Case Report

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Simultaneous Brachial Plexus Block and Combined Two-Segment Spinal-Epidural Anesthesia with Fixation of an Epidural Catheter in the Subcutaneous Canal in a Patient with Polytrauma

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ABSTRACT The article reports an example of the simultaneous use of brachial plexus block and combined two-segment spinal-epidural anesthesia with fixation of an epidural catheter in the subcutaneous canal in an 81-year-old patient after receiving a household injury - closed fracture of the olecranon of the right ulna with displacement of fragments and closed transtrochanteric fracture with a fracture of the right femur fragments. After preoperative preparation and examination, the patient underwent two consecutive surgical interventions within a day: open reduction of comminuted transtrochanteric fracture of the right hip, dynamic femoral screw osteosynthesis and open reduction of fracture of the right olecranon, Weber's osteosynthesis. Surgical interventions were carried out under regional anesthesia: block of the brachial plexus via supraclavicular access and combined two-segment spinal-epidural anesthesia with a method developed in our clinic for fixing an epidural catheter in the subcutaneous canal using a modified spinal needle. After the operation, the patient underwent postoperative pain relief in the form of epidural analgesia for 72 hours. The postoperative period passed without complications. On the 13th day, the patient was discharged for outpatient treatment by a traumatologist. The use of local anesthesia in the form of two methods of regional anesthesia during two consecutive surgical interventions, in an elderly patient with a high anesthetic risk, followed by long-term postoperative anesthesia in the form of epidural analgesia with a reliable method of epidural catheter fixation in the subcutaneous canal without the use of narcotic analgesics, contributed to the successful carrying out two surgical interventions at once, early activation of the patient, absence of complications in the postoperative period. Reliable catheter fixation is very important for the quality of epidural analgesia. Dislocation of catheters by more than 2 cm can lead to migration of catheters from the epidural space, changing the course of anesthesia, deteriorating its quality, or even interrupting it altogether. The new method of catheter fixation in the subcutaneous canal developed by us made it possible to prevent catheter dislocation.

Keywords: regional anesthesia, plexus block, combined two-segment spinal-epidural anesthesia

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CTSSEA – combined two-segment spinal-epidural anesthesia

EA – epidural anesthesia

EC – epidural catheter

INTRODUCTION

Regional methods of anesthesia have become firmly established in the practice of the anesthesiologist. Conductive, plexus and neuraxial blocks allow performing surgical interventions in patients with high anesthetic risk. Their use reduces the risk of intraoperative and postoperative complications.

It becomes possible to use different methods of regional anesthesia simultaneously - their combination. For example: a combination of plexus brachial plexus block, spinal and epidural anesthesia (EA). This combination opens up the possibility of performing anesthesia during surgery and in the postoperative period. Thus, spinal and plexus block makes it possible to perform surgical intervention with high quality anesthesia, and EA can be used to prolong anesthesia during surgery, and in the postoperative period - for postoperative pain relief.

The supraclavicular access block of the brachial plexus is perfect for operations on the upper limb from the middle third of the shoulder to the hand. Supraclavicular access to the brachial plexus can be performed using the Kulenkampff method, ultrasound guidance, or electrical neurostimulation.

The first percutaneous supraclavicular block was performed by the German surgeon Dietrich Kulenkampf in 1911. At that time, the main landmarks were already described: this is the subclavian artery and the first rib. These landmarks are still used today when performing ultrasound-assisted supraclavicular brachial plexus blockade. In 2007, *Casati* et al, when comparing the effectiveness of block under the ultrasound guidance and neurostimulation, recognized their equal effectiveness [1]. It is also believed that ultrasound guidance reduces the incidence of pneumothorax during supraclavicular block [2]. The combination of spinal anesthesia with an epidural gives the following advantages: a) fast onset of high quality anesthesia, practically unlimited in time with the possibility of prolonging the blockade to several anatomical regions; b) minimal toxicity [3]. Also, with combined spinal-epidural anesthesia, the incidence of post-puncture syndrome decreases to 1.3% [4].

The incidence of inadequate EA ranges from 6 to 8% (*Curatolo M.*, 1965; *Witkowski T.*, 1998). The main reason is the displacement of the initially correctly inserted epidural catheter (EC) (*Webster S.,* 1986; *Gartrell P.,* 1992). Dislocation and migration of ECs from the epidural space can lead to inadequate anesthesia, unilateral anesthesia, perforation of the dura mater and total spinal block, intravascular injection of local anesthetic, cessation of epidural analgesia due to complete loss of ECs [5]. Analyzing the literature data, we can talk about a high frequency of EC migration. So, *Grosby E*. in a 1990 study that included 211 patients who received EA for pain relief in labor, noted catheter migration in 54%, while in 70% of these cases catheters completely left the epidural space [6]. Another study (153 patients) showed a 36% frequency of catheter displacement, while in 13.7% of cases the catheters were displaced 1–3 cm inward; outward migration by 1 cm or more was noted in 22.2%, and in 2% - catheters migrated out of the skin (*Bishton IM, Martin PH* ., 1992) [7].

Reliable fixation of EC reduces the risk of its migration and creates conditions for effective and high-quality EA. Reliable EC fixation can be ensured by using special fixation devices or by holding and fixing EC in the subcutaneous canal. If adhesive stickers were used to fix EC, then the frequency of its migration was 75%, while migration of more than 2 cm was 20–25% [8]. Tunneling of EC in the subcutaneous canal is a reliable method of its fixation, in which EC migration was noted only in 10% of cases [9].

There are several ways to perform EC in the subcutaneous canal. For this, in the first method, an unmodified epidural needle is used, which is passed from the lateral position to the EC exit site [10]. In the second method, the epidural needle is modified by breaking off the pavilion of the needle and is passed in this form from the EC in the lateral direction [11]. In the third method, a metal mandrel is drawn from the epidural needle from the EC position in the lateral direction, along which the epidural needle is directed to the EC position [4]. In the future, with these three methods, EC is performed through the lumen of the epidural needle. The fourth method uses a three-component device, the outer cylinder diameter of which is 2.7 mm [12].

Our clinic has developed a new method of EC in the subcutaneous canal using a modified spinal needle, which was used for spinal anesthesia in a complex of combined two-segment spinal-epidural anesthesia (CTSSEA). This method has shown the convenience of EC in the subcutaneous canal and the reliability of

its fixation, which allows long-term and high-quality postoperative epidural analgesia to be performed, and also prevents EC dislocation and infectious complications.

Aim of study: to show the advantages and effectiveness of regional methods of anesthesia in elderly and senile patients with polytrauma, which make it possible to carry out two consecutive surgical interventions for fractures of the bones of the upper and lower extremities.

Case report

Patient N., 81 years old, 2 hours after receiving a domestic injury, was hospitalized in the traumatology department of the City Clinical Hospital of Kotovsk. After a comprehensive examination, the main diagnosis was made: "Closed fracture of the olecranon of the right ulna with displacement of fragments; closed pertrochanteric fracture of the right femur with displacement of fragments. Secondary diagnosis: essential hypertension, grade 3, arterial hypertension - AH grade 1, risk of cardiovascular complications 4; endocrine obesity - 2 degree (body mass index - BMI - 36 kg/m ^{2}); chronic heart failure - CHF 1 (functional class - FC 2); chronic kidney disease - CKD stage 2; cerebrovascular disease - CVD, chronic cerebral ischemia - grade 2 CCI, cognitive impairment. Electrocardiography was performed. Conclusion: "Sinus tachycardia 99 per min. The normal position of the electrical axis of the heart". According to the results of laboratory examination, an increased level of creatinine - 139.6 mmol/L and urea - 11.22 mmol/L was revealed. Considering the patient's age and the presence of concomitant pathology, the anesthetic risk 3 by *ASA*.

The patient is scheduled to undergo two surgical interventions: open reduction of a comminuted pertrochanteric fracture of the right femur, osteosynthesis with a dynamic femoral screw *DHS,* and open reduction of a fracture of the right olecranon, Weber's osteosynthesis.

The council of doctors decided to carry out surgical interventions sequentially (one after the other) under local regional anesthesia by two methods: block of the brachial plexus by supraclavicular access under the ultrasound guidance and CTSSEA with EC fixation in the subcutaneous canal. The use of general anesthesia for surgery for a fracture of the right olecranon was abandoned due to the very high degree of risk.

The operations were performed on the 3rd day after the patient was hospitalized. Features of the anesthetic: in the supine position in the operating room, the right internal jugular vein was catheterized under the ultrasound guidance. Then the block of the right brachial plexus was performed by supraclavicular access under ultrasound guidance with a solution of Ropivacaine 7.5 mg/ml - 30.0 ml (Fig. 1). The onset of anesthesia in 30 minutes. Without waiting for the onset of the brachial plexus block, in the sitting position, CTSSEA was performed with EC fixation in the subcutaneous canal using a modified spinal needle.

The technique was developed on the basis of our medical institution (RF patent for invention No. 2727234 "Method for conducting an epidural catheter in the subcutaneous canal during two-segment spinal epidural anesthesia"). The essence of the method is that after the placement of the EC in the L3 – L4 gap, spinal anesthesia was performed in the L2 – L3 gap with a *G* 26 needle (Fig. 2, 3).

Fig. 1. Right brachial plexus block via supraclavicular access under ultrasound guidance

Fig. 2. Catheterization of the epidural space between L3–L4

Hyperbaric solution of Bupivacaine 20 mg was injected into the spinal canal. The spinal needle was modified afterwards: the hub pavilion was broken off (Fig. 4). EC was put on the proximal end of the needle (Fig. 5). EC *G* 20 is perfect for the *G* 26 spinal needle, and the *G* 19 EC is suitable for the *G* 22. The needle with the EC on it is passed below the EC position under the skin of the lumbar region in the lateral direction (Fig. 6), forming a subcutaneous canal up to 80 mm long (Fig. 7). The diameter of the subcutaneous canal is equal to

the diameter of the EC *G* 20 - 0.9 mm. The canal is narrow and long - 80 mm. This contributes to the firm fixation of the EC. The greater the length of the inner part of the EC, the less the risk of infection of the epidural space and dislocation of the catheter. The length of the inner part of the EC is 160 mm (in the epidural space - 40 mm, from the ligamentum flavum to the exit to the skin - 40 mm, and in the subcutaneous canal - 80 mm). The EC also receives an additional bend at an angle of 90°, which also increases the reliability of its fixation. The time of EC in the subcutaneous canal was 5 minutes [13].

Fig. 3. Spinal anesthesia in the L2–L3 with a G 26 needle

Fig. 4. Modification of the spinal needle

Fig. 5. Connecting the epidural catheter to the spinal needle on it below its position under the skin of the lumbar region

Fig. 6. Passing the needle with the epidural catheter

Fig. 7. An epidural catheter is passed through the subcutaneous canal. The length of the subcutaneous canal is 80 mm

After the CTSSEA, the patient was put in a horizontal position. The onset time of spinal anesthesia was 10 minutes. Anesthesia level at *Th* 10. A good level of sensory and motor block has been achieved. The first surgical intervention was performed - open reduction of comminuted pertrochanteric fracture of the right femur, *DHS* osteosynthesis (Fig. 8). The duration of the operation was 2 hours. After the end of the first one, the second operation was performed - open reduction of the fracture of the right olecranon process, osteosynthesis according to Weber (Fig. 9). The duration of the second operation is 30 minutes.

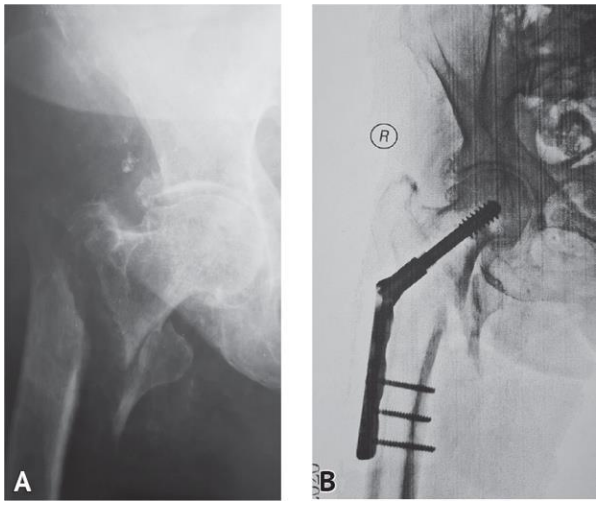

Fig. 8. X-ray images of the transtrochanteric fracture of the right femur before (A) and after surgery (B)

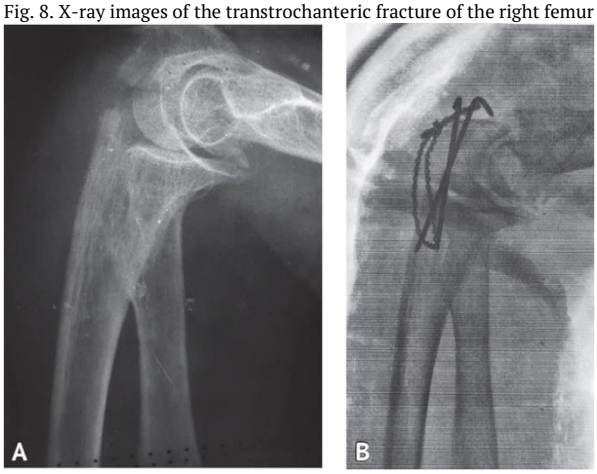

Fig. 9. X-ray images of the fracture of the olecranon of the right ulna before (A) and after surgery (B)

The patient underwent surgery satisfactorily. There were no hemodynamic and respiratory disorders. The volume of preoperative and intraoperative infusion was 1400 ml. Diuresis during the operation was 130 ml. After the end of the surgery, the patient was transferred to the intensive care unit. After regression of spinal anesthesia and a test dose, epidural analgesia was started with a solution of Ropivacaine 2 mg/ml at a dose of 14 mg/h. Regression of the brachial plexus blockade - 9 hours after the injection of the anesthetic. Epidural analgesia was performed for 72 hours.

The level of pain was assessed by the Visual Analogue Scale of Pain - VAS and was 2 cm (mild pain). The patient was additionally carried analgesia for 3 days preparation Ketorol 30 mg intramuscularly twice a day. Changing of adhesive stickers and treatment with an antiseptic solution at the site of epidural puncture and at the site of EC exit on the skin was carried out daily. Special fixation devices were not used; standard adhesive stickers were used. Dislocation of EC was not observed. On the 2nd day, the patient began to sit down in bed.

On the 3rd day he began to sit up in bed with his legs down. On the 4th day of the patient's stay in the intensive care unit, the EC and the catheter of the right internal jugular vein were removed. EC removal was easy. The patient was transferred to the trauma department. In the specialized department, the patient's condition is satisfactory. Treatment, activity and rehabilitation took place as planned. On the 13th day, the patient was discharged for outpatient treatment under the supervision of a traumatologist.

CONCLUSION

The use of regional methods of anesthesia in elderly and senile people significantly reduces the risk of intraoperative and postoperative complications from the cardiovascular and respiratory systems and makes it possible to perform two consecutive surgical interventions for fractures of the bones of the upper and lower extremities. Reliable fixation of ECs in the subcutaneous canal, performed using a modified spinal needle, prevents EC dislocation and migration from the epidural space, promotes high-quality postoperative analgesia. Reducing the level of pain in the postoperative period contributes to the early activation of patients, reducing the risk of postoperative complications, especially in elderly and senile people.

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