

Spinal Drain Standard Operating Procedure

1) SUMMARY

This SOP covers the following:

Spinal Drain Catheter Insertion	Anaesthesia
Intraoperative Management	Anaesthesia/ Vascular Surgery/ Cardiac Surgery
External Drain & Transducer Setup	Anaesthesia/ Recovery/ Critical Care/ Surgery
Postoperative Management & Handover	Anaesthesia/ Recovery/ Critical Care/ Surgery
Nursing Care & Documentation	Anaesthesia/ Recovery/ Critical Care/ Surgery
Troubleshooting	Anaesthesia/ Recovery/ Critical Care/ Surgery
Appendix (GCS and Bromage scale)	

2) INTRODUCTION

Spinal cord injury is still a significant complication following surgery on the descending thoracic and thoracoabdominal aorta, regardless of the indication or underlying pathology.

The aetiology of spinal cord injury is not fully understood but is based on the anatomical and physiological disruption of the spinal collateral arterial network. These insults occur both at the time of intervention but also in the hours and days afterwards. The impact of injury is enormous for any given individual and for society. Spinal cord injury impacts the short and longer-term survival of those affected.

Cerebrospinal fluid drainage, blood pressure manipulation and maintenance of oxygen delivery constitute the most frequently used spinal cord protection techniques.

Implementation of a bundled multimodal protocol may significantly reduce the risk of SCI after thoracoabdominal aortic surgery with the greatest risk reduction occurring in the most vulnerable patients (Hnath *et al.*, 2008; Estrera *et al.*, 2009; Wynn *et al.*, 2009; Scott and Denton, 2016; Scali *et al.*, 2018).

3) DEFINITIONS

<i>ANTT</i>	<i>Aseptic non-touch technique</i>
<i>APTT</i>	<i>Activated partial thromboplastin time</i>
<i>bd</i>	<i>Bis in die (twice a day)</i>
<i>CrCl</i>	<i>Creatinine clearance</i>
<i>CSF</i>	<i>Cerebrospinal fluid</i>
<i>CSFP</i>	<i>Cerebrospinal fluid pressure</i>
<i>COPS protocol</i>	<i>CSF drainage/ Oxygen delivery/ Patient Status protocol (page 12)</i>
<i>CT</i>	<i>Computerised tomography</i>
<i>DVT</i>	<i>Deep vein thrombosis</i>
<i>G</i>	<i>Gauge</i>
<i>GA</i>	<i>General anaesthetic</i>
<i>GCS</i>	<i>Glasgow Coma Scale</i>
<i>HDU</i>	<i>High Dependency Unit</i>
<i>Hb</i>	<i>Haemoglobin</i>
<i>ICP</i>	<i>Intracranial pressure</i>
<i>ICU</i>	<i>Intensive care Unit</i>
<i>iv</i>	<i>Intravenous</i>
<i>LMWH</i>	<i>Low molecular weight heparin</i>
<i>LORT</i>	<i>Loss of resistance technique</i>
<i>MAP</i>	<i>Mean arterial pressure</i>
<i>MCS</i>	<i>Microscopy, culture, and sensitivity</i>
<i>MEP</i>	<i>Motor Evoked Potentials</i>
<i>PLT</i>	<i>Platelets</i>
<i>PDPH</i>	<i>Post-dural puncture headache</i>
<i>sc</i>	<i>Subcutaneous</i>
<i>SCI</i>	<i>Spinal cord injury</i>
<i>SCPP</i>	<i>Spinal cord perfusion pressure</i>
<i>SSEP</i>	<i>Somato-sensory evoked potentials</i>
<i>TAAAR</i>	<i>Thoracoabdominal aortic aneurysm repair</i>
<i>TEG</i>	<i>Thromboelastogram</i>

4) SCOPE

This SOP describes the perioperative management of spinal drains for thoracoabdominal aortic surgery and is to be used by staff in Anaesthesia, Vascular Surgery, Critical Care and Recovery. Advice is to be sought from the responsible team if there are deviations from the parameters set henceforth or if there are any other reasons for concern.

Please note – this SOP does not apply to neurosurgical patients.

5) FULL SOP

Significant progress has occurred over the last decade in developing methods to reduce the risk of neurological complication following thoraco-abdominal aortic surgery. Lumbar spinal drain insertion and manipulation of spinal cord perfusion pressure (SCPP) are becoming a standard of care in the perioperative management of patients undergoing thoracic aortic interventions. The decision to insert a spinal drain should be made preoperatively following discussion between the Consultant Vascular Surgeon and Consultant Anaesthetist.

Spinal Drain Catheter Insertion

Spinal Drain insertion should be carried out by a Consultant Anaesthetist or by a senior registrar under his/her supervision in accordance with the guidance set out in this protocol. The patient should be reviewed for contraindications and consented appropriately. Baseline measurements of neurology and coagulation should be clearly documented.

The hourly turnover of CSF is 10-20 ml, and one would normally expect to have to drain CSF at a rate of approximately 10 ml/h although the required rate will vary from patient to patient (Fedorow, 2010).

CONTRAINDICATIONS (Field *et al.*, 2011)

Active infection (systemic or local)

Unstable patient

Raised ICP

Abnormal coagulation (PLT <100 × 10⁹/l; INR >1.3; APTT ratio >1.4; abnormal TEG)

Anticoagulant and antiplatelet therapy - Please check the latest guidance from the British Society of Haematology (Keeling *et al.*, 2016) and discuss with a Consultant Haematologist if in any doubt:

- *Unfractionated iv/sc heparin within 4h from last dose*
- *LMWH - VTE prophylactic dose < 12h since last dose*
- *LMWH - VTE treatment dose < 24h since last dose*
- *Direct oral anticoagulants - variable depending on their individual ½ life and creatinine clearance:*
 - *Dabigatran < 48h (if CrCl>80 ml/min) since last dose*
 - *Rivaroxaban < 48h (if CrCl >30 ml/min) since last dose*
 - *Apixaban < 48h (if CrCl> 30ml/min) since last dose*
- *Antiplatelet agents:*
 - *Clopidogrel < 7 days*
 - *Prasugrel < 10 days*
 - *Ticagrelor < 5 days*
 - *Ticlopidine < 10 days*

COMPLICATION RATES (Cook, Counsell and Wildsmith, 2009; Rong *et al.*, 2018)

- *Headache 3.9%*
- *Puncture site bleeding 2.1%*
- *Intracranial/ Subarachnoid haemorrhage 1.5%*
- *CSF leak 0.9%*
- *Epidural/ Subdural haematoma 0.8%*
- *Neurological deficit 0.6%*
- *Death 0.3%*
- *Drain fracture 0.1%*
- *Meningitis 0.1%*

Insertion

- Full Asepsis
- Awake or GA
- Sitting or Left Lateral decubitus
- **L3/4 or L4/5 Level**
- LOR Technique to identify epidural space
- Remove LOR syringe and slowly advance (0.5-1cm) the 16G Tuohy needle until **CSF flows freely**
- Insert **catheter** leaving **5-7cm in situ**
- Confirm free drainage and easy aspiration through the catheter
- Secure with LockIt devices and/or transparent adhesive dressings
- Confirm CSF flows freely after applying dressing
- Confirm CSF flows freely after positioning on the operating table
- **DO NOT USE FILTER**** (it can obstruct CSF flow)
- Setup the external drainage system
- Only **flushless** pressure transducer systems are used
- Use **ICP Label on monitor for CSFP**

Intraoperative Management

1. Aim for **target CSFP during TAAAR of 10 mmHg**
2. Start CSF drainage at the beginning of the case in order to slowly **reach the target by the time** the spinal cord is at risk (during **aortic cross clamping or stenting**)
3. Rapid drainage of CSF increases the risk of an intracranial haemorrhage
4. If the **CSFP is >10mmHg** open the three way tap to the drip chamber and **drain 5-10ml of CSF**
5. As long as the CSF remains clear (not blood-stained) continue to drain in 5-10ml aliquots until the target CSFP is reached
6. CSFP should be **monitored continuously** except whilst draining CSF
7. Monitor and record the colour and volume of drained CSF
8. Aim **MAP >85mmHg** post stent graft deployment or after aortic unclamping
9. If the **CSFP is >15mmHg** (e.g. due to restricted CSF drainage) increase the MAP until the Spinal Cord **Perfusion Pressure (MAP-CSFP) is >75mmHg**
10. Maintain **good communication** with the surgical team
11. Complete Spinal Drain Handover **Checklist** on Cerner

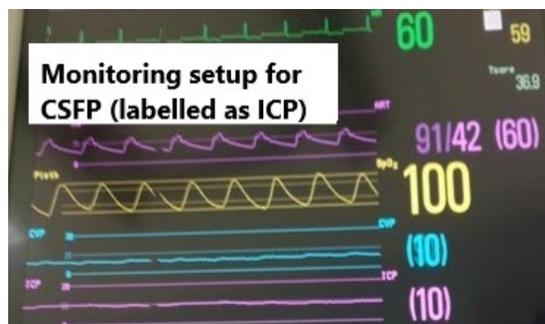
Equipment

Standard Epidural kit with **16G Tuohy needle**
External Drainage System (Theatre 9)
Flushless pressure transducer (Theatre 9)

Troubleshooting

- **If a bloody tap occurs:**
Attempt insertion at a different interspace
Wait 60 minutes before heparinisation
Have a higher index of suspicion for post-operative neuraxial haematoma
- **If two bloody taps occur:**
Discuss with surgeons
Consider postponing surgical intervention
- **If CSF become blood stained**
Stop drainage and re-assess in 30 min
If still blood stained – discuss with surgeons
If clear continue draining
- **If the amplitude of MEPs/SSEPs decreases**
Commence COPS protocol.

Document issues clearly on the anaesthetic chart and 'Spinal Drain Handover Checklist'



External Drainage System & Flushless Pressure Transducer Setup

The system must be **setup by the anaesthetist** and handed over to the:

- Recovery/ ICU Nurse
- Vascular/ ICU Registrar

Complete Spinal Drain Handover **Checklist** on Cerner

External Drainage System & Flushless Pressure Transducer Setup

1. Use an Aseptic Non-Touch Technique (**ANTT**)
2. Do **NOT use Chlorhexidine** at any time
3. Attach collection bag to drip chamber and ensure the three way tap is off to the drip chamber.
4. Attach the drainage set to the spinal drain catheter (**no filter**)
5. Setup and prime a **flushless pressure** transducer
6. Attach primed **flushless** pressure transducer to the second three way tap of drainage set
7. Use non-injectable connectors throughout the circuit for any tap
8. Zero **flushless** pressure transducer at the **level of the right atrium** (same as ART/CVC transducers)
9. **CSFP** labelled as **ICP** on the monitor
10. Hang the **drip chamber** to drip stand using the Velcro straps approximately **15 cm below** level of the flushless pressure transducer.
11. Label flushless pressure transducer and spinal drain: **SPINAL DRAIN – NOT FOR INJECTION**

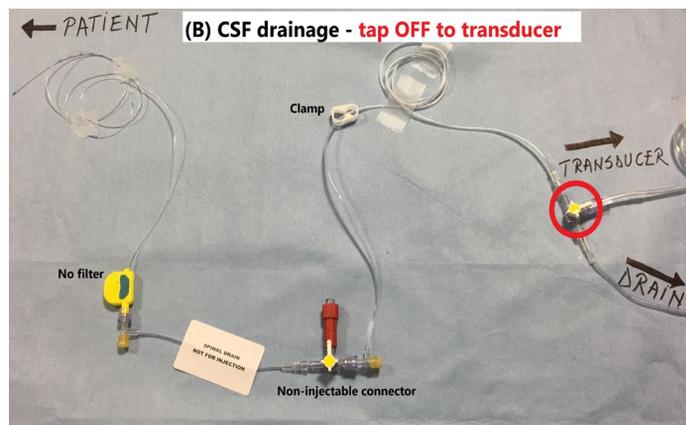
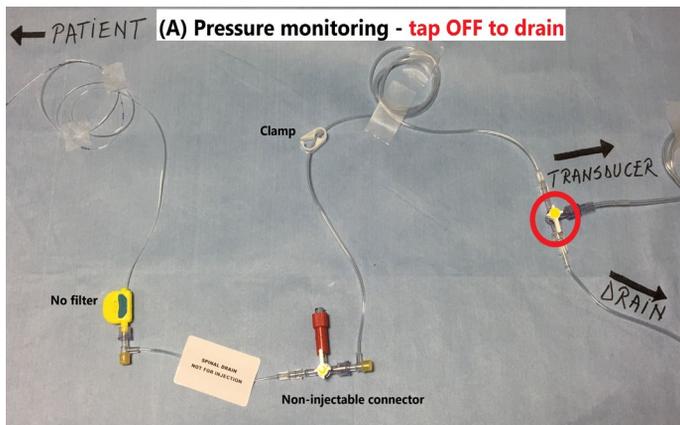
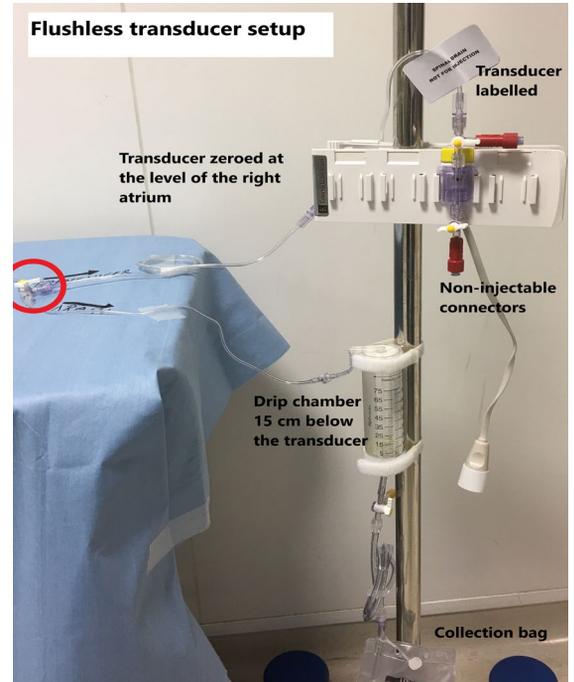
A three-way tap controls whether:

(A) CSF pressure is monitored

(Tap off to drainage)

(B) CSF is being drained into the drip chamber

(Tap off to flushless pressure transducer)



Postoperative Management:

The **Spinal Drain Handover Checklist** will be completed by the Consultant Anaesthetist and the spinal drain will be set up by the Consultant Anaesthetist before leaving the patient in recovery or critical care. Handover is essential with recovery staff, the vascular surgical team and the critical care team. **Section 2 of the Checklist should be repeated when the patient moves from recovery to critical care.**

Spinal Drain Handover Checklist**Section 1**

Insertion
 Practitioner Name: _____ Level of insertion: _____ Depth to skin (cm): _____
 Bloody tap during insertion
 Intra-operative blood-stained CSF
 Intra-operative reduction or loss of motor/ sensory evoked potentials n/a yes
 Epidural for analgesia in situ
 Colour of CSF post procedure: _____ Clear Rosé

Section 2

Ensure there is no filter on the drain
 Ensure the spinal drain is transduced and zeroed at the level of the right atrium
 Ensure the flushless transducer is labelled: SPINAL DRAIN - NOT FOR INJECTION
 Ensure the spinal drain is labelled: SPINAL DRAIN - NOT FOR INJECTION
 Hang CSF drip chamber approximately 15cm below the level of the transducer

Postoperative Care

Position patient head up when draining CSF (max 30 degrees)
 CSFP is transduced and visible on the monitor (labelled on the monitor as ICP)
 Unfractionated Heparin/ LMWH (only if no risk of renal impairment) prescribed
 Standard Target parameters

CSFP \leq 12 mmHg
 MAP > 85-90 mmHg
 Hb > 100 g/l
 P_aO₂ > 8.0 kPa
 SpO₂ > 94%

Changes to Standard Target parameters/plan:

[eg Sedation Hold/ Coag check- FREETEXT BOX]

Postoperative Standard Target Parameters

- CSFP \leq 12 mmHg
- MAP > 85-90 mmHg
- Hb > 100 g/l (Etz *et al.*, 2014)
- P_aO₂ > 8.0 kPa
- SpO₂ > 94%

A target MAP > 85-90mmHg has been chosen to ensure a SCPP (MAP-CSFP) of at least 75mmHg to reduce the risk of delayed postoperative SCI.

Vasopressors should be used once appropriate filling is achieved in order to maintain MAP.

A CSFP \leq 12 mmHg has been chosen in alignment with study designs showing a reduction in the incidence of postoperative neurological deficits. (Fedorow, 2010; Field *et al.*, 2011)

Continuous monitoring with intermittent drainage allows awareness of sudden waveform disruption and possible drain occlusion. It also avoids high volume or high rate drainage and potential intracranial hypotension.

CSF will be drained at a maximum of 15 ml/h in 5ml aliquots to achieve CSFP <12 mmHg.

Following senior review, this may be increased to a maximum of 20 ml/hr.

Large volumes of CSF drainage appear to be an independent risk factor for bleeding.

In some cases, it is difficult to maintain CSFP \leq 12 mmHg, in which case the MAP target needs to be elevated to maintain SCPP >75 mmHg (SCPP = MAP-CSFP).

Whenever turning, moving or transferring the patient, the white clamp must be closed and the three way tap set to transduce (not draining). As soon as the patient is back in bed in the optimal position, the white clamp must be opened and a CSFP waveform must be observed on the monitor.

ACTION PLAN IF CSFP >12mmHg

1. Open three-way tap to drain CSF (tap off to flushless pressure transducer)
2. Drain 5ml of CSF & check again CSFP (tap off to drain)
3. Repeat until CSFP \leq 12 mmHg
4. Do not drain more than 15 ml/hr
5. Inform Critical Care Registrar if target CSFP is not met after 1h
6. Urgent Vascular Review if target CSFP is not met after 2h (Targets may be revised)

Every 12h

Re-zero the flushless pressure transducer at the level of the right atrium (4th intercostal space, mid-axillary line) (Fedorow, 2010; Field *et al.*, 2011).

Check insertion site for evidence of leaks/infection.

Fill in handover checklist (Cerner or ICIP).

Critical Care Nursing Summary for Spinal Drains

Review Handover Checklist

One to one Nursing

Ensure Spinal Drain is highlighted in the Critical Care Safety briefing

Whenever turning, moving or transferring the patient, the white clamp must be closed and the three way tap set to transduce (not draining). As soon as the patient is back in bed in the optimal position, the white clamp must be opened and a CSFP waveform must be observed on the monitor.

TARGETS

CSFP \leq 12 mmHg

MAP > 85-90 mmHg

Hb > 100 g/l

P_aO₂ > 8.0 kPa

SpO₂ > 94%

Hourly Observations

CSFP (labelled on the monitor as ICP)

MAP

GCS

Pupil size and reactivity (Left/Right)

Motor power in lower limbs (Bromage Scale 1-4: See Appendix)

Sensation in lower limbs

CSF colour (clear/rosé/blood stained)

CSF volume drained (ml)

Every 12h

Check insertion site for evidence of leaks/infection.

Re-zero the flushless pressure transducer at the level of the right atrium.

Fill in handover checklist (Cerner or ICIP).

ACTION PLAN IF CSFP >12mmHg

1. Open three-way tap to drain CSF (tap off to flushless pressure transducer).
2. Drain 5ml of CSF & check again CSFP (tap off to drain).
3. Repeat until CSFP \leq 12 mmHg.
4. Do not drain more than 15 ml/hr (20 ml/h only following senior review).
5. Inform Critical Care Registrar if target CSFP is not met after 1h.
6. Urgent Review if target CSFP is not met after 2h (Targets may be revised).

EMERGENCY REVIEW

- ANY NEUROLOGICAL DEFICIT
- FALLING/ LOW GCS
- SEVERE HEADACHE
- BLOOD STAINED CSF
- TURBID CSF
- DRAIN MALFUNCTION
- DRAIN DISCONNECTION
- LEAK AT INSERTION SITE

Postoperative Management: (Fedorow, 2010; Field *et al.*, 2011; Scott and Denton, 2016)

- Where possible, patients should have a sedation hold and neurological assessment as soon as possible post-surgery. If neurology is compromised, this represents a medical emergency and the Vascular Consultant responsible for the patient should be contacted.
- Where possible, repeat sedation hold every 12h for neurological assessment.
- DVT prophylaxis - Unfractionated heparin (5000 units bd) should be considered instead of LMWH whilst the spinal drain is in situ particularly in patients with renal impairment or those at risk of an acute kidney injury.
- No drugs are to be administered via the spinal drain as this has been associated with spinal cord infarction and paraparesis. (Fedorow, 2010) – the risk of injection is mitigated by labelling the drain SPINAL DRAIN – NOT FOR INJECTION and by using non-injectable connectors (see photos – page 5).

Postoperative pitfalls and troubleshooting:

- **Peripheral neurological deficit – MEDICAL EMERGENCY**
 - Inform Vascular/ Critical Care Team. Suspect SCI.
 - Follow 'adapted' COPS protocol (Estreza *et al.*, 2009) Page 12.
 - Lie patient flat, drain CSF freely (as long as it is clear) to a target CSFP < 5 mmHg, MAP > 90 mmHg, SCPP > 80 mmHg, Hb > 100g/l.
 - Spinal Drain should remain in situ for 7 days.
 - If no improvement in neurology within 1h consider Urgent Imaging.
- **Falling GCS/abnormal pupils – MEDICAL EMERGENCY**
 - Inform Vascular and Critical Care Team.
 - Stop CSF drainage.
 - Urgent CT Head to review for intracranial haemorrhage.
- **New onset severe headache – MEDICAL EMERGENCY**
 - Inform Vascular and Critical Care Team.
 - Be alert to the possibility of an intracranial haemorrhage, meningitis, PDPH or CSF leak.
- **Blood stained CSF – POSSIBLE MEDICAL EMERGENCY**
 - Please inform team of worsening in blood staining of CSF.
 - Inform Vascular and Critical Care Team.
 - Suspect intracranial haemorrhage/ spinal haematoma.
 - Stop draining CSF.
 - If asymptomatic - correct coagulopathy, reassess CSF to see if it clears every 1h and consider imaging.
 - If CSF is still blood stained after 4h arrange an urgent CT scan.
 - Altered mental status or focal deficit arrange an immediate CT scan.
- **Turbid/cloudy CSF – MEDICAL EMERGENCY**
 - Inform Vascular and Critical Care Team.
 - Be alert to the possibility of meningitis.
 - Check insertion site for signs of infection.
 - Check temperature and inflammatory markers.
 - Send CSF sample for Gram stain, MCS from collection bag.
 - Discuss with Microbiology.

- **Unable to drain CSF:**
 - Inform Critical Care Registrar.
 - Check for catheter kinking or obvious blockage.
 - Consider redressing the spinal drain making certain to avoid skin folds.
 - If the drain appears to be blocked, discuss with Critical Care Consultant and discuss with the Anaesthetist on call (1201) or Vascular Registrar on call to flush catheter with 2ml of preservative free NaCl 0.9% under fully aseptic conditions.
 - A truly blocked catheter, if still needed clinically, will have to be replaced after discussion with the Vascular Consultant.
 - Contact Anaesthetic Bleep Holder 1201 for replacement.

- **Tubing disconnection:**
 - Consider the system no longer sterile if leakage or disconnection occurs
 - Replace entire spinal drainage system if disconnection occurs. Consult photos for setup or anaesthetist for advice (bleep 1201) where needed.

- **CSF leak +/- postural headaches:**
 - Inform Vascular team if a CSF leak occurs post drain removal.
 - Treatment involves conservative measures which include bed rest, less than 30 degrees head up tilt and hydration.
 - If this does not resolve after 24 hours, further interventions may be required. Contact Consultant Anaesthetist to discuss epidural blood patch.

- **Displacement of drain dressing:**
 - Inform Critical Care Registrar.
 - Review depth of catheter on Spinal Drain Handover Checklist.
 - Should a dressing become unstuck, the exposed area is cleaned with chlorhexidine spray 0.5% w/v in 70% w/v DEB and allowed to dry before application of a fresh adhesive transparent dressing.

Removing the spinal drain:

- The Vascular Team decides when to remove the spinal drain.
- Normally the drain will be in place for 72 hours (removal on Day 4) as this allows a fibrotic response to develop around the catheter, aiding sealing when the catheter is removed.
- The presence of neurological impairment should result in the drain being left in situ for up to five days. Please note – if still clinically indicated, the flushless pressure transducer needs to be changed every 72h as per manufacturer's instructions.
- The patient's blood clotting should be checked and corrected if required.
- Check the timing of anticoagulants.
- Liaise with the surgical team regarding clamping of drain before removal.
- The Critical care nurse should remove the spinal drain. Ensure the blue tip is present when the catheter is removed and document. If the blue tip is not present, do not throw away the catheter and inform the critical care team and vascular team.
- A transparent occlusive dressing should be applied once the catheter is removed.
- Inspect the insertion site every 2h for 24h looking for CSF leak.
- Bed rest is mandatory for 2 hours after spinal drain removal.
- Withhold heparin for 4h post removal of the spinal drain.
- **Continue to monitor motor function and sensation in the lower limbs every hour for 24 hours after the spinal drain is removed.** If a neurological deficit occurs after drain removal, re-insert the spinal drain and adopt the COPS protocol (page 12).

Ensure spinal drain is **transduced** and **zeroed** at the level of the **right atrium**
Review CSFP (Labelled on the monitor as ICP)
Review Spinal Drain Handover Checklist

Targets

- ✓ CSFP \leq 12 mmHg
- ✓ MAP > 85-90 mmHg
- ✓ Hb > 100 g/l
- ✓ P_aO₂ > 8.0 kPa
- ✓ SpO₂ > 94%



If the CSFP is >12 mmHg

1. **Open three-way tap to drain CSF (tap off to flushless pressure transducer)**
2. Drain 5ml of CSF & check again CSFP
3. **Repeat until CSFP \leq 12 mmHg**
4. **Do not drain more than 15 ml/hr**
5. **Urgent Review** if target CSFP is not met after 2h

CSFP

Observations

Hourly

- CSFP (labelled as ICP)
- MAP
- GCS
- Pupil Size and reactivity
- Motor Power in lower limbs
- Sensation in lower limbs
- CSF colour
- CSF volume drained (ml)

Every 12h

- Check insertion site for leak or infection
- Re-zero flushless transducer
- Fill in handover checklist

Ventilated Patients

- Sedation hold within 12h of surgery for neurological assessment where possible
- Repeat sedation hold every 12h for neurological assessment

ICU

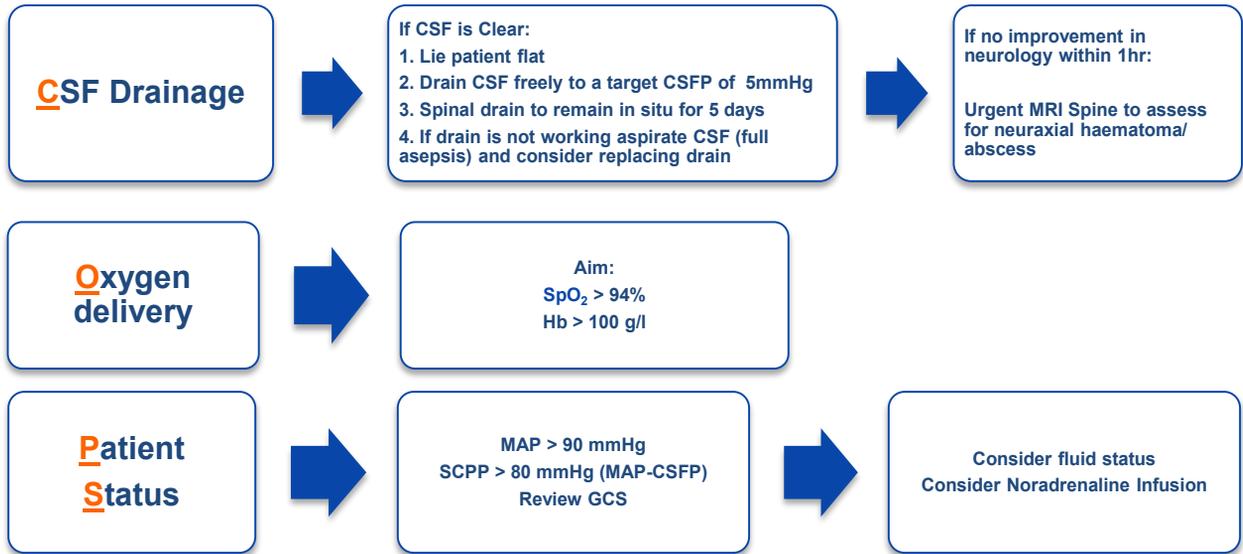
Do's and don'ts:

- **DVT Prophylaxis (LMWH or UFH)** can be given daily
- **Do not give any intrathecal injections via spinal drain** (Increased risk of spinal cord ischaemia)
- Whenever turning, moving or transferring the patient, the **white clamp must be closed** and the three way tap set to transduce (OFF to drain).

Drain Removal

- Confirm with Vascular team – Normally the drain stays in for 72h (Removal on Day 4).
- Also confirm with vascular team regarding clamping of drain prior to removal.
If there is a neurological impairment, the spinal drain should stay in situ for up to 5 days. Please note – if still clinically indicated, the flushless pressure transducer has to be changed every 72h as manufacturer`s instructions.
- Prior to removal, **check clotting and correct it** if required.
- Check timing of anticoagulants.
- **The critical care nurse should remove the spinal drain.** Ensure **blue tip** is present when catheter is removed and document it.
- If the blue tip is not present, do not throw away the catheter and inform the critical care team and vascular team.
- **Apply a transparent occlusive dressing over the insertion site**
- **Inspect** for CSF leak **every 2h for 24h.**
- Mandatory bed rest for **2h** after drain removal.
- Continue **hourly neurological observations for 24h** post drain removal and if neurological deficit occurs consider urgent imaging +/- **re-insertion of spinal drain** and **adopt the COPS protocol.**

PERIPHERAL NEUROLOGICAL DEFICIT
 This is an **EMERGENCY**
 Inform Vascular Registrar/ Consultant **IMMEDIATELY**
COPS PROTOCOL



FALLING GCS/ ABNORMAL PUPILS
 This is an **EMERGENCY**
 Inform Vascular Registrar/ Consultant **IMMEDIATELY**
STOP CSF Drainage
 Urgent **CT Head** to review for intracranial haemorrhage

TURBID CSF - EMERGENCY
 Check insertion site for signs of infection
 Check **temperature** and **inflammatory markers**
 Consider **Meningitis**
 Send **CSF for Gram Stain, MCS** from collection bag
 Discuss with **Microbiology**

BLOOD STAINED CSF
 This is an **EMERGENCY**
Stop draining CSF
 Inform Vascular and Critical Care Team
Suspect intracranial haemorrhage/ spinal haematoma
If Abnormal Neurology → Urgent Imaging
If Asymptomatic:

- **Correct coagulopathy**
- Reassess CSF to see if it **clears every 1h**
- If still blood stained **after 4h → Vascular Review and consider Urgent Imaging**

SEVERE HEADACHE
 This is an **EMERGENCY**
 Differential diagnosis
 ? **Meningitis**
 ? **Intracranial Haemorrhage**
 ? **CSF Leak/ PDPH**

SPINAL DRAIN DISCONNECTION
 Consider the system **no longer sterile** if leakage or disconnection occurs.
 Replace entire spinal drain drainage set if disconnection occurs → Consult photos for setup or anaesthetist for advice (Bleep 1201) where needed

SPINAL DRAIN MALFUNCTION
 Inform Critical Care Registrar – **URGENT** review
 Check for catheter kinking or obvious blockage (redress if needed)
 If it appears to be blocked discuss with Vascular & Anaesthetic Team

Appendix

Glasgow coma scale (Teasdale and Jennett, 1974)

RESPONSE	SCORE
Eye opening	
No eye opening	1
To pain	2
To speech	3
Spontaneously	4
Best verbal response	
None	1
Incomprehensible sounds	2
Inappropriate words	3
Patient confused	4
Patient oriented	5
Best motor response	
None	1
Extensor response to painful stimulus	2
Flexion to painful stimulus	3
Withdraws from pain	4
Localizes to pain stimulus	5
Obeys commands	6

Bromage Scale (Bromage *et al.*, 1964)

Grade	Criteria
1	Free movement of legs and feet
2	Just able to flex knees with free movement of feet
3	Unable to flex knees, but with free movement
4	Unable to move legs or feet

6) IMPLEMENTATION

Training required for staff	Yes
If yes, who will provide training:	<p><i>Training is required for:</i></p> <p>Anaesthesia: Consultants and Registrars</p> <p>Vascular Surgeons: Consultants and Registrars</p> <p>Critical Care: Consultants and Registrars Nursing Staff</p> <p>Recovery Staff</p> <p><u>MDT Leads/ Key Trainers:</u></p> <p><i>Vascular Anaesthesia:</i> Dr Emma James Dr Sadie Syed Vascular anaesthesia fellow Dr Nathalie Courtois</p> <p><i>Vascular Surgeons:</i> Ms Celia Theodoreli-Riga</p> <p><i>Recovery Staff:</i> Nyasha Chironga</p> <p><i>Critical Care:</i> Dr Ahmed ElHaddad Claire Wroe Sian Brown</p>
When will training be provided?	<ol style="list-style-type: none"> 1) Induction Days 2) Induction Booklet 3) Audit Days 4) Simulation 5) Small Group Teaching 6) E Learning 7) Informal Bedside Teaching
Date for implementation of SOP:	May 2019

7) MONITORING / AUDIT

When will this SOP be audited?	May 2020
Who will be responsible for auditing this SOP?	<u>MDT Leads/ Key Trainers</u>
Are there any other specific recommendations for audit?	No

8) REVIEW

Frequency of review	<p>Please indicate frequency of review: <i>Every 3 years - 2021</i> <i>A Review will also occur post introduction of NR FIT devices</i></p> <p>Person and post responsible for the review:</p> <p>Anaesthesia: Dr Emma James Surgery: Ms Celia Theodoreli-Riga Critical Care: Dr Ahmed ElHaddad</p>
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9) REFERENCES

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10) SOP DETAIL

Start Date:	May 2019
Approval Dates	<p>Name of Divisional group: Surgery/Cardiovascular/Cancer Division Date of ratification: 14th of May 2019</p> <p>Name of Directorate group; Date of ratification: Anaesthesia 15th of March 2019 Vascular Surgery 9th of April 2019 Critical Care 10th of April 2019 Cardiothoracic Surgery 23rd of April 2019</p>
Has all relevant legislation, national guidance, recommendations, alerts and Trust action plans been considered, and included as appropriate in the development of this SOP?	<p>Please list ALL guidance considered:</p> <p>Please see References. In addition:</p> <p>Erbel, R. <i>et al.</i> (2014) '2014 ESC guidelines on the diagnosis and treatment of aortic diseases', <i>European Heart Journal</i>. doi: 10.1093/eurheartj/ehu281.</p> <p>Etz, C. D. <i>et al.</i> (2014) 'Contemporary spinal cord protection during thoracic and thoracoabdominal aortic surgery and endovascular aortic repair: A position paper of the vascular domain of the European association for cardio-thoracic surgery', <i>European Journal of Cardio-thoracic Surgery</i>, 47(6), pp. 943–957. doi: 10.1093/ejcts/ezv142.</p> <p>Hiratzka, L. F. <i>et al.</i> (2010) '2010 ACCF/AHA/AATS/ACR/ASA/SCA/SCAI/SIR/STS/SVM Guidelines for the Diagnosis and Management of Patients With Thoracic Aortic Disease', <i>Journal of the American College of Cardiology</i>. doi: 10.1016/j.jacc.2010.02.015.</p> <p>Khan, S. N. and Stansby, G. (2012) 'Cerebrospinal fluid drainage for thoracic and thoracoabdominal aortic aneurysm surgery.', <i>The Cochrane database of systematic reviews</i>, 10(4), p. CD003635. doi: 10.1002/14651858.CD003635.pub3.</p>
Have all relevant stakeholders been included in the development of this SOP?	<p>Please list all (name and role):</p> <p><i>Anaesthesia Consultants:</i> <i>Dr Courtois (SMH)</i> <i>Dr Syed (SMH)</i> <i>Dr James (SMH)</i></p>

	<p><i>Dr Knaggs (SMH)</i> <i>Dr Platt (SMH)</i> <i>Dr Gautama (SMH)</i> <i>Dr Sidhu (SMH)</i> <i>Dr Williamson (SMH)</i> <i>Dr Kynoch (SMH)</i> <i>Dr Illingworth (SMH)</i> <i>Dr Coppel (SMH)</i> <i>Dr Cousins (HH)</i> <i>Dr Borra (HH)</i> <i>Dr Bacon (HH)</i> <i>Dr Berry Clinical Director</i></p> <p><i>Vascular Surgeons:</i> <i>Ms Theodoreli-Riga</i> <i>Mr Bicknell</i> <i>Mr Gibbs</i> <i>Mr Jenkins</i> <i>Prof Davies</i> <i>Mr Nott</i> <i>Prof Standfield</i> <i>Mr Aylwin</i> <i>Mr Jaffar</i> <i>Mr Shalhoub</i></p> <p><i>Cardiac Surgery:</i> <i>Mr Chukwuemeka</i></p> <p><i>Neurosurgery:</i> <i>Mr Tsang</i></p> <p><i>Recovery Staff:</i> <i>Nyasha Chironga</i></p> <p><i>Critical Care:</i> <i>Dr Meacher</i> <i>Dr ElHaddad</i> <i>Dr Ashworth</i> <i>Dr Manikon</i> <i>Claire Wroe</i> <i>Sian Brown</i></p> <p><i>Infection prevention & control:</i> <i>Jan Hitchcock</i></p>
Author/further information	<p>Dr Emma James emma.james15@nhs.net Dr Nathalie Courtois Dr Sadie Syed Dr Sabina Bachtold sabina.bachtold@nhs.net</p>
THIS SOP REPLACES:	ICU Spinal Drain Guideline 2008

11) INTRANET HOUSEKEEPING

Key words	Spinal Drain Vascular
Which Division/Directorate category does this belong to?	Surgery, Cardio-vascular and Cancer Division
Which specialty should this belong to when appearing on the Source?	Vascular Surgery Anaesthesia Critical Care

12) EQUALITY IMPACT OF SOP

Is this SOP anticipated to have any significant equality-related impact on patients, carers or staff?

Yes

No