CASE REPORTS

CONVULSION IN EPIDURAL ANESTHESIA CAUSED BY INTRAVASCULAR INJECTION (A case report and review)

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SUMMARY: *Despite all recommended precautions taken in widely used epidural anesthesia, some life threatening complications still occur. The aim of this case report is to exemplify the possibility of intravascular settlement of the catheter, which may accidentally occur during insertion. Epidural catheterisation was applied to a patient, who was planned to be operated on for an arteriovenous fistula and aneurysm in his left leg. After the negative aspiration test, 10 ml 2 % lidocaine was injected to the patient. Three minutes after the test dose application, toxic reaction and, in particular, convulsion was observed. During the catheter epidural anesthesia, in order to decrease the risk of intravascular injection, we believe that it is important to perform an aspiration test at each centimetre during the catheter insertion for any catheter type, in addition to all precautions mentioned in the literature.*

Key Words : *Catheters, Epidural Anesthesia, Regional Anesthesia, Epidural Injections, Intraoperative Complications, Convulsions.*

INTRODUCTION

Local and regional anesthesia may cause less interference with patient's vital functions than general anesthesia, and reduce the risk of intraoperative and postoperative complications (1,2). However there is always a toxic reaction risk in local anesthesia under some circumstances, such as inappropriate patient selection and poor management, and some complications may still occur (3).

Epidural anesthesia is widely used for therapeutic, operative and diagnostic purposes (4). Even when the rules of application of epidural anesthesia mentioned in the literature are followed, there may still be some complications in practice (5). One of them is convulsion due to intravascular lidocaine injection despite the negative aspiration test, as we observed in our case.

CASE REPORT

MT, a 35-year-old male patient, 166 cm in height and 60 kg in weight, was admitted to the cardiovascular surgery department with a fistula and aneurysm between A. tibialis posterior and V. saphena magna, with the dimension of 4 x 4 cm on at the medial aspect of his left leg.

He had been operated on due to a traumatic subdural hematoma when he was five years old, and three years later, he was started on antiepileptic therapy because of focal and general epileptic seizures. He had had no seizures for the last ten years.

In the preoperative visit, he was informed about epidural anesthesia and his permission was taken for the application. He was infused with 1000 ml. Ringer lactate, his heart rate was 100 bpm, and blood pressure was 120/70 mmHg. In the sitting position, from the L3-L4 interspace a 16-gauge Tuohy needle (Epidural minipack CE, Catheter: Clear nylon, 3 lateral eyes, Portex Ltd, UK) was inserted by the loss of resistance technique. The epidural space was identified and an aspiration test was performed. The epidural catheter was then advanced 5 cm cranially and 3 ml of 2 % lidocaine was injected as the test dose. After waiting for three minutes and deciding that there was no evidence of intrathecal injection, the catheter was fixed under sterile conditions. It was assumed that intravasal or intratechal placement took place during this process. There was neither obstruction nor kinking after giving 1 ml 0.9 % NaCl through the catheter, and neither blood nor cerebrospinal fluid (CSF) was observed during the aspiration. Then, 10 ml 2 % lidocaine was injected through the epidural catheter. Thirty seconds after the injection, the patient was observed to show agitation, excitement, uneasiness and temporary clonic convulsion, which lasted about 1-1.5 minutes without loss of consciousness. After the convulsive seizure was over, his heart rate was 130 bpm, blood pressure 130/95 mmHg and breathing rate 30 per minute.

Since the event began immediately after the lidocaine infusion, it was suspected to be an intravascular injection. Then the catheter was withdrawn gradually whilst the aspiration test was performed it each step. Some blood was observed in the catheter after one centimetre withdrawal. Withdrawal of the catheter was continued until the aspiration test was negative. Considering its type, the catheter was pulled back one more cm to ensure that it was out of the vessel. Because the uneasiness of the patient continued, it was decided to continue with general anesthesia. The catheter was then used for postoperative analgesia. There was no deformity, obstruction or kink observed after the catheter was withdrawn.

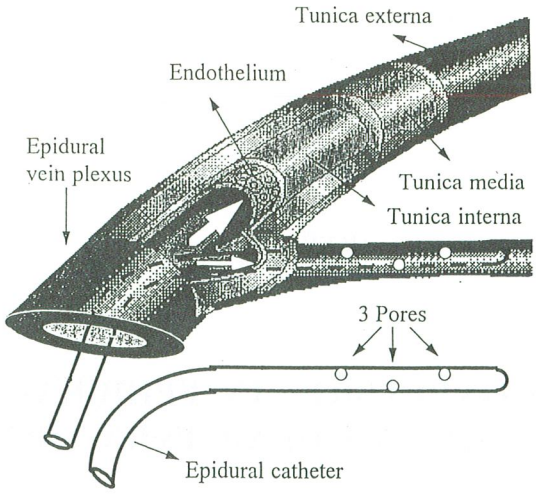

Fig - 1 : Possible placement of the catheter in the epidural vein plexus.

DISCUSSION

The most significant hazard of epidural blockade is unrecognized, unintentional intravascular injection. This is more likely to occur with epidural anesthesia than with other regional techniques because of the number of venous plexuses in the epidural space, and it may be at least partially related to the relatively low pressure existing in these veins. This low pressure, usually equated to intrathoracic pressure, may produce neither a spontaneous flow of blood from a punctured vein nor a positive flow with aspiration; the veins collapse when further negative pressure is applied. Vessel entry can occur on initial insertion of the epidural needle or on insertion of the catheter, or again, because of migration of the catheter tip at any time during ongoing epidural therapy (6,7).

Intravascular placement presents significant patient risks for two reasons. First, vessel entry is sometimes difficult to diagnose. Second, bolus injection of large volumes of local anesthetic can rapidly develop toxic drug concentrations. Seizures, respiratory arrest, and, especially with bupivacaine, cardiac arrest and death can follow (8, 9).

Toxic reactions of the local anesthetics are related to dose and occur with central nerve system and cardiovascular system symptomatology (4, 10). In our case, the

agitation, uneasiness, tachypnoea, tachycardia, hypertension and convulsion that were seen immediately after lidocaine (10 ml, 2 %) suggested that it was a toxic reaction rather than an epileptic seizure recorded in the patient's history.

This convulsion was absolutely or relatively a high dose complication (11). In order to observe a seizure, the given local anesthetic has to be over a certain specific plasma concentration, and this could be possible with a systemic absorption or an intravascular injection (12-14).

In recent studies the critical toxic plasma level of lidocaine has been found to be more than 10 mg ml-1 but in some studies even 5 mg ml-1 has also been reported to be adequate (15-18) . In a study performed by Giasi et al. (19) after the injection of 4 mg kg-1 lidocaine to the epidural space, the blood lidocaine concentration was found to be about 0.4 mg ml-1 after 15 min by systemic absorption, and this dose is not toxic as long as systemic absorption is considered. In our case, since the convulsion developed soon after the injection 10 ml 2 % lidocaine, it indicated rather that this was an intravascular injection than a toxic reaction due to systemic absorption. Hence, the blood which came out after the aspiration test during the process of drawing the catheter as mentioned above proved our debate.

The lidocaine that is injected in to the epidural vein plexus flows into the heart without reaching the liver and mixes in the systemic circulation via the azygous vein (5, 20). In our case, 200 mg lidocaine which was unintentionally intravascularly injected the plasma blood level happened to be nearly 20 µg ml-1 when calculated in accordance with the 15 % of cardiac output (brain blood supply) which already caused an adequate level to initiate a toxic reaction.

There are many reasons for epidural catheter insertion complications (5, 21-25). The risk of vascular injury is 18 %; which occurs during the cannulation or the insertion of the catheter (26). On the other hand, the frequency of vessel entry ranges from 0.2 % to 11 % (27-31). Although the typical frequency seems to be in the range of 2 %, vessel entry may occur more often (7-8.5 % incidence) in obstetrical patients (32,33) and in situations in which the epidural catheter is inserted before injection of the local anesthetic (up to 9 % incidence) (29,34,35).

The features of the catheter are thought to be important in intravascular injections (36). In the selection of radiopaque, thick, rigid and multiple side holed catheters, the likelihood of such complications appear to be greater (5). For single holed catheters, the aspiration test CSF or blood can be seen depending on the settlement area, but with close-end multi-holed catheters, the aspiration test can give false negative results where 10 % epidurosubarachnoidal and 11.5 % intravascular settlement can be seen (37, 38).

The risk of venous insertion is supposed to be equal both in single and multi holed catheters if their rigidity is the same, therefore catheters with less rigidity are recommended (39).

Multi holed catheters are difficult to position. While the distal hole can be in the subarachnoid-subdural space or in a vessel, proximal holes might be in the epidural space and during a slow injection the local anesthetic will flow mostly through the proximal hole, but in fast and forced injections the flow rate will be higher at the middle and distal holes. Consequently, mix block, high spinal anesthesia or toxic reactions could be seen (38, 40-43). Because of multi settlement risk (40), some authors objected to the use of close-end multi-holed catheters (38).

In the study of Collier and Gatt, two different catheters were used in 400 patients in epidural anesthesia. Both have multiple holes and the distance between the holes were different in each catheter, 4 mm (same in our case) and 1 mm respectively. They concluded that there was no important difference between the risk of minor or major complications and the multicompartment settlement. Close and open-ended catheters have the same risk of venous insertion (44). In open ended catheters the insertion can easily be observed whereas the multiple holed close ended catheters the insertion cannot easily be observed since one of the three holes might remain inside the vessel (43).

In open ended single hole catheters the hole can only lie in one anatomical space (38,46), therefore from the positioning point of view they are to be preferred (22,38,41), but it can also be obstructed by a bloody tap and will cause a false negative aspiration test (39).

Preferring a soft catheter, giving 10 cc air or saline, local anesthetic, before moving the catheter ahead and performing frequent aspiration tests and giving test dose of local anesthetic accompanied with epinephrine are the recommendations to assist in the identification of intravascular injections (29,45,47-53). The local anesthetic with epinephrine causes hypertension and tachycardia in the case of intravasal injection (50,51,54-56). In recent studies however it has been shown that such symptoms may cause false positive results due to stress factors (49,57). Additionally this procedure may cause anterior spinal artery thrombosis, benign dysrhythmias and reduction in the placental blood flow (58).

Since 1979 (8, 9), there has been extensive interest in developing a simple and reliable method of detecting incorrect, especially intravascular, placement of an epidural needle or catheter. Multiple regimens for testing epidural needles and catheters have been suggested, although none are ideal. Recommendations include aspiration, incremental injection, and the injection of markers of intravascular placement, such as local anesthetics, epinephrine, air, ephedrine, isoproterenol, succinylcholine, and fentanyl (59).

It is reported that in spite of all of the precautions taken, a 0.01-0.2 % intravascular injection rate can still be seen (60). Intravascular or subarachnoidal injections are thought to be caused by misapplication of the aspiration test, insufficient or misinterpretation of the test dose, or latent intravascular or subdural migration of the catheter (50). However in our case, the reason was thought to be quite different. Epidural veins have thin walls, and have no valves and for that reason, a negative pressure inside the catheter caused the thin wall to collapse over the holes, which resulted in a false negative aspiration test (8, 61). The catheter was inserted about 5 cm into the epidural space. It was thought that the distal end which contains the holes of the catheter reached into a very narrow vessel as the diameter of this vessel was nearly equal to the diameter of the distal part of the catheter (see figure), and as the negative pressure collapsed the vessel during the aspiration test and obstructed the holes, the test was negative but the positive pressure enabled the lidocaine to be injected.

In our case the catheter was inserted into a vessel which had the nearly same diameter as the catheter, and for that reason, the aspiration test was negative.

According to this observation, we concluded that, in order to minimise the risk of intravascular injection, and, in addition to all of the precautious measures proposed in the literature, it is also important to repeat the aspiration test at each centimetre of catheter insertion, since the first entrance of the catheter into the vessel is wide enough not to collapse over the catheter.

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