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## Transient Anterior Spinal Cord Syndrome with Continuous Postoperative Epidural Analgesia

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An unusual case of an anterior spinal artery syndrome involving a single lower limb is described. The differential diagnosis, management, and possible causes are described.

### CASE REPORT

A 59-yr-old, 157-cm tall, 45-kg woman underwent an ileal loop urinary diversion because of a 19-yr history of urinary incontinence. The cause of incontinence was unknown, there were no abnormal neurological signs, and the voiding urethrogram was normal.

There had been no problem with general anesthetics for two bladder suspensions, cesarean section, or total abdominal hysterectomy for fibroids. Spinal anesthesia for a second cesarean section was also uneventful.

Laboratory tests of renal function and coagulation were normal, as were the chest x-ray and electrocardiogram.

In the operating room, an epidural catheter was inserted *via* the L2-3 interspace using a 17-G Touhy needle with the patient in the lateral position. No evidence of intrathecal or iv injection was detected following a 3-ml test dose of 1.5% lidocaine with 1 in 200,000 epinephrine. General anesthesia was induced with sodium thiopental (300 mg) and succinylcholine (80 mg), and following tracheal intubation, anesthesia was maintained with nitrous oxide (60%), oxygen, and isoflurane (0.5-1% delivered concentration). Controlled ventilation (normocapnia) was facilitated by pancuronium. Analgesia was provided by 5-ml increments of 0.5% plain bupivacaine to a total of 25 ml during the anesthetic time of 5.25 h. Preoperative blood pressure was 130/80 mmHg and was approximately 100 mmHg systolic intraoperatively, decreasing three times to 90 mmHg, lasting a total of 10 min. Oxyhemoglobin saturation throughout remained at or above 98%. Surgery proceeded uneventfully, blood loss was estimated to be 500 ml, and she received 3,500 ml of lactated Ringer's solution. Tracheal extubation occurred following reversal of muscle relaxation. Forty-five minutes after surgery,

review by the staff anesthesiologist revealed that she was moving all her limbs and verbalizing coherently. Fentanyl 100  $\mu$ g in 10 ml of preservative-free normal saline was administered *via* the epidural catheter. Following transfer to the ward, continuous epidural analgesia was maintained with an infusion of fentanyl 10  $\mu$ g/ml in preservative-free normal saline at a rate of 40  $\mu$ g/h. At 2 h postoperatively she was reviewed by the anesthesiology resident from the Acute Pain Service. She was pain free, oriented, moving all limbs, and had regained sensation in her legs.

At 2 A.M., approximately 12 h after surgery, the patient awoke and complained to the nurse of numbness and weakness of the left leg. She was immediately reviewed neurologically and was lucid, oriented, and denied any pain. There was sensory loss to touch, pinprick, and cold involving the entire left leg from the inguinal ligament distally. Tone and power of the left leg were markedly reduced with only some very weak knee extension possible. The other limb was normal and anal tone was moderate. The epidural site appeared normal and nothing could be aspirated through the catheter.

A provisional diagnosis was made of epidural nerve root compression, probably due to an epidural hematoma. The epidural infusion was discontinued and an emergency neurosurgical consultation was obtained. The physical signs were confirmed and an anterior-posterior x-ray of the lumbar spine and computerized tomography were performed (figs. 1 and 2). These showed a scoliosis, convex to the right caused by an L<sub>4</sub> hemivertebra (two right pedicles and foramina and one left pedicle and foramen). Intravenous contrast enhancement failed to show the epidural catheter or a space-occupying lesion, and therefore, a few ml of contrast medium were injected through the catheter. It was seen to enter the spinal canal just above the lamina of L<sub>3</sub> and coursed along the left anterolateral aspect of the canal (fig. 2) in a cephalad direction. Its tip entered a left-sided intervertebral foramen, probably T<sub>12</sub>-L<sub>1</sub>. No hematoma or space-occupying lesion were demonstrated; in fact, there was ample space around the lumbar nerve roots and there was free flow of contrast out into the intervertebral spaces (fig. 2).

With the exclusion of epidural nerve root or spinal cord compression, the patient was transferred back to the ward, the catheter was removed intact, and her neurological state reassessed. At this examination, approximately 15 h after surgery, position sense was tested for the first time and found to be present at the great toe and the ankle. Unfortunately, vibration sense was not tested. The physical signs were, therefore, compatible with a lesion in the distribution of the anterior spinal artery on the ipsilateral side to the monoparesis.

A neurologic consultation was obtained, the diagnosis of a probable

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anterior spinal artery thrombosis was confirmed, and an expectant policy was adopted.

Approximately 2 h after removal of the epidural catheter, rapid improvement was noted. Over the course of the next 6 h her motor strength returned, and at approximately 12 h since her first complaint, all abnormal neurologic signs had resolved.

Six weeks following surgery she remained neurologically intact.

### DISCUSSION

Transient neurologic abnormalities following lumbar epidural blockade are, fortunately, much more common than permanent lesions, 0.1% in one series of 32,718 patients<sup>1</sup> compared with 0.02% in a review of 780,000 cases.<sup>2</sup>

Upon initial examination it was thought this patient was exhibiting physical signs consistent with epidural nerve root compression, most likely due to a hematoma, but possibly due to a localized collection of fentanyl. Epidural hematoma is a known complication of epidural anesthesia due to needle or catheter<sup>3</sup> damage of the multiple thin-walled epidural veins. Anticoagulation or a coagulopathy are often associated with the most neurolog-



FIG. 1. Anteroposterior view of the lumbar spine. A scoliosis is shown, convex to the right caused by an L<sub>4</sub> hemivertebra.



FIG. 2. Computerized tomography of the lumbar spine. Contrast medium is present within the epidural catheter in the epidural space, and some is seen in the paravertebral space. The catheter courses along the anteriolateral aspect of the spinal canal.

ically devastating outcomes,<sup>4</sup> but these factors are absent in approximately two-thirds of cases.<sup>5</sup>

Other possible causes of a space-occupying lesion in this case could have been an epidural abscess, a tumor, or a collection of unabsorbed saline associated with the fentanyl infusion.

Such a mechanism has been invoked to explain a case of paraplegia in a woman in labor who was given 40 ml of 0.9% saline via an epidural catheter.<sup>6</sup>

Our patient had an abnormality of the 4th lumbar vertebra that may well have been associated with a spinal stenosis. Skoven *et al.* have recently reviewed a number of cases of paraplegia associated with epidural anesthesia in the presence of spinal stenosis.<sup>4</sup>

Following exclusion of a space-occupying lesion by a normal epidurogram, a diagnosis of anterior spinal artery occlusion was considered the most likely explanation for her clinical signs, even though these were unilateral.

The anterior two-thirds of the spinal cord supplied by the anterior spinal artery contains the anterior and lateral spinothalamic tracts, the anterior horn cells, and the pyramidal tracts. Disruption of the blood supply of this area gives rise to loss of pain and temperature sensation, flaccid paralysis, and later spasticity due to involvement of the pyramidal tracts, but with preservation of position, joint sense, and vibration (carried in the dorsal columns). There is usually retention of urine and feces in the early stages, but automatic bladder and bowel control may eventually be achieved. Obstruction to one or more feeding or radicular arteries causes weakness and sensory impairment that may be restricted to one limb or may be asymmetrical in the two lower limbs.<sup>7</sup> In these cases, considerable or even complete recovery may subsequently take place. In our patient, the mechanism of injury may have been either

venous obstruction or catheter irritation and spasm of the radicular vessels within the intervertebral foramen. The tip of the epidural catheter was seen lying in a left-sided intervertebral foramen where the radicular vessels enter and leave the spinal canal, ipsilateral to the physical signs, and at approximately the appropriate spinal level. Meningeal irritation and radiculitis have been described due to the prolonged presence of an epidural catheter.<sup>‡</sup> This was reversed upon catheter removal. The presence of an epidural catheter in close proximity to the radicular vessels in the intervertebral foramen might give rise to changes in blood flow within these vessels. Occlusion of one of these vessels can give rise to the signs of an anterior spinal artery syndrome in one limb only.

We do not believe that the fentanyl was responsible for causing an alteration in flow, as we are unable to find any information referable to vasospasm with this drug. Although seizures have been reputed with fentanyl,<sup>8</sup> a direct neurotoxic effect has never been suggested, and the dissociation of the sensory loss suggests the lesion in our patient was within the substance of the spinal cord

where these modalities are separated, not within the nerve roots in the epidural space where the fentanyl was infused.

In conclusion, we believe our patient suffered a unilateral transient anterior spinal cord syndrome due to irritation by the epidural catheter tip of the radicular vessels in their intervertebral foramen.

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