Minimalistic thoracoscopic anterior spinal release in Scheuermann kyphosis

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Video clip is available online.

Scheuermann disease is the most common cause of thoracic kyphosis in adolescence. In advanced stages, the disease can cause severe kyphosis ($>70^\circ$) and anterior wedging of thoracic vertebrae, necessitating anterior spinal release through a thoracotomy¹ or video-assisted thoracoscopic surgery (VATS) followed by posterior spinal instrumentation and fusion for correction.² I describe here a novel

ultra minimally invasive (minimalistic) thoracoscopic anterior spinal release that allows excellent results in severe Scheuermann kyphosis.

CLINICAL SUMMARY

A 14-year-old girl with a diagnosis of severe Scheuermann kyphosis (Cobb angle, 83°) was admitted to Tor Vergata University (Rome, Italy) for surgical correction. After obtaining written, informed consent from the patient's parents, my team decided to perform VATS anterior spinal release with subsequent posterior instrumentation and fusion.

After placement of a nasogastric tube and intubation with a double-lumen tube for single-lung ventilation under general anesthesia, the patient was placed in the lateral left-sided decubitus position with 45° semiprone rotation. Through a right-sided thoracoscopic access, three 7-mm flexible trocars were inserted: 1 for a 5-mm, 30° -angled camera at the 10th intercostal space along the middle axillary line and 2 for instrumentation at the 10th and 7th intercostal spaces along the anterior axillary line.

Once the mediastinal pleura was incised, discectomy was performed with dedicated thoracoscopic Kerrison forceps (MIASPAS; Aesculap, Inc, Center Valley, Pa). Performing

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FIGURE 1. Intraoperative right thoracoscopic views of perivertebral anatomy. *Upper left*, The operative field is delimited by the esophagus (ES) and azygos vein (AV) anteriorly and by the splanchnic major nerve (SM) running oblique to the T9 vertebral body (VB). *Upper right*, After incision of the mediastinal pleura, complete discectomy is performed first, with no division of segmental vessels. *Lower left*, Afterward, division of the anterior longitudinal ligament (ALL) is carried out with minimal blunt dissection in the mediastinum, taking care to recognize and spare the thoracic duct (TD). *Lower right*, The final operative view shows the completed spinal release at the level of T8 through T10, with maximal sparing of anatomic structures in the posterior mediastinum.

discectomy as the first step facilitated exposure of the anterior longitudinal ligament from the inner side of the emptied disk spaces. This avoided the need for any sharp dissection anterior to the ligament. The ligament was then divided transversely at the level of the 3 most wedged and rigid disk spaces without use of electrically activated instruments. During this maneuver, mediastinal fatty tissue was gently displaced contralaterally with 5-mm cotton swabs. Segmental vessels were not divided, and attention was paid to recognize and spare the thoracic duct, the sympathetic nerves, and the azygos vein. Once the division of the ligament was complete, vertebral mobility was tested by rotating a Cobb elevator inside the released disk spaces. Finally, a chest tube was placed and the small skin incisions were sutured (Figure 1 and Video 1).

Posterior instrumentation and fusion were performed successfully 5 days later, and the patient was discharged uneventfully 10 days after the first procedure. Before discharge, chest radiography demonstrated a 100% correction of the hyperkyphosis (Cobb angle, 40°; Figure 2). At the last follow-up, 12 months after the operation, the patient is highly satisfied and has had no loss of correction.

Overall, I have used this minimalistic VATS approach in 4 cases of severe thoracic deformity.³ The overall correction rate averaged 75°, with no loss of correction at a median follow-up of 28 months.

DISCUSSION

To date, the only series of VATS anterior spinal release in Scheuermann kyphosis has been reported by Herrera-Soto and coworkers.² Theoretical advantages of VATS include better cosmesis, magnified vision of and more direct approach to disk spaces, reduced blood loss, lower infection rate, and reduced thoracic pain, as well as shorter hospital stay. Disadvantages include a steep learning curve, the need for specialized equipment, loss of tactile feedback, and more difficult management of vascular complications.²

The original VATS approach that I propose is aimed at minimizing the overall invasiveness of the procedure.³ To accomplish this result, I recommend the use of 5-mm instruments passed through 2 intercostal spaces only to minimize both surgical trauma and postoperative pain and to improve cosmetic results. In addition, performing discectomy as the first step facilitates the subsequent visualization of the anterior longitudinal ligament directly from the inner side of the emptied disk spaces and allows division of the ligament without sharp maneuvers carried out anterior to the ligament. The rationale of this minimalistic approach seems in accordance with the anatomic study of OuYang and Ding,⁴ who have recently hypothesized that by taking the intervertebral disk as a reference mark thoracoscopic spinal surgery might be safely performed without the need for

FIGURE 2. *Left*, Preoperative lateral radiograph showing significant thoracic kyphosis with a Cobb angle of 83°. *Right*, Postoperative radiograph demonstrating correction of the spinal deformity to 40°.

ligation of segmental arteries. This also avoids the risk of inadvertent damage to the Adamkiewicz artery, which nourishes the thoracolumbar segment of the spinal cord and has been found to originate in 91% of instances between the T8 and L1 levels. Another structure that needs to be clearly identified and spared during this procedure is the thoracic duct, which runs right sided and close to the anterior longitudinal ligament at this level.

Success of thoracic spine surgery requires multidisciplinary team cooperation, including dedicated thoracic and orthopedic surgeons.

In conclusion, this novel VATS anterior spinal release method achieved excellent results in severe Scheuermann kyphosis. Further investigation is warranted to confirm these preliminary findings.

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