

—Report on Experiments and Clinical Cases—

A Case of Dumbbell Tumor of the Superior Mediastinum Removed by Combined Thoracoscopic Surgery

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Abstract

We report a case of a neurogenic dumbbell tumor in the superior mediastinum resected completely by the combined application of thoracoscopy and neurosurgery performed by an orthopedic surgeon. A 54-year-old female was admitted because her chest X-ray showed a superior mediastinal mass. Computed tomography and magnetic resonance imaging revealed that the tumor was extradural dumbbell-shaped and compressed the spinal cord through the intervertebral foramen between Th2 and Th3. First, she underwent laminectomy of the vertebrae (Th1~Th3) and separation of the tumor from the dura mater and the root of the second left intercostal nerve in the right semilateral position. Then in the same position, three thoracic ports were placed and the tumor was resected completely using thoracoscopy in a one-stage operation. The pathological diagnosis was neurilemmoma. There has been no sign of serious neurologic deficits or of recurrence four years after the operation. Thus, the procedure is a minimally invasive approach, which is both safe and useful. (J Nippon Med Sch 2002;69:58–61)

Key words: mediastinal neurogenic tumor, dumbbell tumor, thoracoscopic surgery, one-stage operation

Introduction

Thoracoscopic surgery is applied not only to remove benign thoracic tumors¹ but also lung cancer². This minimally invasive approach is effective for minimizing postoperative pain and recovery of the perioperative respiratory function.

About 10% of posterior mediastinal neurogenic tumors include a spinal canal component, the two portions of which are connected by a narrow foraminal segment; because of their shape, they have commonly been called hourglass or dumbbell tumors^{3,4}. Most of these dumbbell tumors are benign and origi-

nate from the nerve sheath. It is beneficial and safe for patients to undergo resection of the tumor through a one-stage operation. The various progressive forms of dumbbell tumor have been classified by Eden⁵. Based on Eden's classification, there are combined posterior and thoracic approaches for treatment of dumbbell tumors⁶. The thoracoscopic approach is being used instead of conventional thoracotomy at present.

Here, we report how the dumbbell tumor in the superior mediastinum can be removed completely using thoracoscopy without changing the position in a one-stage operation.

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Case Report

A 54-year-old female presenting with shoulder discomfort was admitted to our hospital in April 1997. Routine laboratory examination results were almost within normal limits. Her chest X-ray showed an abnormal shadow on the left upper mediastinum (**Fig. 1**). Neurologic examination on admission showed sensory



Fig. 1 Chest X-ray on admission shows abnormal shadow on the left upper mediastinum.

weakness of the dominant area of the second left intercostal nerve and acceleration of patella tendon reflex. Computed tomography (CT) showed a dumbbell-shaped mass, measuring up to 3.5 cm in diameter, located in the retropleural space through the left intervertebral foramen between Th2 and Th3. Chest magnetic resonance imaging (MRI) indicated that the tumor was hypointense on the T1-weighted image and hyperintense on the T2-weighted image (**Fig. 2**). Moreover chest Gd-DTPA (gadolinium-diethylenetriamine pentaacetic acid)-enhanced MRI showed a markedly intense enhancement of the tumor. Myelography revealed that a pedicle was present between the vertebrae of Th2 and Th3, measuring up to 1.8 cm long. Chest CT post-myelography (**Fig. 3**) showed that the dumbbell-shaped mass was compressed in the extradural space without connecting to the spinal cord. A CT-guided biopsy was not performed. The preoperative diagnosis was an extradural and paravertebral dumbbell-shaped neurilemmoma (Eden type III). In May 1997, she underwent a planned combined thoracic and posterior approach performed by an orthopedist. Under general anesthesia, she was intubated with a double-lumen endotracheal tube and was placed in the right

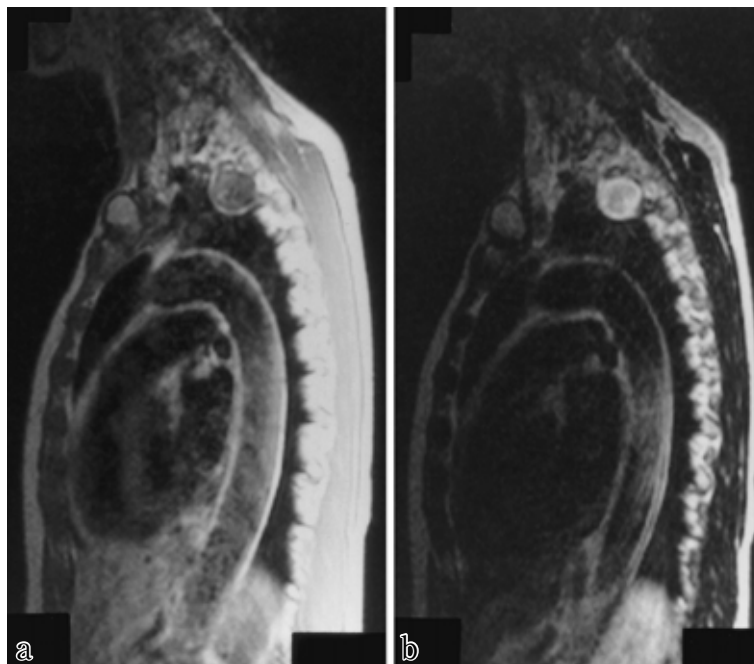


Fig. 2 Chest magnetic resonance imaging on the digital sections indicates that the tumor is hypointense on the T1-weighted image (a) and hyperintense on the T2-weighted image (b).



Fig. 3 Chest computed tomography postmyelography shows that the dumbbell-shaped mass, measuring up to 3.5 cm in diameter and located on the retropleural space through the left intervertebral foramen between Th2 and Th3, is compressed in the extradural space without connecting to the spinal cord.

semilateral position. Initially, an orthopedic surgical team performed laminectomy from the lower half of Th1 to the upper half of Th3, particularly on the left lateral side around Th2, by making a vertical curvilinear skin incision centered between Th2 and Th3. An encapsulated yellowish tumor attached to the dura mater was observed through the left intervertebral foramen between Th2 and Th3. The tumor was connected to the root of the second left intercostal nerve, which was ligated and sheared. Subsequently, we induced collapse of the lung and inserted a thoracoscope from the fourth left intercostal space of the clavicular midline. We observed the tumor protruding from the parietal pleura of the second left intercostal space. Therefore, two thoracic ports were added along the fifth intercostal space of the anterior chest wall. Under the thoracoscope, we separated the tumor along the capsule, carefully confirming the sympathetic nerve. As a result, the tumor crumbled partly, but we were able to extract it from the pleural cavity with a retrieving bag by a one-step procedure. A chest tube was placed under direct vision, the lung was reexpanded, and the other three ports were closed. The total operating time was 270 minutes. Peri- and postoperative

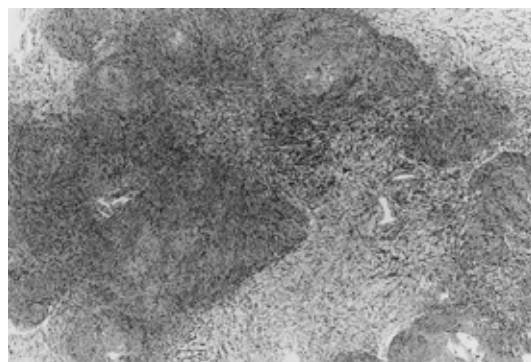


Fig. 4 Pathological examination shows neurilemmoma mixed with Antoni A and B formation (H.E. $\times 100$).

courses were uneventful without serious complications such as pain, neurologic deficits and leakage of spinal fluid. Pathological examination (**Fig. 4**) showed neurilemmoma mixed with Antoni A and B formation, which was suspected to originate from the posterior root of the intercostal nerve. At present, about four years after the operation, there has been no sign of serious neurologic deficits or of recurrence.

Discussion

Dumbbell-shaped neurogenic tumors of the posterior mediastinum are classified into four types depending on their location in relation to the spinal canal and paravertebral component. Eden's classification is as follows: type I, intra- and extradural type; type II, intra- and extradural and paravertebral type; type III, extradural and paravertebral type; and type IV, foraminal and paravertebral type⁵. There are various operative approaches according to the location of the tumor. Tori proposed a better operative approach based on Eden's classification as follows: for type I, the posterior approach; for types II and III, the combined posterior and thoracic approach; and for type IV, the thoracic approach⁶. A type II tumor in a small part of the paravertebral site can be effectively resected only by the posterior approach. Resection of a type III tumor with minimal progression to the spinal cord is considered to be possible only by the thoracic approach. For type IV tumors it is better to induce a posterior incision in the case of a poor visual operative field. In previous reports, there

have been some cases where tumors were resected in a two-stage operation due to the long time required to operate on the spinal cord^{7,8}. Preoperative evaluation of tumor localization and selection of operative procedures are important. The tumor in our case was classified as type III, and we were able to resect the dumbbell tumor completely by a combined thoracic and posterior approach. Instead of conventional thoracotomy, we performed thoracoscopic surgery. This approach is considered to be less invasive and safe. Vallières reported that the advantages of the thoracoscopic approach are reduced perioperative pain and a short hospital stay (e.g., one patient was discharged three days postoperatively)⁹. However, in one patient, they changed to conventional thoracotomy during thoracoscopic surgery due to uncontrolled bleeding of the intercostal artery. Without adhering to thoracoscopic surgery we should immediately change to conventional thoracotomy in cases of huge mass detection, marked adhesion of the pleural cavity and uncontrolled bleeding. In addition, if the posterior approach is required, supportive thoracoscopy is also useful for easy clarification of the anatomical relationship of the pleural cavity.

According to a report by Akwari, 9.8% of mediastinal neurogenic tumors (69/706) were dumbbell tumors, 10% of which were malignant¹⁰. In the case of suspicions of malignancy in preoperative examinations and during operation, we should carefully consider thoracoscopic surgery. However, the thoracoscopic approach is general^{8,9,11}. We were able to resect a dumbbell-shaped neurogenic tumor completely by thoracoscopic surgery with the assistance of an orthopedist. Moreover, a minimally invasive one-stage operation for dumbbell tumors is possible.

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