Epidural block procedure pitfalls

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Abstract
Objectives: To present a number of cases in which pitfalls may occur during the performance of epidural block, so that they may be prevented and corrected during the procedure.

Materials and methods: A retrospective analysis was performed in 118 patients who suffered from lumbar pain, radicular pain or both and who underwent CT-guided minimally invasive anti-inflammatory analgesic treatment by selective injection of drugs in the epidural space, between January 2013 and April 2014. In all cases, a 21-G spinal needle was used to inject depot steroid (betamethasone 3 mg) and anesthetic (lidocaine 1 ml 2% + 0.5 ml bupivacaine 0.5%) or only steroid in those cases where perforation of the dura was suspected. The cases with pitfalls during the procedure were selected.

Results: Five patients (4.23%) had technical complications during epidural block. The complications were observed after an inadequate position of the needle tip (perforation of the dura and insufficient access to the epidural space), which were evidenced by direct aspiration of cerebrospinal fluid (CSF) or by air spread, which was used as a tracer prior to the drug injection. The errors were rapidly detected and corrected without any problems or need for further treatment.

Conclusion: Epidural block is a practice that is frequently used in the management of chronic lumbar pain. Pitfalls and complications of the procedure are rare, but it is important that the physician should have the necessary experience and knowledge for their management and subsequent correction.

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Introduction

At present, epidural block is one of the most common regional analgesia techniques for chronic spinal pain management. This technique consists in delivering a combination of a local anesthetic and a steroid into the epidural space. This space lies within the spinal canal, between the ligamentum flavum and the dura mater (fig. 1a). The local anesthetic injected spreads up and down, blocking the spinal nerves in their pathway from the spinal cord to the corresponding intervertebral foramen. Traditionally performed blindly or under fluoroscopy by anesthesiologists, these procedures under CT guidance show improved efficiency of the technique, associated with lower morbidity and can be performed on an outpatient basis. Complications are rare, although meningitis and neurological damage may occur when improper aseptic techniques are used. There is also a risk of calcifications with the use of triamcinolone; therefore, intrathecal injection should be avoided.

We report our experience in the detection and management of potential technical pitfalls in epidural block, as they may be prevented and corrected during the procedure.

Materials and methods

Between January 2013 and April 2014, we retrospectively evaluated 118 patients aged 12-83 years old with lumbar and/or radicular pain, who were treated with minimally invasive CT-guided selective injection of anti-inflammatory / analgesic drugs in the epidural space. In all cases, a 16-slice GE Brightspeed Computed Tomography (CT) scanner was used. The procedure started with a short lateral scout scan with the patient in the ventral recumbent position to identify the epidural space. About 8 axial images were subsequently obtained by a spiral technique, using 5-mm thickness and interval at low-dose, with 120 kv and 105 mA. Once the selected level had been determined, marks were performed using a fenestrated grid on the patient’s skin. This helped to estimate the appropriate angulation and depth for positioning the needle tip (fig. 1b). In the procedure, a 21-gauge spinal needle is introduced, usually with no administration of local anesthetics, since the discomfort caused by the subcutaneous injection of the anesthetic is similar to that caused by puncture. Additionally, this prevents the interruption of the skin barrier. The success and fastness of the technique lies largely in placing the needle...
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as parallel to the CT beam as possible and perpendicularly to the CT table to be able to follow the complete needle pathway with the lowest number of images (ideally, the entire needle should be seen in a sequence of 3 slices or less). After penetrating the skin, the needle passes through the subcutaneous tissue and the paravertebral muscles; this interface in general is easily noticeable to the touch after the muscle fascia. If the needle advances in the planned direction as marked with the grid, the next level will be perceived by a new resistance: firm, if the needle tip touches the vertebral lamina or just a little more resistant to the previous muscle plane if the needle has met the ligamentum flavum (fig. 1c). At this point, maximum precaution is required and additional images should be obtained before reaching this point, mainly when the physician is not experienced enough. If the needle contacts a bony surface (usually the lamina), it must be pulled back slightly and redirected towards the adequate path to reach the ligamentum flavum, according to the last images obtained. When this target is reached, an injection of 0.5 ml of air is used as tracer to confirm that the epidural space has been reached (figure 1d). While the needle tip advances through the ligament, increased resistance impedes compression of the plunger, keeping the air inside the syringe. The needle is advanced in very short increments by intermittently pushing the plunger softly until the resistance against the plunger disappears. With practice, the operator’s hand will perceive when the ligament has been penetrated.

A depot steroid (betamethasone 3 mg) is injected in combination with anesthetic agents (1% lidocaine 1 ml + 0.5% bupivicaine 0.5 ml) or alone if perforation of the dura mater is suspected.

In our study, we selected cases in which pitfalls were detected by computed tomography during the procedure. Such pitfalls were noticed following inadequate positioning of the needle tip.

Figure 1 (a) Axial anatomy at the lumbar level. (b) Patient in the ventral recumbent position with the fenestrated grid on the skin. (c) Once the entry point has been selected, the needle is advanced close to the ligamentum flavum. (d) Air as a tracer has adequately reached the epidural space.
Results

Of all patients evaluated, 5 (4.23%) experienced technical complications that could be observed during the epidural block. All of them occurred during lumbar epidural blocks.

Case 1 was a 64-year-old male patient who underwent lumbar selective epidural block at L4-L5. After injection of the tracer, air spread into the paravertebral space (figs. 2a and 2b), but the needle tip could be repositioned (fig. 2c) and the procedure was completed smoothly.

Case 2 was a 50-year-old woman who underwent lumbar selective epidural block at L4-L5. The patient had a large posterolateral disk protrusion in contact with the dural sac and the ligamentum flavum (fig. 3a). When perforating the latter, the needle rubbed against disk material; therefore, when air was injected, instead of entering the epidural space, a vacuum disk phenomenon occurred (fig. 3b).

Case 3 was a 43-year-old male patient. Although the needle appeared to be adequately positioned before injecting the tracer, an air-fluid level occurred (instead of air being located laterally to the dural sac, as expected); therefore, intradural location was suspected (fig. 4). Even though there was no aspiration of cerebrospinal fluid (CSF), the needle tip was slightly pulled back and the administration of anesthetics was avoided. Only steroids were injected.

Case 4 was a 61-year-old woman who underwent lumbar selective epidural block at L5-S1. Following injection of the tracer, air flowed into the right facet joint at L5-S1 (figs. 5a and 5b). Upon correction of the error (fig. 5c), no complications occurred.

Finally, case 5 was a 48-year-old woman who underwent lumbar selective epidural block at L2-L3. The needle tip perforated the dura mater, which was evidenced by CSF aspiration (fig. 6a). However, the needle tip could be redirected (fig. 6b), and air was adequately located.

Figure 2 (a and b) Even if the needle apparently penetrates the ligamentum flavum, when air is introduced, it is located in the paravertebral space. (c) When the needle tip position is corrected, air is injected again into the epidural space.
Discussion

Spinal pain is a common complaint in daily medical practice. Management of spinal pain depends on its intensity, but in most cases it can be controlled with medical therapy. Epidural corticosteroid block should be considered only after conservative treatment failure. The only contraindications of epidural corticosteroid block are: allergy to local anesthetic, coagulation disorders or local infection at the site of the planned injection. Furthermore, steroids usually increase blood levels of circulating glucose and blood pressure levels; therefore diabetic and hypertensive patients require more strict monitoring as these changes may remain for approximately 2 months (while corticosteroid effects persist). Complications derived from the technique should be known and, even more importantly, prevented by the physician. Steroids were first used in epidural administration in 1953 by Lievre et al for relief of lumbosciatic pain. Traditionally, epidural blocks or injections were performed blindly by using anatomical landmarks or were fluoroscopically guided, but CT guidance not only allows to accurately reach the desired level; it also helps to avoid vital structures (such as the vertebral artery in the cervical region and the spinal cord) and provides improved visualization and precision of the site where the procedure will be performed, clearing up doubts about the needle pathway. From this perspective, knowledge of the spine anatomy and its presentation in the axial plane is important.

In our study, following the epidural block, no serious complications (e.g. meningitis, abscess, allergic reaction at the site of the injection) were observed.
Figure 5 (a and b) The tip of the needle does not penetrate the ligamentum flavum and air can be identified outside the epidural space, showing left L5/S1 facet joint air arthrogram. (c) The needle advances until it penetrates the ligamentum flavum. Air is located in the epidural space.

Figure 6. (a) With the initial position of the needle, the dura mater is punctured and cerebrospinal fluid is obtained. (b) The needle is pulled back and redirected, as observed in the tip location. Air has been placed in the epidural space.
or hematoma) occurred, but in a few cases, mild adverse reactions were reported, such as back pain at the site of puncture and vasovagal syncope (hypotension). Some patients complained of transient paresthesia of variable intensity, reported as impaired sensitivity in the distal end of lower limbs. In one case, transient paresthesia of lower limbs was documented, which could be attributed to passage of anesthetics to the dural space.

All technical errors during the procedure were rapidly detected and corrected.

**Conclusion**

Epidural block is a commonly used practice for chronic spinal pain management. Even if technical errors and complications during the procedure are rare, it is important to know them and physicians performing this procedure should be experienced enough to avoid them.

**Ethical responsibilities**

**Protection of human subjects and animals.** The authors declare that no experiments were performed on humans or animals for this investigation.

**Confidentiality of data.** The authors declare that no patient data appear in this article.

**Right to privacy and informed consent.** The authors declare that no patient data appear in this article.

**Conflicts of interest**

The authors declare no conflicts of interest.

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