Awake carotid endarterectomy to decrease stroke rate in high-risk patients

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It is controversial whether regional anaesthesia and awake carotid endarterectomy (CEA) is associated with a better perioperative prognosis in comparison with general anaesthesia for CEA. However, awake CEA may well decrease the perioperative stroke risk in patients with pathology associated with a high risk for cerebral ischaemia. This is illustrated in this case report.

Case report

A 56 year old 82kg man presented for a left CEA. He presented initially with dizzy spells and dysarthria. Despite absent carotid artery bruits, Duplex Doppler showed bilateral carotid artery stenoses of 80%.

History

He had a history of smoking, non-insulin dependent diabetes, hypertension and ischaemic heart disease. He had suffered an episode of acute left ventricular failure in the month preceding admission. His oral medications included metformin 850mg 12 hourly, gliclazide 160 mg 12 hourly, nifedipine 30 mg daily, furosemide 40 mg daily and enalapril 5 mg daily. He also received 200mg phenytoin daily for absence seizures.

Examination

On examination he could lie flat and had no features of congestive cardiac failure. Cardiac echocardiography showed a globally poorly functioning left ventricle with an ejection fraction of 30% and mild mitral regurgitation. He had cardiomegaly on chest X-ray and left bundle branch block on the electrocardiogram. His full blood count was normal. He had a urea of 11.1 mmol/l (1.7-8.3mmol/l) and a creatinine of 120 mcmol/l. Random blood glucose was 13.1 mmol/l.

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Anaesthetic Management

Intra-operatively, he was given atenolol 5mg and midazolam 1 mg intravenously. Invasive arterial blood pressure monitoring was established under local anaesthesia. A single injection, deep cervical plexus block with 20ml 0.25% bupivicaine was given after eliciting paraesthesiae at C3. This was supplemented with a superficial cervical plexus block of 10 ml 0.25% bupivicaine. The skin of the mandible was infiltrated with 5 ml 0.25% bupivicaine.

The patient's blood glucose was 5.5 mmol/L. He was haemodynamically stable with a heart rate of 65 and blood pressure of 140/65. The patient was awake and cooperative. Neurological monitoring included communication with the patient and a transduced pressure monitor in the contralateral hand to observe a hand squeeze on command. The patient experienced no symptoms on clamping the carotid artery. The carotid artery stump pressure was 32 mmHg. As there were no symptoms of cerebral ischaemia, the decision was taken to proceed without an internal carotid artery (ICA) shunt. During the carotid artery clamp, the patient had two episodes of dysarthria. The systolic blood pressure was 110 mmHg on both occasions. Administration of 100mcg phenylephrine intravenously resulted in resolution of the dysarthria on both occasions. Total clamp time was 27 minutes.

There were no further complications and the patient was discharged two days later. He has subsequently had a right CEA under regional anaesthesia with no complications.

Discussion

Awake CEA is theoretically attractive in preventing strokes associated with CEA, as it results in less ICA shunt insertion and higher arterial perfusion pressures than general anaesthetic techniques.[1] This case report illustrates two important benefits of an awake CEA. Firstly, ICA shunting can be avoided despite significant contralateral carotid artery disease and a concomitant low carotid artery stump pressure. Secondly, early signs of cerebral ischaemia can be reversed with blood pressure manipulation.

ICA shunting is associated with morbidity.[2] Patients with

contralateral carotid artery occlusion or severe stenosis are up to six times more likely to require ICA shunting than patients with unilateral carotid artery disease.[3,4] The use of regional anaesthesia decreases the use of shunts.[1,5] A trial occlusion of the carotid artery in the awake patient is recommended to determine the need for ICA shunt insertion[6], as opposed to less reliable techniques such as carotid artery stump pressure. Even with severe contralateral stenosis or occlusion, awake neurological assessment as a determinant of the ICA shunt insertion results in a very low stroke rate (2.1%)[7], probably because cerebral ischaemia necessitating ICA shunting is identified and unnecessary ICA shunting avoided.

Although a low carotid artery stump pressure may have a high sensitivity for cerebral ischaemia on clamping of the carotid artery, the lower specificity means that nearly 20% of patients may be shunted unnecessarily.[8] Although the frequency of shunting increases with decreasing carotid artery stump pressures, even a stump pressure below 25 mmHg is not necessarily an indication for ICA shunt insertion.[9] The problem with performing general anaesthesia is that a low carotid artery stump pressure will often result in ICA shunting, although it may not be necessary (as in this patient). The answer however is not a less aggressive approach to ICA shunting under general anaesthesia, as major morbidity during general anaesthesia has been associated with the avoidance of ICA shunting.[10] Thus ICA shunting presents a very real dilemma under general anaesthesia.

Cerebral perfusion pressure is another important consideration for CEA. General anaesthesia for CEA may result in more patients experiencing blood pressure variations associated with cerebral ischaemia than awake regional anaesthetic techniques.[11] The use of vasopressors to keep the arterial pressure within 20% of the baseline increases the risk of myocardial ischaemia[12], and it is thus recommended that selective augmentation of the blood pressure is practised.[13] Awake CEA is attractive as the need for blood pressure manipulation may be less.[11] In addition, selective augmentation of the blood pressure can successfully reverse neurological deficits during carotid artery clamping, obviating the need for ICA shunting.[14] Similarly in this case, blood pressure manipulation on two occasions reversed cerebral ischaemic symptoms, despite contralateral carotid artery stenosis and the absence of an ICA shunt.

In summary, in appropriately selected patients, awake CEA may diminish stroke rates in patients with bilateral severe carotid artery stenosis or contralateral carotid artery occlusion.

References

1. *McCleary AJ, Maritati G, Gough MJ. Carotid endarterectomy; local or general anaesthesia? Eur J Vasc Endovasc Surg 2001; 22: 1-12*
2. *Salvian AJ, Taylor DC, Hsiang Yn, et al. Selective shunting with EEG monitoring is safer than routine shunting for carotid endarterectomy. Cardiovasc Surg 1997; 5: 481-5*
3. *Hafner CD, Evans WE. Carotid endarterectomy with local anesthesia: results and advantages. J Vasc Surg 1988; 7: 232-9*
4. *Connolly JE. Carotid endarterectomy in the awake patient. Am J Surg 1985; 150: 159-65*
5. *Stoneburner JM, Nishanian GP, Cukingnan RA, Carey JS. Carotid endarterectomy using regional anesthesia: a benchmark for stenting Am Surg. 2002; 68: 1120-3*
6. *Luosto R, Ketonen P, Mattila S, Takkunen O, Eerola S. Local anaesthesia in carotid surgery. A prospective study of 111 endarterectomies in 100 patients. Scand J Thorac Cardiovasc Surg 1984; 18: 133-7*
7. *Karmeli R, Lubezky N, Halak M, Loberman Z, Weller B, Fajer S. Carotid endarterectomy in awake patients with contralateral carotid artery occlusion. Cardiovasc Surg 2001; 9: 334-8*
8. *Cao P, Giordano G, Zannetti S, et al. Transcranial Doppler monitoring during carotid endarterectomy: is it appropriate for selecting patients in need of a shunt? J Vasc Surg 1997; 26: 973-9*
9. *Gnanadev DA, Wang N, Comunale FL, Reile DA. Carotid artery stump pressure: how reliable is it in predicting the need for a shunt? Ann Vasc Surg 1989; 3: 313-7*
10. *Love A, Hollyoak MA. Carotid endarterectomy and local anaesthesia: reducing the disasters. Cardiovasc Surg 2000; 8: 429-35*
11. *Illig KA, Sternbach Y, Zhang R, et al. EEG changes during awake carotid endarterectomy. Ann Vasc Surg 2002; 16: 6-11*
12. *Smith JS, Roizen MF, Cahalan MK, et al. Does anesthetic technique make a difference? Augmentation of systolic blood pressure during carotid endarterectomy: effects of phenylephrine versus light anesthesia and of isoflurane versus halothane on the incidence of myocardial ischemia. Anesthesiology 1988; 69: 846-53*
13. *Modica PA, Tempelhoff R, Rich KM, Grubb RL Jr. Computerized electroencephalographic monitoring and selective shunting: influence on intraoperative administration of phenylephrine and myocardial infarction after general anesthesia for carotid endarterectomy. Neurosurgery 1992; 30: 842-6*
14. *Stoneham MD, Warner O. Blood pressure manipulation during awake carotid surgery to reverse neurological deficit after carotid cross-clamping. Br J Anaesth 2001; 87: 641-4.*