ADVANTAGES OF CAROTID ENDARTERECTOMY UNDER LOCAL ANAESTHESIA WITH MINIMAL CEREBRAL MONITORING: AN EXPERIENCE OF 45 CASES

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ABSTRACT

Objective: To evaluate the benefits, efficacy and safety of local cervical plexus block in the performance of carotid endarterectomy, in the absence of sophisticated cerebral perfusion monitoring.

Place and Duration of Study: This study was carried out at Combined Military Hospital (CMH) Lahore, Pakistan from January 2012 to May 2013.

Study Design: Quasi-experimental study.

Patients and Methods: A total of 45 cases of ASA II and ASA III physical status were operated for carotid endarterectomy under local block of cervical plexus. After thorough preanaesthetic assessment, the patients physical conditions were optimized before surgery. Premedication was given with midazolam and sedated during operation with small doses of propofol. Local anaesthesia (LA) was completed by injecting bupivacaine in cervical plexuses C2, C3 and C4 areas. During operation vital signs and adequacy of cerebral perfusion were monitored by keeping the patient awake and making clinical neurological observations. Verbal contact was maintained with the patient. Breathing patterns and motor power were assessed in contralateral upper and lower limbs. Postoperatively patients were interviewed and analgesia during operation was assessed with visual analogue scale. Surgeon's satisfaction regarding intraoperative analgesia was also noted. Patients who required added sedation or local anesthetic agent were also noted. Average duration of surgery time was two hours and average stay of the patients in hospital was five days.

Results: Out of 45 patients, 37 patients (82%) had smooth and comfortable anaesthesia and analgesia. In only 1 patient (2.2%) LA had to be converted into general anaesthesia (GA). In 3 cases (7%) LA was supplemented. One patient (2.2%) developed hoarseness and difficulty in breathing and 1 patient (2.2%) developed hemiparesis intra-operatively; while 1 patient (2.2%) developed hypotension in the immediate postoperative period. One patient (2.2%) developed haematoma at infiltration site. Surgeon satisfaction was excellent in 40 (89%) cases.

Conclusion: Surgery of carotid endarterectomy can be performed adequately and comfortably under LA. In centers where sophisticated facilities for intraoperative cerebral blood flow measurements are not available, clinical intraoperative assessment of cerebral functions is of immense benefit, which is only possible under LA.

Keywords: Carotid endarterectomy, Cerebral monitoring, Local anaesthesia.

INTRODUCTION

Carotid artery disease is a manifestation of generalized arteriosclerosis. In carotid artery atherosclerotic plaques develop at the lateral aspect of bifurcation of the carotid artery[1]. The severity of process parallels that in the other major vessels. Thrombosis is most likely to occur where plaques narrow the lumen to the greatest degree. Internal carotid arteries and vertebral arteries form circle of Wills for brain blood supply[2]. Between systolic pressure 50 and 150 mmHg cerebral blood flow is auto regulated. In hypertensive individuals upper and lower limits of auto regulatory curve are shifted to right, to higher pressures. The principle determinants of cerebral blood flow (CBF) are nerve cell activity, cerebral perfusion pressure, $PaCO_2$, the pH of extracellular fluid in the brain, $PaCO_2$, and neurogenic influences[4].

Patients undergoing carotid endarterectomy may have either local anesthesia (LA) or general anaesthesia (GA). Each type of anaesthesia has advantages and disadvantages that must be considered when choosing optimal anaesthetic for each patient. Benefits of GA include a still

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Received: 07 Jun 2013; Accepted: 19 Sep 2013

patient and a quiet operative field, early control of the airway and ventilation, and the ability to protect the brain should ischemia develop[5]. A major disadvantage of GA is the inability to perform repeated neurological evaluation during surgery. Different studies also suggests that LA allows for greater stability of blood pressure, decreased requirements for vasoactive medications and a decreased incidence of peri operative myocardial infarction[6]. Potential complications associated with LA include seizures, alteration of mental status and loss of patient cooperation associated with cerebral hypo-perfusion, inadequate ventilation and sedation[7].

The surgical technique for carotid endarterectomy involves clamping the carotid artery above and below the diseased area. The artery is most commonly opened using a longitudinal incision, the atheromatous plaque is dissected out and the artery closed. During this time cerebral hemisphere supplied by that artery is at risk of hypo-perfusion and permanent ischemic damage. When the artery is cross clamped the blood flow to the hemisphere must be supplied entirely by the contra lateral internal carotid artery and vertebral arteries along with anterior and posterior communicating arteries of the circle of Willis. Assessing the adequacy of cerebral perfusion during cross clamping is a major issue during this operation[8]. This is usually monitored by EEG, Somatosensory evoked potentials, transcranial doppler and carotid artery stump pressure[9].

In the absence of above mentioned monitoring of cerebral perfusion such surgery becomes quite risky when performed under GA. Most operation theatres in our part of the world, including our own, lack most of these modern, but essential monitoring facilities. However, when surgery is performed under LA, neuro observation efficiently monitors adequacy of cerebral perfusion[10]. The objective of this study was to evaluate the benefits, efficacy and safety of local cervical plexus block in the performance of carotid endarterectomy in the absence of sophisticated monitoring, without compromising patient's or surgeon's comfort at work.

PATIENTS AND METHODS

This quasi-exprimental study was carried out in Combined Military Hospital (CMH) Lahore. Study period was from Jan 2012 to May 2013. CMH Lahore is a tertiary care hospital where patients of vascular pathology are referred from nearby other military hospitals, as well as civilian referrals.

All patients with critical carotid stenosis referred to the vascular surgeon were included in the study. Patients who were grossly disoriented and who were not willing for surgery under LA were excluded. Since majority of the patients were on different medical therapies for their coexisting diseases their medications were continued in the peri operative period and where ever it was required patient's medical condition was optimized by referring them to appropriate physicians. Necessary laboratory investigations were done to diagnose the extent of coexisting pathological problems. In preoperative visit all patients were explained about anaesthetic technique. Patients were reassured for analgesia and safety in the anaesthetic technique, and a request was made for their intraoperative cooperation. Midazolam in a dose of 1.5 mg intravenously was given one hour before the start of the surgical procedure. Just before the start of operation about 40 mg sedating dose of propofol was given for moderate sedation during operative procedure.

Technique of Local Anaesthesia

In our study superficial and deep cervical plexuses were blocked in the sensory areas of C2 to C4. Superficial cervical plexus block was performed by infiltrating 0.5% bupivacaine along middle third of posterior border of sternocleidomastoid (fig-1) and deep cervical plexuses were blocked with three injections as

Described in standard text books[2,4]. Some recent studies have also propagated the use of ropivacaine[11]. Patients were monitored with ECG, oxygen saturation, temperature, expired CO_2, non invasive continuous BP and CVP. Intraoperative clinical neuro-monitoring was performed to check the safety and efficacy of LA, using the following observation:

- Eye opening to spontaneous, verbal or painful stimulus.
- Verbal response of the patient.
- Motor response by asking the patient to move upper and lower limbs on the contra lateral side.
- Breathing was monitored: comfortable, snoring or difficult.
- Gestures of patients were noted that represented level of comfort to surgical stimulus by looking at their faces intermittently.

The comfort of the patient was catered for. Arm to be used for intraoperative power and movement monitoring was occasionally held for reassurance. Routine precautions for fluid infusions and plasma glucose control were ensured. The patient's blood pressure was maintained in its high normal range. In patients with coronary artery disease excessive elevation in the blood pressure was avoided. To ensure control of postoperative hypertension, arterial and venous vasodilators like hydralazine, sodium nitroprusside and in some cases metoprolol were used[12]. To counter loss of chemoreceptor function supplemental oxygen was given to avoid undesirable ischemia[13]. Postoperatively these patients were kept in intensive care for close monitoring.

To validate the benefits, efficacy and safety of this technique patient's were interviewed about comfort and analgesia during the procedure. For this scoring was done on a standard descriptive scale comprising of 5 levels (excellent, good, satisfactory, fair and poor). Adequacy of analgesia was also determined by interviewing the operating surgeon about patient cooperation. Surgeon satisfaction was also rated into 5 levels (excellent, good, satisfactory, fair and poor). Safety was checked by noting down any complications.

The results were noted down on a proforma for each patient and entered in statistical package for social sciences (SPSS – version 16). It was analyzed for descriptive statistics using percentages with frequencies.

Table-1: The anaesthetist experience of adequacy of analgesia.

Satisfactory analgesia	Added requirement of local anaesthesia (LA)	Added requirement of sedation	Complications of local anaesthesia (LA)	Conversion to general anaesthesia (GA)
37 (82%)	3 (7%)	3 (7%)	1 (2%)	1 (2%)

Table-2: Surgeon's satisfaction levels reported after surgery of 45 patients.

Satisfaction level	n (%)
Excellent	40 (89%)
Good	4 (8.8%)
Satisfactory	1 (2.2%)
Fair	0 (0%)
Poor	0 (0%)

Table-3: Patient's satisfaction reported after surgery.

Satisfaction level	n (%)
Excellent	37 (82%)
Good	6 (14%)
Satisfactory	1 (2%)
Fair	0 (0%)
Poor	1 (The converted case) (2%)

RESULTS

Total number of the cases for this study was 45. The average age of the patients was 71.5 year (range: 45-80 year), with 34 (75.5%) being males. A thorough preanaesthetic assessment was made

for common coexisting diseases such as coronary artery disease, chronic obstructive pulmonary disease (COPD), and diabetes. In our study 30 (66.7%) patients were known hypertensive; 20 (44.4%) had diabetes and 10 (22.2%) had stents placed in their coronary arteries. Out of these 3 (6.7%) patients had undergone coronary bypass operation and 5 (11.1%) patients had COPD.

Left carotid artery was involved in 24 (53.3%) patients. Right carotid artery was involved in 12 (26.7%) cases. In 9 (20%) cases there was bilateral disease. Nearly half of the patients were asymptomatic or had minimal symptoms clinically. Among symptomatic patients 15 (33.3%) were having transient ischemic attacks (TIA's), 7 (15.5%) patients presented with hemiparesis.

All 45 cases that were operated under LA consented happily, after reassurance and explanation of the block. Three patients out of 45 (7%) cases complained of discomfort where sedation had to be supplemented with propofol. In another 3 cases (7%) LA had to be supplemented. In one patient (2.2%) we lost the patient's cooperation as patient developed hoarseness and difficulty in breathing and LA had to be converted into general anaesthesia. One patient (2.2%) developed hemiparesis intra operatively. In all the remaining cases surgery was completed uneventfully (table-1).

In 40 patients (89%), operating surgeon reported the anesthesia conditions as 'excellent'. In the remaining 5 patients surgeon had some problems as patient was uneasy and moving during the operation, but no major complaints were noted (table-2).

Postoperatively 37 patients (82%) were satisfied and did not remember any discomfort during surgical procedure. In none of the cases seizures were witnessed as potential toxicity of local anesthetics (table-3).

Postoperatively 7 patients (15.5%) had abnormal elevation of the blood pressure which had to be managed with beta blockers (metoprolol) and sodium nitroprusside. One patient had transient hypotension which was corrected by volume replacement. One patient developed haematoma at the operative site, unrelated to the anesthetic infiltration. None of the patients in our study suffered myocardial infarction.

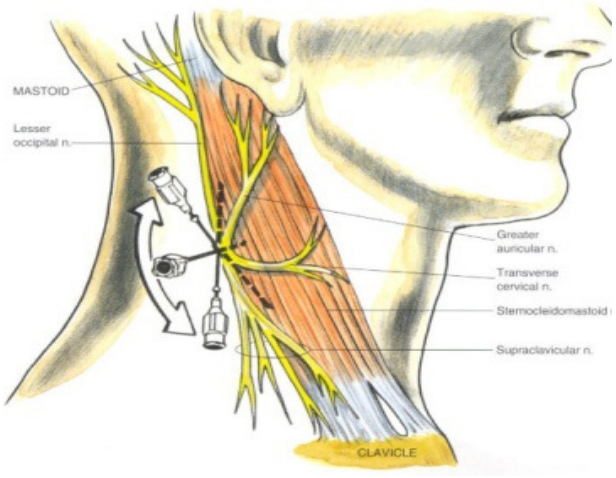

Figure-1: Blockage of superficial cervical plexus.

DISCUSSION

Postoperative studies of carotid endarterectomy in Europe and North America have demonstrated a benefit of surgical treatment for symptomatic patients with more than 70% carotid artery stenosis compared with medical management alone[14]. Practice is changing as a result of these studies and one European carotid artery surgery trial suggests a three to five fold increase in the number of operations performed[15]. One area of debate is choice of anaesthetic technique and its effect on the morbidity and mortality. Despite many years of experience hard evidence confirming best practice is lacking[16]. Preference of anaesthesia is individualized on the personal experience and liking and disliking of anesthesiologists and the preference of operating surgeon but in general no one technique has found clear advantage over the other. The argument becomes different if the recommended monitoring of cerebral perfusion, required for GA is not available, as in most of our setups. LA technique is comparatively simple to learn and

perform, with the added benefit of performing simple neuro-observations during surgery. Another benefit quoted is the absence of postoperative cognitive dysfunction, which can occur in up to 25% of patients have CE under GA[17]. Of course, GA will still be required if patient prefers or conversion becomes necessary[18]. A few studies using remifentanil, with preserved consciousness and the patient alert and collaborating, represents a third valid option that combines the advantages of both GA and LA[19].

Studies comparing LA with GA in carotid endarterectomy surgery have provided evidence of benefits of LA i.e. lower incidence of shunt, greater safety in elderly, less perioperative hemodynamic instability, through assessment of neurological function, lower cardiac and pulmonary complications, and appropriateness in ischemic cardiac disease[20]. Patients who undergo surgery under LA are awake; neuro-observation and motor activity are easy to monitor which offers great advantage over GA. In addition, as reported in our results above there are less hemodynamic fluctuations during local anesthesia as compared to GA[21].

Monitoring of cerebral perfusion during operation, especially when being performed under GA is very important for the anaesthetic and surgical outcome of the operation[22]. These monitoring techniques include the somatosensory evoked potentials, transcranial doppler, internal jugular venous oxygen saturation, internal carotid artery stump pressure. These sophisticated monitoring is either non-existent or cannot be extended to operating areas in our set up. Since neuro-observation can give a reasonable clue to intact cerebral perfusion, surgery of carotid endarterectomy under LA offers much safer option. We only had one complication out of 45 surgeries, and with up to 89% of patients reporting excellent analgesia during surgery. This complication rate compares favourably with 0-4% reported in the literature[23]. Performing surgery under GA without proper monitoring will be like working in a dark unsafe environment[24].

In our experience majority 96% of the patient consented happily for operation under LA when adequate counseling was done for the benefits of LA. Only one patient (2%) preferred to be sleeping instead of being awake during operation. The 82% satisfied patients when interviewed postoperatively, did not remember any discomfort during operation. One patient (2%) developed hemiparesis during operative procedure which was attributed to his previous vascular pathology and surgical complication. The 30-day incidence reported in literature of stroke and death or both is lower for LA group[25]. We did not have a single death. Even in countries where advanced monitoring is available, and GA or LA can be given equally well, 67% still wanted to have it done under LA[26]. It is also not justified to refer high risk patients for stenting or other procedures, just to have them fit for GA, when most of these cases can be performed under LA[27].

Another important factor is the complaint of the surgeons about the patients which may move or moan and distract the surgeon in this complicated procedure. But the surgeon reported an 89% excellent grade. In short LA if performed carefully and skillfully is the most preferable and extremely useful in most of our set ups, as well as in similar resource poor societies.

CONCLUSION

In international studies there is no significant difference in the outcome of the surgery with local or GA in terms of restenosis, neurological events and death in the long term periods. However working in less than ideal conditions where sophisticated monitors for cerebral perfusion are not available, LA is a much safer option, without increasing patient or surgeon's discomfort; but ensuring safety comparable to fully monitored GA.

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