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وزارة الصحة
Ministry of Health
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Directorate General of Khoula Hospital

Neurosurgery Department

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Validated by		**Approved by**	
Name	Ms. Huda AL Abri	Name	Dr. Rashid AL Alawi
Designation	Head of Accreditation Department	Designation	Director General
Signature	Huda	Signature	
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D.G. Office
DIRECTORATE GENERAL OF KHOULA HOSPITAL
SULTANATE OF OMAN - MINISTRY OF HEALTH

Acknowledgement

- **Document Authors:**

1. Dr. Ahmed Al Azri, Consultant of Neurosurgery Department
2. Dr. Nawal Al-Kindi, Consultant, Medical Microbiologist ,Director of Infection Prevention and Occupational Safety
3. Dr. Pravinchandra Kharangate, Specialist of Neurosurgery
4. Ms. Shamsa Al-Sharji, Director of Nursing Affairs
5. Ms. Ameera Al Battashi, Head of Infection Control Department

- **Document Reviewers:**

1. Dr. Mahmood Al Hatali, Neurosurgery Consultant
2. Dr Adil Al Kharusi, Head of Intensive Care Unit
3. Dr. Amal Al Jabri, Consultant, Medical Microbiologist Infection Prevention and Occupational Safety Directorate
4. Dr. Ahmed Alkazroni, Medical microbiologist, Infection Prevention and Occupational Safety Directorate
5. Ms. Shurooq Al Ruqaishi, Acting Head of Section of critical care, leader of Quality Nursing Task Group
6. Ms. Raja Al Rawahi, NICU In-Charge
7. Ms. Zainab Al Farsi, Head of CSSD
8. Ms. Sheikha AL- Ghuzaili- Acting NICU In- Charge
9. Ms. Bushra AL-Abri, Acting In-Charge of Nursing Document Control
10. Ms. Maryam AL- Shammaki, Sr. General Nurse A,SID (QM &PSD)
11. Ms. Samiha AL-Ghafri, MNSW In- Charge
12. Ms. Salwa AL-Balushi, FNSW In - Charge
13. Ms. Manal AL-Hanashi, PSW In – Charge
14. Ms. Rava AL- Mamamari, HOS of Supportive Services Department
15. Ms. Shini Sujet, General Nurse B
16. Ms. Blessy Susan Thomas, General Nurse, NDS
17. Ms. Fatma AL-Juniabi, General Nurse A, ICU

Content

Acronyms

DGKH	Directorate General of Khoula Hospital
MoH	Ministry of Health
ICU	Intensive Care Unit
CT	Computed Tomography
ICP	Intra-Cranial Pressure
EVD	External Ventricular Drain
INR	International Normalized Ratio
IV	Intravenous
CSF	Cerebro-Spinal Fluid
Cms	Centimeters
CC	Cubic Centimeters
DMB	Departmental Management Board
HoD	Head of Department
QM &PSD	Quality Management and Patient Safety Directorate
H2O	Water
PPEs	Personal Protection Equipments
IPC	Infection Prevention and Control
CSSD	Central Sterile Supply Department
SSI	Surgical Site Infection
NHSN	National Healthcare Safety Network
CDC	Center for Disease Control and Prevention

Definitions

- **Insertion of External Ventricular Drain (EVD):** Insertion of an External Ventricular Drain (EVD) is a surgical procedure performed to relieve elevated intracranial pressure (ICP) by draining cerebrospinal fluid (CSF) from the brain's ventricles. It involves making a small incision in the scalp, drilling a burr hole into the skull, and carefully inserting a catheter into the lateral ventricle. The catheter is passed under the skin to exit from the skin away from the incision site, and then this is connected to an external drainage system to control CSF flow. The burr hole and incision site are closed with sutures or staples, and the exiting catheter is fixed to the skin with sutures to prevent accidental pulling out.
- **Maintenance of External Ventricular Drain (EVD):** Maintenance of an External Ventricular Drain involves regular monitoring and care to ensure the system functions correctly and prevents infections. This includes checking the drainage system for CSF output, using aseptic techniques to maintain sterility, regularly dressing the scalp wound and scalp EVD exit point, and performing regular check-ups of the system's function. Flushing the system may be necessary to manage blockages.
- **Removal of External Ventricular Drain (EVD):** Removal of an External Ventricular Drain is the process of safely taking out the catheter when it is no longer needed or when there is a place for revision or exchange with a new catheter. The area around the insertion site and exit point from the skin is sterilized, and the catheter is gently withdrawn. The exit point is closed with sutures, and the patient is monitored for any signs of complications, such as infection or recurrence of elevated ICP.
- **Kocher's point:** This is usually found 10.5 to 11.0 cm back from the nasion and 2.5 to 3.0 cm lateral to the midline, which typically corresponds to the mid-pupillary line. It should be at least 1 cm anterior to the coronal suture to avoid the primary motor cortex. (See Appendix 1).

Guideline for Insertion, Maintenance and Removal of External Ventricular Drain (EVD)

Chapter 1

1.Introduction

Khoula Hospital being the major neurosurgical set-up in Oman is responsible for the management of neurosurgical patients from almost all over the country. External ventricular drainage is an important procedure for diagnosis and treatment of raised ICP in neurosurgical conditions like intraventricular hemorrhage, traumatic brain injuries, ventriculitis, shunt-related infections, and CSF pathway obstructions caused by tumors or other causes. The lack of standardized EVD procedure and variability in patient care at Khoula Hospital necessitates the development of guidelines for the insertion, maintenance, and removal of External Ventricular Drains. This variability can result in increased risks of complications such as infections, catheter blockages, and inconsistent management of intracranial pressure. Additionally, the absence of a unified protocol complicates the training of healthcare professionals, potentially compromising the quality of care. Therefore, comprehensive guideline is essential to address these challenges, ensuring consistent, safe, and effective neurosurgical treatment for all patients.

2. Purpose

The purpose for this guidelines are to:

2.1 Standardize care, enhance patient safety, and improve clinical outcomes.

2.2 Ensures consistent practices, reduces complications, and serves as a crucial training tool for healthcare professionals.

2.3 Align with international standards, optimizes resource use, and supports continuous quality improvement, solidifying Khoula Hospital's role as a leading neurosurgical center in Oman.

3. **Scope**

This guideline of Directorate General of Khoula Hospital applies to all healthcare professionals working with Neurosurgery patients in different wards including staff nurses and doctors.

Chapter 2

5. Structure

5.1 It is the guideline of the Directorate General of Khoula Hospital to ensure that:

a. Once the EVD is connected, the sterility of the EVD system should be maintained.

b. Minimum handling of the EVD system (drainage and collection) should be ensured to prevent breach of the closed circuit.

c. Any handling of the system should be done in a sterile manner.

d. The dressing of the EVD exit point is to be changed by a trained nurse every three days as a routine or/ and when it is soaked or contaminated internally or externally. The dressing should be inspected and documented during every shift.

e. For EVD insertion, blockage management, or flushing, the procedure must involve one doctor, one assisting nurse, and a circulating nurse.

5.2 The EVD insertion:

a. Basic Principles and requirements:

i. The procedure must be performed by neurosurgery doctors.

ii. The procedure of EVD insertion or revision should be performed in the operating theater unless otherwise indicated by the neurosurgeon considering the urgency of the case and the availability of the OT time. In this case, it can be done in the ICU / NICU, and rarely the ward when the patient cannot be taken to the ICU within the appropriate time.

iii. A minimum of 4 EVD insertion sets including the drills and drill pits must be always readily available in the ICU, maintained by the CSSD.

b. The following are the fundamental requirements for the insertion of the external ventricular drainage procedure:

i. EVD set (To reduce the infection risk, it is recommended using antibiotic-impregnated EVD catheter, if not available, then to use the regular catheter).
ii. EVD insertion kits.
iii. Drill Set.
iv. Drill bits: range of 4 to 5 mms diameter drill bits, with length of 5 - 7.5 cms.
v. Hair surgical clipper set.
vi. Extra Gauzes and pads 3 packs each.
vii. Chlorhexidine gluconate (CHX)-containing dressing (See Appendix 2, Fig F).
viii. Crepe bandage (for full head coverage if needed).
ix. Drapes with central hole not more than 3 inches.
x. Clean gloves at least 10 pairs.
xi. Sterile gown.
xii. Chlorhexidine / Povidone iodine surgical scrub.
xiii. Spirit.
xiv. Povidone Iodine.
xv. Sterile gloves of appropriate sizes. 3 sets.
xvi. Suturing set.
xvii. Sterile measuring tape.
xviii. Sterile permanent marker.
xix. Blade knife.
xx. 2 syringes from each (5cc ,10cc ,20cc).
xxi. Xylocaine 2% with Adrenaline 1:2,00,000. (Check the dose with the pediatrician in case of NICU and Pediatric ward).
xxii. Antibiotics – Cefazolin, or Vancomycin (in case of MRSA or B-lactam allergy) of appropriate dose as a single prophylaxis dose.
xxiii. Sterile water of 30 cc for priming of the ICP monitoring set.
xxiv. Normal Saline for flushing of EVD.
xxv. 3-0 nylon suture.

xxvi. Tincture benzoin for adhesive assistance.

xxvii. Tegaderm or appropriate sterile size replacement at least 4x5 inches in size.

xxviii. Pressure monitoring system (if ICP is being monitored).

xxix. Micropore 1 inch tape to fix margins.

c. Consent, Antibiotics and Investigations:

i. ICU invasive procedure consent includes the EVD insertion / reinsertion. It is advised to maintain separate informed consent whenever feasible or through documented discussion in the patient progress notes. Cases of EVDs being done in OT shall have consent as other OT procedures.

ii. Order a single dose of Cefazolin or Vancomycin (if patient is allergic to Penicillins or MRSA colonized or infected earlier) to be given within 60 minutes (if the time allows) prior skin incision as a prophylaxis.

iii. Check the patient's coagulation parameters (INR should be less than or equal to 1.4). Coagulation correction is done, for example by giving fresh frozen plasma or vitamin K (usually 10 mg IV if urgent correction is needed) as indicated.

iv. Check patient's platelets (goal should be greater than 100,000), administer platelets transfusion as indicated in low platelets count or the patient is on anti-platelets therapy.

v. Antibiotics impregnated EVD catheters are recommended to be used to reduce the rare of EVD associated infection.

d. Preparation of head, localization, skin preparation and infiltration:

i. Ensure that the head area is cleared of any obstacles, such as pumps, IV pole and their wires, to facilitate the procedure and maintain safety.

ii. Ensure the patient is positioned appropriately to provide optimal access to the insertion site.

iii. Clip the patient's hair where placement of ventriculostomy will be. Most are placed on the right side at Kocher's point (see discussion below). The preparation is to have a margin of at least 10 cm in all directions around the entry point of the catheter into the skull (See Appendix 1). Consider full hair clipping if expected the patient will have the EVD for a long duration.

iv. Ensure thorough head wash for the patient with scrub Betadine or Chlorhexidine by attending nurse as early as possible after decision of external ventricular drainage is made.

v. Mark the location of Kocher's point. An alternative method is to feel for the coronal suture and mark a spot one centimeter anterior towards the face (mostly on children) in the mid-pupillary line (See Appendix 1).

vi. Open a sterile suturing set for the purpose of preparation of the skin. Prior to cleaning the patient, the surgeon should follow infection control precautions. (hand hygiene and wearing PPEs).

vii. Clean the area with a Chlorohexidine-based soap solution and then clear it with alcohol-based solution and wait for the solution to dry. Chlorhexidine, Povidone-iodine, or another iodine-based cleaning solutions should be used a minimum of three coats, and then allow the area to dry. Do not fan or blow the area dry. A minimum contact time of 3 minutes after the last coat application is recommended. (Do not clean away the povidone iodine).

viii. Infiltrate the surgical site and the EVD tunneling and exit point with the local anesthesia (Lidocaine preferably with Adrenaline).

ix. Open the cranial access kit, instruments and the drapes using sterile technique.

x. Open ventricular catheter and place it on sterile field.

xi. Take some sterile solution (e.g., normal saline) to flush the surgical site clean when required and to flush the ventriculostomy catheter if multiple passes are needed and the tip gets clotted with blood/debris.

xii. Using the sterile towels with central hole or multiple towels to drape the procedure site but ensuring that appropriate anatomical landmarks are visible.

xiii. Half drape can be used to form a sterile field for the rest of the patient's body if needed.

e. Tapping of Ventricle :

i. Re-identify Kocher's point using both your mark (which was probably washed away during re-prepping and distorted during Epinephrine injection) and anatomical landmarks (see discussion above) (See appendix 1).

ii. Attach the drill bit to the drill.

iii. Ensure that the patient is appropriately anesthetized and sedated. Medications such as Fentanyl, Propofol, and Midazolam are commonly used. If the patient is not intubated, perform a supra-orbital nerve block, to anaesthetize the appropriate area, and the procedure is to be attended by ICU doctor to manage the conscious sedation appropriately. It is important not to "snow" cover the patient too much which may interfere with his breathing. If intubated, the patient shall be sedated with intravenous sedation and analgesia since the patient has a "secured" airway.

iv. Make an approximately 1- to 1-inch (2.54 cm) incision down to the skull at Kocher's point. Allow the scalpel blade to cut to the bone. A small self-retaining retractor may be used to "open up" the incision.

v. Place a burr hole / perforator at a 90-degree angle to the skull, using the catch guide on the drill to prevent puncture of the dura with the bit. The key at this step is to use very gentle pressure while spinning the drill bit very fast. Once through the first layer of compact bone, the bit might "fall" into the cancellous bone, where drilling will be easier. Then will reach the second layer of compact bone. Continue to spin the drill quickly but lighten up on the pressure because at this point it is close to the dura.

vi. Use a pair of forceps or saline flush to remove any bone dust or chips as these can get passed into the brain tissue during catheter insertion.

vii. Once the burr hole is made, use a needle to puncture the dura. "Push" away dural leaflets to prevent creating a potential epidural space.

viii. Take the ventricular catheter with the guide wire in place and use one hand as a stabilizing device and advance the catheter slowly but steadily into the parenchyma. The trajectory should be towards the ipsilateral medial canthus of the eye, and the catheter should be orthogonal (exactly perpendicular) to the skull itself.

ix. Advance the catheter 6.0 to 7.0 cm at the most (Review the head CT scan before the procedure).

x. Pull the stylet and assess for CSF pulsations and note the pressure in the catheter.

xi. If no CSF is seen, pull the catheter out and re-place the stylet after washing down the tip of catheter with sterile solution. This will remove any "debris" in the tip of the catheter that may prevent flow.

xii. The direction of first pass is ipsilateral pupil plane, perpendicular to the bone. The second attempt direction - ipsilateral medial canthus plane or third attempt is contralateral medial canthus plane.

xiii. Re-pass the catheter. In general, a maximum of three attempts should be tried unless otherwise adjustment is made towards the appropriate plane. If no CSF is obtained, either the patient is not under pressure, or the catheter is not in the ventricle. At this point either to abort the procedure entirely or suture the catheter in place (see steps below) and get a head CT to identify the catheter placement.

xiv. Once CSF is obtained, place the extracranial end of the catheter onto the trocar tip and pass it through the tunnel access path below the galea layer of the scalp and "pop" out at a site more than two inches away from the burr hole site (this area should have been already sterilized as discussed above). May also consider keeping the trocar tunneled in place earlier before the ventricular puncture. Avoid needle stick injury and avoid recapping.

f. Connections Of the EVD Set:

i. Using blunt forceps to "pinch" the catheter at the skull with non-dominant hand, then using the other hand to pull the trocar through the tunneled pathway, while caring not to pull the catheter from the ventriculostomy.

ii. Cut the catheter off the end of the trocar and place the included capping device on the end of the catheter to prevent CSF from leaking.

iii. Close the incision with 3 or 4 interrupted sutures.

iv. Then using sutures (preferably 3-O nylon) to place a drain stitch at the point where the catheter exits the scalp, and gently wrap the catheter along the head, and place 3 more securing stitches onto the scalp along the course of the catheter.

v. While maintaining sterility, hold up the connection tubing and flush it with saline prior to being connected (priming procedure). If required, may have the nurse/assistant help to hold the catheter ensuring the sterility is maintained. The priming saline can be kept ready before the procedure.

vi. Remove the stop cock device from the tip of the catheter and connect the end of the catheter to the tubing.

vii. Place and tie a silk ligature around the area where the tip of the tubing connects to the catheter to prevent it from becoming dislodged accidentally.

viii. The area around the EVD incision should be thoroughly cleaned. This involves gently wiping away the blood with sterile gauze soaked in saline or antiseptic solution. Ensuring the area is clean and dry is crucial before applying the sterile dressing.

ix. Carefully clean any blood from the patient's hair near the incision site.

x. Cover the wounds with antiseptic or antibiotics impregnated dressing (transparent dressing is preferred), and preferably applying Tincture of Benzoin to facilitate adhesion. The impregnated dressing shall be applied over the EVD exit point if the size is not enough to cover the exit site and the surgical wound. If a transparent dressing is not available, consider using a crepe bandage to cover the entire head.

xi. Clean up all sharp instruments and place them in the appropriate receptacles.

xii. Provide the nurse with an ICP monitoring order. Usually, the initial settings are to place the level at approximately 10-15 cm H2O above the tragus of the ear.

5.3 Nursing role in Monitoring /Maintenance of EVD:

a. The nurse must monitor the EVD level and check the 'zero level' during each shift and when required. In the supine position, the 'zero level' is aligned with the tragus of the ear, while in the lateral position; it is aligned with the nasion. Neurosurgery doctors should be consulted for clarification whenever there is uncertainty (See Appendix 1).

b. The nurse staff to document the patency of the system according to the doctor's description plus the amount and color of the CSF drained.

c. Dressing changes must be performed by a trained staff nurse every 72 hours. The neurosurgery team will provide support when necessary.

d. The EVD must be closed before any changes in the patient's position or during transfers (e.g., for feeding, scanning, moving to the operating room, or transferring to another bed for EVD maintenance). After the transfer or repositioning is complete, including when the patient is in a location outside the ICU, the nurse must verify the EVD level and the 'zero level' before reopening the EVD. The nurse must remain cautious to ensure the EVD is properly levelled and reopened to its previous

setting following any position change or transfer, including when the patient is moved to other areas of the hospital, such as scanning rooms or dialysis.

5.4 Doctors' role in Monitoring /Maintenance of EVD:

a. Basic Principles and requirements:

i. Regular CSF collection shall be done by a doctor.

ii. It is recommended to be done from the reservoir. Only when otherwise indicated, then this to be done from the proximal tubing connection to get more representative CSF sampling for infection, injection of therapy or when proximal tube flushing is required.

b. CSF Sampling procedure:

i. Timing and Frequency:

- CSF samples should be taken when there is a clinical indication of infection, such as fever, elevated inflammatory markers, or changes in neurological status.
- CSF sampling might be performed every 48 hours to closely monitor for pathogens and adjust treatment promptly. Otherwise, a once weekly CSF sampling to be done in all patients having the EVD in-situ.

c. Clinical Indications for Sampling:

i. CSF sampling is indicated for diagnosing infections, monitoring the efficacy of antibiotic treatments, and ensuring shunt clearance before removal or revision of the shunt.

d. Technique and Sterility:

i. The sampling must be performed using a sterile technique to avoid contamination. Proper PPE, including gloves, gown, and mask, is essential during the procedure to maintain a sterile environment.

5.5 The procedure of CSF sampling:

a. Wear a surgical mask.

b. Open the sterile covers using a pair of clean gloves (unsterile), taking care not to touch the system.

c. Open a sterile dressing tray and then put required syringes into the sterile zone.

d. The nurse holds two ends of the connector around 5 inches between two hands, and the area is doused with surgical spirit.

e. Perform hand hygiene by the person sampling the CSF.
f. The person handling the connector system / sampling the CSF should be wearing sterile gloves. If the procedure is aiming proximal flushing of the EVD system or intra-ventricular therapy, fully sterile condition is maintained including a sterile gown and sterile gloves should be worn.
g. Clean the area well with sterile cotton spirit swabs again, then paints with chlorohexidine or povidone iodine & let dry.
h. Place on a sterile mop / sterile cotton pad (available in the dressing tray).
i. Open the bungs and clean the entry point with sterile alcohol-based swabs.
j. Connect syringe and sample CSF.
k. In the event of therapy. The solution shall be prepared in the bottle by the doctor, and then the adequate amount is withdrawn and then injected. A chasing fluid of normal saline is used to push the fluid towards the ventricle (usually not exceeding 2 ml).
l. Recap the point of breach.
m. De-drape the sterile zone and then deglove.

5.6 Procedure for EVD disconnection:

a. Basic considerations:
   i. The nurse should not disconnect the EVD for any reason.
   ii. In the event of EVD disconnection, the nurse to inform the neurosurgery team doctor.
   iii. Incident report to be written.

b. The nursing role:

i. Immediately clean the area around the disconnection site using an alcohol-based solution to maintain sterility.
ii. Place a sterile stopper or clamp on the disconnected EVD to prevent contamination and CSF leakage.
iii. Do not attempt to reconnect the EVD without first alerting the neurosurgical team. Proper assessment and sterile reconnection by neurosurgical team is required.

c. Doctors' role:

i. To assess the disconnection, clean the tip of the disconnected tube with antiseptic substance, and reconnect to a new distal set of tubing and bag.

d. Flushing the blocked EVD technique:

i. Proximal catheter flushing carries risk of infection, hence, shall be used cautiously. For proximal flushing of tubing, to use the most proximal accessible area of connection. Perform flushing under sterile conditions using 1-3 ml of saline.

ii. Flush once, and if the blockage persists, repeat up to a maximum of three times. If the blockage recurs repeatedly, replacement of the EVD might be required.

iii. The flushing procedure should be a strict sterile technique.

e. Procedure for removal of EVD:

i. Basic considerations:

- Mandate for CSF Sampling: Before removing the EVD.
- Culture the EVD Catheter Tip: In cases where an EVD-associated infection is suspected or confirmed, to send the distal tip of the EVD catheter (less than 4 cm) for culture. In general, it is advised to avoid sending catheter tips due to the risk of contamination, which could potentially lead to misleading treatment decisions.

Sterile Removal Procedure:

The removal of the EVD should be done using a sterile technique:

i. Hand rub or pre-procedural wash.
ii. Wearing clean fresh unsterile gloves.
iii. Removal of all the dressing making sure no contact is made with the entry points.
iv. Open a sterile Suturing set, and 3-0 nylon suture.
v. Hand rub / Pre procedural wash.
vi. Donning surgical gloves in the prescribed fashion, then the area is cleaned with surgical spirit and then with povidine iodine x 3 coats. After drying, the area is draped and then anchoring suture is opened and catheter freed. The catheter is

removed making sure it does not touch any structure outside if the tip is planned to be sent for culture to avoid contamination.

vii. (3-0) nylon suture is placed at the site of exit of the drain ensuring no CSF leak after suturing. Additional suturing may be used if there is CSF leak.

viii. Dressing is applied.

ix. Degloving.

f. Infection Control and Surveillance:

i. Care Bundles:

➢ Documentation and Maintenance:

- Assigned nursing staff must complete and maintain insertion and maintenance infection control bundles for every patient (See Appendix 2&3).
- These bundles must always remain in the patient file until the EVD is removed or the patient is discharged.
- Any breaches in aseptic techniques during insertion or maintenance must be documented in the bundle form.

➢ Submission and Retention:

- Upon patient discharge, bundle forms must be submitted to the Infection Control Department.
- Forms shall be retained for a minimum of 90 days for Surgical Site Infection (SSI) surveillance purposes.

g. SSI Surveillance:

i.Inclusion in Surveillance:

➢ All patients undergoing EVD procedures must be included in the SSI surveillance system.

➢ Surveillance must include cases with:

- Positive CSF cultures, or
- Any positive findings within 30 days of EVD insertion—whichever occurs first.

ii. Analysis and Reporting:

- Cases must be analysed using CDC/NHSN criteria to calculate infection rates in a standardized format.
- All cases meeting SSI criteria require a Root Cause Analysis (RCA) using a standard methodology.

iii. Follow-Up: RCA findings must be discussed with the neurosurgical team and assigned nursing staff.

Chapter Three

6.Responsibilities

6.1. Head of neurosurgery department and unit heads shall:

6.1.1. Ensure that the guideline document is available and accessible to all staff

6.1.2. Encourage all staff to be aware of these guidelines and strictly follow them.

6.1.3. Ensure the adherence to care bundles and follow up every time an EVD is inserted, maintained or removed. (Care-bundles: EVD insertion, EVD maintenance, EVD tracking checklist).

6.1.4. Review the Root Cause Analysis (RCA) provided by the infection control team and collaborates with them to address and resolve any identified issues.

6.1.5. Ensure that all neurosurgeons, residents, and staff performing EVD insertions are adequately trained and regularly assessed for competency.

6.2. Neurosurgery doctors shall:

6.2.1 Ensure patients are referred to Therapeutic Nutrition Department following their initial assessment.

6.2.2 Provide ongoing training and supervision to ensure that all staff are competent in the procedures related to External Ventricular Drain (EVD) management.

6.2.3 Regularly review adherence to protocols and address any deviations or non-compliance promptly by nurses and other medical team.

6.2.4 Encourage the nursing staff to adhere to the protocol in maintenance of the External Ventricular Drain.

6.2.5 Ensure that any complications or incidents related to EVD are promptly reported and documented, following the hospital's reporting protocols.

6.2.6 Educate patients and their families about the EVD procedure, potential risks, and care requirements to ensure they are well-informed and involved in the care process.

6.3. Staff Nurse shall:

6.3.1 Notify the assigned doctors to refer neurosurgery patients with an EVD to the Therapeutic Nutrition Department following their initial assessment.

6.3.2 Maintain accurate and thorough documentation of all procedures, observations, and communications related to EVD care.

6.3.3 Ensure to follow the guidelines and procedure strictly.

6.3.4 Be prepared to respond to EVD-related emergencies, such as blockages or disconnections, according to established protocols.

6.3.5 Ensure the wound dressing and cleaning is done properly using ideal cleaning items, once every 72 hours and to inform if there is CSF leak or wound soiling.

6.3.6 Participate in infection control audits and reviews to ensure ongoing compliance with infection prevention guidelines.

6.3.7 Monitor the level of EVD in every shift and inform doctors for any abnormal notes.

6.3.8 Inform IPC nurse about the care bundle forms while case is admitted and handled the forms on discharge to IPC nurse.

6.3.9 Ensure every nurse handling the EVD is trained and can adhere to IPC measures.

6.3.10 Ensure patients are aware about their own right of taking care of EVD and preventing infection (by education, counselling and providing patient education leaflet).

6.3.11 Ensure a strict adherence to care bundles is followed up every time an EVD is inserted, maintained, or removed. (Care-bundles: EVD insertion, EVD maintenance, EVD tracking checklist).

6.3.12 Ensure that all necessary supplies for EVD care, such as dressings, cleaning solutions, and monitoring equipment, are readily available and in good condition.

6.3.13 Provide comprehensive education to patients and their families about EVD care, potential complications, and the importance of hygiene and monitoring.

6.3.14 Ensure that nurses caring for patients with EVD are assigned to clean cases per shift whenever possible.

6.3.15 Ensure that all staff assisting nurses with EVD patients are also assigned to clean cases, avoiding contact with infected cases to prevent cross-infection.

6.3.16 Advise and ensure that family members or attendants do not move close to other infected patients.

6.4. Infection Prevention and Control Nurse shall:

6.4.1.Monitor and ensure adherence to infection prevention protocols, including surveys or audits related to EVD insertion, maintenance and removal practices. (Through daily and weekly IPC surveillance).

6.4.2 Audit the maintenance of EVD (average of at least 3-4 times monthly).

6.4.3 Provide ongoing education and training for healthcare staff on the latest IPC practices, specifically related to EVD care.

6.4.4 Raise attention once the infection rate goes up and to initiate a task force plan to reduce the rate.

6.4.5 Request a Root Cause Analysis (RCA) at least once every quarter to identify and resolve issues. This should be a multidisciplinary team effort.

6.4.6 Regularly analyze infection data and trends and prepare reports for hospital administration and clinical teams to inform quality improvement efforts.

6.4.7 Educate patients and their families on infection prevention measures related to EVDs, covering essential practices such as hand hygiene and recognizing signs of infection. Provide an instruction sheet with this information and distribute it to patients and their families to support understanding and adherence to infection prevention protocols (Appendix 4; A and B).

6.4.8 Work closely with multidisciplinary teams, including neurosurgeons, nurses, and microbiologists, to ensure comprehensive infection control measures are in place.

6.4.9 Develop and implement outbreak management protocols in case of a hospital-acquired infection outbreak related to EVDs.

6.5. CSSD staffs shall:

6.5.1 Ensure double Washing:

i. First Wash in the ICU: After use, the instruments (Drills/beats), should be washed in the ICU to remove immediate contamination.

ii. Second Wash in the CSSD: A thorough second wash is done in the CSSD using appropriate cleaning techniques.

6.5.2 Ensure sterilization (Autoclaving): Instruments are then sterilized using an autoclave to ensure complete sterilization before the next use.

6.5.3 Ensure clear Labelling: The package containing the sterilized items must have a clearly visible list of instruments, including their sizes, on top of the package for easy identification during surgeries.

Chapter Four

7. Document history and version control table:

Version	Description	Name of Authors	Review Date
1	**Initial release**	1. Dr. Shared Samson **2.** Dr. Pravinchandra Kharangate	**2024**
2	**Second version**	1. Dr. Ahmed Al Azri, 2. Dr. Nawal Al-Kindi, 3. Dr. Pravinchandra Kharangate 4. Ms. Shamsa Al-Sharji, 5. Ms. Ameera Al Battashi, Head of Infection Control Department	**2027**

8. Related Documents:

1. Hand Hygiene policy

9. References:

- Dynkevich et al (2016) Establishment of an external ventricular drain (EVD) best practice guideline: The quest for a comprehensive, universal standard for EVD care.[Online]: file:///C:/Users/Hp/Downloads/Establishment%20of%20an%20EVD%20Best%20Practice%20Guideline.pdf (Accessed on July 2024).
- Frey, A.M., & Schears, G. J. (2006). Why are we stuck on tape and suture?: A review of catheter securement devices. Journal of Infusion Nursing, 29(1), 34338.
- Jones. J (2024) How to Maintain the Brain Drain: An Update of a Clinical Practice Guideline for External Ventricular Drain Care and Maintenance. [Online]: file:///C:/Users/Hp/Downloads/research_repository_submission-f258493b-5171-41b4-8fea-a4d67563471a.pdf. (Accessed on July 2024).
- Khalaveh. F et al (2021) Risk factors promoting external ventricular drain infections in adult neurosurgical patients at the intensive care unit4A retrospective study. Frontiers In Neurology, 12, [Online]: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8631749/ (Accessed on June 2024).
- McEwen, M., & Wills, E. M. (2019). Theoretical basis for nursing (5th ed.). Wolters Kluwer. Muralidharan, R. (2015). External ventricular drains: Management and complications. Surgical Neurology International, 6(7), 2713S274. https://doi.org/10.4103/2152-7806.157620 (Accessed on JUly 2024).
- Rojas-Lora.M et al (2023) External ventriculostomy-associated infection reduction after updating a care bundle. Annals Of Clinical Microbiology And Antimicrobials, 22(1), 59369.
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- Thamjamrassri.T et al (2022)A narrative review of the published literature, hospital practices, and policies related to external ventricular drains in the united states: The

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- Vieira.T et al (2022). External ventricular drains: Development and evaluation of a nursing clinical practice guideline. Nursing Reports, 12(4), 9333944.
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10.Appendix:

10.1 Appendix (1): Kocher's point (marked by " ° ") indicated by surface anatomy.

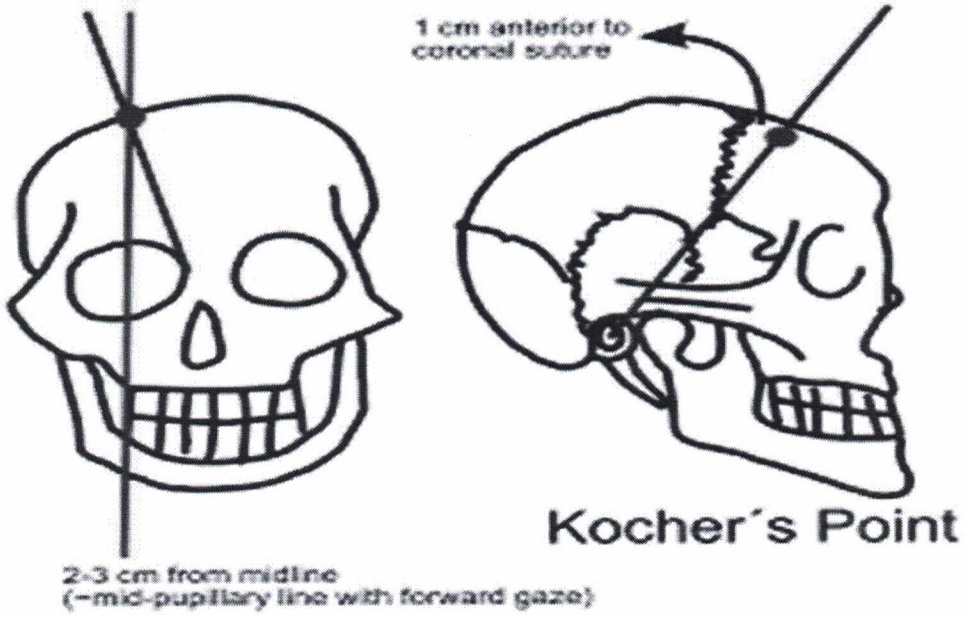


Figure A

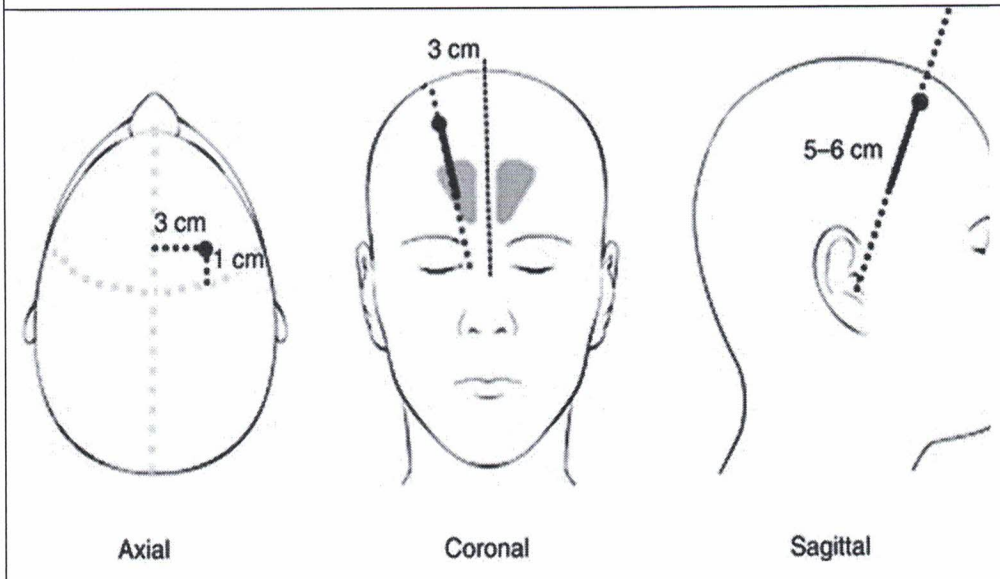
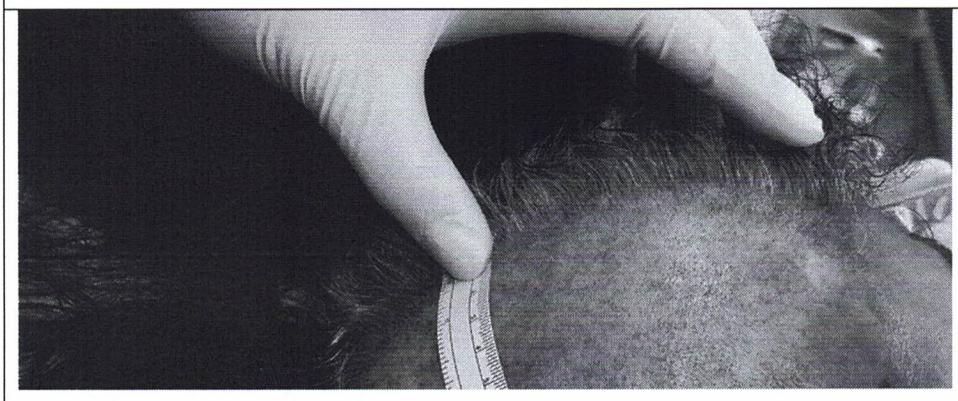
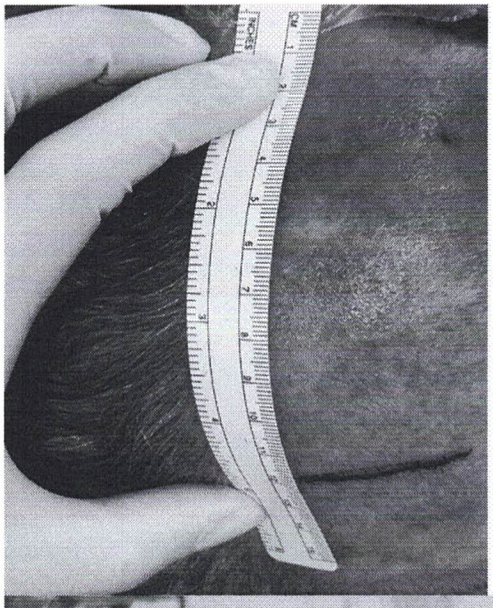


Figure B





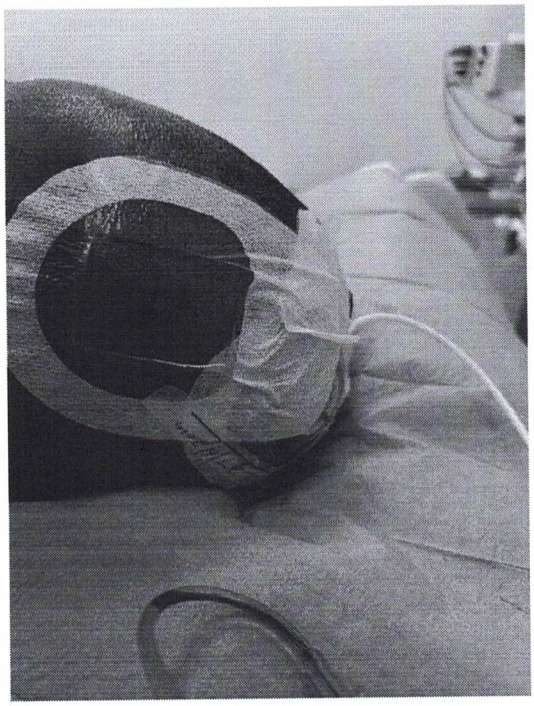


Figure C: Before marking, Shave the head to remove hair using clippers. Ensure the shaved area is sufficiently large for the chlorhexidine gluconate dressing to adhere properly to the skin.

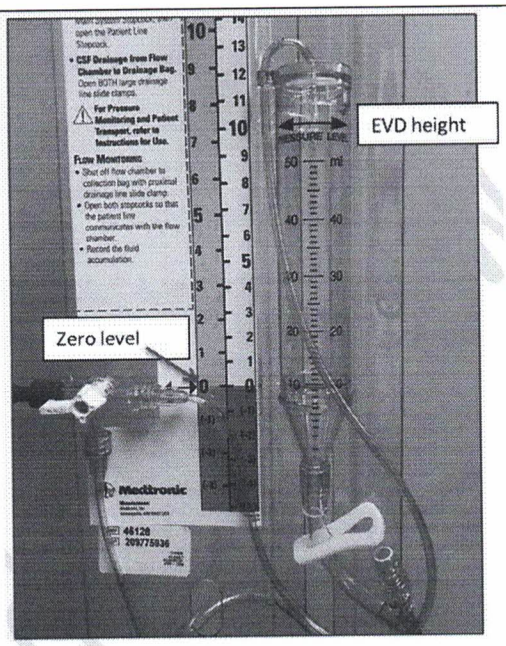


Figure E:

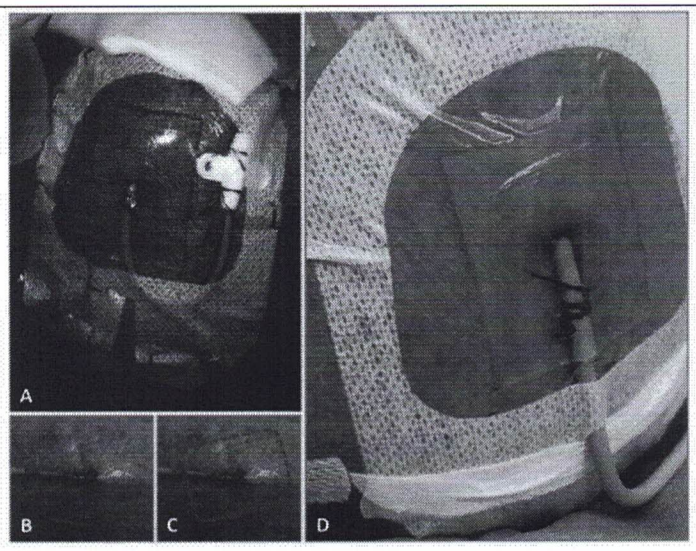


Figure F: Sterile application of a chlorhexidine gluconate (CHX)-containing dressing on the external ventricular drain exit wound intraoperative and replace it every three days.

Figure G: The head is fully shaved before EVD insertion using a surgical clipper.

10.2 Appendix (2): EVD Maintenance Bundle

Date of insertion: **New insertion:**

Inserted by: **team:** **Re-insertion:**

Observed by: **Reason for insertion:**

SN	date							
A	**Dressing**							
1	Catheter is secured using surgical sutures.							
2	Tome patches are applied at 1and 3cm over catheter exit site and a three-way valve at the distal end of the catheter.							
3	A transparent patch is applied on the surgical scar.							
4	Dressing every 72 hours, unless it is wet, dirty (blood or fluid).							
5	Dressing is done by a trained nurse.							
B	**EVD manipulation**							
1	A trained nurse checks dressing daily / each shift.							
2	Hand hygiene and appropriate PPE (cap, mask, sterile gown, and sterile gloves).							
3	Every 72 hours, the neurosurgeon checks dressing replaces necessary parts, and collects a CSF sample of for work up							

	when indicated otherwise once weekly.							
4	Before and after collection, access port and surrounding tubing are cleaned with 0.5% Chlorhexidine in alcohol solution.							
5	Height of the collection system is regulated by the neurosurgeon with the pressure level of "0" cm H2O corresponding to external acoustic meatus of the patient.							
6	In case of diastasis of the surgical incision, CSF leak, or accidental removal, neurosurgeon reinforcement stitches.							
7	Is EVD still required?							
D	**EVD infection**							
1	In case of suspected infection, CSF is collected for work up?							
2	Was IVT antimicrobial given?							
3	Staff signature							

10.3 Appendix (3): EVD Insertion Checklist

Date of insertion: **New insertion:**

Inserted by: **team:** **Re-insertion:**

Observed by:

Reason for insertion:

SN		YES	NO	N/A	REMARKS
A	**Preoperative patient preparation**				
1	Body showering and hair wash with antiseptic soap (Chlorhexidine or Povidone iodine)				
2	Hair removed with clipper and head washing within 2 hours before surgery				
B	**Antibiotic Prophylaxis**				
1	Single dose of antibiotic (Cefazolin or Vancomycin in MRSA carrier) within 60minutes before incision				
C	**EVD INSERTION**				
1	Physicians scrub up and wear cap, mask, sterile gown, and sterile gloves				
2	All members of the staff wash their hand and wear cap, mask and sterile gowns				
3	Head washing with antiseptic soap (Chlorhexidine or Povidone iodine)				
4	Full sterile draping of patient head and body				
5	Skin preparation with gauzes soaked in 2% Chlorhexidine and followed by gauzes soaked with povidone iodine				
6	Unsterile staff keeps at least 50cm away from the surgical field				

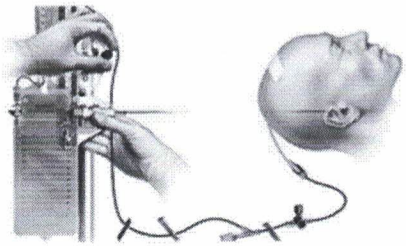
7	Antibiotics-impregnated ventricular catheter in post-hemorrhagic hydrocephalus and in the absence of infection				
8	Non-antibiotics-impregnated catheter in case of infection				
9	Attempts to puncture ventricles were more than 3				
10	Catheter is tunneled approximately 3cm (patients weighing less than 1.500g) to 5 cm from insertion site.				
11	Collection of two CSF samples for chemical and microbiological analysis				

10.4 Appendix (4): Patient health education

A. Arabic

وزارة الصحة
Ministry of Health
المديرية العامة لمستشفى خولة
Directorate General of Khoula Hospital

إرشادات المريض



الإستنزاف البطيني:

هو احد الإجراءات المؤقته لإفراغ السائل النخاعي من خلال وضع انبوب رفيع مصنوع من البلاستك ويتم ايصالها بتصريف خارجي من خلال انبوب رفيعه تزرع تحت الجلد.

دواعي هذا الإجراء:

لتقليل الضغط على الدماغ الناتج من تراكم السائل النخاعي وافراغ السوائل او الدم في حالة العمليات الجراحيه او التعرض لنزيف داخل الدماغ.

الأثار الجانبيه:

- الإصابه بالعدوى.
- اعطال ميكانيكيه كحدوث تشابك ف انابيب التصريف الخارجيه.
- عوامل فيزيائيه كوجود تضييق ف بطيني الدماغ.

كيفية الوقايه والتقليل من نسبة حدوث العدوى:

- استخدام قسطره وأنبيب قد تم تشريبها بالمضادات الحيوية.
- التقليل من أخذ العينات من السائل النخاعي.
- مراقبة مكان إدخال القسطرة ومكان إخراج أنبيب التفريغ للتأكد من عدم وجود تسريب للسائل النخاعي.
- الحفاظ على وضع نظام تجميع السائل النخاعي بشكل مستقيم.
- عدم تغيير أنبوب التصريف بشكل روتيني.
- المحافظة على غسل وتعقيم اليدين قبل وبعد التعامل مع المريض.
- لبس الملابس الوقائية عند التعامل مع المريض.

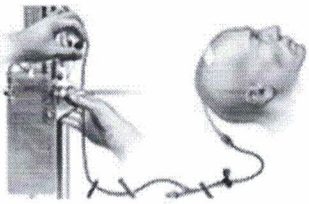
من حق المريض او مرافق المريض ان يطلب من الكادر الطبي ان يقوم بتعقيم وغسل اليدين قبل وبعد ملامسته للمريض وان يقوم بارتداء الملابس الوقائية.

عمل قسم مكافحه العدوى
أميره الحارثي

B.English

Patient instructions

External ventricular drainage (EVD) is a temporary method of draining cerebrospinal fluid (CSF) from the ventricles in the brain. (EVD) system uses a catheter (a thin, plastic tube), which is placed in the ventricle of the brain. This is connected to a drainage system outside the body.



There are many reasons for using external ventricular drainage (EVD). These include:

- Reducing the pressure inside the brain caused by a build-up of CSF.
- Diverting infected CSF from the brain and giving antibiotics directly into the CSF to treat the infection.
- Draining excess fluid and/or blood if a child has had brain surgery or has experienced a bleed into their brain.

Side effect:

- It may cause infection.
- Blocked drain
- Narrowing of the ventricles of the brain

How to prevent infection

- Eliminating routine surveillance CSF sampling
- Hand Hygiene before and after dealing with patients.
- To wear full PPE before dealing with the patient.
- Maintain sterility while inserting EVD and while changing the EVD dressing.

The patient has the right to ask the HCW to maintain hand hygiene and to wear PPE.

IPC TEAM
Amira Al Harthi