Catastrophic Brain Injury Guidelines & the Donation Process

Harry E. Wilkins, III, MD, MHCM
Attending Acute Care Surgeon
Quincy Medical Group

Gift of Life Michigan
KEYSTONE SYMPOSIUM
“The Evolving World of Donation and Transplantation
Secondary Brain Injury Culprits

Hyoxemia

Hypotension

Metabolic Derangement
Catastrophic Brain Injury Guidelines (CBIGS)

- Get critical care involved early
- Maintain hemodynamic stability without pressors
- Maintain oxygenation and oxygen carrying capacity
- Avoid hypothermia
- Correct electrolyte abnormalities
Key Components

- **Adequate oxygenation**
  - Ventilator management
  - Aggressive respiratory hygiene
  - Bronchodilators
  - Bronchoscopy when / if necessary

- **Other areas of concern**
  - Electrolyte management
  - H/H & Coagulation factors
  - Glucose control
  - Temperature
Management 101

- **ABCs:**
  - Secure / assure airway → intubation
  - Provide ventilation → Mechanical ventilation, PEEP, bronchoscropy, CXR, pulmonary hygiene, recruitment maneuvers, positioning
  - STOP bleeding! Adequate IV hydration including crystalloid, HTS, blood & blood products as appropriate
  - Monitoring; CVP, A-line, Flotrac, etc.
Catastrophic Brain Injury Guidelines

Consider obtaining a critical care consult if not already involved in patient care

**Maintain SBP > 100 (MAP > 60)**
1. Consider invasive hemodynamic monitoring
2. Adequate hydration: Ensure adequate hydration to maintain euvolemma
3. Vasopressor support: If hypotensive post adequate rehydration, utilize Neosynephrine as the first pressor of choice up to 2mcg/kg/min followed by Dopamine if needed

**Maintain Urine Output > 0.5ml/kg/hr < 400ml/hr** (consider DI if > 400ml/hr x 2 hours)
1. Treat Diabetes Insipidus with Vasopressin drip 1-2.5u/hr, if UO still > 400ml/hr, give DDAVP 0.5 mcg IV every 2-3 hours
2. If UO falls below 0.5ml/kg/hr, assess fluid status—may need rehydration or BP support

**Maintain PO2 > 100 & pH 7.35-7.45**
1. Adequate ventilation: 5.0-8.0 PEEP
aggressive respiratory hygiene if not contraindicated by patient’s condition (suction and turn every 2 hours)
respiratory treatments to prevent bronchospasm

**Other orders to consider:**
1. Monitor and treat electrolytes maintaining the following:
   - Sodium: 134 – 145 mmol/L
   - Potassium: 3.5 – 5.0 mmol/L
   - Magnesium: 1.8 – 2.4 meq/L
   - Phosphorus: 2.0 – 4.5 mg/dL
   - Ionized Calcium: 1.12 – 1.3 mmol/L
2. Monitor glucose and treat with insulin drip if needed (keep 80-200) rather than SQ
3. Monitor and treat Hgb/Hct/coagulation factors (especially if GSW or other penetrating head injury)
   - Maintain Hgb > 8.0 g/dL and Hct > 24%
   - If PT > 18.0 give 2u FFP
   - If Fibrinogen 70-100 give 2u FFP, if < 70 give cryoprecipitate
   - If platelets < 50 give 6pk of platelets
   *remember to recheck labs after treatment
4. Maintain temp 36-37.5 Celsius with bair hugger/warming-cooling blanket
Initial Trial Results
(One center)

- Used on 7 different patients
- 3 went to rehab or home
- 1 family denied consent/pt stable
- 3 became organ donors resulting in 17 organs transplanted (5.66 OTPD)
Example of a Case

- GSW to head
- Aggressive resuscitation
- Pronounced Dead
- Deterioration during OPO management

?
Physiologic Insult/Critical Illness

- Ischemia
- Inflammatory (SIRS) response

  Capillary leak

  Tissue Edema (Including bowel wall and mesentery)

  Fluid resuscitation

  Intra-abdominal hypertension
Fluids!

Where does 5+ liters go in the human body?

- The brain?
- The lung?
- The skin/soft tissue?
- The gut/mesentery…….
The fluid goes Right Here!!
What is IAH and ACS?

WCACS, Antwerp Belgium 2007

- **Intra-abdominal Pressure (IAP):** Intrinsic pressure within the abdominal cavity

- **Intra-abdominal Hypertension (IAH):** A sustained IAP > 12 mm Hg (often causing occult ischemia) without obvious organ failure

- **Abdominal Compartment Syndrome (ACS):** IAH > 20 mm Hg with at least one organ dysfunction or failure
What intra-abdominal pressures are concerning?

<table>
<thead>
<tr>
<th>Pressure (mm Hg)</th>
<th>Interpretation</th>
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<tbody>
<tr>
<td>0-5</td>
<td>Normal</td>
</tr>
<tr>
<td>5-10</td>
<td>Common in most ICU patients</td>
</tr>
<tr>
<td>&gt; 12 (Grade I)</td>
<td>Intra-abdominal hypertension</td>
</tr>
<tr>
<td>16-20 (Grade II)</td>
<td>Dangerous IAH - begin non-invasive interventions</td>
</tr>
<tr>
<td>&gt;21-25 (Grade III)</td>
<td>Impending abdominal compartment syndrome - strongly consider decompressive laparotomy</td>
</tr>
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How common is IAH?

<table>
<thead>
<tr>
<th>Disease process</th>
<th>IAH incidence</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe Sepsis</td>
<td>41% - 85%</td>
<td>Efstathiou 2005; Malbrain 2005; Reintam 2007; Daugherty 2007; Regueira 2008</td>
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<tr>
<td>Decompensated CHF</td>
<td>60% (IAP ≥ 8 mmHg)</td>
<td>Mullens 2008</td>
</tr>
<tr>
<td>MICU and Mixed ICU population</td>
<td>35% - 64%</td>
<td>Malbrain 2004, Malbrain 2005, Vidal 2008</td>
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Critical Care – OPO Collaboration

- IAH and ACS increasingly appreciated within the last decade
- Critical Care Community more adept at recognizing and treating IAH and ACS
- Critical Care working closer with OPO in donor management
- What role is IAH and ACS playing in donors?
Diagnostic Screening & Treatment for Donors at risk for IAH and ACS

**Screening** (Screen your patient for any of the following)

1) **History**
   - BMI ≥ 35
   - Abdominal trauma (contusions, RP hematoma, crushing mechanism)
   - Mechanism of death is drowning or hanging

2) **Hemodynamic Status**
   - MAP < 50 for 2 consecutive hours in past 48 hours
   - ≥ 2 pressors at or above therapeutic range
     - Epinephrine >0.5mcg/kg/min
     - Norepinephrine >0.1mcg/kg/min
     - Neosynephrine >0.5mcg/kg/min
     - Dopamine >5mcg/kg/min
     - Vasopressin >1u/hour

3) **Fluid resuscitation**
   - ≥ 5 liters if patient has been hospitalized for less than 24 hours
   - Patient appears to have significant edema

4) **Laboratory assessment**
   - Na ≤ 130
   - Lactate > 2.0
   - pH ≤ 7.2 if patient has been hospitalized for less than 24 hours
   - Requiring Bicarbonate drip to maintain normal pH if hospitalized >24 hours

**Grading**

If your patient met any of the above parameters then begin monitoring abdominal pressures every hour. Once pressure reading obtained, rate your degree of IAH as outlined below.

0 = < 12

**Grade I** = 12 – 15

II - III may require intervention, see reverse for interventions

Grade II = > 15 with no organ dysfunction

Grade III = > 20 with organ dysfunction

0 - I requires no intervention, continue to monitor
Therapeutic Measures

1) Consider imaging (discuss with intensivist what might be appropriate)
   □ KUB to r/o ileus
   □ Ultrasound to r/o ascites
   □ CT to r/o retroperitoneal hematoma

2) Positioning
   □ Reverse trendelenberg (keep bed flat and tilted)
   □ Avoid prone positioning if IAP ≥ 15

3) Resuscitation
   □ Consider early use of HTS to allow for smaller volumes
   □ Careful use of diuretics if volume status adequate
   □ Attain negative fluid balance (consider dialysis if indicated)

4) Evacuate intra-abdominal contents
   □ Discontinue any enteral feeds, if applicable
   □ Ensure NG/OG tube in place and functioning
   □ Ensure foley catheter functioning properly
   □ Rectal tube insertion if necessary

5) Consider Pro-kinetics
   □ Erythromycin
   □ Reglan

6) Hemodynamic Support
   □ Vasoactive medications to keep APP (MAP – IAP) ≥ 60
   □ Ensure adequate volume expansion (SVV 8-10)

Invasive Interventions
   □ Paracentesis if evidence of ascites (via ultrasound and physical exam)
   □ Laparotomy if ESTABLISHED ACS (IAP ≥ 20 with organ dysfunction)
MTN’s Experience

- January 2011 – August 2012 (20 months)
  - Proactively monitored 23 donors for IAH
  - Mean age 31.6 years (range 3 y/o – 54 y/o)
    - 15 (54%) trauma
    - 5 (22%) anoxia
    - 3 (13%) stroke / ICH
  - Interventions
    - 1 bedside paracentesis with drain
    - 2 urgent OR for organ recovery
    - 1 opened at bedside
    - 1 taken to OR for laparotomy and return to ICU
Good patient / family care and impact on donation

- Importance of first impression; sets the trust / caring experience for the rest of their hospital stay.

- Family support by physicians, nurses, social workers and chaplains are vital to developing trust and a feeling of being cared for.

- Taking away all hope for recovery from the very beginning may anger families as they feel the staff have ‘given up’ on their loved one and won’t do everything possible to treat them leading to distrust, frustration and confrontation later on.
Excellent messages for staff to share with families

- “His injuries are very serious, however we are doing everything possible to save him”.
- “While her injuries are very severe, and she may not survive, we are hoping for the best outcome”.
- “We are mobilizing all our specialists to provide the best care possible for your child”.
- “We will keep you involved in his care so you can help us provide the best care for him”.
Preserve the option for donation

- Adequate care and resuscitation is the beginning of preserving the option for donation (it is also giving the patient the best chance for *SURVIVAL!*)

- Brain death testing should be delayed until hemodynamically stable and warm!
Effective Request Process

1. The referral must be timely
2. A huddle must occur prior to any mention of donation to determine an appropriate plan for the specific situation, patient and family
3. The plan is carried out
4. If there is a change in the patient/family situation, a re-huddle occurs to determine if the plan should change
The Initial Requestor Makes a Difference!

![Graph showing donation rates with categories: OPO Coordinator, Family Member, Healthcare Team Member.](Rodrigue, et al, 2006)
Process and Outcome Correlation
January, 2009 – December, 2010

- **514** Eligible BD Patients
  - When **ERP** utilized for BD donors – **80%** authorization rate
  - When **non-ERP** utilized
    - 54% authorization rate
    - 48% non-timely
    - 79% donation mentioned prior to huddle

- **104** Eligible DCD Patients
  - When **ERP** utilized for DCD – **78%** authorization rate
  - When **non-ERP** utilized
    - 54% authorization rate
    - 42% non-timely
    - 67% donation mentioned prior to huddle
Critical Elements of Communicating Brain Death

1. Physician shares plan for BD exam with healthcare & donation team
   - Determine if family will be allowed to observe brain death exam

2. Physician offers family the opportunity to observe neuro exam
   - Physician performs appropriate brain death tests

3. Team member escorts family to a private room for physician led discussion of test results
   - Everyone is introduced (team and family)

4. Physician reviews pt’s clinical course in simple, easily understood terms
   - Initial injury, interventions, etiology of neurological decline
   - Use visual aids to enhance family understanding -- CT, CBF study, models/drawings, etc

5. Physician reviews neurologic findings from brain death exam

6. Physician pronounces death
   - “Sadly, this means your loved one has died. His death certificate will show that he died at _______ today.”
   - Offer condolences

7. Take a breath... “allow silence to do the heavy lifting”
   - Physician bases next steps on the family’s response

Silence
“Please take some time to be with your loved one. When you are ready, our support team will help you with what comes next. I am going to step out of the room now unless you have questions about what I have just said. The nurses can find me if you have questions later.”

Very Emotional/Anger
Listen & address concerns
“Please take some time to be with your loved one. When you are ready, our support team will help you with what comes next. I am going to step out of the room now unless you have questions about what I have just said. The nurses can find me if you have questions later.”

Ready for Next Steps
“(MTN Coord name) is a member of our support team who specializes in supporting families at times like this. He and our team are here to help you. I am going to step out of the room now unless you have questions about what I have just said. The nurses can find me if you have questions later.”

References:
