



Assessing degree of external dislocation of epidural catheter in clinical practice in trauma patients

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Abstract. For the purpose of the study, we selected 73 patients who underwent combined two-level spinal-epidural anesthesia with a catheter in the subcutaneous tunnel during operations for lower limbs fractures. All patients underwent postoperative epidural analgesia. We applied a method for assessing the degree of external dislocation of the epidural catheter and an algorithm of actions when a dislocation of the epidural catheter is detected. When changing the fixing aseptic sticker, the degree of epidural catheter dislocation was assessed, and if a pronounced dislocation was detected, additional measures were taken to enhance the fixation of epidural catheter. In 14 cases, we used additional fixation devices “Epi-Fix”, which was associated with the threat of falling out of the epidural catheter with a pronounced degree of dislocation. Additional fixation in this case helped to avoid prolapse and ensure continuation of anesthesia. However, in two cases, the epidural catheter was removed because the dislocation corresponded to the 6th degree of the proposed scale, and its continued use was useless. Thus, the use of the scale we developed enables to monitor and assess the risk of worsening anesthesia and catheter migration or prolapse. Further tactics in relation to prolonged anesthesia depend on an objective assessment of the position of the catheter.

Keywords: epidural analgesia; dislocation of epidural catheter; method for assessing the degree of dislocation of epidural catheter

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Оценка степени наружной дислокации эпидурального катетера в клинической практике у травматологических больных

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Аннотация. В рамках проводимого клинического исследования было отобрано 73 пациента, которым была проведена комбинированная двухуровневая спинально-эпидуральная анестезия с проведением катетера в подкожном туннеле при операциях по поводу переломов

костей нижней конечности. Всем пациентам проводилась послеоперационное эпидуральное обезболивание. Мы применили способ оценки степени наружной дислокации эпидурального катетера. При смене фиксирующей асептической наклейки проводилась оценка степени дислокации эпидурального катетера и при обнаружении выраженной дислокации предпринимались дополнительные меры для усиления фиксации эпидурального катетера. В 14 случаях мы применили дополнительно фиксационные устройства «Epi-Fix», что было связано с угрозой выпадения эпидурального катетера при выраженной степени дислокации. Дополнительная фиксация в данном случае помогла избежать выпадения и обеспечить продолжение анестезии. Однако в двух случаях эпидуральный катетер был удален, вследствие того, что дислокация соответствовала 6 степени предложенной нами шкалы, продолжение его использования было нецелесообразно. Таким образом, применение разработанной нами шкалы позволило проводить мониторинг и оценивать риск ухудшения анестезии и миграции или выпадения катетера. От объективной оценки положения катетера зависит дальнейшая тактика в отношении продленного обезболивания.

Ключевые слова: эпидуральное обезболивание; дислокация эпидурального катетера; способ оценки степени дислокации эпидурального катетера

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INTRODUCTION

One of the components of combined spinal epidural anesthesia (CSEA) is the insertion of a catheter into the epidural space (ES). Epidural catheterization is used for anesthesia or CSEA during surgery and pain relief after surgery.

Many authors note that the use of epidural anesthesia due to the blockade of afferent impulses from the area of operation enables to provide effective analgesia (Nygård E. et al., 2005; Casalino S. et al., 2006), and the blockade of efferent sympathetic impulses to the surgical wound prevents the development of a stress response to the operation (Hemmerling T.M., 2008; Freise H., 2011) [1; 2]. In the practice of trauma departments, epidural anesthesia is effective, especially in old patients (Scott N.B. et al., 2001; Svircevic V. et al., 2013) [3–5]. The quality and duration of anesthesia performed depends on the reliability of fixation of a correctly installed epidural catheter (EC) and the degree of its dislocation. S. Webster, P. Gartell believe that the main reason for the ineffectiveness of epidural anesthesia is the displacement of the initially correctly installed catheter [6; 7]. Improper placement or dislocation of ECs can lead to accidental intravascular injection of local anesthetic, total spinal block when EC penetrates the dura mater, and EC can leave the ES through the intervertebral foramen, which will cause the development

of a unilateral block, thus lead to inadequate analgesia, or EC can completely fall out of ES, which will lead to the termination of the ongoing analgesia [8].

Among the methods of fixing the catheter, the simplest fixation is with adhesive tape, as well as special fixing devices, such as Lockit and “Epi-Fix”. Dislocation of the catheter may occur depending on the constitutional features of the patient, the site of the exit of EC on the skin, the position of the patient on the operating table or in bed, the degree of activity of the patient, the skill level of the staff caring for the EC, the characteristics of fixing devices and stickers. I.M. Bishton, P.H. Martin note that when fixing EC on the skin with a patch, internal and external migration occurs in 36 % of patients [9], according to other sources in 75 % of patients, while in 20–25 % of cases the displacement amplitude exceeds 2 cm [10]. E. Crosby also notes a high frequency of displacement of correctly placed ECs [11]. We described a method for assessing the degree of external dislocation of EC, which shows the dependence of the quality of epidural analgesia on the dislocation degree of EC [12]. Dislocation will worsen the quality of anesthesia, up to its termination. Therefore, taking into account the dislocation degree of EC, it is possible to quickly assess the risk of deterioration in the quality of anesthesia or its termination.

Purpose of the study: provide data on the use in practice of a method for assessing the degree of external dislocation of EC, which allows more accurately determining the risks of catheter migration and prolapse and making quick decisions regarding the tactics of further anesthesia.

MATERIALS AND METHODS

For the purposes of this study, we applied a method for assessing the degree of external dislocation of EC (table 1): 1st dislocation degree – from 0 to 5 mm (no dislocation), 2nd dislocation degree – more than 5 mm to 10 mm (minor dislocation), 3rd dislocation degree – more than 10 mm to 15 mm (moderate dislocation), 4th dislocation degree – more than 15 mm to 20 mm (pronounced dislocation), 5th dislocation degree – more than 20 to 30 mm (threat of prolapse, such a dislocation may lead to inadequate incomplete pain relief), 6th dislocation degree – more than 30 mm (assessed as prolapse or complete EC dislocation) [12].

This study analyzed 73 cases of combined two-level spinal epidural anesthesia (CTLSEA) with EC fixation in the subcutaneous tunnel in trauma patients. Anesthesia was performed during operations for such lower limbs fractures as proximal femur fractures – 52 (71.2 %), diaphyseal femur fractures – 18 (24.7 %), lower leg fractures – 3 (4.1 %). Of the 73 patients, there were 19 (26.0 %) men and 54 (74.0 %) women. The age of the patients ranged from 19 to 95 years. 61 patients (83.6 %) were elderly, senile and long-livers. Comorbidities were present in 100 % of patients. The physical status and anesthetic risk of patients were assessed using scale

Table 1

Scale for assessing the degree of external dislocation of epidural catheter

Dislocation degree	Value	Dislocation characteristic
1	0–5 mm	no dislocation
2	5–10 mm	minor dislocation
3	10–15 mm	moderate dislocation
4	15–20 mm	pronounced dislocation
5	20–30 mm	threat of prolapse
6	over 30 mm	catheter prolapse

of American Society of Anesthetists. For CTLSEA, Perifix epidural anesthesia kits from B/Braun with Tuohy needle G18 and EC G20 (0.85 × 0.45 × 1000 mm) were used. Three lateral holes were located at a distance of 14 mm from the distal end of the EC. The EC was marked. The first label, in the form of a single strip, was located at a distance of 55 mm from the distal end of the EC. Marks in the form of one strip were repeated every 10 mm. Two adjacent marks were located at a distance of 105 mm from the distal end of the EC. At a distance of 155 mm from the distal end there were three adjacent labels and at a distance of 165 mm one label was located. By the location of two and three adjacent marks, it is very easy to navigate and determine the degree of EC dislocation. To install the EC at the required distance of 45 mm, it must be carried out so that three adjacent marks are visible in the pavilion of the epidural needle 88 mm long, which are a good visual reference.

To conduct and fix EC in the subcutaneous tunnel, a modified spinal needle G26 was used. This method has a patent for the invention (RU no. 2727234 C1. IPC A61 19/00 published 21.07.2020 “Method of inserting an epidural catheter in the subcutaneous tunnel when performing two-level spinal-epidural anesthesia”) [13]. Additionally, the EC at the site of exposure to the skin of the lumbar region was fixed with an adhesive tape.

Prolonged epidural analgesia was started in the postoperative period after the regression of sensory and motor blockade, after a test dose of local anesthetic – lidocaine solution 20 mg/ml – 3.0 ml (60 mg) and its evaluation.

Postoperative analgesia for all patients was carried out in the form of prolonged epidural analgesia by injecting a local anesthetic solution – ropivacaine 2 mg/ml into the ES at an injection rate of 5.0 ml/hour to 9.0 ml/hour, at a dose of 10–18 mg/hour. The duration of postoperative analgesia ranged from 1 to 5 days. At the same time, anesthesia lasted 5 days in 2 patients. The mean time of postoperative epidural analgesia was 3.15 days (75.6 hours). The aseptic fixing sticker was changed the next day after the operation and then as needed.

RESULTS

The degree of external dislocation of the EC was assessed during the change of the aseptic fixing sticker and at the time the catheter was removed from the ES. In the study, no internal dislocation of EC was noted. The analysis showed that the dislocation of the 1st degree was in 11 cases, which amounted to 15.1 %. Dislocation of the 2nd degree was in 25 cases, which amounted to 34.2 %. Dislocation of the 3rd degree was in 26 cases, which amounted to 35.6 %. Dislocation of the 4th degree was in 8 cases, which amounted to 11.0 %. Dislocation of the 5th degree was in 1 case, which amounted to 1.4 %. Dislocation of the 6th degree was in 2 cases, which amounted to 2.7 %. Given the importance of external dislocation for the quality of epidural anesthesia, 4 groups of dislocation were formed: group of 1st dislocation degree (dislocation from 0 to 5 mm) – no dislocation; group of 2nd and 3rd dislocation degrees (dislocation more than 5 to 15 mm) – will not lead to deterioration in the quality of anesthesia; positive group of 4th and 5th dislocation degrees (dislocation more than 15 to 30 mm) – a high probability of deterioration in the quality of anesthesia, increased alertness is required when caring for EC and additional fixation; negative group of 6th dislocation degree

(dislocation more than 30 mm) – complete dislocation or loss of EC. For clarity, the results are displayed in a graph (fig. 1).

Evaluation of the degree of external dislocation of EC enables to assess the risk of deterioration in the quality of anesthesia and quickly take measures to prevent deterioration in the quality or termination of postoperative epidural analgesia.

With a dislocation of the 1st degree, no more than 5 mm, we did not use additional fixation measures. With dislocation of 2nd and 3rd degrees, additional attention was paid to changing aseptic dressings and monitoring the dislocation by the doctor. In dislocation of 4th and 5th degrees, special fixing devices were used to additionally fix the catheter due to an increased risk of its falling out. With a dislocation of the 6th degree, more than 30 mm, it was considered inappropriate to continue anesthesia and the administration of a local anesthetic was stopped. The catheter was removed. In our study, this happened in 2 cases. The rest of the patients received high-quality anesthesia at the planned time intervals.

CONCLUSIONS

The use of the method for assessing the degree of external dislocation of the epidural catheter in clinical practice allows to dynamically

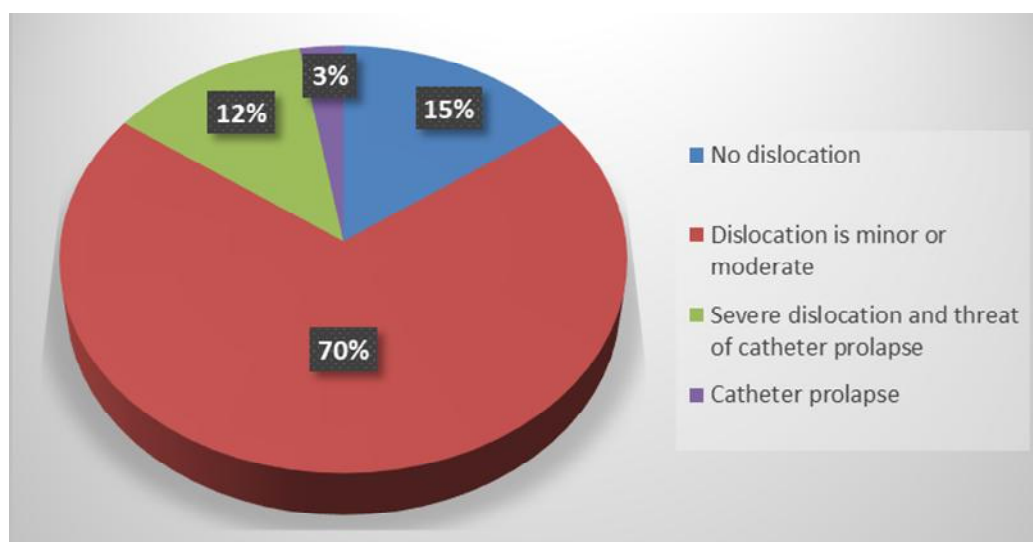


Fig. 1. Dislocation of epidural catheters when combining degrees, taking into account their significance for ongoing epidural analgesia

assess the risk of worsening epidural analgesia and take additional measures in a timely manner in case of a threat of further migration and catheter

loss, which is certainly important for trauma patients after extensive operations and at early physical activation.

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