Set up audience participation

1. Take out your silenced phone
2. Open a web browser
3. Go to: PollEv.com/kenbrady584

Test question

Case #1: Multi-system trauma

- 20-year old rollover MVA. Unconscious, 30 min to ED in Collar:
  - GCS 7: Eyes closed (1), unintelligible mumbling (2) and withdrawal to painful stimulus 4 extremities (4)
  - HR110; ABP 95/55; T 35.5°C
  - Pulmonary contusion (SpO2, 90% on 100% NRB)
  - Angulated mid-shaft radius/ulnus fracture
  - Scalp laceration
Acute brain trauma management

- Step 1: Avoid herniation
  - Airway control
  - Oxygenation
  - Ventilation
  - ABP support
  - Anesthesia
  - Osmolar therapy

Evidence? Physiologic principles

Would you do a rapid sequence intubation?

- Yes
- No

Would you treat ICP empirically with osmolar therapy?

- yes
- no
Brain Trauma Foundation Guidelines 4th edition

12. INTRACRANIAL PRESSURE MONITORING

LEVEL I AND II A
There was insufficient evidence to support a Level I or II A recommendation for this topic.

LEVEL II B
Management of severe TBI patients using information from ICP monitoring is recommended to reduce in-hospital and 2-week post-injury mortality.

• Does this patient have severe TBI? Not defined in 4th edition!

Brain Trauma Foundation Guidelines 3rd edition

“Intracranial pressure (ICP) should be monitored in ... severe TBI (GCS 3-8 after resuscitation) and an abnormal computed tomography (CT) scan. An abnormal CT scan of the head is one that reveals hematomas, contusions, swelling, herniation, or compressed basal cisterns.”

ICP monitoring kerfuffle

• Alali et al: retrospective n = 10,000
  — OR of death compared to no ICP monitor: 0.44 (0.31 to 0.63)
• Chesnutt et al: RCT n = 324
  — Mortality, GOS no difference
• Farahvar et al: retrospective n = 1,307
  — OR of 2-week mortality compared to no ICP monitor: 0.64 (0.41 – 1.00)
• Gerber et al: retrospective n = 2,320
  — Temporal improvements in guideline adherence (ICP monitoring) associated with temporal decrease in mortality
• Talving et al: prospective cohort, n = 216
  — OR of death 0.15 (-0.03 – 0.74) longer ICU/Hospital stay with ICP monitoring

Posted to the OR

Patient intubated, ICP monitor (EVD) and Licox monitor placed at bedside, trended on the Moberg system.

Now posted for angiography, vascular exploration and fasciotomy due to pulsatile hematoma in the forearm.
Elevated ICP

Frequent ICP elevations lasting 10-20 minutes with associated decrease in $P_fO_2$
- Sedated, paralyzed, 36.5°C
- $SpO_2$ 98%, TV 450, rate 12, PIP 24, PEEP 4, $P_FO_2$ 40%
- HR 80, ICP, ABP, $PBTO_2$ shown on right.
- Na 142, Hb 10.3, 7.43/37/120

ICP is 45 mmHg positioning for angiography injection

BTF guidelines: Osmolar therapy

“The Committee is universal in its belief that hyperosmolar agents are useful in the care of patients with severe TBI. However, the literature does not currently support recommendations that meet the strict criteria for contemporary evidenced-based medicine approaches for guideline development.”

BTF guidelines: hypothermia

- Early (within 2.5 h), short-term (48 h post-injury), prophylactic hypothermia is not recommended to improve outcomes in patients with diffuse injury

Rank your preference of anesthetic maintenance agents

- Pentobarbital
- Propofol
- Volatile anesthetic
- Dexmedetomidine
- Benzodiazepine
- Remifentanil
BTF guidelines: Anesthetic

- Administration of barbiturates to induce burst suppression measured by EEG as prophylaxis against the development of intracranial hypertension is not recommended.

- High-dose barbiturate administration is recommended to control elevated ICP refractory to maximum standard medical and surgical treatment. Hemodynamic stability is essential before and during barbiturate therapy.

- Although propofol is recommended for the control of ICP, it is not recommended for improvement in mortality or 6-month outcomes. Caution is required as high-dose propofol can produce significant morbidity.

BTF guidelines: Ventilation

- Prolonged prophylactic hyperventilation with PaCO2 of ≤25 mm Hg is not recommended.

CO2 response 1: Vasoconstriction

CO2 response 2: Pressure Passive

CO2 response 3: Preserved CBF
CO2 response 4: hypercarbia

BTF guidelines: Ventilation
- Hyperventilation is recommended as a temporizing measure for the reduction of elevated ICP.
- Hyperventilation should be avoided during the first 24 h after injury when CBF often is reduced critically.
- If hyperventilation is used, SjO2 or BtpO2 measurements are recommended to monitor oxygen delivery.

Would you give this patient steroids for brain swelling?

Yes

No

BTF guidelines: steroids
- The use of steroids is not recommended for improving outcome or reducing ICP. In patients with severe TBI, high-dose methylprednisolone was associated with increased mortality and is contraindicated.

Case #2: DVT concerns
78 year old man falls from third stair.
- GCS 12: eyes open to voice(3) confused(4) localizes to pain(5).
- CT shown on right:
- Pelvic fracture of superior and inferior pubic rami.
BTF guidelines: DVT prophylaxis

- LMWH or low-dose unfractioned heparin may be used in combination with mechanical prophylaxis. However, there is an increased risk for expansion of intracranial hemorrhage.
- In addition to compression stockings, pharmacologic prophylaxis may be considered if the brain injury is stable and the benefit is considered to outweigh the risk of increased intracranial hemorrhage.
- There is insufficient evidence to support recommendations regarding the preferred agent, dose, or timing of pharmacologic prophylaxis for deep vein thrombosis.

Case #3: Surgery in setting of TBI

11 year old boy pedestrian struck.
- GCS 10: eyes open to pain(2) inappropriate words(3) localizes pain(5)
- HR 130, ABP 145/95, R 45, S, O2 95% NRB
- Rib fractures on CXR
- CT shown
Admitted to the ICU for observation

Case #3: Surgery in setting of TBI

11 year old boy pedestrian struck.
- Overnight his GCS fluctuates from 7 to 12, agitated and combative
- CXR in AM shows massive pleural effusion and mediastinal shift
- HR: 125; ABP 90/45; R 45; S, O2 90% NRB

Posted for thoracotomy/hematoma evacuation

How would you rank the effectiveness of the following recommendations?

Place a chest tube at the bedside with local anesthetic and fentanyl
Provide standard general anesthesia with ETT
Provide general anesthesia with ETT after placement of an ICP monitor
Provide general anesthesia with ETT using rapidly reversible agents (remifentanil)

Summary

- Wear a helmet when skiing