Use of Imaging Agent to Determine Postoperative Indwelling Epidural Catheter Position

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Background:
Epidural anesthesia is widely used to provide pain relief, whether for surgical anesthesia, postoperative analgesia, treatment of chronic pain, or to facilitate painless childbirth. In many cases, however, the epidural catheter is inserted blindly and the indwelling catheter position is almost always uncertain.

Methods:
In this study, the loss-of-resistance technique was used and an imaging agent was injected through the indwelling epidural anesthesia catheter to confirm the position of its tip and examine the migration rate. Study subjects were patients scheduled to undergo surgery using general anesthesia combined with epidural anesthesia. Placement of the epidural catheter was confirmed postoperatively by injection of an imaging agent and X-ray imaging.

Results:
The indwelling epidural catheter was placed between upper thoracic vertebrae (n = 83; incorrect placement, n = 5), lower thoracic vertebrae (n = 123; incorrect placement, n = 5), and lower thoracic vertebra-lumbar vertebra (n = 46; incorrect placement, n = 7). In this study, a relatively high frequency of incorrectly placed epidural catheters using the loss-of-resistance technique was observed, and it was found that incorrect catheter placement resulted in inadequate analgesia during surgery.

Conclusions:
Although the loss-of-resistance technique is easy and convenient as a method for epidural catheter placement, it frequently results in inadequate placement of epidural catheters. Care should be taken when performing this procedure. (Korean J Pain 2010; 23: 247-253)

Key Words:
epidural anesthesia, iotrolan, pain, postoperative, radiography.
**INTRODUCTION**

Because epidural anesthesia can be carried out relatively conveniently, it is widely used in clinical settings for surgical anesthesia, postoperative pain relief, and treatment of chronic pain. Epidural anesthesia is also effective for postoperative anesthesia and may improve the survival rate of surgical patients [1]. In addition, it is becoming clear that epidural anesthesia has multiple effects, including controlling a variety of stress reactions to surgery and reducing surgery-related complications [1–3].

The general method for locating the epidural cavity is the loss-of-resistance technique, which utilizes the fact that the epidural cavity is a vacuum. This procedure is performed blindly and relies on fingertip perception; however, in some cases loss-of-resistance is achieved in locations other than the epidural cavity. Therefore, it is possible to erroneously place the epidural catheter in the paravertebral space, prevertebral space, subarachnoid membrane, subdural membrane, or a blood vessel. Even if the epidural needle arrives at the epidural cavity as intended, the indwelling catheter will not necessarily be suitably positioned or under appropriate conditions. Furthermore, when the procedure is accurately carried out and the catheter is considered to have been successfully placed in the epidural cavity, doubts may still arise about the indwelling epidural catheter’s position and condition such as inadequate anesthesia, pain relief in a larger area than anticipated, motor paralysis of the patient, or excessive change in hemodynamic stability.

Epidural imaging is widely used as a diagnostic tool for a variety of patients with vertebral conditions [4,5]. It is also used to confirm the position of the epidural catheter or epidural cavity itself, or to determine the spread of epidural anesthesia to the epidural cavity. As such, it is an effective confirmatory step for the safe clinical use of epidural anesthesia [6].

We hypothesized that it might be possible to easily confirm placement of the epidural catheter and the imaging scope by administering an imaging agent through the epidural catheter postoperatively and then taking X-rays of the thoracic or abdominal area.

**MATERIALS AND METHODS**

1. **Subjects**

The Institutional Review Board of the Faculty of Medicine at our university approved the study protocol, and both patients and controls provided informed consent. The study duration spanned a 9-month period from April 2007 to December 2007. Of all surgical, urological, and obstetric patients scheduled to undergo surgery using the combination of epidural anesthesia and general anesthesia, patients with a prior history of hypersensitivity to iodine or iodine imaging agents; patients with critical cardiac, hepatic, or renal impairments; and those with an American Society of Anesthesiologists (ASA) physical status classification of III or higher were excluded. Study objective were explained and consent obtained from the 268 patients who agreed to participate (Table 1).

2. **Administration of epidural anesthesia**

Before general anesthesia, 17 G × 80-mm Tuohy needles (Hakko Medical Co., Tokyo, Japan) were inserted in the lateral position during complete wakefulness and advanced to the epidural cavity by means of either 5 ml of air or physiological saline solution using the loss-of-resistance technique. After confirming there was no reverse flow of cerebrospinal fluid or blood, the epidural catheter (950 mm with a diameter of 1.0 mm, Hakko Medical Co., Tokyo, Japan) was advanced 3 to 5 cm. A test dose was then injected through the catheter (3 ml of 1% Xylocaine

<table>
<thead>
<tr>
<th>Operated region</th>
<th>Epidural catheter indwelling region</th>
<th>X-rayed region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thoracic surgery (lungs, mediastinum, esophagus)</td>
<td>Upper thoracic vertebrae (T5-T10)</td>
<td>Thoracic area</td>
</tr>
<tr>
<td>Abdominal surgery (stomach, upper alimentary canal, pancreas, kidneys, vesica, abdominal aortic aneurysm)</td>
<td>Lower thoracic vertebrae (T8-T12)</td>
<td>Abdominal area</td>
</tr>
<tr>
<td>Pelvic interior surgery (gynecological surgery, prostate)</td>
<td>Lower thoracic vertebrae-lumbar area (T12 or lower)</td>
<td>Abdominal area (centered around the pelvis)</td>
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</table>

Cases were classified based on surgical site, epidural catheter placement location, and X-ray imaging site.