



Does interscalene block increase intracranial pressure?

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Case Report

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ABSTRACT

Interscalene brachial plexus (ISB) block is widely used in shoulder and humerus surgeries, especially in patients that have high risk for general anesthesia. Increased intracranial pressure (ICP) is not among the complications of this block because there is no data about this issue in the literature. In this traumatic case report, a patient with headache and with a known meningioma in his right temporo occipital region is gonna have a proximal humerus fracture surgery with ISB block under repetitive optic nerve sheath diameter measurements. The result of this case report can add a unique information to the ISB literature.

Keywords: brachial plexus block, intracranial pressure, jugular veins, meningioma, optic nerve.

İnterskalen blok kafa içi basıncı arttırıyor mu?

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Öz

İnterskalen brakial pleksus (ISB) bloğu, özellikle genel anestezi riski yüksek olan hastalara uygulanmakla beraber omuz ve humerus ameliyatlarında yaygın olarak kullanılmaktadır. Literatürde bu konu ile ilgili veri olmadığı için kafa içi basıncının artması (İKİB) bu bloğun komplikasyonları arasında yer almaz. Bu travmatik vaka sunumu, baş ağrısı şikayeti olan ve sağ temporo-okspital bölgesinde meningiom olduğu bilinen hastanın, tekrarlayan optik sinir kılıf çapı ölçümleri altında ISB blok ile proksimal humerus kırığı ameliyatı vakasıdır. Bu vaka raporunun sonucu, ISB literatürüne benzersiz bir bilgi ekleyebilir.

Anahtar sözcükler: brakial pleksus bloğu, intrakraniyal basınç, juguler ven, menenjiom, optik sinir.

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Introduction

Interscalene brachial plexus (ISB) block is the most commonly chosen block method in humerus and shoulder surgeries for providing anesthesia and analgesia. Even if it provides a great analgesia in shoulder and humeral region, it has some complications such as ipsilateral phrenic nerve blockage, hoarseness and horner syndrome. The effect of ISB block on intracranial pressure (ICP) is unknown even its increasing effect on cerebral oxygenation was recently shown.¹

Optic nerve sheath diameter (ONSD) is a popular, non-invasive measurement technique that gives information about intracranial pressure. 5 millimeter (mm) was generally accepted as an upper limit of ONSD measurement in studies although a specific and exact cut-off value could not be determined.^{2,3} Kimberly et al. have systematically confirmed that the threshold of 5 mm in ONSD reflects ICP above 20 mmHg.³ In another study, the optimal limit of ONSD for the determination of ICP above 20 mmHg was found to be ≥ 5.0 mm with 94% sensitivity, 98% specificity.²

In this case report, ONSD, the maximum diameter (Dmax) and the minimum diameter (Dmin) of internal jugular vein (IJV) were measured intraoperatively in a proximal humerus fracture surgery under a successful ISB block on a patient with meningioma.

CASE REPORT

A 58-year-old, 72 kg male patient was evaluated in the emergency room due to a car accident. He had left proximal humerus fracture, multiple rib fractures between the 4-9 ribs at five levels on the left side and between the 3-6 ribs at three levels on the right side. The patient had neither pneumothorax nor hemothorax but had lung contusion and minimal alveolar hemorrhage in both lungs in his thoracal computerized tomography (CT) scan. The patient was tachypneic (32 breath/minute), his peripheral oxygen saturation (SpO₂) was 90% (with nasal O₂, 5 lt/min). He had no trauma history to his head. His first brain CT scan was normal except a meningioma with a 1,9 cm size in left temporo occipital region. In anamnesis, it was learned that meningioma was newly diagnosed in the past month and it causes rare headache episodes. He had no chronic systemic disease. Open surgical reduction for proximal humerus fracture was planned by orthopedic surgeons. Single-shot ISB block was planned as anesthetic technique because mechanical ventilation can cause hemothorax or pneumothorax in the patient with existing lung contusion, alveolar hemorrhage and multiple rib fractures.

Intervention and Measurements

The position was beach-chair with an angle of 45-degree. Invasive arterial catheterization was administered to the right radial artery. After the monitorization process, his first vital signs were recorded as TA: 115/72 mmHg, pulse: 93 beat/minute, SpO₂: 91% (with nasal O₂ 5 lt/minute). The skin of the left neck was disinfected with betadine iodine. When the ultrasound (US) (Esaote myLab, Siffredi 58, Genova-Italia) was preparing for the block, the patient complained about a headache. His blood pressure increased to 147/78 mmHg with the pulse of 112 beat/minute. The patient was administered 2 mg of midazolam for his preoperative anxiety. The team decided to measure ONSD with ultrasound for perioperative ICP follow-up. For assessing the drug-volume effect around the IJV, Dmax and Dmin of IJV were measured.

ONSD was measured for each eye. A linear probe was used to obtain axial cross-sectional images of the optic nerve, and the ONSD was measured 3 mm posterior to the orbit. The sonographer performed three measurements on each eye. ONSD was measured in horizontal (transverse) section in all measurement times. The resulting three measurements for one eye were then averaged to yield a mean ONSD for that eye.

ISB block with US was achieved in classical method. A drug combination of 25 ml, consists of 10 ml of 0.5% bupivacaine and 15 ml prilocaine, was injected around C5 and C6 plexus. Motor block was assessed by no abduction of the arm, sensory block was assessed by pin-prick test.

The surgery started with the skin incision at the 25th minute of the successful ISB block with the crystalloid infusion rate of 600 ml/hour.

Patient's headache was severely started again towards the end of the operation (at the 60th minute of the ISB block). ONSD, Dmax, Dmin, blood pressure and heart rate were recorded before ISB block, at the 15th minute, and at the 60th minute of the ISB block (Table 1 and Figure 1).

1,5 g/kg 20% mannitol infusion was administered for 30 minutes. After 600 ml urine output was seen, the patient's headache was relieved completely at the recovery room. The last ONSD values were 5,4 mm for left eye and 5,1 mm for right eye. A cranial CT scan for the patient was suggested to the surgeons and the patient was delivered to orthopedics clinic with no pain. No complication related to ISB block was observed. There were no additional drugs (sedative, analgesic or any other drugs that may effect ONSD) used in intraoperative period.

Table 1: Data of basal and intraoperative measurements.

	Basal	15 th minute	60 th minute
ONSD for left eye (mm)	4.2	5.2	6.4
ONSD for right eye (mm)	4.0	5.0	6.0
Dmax (mm)	13	9.7	4.4
Dmin (mm)	5	3.1	2.5
HR (beat/minute)	89	91	90
Blood pressure (mmHg)	109/74	108/73	118/76
MAP (mmHg)	89	87	90

ONSD: optic nerve sheath diameter

Dmax: maximum diameter of internal jugular vein

Dmin: minimum diameter of internal jugular vein

HR: heart rate

MAP: mean arterial pressure.

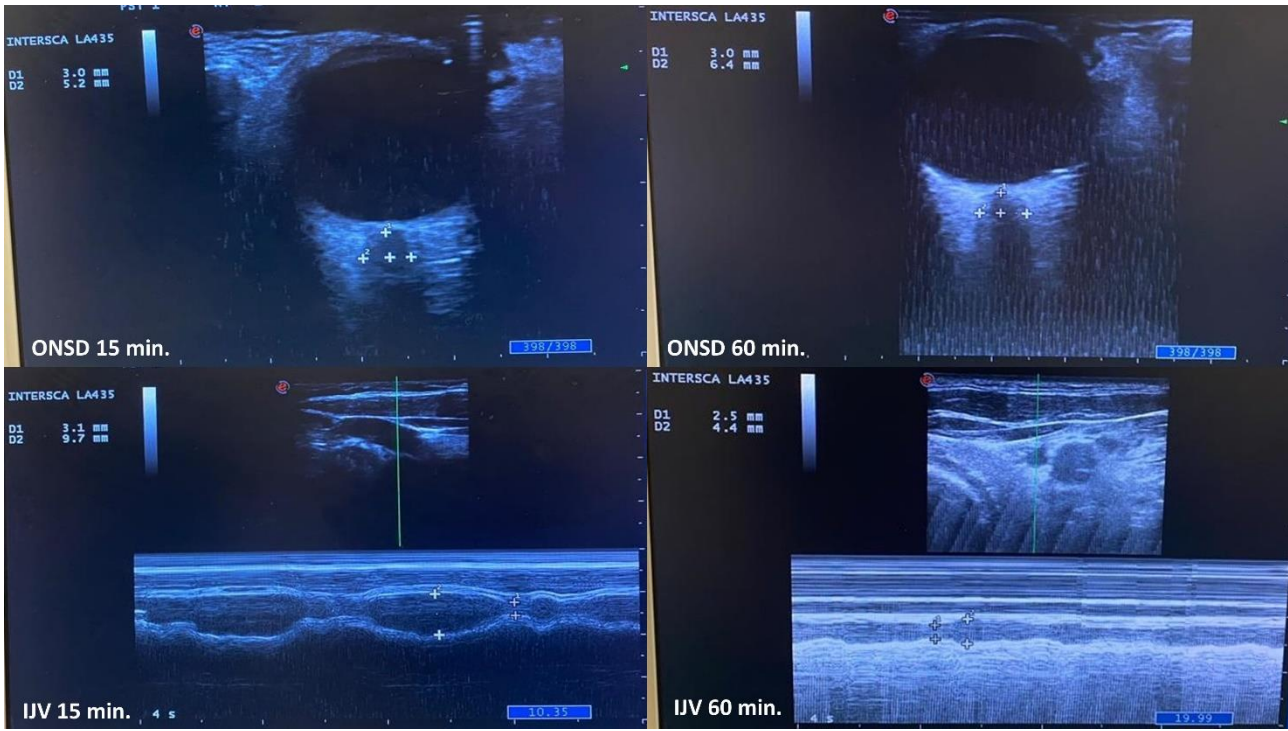


Figure 1: ONSD and IJV measurements.

Discussion

In this case, the effect of ISB block on ICP was questioned for the first time as far as we know in the literature. The most important result of this case report was an increased ICP without a systemic hypertension and decreased Dmax of IJV where the 25 ml of local anesthetic was injected around.

Since the interscalene block was defined by Winnie in 1970, it has been frequently used for anesthesia and analgesia, especially in shoulder and humerus surgeries.⁴ ISB block can be a very valuable anesthetic technique when there is a patient with a high risk of general anesthesia for example our presented case. Even the ISB block is a rescue technique, it can cause serious complications such as phrenic nerve blocking and Horner's syndrome. None of the known complications of ISB block was observed in our case but an adverse effect (high ICP) was observed in our case without systemic hypertension.

There can be other factors affecting the ICP intraoperatively. For example iv anesthetics, volatile anesthetics, mechanical ventilation, some patient positions during surgery. In our case, patient was in beach-chair position and only midazolam administered in a premedication dose of 2 mg. So, this anesthetic approach is much more suitable for investigating the effect of ISB block on ICP other than general anesthesia. There are two researches about the effect of ISB block

on cerebral oxygenation with near-infrared spectroscopy (NIRS). The major handicap of these studies are all the patients were in general anesthesia. Even if the other effects on ICP presents in that studies, ISB block in patients with beach-chair position does not lower the cerebral oxygenation.⁵ In a retrospective study of Coşarcan et al, they have found that ISB block can increase cerebral oxygenation in patients with beach-chair position.¹ Their hypothesis is about a cervical sympathetic blockage due to local anesthetic injection during ISB block. After this blockage cerebral vasodilation occurs and cerebral oxygenation increases. Our hypothesis differs from Coşarcan et al's. We think that, our local anesthetic can limit the maximum diameter of IJV and venous return from the cranium decreases. It can cause an increase in ICP. So cerebral oxygenation can rise because of high ICP.

Conclusion

In this case report, it was shown that ISB block can be a factor that increases the intracranial pressure by applying a pressure with 25 ml of local anesthetic around IJV. This result needs to be confirmed with prospective, randomized studies. Until the effect on ICP was proved, intraoperative ONSD measurements in patients with ISB block is recommended in clinical practice.

Declarations

Author contribution statement

Ođuz Gündođdu: Conceived and designed the experiments; Performed the experiments; Wrote the paper; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools

Onur Avcı; Conceived and designed the experiments, proofreading

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Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

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