CASE REPORTS

Anesthesiology
78:785–787, 1993
© 1993 American Society of Anesthesiologists, Inc.
J. B. Lippincott Company, Philadelphia

Gadolinium-enhanced Magnetic Resonance Imaging and Autopsy
Findings in a Patient with Cauda Equina Syndrome

Devanand Mangar, M.D.,* Wifredo Gonzalez Jr., M.D.,† Craig Linden, M.D.‡

SPINAL anesthetic provided through a catheter has potential advantages when compared to that accomplished with a single injection through a needle. Recently, attention has been focused on the use of small-bore catheters for continuous spinal anesthesia and postoperative analgesia.1 Numerous cases of cauda equina syndrome have been reported in the literature after continuous spinal anesthesia.2–6 A Food and Drug Administration safety alert§ reported cauda equina syndrome in several patients in whom the small-bore 28-G catheters had been used to deliver 5% lidocaine. We describe a case of cauda equina syndrome with documented radiographic changes by magnetic resonance imaging (MRI) enhanced with gadolinium and the autopsy findings in a patient who was given a continuous spinal anesthetic through a 20-G catheter.

Case Report

A 69-yr-old, 90-kg, 178-cm man was admitted for an exploratory laparotomy, vagotomy, antrectomy, and Billroth I type gastric reconstruction. Blood pressure was 120/55 mmHg, pulse 62 beats/min, and respiratory rate 16 breaths/min. Laboratory data, including coagulation tests and chest roentgenogram, were within normal limits. Electrocardiogram revealed normal sinus rhythm with inverted T waves in leads I, II, III, AVL, and AVF.

After the urinary catheter was removed on the fourth postoperative day, the patient developed urinary retention requiring frequent catheterization. Several episodes of diarrhea on the fourth and fifth postoperative days were attributed to "dumping syndrome." The patient later reported that he was unaware of defecating during these episodes. Continued bladder and bowel incontinence led to the diagnosis of cauda equina syndrome.

Neurologic examination revealed decreased perineal pinprick sensation, decreased anal sphincter tone, and absent cremasteric reflex. Plain radiographs and an MRI scan of the thoracic and lumbar spinal spine were negative (figs. 1A and 1C). The symptoms persisted without improvement, and on the 18th postoperative day, a repeat MRI scan, with contrast (gadolinium), showed abnormal linear enhancement in the distribution of nerve roots in the cauda equina at the L1–L2 level (figs. 1B and 1D). Analysis of cerebrospinal fluid was

Anesthesiology, V 78, No 4, Apr 1993
Fig. 1. Abnormal enhancement along cauda equina. (A and B) T1 weighted sagittal images pre- and post- contrast show linear Gadolinium-enhancement posteriorly inside the thecal sac. (C and D) T1 weighted axial images show multiple rounded foci of Gadolinium-enhancement in cross section.
negative except for a mildly increased protein of (110 mg%) consistent with an inflammatory process. Microbial cultures of the cerebrospinal fluid were negative. The patient was given 8 mg dexamethasone every 6 h, which was gradually reduced over 2 weeks. Six weeks postoperatively, the patient's symptoms persist, requiring self catheterization every 6 h and bowel training.

Eight weeks postoperatively, the patient was readmitted to the hospital with congestive heart failure and abdominal pain. Over the course of a week, his medical condition deteriorated. He expired, and postmortem examination revealed marked thickening of the dura and leptomeninges extending to the nerve roots producing endoneural and perineural fibrosis with axonal degeneration.

Discussion

In the majority of case reports2-6 of cauda equina syndrome, the evaluation included either a computed tomography or a MRI scan. None of these studies revealed abnormalities correlating with the clinical picture. The gadolinium-enhanced MRI scan showed evidence of a possible inflammatory reaction in the affected nerve roots. Furthermore, the increased cerebrospinal fluid protein was suggestive of an inflammatory process. Postmortem examination of our patient showed marked thickening of the dura and leptomeninges extending to the nerve roots producing endoneural and perineural fibrosis with axonal degeneration. This correlates with the enhancement pattern on MRI. The pathologist also noted that the patient had an extensive fibrotic reaction at sites of previous cardiac surgery with restrictive pericarditis, Billroth I with extensive abdominal adhesions, and adhesions in the retroperitoneum associated with aortic graft. The pathologist felt that the patient showed a propensity to mount a fibrotic response, and that the findings in the lumbar meninges could be in response to the mechanical trauma of the catheter as well as the local anesthetic.

The MRI enhancement findings are nonspecific and have been described in inflammatory7 and neoplastic conditions,8 such as arachnoiditis and leptomeningeal carcinomatosis, and following spinal cord injury.9 In a study of benign arachnoiditis presumably due to previous myelography or surgery, 7 of 13 patients showed mild or moderate enhancement.10 A case of thickened enhancing nerve root was seen as a complication of epidural anesthetic in a patient from Mexico and was attributed to preservative agents in the anesthetic used in South America.11

The detection of abnormal nerve root enhancement in the intrathecal space requires careful review and is facilitated by side-by-side comparison with precontrast images (fig. 1).8 Magnetic resonance imaging can allow visualization of abnormal thickening of individual nerve roots and clumping of these roots, indicating changes that are pathologic.8

A recent Food and Drug Administration safety alert§ regarding cauda equina syndrome described 11 patients with cauda equina syndrome after continuous spinal anesthesia with small-diameter catheters and 5% lidocaine in 7.5% glucose. Shortly thereafter, these catheters were recalled by the Food and Drug Administration. However, clinicians still use continuous spinal anesthesia, but with large-bore catheters, as in this case.

In summary, we have shown with this report that the enhanced MRI is supported by the autopsy findings and may be used to correlate and document findings in patients who develop cauda equina syndrome after continuous spinal anesthesia. The direct neurotoxic effect of local anesthetic has been implicated as a cause of injury. However, as demonstrated in this case, the possibility of scarring developing in some patients, further compromising neural function, must be considered.

References