O.N. Yamshchikov, A.P. Marchenko, S.A. Yemelyanov,
A.V. Cherkaeva, S.A. Mordovin, A.N. Petrukhin

COMBINED TWO-LEVEL SPINAL EPIDURAL ANESTHESIA WITH FIXATION OF EPIDURAL CATHETER IN SUBCUTANEOUS CANAL IN A LONG-LIVER PATIENT WITH A CLOSED HIP FRACTURE

DOI 10.25789/YMJ.2021.75.10

УДК 616-089.5-031.83

The article discusses a clinical case of combined two-level spinal-epidural anesthesia (CDSEA) with fixation of an epidural catheter (EC) in the subcutaneous canal in a long-liver patient with a closed hip fracture. Use of local anesthesia in the form of KDSEA, followed by long-term postoperative anesthesia in a long-liver patient with a high anesthetic risk and multiple comorbid pathology in the form of epidural analgesia with a reliable method of EC fixation in the subcutaneous canal during surgery for a fracture of the proximal femur contributed to its successful implementation, the absence of complications in the postoperative period and early activation of the patient.

Keywords: combined double-level spinal-epidural anaesthesia, subcutaneous tunnel, modified spinal needle.

Aim: to show the effectiveness of TCSEA in long-livers patients in the surgical treatment of fractures of the lower limb bones, as well as the effectiveness of the method developed by us for fixing EC in the subcutaneous canal, preventing its dislocation.

Introduction. Epidural anesthesia is firmly established in the practice of the anesthesiologist. One of the main advantages of this method is the ability to prolong anesthesia and provide postoperative pain relief. The Tuohy needle used for EC placement can also be used for EC in the subcutaneous "tunnel" [14].

The combination of spinal anesthesia with epidural anesthesia gives even more advantages, to be precise : we get a fast onset of high quality anesthesia, practically unlimited in time with the possibility of prolonging the blockade to several anatomical regions and minimal toxicity [13].

Also, with TCSEA, the incidence of post-puncture syndrome decreases to 1.3% [4]. The incidence of inadequate EA ranges from 6 to 8% [12]. The main reason is the displacement of the initially correctly established EC [15,16].

Dislocation and migration of EC 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, termination of EA due to complete loss of EC [1].

Analyzing the literature data, we can talk about a high frequency of EC migration. So Grosby E. in a study in 1990 that included 211 patients who received EA for pain relief in labor,in 54% was noted the migration of catheters, while in 70% of this number the catheters completely left the epidural space [11]. Another study in 153 patients showed a 36% incidence of catheter displacement,at the same time, in 13.7% of cases, the catheters were displaced inward by 1-3 cm, and in 22.2% external migration of 1 cm or more was noted, and in 2%, complete loss of catheters [8] . 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 the use of special fixation devices or EC fixation 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% [9]. 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 [10].

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 [6]. In the second method, the epidural needle is modified by breaking off the needle cannula and is passed in this from the EC position in the lateral direction [2]. 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 passed to the EC position [3].

Further, with these three methods, EC is performed through the lumen of the epidural needle. The fourth method uses a three-component device, in which the outer cylinder diameter is 2.7 mm [7]. In our clinic, we have developed a new method for EC placement in the subcutaneous canal using a modified spinal needle, which was used to conduct spinal anesthesia in the complex TCSEA procedure .

This method showed the convenience of EC placement in the subcutaneous canal and the reliability of its fixation, which allows a long-term and high-quality postoperative EA, as well as the absence of EC dislocation and the absence of infectious complications.

Clinical case description. A 95-year-old patient, had a domestic injury on 03/21/2021, on the 03/22/2021, the ambulance team was taken to the admission department of the Kotovsk City Clinical Hospital, examined by a traumatologist on duty, hospitalized in the trauma department with a diagnosis: Closed fracture of the right hip neck with displacement of fragments. An instrumental examination was performed (X-ray examination of the thoracic viscera, X-ray of the right hip joint).

Radiologist's conclusion: Diffuse

G.R. Derzhavin Tambov State University: **YAMSHCHIKOV Oleg Nikolaevich** – MD, Associate Professor, Head of the Department, travma68@mail.ru, orcid.org/0000-0001-6825-7599; **MARCHENKO Alexander Petrovich** – Senior lecturer, orcid.org/0000-0002-9387-3374; **YEMELYANOV Sergey Alexandrovich** - Associate Professor, orcid.org/0000-0002-5550-4199; **CHERKAEVA Alexandra Vladimirovna** – resident doctor, orcid.org/0000-0001-8648-2263; **MORDOVIN Sergey Alekseevich** – Assistant of the Department, orcid.org/0000-0001-5873-3555; **PETRUKHIN Anton Nikolaevich** – Assistant of the Department, orcid.org/0000-0002-5830-9356.

pneumosclerosis. Aorto-atherosclerosis. Transcervical fracture of the right femoral neck with a relatively pronounced displacement of the fragments. Electrocardiography was performed. Conclusion: Sinus rhythm 88 in 1 min. EOS is deviated sharply to the left. Incomplete Left bundle branch block.

According to the results of laboratory examination, an increased level of total bilirubin was revealed - 33.55 μmol / l, direct bilirubin - 17.21 μmol / l, platelets were reduced - 120 x 109 / l. Examined by a general practitioner and neurologist. Conclusion: ischemic heart disease. Atherosclerotic cardiosclerosis. Essential hypertension 3 St. , AH 2 St. , the risk score 4. CHF (Chronic Heart Failure) 2a (FC3). COPD 3 stg., Moderate severity, mixed type. Dilation of the cavities of the heart. Senile asthenia. Calcification of the valve apparatus: aortic stenosis, mitral valve insufficiency. CeVD (Cerebrovascular diseases) . CCI (chronic cerebral ischaemia) , Mild cognitive impairment.

Multisegmental osteochondrosis of the spine. Kyphoscoliosis of the thoracic region. Obliterating atherosclerosis of the arteries of the lower extremities. CKD Stg. 2(Chronic kidney diseases) . Hyperplasia of the prostate gland. Cysts of both kidneys. The patient is scheduled to undergo surgery: Closed reposition of the fracture of the right femoral neck, osteosynthesis with screws. Taking into account the patient's age, the presence of concomitant pathology, the anesthetic risk was set at 4 grade according to the ASA.

The council of physicians decided to perform a surgical intervention under local regional anesthesia by the TCSEA method with EC fixation under the skin of the lumbar region using a modified spinal needle. The operation was performed on the 2nd day after the patient was hospitalized. Features of the anesthetic: In the supine position in the operating room, the peripheral vein of the right upper extremity was catheterized.

Further, in the sitting position, TCSEA was performed with EC fixation in the subcutaneous canal using a modified spinal needle. The method was developed in our medical institution [5]. The essence of the method is that after the placement of the EC in the interval L3 - L4 (photo No. 1), spinal anesthesia is performed in the interval L2 - L3 with a G 26 needle (photo No. 2.) Hyperbaric solution of Bupivacaine 20 mg is introduced into the spinal canal.

The spinal needle is then modified: the needle pavilion is broken off. The EC is put on the proximal end of the needle (photo No. 3). EC G 20 is ideal for spinal needle G 26. The needle with EC on, is passed below the EC position under the skin of the lumbar region in the lateral direction (photo no. 4), forming a subcutaneous canal up to 70 mm long. The diameter of the subcutaneous canal is equal to the diameter of the EC G 20 - 0.9 mm. The channel is narrow and 70 mm long. 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 skin exit - 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 placement in the subcutaneous canal was 5 minutes. After TCSEA, the patient is given an horizontal position. The onset time of spinal anesthesia was 10 minutes.

Anesthesia level - Th10. A good level of analgesia, sensory and motor block (Bromage -3 grade). Surgical intervention was performed - closed reduction of the fracture of the right femoral neck, osteosynthesis with screws. The duration of the operation was 1 hour 10 minutes. The patient underwent surgery satisfactorily, there were no hemodynamic and respirat ory disorders.

The volume of preoperative and intraoperative infusion was 900 ml. Diuresis during the operation was 120 ml. At the end of the surgery, the patient was transferred to the postoperative ward of the trauma department. After regression of spinal anesthesia, after the test dose, EA was started with a solution of Ropivacaine 2 mg / ml at a dose of 18 mg / h. EA was carried out for 4 days. The pain level was assessed by the VAS and was 2 cm (mild pain).

Changing of adhesive stickers and treatment with an antiseptic solution at the site of the epidural puncture and at the site of the EC outlet on the skin was carried out daily. No special fixing devices were used. Standard adhesive stickers were used. On the second day, the patient began to sit down in bed. On the third day, he began to sit up in bed with his legs down.

Four days after the operation, the EC was removed. The external dislocation of the EC at the time of extraction was 7 mm, which is assessed as an insignificant dislocation that does not affect the quality of anesthesia. Removal of EC went without technical difficulties. Treatment,

Fig. 1. Catheterization of the epidural space in the L3-L4 interval

Рис. 2. Spinal anesthesia between L 2 - L3 with a G 26 needle

Рис. 3. The EC is put on the proximal end of the needle

Рис. 4. The needle with the EC on it is held below the EC position under the skin of the lumbar region

activation and rehabilitation took place as planned. On the 15th day, the patient was discharged for outpatient treatment by a traumatologist.

Conclusion. The use of regional methods of anesthesia in long-livers patients during surgical treatment of fractures of the bones of the lower extremities significantly reduces the risk of developing perioperative complications of the cardiovascular and respiratory systems. Reliable fixation of EC in the subcutaneous canal, performed using a modified spinal needle, prevents EC dislocation from the epidural space, which contributes to 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 long-lived patients.

Reference

1. Эпштейн С.Л., Карпов И.А., Овечкин А.М. Анализ эффективности различных способов фиксации эпидурального катетера Центр эндохирургии и литотрипсии, Национальный медико-хирургический центр им. Н.И.Пирогова, ММА им. И.М.Сеченова, Москва) [Epstein SL, Karpov IA, Ovechkin AM. Analysis of the effectiveness of various methods of fixing the epidural catheter Center for Endosurgery and Lithotripsy, National Medical and Surgical Center named after N.I. Pirogov, I.M. Sechenov MMA, Moscow) (In Russ.).] https://www.critical.ru/RegionarSchool/publications/0076/

2. Ильин С.А., Субботин В.В., Мироненко А.В. Безопасный способ постановки эпидурального катетера в «туннеле» для продленной анестезии. Патент RU 2 301 083 C2. МКП A61M 19/00 (2006. 01) [Ilyin SA, Subbotin VV, Mironenko AV. A safe way to place an epidural catheter in a "tunnel" for prolonged anesthesia. Patent RU 2 301 083 C2. MKP A61M 19/00 (2006. 01) (In Russ.).]

3. Корячкин В.А. Нейроаксиальные блокады. Санкт-Петербург ЭЛБИ-СПб 2013. с 276 – 277 [Koryachkin V. A. Neuroaxial blockades. Saint Petersburg ELBI-SPb. 2013; 276-277 (In Russ.).]

4. Корячкин В.А. Нейроаксиальные блокады. Санкт-Петербург ЭЛБИ-СПб 2013. с 283 – 284 [Koryachkin V. A. Neuroaxial blockades. Saint Petersburg ELBI-SPb 2013; 283-284 (In Russ.).]

5. Марченко А.П., Ямщиков О.Н., Емельянов С.А. Способ проведения эпидурального катетера в подкожном канале при проведении двухсегментарной спинально-эпидуральной анестезии. Патент RU № 2 727 234 C 1 класс МПК A 61 19/00 от 21.07.2020 [Marchenko AP, Yamshchikov ON, Yemelyanov SA. Method of conducting an epidural catheter in the subcutaneous canal during two-segment spinal-epidural anesthesia. Patent RU No. 2 727 234 C 1 class IPC A 61 19/00 dated 21.07.2020 (In Russ).].

6. Кузьмин В.В., Егоров В.М. Способ фиксации эпидурального катетера при продленной эпидуральной анестезии. Патент RU 2 309 772 C1 A61M 19/00 (2006.01) [Kuzmin VV, Egorov VM. Method of fixing the epidural catheter during prolonged epidural anesthesia. Patent RU 2 309 772 C1 A61M 19/00 (2006.01)

7. Николаев А.В. Устройство для формирования подкожного туннеля и проведения эпидурального катетера. Патент RU 26426 U1. МКП A61M 25/06 (2000. 01) [Nikolaev A.V. A device for forming a subcutaneous tunnel and conducting an epidural catheter. Patent RU 26426 U1. MKP A61M 25/06 (2000. 01)

8. Bishton I.M, Martin P.H, Vernon J.M, Liu W.H. Factor influencingepidural catheter migration. anaesthesia. 1992; 47 (7): 610-2.

9. Clark M., O'Hare K., Gorringe J. The effect of the Lockit epidural catheter clamp on epidural migration: a controlled trial. *Anaesthesia*. 2001; 56: 865-870.

10. Coupe M., Al-Shaikh B., 1999; Carrie L. E. S., 2000 Thipathi M., et all. Epidural catheter fixation: subcutaneous tunneling with a loop to prevent displacement. *Anaesthesia.* Nov. 2000: 55(11); 1113.

11. Crosby E. Epidural catheter migration during labour: a hypothesis for inadequate analgesia. *Can. J.Anaesth*. 1990; 37: 789-793.

12. Curatolo M., Orlando A., Zbinden A. Failure rate of epidural anaesthesia for foot and ankle surgery. A comparison with other surgical procedures. *Eur. J. Anaesthesiol*. 1995; 12: 363-367.

13. Curelaru I. Long duration subarachnoidal anesthesia with continuous epidural blocks. *Prak Anaesth Wiederbelebung Intensivther*. 1979; 14: 71-8

14. Thipathi M., et all. Epidural catheter fixation: subcutaneous tunneling with a loop to prevent displacement. *Anaesthesia.* 2000; 55(11): 1113

15. Webster S. Migration of epidural catheters (letter). *Anaesthesia.* 1986; 41: 654

16. Gartrell P. Disappearing epidural catheters (letter). *Anaesth. Intensive Care*. 1992; 20: 363-367