

External Ventricular Drainage Weaning Protocol

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Structured approach to evaluate readiness for **external ventricular drain (EVD)** removal and minimize risk of **hydrocephalus relapse** or **shunt dependency**.

□ Indications to Start Weaning

- Resolution of acute condition (e.g., stabilized IVH or ICH)
- **Neurologically stable** for ≥ 24 –48 hours
- Controlled **ICP (< 20 mmHg)** with minimal or no CSF drainage
- No evidence of active infection or new hydrocephalus on imaging

□ Stepwise Weaning Protocol

□ Step 1: Elevation of Drainage Level

- Raise drain to **+20 cmH₂O** above EAM
- Monitor for 24 hours
- If no CSF drainage and patient stable → proceed to next step

□ Step 2: EVD Clamping Trial

- **Clamp EVD completely** (closed system, monitor ICP)
- Monitor for:
 1. $\uparrow$ ICP (> 20 –25 mmHg)
 2. $\downarrow$ consciousness or new symptoms
 3. New ventricular enlargement on CT
- Duration: **24–72 hours**, depending on risk and tolerance
- If tolerated → CT scan → consider EVD removal

□ Failure Criteria

- ICP spikes > 25 mmHg (sustained)
- Neurologic deterioration

- New or worsening hydrocephalus on CT
- Symptomatic bradycardia, vomiting, headache

□ If Weaning Successful

- Unclamp EVD and **drain 10-15 mL slowly before removal** (optional)
- Remove catheter under sterile conditions
- Apply occlusive dressing and monitor site
- Monitor patient closely for 48-72 h post-removal

□ If Weaning Fails

- Re-open EVD and reassess need for:
 1. **Repeat weaning trial** after 48-72 h
 2. **Permanent CSF diversion** (e.g., ventriculoperitoneal shunt)

⚠ Pearls & Precautions

- Do not rush clamping in unstable or comatose patients
- Ensure no **obstruction** before concluding tolerance (a dry EVD can be blocked)
- Always confirm with **neuroimaging** before final removal

□ When to Convert EVD to VP Shunt

Clinical criteria and decision-making pathway to determine when a patient with an **external ventricular drain (EVD)** requires **permanent CSF diversion** via ventriculoperitoneal (VP) shunt.

□ Indications for VP Shunt Conversion

- Persistent **hydrocephalus** despite EVD > 7-10 days
- **Weaning failure** after ≥ 2 trials (clamping intolerance or ICP crisis)
- **Recurrent CSF drainage need** (e.g., > 150-200 mL/day to maintain ICP < 20 mmHg)
- New or worsening **ventricular enlargement** on imaging
- Clinical deterioration when EVD is clamped
- Known **obstructive hydrocephalus** (e.g., aqueductal stenosis, post-SAH, IVH with cast)
- Recurrent **intraventricular hemorrhage**, chronic communicating hydrocephalus
- Recovery phase of **poor-grade SAH or IVH** with persistent CSF resorption failure

□ Additional Considerations

- Perform **repeat CT scan** after EVD clamping trial
- Confirm **no CSF infection** (send CSF culture, cell count)
- Rule out **reversible causes** (e.g., meningitis, elevated protein > 150 mg/dL)
- For IVH patients: delay shunting if active **blood clearance** is ongoing

□ Pre-Shunt Planning

- Normalize coagulation parameters
- Decide on **programmable vs fixed-pressure valve**
- Consider **endoscopic third ventriculostomy (ETV)** as alternative in non-communicating cases
- Confirm **no active infection or sepsis**
- Discuss **shunt dependency risk** with patient/family

□ Contraindications to Shunt Placement

- Active CSF infection (e.g., ventriculitis)
- Uncontrolled systemic sepsis
- Very high protein or debris in CSF
- Unstable patient not yet optimized for surgery

□ How Many Negative CSF Cultures Are Required?

To safely remove an **external ventricular drain (EVD)** or convert to a **ventriculoperitoneal (VP) shunt**, the following microbiological criteria must be met:

□ Recommended: 2-3 Consecutive Negative CSF Cultures

- Ideally spaced **24-48 hours apart**
- Collected **after antibiotic therapy** is completed or near completion
- **No growth** on culture
- Normalizing **CSF cell count and protein** (↓ WBC, ↓ neutrophils, ↓ protein)

□ Rationale

- One negative culture may **miss low-level or biofilm infections**
- Shunting in presence of infection → ↑ risk of:
 1. Shunt infection
 2. Shunt malfunction
 3. Recurrent ventriculitis or abscess

□ Practice Summary Table

Scenario	Recommended Cultures Before Shunt/Removal
Documented ventriculitis	≥ 3 negative cultures
No prior infection	1-2 negative samples may suffice
SAH / IVH patients	Prefer 2-3 negative cultures

□ Important

- Always evaluate **CSF glucose, protein, cell count** along with culture
- Avoid CSF sampling unless clinically indicated to **reduce infection risk**

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