

Cerebrospinal fluid drainage using C-arm to prevent spinal cord injury in a patient with severe scoliosis undergoing thoracoabdominal aortic aneurysm repair

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Abstract: Postoperative paraplegia resulting from spinal cord ischemia is a devastating complication of thoracoabdominal aortic aneurysm repair. In that, various methods had been tried to prevent postoperative spinal cord ischemia. Crawford type I, II thoracoabdominal aneurysm has a high-risk of postoperative paraplegia and cerebrospinal fluid (CSF) drainage during surgery reduces this risk. Despite the benefits of CSF drainage, inserting CSF drainage catheter in patients with severe scoliosis has technical difficulties and may lead to major complications due to spinal deformity. For patients with severe scoliosis, the fluoroscopy and ultrasound image can be useful during CSF drainage catheter insertion. We report of a case of cerebrospinal fluid drainage using C-arm to prevent spinal cord injury in a patient with severe scoliosis undergoing thoracoabdominal aortic aneurysm repair. We have had a successful insertion of CSF drainage catheter without any technical difficulties and complications. The patient was discharged without any postoperative neurological symptoms.

Keywords: Thoracic aortic aneurysm, Cerebrospinal fluid drainage, Paraplegia, Scoliosis.

INTRODUCTION

Paraplegia caused by spinal cord ischemia is a major complication of open thoracoabdominal aortic aneurysm (TAAA) repair [1,2]. In particular, Crawford type I and II TAAA repair has an extensive aneurysm (surgical area or operating range) and shows high probability of postoperative paraplegia caused by stoppage of blood supply due to vertebral artery segments[3]. Among the measures used to reduce the risks associated with TAAA repair, cerebrospinal fluid (CSF) drainage has proven to be effective[1].

It is difficult to perform CSF drainage in patients with severe scoliosis because of technical limitations, and it may lead to complications such as neurological damage, spinal hematoma, and post-dural puncture headache. Therefore, the pros and cons of this procedure should be considered before its application[4, 5].

In this report, we present a case of successfully performed CSF drainage in a severe scoliosis patient, who showed lumbar Cobb angle of 75.1° and a thoracic Cobb angle of 87.1° measured using fluoroscopy.

CASE REPORT

A 55-year-old man weighing 50 kg and 168 cm tall was scheduled for open TAAA repair. The

patient had a Crawford type II TAAA with Marfan syndrome and severe scoliosis. Preoperative thoracolumbar radiography showed severe scoliosis with a lumbar Cobb angle of 75.1° and a thoracic Cobb angle of 87.1° (Fig. 1). The catheterization procedure was expected to be associated with various technical difficulties and complications because of the spinal deformity and stenosis caused by the severe scoliosis. Therefore, CSF drainage was necessary to prevent paralysis caused by spinal cord injury.

Total intravenous anesthesia was induced using 2% propofol, remifentanyl, and rocuronium. The patient's vital signs were stable. He was positioned in a semi-lateral decubitus position, and a 16-gauge Tuohy needle was inserted at the lumbar 3rd – 4th interspace by using C-arm fluoroscopy (Fig. 2). The Tuohy needle was advanced using fluoroscopy, and the catheter was left in place for continuous drainage until the CSF was drained successfully. The patient was positioned supine, and the operation was started.

The operation lasted for 12 hours, and 240 ml of CSF was drained during this period. The mean blood pressure was 70-90 mmHg and body temperature was 32-34°C during cardiopulmonary bypass. The patient was shifted to the intensive care unit after the operation, and postoperative radiography showed that the CSF

drainage catheter was well placed in the intrathecal space (Fig. 4). On postoperative day 3(POD #3), 262ml of CSF was drained, and on POD #4, the amount of CSF drained decreased to 138 ml. No neurological deficits or other complications associated with the use

of a CSF drainage catheter were observed on POD #3 and#4. On POD #4, the CSF drainage catheter was removed, and on POD #36, the patient was discharged from the hospital with no complications.

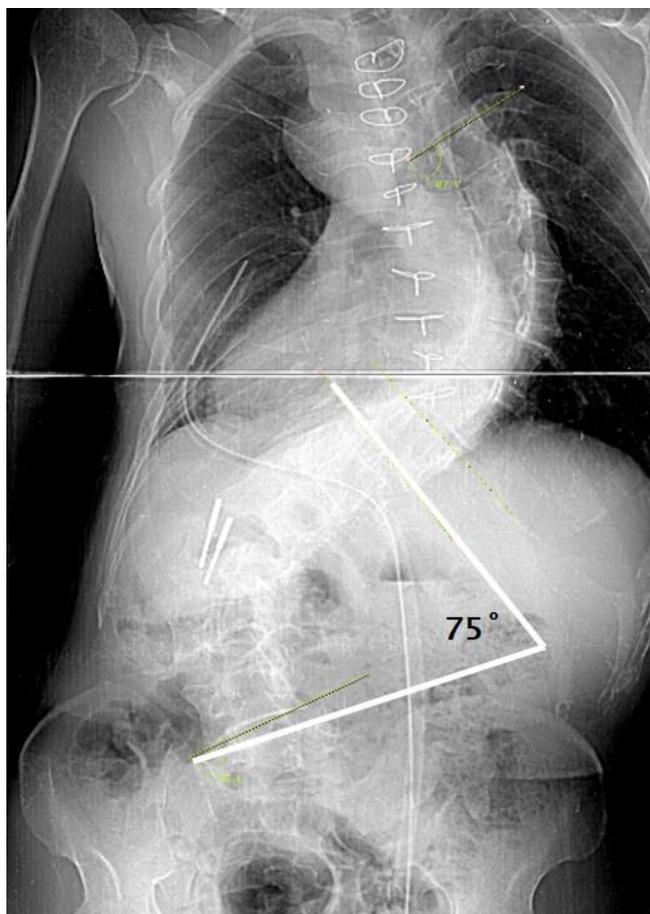


Fig-1: Thoracoabdominal X-ray. Preoperative simple thoracoabdominal X-ray shows severe scoliosis with Cobb's angle of 75.1° on lumbar area which can be indicated for surgical correction (arrow)



Fig-2: This figure shows the semi-lateral decubitus position of the patient due to severe scoliosis during CSF drainage needle insertion under C-arm.

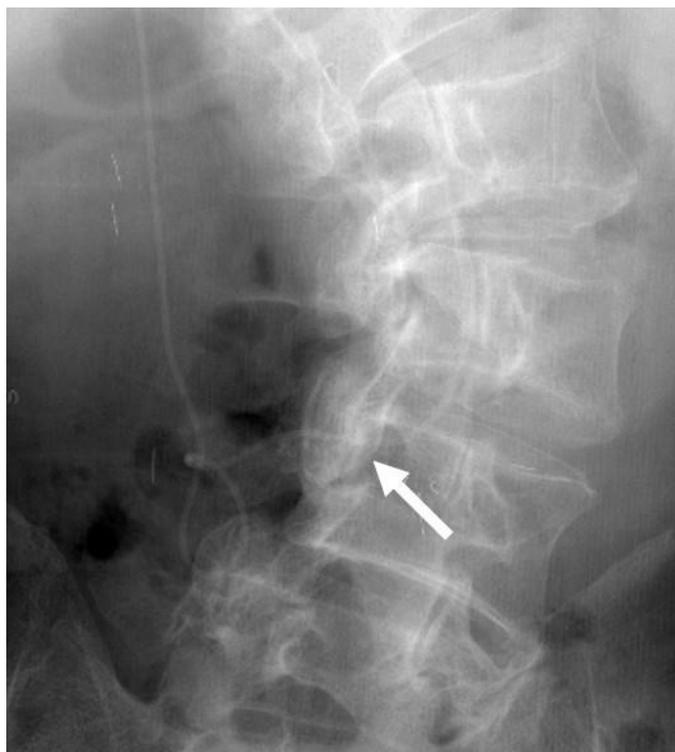


Fig 3: Lumbar X-ray shows the correct placement of the CSF drainage catheter at the L4-5 space (arrow).

DISCUSSION

Postoperative paraplegia after TAAA repair is known to occur in 10-20% of the patients[5]. This condition is fatal with a high mortality rate[1,2]. The postoperative mortality rate in patients without neurological damage is 4.5%, but it can increase to 45.5% in the presence of paraplegia caused by spinal ischemia[1]. Several methods such as hypothermia induction, CSF drainage, high mean BP maintenance, and Intercostal artery replacement have been reported to prevent postoperative paraplegia after TAAA repair[4–6]. TAAAs are classified as Crawford types I to IV. For Crawford type I and II aneurysms, the operating range is wide, and therefore, it is safe to perform CSF drainage to prevent postoperative paraplegia[1,5]. Coselli *et al.*; reported an 80% decrease in the relative risk of postoperative paraplegia in patients undergoing CSF drainage; 2.6% of those who underwent CSF drainage compared to 13% of those who did not undergo CSF drainage had neurological injuries[1]. In the present case, the patient presented with a Crawford type II aneurysm and required CSF drainage to prevent postoperative spinal cord ischemia caused by TAAA repair.

Moreover, the patient had Marfan syndrome and spinal scoliosis. Spinal scoliosis occurs with kyphoscoliosis, which involves the gradual deformation of the spine. Scoliosis can be classified by etiology into 3 main types: congenital, neuromuscular, and idiopathic[7]. The severity of scoliosis is evaluated using Cobb angles. In patients with idiopathic scoliosis, the Cobb angles measure 11° to 25° for mild scoliosis,

25° to 50° for moderate scoliosis, and >50° for severe scoliosis[8]. In the present case, the patient had a Cobb angle of >75°, suggesting severe scoliosis. Generally, the use of a CSF drainage catheter in severe scoliosis patients is associated with technical difficulties and a high risk of complications such as neurological damage, spinal hematoma, post dural puncture headache, and intracranial hemorrhage[4,5,7]. Therefore, ultrasonography guided CSF drainage is recommended first in severe scoliosis patients with Cobb angles of >50° because ultrasonography does not involve radiation and can be performed easily. If ultrasonographic images cannot be obtained, the use of a C-arm is recommended[8]. Therefore, in this study, we used ultrasonography first after the induction of anesthesia; however, because the quality of the images obtained was unsatisfactory, a C-arm was used for CSF drainage. The CSF drainage catheter was inserted successfully, and the patient's vital signs were stable during the procedure.

The mechanism of postoperative paraplegia after TAAA repair involves spinal infarcts caused by cell damage due to low blood flow and O₂ levels[4]. Spinal cord perfusion pressure is measured as the difference between the mean BP and intracranial pressure(ICP) or central venous pressure[5]. Use of aortic cross-clamping during thoracoabdominal surgery increases central venous pressure and ICP and decreases spinal cord perfusion pressure, leading to spinal cord ischemia. To prevent spinal cord ischemia, we try CSF drainage to increase CSF perfusion pressure from lowered ICP[5,6]. The CSF drainage rate is

usually maintained between 10 and 15 ml/h [9]. In this study, the drainage rate was maintained between 10 and 15 ml/h because of the wide operating range.

CONCLUSION

Patients with severe scoliosis frequently present with cardiopulmonary problems and a difficult airway and usually experience difficulties with CSF drainage because of spine deformities. Therefore, a thorough preoperative evaluation is essential for patients requiring CSF drainage. Other surgical methods in combination with imaging techniques such as ultrasonography and fluoroscopy should be considered in these patients.

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