Every year in the UK, carotid artery occlusive disease kills approximately 1 in 100 of the population aged more than 75 yr. The underlying pathophysiology is development of a plaque at the carotid bifurcation with ulceration and embolization of thrombus or plaque debris causing transient ischaemic attacks (TIA) or a stroke. The risk of stroke is approximately 5% per annum if asymptomatic and 10% per annum in a patient with TIA. One-third of strokes are fatal, one-third leave significant morbidity and one-third recover. Carotid endarterectomy is a preventative operation to reduce the incidence of embolic and thrombotic stroke.

The first carotid endarterectomy was performed at St Mary’s Hospital, London, in 1954. In the UK, by 1992 approximately 3000 were being performed every year. This number had been increasing steadily over the previous 10 yr. This increase was probably a result of publication of the results of large prospective studies from North America and Europe showing the benefit of surgical over medical strategies for the treatment of high grade carotid stenosis. In the USA, approximately 100,000 carotid endarterectomies are performed every year, much higher proportionately than in the UK, perhaps because of the greater tendency of American surgeons to operate on patients with asymptomatic carotid stenosis. However, the surgical indications for carotid endarterectomy in the UK are also changing, with more asymptomatic patients and more patients with recovered strokes being operated on. This trend is likely to continue in the future, with greater emphasis on preventative medicine and screening for cardiovascular diseases. Indeed, the European Carotid Surgery Trial data suggest that there will be a three- to five-fold increase per annum in the number of carotid endarterectomies performed.

Unfortunately, carotid endarterectomy carries a significant perioperative mortality rate from stroke and myocardial infarction which may even approach 5%. Thus anaesthetic and surgical techniques are constantly under scrutiny to try to reduce this relatively high incidence of morbidity and mortality for an operation which in itself is only preventative. Regional anaesthesia is an alternative to general anaesthesia which has attracted considerable attention amid claims of a reduction in operative morbidity and mortality. This review describes the problems and some solutions for providing regional anaesthesia for carotid endarterectomy.

Regional or general anaesthesia?

There can be few operations in which there is such a discrepancy between the opinions of anaesthetists and surgeons, in terms of the best anaesthetic technique to use, as there is for carotid endarterectomy surgery.

In the UK, carotid endarterectomy has traditionally been performed under general anaesthesia because of surgeons’ and patients’ preferences, but perhaps additionally because many British anaesthetists are not comfortable or trained to perform cervical plexus blocks or cervical epidural anaesthesia. However, in the USA, regional anaesthesia for carotid endarterectomy is used more commonly. A recent survey of 216 American neuro-anaesthesiologists found that 17% of carotid endarterectomies were performed under regional anaesthesia, although overall in the USA this value is probably much higher as American neurosurgeons appear less inclined to use regional anaesthesia than vascular surgeons. There has been more interest recently on both sides of the Atlantic Ocean with the increasing body of evidence that morbidity, and even mortality, may be reduced if carotid surgery is carried out using a regional anaesthetic technique. This has now reached the point where a multicentre, prospective, randomized, controlled comparison of regional vs general anaesthe-
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Both regional and general anaesthesia can be used for carotid endarterectomy. Advocates of general anaesthesia claim other advantages apart from ease of monitoring cerebral perfusion, including: lower requirement for shunting; lower cardiovascular morbidity; shorter ICU and hospital stay; less expense overall than general anaesthesia; and avoidance of intubation in patients with COPD. There are more subtle advantages, such as avoidance of ‘blind’ arterial pressure augmentation and its potentially detrimental effects on the heart and better cerebral autoregulation compared with general anaesthesia. However, there are clearly disadvantages with this method, such as: complications of the various regional techniques; problems of emergency intraoperative airway control; the fact that it does not prevent myocardial ischaemia, and the high degree of patient co-operation and contact required throughout the procedure.

Against this highly polarized background, is there any firm evidence that either of the techniques is associated with an improvement in outcome? Unfortunately no large, prospective, randomized studies are available to draw firm conclusions. A recent meta-analysis by Tangkanakul, Counsell and Warlow of all studies published comparing regional and general anaesthesia for carotid endarterectomy noted that there were only three randomized studies examining 143 patients, but that there were 17 non-randomized studies investigating almost 6000 patients, which were subject to the potential flaws and biases of non-randomized, retrospective studies. Definite conclusions are thus not possible. However, the authors concluded that there are ‘potentially important benefits from performing carotid endarterectomy under local anaesthesia’ and recommended that a prospective randomized study of 2000 patients be conducted to answer the question. Such a study would have 90% power to detect a 50% difference in perioperative stroke or death at the 5% significance level.

Of the three published, randomized, controlled studies, only one has shown significant differences in outcome in a group of 100 patients—a small reduction in the incidence of local haematoma in patients receiving local anaesthesia and a significant decrease in carotid shunting. Two other randomized studies examined a smaller number of patients and concentrated on haemodynamic differences, showing that hypertension was more common in the peroperative period and hypotension was more common after operation in the local anaesthetic groups. However, in the non-randomized studies, there were apparently large differences in outcome between general and regional anaesthesia. Thus there are studies showing a significant reduction in the incidence of perioperative stroke, cardiovascular post-operative complications (including myocardial ischaemia, arrhythmia, myocardial infarction and heart failure) and hospital and ICU stay. Combining the data from these non-randomized studies, Tangkanakul, Counsell and Warlow
suggest that overall, within 30 days of operation, the use of regional anaesthesia is associated with a 50% reduction in the relative odds of death, stroke, myocardial infarction and pulmonary complications such as pneumonia, pulmonary embolus and prolonged intubation. However, the authors point out many flaws in the non-randomized studies, including the retrospective nature, use of non-sequential analysis and the fact that in many, statistical analysis of the number of arteries operated on was performed, not the number of patients (i.e. some patients underwent bilateral procedures). Clearly, in order to undergo the second carotid endarterectomy, a patient must survive the first operation.

A definitive answer to the question as to which technique is best is eagerly awaited. Meanwhile, regional anaesthesia for carotid surgery is becoming increasingly popular in the UK, with several vascular surgeons and anaesthetists having recently adopted or considering adopting the technique. In the UK, we are ideally placed to conduct a randomized, controlled study of general vs regional anaesthesia for carotid endarterectomy which might finally settle this important question.

Which regional anaesthetic technique should be used?

Carotid endarterectomy under regional anaesthesia requires block of the second (C2), third (C3) and perhaps the fourth (C4) cervical dermatomes (Fig. 1) which may be accomplished in several different ways. No differences in morbidity or mortality have been shown between these different regional techniques. Regional anaesthesia is suitable for any of the surgical approaches to the carotid artery, including transverse and vertical incisions, although local anaesthetic supplementation will be required if a transverse incision crosses the midline.

**Local infiltration**
The use of local infiltration alone has been described and is currently used by some surgeons, although this technique may be slow, uncomfortable, and would certainly not be tolerated well by all patients. Many surgeons do not have the patience to use this technique effectively although it is certainly feasible. Thus it may be more appropriate to use a regional technique.

*Cervical epidural anaesthesia*

This is not used much in the UK, although there are large case series reporting its successful use in patients undergoing carotid surgery, particularly in France. For placement of the epidural catheter, patients are positioned sitting with the neck flexed, chin on chest, to open the lower cervical interspaces. A 16- or 18-gauge Tuohy needle is introduced in the midline with a drop of saline in the hub, which is aspirated inwards by negative pressure when the needle enters the cervical epidural space (‘hanging drop’ technique). An epidural catheter is then threaded through the Tuohy needle to leave 3–4 cm in the epidural space. After negative aspiration, a suitable test dose is administered followed by 10–15 ml of a local anaesthetic solution, such as 0.5% bupivacaine.

Proponents of cervical epidural anaesthesia cite the simplicity and success of the technique. However, all cervical and upper thoracic nerve roots are potentially affected bilaterally. There is significant associated morbidity, including a high incidence of cardiovascular side effects such as hypotension and bradycardia, respiratory failure requiring intubation in 1%, dural puncture in 0.5% and bloody tap in 2%. Alterations in pulmonary function are detectable in 100% of recipients and its use for routine clinical purposes has therefore been condemned. Additionally, in our experience, placement of a cervical epidural in an elderly patient with calcified spinous ligaments in the sitting position using the hanging drop technique is not to be undertaken lightly. Cervical plexus block, which is easier to perform, affects unilateral nerve roots only and has less cardiovascular side effects, is a safer alternative.

**Deep cervical plexus block**
The cutaneous distribution of the cervical plexus is shown in Figure 1. It may be blocked either deep, as the spinal nerves lie on the cervical transverse processes (Fig. 2, 3),
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or superficially, as the cutaneous branches emerge from the posterior border of the sternocleidomastoid (Fig. 4). For carotid surgery, commonly a deep cervical plexus block is used alone or a combination of deep and superficial cervical plexus block. Deep cervical plexus block is technically more difficult to perform and may be associated with more serious complications than superficial cervical plexus block, although it may be more reliable and provide better postoperative analgesia. The deep block may be performed by single injection at C3 or C4, as first described by Winnie and colleagues, or by a three-injection technique at C2, C3 and C4, as described by Moore. The modified single-injection technique of Winnie and colleagues at C3 is favoured by the authors and is described in detail below (Fig. 2, 3).

The patient lies supine, slightly sitting up, with the head turned to the opposite side. The skin is disinfected with chlorhexidine in alcohol. The cervical transverse processes are palpated manually, approximately 1 cm posterior to the posterior border of the sternocleidomastoid. The C3 transverse process may be located by counting up from the C6 transverse process (Chassaignac’s tubercle) which is at the level of the cricoid cartilage. After intradermal infiltration of 1% lidocaine 0.25 ml at the level of the C3 transverse process, a 1-inch, 25-gauge needle is introduced at right angles to the skin but aiming in a slightly caudal direction to avoid intrathecal injection. After location of the transverse process 1–2 cm from the skin, or after the patient reports paraesthesia in the distribution of the cervical plexus (Fig. 1), 0.375% plain bupivacaine 20 ml is injected by a second operator. An immobile needle technique is used in which a short length of tubing is placed between the needle and syringe to minimize needle movement resulting from manipulation of the syringe. In our experience, it is more common to attempt injection too posteriorly rather than too anteriorly.

Controversy persists as to whether paraesthesia should be actively sought during placement of a regional block, with some evidence that this leads to a higher incidence of postoperative dysaesthesia. This view has been challenged as techniques eliciting paraesthesia have been shown to make axillary brachial plexus block more effective. Deep cervical plexus block also appears to be more successful in terms of less additional local anaesthetic requirements when paraesthesia is elicited during placement or when a nerve stimulator is used to make the block more effective. Unpublished observations suggest that paraesthesia is reported by 30–50% of patients undergoing deep cervical block placement. Further study is underway to determine if the dermatome where paraesthesia is elicited is important in determining the efficacy of cervical block.

Whichever technique is chosen for deep block there are serious potential complications, including: vertebral artery injection producing immediate loss of consciousness or convulsions; subarachnoid or epidural injection; and phrenic nerve palsy. The latter occurs in the majority of recipients of deep cervical block but appears to be tolerated reasonably well by those with normal pulmonary function. However, in patients with underlying pulmonary dysfunction, this may cause severe respiratory embarrassment. In selected patients with underlying respiratory impairment it may be more appropriate to perform superficial block alone which is effective for surgery.

Other potential side effects of deep cervical plexus block include: local haematoma (which is rarely a significant problem); hoarseness (caused by recurrent laryngeal nerve involvement); dysphagia; stellate ganglion block, which may be bilateral; and Horner’s syndrome. Aspiration of blood during placement of cervical plexus blocks is common, occurring in as many as 30% of cases. Therefore, it is vital to aspirate frequently during injection of local anaesthetic to avoid intravascular injection, which may have profound consequences, including immediate grand mal seizure. Complications may also be caused by surgery itself, particularly cranial nerve damage, which may occur in up to 25% of patients undergoing carotid endarterectomy.
Control of arterial pressure should have been achieved in carotid disease. Patients requiring coronary artery surgery is required only if there are active symptoms or signs of uncontrolled angina, recent myocardial infarction or aortic valvular disease. A resting electrocardiograph (ECG) should be available for all patients but a detailed cardiac work-up be performed. Patients requiring carotid artery surgery commonly have co-existing medical problems: indeed, widespread arterial disease, particularly evidence of heart failure, uncontrolled angina, recent myocardial infarction or aortic valvular disease. A resting electrocardiograph (ECG) should be available for all patients but a detailed cardiac work-up is required only if there are active symptoms or signs of cardiac disease. Patients requiring coronary artery surgery and carotid surgery are usually operated on sequentially with the more critical surgery performed first. Hypertension is the single major risk factor in stroke and adequate control of arterial pressure before operation significantly reduces the risk of postoperative hypertension or neurological events. Control of arterial pressure should have been achieved before presentation for carotid artery surgery and normal antihypertensive medications should be given on the morning of surgery, together with anti-anginal medications.

It is often the case that patients have been receiving antiplatelet medications, such as low-dose aspirin or dipyridamole, and these are usually continued until the day of surgery, although individual surgeons’ preferences may vary. Many of these patients are diabetic, and the perioperative management of diabetes mellitus should be the same regardless of whether they receive regional or general anaesthesia. Complications such as renal impairment should be identified, and occasionally retinopathy (proliferative, with a high risk of haemorrhage) should be treated before carotid artery surgery. Hyperglycaemia may worsen the damage to ischaemic brain tissue and must be avoided. The use of insulin/dextrose/potassium infusions may be required to control insulin-treated diabetics.

Respiratory disease is also common in this population in whom there is a high prevalence of tobacco smoking. Asthma and chronic obstructive pulmonary disease are probably easier to manage in the awake, non-intubated patient than in the patient under general anaesthesia. Occasionally, such patients are unable to tolerate the procedure without repeated coughing or respiratory difficulties when lying still under surgical drapes for 2–3 h. Additionally, some techniques of regional anaesthesia may cause further respiratory compromise associated with phrenic nerve paralysis. Thus a detailed history and examination should predict high-risk patients in whom pulmonary function testing will give a more detailed assessment, and in a few cases such information will identify patients for whom an alternate regional technique is appropriate, or even that general anaesthesia is required. Anxiolytic premedication with a benzodiazepine or opioid is required for most patients, but over-sedation during the period of carotid artery cross-clamping must be avoided.

Patients will also be encountered who have had previous carotid surgery and require re-operation for stenosis. Regional anaesthesia may be used successfully in these patients despite the difficulty of the operative dissection and the fact that the disease may extend unusually high into the internal carotid artery. When the disease is very high, local anaesthetic supplementation by the surgeon is invariably required.

At the preoperative visit, considerable efforts should be made explaining to a patient the benefits of undergoing carotid artery surgery under regional anaesthesia. It is our experience that persuading a patient to undergo carotid endarterectomy under regional anaesthesia is not a problem when the concept of monitoring cerebral perfusion during carotid clamping is explained in greater detail. When combined with the knowledge that they will receive adequate sedation, that the anaesthetist will be talking to them throughout the procedure and that general anaesthesia may still be induced if required, the number of patients that refuse regional anaesthesia outright is very low.

**Superficial cervical plexus block**

Superficial block is rarely used alone for carotid surgery. The deep branches of the cervical plexus supplying the neck muscles are not blocked and therefore there is the theoretical drawback of lack of neuromuscular block making surgery on deep structures more difficult. Despite this, superficial block is certainly an effective technique for carotid artery surgery. It has been used to ‘fill in’ inadequately blocked dermatomes from the deep block. Superficial cervical plexus block is simpler to perform than deep block (Fig. 4). With the patient positioned as for the deep block, the skin is disinfected and an intradermal ‘bleb’ of 1% lidocaine is raised at the midpoint of the posterior border of the sternocleidomastoid. Bupivacaine 0.375% (20 ml) is injected in the subcutaneous plane along the posterior body of the sternocleidomastoid in cranial and caudal directions from this point. We have found it beneficial to infiltrate with local anaesthetic solution along the inferior border of the mandible, to block afferent branches from the facial nerve. This appears to reduce the pain associated with prolonged use of a retractor under the mandible at the cephalad end of the incision.

Attention should be paid to the total dose of local anaesthetic administered when using combined deep and superficial cervical plexus blocks. Large doses of local anaesthetic approaching toxic limits have been used and plasma concentrations have been reported as approaching toxic levels after combined deep and superficial cervical plexus blocks. The question of which local anaesthetic agent to use is also relevant. Bupivacaine or lidocaine or a mixture of the two are commonly used, although the use of lidocaine alone may not provide adequate analgesia for the duration of the procedure. It may on occasions last up to 3 h. The use of ropivacaine has also recently been described which may have advantages over bupivacaine in terms of its safety profile.

**Preoperative patient assessment**

Patients requiring carotid artery surgery commonly have co-existing medical problems: indeed, widespread arterial disease is not uncommon. The most common complications after carotid artery surgery are cardiac. Therefore, the preoperative visit should be directed at identifying active cardiovascular disease, particularly evidence of heart failure, uncontrolled angina, recent myocardial infarction or aortic valvular disease. A resting electrocardiograph (ECG) should be available for all patients but a detailed cardiac work-up is required only if there are active symptoms or signs of cardiac disease. Patients requiring coronary artery surgery and carotid surgery are usually operated on sequentially with the more critical surgery performed first. Hypertension is the single major risk factor in stroke and adequate control of arterial pressure before operation significantly reduces the risk of postoperative hypertension or neurological events. Control of arterial pressure should have been achieved...
Perioperative monitoring

Monitoring, instituted before placement of the regional block, consists of five-lead electrocardiography (leads II and V5),32 invasive arterial pressure measured from the contralateral radial artery and started before placement of the block, a non-invasive arterial pressure cuff, oxygen saturation ($SpO_2$) and end-tidal carbon dioxide partial pressure ($PetCO_2$), which may be approximated using a 2-m length of fine manometer tubing placed within the oxygen face mask.8 Patients are given oxygen 4 litre min$^{-1}$ via a face mask throughout the procedure. i.v. access via a peripheral cannula of at least 16-gauge is required and an infusion of crystalloid commenced. Additional venous access may be required for infusion of vasoactive drugs. Small amounts of a benzodiazepine (diazepam 5–10 mg or midazolam 1–2 mg) may be administered i.v. for anxiolysis during insertion of the regional block, but when surgery commences, further sedative medication should be avoided if possible to allow meaningful assessment of the patient’s neurological condition during cross-clamping. When in the operating theatre, the operating table can be positioned so that the patient is in a ‘deck chair’ configuration which may be more comfortable than a standard supine position. Patients should be encouraged to empty their bladder immediately before arrival in the anaesthetic room.

Diagnosis, management and treatment of perioperative problems

Neurological dysfunction

It is of paramount importance during regional anaesthesia for carotid endarterectomy that verbal contact with the patient is maintained throughout the operation as this is the principal reason for performing the surgery with the patient awake. Patients who develop symptoms of cerebral ischaemia such as slurring of speech, altered grip strength or decreased conscious level after a 2-min trial cross-clamp of the internal carotid artery should have a carotid shunt inserted immediately to maintain ipsilateral carotid flow.9 Even so, these patients are more likely to develop postoperative neurological complications.23 Patients who develop changes in neurological function often do so at the time of cross-clamping, but there may be a significant delay in presentation, which may be related to episodes of perioperative hypotension.51

The patient’s head should be easily accessible to the anaesthetist throughout the procedure, which may be accomplished by elevating the surgical drapes away from the patient’s head using a Mayo table or an ‘L’ bar (Fig. 5). The contralateral arm should also be accessible to facilitate testing of grip strength.

Alternative methods of assessing motor power in the limbs include the use of a child’s ‘squeezy’ toy, held in the patient’s contralateral hand and squeezed intermittently by the patient to demonstrate motor power qualitatively90 or the use of an air-filled bag attached to a pressure transducer held by the patient and which, when squeezed intermittently, generates a visible pressure waveform on an attached monitor.42

Patient discomfort

No regional technique for carotid endarterectomy is perfect on every occasion. The largest published series describing 1000 cervical blocks for carotid surgery reported a supplementation rate with local anaesthetic of 53%, with 66% of patients requiring sedation in the peroperative period and 2.5% requiring conversion to general anaesthesia.25 There are several reasons for this. First, patients are sometimes encountered in whom the carotid bifurcation or the internal carotid artery disease extends so high that the incision has to be extended into tissues not supplied by the cervical plexus, but rather by cranial nerves. Second, no matter how effective the block, as tested by analgesia to pinprick before incision, patients sometimes complain of pain from dissection around and within the carotid sheath. This may be a reflection of additional afferent fibres accompanying the sympathetic innervation of the carotid vessel. Finally, the use of surgical retractors, particularly under the mandible, may also stimulate tissues not covered by the block. Supplementation of the block should not therefore be regarded as a failure of the anaesthetic technique, but as a necessity to allow surgery to proceed successfully.

Judicial supplementation of the block by the surgeon with 0.5% lidocaine should therefore be encouraged if required, but the anaesthetist should be constantly vigilant to the possibility of intra-arterial injection of local anaesthetic. One of the authors has witnessed a grand mal fit, albeit very short-lived, after accidental injection of only 0.5% lidocaine 1 ml into the internal carotid artery under exactly these circumstances.

Conversion to general anaesthesia

This may ultimately be necessary for a variety of reasons, including loss of consciousness, airway obstruction, claus-
trophobia, restlessness or grand mal seizure. The conversion rate to general anaesthesia is very low, generally ranging between 1% and 3%. However, tracheal intubation of a patient under surgical drapes with an exposed, or even clamped, internal carotid artery is technically challenging, associated with haemodynamic instability and certainly risky for the patient. A minimalist approach is desirable. Minimal disturbance to the surgical field and the patient’s haemodynamic status may result if a laryngeal mask airway is used to secure the airway after preoxygenation and induction with propofol. This has been reported previously for carotid endarterectomy under elective general anaesthesia and shown to be associated with less hypertensive and tachycardic episodes than general anaesthesia using a tracheal tube. It is our preferred method if conversion to general anaesthesia is required in the peroperative period. The use of the ‘L’ bar over the patient’s head enables rapid access for airway control if it is required in an emergency by swinging the bar away in a caudal direction without de-sterilizing the open carotid wound.

Haemodynamic instability

Haemodynamic instability tends to be less common during regional anaesthesia compared with general anaesthesia. Arterial pressure is measured in both arms non-invasively before operation. Arterial pressure during operation is maintained within 20% of calculated limits either way of the higher of these recordings. For persistent hypertension, an i.v. infusion of a vasodilator such as glyceryl trinitrate 1–5 mg h⁻¹ or beta adrenoceptor block with metoprolol 1 mg or labetalol 5 mg may be used. Persistent hypotension, although much less common under regional than general anaesthesia, should also be treated, for example with a phenylephrine infusion (prepared by diluting phenylephrine 10 mg in 50 ml saline (200 µg ml⁻¹), infusion rate 1–30 ml h⁻¹ (3.3–100 µg min⁻¹)). Infiltration with local anaesthetic or section of the carotid sinus nerve by the surgeon is sometimes performed to reduce intraoperative haemodynamic instability, although it has been shown to increase the incidence of postoperative hypertension and is no longer recommended.

Fluid balance

Major blood losses are rarely a problem during carotid endarterectomy, so perioperative fluid administration should only replace fluid losses. In practice, this is no more than 500–1000 ml of crystalloid fluid. I.v. infusion of large volumes of fluid can lead to a full bladder which may require emptying during operation, a challenging problem, although not insurmountable. Glucose-containing solutions should not be administered to patients undergoing carotid cross-clamping because of the deleterious effects of hyperglycaemia on potentially ischaemic areas of brain.

Patient restlessness

This may be a symptom of inadequate cerebral perfusion. It may also be the result of a patient lying immobile for 3 h under surgical drapes on a hard operating table with their head turned to one side. Some patients find the surgical drapes claustrophobic and become subjectively ‘hot and bothered’ under them. We have found a Bair Hugger forced air warmer (Augustine Medical, Eden Prairie, MN, USA) with temperature set on ambient, blowing cool air onto the patient’s face, to be a very successful means of overcoming this problem (Fig. 5).

It is our experience that limiting i.v. sedation to small doses of benzodiazepines at the beginning of the procedure enhances patient co-operation with surgery. This is further ensured by constant reassurance and appropriate augmentation of the block with local anaesthetic by the surgeon if required. As a last resort, a low-dose propofol infusion (e.g. 20–50 mg h⁻¹) may be used. Rarely, patients cannot tolerate this surgery awake even with adequate regional block and in these patients there is no substitute for general anaesthesia.

Postoperative problems

Postoperative problems after carotid endarterectomy are relatively common (Table 1), which is why careful observation in a well-staffed recovery area is necessary. Haemodynamic complications are particularly common and therefore invasive arterial pressure and ECG monitoring should be continued on recovery. Routine admission to intensive care is probably not necessary. However, a period of close observation is worthwhile. Postoperative haemodynamic monitoring in recovery for 3 h reduced ICU admission to 2.3% and saved 30% of hospital costs. Twenty-four hour total hospital stay has even been reported, although most surgeons and anaesthetists would like to observe their patients after operation for a longer period. Analgesia may be given but is rarely required in recovery after a regional technique. If patients are haemodynamically stable after 4 h, they may be discharged to the ward. If there is evidence of myocardial ischaemia, haemodynamic instability or neurological impairment, they should be transferred to the intensive care unit for further close monitoring.

Wounds must be observed carefully for signs of swelling and, if required, re-explored immediately by the surgeons in the operating theatre. Swelling of wounds may be caused by frank haematoma but also by generalized oedema of the cervical tissues which occurs in all patients undergoing this procedure.
Conclusions
Carotid endarterectomy is likely to become an increasingly common operation as the population ages. Preventative medicine assumes a higher priority and life expectations change. Regional anaesthesia is attractive and gaining in popularity because of easy and reliable monitoring of cerebral perfusion, lower overall costs and possibly a lower incidence of morbidity and mortality. Pending the results of large-scale, randomized, controlled comparisons of general vs regional anaesthesia, the experience of the surgical (and anaesthetic) teams is probably the most important factor in deciding which anaesthetic technique to use for carotid endarterectomy. Cervical plexus blocks are suitable in most patients but a few will always require general anaesthesia.

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