Anaesthesia for carotid surgery

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Abstract

Carotid endarterectomy (CEA) is a surgical procedure to prevent strokes in patients with atheromatous disease at the carotid bifurcation. The effectiveness of CEA has been established in large clinical trials. Patients should have surgery performed within 2 weeks from the onset of symptoms. This time frame presents a challenge to the anaesthetist and surgeon in risk stratifying and optimizing patients for surgery. Optimization includes blood pressure (BP) control and use of antiplatelet and lipid-lowering therapy. CEA can be carried out under general anaesthesia (GA) or regional anaesthesia (RA) with the advantages and disadvantages of both techniques discussed. Understanding surgical technique and the implications for anaesthesia is important, specifically the use of carotid shunting, eversion technique and patch angioplasty. Cerebral perfusion monitoring can be used during CEA to reduce neurological morbidity and mortality. The gold standard remains an awake patient where sensory, motor and higher mental functions can be assessed continuously. Intraoperative and postoperative management may involve haemodynamic and neurological complications such as stroke, cerebral hyperperfusion syndrome, heart failure and myocardial infarction. Compromise to the airway can occur as a result of oedema or haematoma and the latter may require exploration in theatre.

Keywords Anaesthesia; carotid endarterectomy; general; regional; stroke

Royal College of Anaesthetists CPD Matrix: 3A05

Learning objectives

After reading this article, you should be able to:

- describe the preoperative assessment for carotid surgery
- explain the advantages of both general and regional anaesthesia in this patient group
- describe methods of monitoring cerebral perfusion
- describe the management of cardiovascular and neurological problems in the intraoperative and postoperative period

Introduction

Stroke is a major health problem in the UK. Carotid endarterectomy (CEA) is a preventative surgical procedure performed to reduce the incidence of embolic or thrombotic strokes. Benefit from CEA is greatest when performed within the first 14 days of a transient ischaemic attack (TIA) or stroke in patients with symptomatic severe carotid artery stenosis. The latest NICE guideline[1] recommends surgery within 14 days of a stroke or TIA for patients with carotid artery occlusive disease (Figure 1). The National Stroke Strategy goes further by suggesting that CEA be performed within 2 days after onset of symptoms, however surgery performed within 2 days of a TIA or stroke may be associated with a higher perioperative risk compared to surgery performed after 3 days.[2] Maximal benefit is in patients with a high-grade carotid artery stenosis (70–99%) with a 5-year absolute risk reduction of 16% for an ischaemic stroke. Early referral is essential as the risk of a fatal or disabling stroke is highest within the first few days after a TIA.

Preoperative assessment

CEA carries significant morbidity and mortality with the NASCET study[3] reporting a combined stroke and death rate of 6.5% for CEA. Preoperative assessment should optimize any existing coronary artery disease, hypertension, diabetes mellitus, chronic renal disease and respiratory disease, which are common in this group of patients.[4]

All patients presenting with an ischaemic stroke or a TIA should be on dual antiplatelet therapy (aspirin and clopidogrel) for secondary prevention. There is no significant increase in bleeding risk continuing antiplatelet medication perioperatively. Statin therapy in symptomatic patients undergoing CEA is associated with a reduction in hospital stroke and mortality rates, even when started one week before CEA.

Untreated preoperative hypertension is associated with postoperative hypertension which can lead to wound haematoma with airway obstruction, cerebral hyperperfusion syndrome and may exacerbate pre-existing cardiac disease. Conversely, overtreatment or a rapid reduction in BP can cause cerebral hypoperfusion leading to an ischaemic stroke. As the optimal preoperative BP targets remain unclear due to the paucity of clinical data, a systolic BP of less than 160 mmHg before CEA is acceptable by most surgeons and anaesthetists.

Surgical technique

CEA is performed via a neck incision along the anterior border of sternocleidomastoid muscle. The common (CCA), internal (ICA) and external carotid arteries (ECA) are exposed and usually the hypoglossal nerve is visualized. The ICA is clamped first to prevent embolization and an arteriotomy is performed. Carotid cross-clamping causes a physiological increase in the BP from baseline which reverses upon its removal (Figure 2). This effect is obtunded in patients having a general anaesthetic (GA). There are two surgical techniques, namely a standard CEA, or an eversion CEA and most studies have shown no significant difference between the two techniques.

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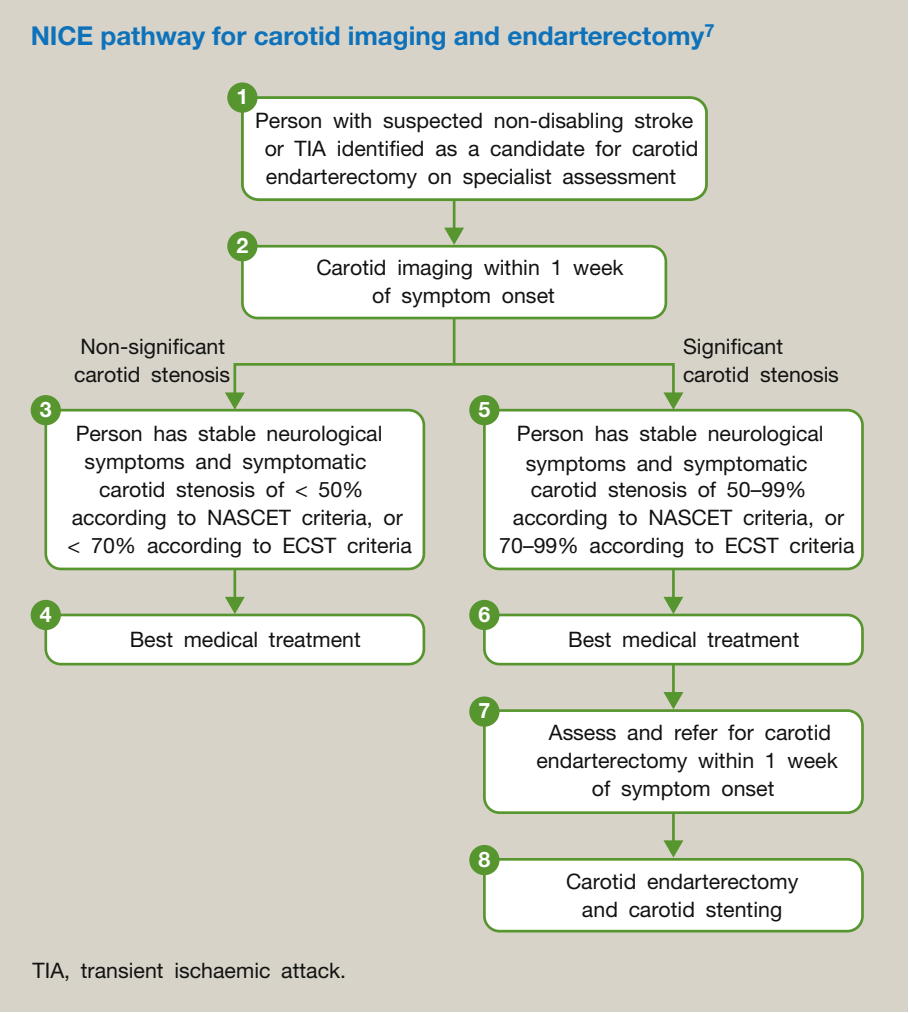

Figure 1

Prior to clamping of the vessels, a bolus of 3000–5000 units of heparin is given. There is no evidence that a weight-based dose is safer. A shunt can be used during the clamping phase of CEA to maintain blood flow from the CCA to ICA. A shunt is generally used in CEA patients under GA and in around 10% of patients under RA. They are useful in patients with contralateral carotid stenosis or a compromised Circle of Willis. Shunt complications include air or plaque embolization, intimal tears and carotid dissection. Following the endarterectomy, the vessel can be closed primarily but more often is patched with either synthetic material or autologous vein.

Anaesthetic technique

CEA can be performed under GA or regional anaesthetic (RA) (Table 1). The GALA trial[5] compared both, with the primary outcome being proportion of patients with myocardial infarction (MI), stroke or death between randomization and 30 days after surgery. The combined primary outcome was 4.5% in the RA group and 4.8% in the GA group. There was no difference in secondary outcomes that included MI, stroke, death at 1 year and length of hospital stay. A meta-analysis undertaken the following year showed that the odds ratio for 30-day stroke or death were similar, but RA is associated with a significant reduction in postoperative haemorrhage.[6]

GA involves tracheal intubation and controlled ventilation to maintain a normal carbon dioxide tension. Minimum monitoring includes five-lead ECG, invasive and non-invasive BP, pulse oximetry and capnography. Maintenance can be with a volatile or intravenous anaesthetic agent and a short-acting opioid such as remifentanil. This combination allows for rapid emergence and early assessment of the patient's neurological function. Nitrous oxide should be avoided due to its effects of increasing cerebral metabolic rate and oxygen consumption and is associated with an increase in myocardial ischaemia. Irrespective of the agent used, there is a reduction in sympathetic and baroreceptor activity resulting in a dose-dependent decrease in cardiac output and BP. At the time of carotid cross-clamping the BP should be augmented by 20% from the patient's baseline. This is crucial to avoid cerebral hypoperfusion and a vasopressor infusion such as metaraminol or phenylephrine together with fluid boluses can be used. Augmenting the BP is not without risks as it can cause myocardial ischaemia, intracerebral haemorrhage and wound haematoma.