

EM CASE OF THE WEEK.

BROWARD HEALTH MEDICAL CENTER
DEPARTMENT OF EMERGENCY MEDICINE



Care Warriors

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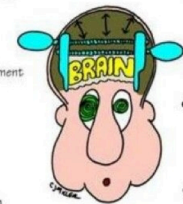
Elevated Intracranial Pressure

A 23-year old male with a history of pilocytic astrocytoma status post resection and shunt placement with multiple revisions is brought to the ED by EMS for altered mental status. His parents, who stated that at 6AM the patient was at his baseline, provided history. However, at 8AM, he was found on the floor minimally responsive and confused, which prompted medical attention. Glucose was 106, which was taken by EMS en route. Parents state that condition was worsening upon arrival to the ED around 12PM. On presentation, the patient is obtunded and lethargic. Blood pressure was 122/74mmHg, HR 116, and RR 18, O2 sat 98% on room air. Physical examination revealed the patient lying in bed, with his eyes closed, unable to respond to verbal commands. However, he is able to react to pain with normal flexion of limbs. Gag reflex is present but weak. Shunt located in the right parietal region is intact but resistant on palpation. Glasgow score was calculated to be a 6. What is the most appropriate initial management for this patient's condition at this time?

- A. CBC and CMP
- B. Non-contrast CT Scan of Brain w/ shunt series and perform shunt pump test
- C. Order ABGs and intubate
- D. Administer Vancomycin 15mg/kg q8H and Cefepime 2g q8H
- E. Perform lumbar puncture with culture, cytology, CBC w/ differentials

INCREASED INTRACRANIAL PRESSURE

- Changes in LOC
- Headache
- Eyes
 - Papilledema
 - Pupillary Changes
 - Impaired Eye Movement
- Seizures
 - Impaired Sensory & Motor Function
- Posturing
 - Decerebrate
 - Decorticate
 - Flaccid
- Changes in Vital Signs:
 - Cushing's Triad:
 - ↑ Systolic B/P
 - ↓ Pulse
 - Altered Resp Pattern
- Vomiting
- Decreased Motor Function
 - * Change in Motor Ability
 - * Posturing
- Changes in Speech



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Causes for elevated ICP:

1. Tumor
2. Trauma
3. Emboli/blood clot
4. Hydrocephalus
5. Metabolic Derangement
6. Abscesses, Cysts
7. Hemorrhage
8. Idiopathic or benign

EM Case of the Week is a weekly "pop quiz" for ED staff.

The goal is to educate all ED personnel by sharing common pearls and pitfalls involving the care of ED patients. We intend on providing better patient care through better education for our nurses and staff.

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The correct answer is C.

Because the patient's Glasgow score is a 6, there is indication to intubate because of the risk of airway compromise and aspiration. Otherwise, a stat non-contrast CT with shunt series would be the next step to evaluate for the correct source of his clinical presentation, such as a bleed due to his fall or compromised shunt patency. Remember that addressing ABCs supersedes any medical or radiographic investigation.

Management

Patients with brain injury of any etiology are at risk for developing increased intracranial pressure (ICP). When ICP is greater than 20 mmHg for more than five to ten minutes in a patient who is not stimulated, the patient is to have acute intracranial hypertension (AIH). This is a medical emergency, requiring rapid diagnosis and intervention to avoid irreversible damage to the brain.

A step-wise algorithm exists to provide a standardized approach to manage the ICP. Nevertheless, it is important to keep in mind that airway, breathing, and circulation should be assessed first and that surgical intervention may precede medical therapy in severe cases.

1. Basic initial measures should include elevating the head to 30 degrees, positioning the head midline, initiating seizure prophylaxis, providing volume resuscitation, avoiding hyperglycemia and hyperthermia, and temporize with hyperventilation

2. Often an overlooked therapy, sedation is an effective means to alleviate agitation and decrease metabolic demands, consequently preventing rising of ICP. First line agents include a short-acting sedativehypnotic agent, like propofol, and an analgesic agent.

3. Augmenting of MAP with vasopressors, such as phenylephrine or norepinephrine raises CPP, thus lowering ICP. However, there is a fine limit and when MAP is too high, a short acting, titratable agent, such as labetalol or nicardipine should be used. BTF recommends the systolic blood pressure to be >100mmHg for patients aged 50-69 years and >110mmHg aged 15-49 or >70 years; cerebral perfusion pressure (CPP) to be between 60-70mmHg; and, ICP to be <20. There is a higher association with poor neurological outcome in hypotensive situations versus hypertensive.

4. Osmotherapy with IV mannitol 1-1.5g/kg infused over 30 minutes every 6 hours or hypertonic saline can be used with a target sodium concentration between 150-155 mEq/L. In acute, severe settings, a smaller volume and higher concentration given as a IV push over 15 minutes is recommended.

5. Hypothermia with temperature maintenance at 33 degrees Celsius reduces ICP, but it does not confer improved long term outcomes. Hypokalemia, arrhythmias, and hypotension may occur.

6. Barbituate coma has fallen out of favor due to side effects such that this option has disappeared or remains as a last resort therapy.

Discussion

Sources for shunt can be divided into non-infectious and infectious:

A. Non-infectious

- Obstruction- most common cause of shunt malfunction, ~ 56-83% of failures
- Over-drainage
- Ventricular Loculation
- Catheter Fracture due to biomechanical forces from growth and catheter degradation
- Catheter Disconnect/Misplacement/Migration

B. Infectious- ~8-10% of shunt malfunctions

- Staphylococcus, especially coagulase negative staph, are responsible for 90% of infections

Interventions include:

1. Shunt Pump Test- compression maneuver at the reservoir

- a. Resistance is concerning for distal malfunction
- b. No refill is concerning for proximal malfunction

2. Tapping the shunt- use a 25-gauge needle and target the reservoir

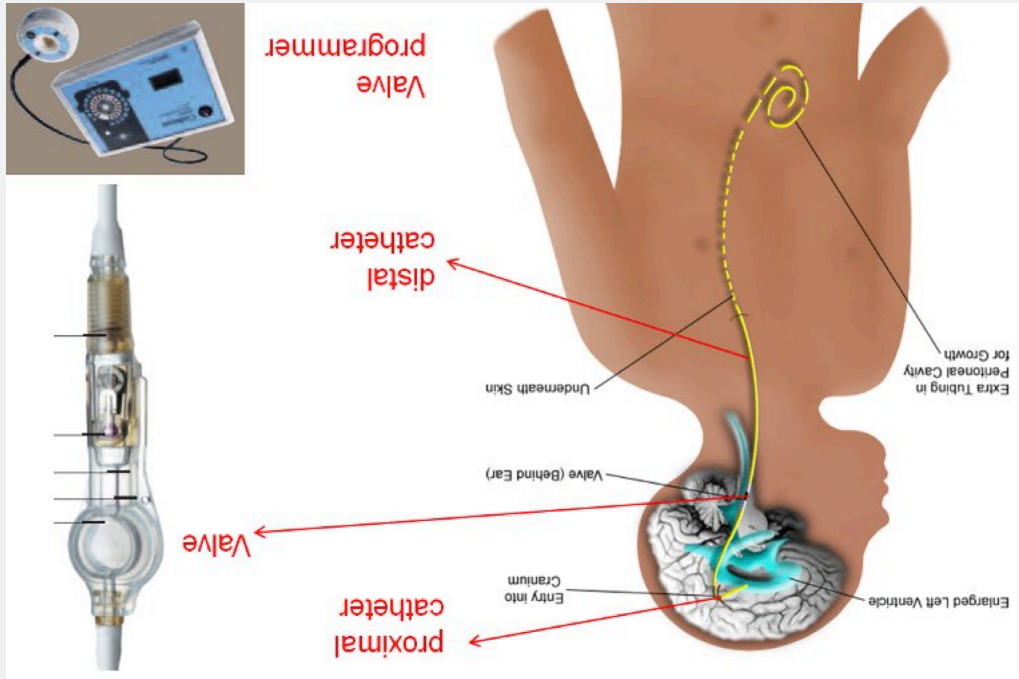
3. Antibiotics (if infection suspected)- Vancomycin for gram + coverage PLUS Cefepime/ceftazidime/meropenem for gram - coverage

For a list of educational lectures, grand rounds, workshops, and didactics please visit

BrowardER.com and **click** on the **"Conference"** link.

All are welcome to attend!

Warriors



This month's case was written by Jennifer Wong is a 4th year medical student from NSU-COM. She did her emergency medicine rotation at BHMC North in February 2018. Jennifer plans on pursuing a career in Dermatology after graduation.

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<http://ecs.utdallas.edu/research/researchlabs/QoLT/projects.html>

The four components of the shunt include:

1. **Proximal catheter**- originates in lateral ventricle
2. **Reservoir**- underneath subcutaneous tissue post-auricular. Allows access for CSF sampling and pressure monitoring
3. **Valve**- one-way valve that controls flow into the distal catheter
4. **Distal Catheter**- tunneled subcutaneously into another body cavity for reabsorption

CSF shunts drain CSF from the ventricular system to a site of absorption, typically in the peritoneal or atrium.

Take Home Points

- A high index of suspicion is vital to diagnose increased ICP and shunt malfunction. Signs can be vast and non-specific.
- Always consider ABCs.
- Hypotensive situations are more detrimental than hypertensive
- A history of prior shunt revision or infections are indicators of future shunt failures.
- Phenobarbital and hypothermia are last ditch noninvasive efforts to decrease metabolic demands and control the intracranial pressure.
- Last ditch invasive efforts include decompressive craniotomy