Post-operative management after

ENDOVASCULAR AORTIC PROCEDURES

e.g. EVAR / TEVAR / FEVAR / BEVAR (or combinations)

SCOTTISH NATIONAL TAAA AND COMPLEX AORTIC SERVICE
ROYAL INFIRMARY OF EDINBURGH

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CARDIOVASCULAR RISK

Issue

- Pre-existing coronary artery disease is common.
- Haemodynamic change, especially tachycardia, may result in coronary plaque rupture.
- A hypercoagulable state usually develops post-operatively.

Targets

- **5 lead ECG** monitor with ST segment alarms on (alarm range -1.0 mm to +1.0 mm for II and V5).
- **12 lead ECG** on arrival to recovery / critical care, if ST segment alarm or patient complains of chest pain.

- Aim **HR <80**. If patient is on a beta-blocker, maintain beta-blockade. Treat hypotension by other means - omit other anti-hypertensive drugs, give fluid / vasopressor.
- Aim **MAP >65** (or >70 if coronary disease - see Trak handover). Fluid challenges preferable to vasopressor.
- Aim **SBP <180**. Use oral / IV agents to lower BP if necessary.
- Keep **Hb >70 g.L^{-1}** (>80 g.L-1 in patients with coronary artery disease, higher if spinal cord ischaemia suspected - see 'Spinal Cord Ischaemia Guideline').

- Continue **aspirin** and **LMWH / minihep** therapy provided there is no severe coagulopathy or significant bleeding.
- Continue **statin** therapy (give NG if can't be given orally) to stabilise coronary plaques.
- Normalise electrolytes, particularly **potassium** & **magnesium** to reduce risk of arrhythmias.

HAEMORRHAGE / HAEMATOLOGY

Issue

- Significant bleeding after endovascular aortic repair is unusual, although bleeding from groins can occur.
- Platelets can drop significantly post-procedure due to multiple factors.
- Haemolysis can occur due to altered haemodynamics within the stent graft.
- A pro-thrombotic state may develop with increased risk of thrombotic complications (e.g. MI, PE).

Targets

All patients, first 48 hours post-procedure:

- Immediate post-op bloods (recovery or critical care admission) should include FBC & coagulation screen.
- **Aim platelet count ≥70 x 10^{9}.L^{-1}.** Treat with platelets. Discuss with haematology if platelets persistently low.
- **Aim INR ≤1.5.** Treat with FFP.
- **Aim fibrinogen ≥1.5.** Treat with FFP.
- **APTT ratio** may be moderately elevated post-op because heparin is given in theatre. Treatment of an isolated moderately raised APTT ratio (e.g. 2-3) is not required unless there are clinical signs of significant bleeding.

Significant ongoing bleeding suspected:

- Contact on call vascular surgeon urgently.
- Use serial ClotPro / ROTEM assays to rapidly assess coagulation. Treat as per ClotPro / ROTEM protocol.
- Ensure formal lab FBC & coagulation screen also sent.

RESPIRATORY

Issue

- Pre-existing lung disease is common.
- Risk of post-operative atelectasis / pneumonia.

Targets

- Aim **SpO2 94-98%**.
- Encourage deep breathing & coughing.

RENAL / FLUIDS

Issue

- Pre-existing renal impairment is common.
- Patients receive IV contrast during stenting.

Targets

- Patients without established oral intake should receive maintenance IV fluid, not >30 ml/kg/day.
- If sustained urine output <0.5 ml/kg/hr check U&E, give IV fluid bolus & reassess.

LEGS

Issue

- Distal ischaemia may develop postoperatively due to stent thrombosis, embolism or complications following femoral sheath use.
- Compartment syndrome is a risk following long procedures with associated ischaemic time.

Targets

- **Check leg pulses, temperature & colour** every hour for 6 hours post-op then every 6 hours.
- Some pulses may not be assessable - confirm with vascular surgeons.
- Unexplained leg pain or weakness should be reported to medical staff.

CLOSURE DEVICES

Issue

- Large diameter sheaths to femoral arteries.
- Suture-mediated closure devices are used following percutaneous access.
- Device failure can lead to groin bleeding.
- Sitting the patient up too quickly may compromise the closure device.

Targets

- First 1 hour post-procedure: Lie flat with straight legs, check groins every 15 mins.
- 1 to 6 hours post-procedure: Can sit up to 45 degrees, check groins every hour.
- After 6 hours post-procedure: Can carefully mobilise, check groins every 6 hours.
- If significant bleeding / swelling, apply manual compression & contact on call vascular surgeon.

VTE

Targets

- **Minihep 5000 units BD** or **LMWH** (prophylactic dose as per critical care guidelines) - depends on risk of spinal cord ischaemia. See Trak.
- 1st dose 6 hours post-op unless otherwise specified on Trak, or significant bleeding.
- **No TEDS or calf compression boots**, unless explicitly stated in Trak handover.

OTHER

Issue

- Some patients have SIRS response & back pain due to sac thrombosis. No specific treatment other than analgesia.

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Post-operative management specific to ENDOVASCULAR AORTIC REPAIR WITH MODERATE RISK OF SPINAL CORD ISCHAEMIA

e.g. TEVAR

SPINAL CORD ISCHAEMIA

Issue

- The stent graft covers and occludes arteries supplying the anterior spinal artery.
- Spinal cord perfusion can remain precarious for several weeks after stent deployment.
- CSF drain not routinely inserted pre-operatively.

Targets

- **Assess leg power EVERY 2 HOURS for the first 48 hours post-op**. Thereafter, at least 6-hourly (or more frequently if specified).
- Aim **MAP >70** or higher if specified on Trak.
- **Avoiding hypotension / hypoxia is critical.**
- Respond quickly to drops in BP & SpO2, particularly if patient unstable (e.g. reintubation).

- If **leg weakness** develops:
  - Notify medical staff.
  - Raise the MAP target by 10 (usual max 100).

- If weakness persists for 30 minutes despite these interventions:
  - **CSF drainage should be considered**.
  - Discuss with the critical care consultant urgently (0800-1800 Mon to Fri also discuss with the vascular anaesthetist in theatre 18).
  - Ensure the patient has had a FBC & coag screen checked within the past 4 hours.

- Urgent imaging for epidural haematoma should also be considered (although spinal cord ischaemia is more common).
- MRI is best but CT is easier to facilitate quickly. Seek advice from radiology / neuroanaesthesia.

Post-operative management specific to ENDOVASCULAR AORTIC REPAIR WITH HIGH RISK OF SPINAL CORD ISCHAEMIA

e.g. Extensive TEVAR, BEVAR, FEVAR with complicating factors

SEE ALSO: SPINAL CORD ISCHAEMIA GUIDELINE

SPINAL CORD ISCHAEMIA

Issue

- The stent graft covers and occludes many arteries supplying the anterior spinal artery. The more extensive the stent, the higher the risk.
- Spinal cord perfusion can remain precarious for several weeks after stent deployment.
- **CSF drain** usually inserted pre-operatively.
- Weakness due to spinal cord ischaemia (SCI) is more common than an epidural haematoma.
- **Optimising spinal cord perfusion is time critical & may prevent permanent paraplegia.**

Targets

- **Assess leg power EVERY HOUR for the first 48 hours post-op.** Thereafter, at least 6-hourly (or more frequent if specified).
- Aim **leg movement score ≤2** (can bend knees).
- Aim **MAP >70** or higher if specified on the 'Spinal Cord Ischaemia Guideline'.
- **Avoiding hypotension / hypoxia is critical.**
- Respond quickly to drops in BP & SpO2, particularly if patient unstable (e.g. reintubation).

- If **leg weakness** develops:
  - Notify medical staff.
  - Raise the MAP target by 10 (usual max 100).
  - Consider lowering CSF pressure - see 'Spinal Cord Ischaemia Guideline'.

- Urgent imaging for epidural haematoma should be considered (although SCI is more common).
- MRI is best but CT is easier to facilitate quickly. Seek advice from radiology / neuroanaesthesia.

Post-operative management specific to ENDOVASCULAR AORTIC REPAIR WITH MODERATE / HIGH RISK OF VISCERAL ISCHAEMIA

e.g. FEVAR, BEVAR

VISCERAL ISCHAEMIA

Issue

- Stents are placed into visceral arteries, with risk of malperfusion due to thrombosis or dissection.
- Visceral ischaemia may result, where blood flow to liver, GI tract and kidneys is interrupted.

Targets

- Avoid excessive vasopressor administration. Frequent fluid challenges & reassessment.
- Daily LFTs.
- Beware suddenly rising creatinine without another explanation which may reflect renal ischaemia.
- Beware rising lactate not responding to fluid resuscitation, or unexplained abdominal pain which may reflect GI tract ischaemia.
- If concern regarding visceral ischaemia, discuss urgently with vascular surgeon & consider CT angiogram.

Post-operative management specific to COMBINED SINGLE STAGE OPEN & ENDOVASCULAR AORTIC REPAIR

e.g. carotid-subclavian & TEVAR. carotid-carotid-subclavian (hemi-arch debranching) & TEVAR, full arch debranching & TEVAR

WOUNDS

Targets

- **Mepore** dressing: leave intact for 2 days.
- **Blue swabs / tegaderm**: leave intact for 5 days.
- If strike through more than a very small amount change dressing & inform surgeon.
- Daily observation for haematoma / infection.

DRAINS

Targets

- Low grade suction if specified by surgeons.
- Document output hourly.
- **Alert surgeons if >500 ml out in 1 hour.**

STERNOTOMY

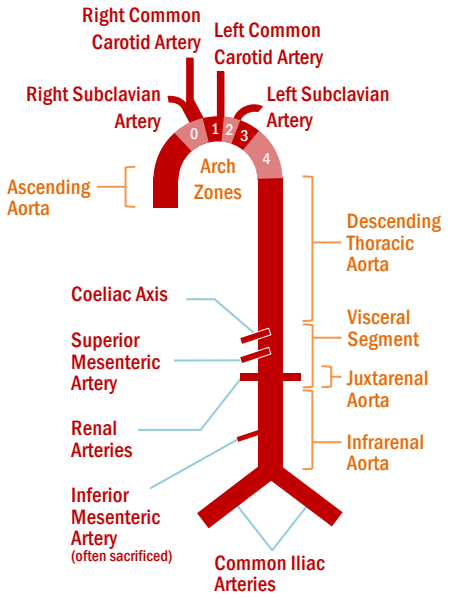
Issue

- Full arch debranching involves a sternotomy.
- Bleeding (particularly in the first hours post-op) can cause cardiac tamponade, a surgical emergency that may require chest reopening.

Targets

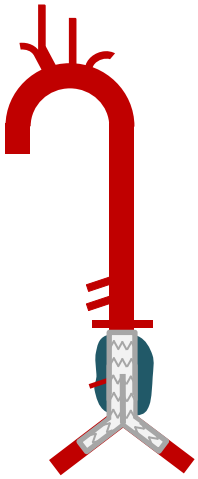
- Ensure there is a **reopening pack** in the patient's bed space at all times.
- If tamponade is suspected, call **2222**:
  - Declare "**medical emergency**"
  - State your **location**
  - Request "**cardiothoracic emergency team**"

NORMAL AORTA



AORTIC STENTING PROCEDURES

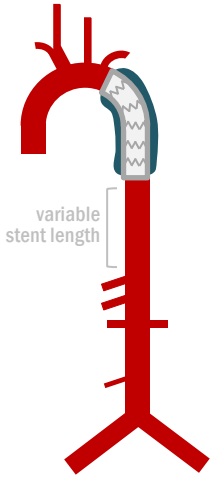
EVAR
(ENDOVASCULAR AORTIC REPAIR)
e.g. infrarenal abdominal aortic aneurysm



spinal cord ischaemia risk
LOW

visceral ischaemia risk
LOW

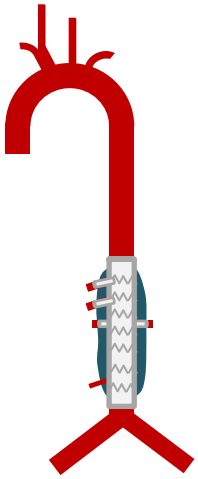
TEVAR
(THORACIC ENDOVASCULAR AORTIC REPAIR)
e.g. descending thoracic aortic aneurysm, penetrating ulcer or transection



spinal cord ischaemia risk
MODERATE or HIGH
depends on extent of TEVAR (>20cm high risk)

visceral ischaemia risk
LOW

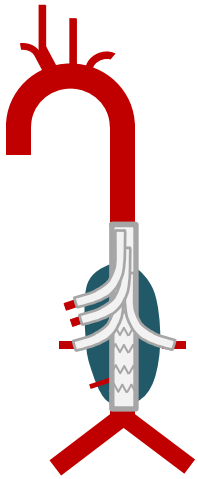
FEVAR
(FENESTRATED ENDOVASCULAR AORTIC REPAIR)
e.g. aneurysm of visceral segment



spinal cord ischaemia risk
MODERATE or HIGH
risk increased by complicating factors e.g. combined with distal TEVAR, poor quality aorta, previous aortic intervention

visceral ischaemia risk
MODERATE

BEVAR
(BRANCHED ENDOVASCULAR AORTIC REPAIR)
e.g. large aneurysm of visceral segment



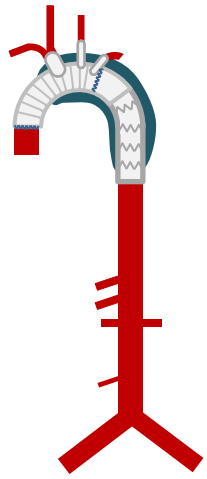
spinal cord ischaemia risk
HIGH

visceral ischaemia risk
HIGH

COMBINED PROCEDURE (ARCH REPLACEMENT)

FROZEN ELEPHANT TRUNK & TEVAR
e.g. aortic arch zone 0 & 1 aneurysms (patient fit for open arch replacement)

Usually TEVAR delayed until recovered from arch surgery (i.e. two stage)



spinal cord ischaemia risk
MODERATE or HIGH
depends on extent of TEVAR (>20cm high risk)

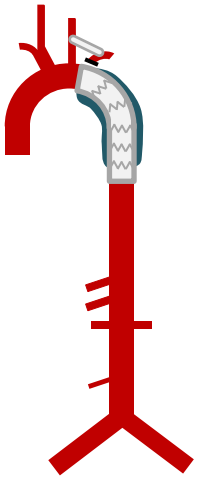
visceral ischaemia risk
LOW

COMBINED PROCEDURE (ARCH DEBRANCHING)

LEFT CAROTID-SUBCLAVIAN BYPASS & TEVAR
e.g. aortic arch zone 3 aneurysm

Usually same-day (i.e. single stage)

surgical incision
LEFT NECK



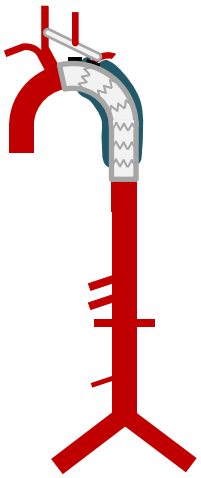
spinal cord ischaemia risk
MODERATE or HIGH
depends on extent of TEVAR (>20cm high risk)

visceral ischaemia risk
LOW

CAROTID-CAROTID-SUBCLAVIAN BYPASS (HEMI-ARCH DEBRANCHING) & TEVAR
e.g. aortic arch zone 2 aneurysm

Usually same-day (i.e. single stage)

surgical incision
BILATERAL NECK



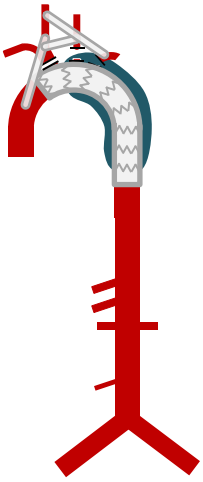
spinal cord ischaemia risk
MODERATE or HIGH
depends on extent of TEVAR (>20cm high risk)

visceral ischaemia risk
LOW

FULL ARCH DEBRANCHING & TEVAR
e.g. aortic arch zone 0 & 1 aneurysms, (patient not fit for open arch replacement)

Usually same-day (i.e. single stage)

surgical incision
STERNOTOMY + BILATERAL NECK



spinal cord ischaemia risk
MODERATE or HIGH
depends on extent of TEVAR (>20cm high risk)

visceral ischaemia risk
LOW