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Case report

Use of uniportal video-assisted thoracic surgery combined with a posterior approach to resect a dumbbell-shaped mediastinal granular cell tumor: A case report

Masashi Takeda [a], Yoshifumi Sano [a,*], Seiji Shigekawa [b], Riko Kitazawa [c], Ryujiro Sugimoto [d], Hironori Izutani [a]

[a] Department of Cardiovascular and Thoracic Surgery, Ehime University Graduate School of Medicine, 454 Shitsukawa, Toon City 791-0295, Japan
[b] Department of Neurosurgery, Ehime University Graduate School of Medicine, 454 Shitsukawa, Toon City 791-0295, Japan
[c] Department of Molecular Pathology, Ehime University Graduate School of Medicine, 454 Shitsukawa, Toon City 791-0295, Japan
[d] Department of Thoracic Surgery, Kure Kyosai Hospital, 2-3-28 Nishi-chuou, Kure City 737-8505, Japan

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ABSTRACT

Introduction: A dumbbell-shaped mediastinal granular cell tumor has never been reported, and there have been no reports of dumbbell-shaped tumors resected with a combination of uniportal video-assisted thoracic surgery and the posterior approach.

Presentation of case: An 18-year-old woman was diagnosed with a mediastinal dumbbell-shaped granular cell tumor by computed tomography. Complete resection was achieved via a posterior approach combined with the uniportal video-assisted thoracic surgery. First, a T3 left hemilaminectomy was performed in the prone position and the tumor located inside the intervertebral foramen was removed as far as possible. Next, the patient was repositioned to the right lateral decubitus position, a 2.5-cm skin incision was made on the 4th intercostal posterior axillary line, and resection of the residual tumor was performed. Pathological diagnosis of the resected tumor revealed a benign granular cell tumor. The patient recovered post-surgery and no tumor was reported in the 4-month follow-up magnetic resonance imaging.

Discussion: This is the first reported case of a mediastinal dumbbell-shaped granular cell tumor and its successful resection using a combined posterior and uniportal video-assisted thoracic surgery approach.

Conclusion: This is a potentially safe and effective procedure for mediastinal granular cell tumors, with outstanding cosmetic advantages.

1. Introduction

Most tumors arising from the posterior mediastinum are benign neurogenic tumors, with only 10% having dumbbell morphology. Among these dumbbell-shaped tumors, schwannomas are considered the most common, followed by neurofibroma, ganglioneuroma, and paraganglioma [1]. Granular cell tumors were first described in 1926 by the Russian pathologist Alexei Ivanovich Abrikossoff [2]. It is now considered to be of Schwannian derivation [3,4], but a subset of S100-negative "non-neural" granular cell tumors have been identified that may not be derived from neural tissue [5–7]. It has been reported in every organ system, but it has been most commonly reported in the skin, oral cavity, gastrointestinal tract, breast, and respiratory tract, but rarely occurs in the mediastinum. It can appear in all age groups but is thought to arise most commonly in women in their 40s to 60s [8].

Here, we report a case of a dumbbell-shaped mediastinal granular cell tumor that was completely resected by the posterior approach combined with uniportal video-assisted thoracic surgery (UniVATS). The case report has been reported in line with the SCARE 2020 criteria [9].

2. Presentation of case

The patient was an 18-year-old female student without any medical,

Abbreviations: CT, computed tomography; MRI, magnetic resonance imaging; UniVATS, uniportal video-assisted thoracic surgery.

* Corresponding author.
E-mail address: ysano@m.ehime-u.ac.jp (Y. Sano).

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family illness, or smoking history and showed no symptoms. She visited a local doctor because of an abnormal shadow on a chest X-ray taken during a medical checkup for university enrollment. She was referred to our department because computed tomography (CT) revealed a posterior mediastinal tumor.

She demonstrated no abnormal pulmonary or neurologic findings. Routine laboratory parameters were within the normal limits. Chest radiography revealed a tumor on the left side of the thoracic vertebrae. The tumor, with a diameter of 25 mm, was seen between the base of the 3rd and 4th rib on a CT scan. Magnetic resonance imaging (MRI) revealed that the left T3/4 intervertebral foramen was dilated, with a dumbbell-shaped tumor extending to the posterior mediastinum (Fig. 1). Based on these findings, we diagnosed it as a dumbbell-shaped neurogenic tumor, and initially, surgical resection was planned with a posterior approach.

First, a T3 left hemilaminectomy was performed in the prone position with a standard posterior midline skin incision, and the tumor located inside the intervertebral foramen between the left T3/4 was removed as far as possible. Since it was judged that the resection could not be completed only from the posterior approach, we decided to add a transthoracic approach. The patient was repositioned to a right lateral decubitus position, and a short skin incision, 2.5 cm in length, was made on the 4th intercostal posterior axillary line. Subsequently, resection of the residual tumor was performed using a rigid 5-mm thirty-degree thoracoscope (Fig. 2). A drainage tube was inserted through the uniport to the left thoracic cavity, and the wound was closed; the surgery was completed without any issues.

The postoperative course was uneventful, without any complications. The chest tube was removed on postoperative day 1, and she was discharged on postoperative day 8 in a stable condition. Four months after the surgery, she was doing well without any problems, and no residual tumor was found via MRI (Fig. 3).

The final pathological diagnosis of the resected tumor revealed a benign granular cell tumor with the following findings: a diffuse proliferation of polygonal cells with abundant granular eosinophilic cytoplasm. No abnormal mitoses or atypia were observed. Immunohistochemistry findings were positive for S-100 and SOX10, and Ki-67 index was 1%–2%, which were consistent with benign granular cell tumors (Fig. 4).

3. Discussion

This study reports an extremely rare case of granular cell tumor treatment with two novel findings. First, the tumor was a posterior mediastinal dumbbell tumor, which was identified postoperatively as a granular cell tumor. Second, the tumor was completely removed using UniVATS with the posterior approach. To the best of our knowledge, a dumbbell-shaped mediastinal granular cell tumor has never been reported, and there have been no reports of dumbbell-shaped tumors resected with a combination of UniVATS and the posterior approach.

Historically, thoracic dumbbell-shaped tumors have been categorized according to Eden's classification [10] into the following types, based on their location: type 1, intra-and extradural; type 2, intra-and extradural and paravertebral; type 3, extradural and paravertebral; and type 4, foraminal and paravertebral.

In this case, the tumor was considered to be Eden type 3 because the tumor in the spinal canal was extradural and continuously presented in the paravertebral area through the intervertebral foramen. Typically, it is difficult to completely resect dumbbell-shaped tumors of Eden types 2, 3, and 4 from inside the spinal canal using a posterior approach, or by thoracotomy or VATS alone.

In this case, since the patient was a young woman and the tumor was most likely benign, the cosmetic aspect was also considered important. For that reason, initially, we wanted to complete the tumor resection with only the posterior approach. However, during the operation, we deemed that the posterior approach by itself was insufficient; therefore, a lateral approach was added. However, the resulting wound scar after a lateral chest approach is more noticeable than that after a posterior approach. Wu et al. first introduced the use of UniVATS for mediastinal tumor resection in 2015 [11]; since then, the use of this technique has spread rapidly. A retrospective study comparing the uniportal approach with conventional VATS with regard to short-term outcomes concluded that it is better not only in terms of cosmetic outcome, but was also associated with a shorter hospital stay and less postoperative pain than conventional VATS [12]. On the other hand, UniVATS is also known as technically more difficult than open thoracotomy, conventional VATS, or robotic-assisted VATS, because it has many limitations. Here, we applied this technique for this patient primarily because of its cosmetic and less invasive nature, and the result was satisfactory.

In the future, a comparison of the invasiveness and usefulness between these approaches via a multicenter randomized controlled study will be helpful for physicians who are considering these procedures. However, because of the limited number of cases, accumulation of additional similar cases using this new minimally invasive method will be needed.

4. Conclusions

Posterior mediastinal granular cell tumors are extremely rare, and this is the first report of a posterior mediastinal dumbbell-shaped granular cell tumor. The appropriate preoperative and operative strategies are not well established. Uniportal VATS tumor resection of the

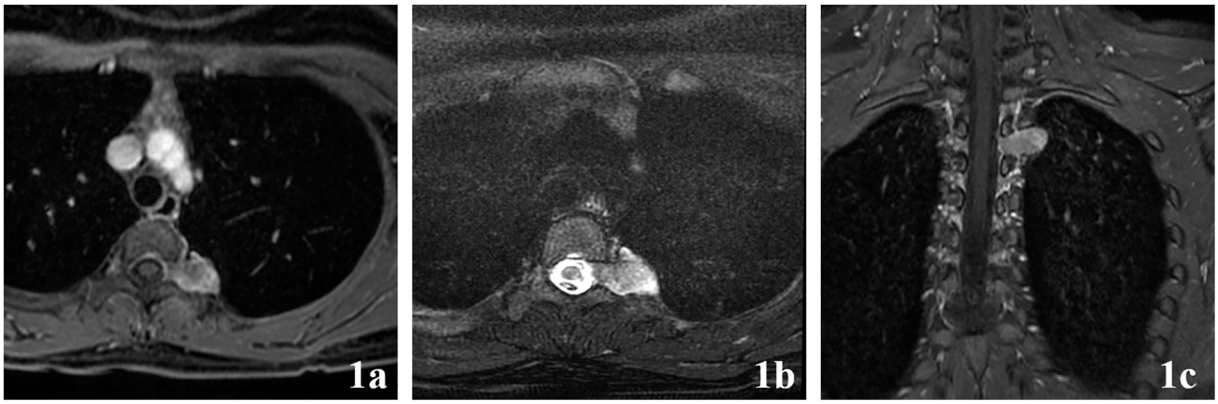

Fig. 1. Magnetic resonance imaging (MRI) findings.
The posterior mediastinal dumbbell-shaped tumor showed a low signal on the T1-weighted image (Fig. 1a, axial view) and a high heterogeneous signal on the T2-weighted image (Fig. 1b, axial view). MRI findings suggest that the tumor had spread from the intervertebral foramen into the spinal canal (Fig. 1c, coronal view).

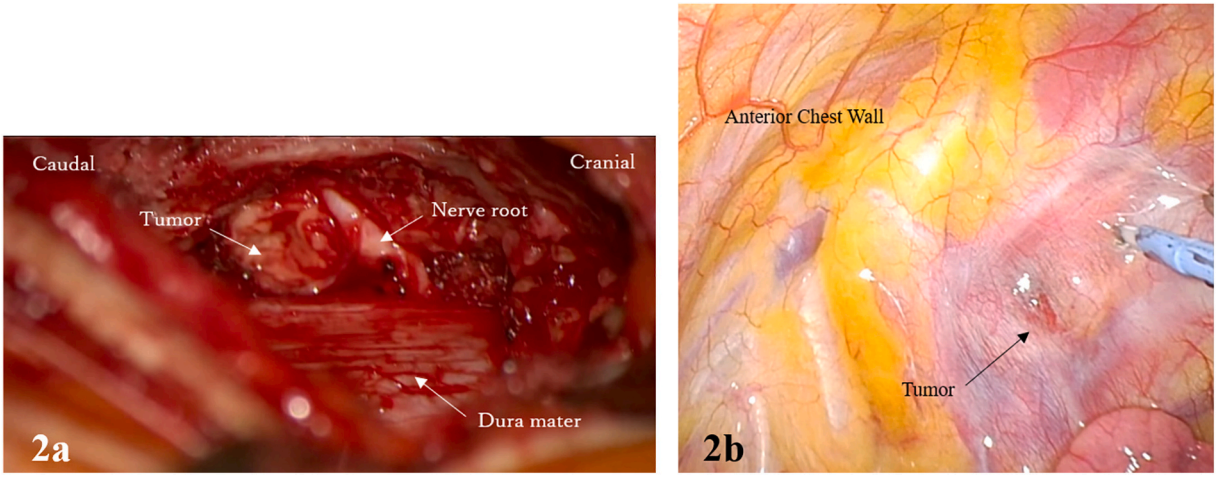

Fig. 2. Intraoperative findings.
Intraoperative photograph with the posterior approach. Tumor location was extradural, and inside the intervertebral foramen between the left T3/4. The tumor was hard and bled easily, but did not adhere to the nerve roots (Fig. 2a). Intraoperative photograph with the uniportal video-assisted thoracic surgery (UniVATS) approach. The tumor was seen through the pleura and contact with the lower edge of the 3rd rib (Fig. 2b).

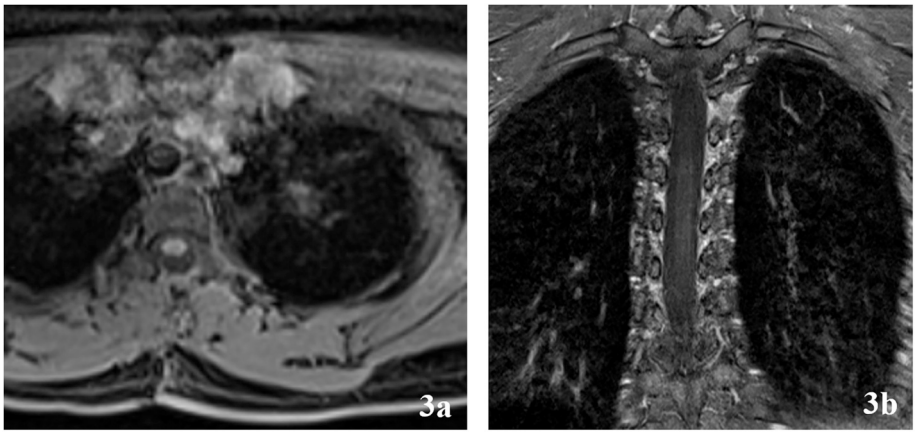

Fig. 3. Post-surgical magnetic resonance imaging (MRI) findings. Four months after the surgery, no residual tumor was found on MRI. T1-weighted image, axial view (Fig. 3a); and T1-weighted image, coronal view (Fig. 3b).

intrathoracic portion of posterior mediastinal dumbbell tumors is a promising surgical technique that offers the benefits of better cosmetic outcomes and being a less invasive procedure with adequate visualization and operability in comparison with thoracotomy and even conventional VATS.

Ethics approval and consent to participate

Not applicable as per institutional policy.

Consent for publication

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Availability of data and materials

The data that support the findings of this study are available from the corresponding author, [YS], upon reasonable request.

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CRediT authorship contribution statement

M.T. wrote the whole of the manuscript. Y.S. took responsibility for the construction of the whole or body of the manuscript. S.S., R.K, and R. S. took in data management. H.I. organized and supervised the article.

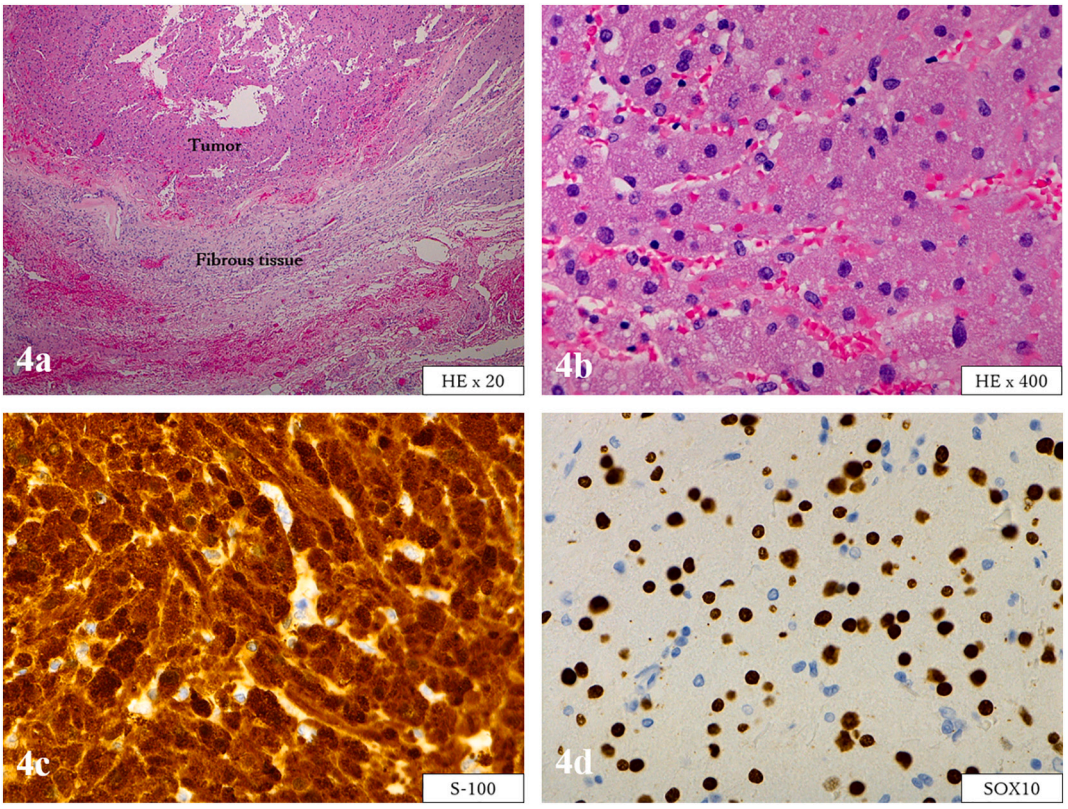

Fig. 4. Hematoxylin-eosin staining of resected tumor section (Fig. 4a, ×20; 4b, ×400). Proliferation of polygonal cells with oval hyperchromatic nuclei and abundant granular eosinophilic cytoplasm. Immunohistochemistry revealed S-100 positivity (Fig. 4c) and SOX10 positivity (Fig. 4d).

Declaration of competing interest

All authors have no affiliations with or involvement in any organization or entity with any financial interest, or non-financial interest in the subject matter or materials discussed in this manuscript.

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