



**LKH  
FELDKIRCH**

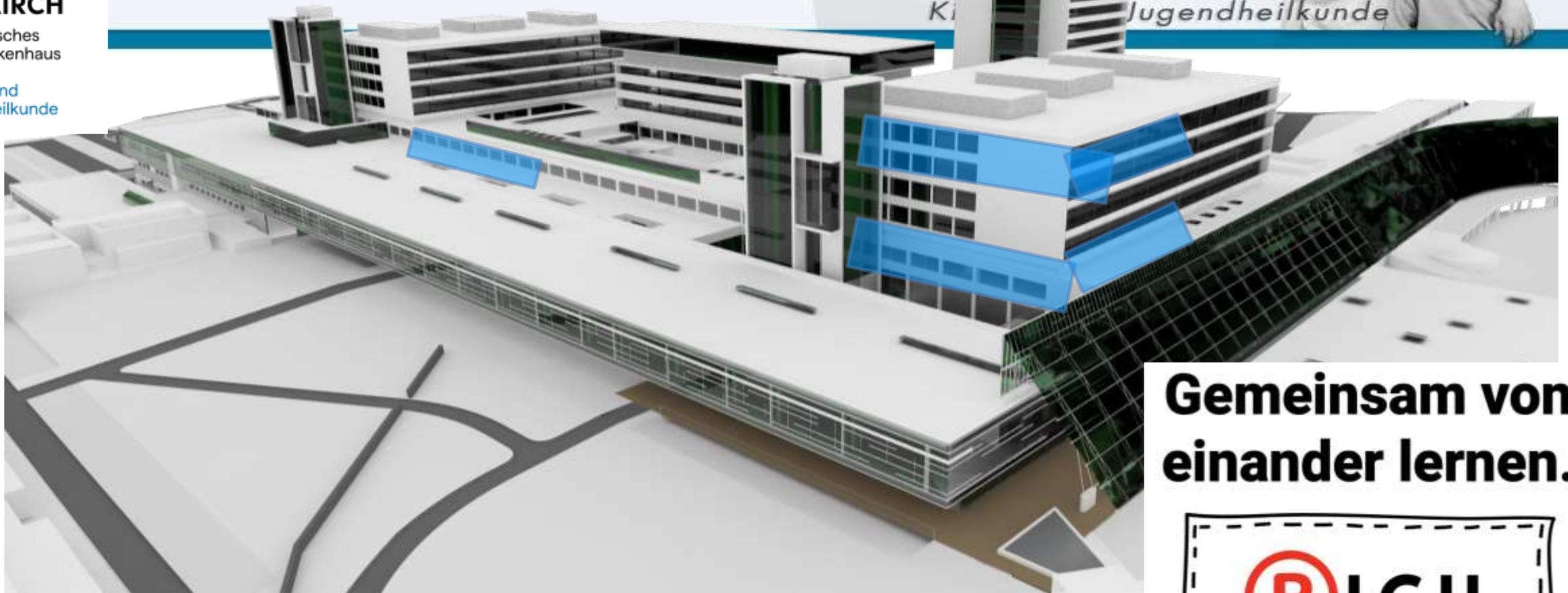
Akademisches  
Lehrkrankenhaus

Kinder- und  
Jugendheilkunde

LANDESKRANKENHAUS FELDKIRCH

isches Lehrkrankenhaus

Ki Jugendheilkunde



# Neurocritical Care

Burkhard Simma  
November 2024

**Gemeinsam von  
einander lernen.**







# Monitoring and Pediatric Trauma Center



- Basel
- Bern
- Genf
- Lausanne
- Luzern
- St. Gallen
- Zürich

Level I pediatric trauma center: Injury Severity Score  $>(12)16$   
(Hochspezialisierte Medizin, HSM; CH)



## Injury Severity Score; ISS

| Region                 | Injury Description       | AIS | Square Top Three |
|------------------------|--------------------------|-----|------------------|
| Head & Neck            | Cerebral Contusion       | 3   | 9                |
| Face                   | No Injury                | 0   |                  |
| Chest                  | Flail Chest              | 4   | 16               |
| Abdomen                | Minor Contusion of Liver | 2   |                  |
|                        | Complex Rupture Spleen   | 5   | 25               |
| Extremity              | Fractured femur          | 3   |                  |
| External               | No Injury                | 0   |                  |
| Injury Severity Score: |                          |     | 50               |

| AIS Score | Injury     | ISS            |
|-----------|------------|----------------|
| 1         | Minor      | 1-8 Minor      |
| 2         | Moderate   | 9-15 Moderate  |
| 3         | Serious    | 16-24 Serious  |
| 4         | Severe     | 25-49 Severe   |
| 5         | Critical   | 50-74 Critical |
| 6         | Survivable | 75 Maximum     |

Sum of the square of the three main affected organs

Level I pediatric trauma center: Injury Severity Score > (12)16

(Hochspezialisierte Medizin, HSM; CH)

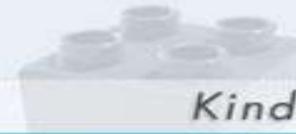
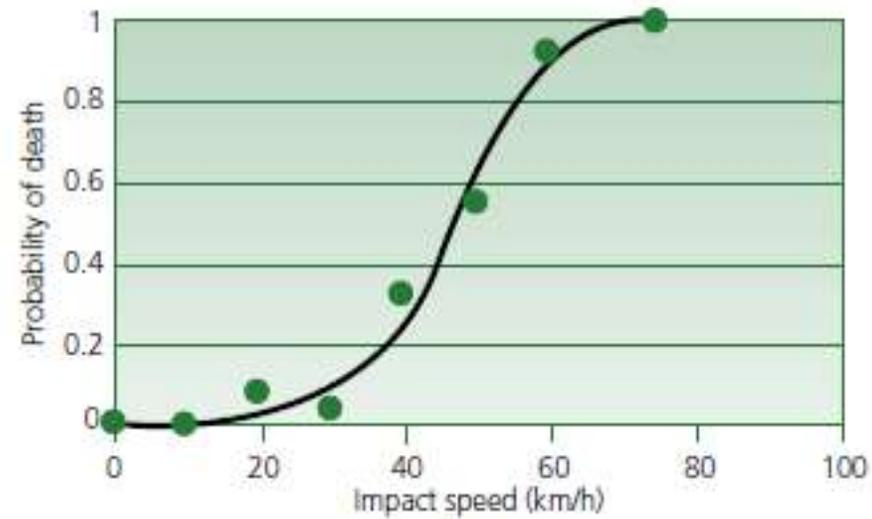


FIGURE 8

Pedestrian fatality risk as a function of the impact speed of a car



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ÖSG 2023 (Stand 15.12.2023)

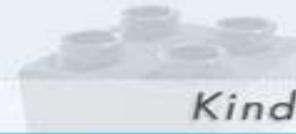
Anhang 4 – SHT

## Anhang 4: Präklinische Versorgung von schweren Schädel-Hirn-Traumen

- obligatorische Verwendung der Kapnographie
- Verwendung von Ringerlösung oder anderer balancierter Elektrolytlösungen
- KEINE Verwendung von Ringerlaktat
- KEINE Verwendung von Steroiden
- rascher Transport in das nächstgelegene geeignete Traumazentrum

Quelle:

[https://www.igeh.org/wp-content/uploads/2020/02/Empfehlungen\\_zur\\_Erstversorgung\\_SHT\\_Final\\_Version.pdf](https://www.igeh.org/wp-content/uploads/2020/02/Empfehlungen_zur_Erstversorgung_SHT_Final_Version.pdf)[https://www.oegari.at/web\\_files/dateiarchiv/editor/empfehlung\\_zu\\_erstversorgung\\_sht\\_2013.pdf](https://www.oegari.at/web_files/dateiarchiv/editor/empfehlung_zu_erstversorgung_sht_2013.pdf)Methodik zur Studie: [https://www.igeh.org/wp-content/uploads/2020/02/Erste\\_Ergebnisse\\_Prehospital\\_Projekt\\_Nov\\_2012.pdf](https://www.igeh.org/wp-content/uploads/2020/02/Erste_Ergebnisse_Prehospital_Projekt_Nov_2012.pdf)



# Clinical examination

## Glasgow Coma Scale (GCS) and mortality

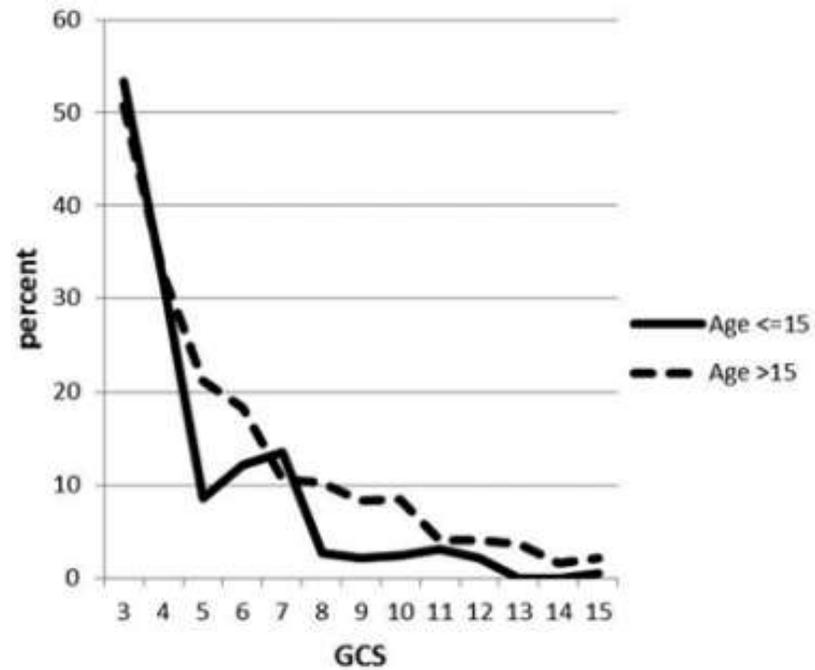


FIG. 2. Left: Percentage of deaths according to GCS score.



## Trauma - structured approach

- Primary survey (**AcBCDE**) – Resuscitation
  - „Treat first what kills first“
- Secondary survey
- Emergency treatment
- Definitive Care





## Treat first what kills first - AcBCDE

- **Ac:** Airway and cervical spine stabilization
- **B:** Breathing
  - Normoventilation, DOPES
- **C:** Circulation
  - No signs of shock in isolated TBI
  - Abdominal injuries possible even with intact skin
- **D:** Disability: Neuro Status
- **E:** Exposure

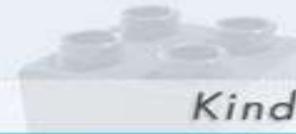




# Ac: Trauma - Immobilization



9.5 Placement of the sized cervical collar while the spine is maintained inline



# Ac: Spinal Cord Injury

Emergency Department and PICU Clinical Pathway for Evaluation/Treatment of Children with Suspected Traumatic Spinal Cord Injury

Goals and Metrics

Patient Education

Provider Resources

**Related Pathways**

[Nutrition for the Traumatically Injured Patient - ICU](#)  
[Trauma Resuscitation - ED](#)

Traumatic Spinal Cord Injury Suspected

**Resuscitation Complications**

Neurogenic shock  
 Spinal shock  
 Respiratory Failure  
 Temperature instability

Initial Assessment and Resuscitation

**Goals**

Avoid hypotension  
 Avoid hypoxia - Titrate supplemental O<sub>2</sub> for SpO<sub>2</sub> > 92 and < 98%  
 Maintain normothermia  
 Maintain safety  
 Adequate analgesia

**Trauma Team Resuscitation**

ATLS protocol  
 Spinal immobilization, including cervical collar  
[Spinal Trauma Consult Procedure](#)

Plain Radiograph, +/- Dedicated CT

Admission to PICU

Ongoing Resuscitation

**24 - 48 hours**

**Goals**

Avoid hypotension  
 Avoid hypoxia - Titrate supplemental O<sub>2</sub> for SpO<sub>2</sub> > 92 and < 98%  
 Prevent secondary neurological injury  
 External/internal stabilization of spine, as indicated  
 Tertiary exam per ATLS Standard, treat additional injuries

**Stabilization Complications**

Spinal shock  
 Orthostatic hypotension  
 Respiratory insufficiency  
 Feeding Intolerance

**Evidence**

[Neurogenic Bowel and Management after Spinal Cord Injury: A Narrative Review](#) [3]

[Neurogenic Bladder: Physiology, Pathogenesis, and Management after Spinal Cord Injury](#) [3]

[Early Acute Management in Adults with Spinal Cord Injury: A Clinical Practice Guideline for Health-care Professionals](#) [3]

[Acute Traumatic Spinal Cord Injury](#) [3]

[Pediatric Spinal Cord Injury: A Review by Organ System](#) [3]

[Spinal Cord Injuries in Children and Adolescents](#) [3]

[Rehabilitation of a Child With a Spinal Cord Injury](#) [3]

[Spine Injuries in Polytraumatized Pediatric Patients: Characteristics and Experience from a Level I Trauma Center Over Two Decades](#) [3]

[Spinal Cord Injury: What Are the Controversies?](#) [3]



# Ac: Spinal Cord Injury

Emergency Department and PICU Clinical Pathway for Evaluation/Treatment of Children with Suspected Traumatic Spinal Cord Injury

Evidence

[Neurogenic Bowel and Management after Spinal](#)

**Neurological Stability/Prevent Secondary Injury**

No methylprednisolone unless specifically directed by Neurosurgery

**Note:** Available medical evidence does not support a significant clinical benefit from the administration of methylprednisolone for 24-48 hours, instead suggesting harmful side effects.



24 - 48 hours

**Goals**

- Avoid hypotension
- Avoid hypoxia - Titrate supplemental O<sub>2</sub> for SpO<sub>2</sub> > 92 and < 98%
- Prevent secondary neurological injury
- External/internal stabilization of spine, as indicated
- Tertiary exam per ATLS Standard, treat additional injuries

**Stabilization Complications**

- Spinal shock
- Orthostatic hypotension
- Respiratory insufficiency
- Feeding Intolerance

[Acute Traumatic spinal Cord Injury](#) ☞

[Pediatric Spinal Cord Injury: A Review by Organ System](#) ☞

[Spinal Cord Injuries in Children and Adolescents](#) ☞

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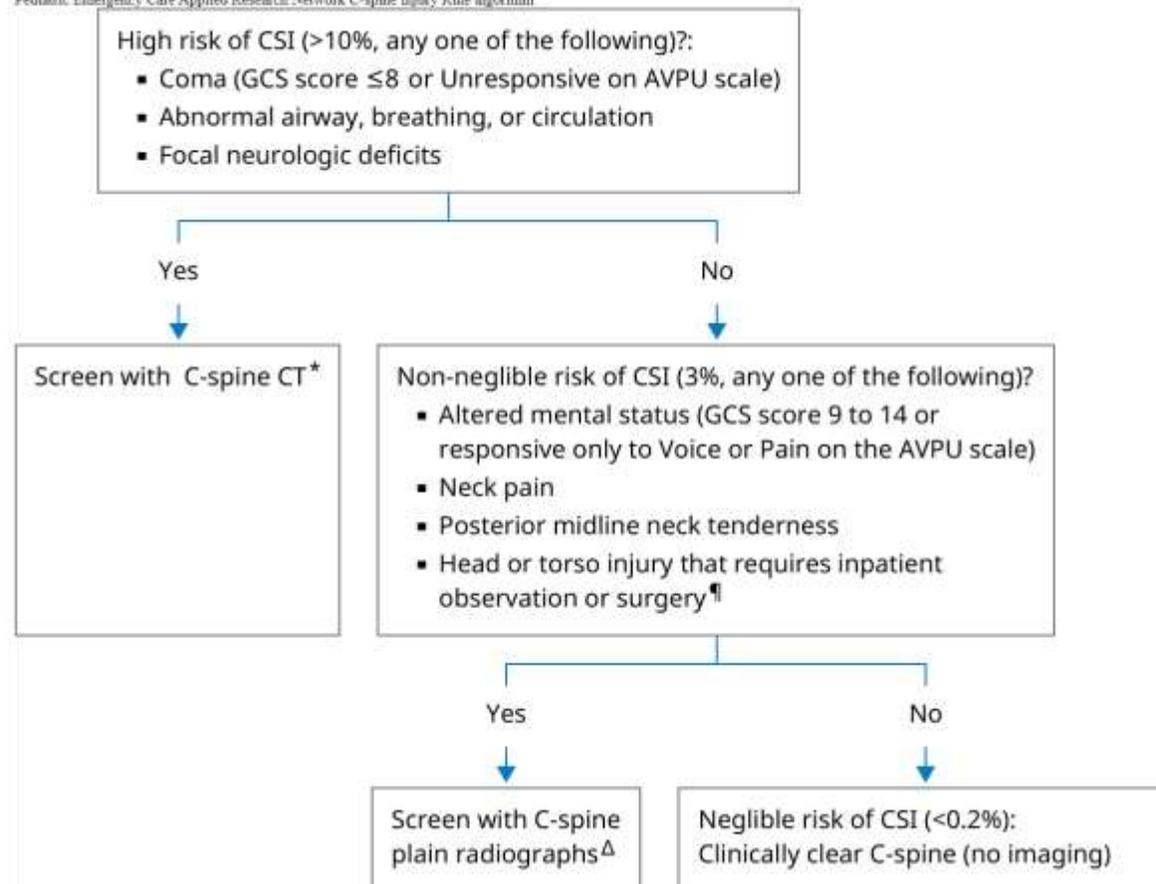


UpToDate®

spinal cord injury in children



Pediatric Emergency Care Applied Research Network C-spine Injury Rule algorithm





# Ac: Spinal Cord Injury

## Neurologic deficits in spinal cord injury

| Level of Lesion | Neurologic findings                          |                                     |  |
|-----------------|--|-------------------------------------|--|
|                 | Motor*                                       | Sensory level                       | Reflex*  |
| <b>Cervical</b> |  |                                     |  |
| C2              | Facial muscles, apneic                       | Occiput                             | No upper or lower extremity reflex                   |
| C3              | Facial muscles, apneic                       | Thyroid cartilage                   | No upper or lower extremity reflex                   |
| C4              | Spontaneous breathing                        | Suprasternal notch                  | No upper or lower extremity reflex                   |
|                 |  | Posterior neck                      |  |
| C5              | Shrugging and external rotation of shoulders | Below clavicle                      | Biceps present, remainder absent                     |
|                 |  | Middle deltoid                      |  |
| C6              | Elbow flexion Wrist extension                | Thumb                               | Biceps and brachioradialis present, remainder absent |
| C7              | Elbow extension                              | Index and middle fingers            | Triceps and above present, remainder absent          |
|                 | Wrist flexion                                |                                     |  |
| C8              | Finger flexion                               | Small finger and ulnar side of hand | Triceps and above present, remainder absent          |

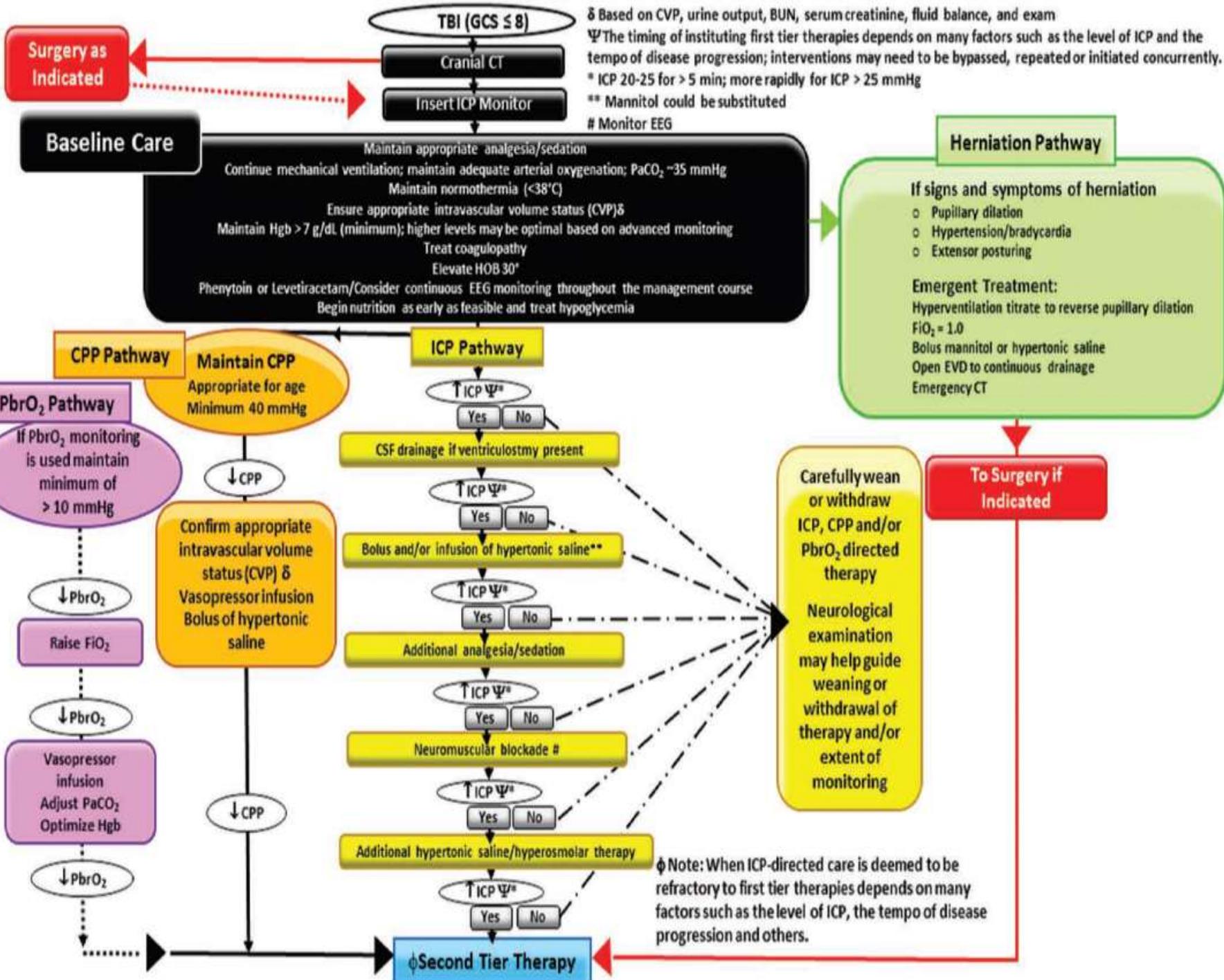


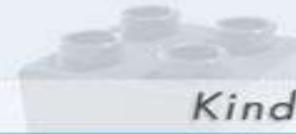
## Ac: Spinal Cord Injury

- A normal cervical spine X-ray does not exclude an injury (SCIWORA)
- Cervical Spine CT within 1 hour
  - Initial GCS <13
  - Intubated
  - Peripheral focal neurologic signs
  - Limb Paraesthesia
- Methylprednisolon:
  - 30 mg/kg <8 (3)h injury,
  - than 5.4 mg/kg/h for 24 hours

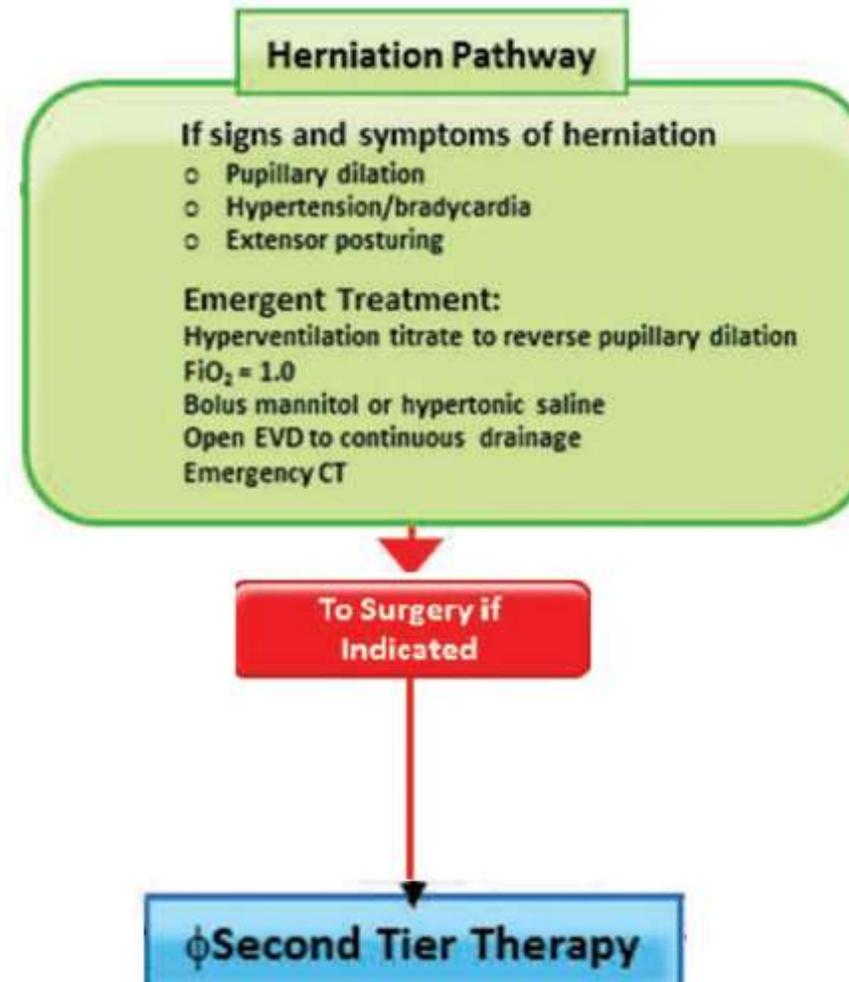
NICE: National Institute of Health and Care Excellence







## D: Herniation Pathway



irrespective of high ICP y/n

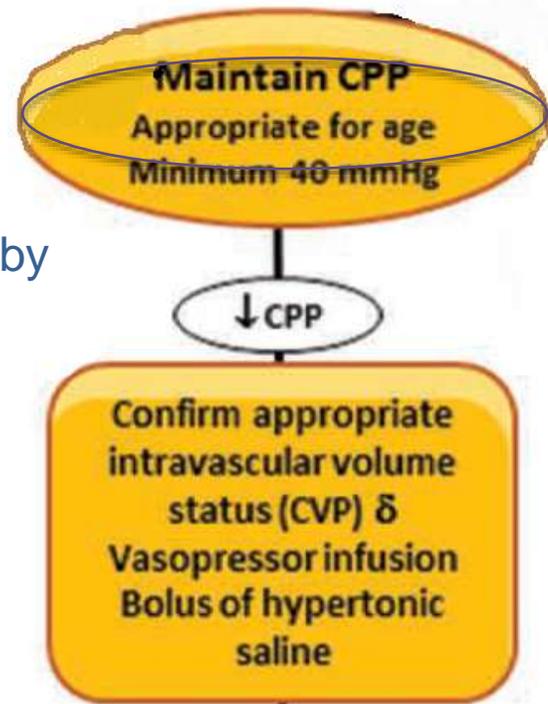


## FIRST TIER THERAPIES

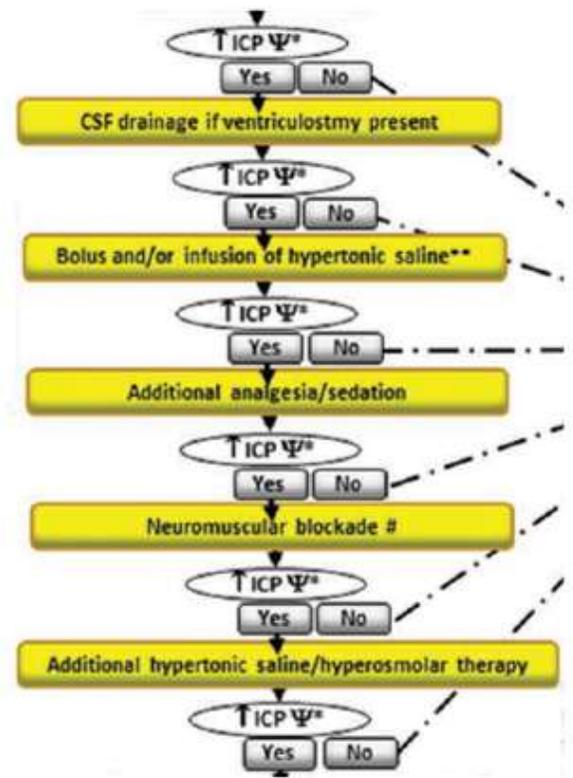
### PbrO<sub>2</sub> Pathway

- CVP 4-10 mmHg  
 MAP 50<sup>th</sup> percentile  
 SBP >70 +(2 x age in years) by
- fluid bolus
  - vasopressors

### CPP Pathway



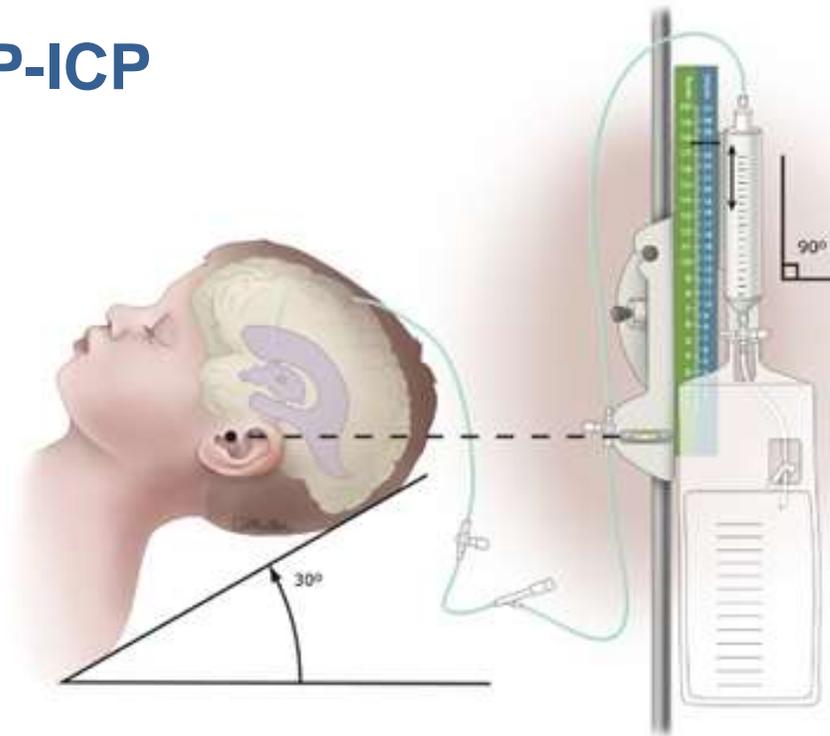
### ICP Pathway





# Cerebral Perfusion Pressure (CPP)

**CPP=MAP-ICP**



MAP: Nicht klar definiert ist die Höhe der arteriellen Messung:  
auf Herzhöhe od. Foramen Monroi

1 cm H<sub>2</sub>O= 0,73 mmHg



# Monitoring

## Pressure reactivity index (PRx)

Correlation coefficient of MAP and ICP

response of ICP to changes in arterial blood pressure

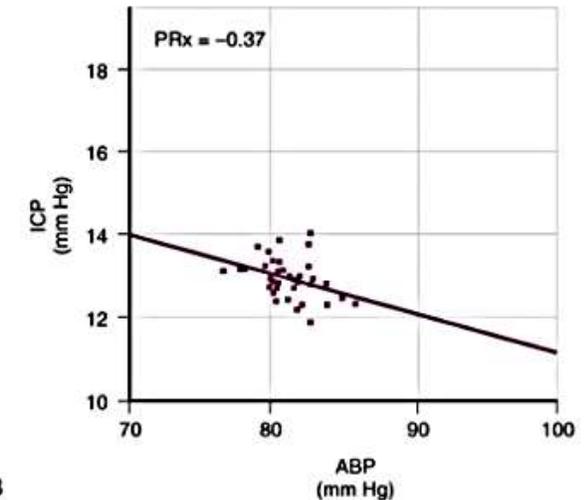
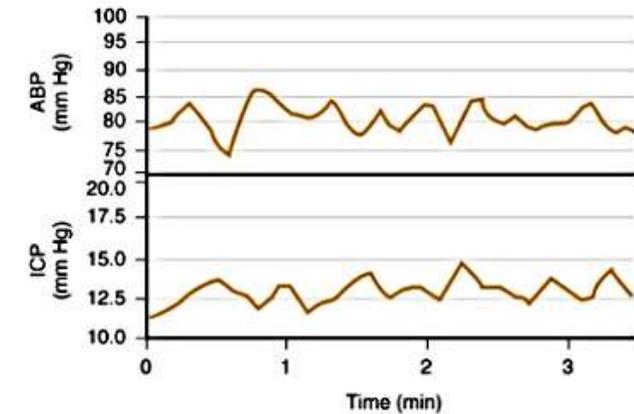
PRx: negative or near zero

any rise in MAP lead to inverse change in ICP (and CBV)

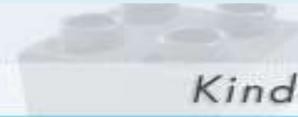
**normal cerebrovascular bed**

PRx: positive

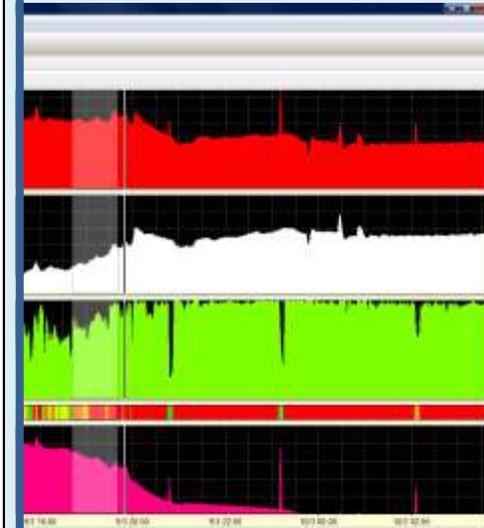
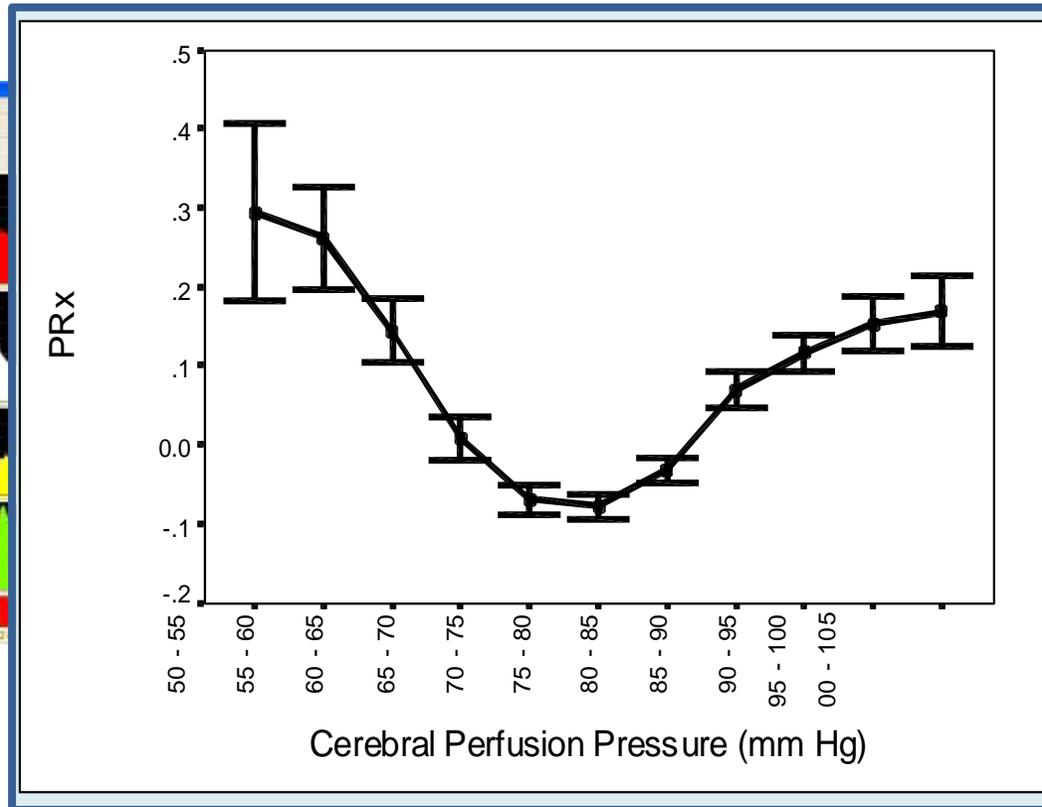
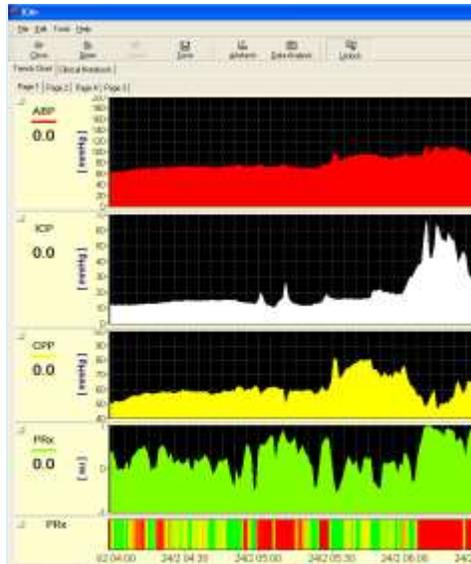
**non-reactive vascular bed**



B



## Optimal CCP – oriented therapy

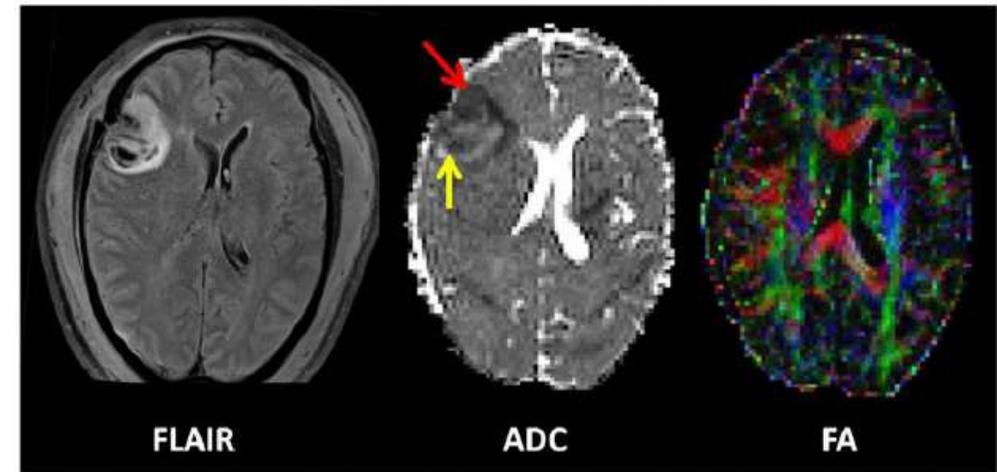




# Neuroimaging

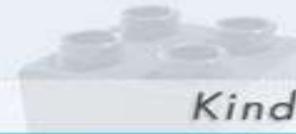
**ADC:** apparent diffusion coefficient diffusion of water molecules to generate contrast in MR images

- high ADC: vasogenic edema
- low ADC: cytotoxic edema, ischemia



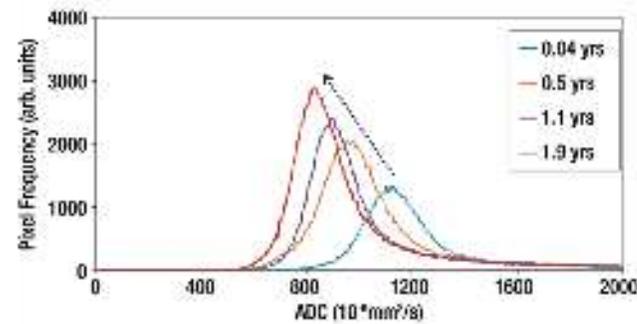
**FIGURE 2 |** Example of an early contusion in a 49-year-old male who sustained a severe TBI after an alleged assault. He was GCS 4 at the scene. Imaging was performed approximately 48 h after injury. A left frontal contusion can be clearly seen on the FLAIR image. The apparent diffusion coefficient map (ADC) shows a

cytotoxic rim (red arrow) and vasogenic rim (yellow arrow). The combined fractional anisotropy and directional map (FA) shows loss of fibers integrity at the site of the contusion. Color hue indicates direction as follows; red, left-right; green, anteroposterior; blue, superior-inferior.



# Neuroimaging

**ADC:** normal values ( $650\text{--}700 \times 10^{-6} \text{ mm}^2/\text{sec}$ )

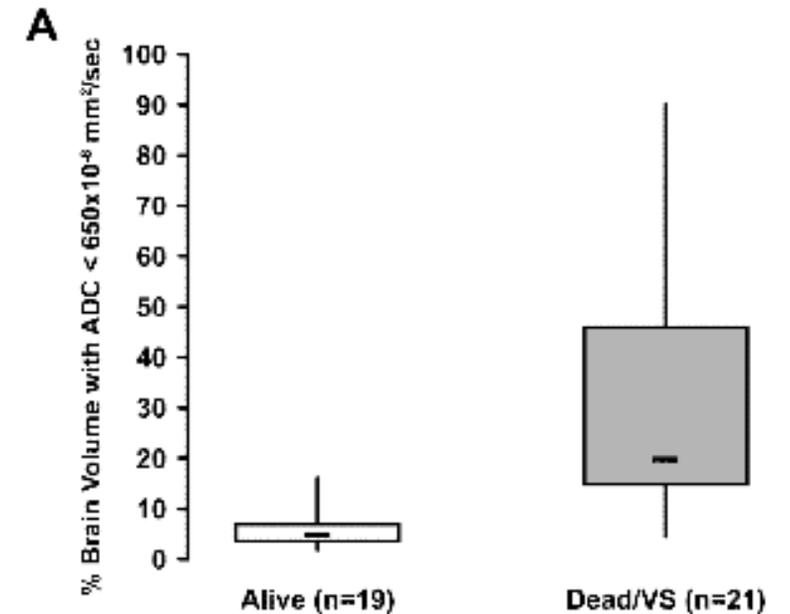


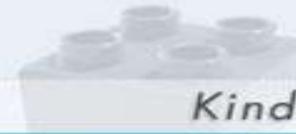
**ADC:** prognosis

**Percentage of brain volume with an ADC <650**

<3% good outcome

>20%: poor outcome





# Head Injury - Recommendations

Level I: none

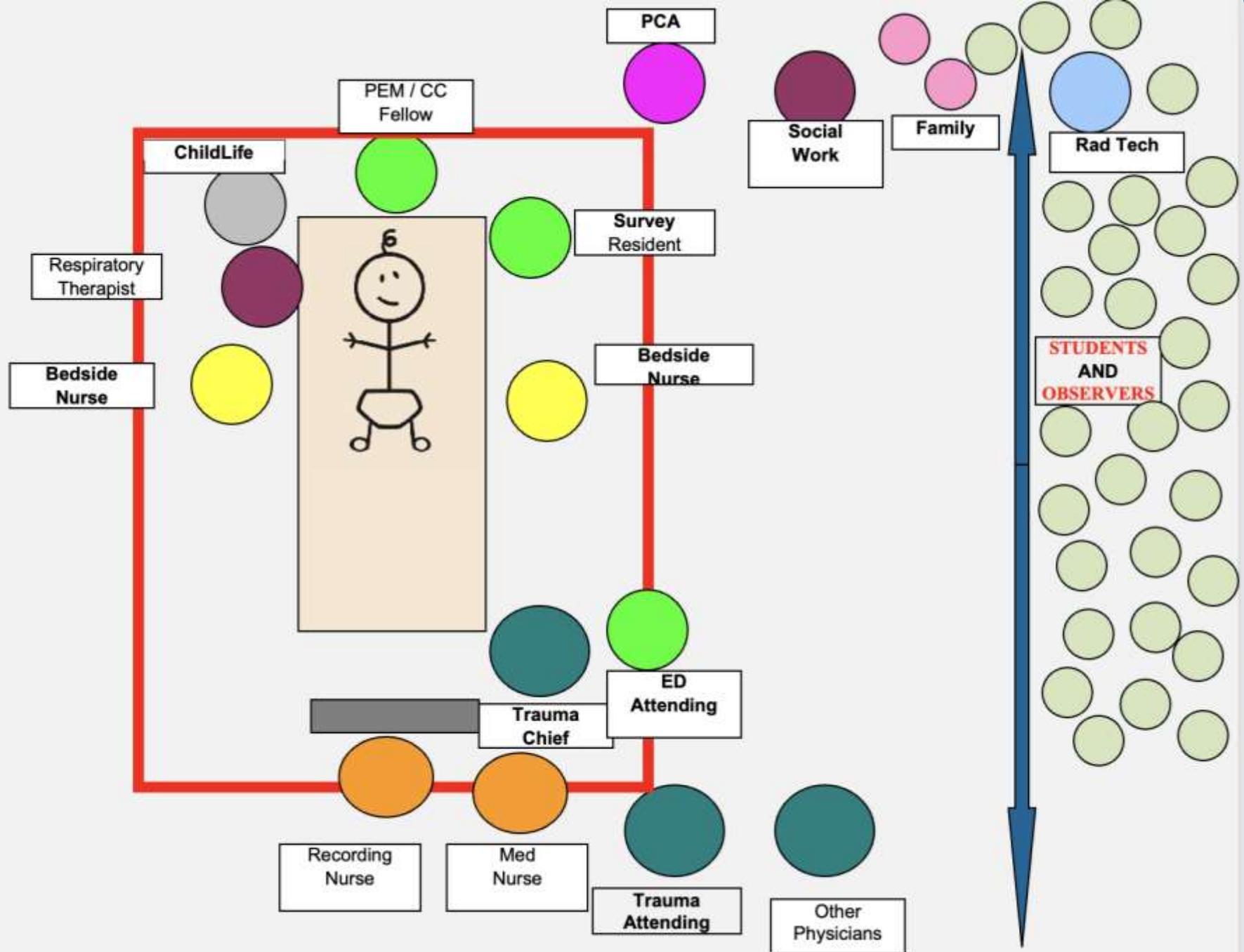
Level II: one is supportive

- Bolus hypertonic saline is recommended...

two for avoiding

- prophylactic moderate hypothermia is not recommended...
- use of immune-modulating diet is not recommended...

Level III: 19





## Case

10a, female,

vomiting w/o diarrhea, lethargy, polyuria, polydipsia

VS: T 37.8°C, HR 75, RR 20, RR 80/40-55, SpO<sub>2</sub> 92, GCS 13





# Case

## Diagnose

A: Meningitis

B: Gastroenteritis

C: Diabetische Ketoazidose

D: Trauma

E: weder A - D



## Case

10a, female,

vomiting w/o diarrhea, lethargy, polyuria, polydipsia

VS: T 37.8°C, HR 75, RR 20, RR 80/40-55, SpO<sub>2</sub> 92, GCS 13

pH 6.89; BE -26mmol/L; pCO<sub>2</sub> 23mmHg, sodium 133mmol/L, glucose 368mg/dL



## Case

10a, female,

vomiting w/o diarrhea, lethargy, polyuria, polydipsia

VS: T 37.8°C, HR 75, RR 20, RR 80/40-55, SpO<sub>2</sub> 92, GCS 13

pH 6.89; BE -26mmol/L; pCO<sub>2</sub> 23mmol/L, sodium 133mmol/L, glucose 368mg/dL

Fluid: 2x maintenance, insulin: 0.02E/kg/h because of low blood glucose

GCS 8

after 7h: pH 7.16; BE -24mmol/L; pCO<sub>2</sub> 12mmHg, sodium 128 mmol/L, glucose 306mg/d

# General cerebral edema



pH 7.17; BE -13 mmol/L; pCO<sub>2</sub> 29mmHg, **sodium 122 mmol/L**, glucose 330mg/dl



## DKA and cerebral edema

Fluids:

Maintenance: 3000mL/m<sup>2</sup>/d, 0.9% NaCl

Potassium phosphate (K<sub>2</sub>HPO<sub>4</sub>) 0.15 mval/h + KCl; Insulin 0.1 U/kg/h

**NaCl 3% 8x3mL/kg over 10h, Mannitol 0.5g/kg**

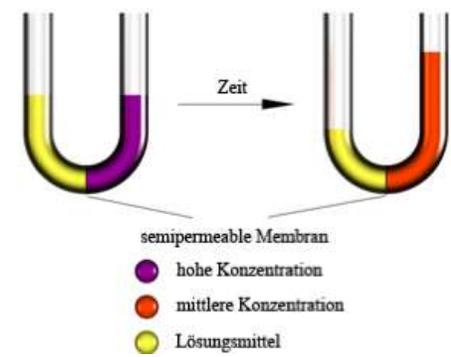
after 4 hours:

pH 7.31, **sodium 133 mmol/l**, glucose 195mg/dl

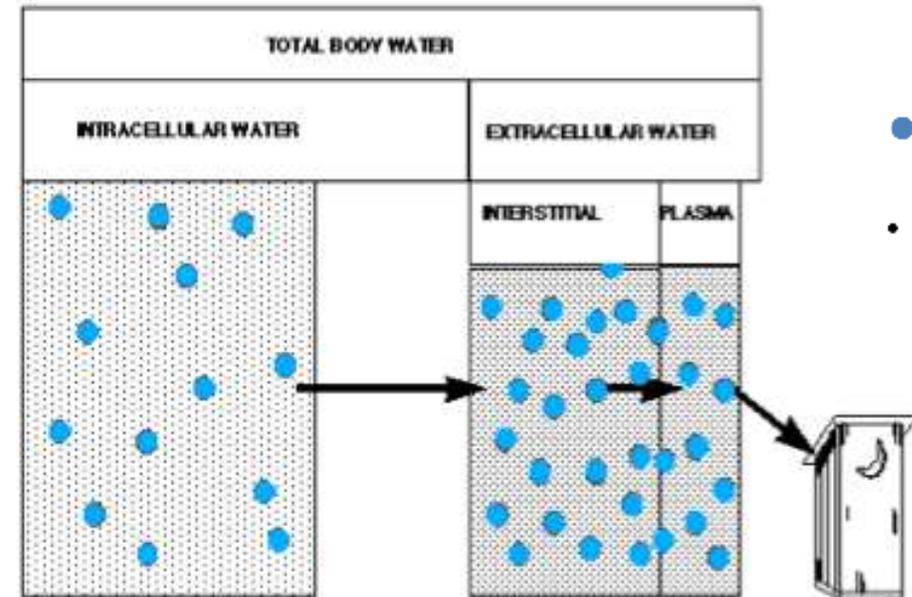
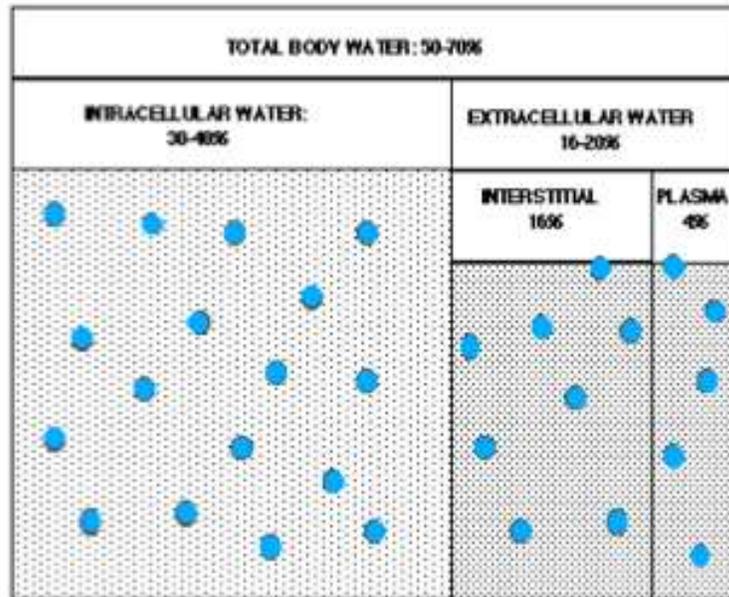
after 8 hours:

pH 7.36, **sodium 132 mmol/l**, glucose 119 mg/dl

**2 Na<sup>+</sup> + (Glucose, mg/dl:18) + (BUN mg/dl:2.8)**

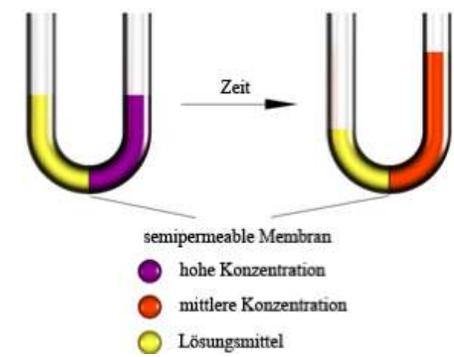


# DKA and cerebral edema

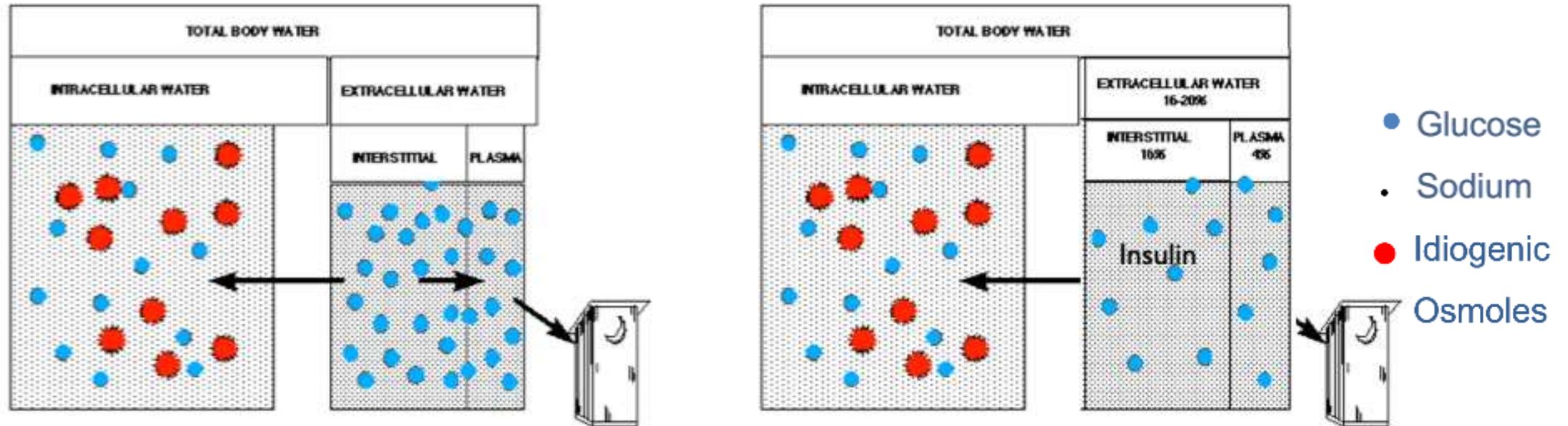


- Glucose
- Sodium

**2 Na<sup>+</sup> + (Glucose, mg/dl:18) + (BUN mg/dl:2.8)**

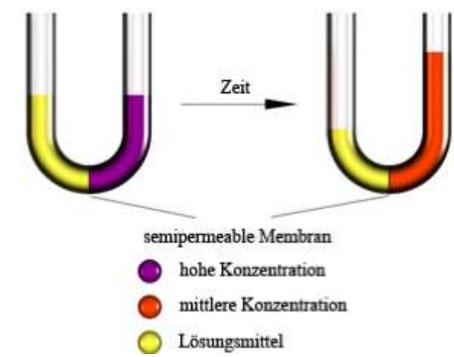


## DKA and cerebral edema



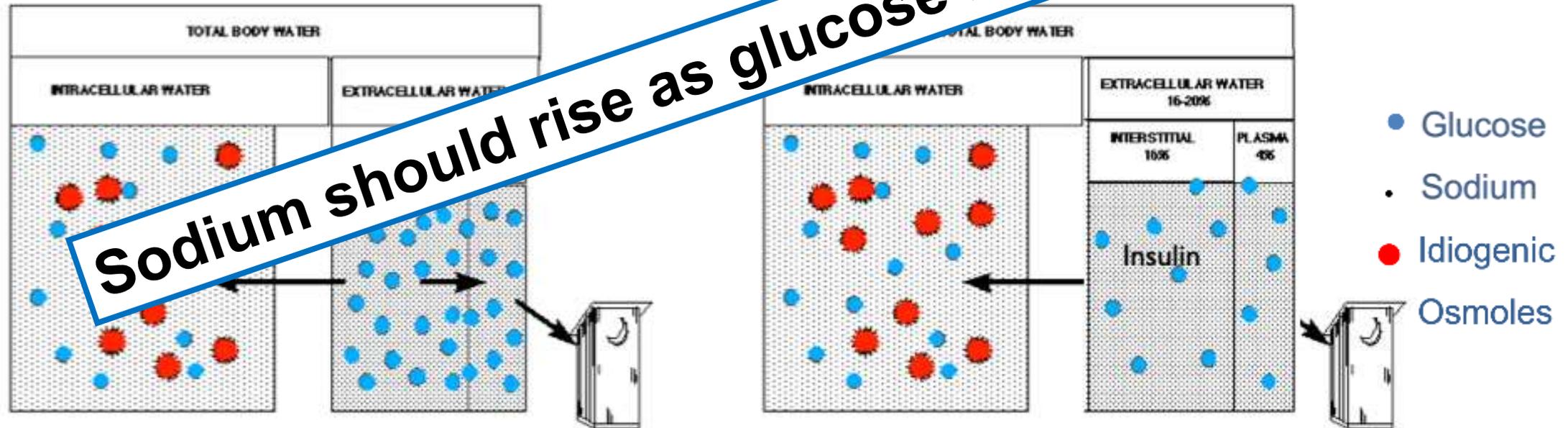
Hyperglycemia, the brain generates "idiogenic osmoles" which draw water back  
 Due to (too) early insulin therapy, extracellular glucose falls (too fast) whereas idiogenic osmoles remain constant.

$2 \text{ Na}^+ + (\text{Glucose, mg/dl:18}) + (\text{BUN mg/dl:2.8})$



# DKA and cerebral edema

**Sodium should rise as glucose falls**



Hyperglycemia, the brain generates "idiogenic osmoles" which draw water back  
 Due to (too) early insulin therapy, extracellular glucose falls (too fast) whereas idiogenic osmoles remain constant.



## Case #3

8yrs, boy

Headache, hemiparesis upper right limb, right central palsy of 7<sup>th</sup> cranial nerve,

Babinski right, changing consciousness

Admission within 2hrs

VS: T 36.8°C, HR 90min<sup>-1</sup>, BP 130/80mmHg, RR 15min<sup>-1</sup>, SpO<sub>2</sub> 96%, GCS 14

Medical history: chickenpox 2 mo ago

BSR 3/10, CRP normal



# Case

## Diagnose

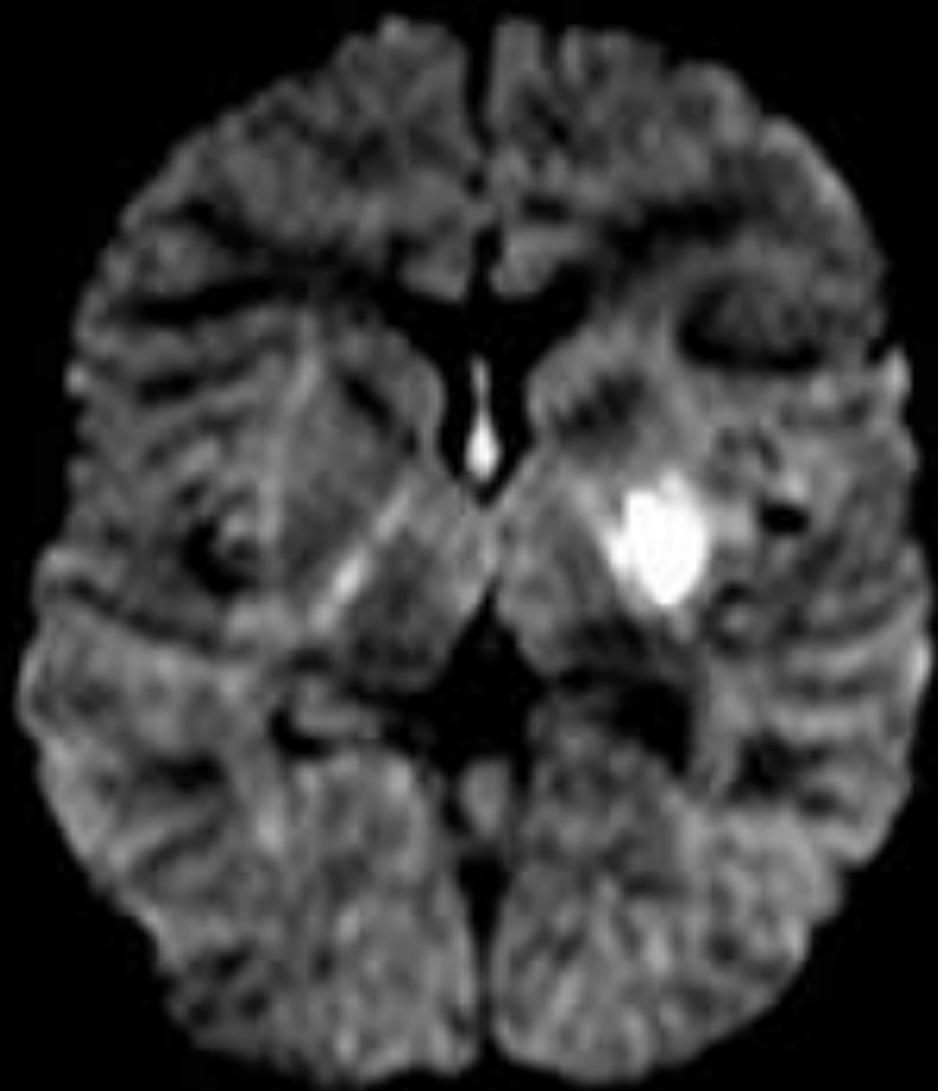
A: Meningitis - Lumbalpunktion

B: Bildgebung - konventionelles CT - Lumbalpunktion

C: „wait and see“

D: Bildgebung – MR mit Angiographie

E: weder A - D





# Stroke – Risk Factors

1:15.000 of pts with varicella or in 30% of pts with stroke

Infection V/I

VZV infection in the last 12 mo

Unilateral stenosis of one great vessel

VZV-PCR a/o VZV IgG pos in LP

Prognosis: neurological deficit in 80%; stroke recurrence in 45%



# Stroke – Risk Factors

## Risk of recurrence

- Perinatal Stroke: recurrent stroke risk  $<1\%$
- Childhood Stroke: recurrent stroke risk is **15-18%**
- Children with cardiac disease/arteriopathy may have up to a increased risk of recurrence (even **five fold** on antithrombotics)

# STROKES CAN HAPPEN AT ANY AGE

Pediatric stroke can happen in infants, children and even before birth.



## PERINATAL STROKE

Last few months of pregnancy to 1-month-old

## CHILDHOOD STROKE

1-month-old to 18 years

### Risk Factors

The cause in most perinatal strokes remains unknown.

Risk factors that could lead to stroke include:

- Congenital heart disease
- Disorders of the placenta
- Blood clotting disorders
- Infections (e.g. Meningitis)

Risk factors in children ≠ Risk factors in older adults

Risk factors for children include:

- Congenital heart disease
- Diseases affecting the brain's arteries
- Infections affecting the brain or other organs
- Head trauma
- Sickle cell disease
- Autoimmune disorders

No previous risk factor is identified in about half of childhood stroke cases.

### Warning

Signs of a perinatal stroke may go unrecognized for months or years because the signs can be subtle.

**Newborns:**

Seizures may be an early sign:

- Repetitive twitching of face, arm or leg
- Apnea (pauses in breathing) associated with staring

**Developing Children:**

- Decreased movement or weakness on one side of the body
- Showing a hand preference, or consistently reaching out with only one hand before 1 year of age

### Signs

Signs are often missed in children because there is a lack of awareness that strokes can happen in this age group.

# F. A. S. T.

Face Drooping Arm Weakness Speech Difficulty Time to Call 911

Additional Signs in Children Include:

- Severe sudden headache, especially with vomiting and sleepiness
- Weakness or numbness on one side of the body
- Difficulty speaking or understanding others
- Vision loss or double vision
- Severe dizziness or loss of coordination
- New-onset of seizures usually on one side of the body

### Time is Brain at Any Age

**Newborns:**

Quick recognition → Prompt medical evaluation and treatment

**Babies:**

Early diagnosis → Rehabilitation treatment can start while a young brain is still developing



**Don't delay!**

Prompt diagnosis and treatment of stroke in children is as critical as it is in adults.

Learn more at:  
[iapediatricstroke.org](http://iapediatricstroke.org)  
[StrokeAssociation.org](http://StrokeAssociation.org)



Together to End Stroke™

# PEDIATRIC STROKE

Less common than adults, but as common as pediatric brain tumors.

Know the common symptoms of a stroke. There may be treatment if you act **F.A.S.T.**

## FACE

# F



### Face Looks Uneven

Ask the person to smile.

Does one side of the face droop?

## ARM

# A

### One Arm Hanging Down

Ask the person to raise both arms.

Does one side drift downward?



## SPEECH

# S



### Slurred Speech

Ask the person to repeat a simple phrase.

## TIME

# T

If you observe any of the signs...  
call 911 immediately.



Remember...



Time =  BRAIN



St. Louis Children's Hospital complies with applicable federal civil rights laws and does not discriminate on the basis of race, color, national origin, age, disability or sex.  
Atención: Hoy servicios de asistencia de idiomas disponibles a su disposición sin costo. Llame al 314-747-6862 (TTY: 1-800-735-2889).  
注意: 本院提供语言协助服务, 如有需要请致电 314-747-6862 (TTY: 1-800-735-2889).

# WATCHING THE CLOCK

By AMERICAN HEART ASSOCIATION NEWS

Under new treatment guidelines, people having mild strokes can now be considered for a medication given within several hours to help dissolve a clot. Clot-snaring devices can also now be used up to 24 hours after the start of a stroke in some patients with clots blocking a large vessel in the brain.



## 0 MINUTES

Onset of stroke symptoms

## WITHIN 3-4½ HOURS

Clot-dissolving drug alteplase for mild and severe strokes

## WITHIN 6-24 HOURS

Mechanical thrombectomy with stent retrievers for large-vessel clots

Source: American Heart Association/American Stroke Association  
Published: Jan. 24, 2018

Pediatric Emergency Medicine in Practice: An Innovative & Interactive Course for Real World Experience



## Pediatric Emergency Medicine In Practice: An Innovative & Interactive Course for Real World Experience

Presented by Boston Children's Hospital  
& Children's Hospital of Philadelphia

Door-to-needle time of  $\leq 60$  min



Figure 8. In-hospital timeline as a goal for all patients with acute ischemic stroke who are eligible for treatment with intravenous alteplase. Adapted from AHA/ASA, 2018 Update to the 2016 Guidelines for the Early Management of Acute Ischemic Stroke.

Stroke alert system  
Boston Children's 82 min

≠ LKHF 19min





# Initiate neuroprotection as soon as stroke is suspected...

| Target                | Monitoring   |
|-----------------------|--|
| Normotension          | CR monitor, VS <u>hourly</u> or more frequently as clinically indicated  |
| Normovolemia          | IV maintenance fluid<br>NS, may add dextrose for infants < 6 months<br>NS bolus as clinically indicated  |
| Normal Oxygenation    | Administer supplemental oxygen to <u>all</u> patients<br>Maintain pulse ox $\geq 95\%$   |
| Neurologic Assessment | Neuro check hourly until admission to ICU  |
| Normoglycemia         | Monitor POC glucose on admission and q 2 hours<br>Notify MD if < 60 or > 150 mg/dL   |
| Normothermia          | Maintain temp < 38°C<br>Measure q 2 hours<br>Administer acetaminophen as needed  |
| Seizure Control       | Treat seizure ASAP<br><u>Status Epilepticus Pathway*</u>   |
| Activity              | NPO<br>Restrict to bedrest<br>Suspect ischemic stroke: HOB flat<br>Suspect CSVT or ICH: HOB up 30°<br>Do not allow ambulation, upright sitting for toileting or transfer to Radiology<br>Not needed for infants < 6 months |

# Akut und Dauertherapie



|   | UK-Guideline 2017  | ACCP-Guideline 2012   | AHA 2019   |
|---|--|---|--|
| <b>Neonataler Schlaganfall</b>                |  |   |  |
| Allgemein                                     |  | UFH o. LMWH bei <u>kardioembolischer</u> Ursache  | Aspirin, UFH o. LMWH bei schwerwiegenden Risikofaktoren  |
| Sinusvenenthrombose                           |  | UFH o. LMWH initial, dann LMWH für 1,5-3 Monate   | UFH o. LMWH erwägen, v.a. bei klinischer Verschlechterung o. Thrombus-Progress   |
| <b>Kindlicher Schlaganfall, akut</b>          |  |   |  |
| Allgemein                                     | Aspirin 5mg/kg (max. 300mg) für 14d, um 24h verzögert nach <u>rtPA</u> | UFH, LMWH o. Aspirin bis Ausschluss <u>kardioembolische</u> Ursache o. Dissektion   | LMWH oder Aspirin für 5-7 Tage bis zur Klärung der Ätiologie   |
| <u>Alteplase</u>                              | Bei ausgewählten Patienten im Lyse-Fenster                             | Nur im Rahmen von Forschungsprotokollen   | Bei ausgewählten Patienten im Lyse-Fenster   |
| <u>Kardioembolische/thrombotische</u> Ursache | Aspirin oder Antikoagulation, je nach interdisziplinärem Konsens       |   | UFH o. LMWH  |
| <u>Vaskulopathien</u>                         |  | Aspirin bei <u>Moyamoya</u>   |  |
| Sinusvenenthrombose                           |  | UFH o. LMWH, bei signifikanter Blutung ev. Verlaufs-Bildgebung nach 5-7 Tagen und Antikoagulation nur bei Thrombus-Progress | Allgemein: UFH, LMWH o. Warfarin je nach Blutung/Blutungsrisiko<br>Septische Ursache: operative Sanierung und Antibiotika, Antikoagulation bei Thrombus-Progress |
| <b>Kindlicher Schlaganfall, Dauertherapie</b> |  |   |  |
| Allgemein                                     | Aspirin 1mg/kg (max. 75mg), Dauer individuell festlegen                | Aspirin für mindestens zwei Jahre   | Aspirin 3-5mg/kg/d für mindestens 2 Jahre  |
| <u>Kardioembolischer</u> Ursache              | Aspirin oder Antikoagulation, je nach interdisziplinärem Konsens       | LMWH o. VKA für mindestens 3 Monate   | LMWH o. Warfarin für 3-6 Monate  |
| Dissektion                                    |  | LMWH o. VKA für mindestens 6 Wochen   |  |
| Prothrombotische Erkrankung                   |  |   | LMWH o. Warfarin für 3-6 Monate, Langzeit bei ausgewählten Erkrankungen  |
| <u>Vaskulopathien</u>                         | Revaskularisation bei <u>Moyamoya</u> erwägen                          | Revaskularisation bei <u>Moyamoya</u> erwägen<br>Nicht- <u>Moyamoya</u> : UFH, LMWH o. Aspirin für 3 Monate                 | Revaskularisation bei <u>Moyamoya</u>  |
| Sinusvenenthrombose                           |  | LMWH o. VKA für mindestens 3 Monate, bei anhaltender Thrombose für 6 Monate   | LMWH o. Warfarin für 3-6 Monate, länger bei Risikofaktoren   |
| Erneuter Schlaganfall unter Aspirin           |  | Wechsel zu Clopidogrel, LMWH oder VKA   |  |



