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Clinical experience

The hemodynamic effect of intermediate cervical plexus block compared to general anesthesia in high risk patients with carotid endarterectomy

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Key words: intermediate cervical block, general anesthesia, carotid endarterectomy

Abbreviations:
ICB – intermediate cervical block
GA – general anesthesia
CEA – arotid endarterectomy
SCM – sternocleidomastoideus
C6 – cervical vertebra 6
ICU – intensive care unit
MAP – mean arterial pressure

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Abstract

Background and purpose: *Preventive open carotid surgery is a mainstay treatment for stenosis of internal carotid artery. Anesthesia management is crucial in these patients with many comorbidities. Both, general or regional anesthesia are the correct choice. The purpose of our trial was to compare the hemodynamic stability of intermediate cervical plexus block relative to general anesthesia in ASA III and ASA IV patients.*

Materials and methods: *Prospective study, approved by ethics committee, was conducted in the University hospital Zagreb from 2006 till 2010. Eighty nine high risk patients with carotid endarterectomy were enrolled. Thirty five patients were performed in the intermediate cervical block and fifty four in general anesthesia. From medical records, following data were collected – age, sex, ASA status. Mean arterial pressure was calculated. The change of mean arterial pressure during the operation for more than 20% was considered as hemodynamic instability. Postoperative hospital stay was recorded.*

Results: *Significantly higher hemodynamic stability is found in the group of patients with intermediate cervical block (chi-square test=27,763, $p<0,01$). The median intensive care unit stay was 2,47 days for general anesthesia group, compared to one day for intermediate cervical group.*

Conclusion: *General anesthesia and intermediate cervical block provide effective anesthesia condition for carotid endarterectomy. According to the results of our trial, intermediate cervical block compared to general anesthesia is more hemodynamic stable, associated with shorter hospital stay.*

INTRODUCTION

Stenosis of internal carotid artery is one of the leading cause of cerebral infarction. Both, general or regional anesthesia are used successfully for carotid surgery *(1, 2, 3)*. Intermediate cervical block (ICB) is relatively simple technique and together with mandibular branch block and local anesthesia of the jugular region efficient for open carotid surgery *(3, 4)*. ICB has less complications compared to deep cervical block and is more successful than superficial cervical block. The main advantage of cervical block regarding general anesthesia (GA) is awake patient with maintained cerebral autoreguation (1, 3, 5, 6). Up to now, patient's consciousness is the best monitoring of adequate cerebral circulation and efficient perfusion. On the other

hand, GA and anesthetics have protective effect on cerebral cells. They decrease oxygen demand, and therefore prevent hypoxia in the case of cerebral hypoperfusion. However, the problem in GA is monitoring. So far neither monitoring was effective as awake patient. But why is it so important? It is important, in making decision, to put or not to put the shunt. Yet, placement of the shunt carries with itself risk of embolisation and possible cerebral incident *(3, 6)*. In accordance with stated, cervical block has advantages compare to GA.

Mostly, patients with stenosis of internal carotid artery have numerous comorbidities *(3, 7)*. Therefore, anesthesia should be associated with minimal negative consequences. One of the investigated influences, is hemodynamic stability in a vascular patient and thereto unstable. Hence, we conducted study to analyse hemodynamic stability of high risk patients for carotid surgery in ICB in contrast to GA.

MATERIALS AND METHODS

We conducted a prospective clinical trial which enrolled 89 high risk patients for scheduled, preventive carotid endarterectomy (CEA). Study was conducted from January 2006 till November 2010 in the University hospital Zagreb approved by ethics committee. Thirty five patients were done in ICB and 54 in GA.

Patients were premedicated with 10 mg of morphine hydrochloride intramuscularly, 30 minutes before surgery. In addition to standard monitors, invasive arterial blood pressure monitoring and PICC (Peripherally inserted central catheter) inserted through v. brachialis are used for patients undergoing carotid surgery.

Followed parameters were next – age, sex, ASA status (3 and 4), preoperative disease, intensive care unit (ICU) stay, hemodynamic stability. ASA status is associated with perioperative mortality risk. ASA 1 are normal healthy patients, ASA 2 have mild systemic disease, ASA 3 are patients with severe systemic disease with complication, ASA 4 patients have severe systemic disease which is a constant threat to life, ASA 5 are moribund patients, and ASA 6 are brain-dead patients. Before carotid artery clamping, heparin (5000 ij iv) was applied.

Mixture of 30 ml of levobipuvacaine 0.375% (maximum doses 2ml/kg) with epinephrine 1:200000 was used for ICB. Besides, mandibular branch block was infiltrated with 5 ml of 2% lidocaine and field block from suprasternal notch to thyroid cartilage with 2 to 3 ml of 2% lidocaine. Ten to fifteen minutes after the block was performed surgical incision was started *(3)*.

While performing the ICB patient is supine with head slightly facing to contralateral side. It should be wrapped and performed using aseptic technique. Twenty five gauge needle is used. Main landmarks are sternocleidomastoid (SCM) muscle, mastoid process and cervical vertebra 6 (C6). Midpoint (Erb's point) of the line connecting mastoid process with transverse process of the C6 (Chassaignac's tubercle) by posterior border of clavicular head of SCM muscle (lifting the head up, SCM muscle is accenuated) is site of the needle insertion. Investing layer of the deep cervical fascia should be punctured and felt like a pop, and 10 ml of the local anesthetic mixture is slowly injected with frequent aspiration. Another 10 ml of the mixture is slowly applied longside the SCM muscle from the mastoid process till midline and another 10 ml from the Chassaignac's tubercle till midpoint *(1, 3, 8)*.

On the other hand, balanced GA is performed using sufentanyl (0.3 microg/kg), etomidate (3 mg/kg) and vecuronium (0.1 mg/kg) for induction. For maintenance, sevoflurane (1 MAC), O2: air= 50:50, sufentanyl (0.1 microg/kg) and vecuronium (0.03 mg/kg) is used.

Neuromuscular and hemodynamic monitoring are essential for carotid artery surgery in high risk patients. Awake patient is a cornerstone of CEA in cervical block, due to functional brain monitoring. Therefore, patient gets only small doses of sufentanyl (5 mikrog) prior performing the block to decrease discomfort. During the operation, patient has to squeeze the toy in the contralateral hand on command, for monitoring of neuromusscular function during the carotid artery clamping, when brain hypoperfusion is expected. Monitoring of brain function during GA was not applied. Hemodynamic monitoring for GA and ICB is assessed with electrocardiographic lead 2 and invasive arterial pressure monitor. Mean arterial pressure (MAP) was calculated according to the following formula, MAP= (2x diastolic arterial pressure + systolic arterial pressure) / systolic arterial pressure. Starting MAP was baseline. Importantly, hemodynamic instability is defined as change of MAP during the carotid clamping more than 20% in comparison to baseline MAP.

Data were analyzed with descriptive statistics and chi-square test.

RESULTS

GA and ICB were provided adequate operative condition. Success rate of ICB was complete without need to convert into GA. Postoperative, all patients go to ICU.

Eighty nine high risk patients were scheduled for preventive open carotid surgery. Thereof, thirty five pati-

TABLE 1

Patients characteristics.

	ICB	GA
Age	68	64
Male	20	37
Female	15	17
Total no of patients	35	54
ASA 3	31	54
ASA 4	4	0
ICU stay (day)	1	2,47

TABLE 2
Hemodynamic data.

	ICB	GA
Hemodynamic stability	18	2
Hemodynamic instability	17	52
	35	54

ents were done in ICB and 54 in GA. Patients characteristics are listed in Table 1. Median age was 68 for ICB group and 59 years for GA group. There were 20 man and 15 woman in ICB group, and 37 man and 17 women in GA group. According to ASA classification, our study included 31 patients ASA 3 and 4 patients ASA 4 in ICB group, and 54 patients ASA 3 in GA group. High preoperative ASA status was consequence of cardiovascular or neurologic disease with functional limitation.

Hemodynamic data are described in Table 2. Hemodynamic stability was seen in 18 ICB patients and hemodynamic instability in 17 patients. Only two patients were hemodynamic stable in the group of patients done in GA, compared to 52 patients who were hemodynamic unstable. Significantly higher hemodynamic stability is found in the group of patients with ICB (chi-square test=27,763, $p<0.01$).

The median ICU stay was 2.47 days in GA group, and 24 hours in ICB group.

DISCUSSION

Stenosis of inernal carotid artery is a common state, associated with significant morbidity and mortality.

Treatment of choice for carotid artery stenosis are medical therapy, stent insertion or open surgery. Open carotid surgery is still a gold standard for stenosis of internal carotid artery due to higher risk of restenosis with stenting *(1, 3, 9)*. Regional anesthesia in comparision with GA is associated with decreased rate of shunt insertion *(1, 9)*.

Solely unilateral cervical plexus block for CEA, mostly is inadequate. Branches of contraletral cervical plexus should also be included in receiving the effective and dense block. Therefore, mandibular branch block and block of suprasternal notch to thyroid cartilage is important, especially for skin incision and placing the retractor *(1, 2, 3)*.

Majority of patients with indicated carotid surgery have different preoperative comorbidity as hypertension, advanced arteriosclerosis, diabetes mellitus, preexisting neurologic incidents, stroke or transient ischemic attack and myocardial infarction. Therefore, mostly they are classified as ASA 3 and sometimes as ASA 4. Preoperative ASA status is associated with mortality rates, and for ASA 3 and 4 is about 2 to 4%, and 8 to 20%, consequently. The principal cause of operative morbidity and mortality is myocardial infarction and stroke. Rapid blood pressure changes in induction and during cross clamping require continuous monitoring to treat hypotension promptly. Hemodynamic stability, or in other words – adequate mean arterial pressure, is important to ensure optimal coronary and cerebral perfusion pressure and thereby prevents intra- and postoperative cardiac and neurological complication *(3,10,11)*.

Among patients undergoing the open carotid surgery, we found more hemodynamic stable patients in ICB in contrast to GA group. Also we found shorter stay in the ICU. According literature, effect of ICB on hemodynamic stability is divided and inconclusive *(9, 10)*. Meitzner and al reported lower cost and incidence of neurologic complication *(10, 11)*.

Our findings also have some limitations. First, sample size is small, and the study has to include larger number of patients. Second, duration of the operation is much longer with inexperienced surgeons. Due to patient's intraoperative position, patient satisfaction with cervical block is not always positive. Also, ASA III and IV patients are subgroup of patients who may have more benefits of ICB. Thereby, additional research is necessary to confirm benefits of cervical block on large series.

Finally, we found the correlation of type of anesthesia with investigated hemodynamic stability. ICB has hemodynamic benefits compared to GA especially in high risk population. Therefore, it is the technique of choice for CEA due to lower incidence of complications.

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