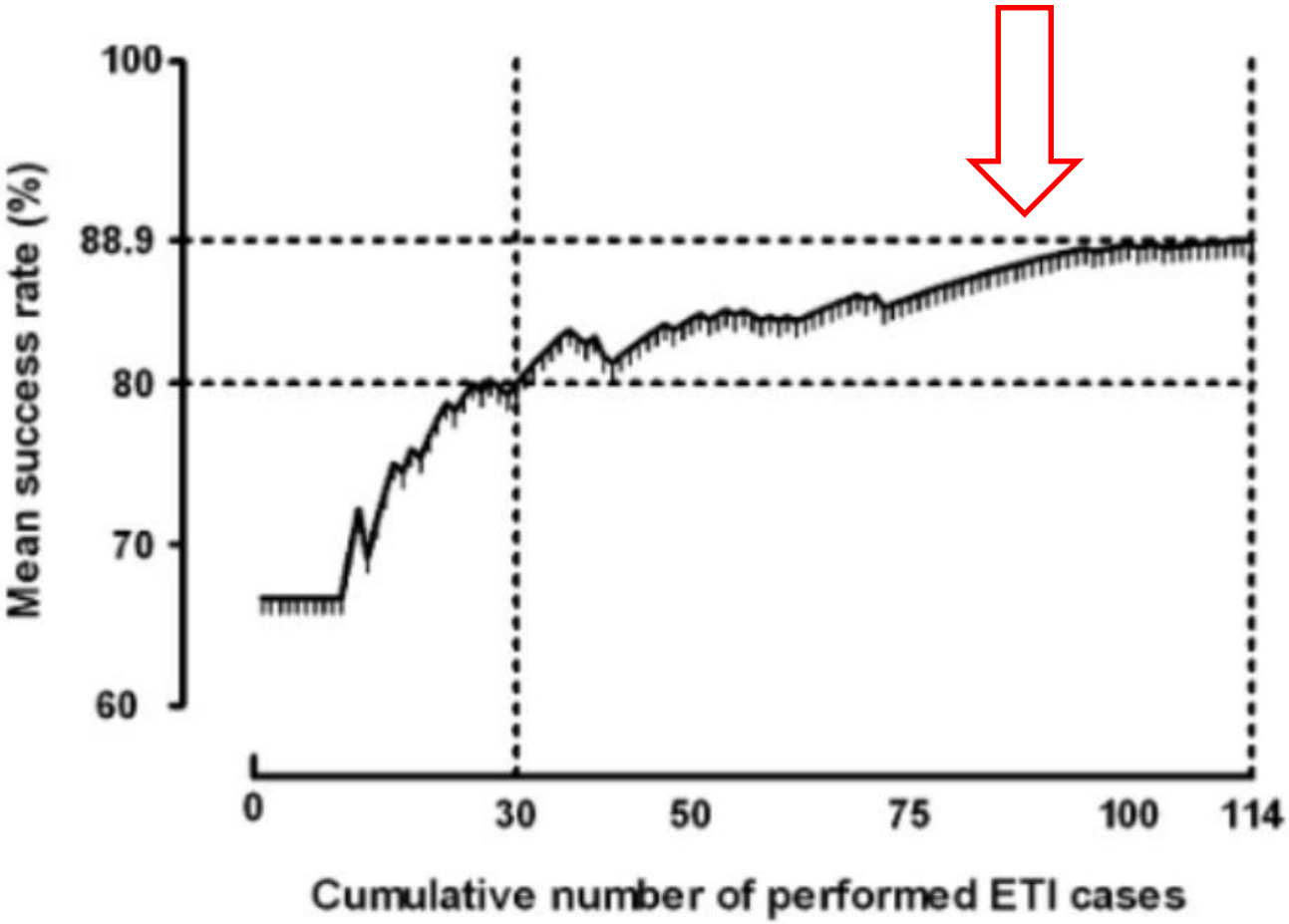
1 Department of Anaesthesiology, VU University Medical Centre, Amsterdam, The Netherlands, **2** Helicopter Emergency Medical Service "Lifeliner 1", VU University Medical Centre, Amsterdam, The Netherlands, **3** Department of Epidemiology and Biostatistics, VU University Medical Centre, Amsterdam, The Netherlands, **4** Institute for Cardiovascular Research, VU University Medical Centre, Amsterdam, The Netherlands



Conclusions

Effects of prehospital endotracheal intubation depend on the experience of prehospital healthcare providers. Intubation by paramedics who are not well skilled to do so markedly increases mortality, suggesting that routine prehospital intubation of TBI patients should be abandoned in emergency medical services in which providers do not have ample training, skill and experience in performing this intervention.

PLOS ONE | DOI:10.1371/journal.pone.0141034 October 23, 2015


100
88.9
80
70
60
Mean success rate (%)
0
30
50
75
100
114
Cumulative number of performed ETI cases

- Nie sú jednoznačné údaje dokazujúce prospech endotracheálnej intubácie oproti **adekvátnej ventilácii maskou a samorozpínacím vakom**

- V prípade prednemocničnej ETI – **skúsený personál**, **monitorig EtCO2**

- Etomidat 0,3 mg/kg i.v.
- S-Ketamin 1-2 mg/kg i.v.

Hemodynamická stabilita

Stabilizácia pacienta

Vek	Normoventilácia počet dychov/min	Hyperventilácia počet dychov/min
Dospelí	10	20
Deti	20	30
Dojčatá	25	35

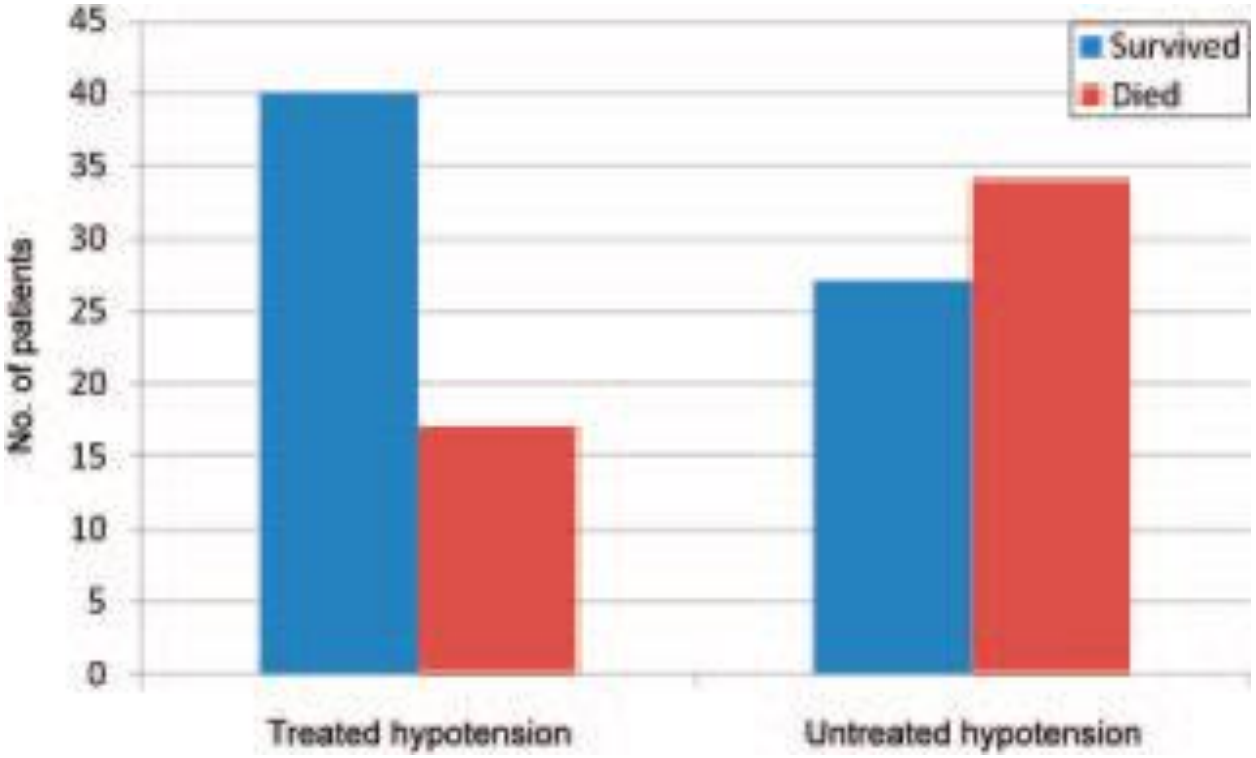
VT = 5-8 ml/kg alebo **prispôsobiť exkurziám hrudníka**

•3 x 20 ml/kg

•Po každej dávke prehodnotiť stav dieťaťa
•!max. denná dávka koloidov!

•Nie ! glukózové roztoky, 1/1 HR (Na 131 mmol/l)!

•Skoré nasadenie katecholamínovej podpory



Hypotenzia

Zebrack M., Dandoy Ch. et al. Early Resuscitation of Children With Moderate-to-Severe Traumatic Brain injury, Pediatrics 2009, 124, 56-64

Hypertonický 3% NaCl

- Zvyšuje osmolalitu plazmy
- Zlepšuje pomery na bunkovej membráne neurónu
  - Znižuje hladiny excitačného glutamátu
- Znižuje ICP
- Stabilizuje hemodynamiku

2 – 5 ml/kg

Walker A. P., Harting M.T et al. Modern Approches to Pediatric Brain Injury Therapy Journal of Trauma, 2009, Vol. 67, No.2 Supp. 120-127

Manitol

- Redukuje viskozitu krvi, redukuje extravaskulárny objem
- **Preventívne podanie v prednemocničnej fáze sa neoporúča**
- Pri zhoršení neurologického nálezu alebo znakoch herniácie
- Manitol často používaný – **nebola nájdená adekvátna štúdia**

20% Manitol 0,25 – 1 g/kg za 15-30 min

Manitol vs. 3% NaCl

Mannitol Versus 3% NaCL for Management of Severe Pediatric Traumatic Brain Injury

Asma A. Taha, PhD, CPNP, Cheryl Westlake, PhD, ACNS-BC, Lina Badr, DNSc, CPNP, and Mudit Mathur, MD, FCCM

www.npjournal.org

Manitol + 3% NaCl – lepší GOS

Hypotermia

- Rutinné použitie hypotermie nemôže byť odporúčané u detí s KCP

Hutchinson JS, Ward RE, Lacroix J, et al: Hypothermia therapy after traumatic brain injury in children. N Engl J Med 2008, 358: 2447-2456

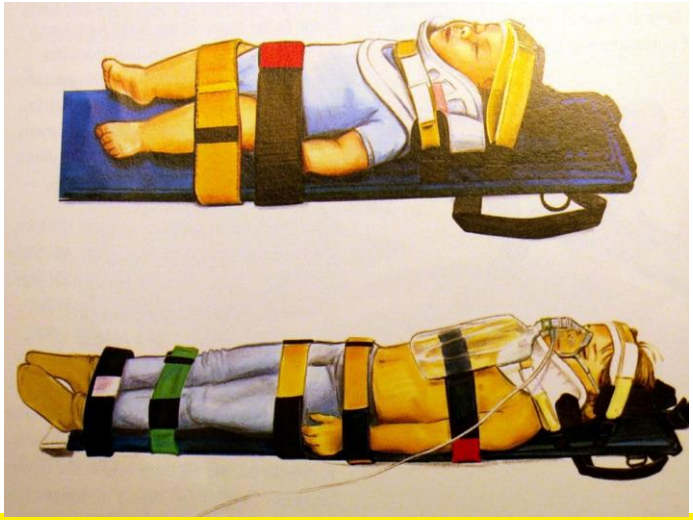
Kortikosteroidy

- Rutinné použitie u detí s KCP sa neodporúča

  Guidelines for the acute medical management of severe traumatic brain injury in infants, children, and adolescents, Ped.Crit. Care 2003, Vol.4, No 3

Transport

- Schantzov golier (! odtok z VJI u malých detí), chrbticová dlaha, vákuová podložka
- Elevácia hornej polovice tela **30º**
- Dostatočná analgosedácia, relaxácia, UVP
- Monitoring: EKG,TK, sat. O_2, $ETCO_2$
- **do detského traumacentra - LZS**



Z čoho majú lekári RLP **strach**

- **Emócie**

C C
B B
A A
Airway
Breathing Circulation

KEEP
CALM
AND
BE
COOL