tissue, to enable the cerebral blood to perfuse every 100g of brain tissue

- Normally, 70-100 mmHg
- In case of ICP increase, if CPP is from 50-60, it would mean ADEQUATE Cerebral Blood Flow (CBF)
- If it would be less than 50 mmHg (<50), there is ischemia, meaning there is lack of oxygenation to the brain
- If it would be less than 30 mmHg (<30), there is neuronal death

If you are doing CPR, how long to do you perform compression? 2 minutes. The patient must breathe in 2 minutes

In 2 minutes without oxygenation to the brain, metabolism there will stop.

In 4-6 minutes without oxygen, the brain will die

TERMS TO UNDERSTAND (Pressure Changes)

1. **Elastance** – refers to the stiffness of the brain
2. **Compliance** – refers to the expandability of the brain

Stages of ICP increase

⇒ **Stage 1 (compensatory stage)**

- No manifestations yet of ICP increase
- If you are still able to compensate, there is an increase in compliance (brain is still able to expand)
- There is also a decrease in elastance (brain is still soft)

⇒ **Stage 2 (early manifestations stage)**

- Papilledema: term that is exclusively used when a disc swelling is secondary to increased intracranial pressure (ICP).
- Has lower compliance (less able to expand)
- Increasing elastance (there is now increasing stiffness of the brain

⇒ **Stage 3 (severe manifestations stage)**

- Patient is now in critical condition
- Increased elastance (brain is now stiff)
- Decreased compliance (less able to expand)
- Patient may die

⇒ **Stage 4 (very serious stage)**

- Patient may die
- Increase ICP to terminal levels because we now have the shifting of the brain (brain herniation)
- The increase buildup inside the cranial vault, will move the other structures inside the brain aka HERNIATION

Cause of ICP Increase

1. Cerebral Edema: also known as brain swelling. It's a life-threatening condition that causes fluid to develop in the brain; no more grooves
2. Abscess: infection inside the brain tissue; there is pus and the inflammation surrounding the region; there is displacement because of swelling so there is high pressure then there is brain herniation because there is movement of other structures within the brain.
3. Brain Tumor: increasing volume of the brain tissue; surrounding the tumor, there is inflammation; inflammation will cause mass effect: there is an increase in the volume of the tumor especially if it is a fast-growing tumor
   - Usually tumor grows in supporting cells like the neuroglial cells because it is highly vascular
4. Infarcts (death cell): if there is a clot, there is blockage, the portion perfused by the medial cerebral artery is not oxygenated and therefore can cause death of the cell; space-occupying lesion (ischemic type of stroke) and so stroke can likewise cause an increase ICP
   a. Penumbra – less oxygenated portion of the brain
5. Subdural Hematoma / Hemorrhagic / rupture of the blood vessel

- Both hemorrhagic and ischemic type of stroke may cause increase in ICP
- Case of a ruptured blood vessel which occurred at the subdural meningeal layer of the brain
- Protection of the brain:
  - Skull (8 cranial & 14 facial bones)
  - Cerebrospinal Fluid (CSF)
  - Blood Brain Barrier (BBB)
  - 3 MENINGES / MENINGAL LAYER:
    - Dura Mater
    - Arachnoid
    - Pia Mater
- Bridging veins may rupture
- Acceleration of the brain (it moved forward) so the impact will blow back the brain and there is deceleration of the brain

- ◊ Rx – vasopressin, desmopressin, acetate
- ◊ SIADH (Syndrome of inappropriate antidiuretic hormone secretion is a condition in which the body makes too much antidiuretic hormone (ADH)) – dilutional hyponatremia → cerebral edema → changes in LOC → seizures → coma
- ◊ 200 cc per hour – polyuria in two consecutive hours

- Many retention of fluids
  - Dilutional hyponatremia
  - Osmotic diuretics (mannitol)

3. Nutritional Therapy: early feeding – within 3 days after injury – malnutrition promotes cerebral edema

- Within 3 days after injury
- Suction/oxygen apparatus at bed side
- Padded tongue depressor
- Anticonvulsant
- Dim the room
- No visitors

4. Protection from injury

- Use restraints judiciously
- Seizure precaution; minimize environmental stimuli

5. ICP monitoring when ordered for sustained increased ICP (> 20mmHg) persisting 15 min or more
6. Treat fever aggressively – increased CBF and cerebral blood volume → increase ICP
7. Administer medications as ordered

- Corticosteroids: anti-inflammatory (cerebral edema) – not for head injury
  - dexamethasone (Decadron) – could pass BBB
- Barbiturates – for seizure, rest cerebral tissues – reduce metabolic requirements
  - pentobarbital (Nembutal) – benzodiazepine/dilatin; pt. will sleep
- Osmotic diuretics – draw fluids towards plasma
  - Mannitol (Osmitrol), glycerol & urea
    - Crystalize at room temp; hulom in warm water – given at soluset
    - 100 mL every 6 hours – given by IV – attached to a flow meter
    - Increase plasma osmolality
    - Enhanced flow of water from tissues including the brain and CSF
    - Into interstitial fluid & plasma

  * watch for urine output
    - Decrease cerebral edema, elevated ICP, and CSF volume & pressure
- Loop diuretic: single does; check BP
  - furosemide (Lasix)
- Anticonvulsant: long term therapy seizure (Lipakote)
  - phenytoin Na (Dilantin) – good oral hygiene (can cause gingival hyperplasia
- Antiulcerants
  - Proton pump inhibitors (PPI)/histamine H2 receptor blockers/antacids – omeprazole, ranitidine
- Neuroprotectant
  - citicholine

Stool softeners
- senna