



The new Scandinavian guidelines for prehospital management of patients with severe brain injury – will they save lives and reduce brain damage?

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Scandinavian Neurotrauma Committee

A sub-committee of the Scandinavian Neurosurgical Society

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History

- Brain trauma foundation
(<http://www.braintrauma.org/>)
- Scandinavian Neurotrauma Committee
Published Scandinavian guidelines for
management of minimal head injury in
2000*

* Ingebrigtsen T et al: Scandinavian Guidelines forJ Trauma 2000; apr 48(4):760-6





Brain trauma foundation

- Management and prognosis of severe traumatic brain injury
- Prehospital management of traumatic brain injury
- Surgical management of traumatic brain injury
- Acute medical management of severe traumatic brain injury in infants, children and adolescents

<http://www.braintrauma.org/>



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Development of guidelines

- BTF and epidemiologists at Oregon Evidence-based Practice Center.
- Topics picked by BTF.
- Review by BTF and epidemiologists
- Literature search 1995 to July 2006





Quality assessment of studies

- Screening test relevant, available, adequately described
- Study uses credible reference standard, performed regardless of test results
- Reference standard interpreted independently of screening test
- Handles indeterminate results in a reasonable manner
- Spectrum of patients included in the study
- Adequate sample size





Level of recommendation

- **Level I:** Good quality RCT.
- **Level II:** Moderate quality RCT, good quality cohort or case-control study.
- **Level III:** Poor quality RCT, moderate/poor cohort or case-control, Case series, databases etc.





Recommendations for assessment

- Oxygenation and blood pressure
- Glasgow Coma Scale Score
- Pupil examination





Recommendations for treatment

- Airway/ventilation/oxygenation
- Fluid resuscitation
- Cerebral herniation
- Systems of Trauma Care and Hospital Transport Decision.





Oxygenation and blood pressure

(Adult)

- Oxygenation should be measured with a pulse oximeter.
- Blood pressure should be measured using the most accurate method available
- Oxygenation and blood pressure should be measured as often as possible and should be monitored continuously if possible.





Oxygenation and blood pressure

(Pediatric)

- Oxygenation should be measured with a pulse oximeter using an appropriate pediatric sensor.
- Blood pressure should be measured using the most accurate method available, documentation of mental status, quality of peripheral pulses, and capillary refill time can be used as surrogate measures





Glasgow Coma Scale Score

(Adult)

- Prehospital measurement of the Glasgow Coma Scale (GCS) is a significant and reliable indicator of the severity of traumatic brain injury, particularly in association with repeated scoring and improvement or deterioration of the score over time.





Glasgow Coma Scale Score

(Pediatric)

Eye opening

Spontaneous	4
Speech	3
Pain	2
None	1

Verbal respons

Coos, Babbles	5
Irritable cries	4
Cries to pain	3
Moans to pain	2
None	1

Motor respons

Normal spontaneous movement	6
Withdraws to touch	5
Withdraws to pain	4
Abnormal flexion	3
Abnormal extension	2
None	1





Pupil examination (Adult and pediatric)

- Evidence of orbital trauma should be noted.
- Pupils should be measured after the patient has been resuscitated and stabilized
- Note left and right pupillary finding.
- Asymmetry is defined as > 1 mm difference in diameter
- A fixed pupil is defined as < 1 mm response to bright light





Airway/ventilation/oxygenation

(Adult)

- Insufficient data so support level I or II recommendations
- All patients with severe head injury should be given oxygen.
- Avoid hypoxemia and correct immediately when identified.





Airway/ventilation/oxygenation

(Adult)

- An airway should be established if
 - GCS < 9 and
 - The airway is obstructed or
 - It is impossible to maintain sat > 90
- When endotracheal intubation is used to establish an airway, confirmation of placement of the tube in the trachea should include lung auscultation and end-tidal CO₂ determination.





Airway/ventilation/oxygenation

(Adult)

- In ground transported patients in urban environments, the routine use of paralytics to assist endotracheal intubation in patients who are spontaneously breathing, and maintaining an SaO₂ above 90% on supplemental oxygen, is not recommended, **unless used by rigoursley trained and skilled paramedics/nurses or doctors with intubation skills (Emergency physiscians and anaesthesiologists).**





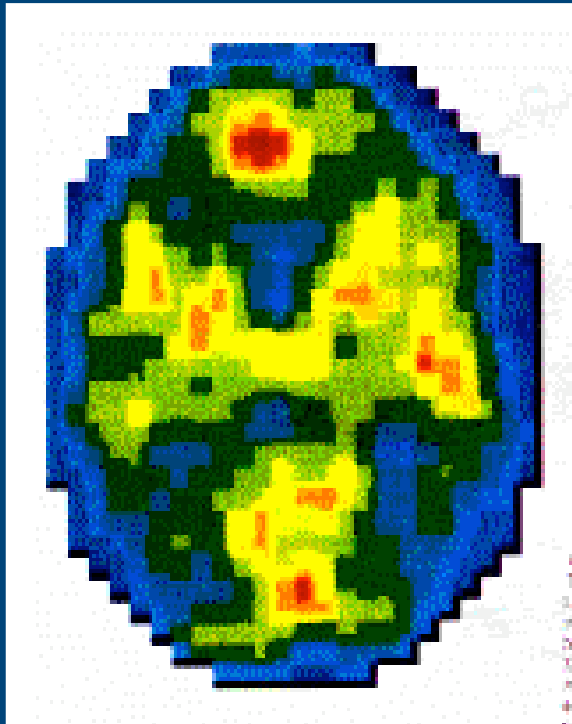
Airway/ventilation/oxygenation

(Adult)

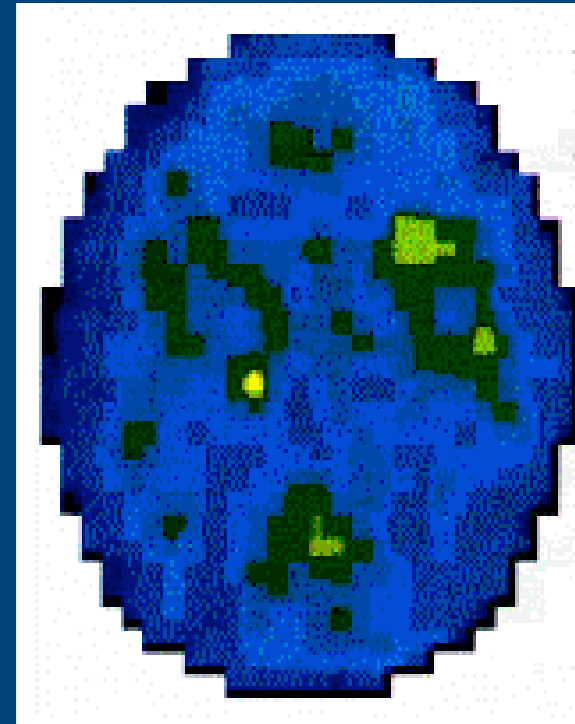
- EMS systems implementing endotracheal intubation protocols should monitor blood pressure, oxygenation, and $ETCO_2$.
- Hyperventilation should be avoided unless the patient shows signs of herniation, and corrected immediately when identified.



rCBF with hyperventilation



Normoventilation



Hyperventilation



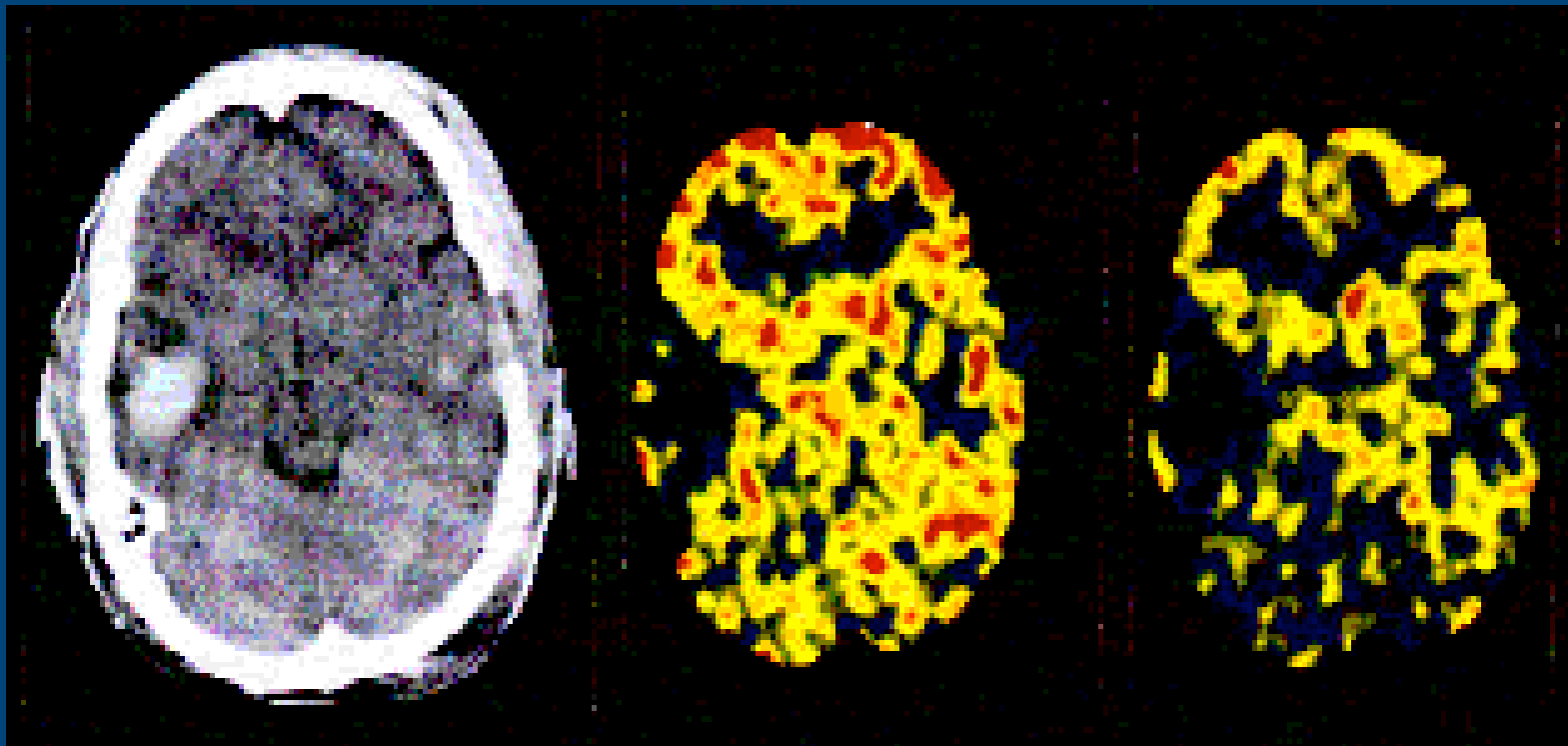
CBF with hyperventilation



CT

Xenon-CBF
normoventilation

Xenon-CBF
hyperventilation



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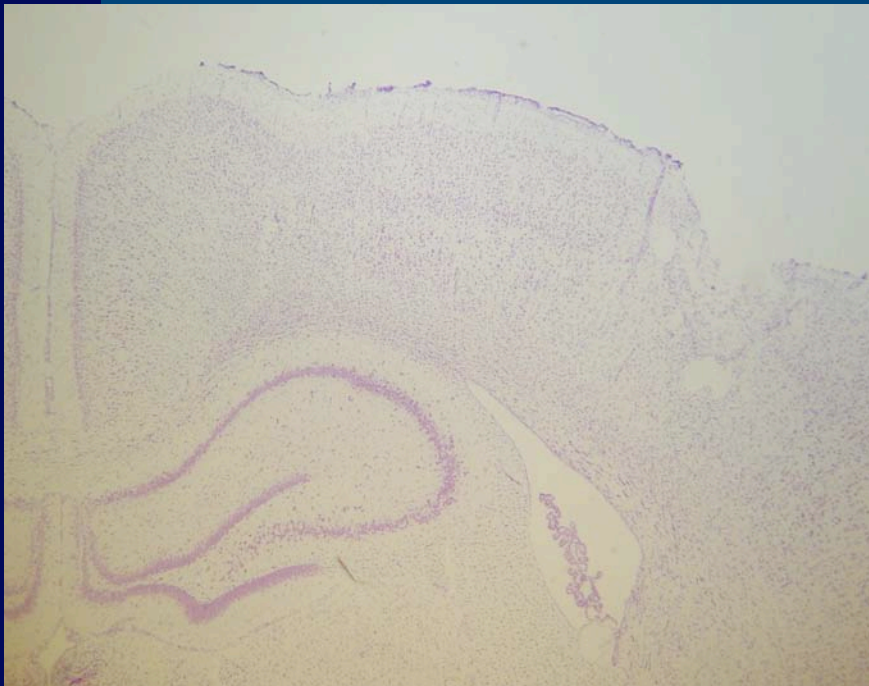
McLaughlin MR: J Neurosurg (1996)



Infarct size following controlled cortical impact



Rats anaesthetized and given a controlled cortical impact



Normoventilation after TBI



Hyperventilation after TBI





Airway/ventilation/oxygenation

(Pediatric)

- There is no evidence to support out of hospital endotracheal intubation over bag valve mask ventilation in pediatric patients with TBI (level II*).

*Gausche et al. Effect of out-of-hospital pediatric endotracheal intubation on survival and neurologic outcome. JAMA 283:783-790, 2000.





Fluid resuscitation (Adult)

- The administration of fluids in the prehospital setting is recommended to avoid hypotension and/or limit hypotension to the shortest duration possible (level II).
- Hypertonic resuscitation in the prehospital setting, generally utilizing hypertonic saline with or without dextran, is recommended (level III).





Fluid resuscitation (Pediatric)

- The administration of fluids in the prehospital setting is recommended to avoid hypotension and/or limit hypotension to the shortest duration possible.





Cerebral herniation (Adult and pediatric)

- Clinical signs of cerebral herniation should lead to intubation and hyperventilation.
- Neurologic status requires frequent reevaluation and, in the subsequent absence of clinical signs of herniation, hyperventilation should not be continued.





Cerebral herniation (Adults)

- Osmotherapy (Mannitol or hypertonic NaCl) should only be used combined with optimal circulatory monitoring and only by trained providers.
- Osmotherapy is not recommended for prehospital use.





Cerebral herniation (pediatric)

- No data on osmotherapy.





Systems of Trauma Care and Hospital Transport Decision.

- All regions should have an organized trauma care system.
- Protocols are recommended for communication and to direct EMS personnel regarding destination decisions for patients.
- A decision protocol for management of prehospital resources is recommended.





Systems of Trauma Care and Hospital Transport Decision.

- It is recommended that patients with severe TBI should be transported directly to a facility with immediately available CT scanning, prompt neurosurgical care, and the ability to monitor intracranial pressure.
- Stabilization and treatment of life threatening extracranial injuries at rural hospitals is only recommended in areas with long transport time to a trauma center.





Discussion/conclusion I

- American guidelines rewritten to fit Scandinavia.
- Lack of hard scientific evidence
- Can you readily transfer results from inhospital studies into the field?





Discussion/conclusion II

- Virtually no pediatric data
- When trauma systems are executed, factors other than medical advice play an important role.
- Prevention of accidents is the key





Guidelines will not save lives!

Well educated prehospital providers and other health care workers will save lives, if they adhere to guidelines





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