Vascular

Carotid endarterectomy

Preoperative assessment of a patient for carotid endarterectomy

Abdominal aortic aneurysm

Thoracic aortic aneurysms
Carotid endarterectomy

Indication
Symptomatic carotid disease > 70% occlusion: proven benefit in long-term stroke rate
Asymptomatic disease > 50-60% occlusion: reduces ipsilateral stroke rate

Perioperative morbidity
Stroke 3-5%, most postoperatively (> 50% after 4 hours post-op)
Risk factors: previous stroke, poor BP control post-op
AMI 0-4%

Preparation
Cardiac investigation indicated only for unstable angina, recent MI or decompensated CCF
70% of patients have silent IHD, diagnosis does not alter management
Relative priority of CAGS is undetermined

Anaesthetic management
Objectives
Cardiac and neurological protection from ischaemia
Cardiovascular stability
Early postoperative neurological examination

Monitoring
Routine plus ST segment monitoring, arterial line, large IV
Arterial line in arm with highest BP on examination
CVC generally avoided

GA
Fairly routine
Consider propofol “book-end” technique for rapid awakening
O₂, N₂O, isoflurane maintenance
Ready availability of pressors and nitrates for BP control
Continued BP control with emergence and post-op
Maintain normocapnia and normoglycaemia
Cerebral protection: high dose barbiturates for burst-suppression

Regional
Deep and superficial cervical plexus block
Exclude contraindications, monitor, IV access, assistant
Detail of technique

Advantages
Continuous functional neurological monitoring
High level of patient acceptance: 92% would have again
Possible lower risk of perioperative stroke
Possible lower risk of cardiopulmonary complications
Less BP lability intra- and post-operatively
No instability on “wake-up”

Disadvantages
High plasma levels of LA
Phrenic nerve block
Higher catecholamine levels, ? more tachycardia

Clamping
Order: ICA, CCA, ECA
Observe neurological findings for 2-3 minutes (regional) or BP, stump pressure, other monitors (GA)

Unclamping
Order: ICA (flush), clamp ICA, ECA, CCA, ICA

Postoperative complications
Neurological complications
Usually due to intraoperative embolization or hypoperfusion or endarterectomy site embolization or thrombosis
Some due to intracerebral haemorrhage (0.4-2%) or hyperperfusion
Rate strongly correlates with surgical technique

Hypertension, hypotension
Usually due to carotid sinus baroreceptor dysfunction but hypoventilation, pain, bladder distension should be excluded
Treated aggressively to minimize risk of cerebral or myocardial injury

Nerve injury
Commonly recurrent laryngeal, superior laryngeal, hypoglossal or marginal mandibular

Wound haematoma requires prompt drainage if airway compromised
Preoperative assessment of a patient for carotid endarterectomy.

Surgery
Elective, high risk
1-2% mortality, 4-10% morbidity

Issues
Access to airway
Cerebral protection

Assessment
Identify myself and patient, confirm procedure, explain role

History
CVS
Symptoms of cerebrovascular disease
Hypertension, usual BP as basis for intraoperative aim
Coronary vascular disease
MI, angina, SOB, symptoms of failure
Peripheral vascular disease symptoms
NYHA functional classification
Respiratory disease
Commonly smokers, COAD
Other illnesses
Diabetes, renal impairment

Examination
Focuses on cardiac and respiratory complications
Document neurological status

Medications
Decision whether to continue or withhold
Commonly on multiple medications
Antiplatelet, ß-blockers, diuretics, ACEI, others

Investigation
ECG: high incidence of IHD
U&E, FBE
If IHD, consider echo, thallium scan or angiography
Carotid disease is generally treated before CAGS
But other revascularization options may be considered

Overall
Diseases unstable or stable, optimized or not
Plan for risk minimization

Consult
Appropriate referral for optimization of function

Consent
Anaesthetic plan: GA or regional
Regional requires detailed explanation in advance

Risks
General: allergy, aspiration, blood transfusion, cardiac event, dental injury, death, awareness
Specific: stroke risk

Postoperative plan
Ward or HDU
Analgesia

Premedicate
Aiming for normotension, normocapnia, anxiolysis
Usual antihypertensives, antiplatelet drugs as per surgeon’s instructions
Anxiolytic: temazepam
Abdominal aortic aneurysm

Natural history
  Progressive enlargement and rupture
    5 y rupture rate
    4-7 cm  25%
    7-10 cm  45%
    >10 cm  60%
  Risk of rupture rises with diameter and rate of expansion
    Greater than risk of surgery at ≥5 cm or ↑ ≥0.5 cm in 6 months

Preoperative
  Assessment
    Similar to endarterectomy

Intraoperative
  Monitoring
    Routine, plus arterial line, multiple large IVs, CVC or Swan sheath
    Cell-saver for large anticipated blood loss
    Consider nasopharyngeal airway placement prior to heparinization if extubation planned

Induction
  GA with minimized BP rise, epidural catheter or
  Spinal or CSE for endoluminal repair

Crossclamping
  Effects depend on level of clamping, collateral circulation and physiological reserve
    Little effect from infrarenal clamp, major changes with thoracic clamp

Haemodynamic
  ↑ SVR (direct): ↑ BP, ↓ ejection fraction, ↓ CO, ↑ LVEDV,
  ↑ contractility, ↑ coronary flow
  reflex ↑ sympathetic tone: ↑ SVR, ↑ venous return, ↑ PAOP & CVP,
  ↑ LVEDV, ↑ CO (if good myocardial function)
  If coronary stenosis: segmental wall motion abnormality, ischaemia or LV failure
    Wall motion abnormalities in 40% of infrarenal and 90% of supracoeliac clamps

Metabolic
  Distal ischaemia: ↓ VO₂, ↓ CO₂ excretion, ↑ SvO₂, ↑ catecholamines
  Metabolic acidosis, if ventilated: respiratory alkalosis

Intervention
  Afterload reduction
    SNP, volatiles, amrinone, epidural, remifentanil
  Preload reduction
    GTN, epidural, shunt or left heart bypass
  Renal protection
    Mannitol, dopamine, fluids
    Suprarenal clamp → 90% reduction in RBF
    Infrarenal clamp → 40% reduction in RBF

Unclamping
  Haemodynamic
    ↓ SVR, ↓ CVP, ↓ CO, ↓ BP, ↓ contractility
  Metabolic
    ↑ VO₂, ↓ SvO₂, ↑ lactate, PGs, activated complement, myocardial depressants
  Intervention
    ↓ vasodilators & volatiles, IV filling, pressors
Reapply crossclamp if unacceptable hypotension

Emergence
Extubate on table if stable: normothermia, normal ABG, no massive transfusion
Thoracic aortic aneurysms

Classification
DeBakey
I   thoracoabdominal
II  ascending and arch
III descending ± abdominal
Crawford I-IV

Risk with surgery
Mortality  5-15%
Paraplegia 5-40%
ARF  3-30%
All depending on extent of aneurysm

Issues
Planned technique
   Extracorporeal circulation
   One-lung ventilation
Monitoring
   Spinal cord function
Protection
   Spinal cord, renal, cerebral, myocardial

Preoperative
Assessment
   As any vascular or thoracic patient, plus anatomical detail of aneurysm
   Respiratory function if OLV planned

Intraoperative
Monitoring
   Routine, plus
   IV access: 8.5 Fr x 3 (PA catheter and 2 rapid infusers)
   Arterial line in right radial ± femoral if femoral bypass
   Temperature (core and periphery), TOE, SSEPs
Induction
   Minimizing hypertension with cardiac-type induction
   Left-sided DLT for left lung deflation (minimizes risk of occluding RUL)
Maintenance
Bypass
   Full bypass with flow into ascending aorta
   Partial bypass with flow LA → femoral artery
   Passive shunt around clamped aorta
   No bypass “clamp and run”
      Clamp duration
      30 min  10% paraplegia
      60 min  90% paraplegia
   Deep hypothermic circulatory arrest (DHCA) for arch aneurysms
   ± cold oxygenated retrograde cerebral perfusion
Spinal protection
   CSF drainage, hypothermia, intrathecal papaverine
Renal protection
   Dopamine, mannitol, fluid loading, frusemide
Myocardial protection
   Clamping and unclamping: compensate for haemodynamic changes with vasoactive drugs
Emergence
   Change DLT for single-lumen tube with changing catheter
   Transfer ventilated to ICU