

Recognition & Management of raised ICP

HDU Course 2014
By Kimberley Hamilton
Lecturer Practitioner
PICU/ Ward 32
BRHFC

Session Content

- Causes and presentation of increased ICP
- Nursing and medical management of raised ICP

What is ICP?

- ICP is a pressure measurement which reflects the relationship between the volume of the skull contents and the rigid compartment of the skull.

The skull contents are:-

- Brain and intracellular water 80-85%
- Cerebral blood flow 3-7%
- Cerebrospinal fluid 5-12%

What Is Normal ICP?

- ICP fluctuates constantly.
- ICP changes with events such as arterial pulsation, coughing sneezing etc
- ICP in a quiet subject is 5-13mmHg
- Sustained ICP above 15mmHg is abnormal
- 21-40mmHg is moderately increased
- >40mmHg is severely increased.

Name some causes of raised ICP?



What Happens when ICP is Raised?

- Any condition which increases the Volume within the skull (Haemorrhage, Tumour, Hydrocephalus) will increase the Intracranial Pressure
- As the brain swells due to cerebral oedema pressure in the skull increases.
- Cerebral blood flow is reduced and further cell ischaemia and death occurs
- This is termed secondary brain injury
- If the pressure continues to increase the brain begins to herniate around the tentorium cerebelli this process is irreversible.
- When large portions of the brain stem herniate death occurs (coning).

Signs & Symptoms of Raised ICP

- Growth of head in unfused skulls/ separation of skull plates
- Bulging fontanelle (if still present)
- Headache (morning, worse coughing, sneezing & bending)
- Vomiting (with or without nausea)
- Papilledema (visual disturbances, optic atrophy, blindness)
- Ocular Palsies
- Personality/ Behavioural changes
- Backache

Late & Pre terminal Signs....



- Pupillary dilatation
- Abducens palsies
- Cushings Triad
 - Hypertension widening pulse pressure
 - Bradycardia
 - Irregular respiration

Care in Raised ICP

The interventions to treat raised ICP are designed to reduce the secondary brain injury as much as possible. After all it is too late to stop the original Brain Condition.



Nursing care of the child with raised ICP

The following are the “neuroprotective” measures that will need to be taken to optimise cerebral perfusion and prevent the ICP from rising further

- These include ongoing care
- Avoid all activities that increase ICP, think before any action taken!

Airway and Respiratory Management

- Aim to keep:-
- PaO₂ 100 mmHg and PaCO₂ 35-40mmHg (Decreased PaO₂ and increased PaCO₂ are potent vasodilators resulting in increased blood flow to the head).
 - When suctioning pre-oxygenate.
 - Send regular specimens to avoid untreated infection.
 - Physiotherapy but observe ICP, remember coughing increases ICP.
 - If acute rise in ICP:-
 suspected by a fall in HR and rise in BP
 - hand ventilate to lower CO₂ – Only recommended short term

Cardiovascular management

- Need to maintain an adequate cerebral perfusion pressure (CPP)
- CPP = Mean ABP – ICP

Age	Mean ABP
0-12 months	55mmHg
1-5 years	65mmHg
5-10 years	75mmHg
>10 years	90mmHg

Cardiovascular management

- Maintain mean BP - May need to start inotropes to do this :-
Nor-adrenaline (causes vaso-constriction)
- Keep fluids limited to 70% maintenance give as isotonic saline – but observe for dehydration
- Keep plasma Sodium levels high end of normal 145-150mmol/L. May need bolus of hypertonic saline if low 5% Saline = 3ml/kg 3% Saline = 5ml/kg
- Furosemide may be beneficial to reduce fluid load
- Pyrexia -Being febrile increases the metabolic and oxygen requirements, so need to reduce a temperature. However it's important to remember that shivering also raises a child's metabolic rate.
- Need arterial and CVP monitoring if condition severe.

Positioning

- Positioning is very important
- Head up 30%
- Midline to avoid jugular venous outflow obstruction and c-spine protection.
- If collar insitu ensure not too tight- if child muscle relaxed consider changing to sandbags and strapping only
- ETT strapping not too tight

Neuro Observations

- Ongoing neuro assessment using Glasgow Coma Scale. Appropriate to age.
- Pupils in sedated/muscle relaxed child can be the only accurate indicator
 - Dilated/ reactive pupils may indicate seizures
 - Dilated/fixed pupils indicates pressure on 3rd cranial nerve indicative of Raised ICP. In association with ↑Bp & ↓P, very poor sign.
 - This would require immediate intervention
- Seizure management

COMFORT

- Tricky balance ideally you need to be able to assess neurology, however you can't afford stimulation from pain/ environment to further raise ICP if severe.
- Pain relief, especially if other injuries post trauma
- Sedation – Caution in non-ventilated children hypoxia/ hypoventilation from inadequate respiration = Secondary insult

NUTRITION

- (Naso-gastric tube) As long as there is no basal skull fracture otherwise Oral Gastric Tube.
- Early enteral feeding.
- May need TPN.
- Monitor BM's.
- Nb. An increase in ICP may induce vomiting, which will in turn increase ICP further.

RENAL

- Catheterise.
- Monitor urea and electrolytes.
- Observe for oliguria/polyuria.
- Regular urinalysis.

Other Medication/Treatment:-

- Seizure Prophylaxis in TBI:-
Phenytoin 15mg/Kg loading dose then regularly for 14 days

Treatment for acute rise in ICP or deterioration in CVS condition:-

- Hand ventilate to lower CO₂
- Osmotic diuretic - Mannitol 0.5g/Kg
- Hypertonic Saline Bolus
- Cooling to 35°C
- Barbiturate therapy –Thiopentone infusion

PSYCHOLOGICAL

Sensory.

- Be aware you don't know what they can understand/ hear
- Nb. Auditory stimulation may increase ICP.

Family and siblings.

- Admission to Hospital is very stressful for the families. It is essential that they are kept fully informed of all care and that they are aware of potential neurological challenges their child and they will face.
- Psychologist Input. May be post traumatic stress issues.

Neurosurgery

- Raised ICP which requires neurosurgical input is an emergency
- Delays in treatment increase morbidity & mortality
- No time for Transport Team – Local centre need to act ASAP
- Surgical Interventions =
 - ICP Bolt insertion (for monitoring only if traumatic cause situation will get worse before improvement)
 - Removal/ reduction of space occupying material
 - CSF Drainage – EVD, VP Shunt, Ommaya reservoir
 - Craniectomy
 - Removal of bone flap

References

- -Content borrowed from Shaun Miller, Bev Cejer, Sandra Cutts and PICU/ Neurosurgical Guidelines
