



### What is this?

This is an external ventricular drain (EVD). Compare this with an Intracranial Pressure (ICP) Bolt or Codman intraparenchymal catheter (last week's kit of the week).

### How is it inserted?

The catheter is inserted in theatres by a neurosurgeon. The tip sits in one of the lateral ventricles.

### How does it work?

The tip of the drain sits in the lateral ventricle and connects to a collection chamber which is set at a certain height. This, in turn, is connected to a drainage bag. The height of the collection chamber corresponds to a pressure (measured in cmH<sub>2</sub>O). When zeroed at the patient's tragus, CSF will only drain when ICP exceeds this pressure.

### What is it used for?

CSF is produced by choroid plexus predominantly in the lateral and third ventricles. It then circulates around the subarachnoid space in the brain and spinal cord. When this flow is interrupted at an intracranial location, obstructive hydrocephalus results, causing a build-up of CSF and raised ICP. This is one of the commonest reasons for inserting an EVD. The EVD can act as a **measuring** device for ICP (when a transducer is applied) and be used for CSF sampling. An EVD may also be used **therapeutically**, depending on the underlying pathology. This includes drainage of CSF in causes of raised ICP. Neurosurgeons may also use the drain to give intrathecal treatments including antimicrobials and chemotherapy.

### What are the benefits vs ICP bolt?

An EVD is the gold-standard ICP measurement device. It gives a better estimate of global ICP. It can also be re-calibrated after insertion- an ICP bolt

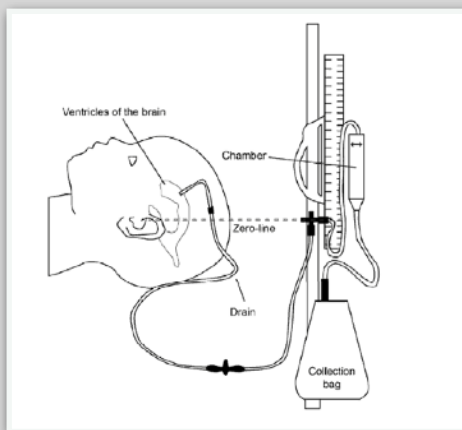
cannot. EVDs can be used for sampling, measuring pressure and provision of therapy- a bolt is purely for measuring pressure. The EVD is cheaper than a bolt.

### What are the drawbacks compared to a bolt?

The EVD is more invasive with higher risk of traumatic complication. The EVD is also at much higher risk of infection, particularly ventriculitis. Air may also be entrained into the ventricles causing pneumocephalus.

### When can you take out the EVD?

After some time, the drain is usually 'challenged' by raising the chamber to above the suspected ICP. If there is ongoing drainage at this level, the drain is still needed and may be internalised (this is usually in the form of a Ventriculo-Peritoneal shunt). If drainage settles at this pressure, next the drain is 'clamped' (the tap is closed). If there are no negative clinical consequences, and the drain is not needed in order to give intrathecal treatments, the neurosurgeons may remove it.



### What if it stops draining?

CSF will only drain if the ICP is higher than the drain set height. If you are called because an EVD output is low, you should check that it is not deliberately being challenged. Next you should check that it is open at all taps towards the collection chamber. You should then look at the clear catheter and see if there is oscillation of the CSF meniscus- this implies patency of the system. Blockage or

displacement is a possible cause which can have severe consequences- consult an ACCU senior who may recommend neurosurgical discussion. Only the neurosurgical team should take samples, flush or aspirate a drain.

### What is ventriculitis?

Ventriculitis is the inflammation (usually infection) of the lining of the ventricles. This can cause sepsis, neurological dysfunction and death if not treated. EVDs and shunts are often the predisposing factor to infection. Handling of the EVD necessitates aseptic precautions to mitigate this risk. Diagnosis is confirmed by sending CSF for MCS (accessing the CSF for this also puts the patient at risk of ventriculitis). Treatment comprises intrathecal +/- intravenous antibiotics.