Cervical Block Versus General Anesthesia in Carotid-Subclavian Bypass Surgery

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Citation

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Abstract

Background: Carotid-subclavian bypass surgery is a procedure carrying the risks of neural and/or myocardial injury. Therefore, awake, responsive patients are desired, in order to be aware of any injury immediately during surgery and to change the strategy as required.

Materials and Methods: In this study, the medical records of 66 patients undergoing carotid-subclavian bypass surgery between January 1990 and January 2003 were reviewed to compare combined superficial-deep block (Group I; n=41) and general anesthesia (Group II; n=25) with respect to short-term results.

Results: There were no intraoperative mortalities. One peroperative cerebrovascular accident was observed in patients with the carotid-subclavian bypass procedure. There was only one death due to myocardial ischemia early in the postoperative period. Both patients had been given general anesthesia. There were six (9%) morbidities within this period, as follows: three reoperations due to bleeding, one brachial embolectomy due to embolization of the distal arterial system, and two reoperations due to early graft thrombosis.

Conclusions: Combined superficial-deep cervical plexus block is practical and clinically superior alternative to general anesthesia for carotid-subclavian bypass surgery .

INTRODUCTION

Peripheral nerve blocks are cost-effective and safe anesthetic techniques that are receiving growing attention all over the world. In addition to their general numerous benefits, including patient satisfaction and early hospital discharge, in some special operations both the surgeon and the anesthesiologist prefer the patient awake because of the risk of neurologic injury.

Subclavian steal syndrome (SSS) occurs when there is stenosis or occlusion of the subclavian artery proximal to the vertebral artery. This blockage reverses normal direction of blood flow in the vertebral artery, and is named “steal” because it steals blood from the cerebral circulation. Subclavian steal syndrome is diagnosed with the symptoms of reversed vertebral artery flow causing cerebral ischemia with associated symptoms of vertebrobasilar hypoperfusion and/or symptoms of brainstem or arm ischemia. This syndrome is still an important consideration in the differential diagnosis of cerebral and brachial ischemia [1].

Additionally, occlusive disease of the subclavian artery today seems to cause another subset of SSS, that is, the coronary-subclavian steal syndrome (CSS) that occurs in patients who have undergone coronary artery revascularization with the internal mammary artery [2,3,4,5]. After left internal mammary artery (IMA) graft surgery to the coronary artery, the vascular segment between the origin of the subclavian artery and the coronary artery becomes part of the coronary circulation functionally. Thus, stenosis in each part of this segment can directly cause myocardial ischemia.

The aim of the treatment is to restore permanent antegrade blood flow to the vertebral and internal mammary arteries, and thereby to eliminate cerebral and myocardial hypoperfusion. The traditional treatment of SSS has been surgery [6,7,8]. In this situation, extra-anatomic revascularization with carotid subclavian bypass can be performed to prevent cerebral and/or myocardial ischemia, which is particularly important for patients with CSS due to the risk of having to redo coronary artery reconstruction [9,10]. In this procedure because of the possibility of cerebral and/or myocardial ischemia, awake, cooperative, responsive patients are desired. Combined superficial-deep cervical plexus block provides for excellent operating conditions in this regard.

PATIENTS AND METHODS

In this retrospective study, the medical records of 66 patients undergoing carotid-subclavian bypass for symptomatic occlusive subclavian artery disease were reviewed. Fifty-four patients with SSS and 12 patients with CSS underwent surgery in which polytetrafluoroethylene (PTFE) grafts were used (Gorotex; W.L. Gore and Associates, Inc, Flagstaff, Arizona) between January 1990 and January 2003 at our institution. The medical records were reviewed to establish the demographic data, risk factors, presenting clinical manifestation, location of the subclavian disease, and immediate postoperative results. Indications for surgery were classified as arm ischemia (claudication or rest pain), symptomatic subclavian steal or vertebrobasilar insufficiency (VBI), or myocardial ischemia.

All patients underwent noninvasive dupplex ultrasonographic scanning and angiographic evaluations (four-vessel arch aortography with carotid and subclavian arteriography) before surgery. Following diagnosis, the patients were also assessed for operation by neurologists to rule out other causes of the symptoms. The appropriate anesthesia type for patients was determined by considering overall patient status and noninvasive and invasive evaluations as well as preferences of the anesthesiologist, surgeon, and patient.

A 20-gauge cannula was placed in the contralateral radial artery for blood pressure monitoring. In addition, five-lead electrocardiography (leads II and V5) and pulse oximetry were monitored before placement of the cervical block. Optimal oxygenation by the use of nasal canula was ensured through the entire procedure.

A deep cervical plexus block was performed with the patient in supine position and the head facing away from the side to be blocked. For this block we used the mastoid process, transverse process of the sixth cervical vertebra (C6), and the posterior border of the sternocleidomastoid muscle as landmarks [13]. After a line connecting the mastoid process to the transverse process of the C6 was drawn, C2 and C4, were found to be 2 and 4 cm caudal from the mastoid process, respectively. Thereafter a needle was inserted and advanced at an angle perpendicular to the skin plane until the transverse proces was contacted.

At this point, the needle was withdrawn 1 to 2 mm, and 4 mL of 2% lidocaine was injected slowly with intermittent aspiration to rule out intravascular injection. Then superficial cervical plexus block was performed by injecting 10 mL of 2% lidocaine at the midpoint of the posterior border of the sternocleidomastoid muscle using a “fan” technique. The surgeon supplemented the blocks with local infiltration of 1% lidocaine as neccessary.

General anesthesia was induced with propofol 2 mg/kg IV and fentanyl 2 μg/kg IV, and maintained with sevoflurane (1% to 2%) and 3 L/min of nitrous oxide in 3 L/min oxygen. Muscle relaxation was provided by vecuronium bromide 0.1 mg/kg.

After the surgical exposure of the common carotid and subclavian arteries through an anterior supraclavicular incision, the subclavian artery and carotid artery were identified and exposed for bypass. The identified portion of the subclavian artery was distal to the IMA and medial to the brachial plexus. Subclavian distal anastomosis was principally applied before carotid anastomosis under cross-clamp. During the cross-clamp period, patients receiving cervical plexus block were asked questions to assess mental and cardiac status, which is the main superiority of peripheral nerve blocks to general anaesthesia. Perioperative morbidity and mortality were defined as events occurring within 30 days of operation.

RESULTS

The main clinical presentation was SSS in 54 patients, and CSS in 12 patients. The demographic characteristics of the patients are summarized in Table I. In the SSS group, 21 (39%) patients were given general anesthesia whereas 33 (61%) were given cervical block. Two patients in the cervical block group required concomitant carotid endarterectomy (CEA) for high-grade stenosis before the bypass procedure. In the CSS group, 8 (75%) patients were given nerve block and 4 (25%) of them received general anesthesia (Table II). No patients in the cervical block group required conversion to general anesthesia.

Figure 1

Table 1: Demographic characteristics of patients

Demographic		S.S.S		C.S.S
	No.	Percentage	No.	Percentage
Average age (years)		60 (range, 42-70)		66 (range, 62-74)
Men/women	32/22	60%/40%	9/3	75%/25%
Smoking	35	65%	10	83%
Diabetes mellitus	15	27%	3	25%
Hypertension	24	45%	6	50%
Coronary disease	19	35%	12	100%
Cerebrovascular disease	10	20%	4	33%
Peripheral arterial diseae	10	20%	5	42%
Carotid artery disease	30	55%	6	50%
Site of lesion: left/right	39/15	72%/28%	12	100% left
Stenosis/occlusion	20/34	38%/62%	3/9	25%/75%

All of the patients who underwent surgery for subclavian artery disease were symptomatic. Table II summarizes the predominant symptoms of the patients. The symptoms of cerebral ischemia were predominant in 43 patients (80%).

Figure 2

Table 2: Patient symptoms

	S.S.S		C.S.S	
Symptoms	Number	%	Number	%
Dizziness/vertigo	38	70%	6	50%
Syncope	20	37%	2	15%
Ataxia	7	12%	6	50%
Visual field disturbance	8	15%	4	25%
Hemiparesis	3	5%	0	0%
Claudication	14	27%	2	15%
Distal embolus	5	10%	0	0%
Digital necrosis	2	2%	0	0%
Myocardial ischemia	2	2%	12	100%

Figure 3

Table 3: Type of anesthesia for carotid-subclavian bypass patients

Type of anesthesia			
Patients with	General	Local	Total
S.S.S	21 (39%)	33 (%61)	54
C.S.S	4 (25%)	8 (%75)	12
Total	25 (38%)	41 (62%)	66

However, symptoms of arm ischemia were predominant in only 11 patients (20%) with SSS. The most common symptom of cerebral ischemia was dizziness, which was found in almost 70% of all cases. Loss of consciousness and/or previous syncope were present in 37% of the patients. However, intermittent claudication, the most common symptom of ischemia of the upper extremities, was found in 27% of all cases. The predominant symptom in patients with CSS was the recurrent chest pain after aortocoronary bypass surgery (ACBG). The mean duration between the initial ACBG with the in-situ IMA conduit and the recurrent chest pain due to symptomatic steal was 60 months (range, 24 to 116 months).

There was no intraoperative mortality in our patients who were operated on due to symptomatic SSS and CSS. Only one peroperative cerebrovascular accident was seen in patients with SSS during the carotid-subclavian bypass procedure. That patient was given general anesthesia. Upon examination of perioperative morbidity and mortality occurring within 30 days of operation, we noted only one death on the second postoperative day due to myocardial ischemia. This patient also had received general anesthesia. Six (11%) morbidities in patients with subclavian artery disease were observed within this period. Two patients operated upon under general anesthesia and one patient operated upon under regional anesthesia were reoperated due to bleeding. One patient receiving regional anesthesia underwent brachial embolectomy due to embolization of the distal arterial system. In addition, two patients with SSS underwent reoperation due to early graft thrombosis (one was operated under general and the other under regional anesthesia). These two patients were given general anesthesia in the second operation.

The patients who underwent regional anesthesia were discharged from the hospital after a mean of 2.68 ±0.64 days. However, patients who underwent the operation under general anesthesia were discharged from the hospital after a mean of 3.4 ±0.81 days ($p<0.01$).

DISCUSSION

A combined superficial-deep cervical plexus block is an effective alternative to general anesthesia in patients undergoing carotid-subclavian bypass surgery.

The cervical plexus is formed by the anterior rami of the first four cervical nerves. It is located in the tissue plane behind the sternocleidomastoid muscle and gives off both superficial and deep branches. The superficial cervical plexus supplies the skin and the superficial structures of the head, neck, and the shoulder. The deep branches, on the other hand, supply the deeper structures including the muscles of the anterior neck and the diaphragm [11].

In some special surgeries, such as carotid endarterectomy and carotid-subclavian bypass, fully conscious, oriented, and cooperative patients are required. Regional anesthesia for carotid endarterectomy is now a well-accepted technique [12,13]. But the same technique is not common for the carotid-subclavian bypass procedure. Since this procedure also has the risk of neurologic injury, regional anesthesia might be the appropriate technique.

The most common location for an atherosclerotic lesion causing reversal of blood flow is the proximal part of the left subclavian artery. Fortunately, this part is easy to expose through a supraclavicular incision under cervical block. In addition to the effectiveness of the regional technique to be used, other factors must also be considered before selection of the block.

These factors include the difficulties that might be confronted in performing the block, the total dose of local anesthetic used, the potential complications of the block used, and the patient's psychological state. Both deep and superficial cervical plexus blocks are associated with complications [14]. Deep cervical block has been reported to cause diaphragmatic dysfunction, which may have an important impact on patients with underlying respiratory disease [15,16]. Epidural or subarachnoid injections may also be seen during placement of a deep cervical block as well as injection into the vertebral artery. But the rate of such complications is very low, especially when the block is performed by an experienced anesthesiologist. We did not see any of these complications in our patients.

An unresolved topic is whether paresthesia should be sought actively during placement of a regional block. It is thought that paresthesia occurs due to mechanical stimulation of the nerve. Some authors suggest that the paresthesia technique may lead to neuropathy [17]. However, Stoneham and associates reported that deep cervical block with paresthesia was more effective and that the requirement for an additional local anesthetic was less [18]. Nevertheless, in the modern practice of peripheral nerve blocks, the paresthesia technique is unreliable, especially in some “deep” blocks, and causes greater patient discomfort [11].

In the field of peripheral nerve blockade, another very important concern is local anesthetic toxicity. Some authors suggest that the overall dose of local anesthetic used may be very high when combined deep and superficial blocks are used [19,20]. Although we did not measure the blood levels of lidocaine, we did not see any signs and symptoms of local anesthetic toxicity in our patients.

The impact of different anesthetic techniques on hemodynamics, especially in patients with cardiac problems, is another topic under debate. Sbarigia and associates compared regional and general anaesthesia with respect to the hemodynamic impact of these two techniques in patients undergoing carotid endarterectomy. They reported that patients who received cervical block had a rate of myocardial ischemia that was half that of patients who had general anesthesia [21]. Allen and associates found that general anesthesia was related to greater blood pressure instability [12]. In our patients, only one individual who was given general anaesthesia had myocardial ischemia on the second postoperative day, and unfortunately died. There were no cardiac events in patients receiving regional anesthesia, which is parallel to what Allen and associates have reported [12].

On the other hand, comparing the neurologic outcomes of the two techniques, only one of our patients had a cerebrovascular accident; this patient had been given general anesthesia. This is consistent with the principle that has become generally accepted— that no monitoring device can be as accurate as an awake patient.

This study was limited by the small number of patients undergoing carotid-subclavian bypass surgery. But the results are in agreement with those of other studies [12,21,22,23]. Thus we suggest that cervical block is an effective and practical alternative to general anesthesia, particularly in high-risk and elderly patients.

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