

Prevention & Treatment of Paraplegia After Major Aortic Procedures

Including Open Type 1/2/3/4/5 TAAA Repair &
Complex Endovascular Aortic Procedures (TEVAR/BEVAR/FEVAR)

Name:
DOB:
CHI:

ATTACH PATIENT LABEL

Procedure: _____

Date: _____ Consultant Surgeon: _____ Consultant Anaesthetist: _____

Initial Post-Op MAP Target & CSF Drainage Parameters (if CSF drain in situ)

MAP target	Pset (Liquoguard) or CSF drain set level (External CSF drain)	Vset (Liquoguard only)	Date	Time	Sign	Print
See Trak clinical notes for further changes in parameters						
Nursing Care If Pset/CSF drain set level <10mmHg the patient should be supine or very slightly head up (<10°). If Pset/CSF drain set level ≥10mmHg the patient can be up to 45° head up. The Liquoguard CSF Pump (page 3) does not need to be paused or clamped when moving the patient/drain. A traditional External CSF Drain (page 4) should be clamped when moving the patient/drain.						

Prevention of Paraplegia

1. Ensure above MAP target achieved. Respond quickly to drops in BP (e.g. after epidural top-up).
2. If CSF drain in situ, ensure it is patent & draining (see pages 3/4 for troubleshooting).

Detection of Paraplegia

- Leg movement should be assessed hourly & documented on the 24 hour chart (see scale on page 2).
- Intubated patients should be lightly sedated with short-acting agents to permit hourly assessment.
- Assessment and charting of leg movements should continue throughout the hospital admission, at least 4 times per day following removal of a CSF drain.

TREATMENT OF PARAPLEGIA

These interventions are time-critical and may prevent permanent paraplegia

1. Raise MAP target by 10mmHg and ensure target achieved with fluid challenge ± vasopressor.
2. Switch off epidural infusion (if applicable) to exclude epidural-related motor block.
3. If CSF drain in situ, lower CSF pressure (PCSF) by increasing CSF drainage:
 - LIQUOGUARD CSF MANAGER: Reduce Pset in 5mmHg increments & check PCSF drops to new level.*
 - EXTERNAL CSF DRAIN: Drop drain set level to 0mmHg for 1 hour max. Lie the patient flat.**
4. Notify medical staff, call vascular anaesthetist & surgeon.
5. Monitor closely for improvements.

*If PSET is not achieved a higher Vset may be used after discussion with the vascular anaesthetist.

**It is important the external CSF drain set level is raised again ASAP because of the risk of intracranial haemorrhage.

Background: Paraplegia from Spinal Cord Ischaemia

- Intercostal and lumbar arteries arising from the aneurysm form an important part of the blood supply to the anterior spinal artery. In open repair, some but not all of these arteries may be connected to the graft. In endovascular repair, all arteries covered by the stent graft are occluded.
- Blood supply to the anterior spinal artery is therefore precarious after surgery.
- Intra-operative spinal cord ischaemia may cause post-op cord oedema and raised CSF pressure, which further impairs spinal cord perfusion.
- Strategies aim to optimise spinal cord perfusion pressure.
- Spinal Cord Perfusion Pressure = Mean Arterial Pressure (MAP) – CSF Pressure (PCSF).

MAP

- Maintain MAP > target specified above. *Avoid episodes of marked hypotension.*
- If using noradrenaline to achieve MAP target, ensure patient is adequately filled (e.g. warm peripherally).

PCSF

- Normal CSF pressure (PCSF) = 8-15 mmHg with the patient supine, zeroed at the level of the heart.
- CSF is usually drained for 24-48 hours post-op, aiming to keep PCSF down (usually below 10 mmHg).
- If there has been no leg weakness, drainage will usually be stopped after 24 hours.
- The CSF drain is usually left in place for a further 24 hours, in case drainage needs to recommence.
- If there has been leg weakness then a more prolonged period of CSF drainage may be appropriate.

Risks of CSF Drainage

- The main risk of CSF drainage is subdural or cerebellar haematoma.
- Observe for decreasing conscious level or severe headache.

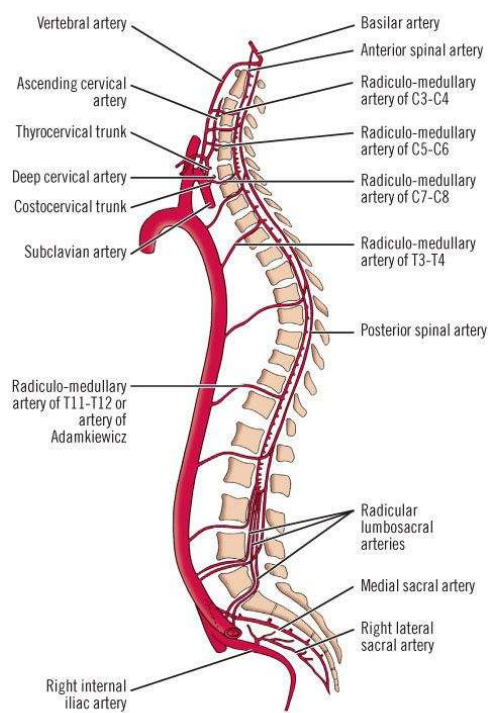
Leg Movement Score (same as NHS Lothian Epidural Infusion Chart Version 3)

0	1	2	3	4
Full Power	Weak, but can lift foot off bed	Able to bend knee up	Foot / toe movement only	No movement

Contact Details

Vascular Surgical Registrar - via switchboard

Vascular Anaesthetic Consultant



LiquoGuard CSF Pump

This system combines a CSF pressure monitor with a pressure-triggered pump which *actively* pumps out CSF. This system offers 3 advantages over the external CSF drain: constant monitoring of PCSF, detection of CSF drain blockage & reduced risk of over-drainage.



The pressure transducer clips onto an ECG electrode & should be kept at the level of the heart. It should either be stuck to the patient's lateral upper right arm (in line with their heart), or secured next to the A-line/CVP transducers. If the patient is extubated and wishes to lie on their side, the transducer must be moved off the patient to beside the A-line/CVP transducers. The drainage tubing and 3-way tap should be clearly labelled as *CSF DRAIN*, with a red cap on the side-arm of the 3-way tap.

2 parameters are set:

- Pset = the CSF pressure above which the pump will drain CSF (usually 10mmHg initially).
- Vset = the maximal rate at which CSF will be drained (usually 20ml/hr initially).

Alarms are usually set at 20mmHg (high PCSF) & -1mmHg (low PCSF).

Every hour the following should be charted on the 24-hour chart along with leg movement score:

1. Pset
2. Vset
3. PCSF
4. CSF drained past hour (obtained from 'info' tab – volumes)

Tips

- The system is active when a play (▶) symbol is displayed in the bottom right corner. Touch the ▶ symbol to enter pause mode.
- The system is paused when a pause (||) symbol is displayed in the bottom right corner. No CSF drainage will occur but PCSF will still be monitored. This is the equivalent of 'clamping the CSF drain'. Touch the || symbol to enter active mode.
- The 'flow rate' displayed is time-averaged over the previous hour. To assess whether the pump is currently draining CSF, look for the rotor actually moving.

Troubleshooting (discuss all changes in CSF drainage parameters with medical staff)

- For treatment of paraplegia see page 1.
- **'Loss of pulsatile waveform' or 'low PCSF' alarm**
CAUSE: CSF drain may be blocked. This can occur due to drain kinking (either external or within the patient's back), or blockage with debris or blood.
ACTION: *Urgent action should be taken to try and unblock the CSF drain.* Try a patient position change, pillow under the knees or slight head-up tilt to remove some lumbar spine lordosis. If the alarm is ongoing after 5 minutes, please contact the vascular anaesthetist immediately.
- **Blood in CSF**
CAUSE: Usually due to trauma/heparinisation. Rarely can be a sign of intracranial bleeding.
ACTION: If leg neurology is reassuring, reduce Vset by 5ml/hr and monitor. Monitor GCS and neurology carefully. There is an increased risk of CSF drain blockage – do not pause CSF pump unless further evidence of intracranial bleeding.
- **Rapid drop in GCS or severe headache**
CAUSE: Suspicion of intracranial bleeding.
ACTION: Pause CSF pump (ensure || is displayed). Contact vascular anaesthetist urgently. Consider urgent CT head.

External CSF Drain

This system allows for *passive* drainage of CSF if the PCSF is over a set threshold (the CSF drain set level). The rate of CSF drainage is determined by the pressure difference between the PCSF and the CSF drain set level. PCSF is not routinely monitored with this system.

The mmHg scale should be used (*not* the cmH₂O scale). The zero level should be kept at the level of the heart (same level as arterial line & CVP transducers). The drainage tubing and the 3-way tap should be clearly labelled as *CSF DRAIN*, with a red cap on the side-arm of the 3-way tap to reduce the risk of inadvertent injection into the CSF drain.



Every hour the following should be charted on the 24-hour chart along with leg movement score:

1. CSF drain set level
2. CSF drained past hour
3. Cumulative CSF drained past 4 hours

Troubleshooting (discuss all changes in CSF drainage parameters with medical staff)

- For treatment of paraplegia see page 1.

- **No CSF drained for 2 consecutive hours**

CAUSE: CSF drain may be blocked.

ACTION: *Urgent action should be taken to establish whether the CSF drain is blocked, and to unblock it if so.* Lower the drain level briefly to zero to ensure that a drop or two of CSF drains confirming that the catheter is not blocked. Then immediately raise the drain back to the previous level. If no CSF drops then the CSF drain is blocked. Try a patient position change, pillow under the knees or slight head-up tilt to remove some lumbar spine lordosis. If this does not unblock the drain, please contact the vascular anaesthetist immediately (see page 2).

- **CSF drained in past hour >20ml or cumulative CSF drained in past 4 hours >60ml**

CAUSE: If this level of drainage is sustained, the risk of subdural/cerebellar haematoma is of more concern.

ACTION: If no leg weakness, raise the CSF drain set level by 5 mmHg. If leg weakness present or develops after raising CSF drain set level, please contact vascular anaesthetist.

- **Blood in CSF**

CAUSE: Usually due to trauma/heparinisation. Rarely can be a sign of intracranial bleeding.

ACTION: If no leg weakness, raise the CSF drain set level by 5mmHg. Monitor GCS and neurology carefully. If leg weakness is present or develops after raising CSF drain set level, please contact vascular anaesthetist.

- **Rapid drop in GCS or severe headache**

CAUSE: Suspicion of intracranial bleeding.

ACTION: Clamp CSF drain by turning the 3-way tap 'off to patient'. Contact vascular anaesthetist urgently. Consider urgent CT head.