

EXTERNAL VENTRICULAR DRAIN – PATIENT CARE PRACTICE GUIDELINE[®]

DOCUMENT SUMMARY/KEY POINTS

- Indications for insertion of an external ventricular drain (EVD) include problems associated with the production, flow or absorption of cerebrospinal fluid (CSF) may cause an increase in intracranial pressure.
- An EVD is a closed sterile system that allows CSF to drain freely into a flow chamber that can be adjusted to a prescribed level.
- EVDs are inserted by a Neurosurgeon in the operating theatre under sterile conditions.
- CSF specimens are taken in accordance with neurosurgical instructions to allow the Neurosurgeons to determine if there is an infection present.
- An EVD must be clamped during patient transfer.
- Only accredited nursing staff may obtain CSF from the external ventricular catheter for the purpose of specimen collection.
- Surgical ANTT principles must be adhered to during CSF sampling procedure and bag change.
- In a hospital setting, hourly drainage and drain observations are required and must be documented in the patient's electronic medical record (eMR).
- During leg 2 of a NETS retrieval the drain observations are conducted 15-minutely along with the routine 15-minutely observations and is recorded on the NETS clinical observation chart.

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

Approved by:	SCHN Policy, Procedure and Guideline Committee	
Date Effective:	1 st September 2021	Review Period: 3 years
Team Leader:	Clinical Nurse Specialist	Area/Dept: Neurology

CHANGE SUMMARY

- Replaces CHW *External Ventricular Drain-Patient Care* Guideline (2007-6008 v4) and is now a SCHN document.
- Replaces NETS guideline *External Ventricular Drain and Intracranial Pressure – NETS (Policy number 2014-5016 v2)*
- **12/08/2022:** Minor review:
 - i. page 1 changed “Document summary/key points” to specify hourly drainage observations were in a hospital setting only. However, during NETS retrievals the drainage observations on leg 2 of the retrieval are to be conducted every 15 minutes with routine 15-minutely observations
 - ii. Added NETS teams’ responsibilities to section 1.3 and 1.5
 - iii. Section 1.6: Added other EVD systems encountered in NSW hospitals ie. NETS Exacta system and the Becker™ External Drainage system
 - iv. Section 1.7.1: added NETS actions
 - v. Section 1.8 and 1.9: added NETS observation/documentation requirements
 - vi. Section 1.11: added NETS team actions
 - vii. Section 2.1: added what was relevant and not relevant for NETS teams
- **16/01/2023:** Minor review.
 - i. Added to relevant sections that NETS teams are to continuously monitor ICPs during leg 2 of a NETS retrieval, and to have the EVD off to drain, unless drainage is required
 - ii. Added to relevant sections that NETS teams are to record ICP reading, together with CPP, during 15-minutely routine observations.

READ ACKNOWLEDGEMENT

- All clinical staff involved in the care of external ventricular drainage (EVD) or lumbar drainage via an EVD set are required to read and acknowledge they understand this document.

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1 External Ventricular Drains

An External Ventricular Drain (EVD) is a temporary system which allows drainage of cerebrospinal fluid (CSF).

1.1 Indications for use

External Ventricular Drains are inserted in order to manage:

- CSF infections
- obstruction to CSF flow
- raised intracranial pressure
- hydrocephalus of the neonate

1.2 Infection Control

- Surgical ANTT must be applied when sampling from the EVD and completing an EVD bag change.
- Patients with an EVD may require prophylactic intravenous antibiotics; this is to be at the discretion of the Neurosurgical Team/ Infectious Diseases Team.

1.3 Staff Responsibility

It is the responsibility of the nursing staff to monitor the EVD hourly and document the observations and neurological observations (see observation section). During a NETS retrieval it is the responsibility of the clinical team (nurse/doctor) to monitor and document ICP, CPP and neurological observations 15-minutely during leg 2 of transport, along with routine observations. It is also the responsibility of nursing staff or NETS team, to keep the drain at the prescribed height in order to facilitate CSF drainage within acceptable parameters and notify the appropriate member of the Neurosurgical team if drainage is outside these parameters, or to troubleshoot any other issues such as a blocked drain or drain dislodgement. For NETS teams, it is their responsibility to discuss this contingency plan with the PICU and/or neurosurgical team during the final conference call in preparation for leg 2 of the journey to the receiving destination.

1.4 Staff Accreditation

Post insertion care and management of EVDs can only be performed by Registered Nurses who have undergone appropriate SCHN education and accreditation (see Clinical Skills Assessment Framework policy for more information). For accreditation on Grace NICU, please see the Clinical Nurse Educators for information. For other areas, EVD accreditation is achieved on completion of the [EVD Clinical Skills Assessment](#) (CSA).

Prior to completion of the CSA, those undertaking accreditation must:

- Read and acknowledge the SCHN External Ventricular Drain Practice Guideline;
- Participate in an EVD practical skills demonstration;
- Complete an appropriate education package as per unit CNE advice (area dependent).

1.5 Patient Care after EVD Insertion

An EVD is inserted in operating theatres under general anaesthesia. It involves the placement of a drainage catheter into one of the lateral ventricles of the brain via a burr hole. The catheter then connects externally to the drainage system. Post-operative orders are documented in the patient's electronic medical record. Please refer to section [1.8 Observations](#) for frequency of neurological observations. For NETS retrieval teams, ensure a copy of the referring hospital post-operative orders, or the contingency plan that was discussed with the SCHN neurosurgical team, is documented in the NETS paperwork and accompanies the patient to the receiving destination.

Staff in PACU should contact the neuroscience ward or PICU for post-operative EVD assistance while waiting for the patient to be transferred out of recovery. Upon transfer to the ward/ICU, a thorough handover of the system should be given to the receiving nurse. This is to include a site check, a system check (three-way tap position, drain set up, and drip chamber height), and provision of any instructions regarding the management of the drain.

Note: The EVD must be clamped when the patient is being transferred in order to prevent over or under drainage and potential injury to the patient's brain tissues. This includes during retrieval unless drainage is required because ICPs are greater than the prescribed acceptable level. During leg 2 of retrieval the ICPs should be continuously monitored with the EVD off to drain.

1.6 Equipment Set Up

There are three EVD systems in use within the SCHN, however NETS retrieval teams may encounter other EVD systems in any NSW health facility during inter-hospital transfers. For specific instructions on how to set up each system refer to the relevant EVD resource available from the *'For Staff'* tab in the EVD ePolicy page on the SCHN intranet:

- [Setting up a Medtronic Duet EVD System \(CHW\)](#)
- [Setting up a Codman EDS 3 System \(SCH\)](#)
- [Setting up an Exacta EVD System \(NETS\)](#)

1.7 Levelling the EVD

1.7.1 External Ventricular Drainage

- It is vital that the system is levelled correctly in order to facilitate adequate drainage of CSF. The system must be clamped during this process to prevent adverse events. This applies to all EVD systems.
- Check the pressure level of the drip chamber is set at the ordered height and adjust as necessary. Ensure that if you adjust the level of the drip chamber that you lock the chamber into place by firmly turning the locking mechanism to the right. Ensure that the unit of measurement in use is cmH₂O.
- With the patient in a supine position use a spirit level or laser level (SCH and NETS) to measure from the external auditory meatus (EAM) across to the point of zero on the drain. "The external auditory meatus is the external anatomical reference point which

corresponds most closely with the Foramen of Monro¹ (See [Figure 1](#)). If the child is in the lateral position or their head to the side, measure from the bridge of the nose.

- Open the proximal and distal EVD system stopcocks to drainage and observe for oscillation to indicate drain patency.

It is important that the drain is levelled accurately. Placement above or below the desired level could seriously alter the rate and volume of CSF drainage which will impact the child's intracranial pressure and level of consciousness.

The CSF should be observed to oscillate continuously in the tubing and drain intermittently.

If there is no oscillation of CSF in the tubing, or drainage into the chamber, **notify the Neurosurgical Registrar and Neurosurgical CNC (SCH only)** promptly.

For NETS teams, notify the referring neurosurgeon that sited the EVD, or notify the receiving neurosurgical team via the NETS clinical coordination centre.

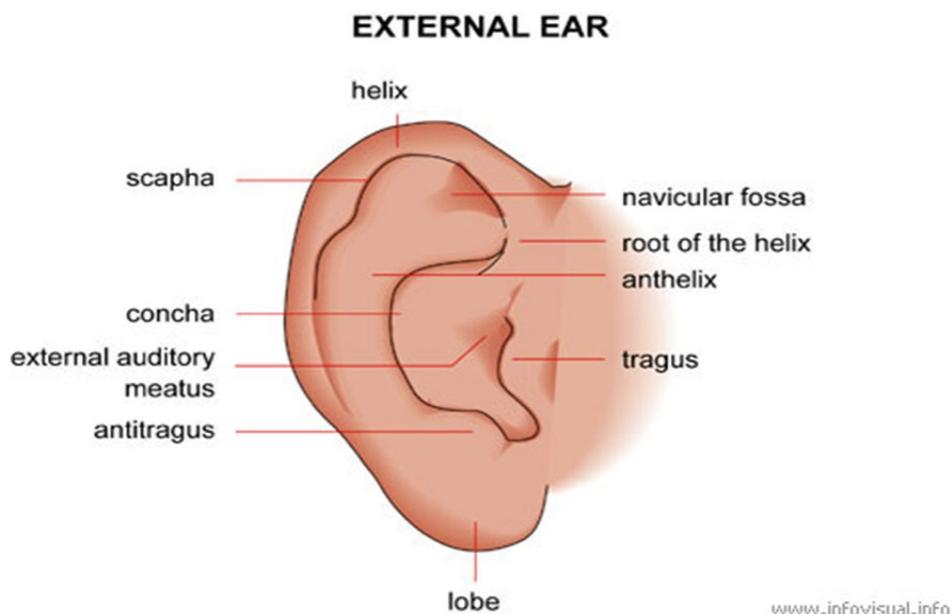
NOTE: Both mmHg and cmH₂O are represented on the measurement scale

Ensure drain is measured to cmH₂O on the ventricular setting for an EVD

Important Note:

During the course of general nursing care and daily activities, it is necessary at times to clamp the drain. In order to prevent clinical deterioration in the child's condition and blockage of the system, the EVD should not be clamped for a period of greater than 1 hour on any one occasion, unless ordered by the neurosurgical team. For NETS teams, unless drainage is required during leg 2, the EVD should remain on continuous monitoring of ICPs only, and off to drain, as severe turbulence or road conditions may result in inadvertent CSF drainage.

Figure 1



1.7.2 Lumbar Drainage via an EVD System

- It is vital that the system is levelled correctly in order to facilitate adequate drainage of CSF. The system must be clamped during this process to prevent adverse events.
- Ensure the zero point of the drain is levelled to the landmark specified in the Neurosurgical instructions using a spirit or laser (SCH only) level. This may be the bed height, patient's iliac crest or shoulder dependant on Neurosurgical preference.
- Check that the pressure level of the drip chamber is set to the ordered height or titrated appropriately to achieve the designated goal output per hour (mL/hr). The instructions for drain management when aiming for a goal output will vary due to the clinical situation and preference of the Neurosurgeon. This should be documented clearly in the patient's notes and Medical CSF Drainage information in PowerChart.
- Ensure there are no kinks in the drainage tubing and open the proximal and distal EVD system stopcocks to drainage. The CSF will not oscillate in the tubing and drain.
- Hourly assessment of the drain, output and site must be completed as per section 1.8.

It is important to monitor the catheter insertion site for signs of leaking or infection. **Notify the Neurosurgical Registrar or Neurosurgical CNC (SCH only)** promptly if this occurs.

1.7.3 Subdural drainage via an EVD system

- Subdural drainage may also occur via an EVD system.
- Ensure drain is measured to cmH₂O. At CHW, the drain should be set-up as ventricular drainage.
- The level of the drain must be set at the height and landmark recommended by the Neurosurgical Consultant and documented by the Neurosurgical Registrar. Individualised parameters for expected drainage output amount may also be required if warranted by the clinical situation.
- The patient may have multiple drains in situ. They should be labelled according to exit site to prevent confusion when documenting output and hourly checks in PowerChart.
- Hourly assessment of the drain, output and site must be completed as per section 1.8. Unlike ventricular drainage, the fluid may not oscillate within the drainage system tubing or drip chamber.

Subdural and lumbar drains may not always be attached to an EVD system. Staff caring for these drains should follow the instructions provided by the Neurosurgical team.

1.8 Observations

- The level of the drainage system must be checked hourly, or when the child alters the position of their head. During leg 2 of a NETS retrieval the EVD will be checked 15-minutely along with the routine 15-minutely observations.
- The prescribed height (measured in cmH₂O) must be checked every hour, or 15-minutely on leg 2 of NETS retrievals.
- Check that the CSF in the tubing is oscillating (for ventricular drainage); this indicates that the drain is patent.
- Record the amount of CSF accumulated in the drip chamber each hour, or 15-minutely on leg 2 of NETS retrievals, and empty into the collection bag. Ensure you re-clamp the stopcock to the collection bag so as not to lose the following hour's drainage.
- Check the drain dressing and the entry site of the catheter hourly. The dressing should NOT be wet. This indicates a leak which may lead to infection. If the dressing is wet, cover the CSF leak with a clean, dry dressing, and notify the Neurosurgical registrar, or medical officer on duty.
- These observations must be documented in the CSF Drainage Care chart found in iView of PowerChart, or on the NETS patient observation chart (scanned into Powerchart).
- If the drain height is to be altered, the Neurosurgeon or Neurosurgical Registrar must note this on the CSF Drainage Care Chart and in the child's clinical progress notes. NETS teams should document in the NETS medical record any drain height changes prescribed by the receiving neurosurgical team.
 - **Note:** If at any time the drain is clamped, **it is important to record the time of clamping and unclamping on the CSF Drainage Care chart, or on the NETS patient observation chart.**
 - Children with EVDs should have neurological observations; ½ hourly to 1/24 neurological observations and vital signs if the child has just returned from operating theatre, is unstable or the drain is clamped. NETS teams will document neurological observations 15-minutely during leg 2 of retrieval.
 - 4/24 if the patient's neurological condition is stable.

Table of Normal Circulating CSF Volumes

Age group	Circulating CSF Volume
Newborn	5mL
Infant	40 – 60mL
Young Child	60 – 100mL
Older Child	100 – 120mL
Adult	100 – 160mL

1.9 Documentation

- Hourly EVD checks and CSF drainage are documented electronically in PowerChart.
- NETS teams are to document in the patient observation chart ICP readings, CPP and any CSF drainage 15-minutely during leg 2.
- The Neurosurgical Registrar (or RMO on behalf of the Registrar) must prescribe daily, the drain height in cmH₂O and instructions on the AdHoc form Medical CSF Drainage Documentation.
- For specific instructions on documenting EVD-related orders and observations, see eMR Quickstarts via learning.kids [External Ventricular Drain \(EVD\) - Documenting CSF Output](#).

1.10 Drain removal

- EVDs, lumbar drains and subdural drains can only be removed on the ward by the Neurosurgical Registrar.
- Refer to local policy regarding drain removal instructions within the PICU and CICU settings.

1.11 Precautions

- Drainage output must be closely monitored as over drainage or under drainage may have detrimental consequences to the child. **These limits should be prescribed by the treating team and reviewed on a regular basis** (for example, if the EVD drains more than 25 mL/hr for two consecutive hours, contact the on-call Neurosurgical Registrar).
- **If there is a significant or sudden alteration in the amount of drainage, either *increased* or *decreased*, NOTIFY the Neurosurgical Registrar as soon as possible.**
- **If the patient's level of consciousness deteriorates at any time including whilst the drain is clamped pre-operatively, the Neurosurgical Registrar MUST be notified URGENTLY and the CERS system activated appropriately.**

- Parents and carers require education about care of the drain notifying the nursing staff in the event the child alters their position unexpectedly.
- NETS teams are to contact the receiving neurosurgical team or PICU via the NETS clinical coordination centre with any of the above precautions.

Note:**The system is to remain UNCLAMPED at all times except:**

- When changing the position of the patient e.g. log rolling, sitting up etc.
- When the patient is positioned outside the bed e.g. feeding
- One hour post intrathecal medication.
- ½ an hour prior to taking a CSF specimen
- During transit to another area, including during leg 2 of the retrieval process, where the EVD will be open to monitoring of ICPs only, unless drainage is required
- The neurosurgical registrar will advise if and when the drain needs to be clamped. This may occur preoperatively when the child is booked for shunt re-insertion or change of the EVD, or if excess CSF drainage has occurred. Changing External CSF Drainage Bags & Collecting CSF Specimen

1.12 General Principles

- A CSF specimen is collected to determine if there is an infection present, or to monitor an existing infection.
- Surgical ANTT principles apply when collecting a CSF specimen and changing the drainage bag.
- The frequency of sampling and location from which the sample should be collected will be prescribed by the Neurosurgical team.
- CSF drainage bags are to be changed weekly or when they are three quarters full (whichever occurs first).
- If sampling from the proximal port, clamp the drainage system ½ hour prior to procedure to assist in the collection of the specimen.
- If sampling from the drip chamber allow CSF to accumulate in the for no longer than an hour.
- Accredited nursing staff ONLY may obtain CSF from the external ventricular catheter.
- NETS teams are generally unlikely to need to change the drainage bag or collect CSF samples during a NETS retrieval. Any CSF sample should already have been collected by the attending neurosurgeon when the EVD catheter was sited at the referring hospital.

1.13 Sampling via the Proximal Three-Way Tap

Please note that an additional staff member may be used to assist with the procedure

1.13.1 Equipment

- Sterile gloves
- Sterile plastic drape
- CSF specimen tube
- Sterile luer lock cap
- 2% Chlorhexidine Gluconate in 70% alcohol swabs

1.13.2 Procedure

- Clamp the drainage system to performing the procedure in order to facilitate ease of CSF collection if necessary.
- Explain the procedure to the child and/or family, and ensure child's privacy is maintained. An assistant may be used to hold the CSF collection tube.
- Wash hands (soap and water/alcohol based hand rub), don non-sterile gloves from the medication room/procedure trolley and open equipment on to the sterile field.
- Remove and dispose of gloves
- Wash hands for 1 minute using 2% Chlorhexidine Gluconate hand wash and don sterile gloves.
- Pick up the three-way stopcock closest to the patient and continue to hold with one hand.
- Clean the three-way stopcock and luer lock cap for 20 seconds with a 2% Chlorhexidine Gluconate in 70% alcohol swab and allow it to dry naturally for a minimum of 20 seconds.
- The white stopcock is then opened to the child and closed to the drainage system. Remove the luer lock cap from the free port on the three-way tap and allow the CSF to drip into the specimen tube. **In order to maintain sterility it is important that the three-way tap does not come into contact with the CSF tube.** The required amount for a CSF specimen is 1 – 2mL. The white stopcock is then closed to the child and a new sterile luer lock cap applied to the open port.
- Reposition the patient if required and ensure they are comfortable and remeasure the drainage system. **Ensure that the appropriate three-way taps are unclamped before you leave the patient.**
- Dispose of equipment appropriately, label CSF specimen and send to pathology **immediately.**

1.14 Sampling via the Burette

1.14.1 Equipment

- Sterile gloves
- Sterile plastic drape
- CSF specimen tube
- 1 x 2% Chlorhexidine Gluconate in 70% Alcohol swab
- 10 mL luer lock syringe
- Needleless access device (NAD)

1.14.2 Procedure

- Allow CSF to accumulate in drip chamber for no longer than one hour.
- Ensure the three-way stopcock is off to the chamber, and that the system is clamped.
- Wash hands (soap and water/alcohol-based hand rub), don non-sterile gloves from the medication room/procedure trolley and open equipment on to the sterile field.
- Remove and dispose of gloves
- Wash hands for 1 minute using 2% Chlorhexidine Gluconate hand wash and don sterile gloves.
- Attach the luer lock syringe to the NAD and place on the sterile field.
- Using the 2% Chlorhexidine Gluconate in 70% Alcohol swab, clean the needleless access device at the base of the drip chamber for 20 seconds and allow to dry naturally for a minimum of 20 seconds.
- Remove the old NAD and discard it.
- Attach the new NAD and luer lock syringe to the open port.
- Turn the three-way stopcock off to the drainage bag.
- Using the already attached luer lock syringe, gently withdraw the CSF sample (1-2 mL) from the drip chamber via the NAD.
- Remove syringe and transfer the sample into a CSF specimen tube.
- If necessary, the remaining CSF should be drained from the drip collection chamber to the bag. Ensure the drainage system is levelled appropriately and open before leaving the patient.
- Dispose of waste and PPE appropriately and label and send the CSF sample off for processing.

1.15 Changing the Drainage Bag

Please note that an additional staff member may be required to assist with the procedure

1.15.1 Equipment

- Sterile EVD drainage bag (if bag requires changing)
- Sterile gloves
- Sterile plastic drape
- 1 x 2% Chlorhexidine Gluconate in 70% Alcohol swab

1.15.2 Procedure

- Ensure the drip chamber stopcock is off to the bag.
- Wash hands (soap and water/alcohol-based hand rub), don non-sterile gloves from the medication room/procedure trolley and open equipment on to the sterile field.
- Remove and dispose of gloves
- Wash hands for 1 minute using 2% Chlorhexidine Gluconate hand wash and don sterile gloves.
- Using 2% Chlorhexidine Gluconate in 70% alcohol swab, clean the connection below the drip chamber and the neck of the drainage bag for 20 seconds and allow to dry naturally for a minimum of 20 seconds.
- Unscrew the flaps on the top of the bag to remove it. Pass the bag to an assistant and replace with a new clean bag.
- Dispose of the full CSF bag into a yellow clinical waste bin.
- Ensure drainage system is levelled appropriately and open before leaving the patient.

2 References

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