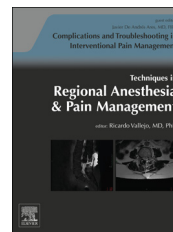


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## Epiduroscopy: Complications and troubleshooting

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### ABSTRACT

Epiduroscopy is a minimally invasive diagnostic and therapeutic technique that was introduced in clinical practice in early 1990s. We have performed a systematic review of side effects and complications reported in literature. Troubleshooting to prevent or reduce complications has been proposed. Dural puncture and fluid injection overpressure were the main causes of complications. According to the published evidence, conventional epiduroscopy is a safe procedure with no mortality and little morbidity.

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### Introduction

Epiduroscopy (periduroscopy, epiduraloscopy, extraduroscopy, or spinal endoscopy) is a minimally invasive endoscopic technique that allows diagnostic and therapeutic approaches in patients having failed back surgery syndrome (FBSS) and other cases of low back pain and radiculopathy.

Although there were prior attempts of myelotomy with rigid optics, the breakthrough for clinical application of epiduroscopy was the development of small-caliber flexible optics in the late 1980s. In 1985, Blomberg<sup>1</sup> reported the first epiduroscopic observations in autopsy cases. In 1991, Heavner et al<sup>2</sup> reported the first results of the endoscopic examination of rabbits, dogs, and human cadavers using a flexible endoscope. Since then, publications related to clinical applications of epiduroscopy performed via the sacral hiatus have appeared. In 1996, the US Food and Drug Administration approved epiduroscopy for visualizing the epidural space. In 2008, the first clinical results of an interlaminar approach for epiduroscopy in patients with FBSS were described,<sup>3</sup> and other approaches such as retrograde or transforaminal are nowadays performed.

A recent review by Kallewaard et al<sup>4</sup> confers a positive recommendation for epiduroscopy for FBSS treatment based on the published evidence.

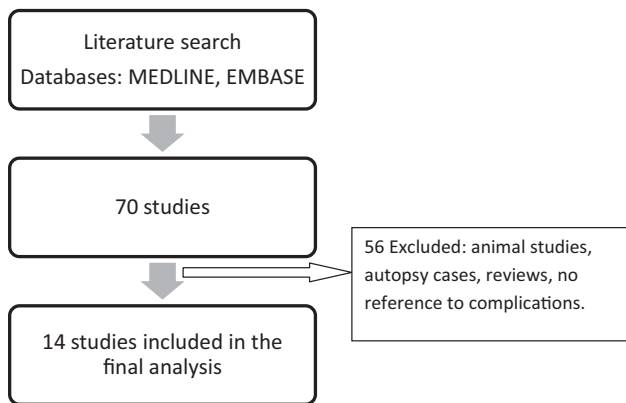
However, epiduroscopy as an invasive procedure bears undesirable side effects related to the technique itself, the administered drugs, or other adjuvant devices used (laser, radiofrequency, and Fogarty catheter). The aim of this study is to revise the side effects reported and propose troubleshooting to reduce, prevent, or deal with them.

### Methods

The PubMed and Embase databases were systematically searched to find articles related to epiduroscopy. The last computer search was performed on September 2014. Search terminology included epiduroscopy, epiduroscopic treatment, and all possible synonyms. The search was performed without language restriction, but only articles in English, French, Spanish, or German were finally reviewed.

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**Fig. 1 – Flowchart for included studies.**

Owing to the limited number of articles published under these key words or with these terms included in the title or in the abstract, all the articles were analyzed by looking for any complications reported in the results or discussion sections (Figure 1). The selected articles have been included in a table and are chronologically ordered by author, type or article (case report, prospective study, or retrospective study), and complications described (Table 1).

Studies describing complications related to adjuvant devices during surgical epiduroscopy, such as laser or radio-frequency, have not been included. These techniques exceed the usual concept of an epiduroscopy procedure, and their usefulness is not yet well established. They have only been considered for discussion.

## Results

A total of 70 articles published between 1985 and 2014 (September) were initially found with the broad search terms that were previously described. Reviews, animal studies, and studies performed on cadavers were excluded from the first analysis. The selected articles were thoroughly read to find any reference to complications related to the epiduroscopic technique. Finally, only 14 articles reported some complications associated with the procedure and have been included in Table 1.

These articles include 8 prospective studies (308 patients), 1 retrospective study (60 patients with 77 epiduroscopic procedures), and 5 case reports that describe 6 specific complications. Epiduroscopy was performed in 276 patients (70.6%) with FBSS and in 115 patients (29.4%) without previous back surgery.

Side effects and complications ranged from transient minor discomfort to rare but severe visual disturbances and encephalopathy: (i) Intraoperative discomfort—pain at the site of introduction and transient neurologic symptoms (TNS) related to changes in the epidural pressure caused by saline infusion (paresthesias, low back pain, headache, neck pain, or transient hypoacusia). (ii) Nonpersistent postprocedural low back or radicular pain, rash, and itching. (iii) Dural puncture (21 cases) and post-dural puncture headache (PDPH) (6 cases). (iv) Suspected infection (14 cases) and confirmed infection (2 patients). (v) Visual impairment associated with retinal

hemorrhages (2 cases). (vi) Others such as intradural cyst (1 case), intravascular injection (2 cases), and encephalopathy and rhabdomyolysis induced by contrast media (1 case).

## Discussion

According to literature, complications related to epiduroscopy are sparse and usually minor. Most of them are TNS, and there is a nonpersistent increase in pain in the affected area, similar to those shown in conventional epidurolysis and some epidural blocks.<sup>15</sup> Of the 391 patients included in the selected studies, only 14 cases of major complications (3%), most of them reversible and with no mortality, were reported (Table 2).

### Transient neurologic symptoms

Cases of transient headache, neck pain, dizziness, or hypoacusia during injection of saline boluses have been described.<sup>3,9</sup> These are well-known symptoms in patients who are referred to epiduroscopy or epidurolysis and are directly related to the pressure of injection. Patients with spinal stenosis or with severe epidural fibrosis, which stops cranial or caudal fluid diffusion, can suffer TNS with slow volumes of fluid injection.

These complaints usually last a few seconds. Saline flushing must be suspended immediately. If these symptoms do not disappear within 5 minutes<sup>4</sup> or reappear with low-pressure flushes,<sup>3</sup> the procedure must be discontinued.

Epiduroscopy must be performed under light or “conscious” sedation to promptly detect these TNS and immediately stop epidural saline injection.<sup>3</sup> Otherwise, serious complications such as retinal impairment can appear. Some authors<sup>9,18</sup> propose to monitor epidural pressure and limit it to an upper level of 50–60 mm Hg. Procedure duration is associated with a progressive raise in epidural pressure, and a 60-minute limit has been arbitrarily advocated as the maximum time to be used.<sup>3,9</sup> There are no well-established limits in the volume of fluid to be injected. A limitation of 60 mL of epidural fluid injection has been proposed,<sup>18</sup> although most authors administer greater volumes.<sup>9,10</sup> In our experience, the “60-limit rule,” 60 minutes, 60 mm Hg, and 60 mL, seems to be a good rule to take into consideration during spinal endoscopy.

### Post-dural puncture headache

PDPH is the most common major complication reported (50%). Dural puncture usually occurs during fiberscope advance. When fibrosis or adhesions are found, attempts are made to break adhesions using saline boluses or by means of the tip of the endoscope. During these maneuvers, a dural puncture or tear can occur. In some cases, it may go unnoticed.<sup>5,9</sup> With an interlaminar approach, dural puncture can be directly caused by epidural needle puncture.<sup>3</sup>

In the selected studies, 21 cases of dural puncture were registered, but only 6 cases of PDPH were finally reported. Most of them were treated with conventional analgesics, IV fluids, and lying flat, while 2 cases required blood patches.<sup>9</sup> All of them were discharged uneventfully in a few days. The

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