Hemothorax caused by the trocar tip of the rod inserter after minimally invasive transforaminal lumbar interbody fusion: case report

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Minimally invasive surgery (MIS) for transforaminal lumbar interbody fusion (MIS-TLIF) is widely used for lumbar degenerative diseases. In the paper the authors report a unique case of a hemothorax caused by the trocar tip of the rod inserter after MIS-TLIF. A 61-year-old woman presented with thigh pain and gait disturbance due to weakness in her lower right extremity. She was diagnosed with a lumbar disc herniation at L1–2 and the MIS-TLIF procedure was performed. Immediately after surgery, the patient's thigh pain resolved and she remained stable with normal vital signs. The next day after surgery, she developed severe anemia and her hemoglobin level decreased to 7.6 g/dl, which required blood transfusions. A chest radiograph revealed a hemothorax. A CT scan confirmed a hematoma of the left paravertebral muscle. A chest tube was placed to treat the hemothorax. After 3 days of drainage, there was no active bleeding. The patient was discharged 14 days after surgery without leg pain or any respiratory problems. This complication may have occurred due to injury of the intercostal artery by the trocar tip of the rod inserter. A hemothorax after spine surgery is a rare complication, especially in the posterior approach. The rod should be caudally inserted in the setting of the thoracolumbar spine.

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KEY WORDS hemothorax; complication; spine surgery; minimally invasive transforaminal lumbar interbody fusion; upper lumbar disc herniation; rod inserter

TRANSFORAMINAL lumbar interbody fusion (TLIF) is an effective surgical treatment for lumbar degenerative conditions. Minimally invasive surgery (MIS) techniques for TLIF (MIS-TLIF) have been demonstrated to reduce the damage of paraspinal muscles as well as decrease blood loss and postoperative pain, shorten length of hospital stay, and be more cost-effective treatments.^{1,5,6,17,18} In addition, clinical outcomes including visual analog scale score and Oswestry Disability Index were clinically equivalent between MIS and open TLIF. Therefore, the MIS-TLIF technique has been widely used in the treatment of lumbar degenerative diseases. Perioperative complications in MIS-TLIF are uncommon. Several studies have suggested trends toward lower rates of surgical complications including dural tear, infection, graft malposition, neurological deficit or nerve injury, and hematoma in MIS cohorts.⁵ On the other hand, MIS techniques have a surgi-

cal learning curve and there are some risks of MIS-specific complications such as screw malposition, vascular injury for guidewire-assisted pedicle screw insertion, and a disconnecting rod and screw system.^{9,12} The occurrence of a hemothorax after posterior spine surgery is a rare complication. In addition, there have been no published reports of a hemothorax after MIS-TLIF. In this paper we present a patient who experienced a hemothorax caused by the rod trocar tip after MIS-TLIF for the treatment of upper lumbar disc herniation.

Case Report

History and Examination

A 61-year-old woman presented with right thigh pain and gait disturbance along with weakness of her lower right extremity. She was diagnosed with lumbar disc her-

ABBREVIATIONS MIS = minimally invasive surgery; TLIF = transforaminal lumbar interbody fusion.

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niation at L1–2 on MRI (Fig. 1). The patient was treated with pain management using medication and an epidural block at the local hospital; however, symptoms of intermittent claudication progressed due to right thigh pain. Surgical treatment was considered due to her persistent severe leg pain. MIS-TLIF was chosen because the disc herniation was located at the L1–2 level and it avoids significant retraction of the cauda equina and conus medullaris.

Surgical Procedure

A 3-cm longitudinal incision at the right-side L1–2 level was made for placement of the Quadrant retractor system (Medtronic Sofamor Danek). After the right-side L1–2 facet joint was removed using an osteotome and rongeurs, a discectomy was performed. Autologous bone grafts obtained from the removed facet and lamina were packed in the anterior disc space. A single polyetheretherketone cage (Capstone; Medtronic Sofamor Danek) was placed obliquely into the L1–2 disc space and then the Quadrant tube retractor system was removed. Percutaneous pedicle screws were placed through a guidewire under fluoroscopic guidance using the Sextant system (Medtronic Sofamor Danek). After pedicle screw insertion, the extenders were connected and the rod inserter and trocar tip were attached to the 2 screw-extender assemblies. A 1-cm longitudinal incision was made to path to gain access to the fascia and muscle. The rod trocar was inserted cranially until it touched the proximal screw. Positioning of the screws and rod was confirmed with anteroposterior and lateral fluoroscopy.

Postoperative Course

Immediately after surgery, the patient's thigh pain resolved and the patient remained stable with normal vitals. The next day after surgery, she developed severe anemia and her hemoglobin level decreased to 7.6 g/dl, which required blood transfusions. A chest radiograph and CT scan revealed a hemothorax (Fig. 2A and B). A plain CT scan revealed swelling of the left-side paraver-

FIG. 2. Anteroposterior postoperative plain radiograph (A) and axial CT scan (B) show a hemothorax on the left side. An axial CT scan at T-11 demonstrates a hematoma (arrow) of the paravertebral muscle (C). An axial CT scan shows the location of pedicle screws at L-1 (D).

tebral muscle at the T-11 level (Fig. 2C). We evaluated the perforation of the aorta branches during pedicle screw insertion. The pedicle screws did not breach the lateral and anterior vertebral wall. In addition, screw tips at the L-1 and L-2 level were located in the retroperitoneal space that were not in the thoracic cavity (Fig. 2D). However, the enhanced CT images did not confirm arterial bleeding. A chest tube was placed between the fifth and sixth ribs to treat the hemothorax in the left thorax. Initially, a total of 300 ml of bloody drainage was confirmed but active bleeding had already stopped. Her blood hemoglobin level did not decrease after blood transfusions. The chest tube was removed after 3 days of drainage. The patient was discharged 14 days after surgery without leg pain or any respiratory problems. This complication may have occurred due to injury of the intercostal artery by the trocar tip of the rod inserter.

Discussion

The complication rate of MIS-TLIF is 0–40%.^{5,9,12,20,22} Surgical-procedure related complications after MIS-TLIF include dural tear, infection, graft malposition, screw malposition, neurological deficit or nerve injury, and hematoma. Wang and Zhou reported that the overall incidence of perioperative complications associated with MIS-TLIF surgery was 37% in 204 patients.²⁰ The rate of surgical procedure-related complications and medical complications were 23% and 14%, respectively. Leg sensory disturbance was the most common complication, occurring in 12%; the second most common complication was dural tear, occurring in 10%. Several studies reported trends toward lower complications rates in the MIS group than the open group.²⁰ On the other hand, Lau et al. noted that the MIS-TLIF group had a higher rate of complications, which might have been associated with the learning curve.⁹ Wang et al. reported that MIS-TLIF is a safe and

FIG. 1. Sagittal (left) and axial (right) T2-weighted MR images at L1–2 demonstrate the significantly herniated disc (left) and right-side compression of the spinal canal (right).

FIG. 3. A lateral plain radiograph (left) shows the proximal screw head is deeper than the distal screw head. The skin incision on the left side (right) is located more cranially than the right side (arrow). Figure is available in color online only.

effective procedure for disc herniation in the thoracolumbar junction.²¹ There were no major complications after MIS-TLIF for treatment of upper lumbar disc herniation.

A hemothorax is a collection of blood in the pleural space and may be caused by penetrating trauma. A hemothorax after spine surgery is a rare complication, especially in the posterior approach. Most previously reported hemothorax cases were related to the anterior approach, caused by anterior instrumentations or thoracoplasty.^{2,4,7,8,11,14,15,19} Only 5 articles have been published involving a hemothorax after spine surgery via the posterior approach.^{3,10,13,16} Modi et al. reported 3 cases of hemothoraxes after posterior pedicle screw instrumentation surgery in patients with flaccid neuromuscular scoliosis. They concluded that the cause of the hemothorax was breaching of the lateral wall of the pedicle or the anterior vertebral body cortex during

FIG. 4. Three-dimensional CT scans show the apex of the left-side rod is located close to the bottom of the twelfth rib (arrow). Figure is available in color online only.

FIG. 5. The lateral cutaneous branch of the intercostal artery was injured by the rod trocar tip during its path through the fascia and muscle. Copyright Keishi Maruo. Published with permission. Figure is available in color online only.

pedicle screw probing or insertion.¹⁰ Pang et al. reported a hemothorax caused by a Gelpi retractor during posterior surgery for adolescent idiopathic scoliosis.¹⁴

In the present case, a postoperative CT scan confirmed a hematoma of the left paravertebral muscle at the T-11 level, which is the skin entry point of the trocar tip. The trocar tip of the rod inserter was inserted cranially through the left paravertebral muscle. The radiograph confirmed the proximal screw head position was deeper than the distal screw head (Fig. 3 left). Therefore, the left skin incision of the rod insertion was located more cranially than the right side (Fig. 3 right). This means the rod trajectory was started at a deeper level through the twelfth rib. A 3D CT scan revealed there is some possibility that the rod trocar tip passed by the twelfth intercostal artery (Fig. 4). Therefore, the lateral cutaneous branch of the intercostal artery was injured by the rod trocar tip during its path through the fascia and muscle (Fig. 5). To our knowledge, there have been no published reports of a hemothorax after MIS-TLIF caused by rod trocar tip. The rod should be inserted caudally in the setting of thoracolumbar levels.

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Disclosures

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Author Contributions

Conception and design: Maruo. Acquisition of data: Maruo. Analysis and interpretation of data: Maruo. Drafting the article: Maruo. Critically revising the article: Maruo. Reviewed submitted version of manuscript: all authors.

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