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SHORT COMMUNICATION

Robotic assisted thoracoscopic surgery (RATS) for excision of posterior mediastinal mass

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Abstract
Robotic assisted thoracoscopic surgery (RATS) has become the first choice for excision of posterior mediastinal masses by the adult thoracic surgeons; however, its use in the pediatric age group is yet to get popular as suggested by the literature which shows very few case reports and case series. We present a 9-year-old female child who presented with posterior mediastinal mass and was successfully managed with RATS.

Keywords RATS · VATS · Posterior mediastinal tumors · Ganglioneuroma

Introduction

Robotic surgery is increasingly being used for the excision of posterior mediastinal masses as it allows the minimally invasive approach of video-assisted thoracoscopic surgery (VATS) and at the same time overcoming its limitations. However, the use of robotic assisted procedures is not yet popular among the pediatric thoracic surgeons. We present a case of posterior mediastinal mass in a 9-year-old girl which was excised with robotic assistance.

Report presentation

Nine-year-old female presented with complaints of pain right side chest with cough for 1.5 month. On seeing a mediastinal widening on a chest X-ray, the treating physician advised a magnetic resonance imaging (MRI) of the chest and spine, which revealed a posterior mediastinal mass of size approximately 6 × 4 cm, extending from the second to the upper border of sixth thoracic vertebrae with minimal intraspinal extension at the D2 level (Fig. 1). Her urinary catecholamine levels were normal. A preoperative computed tomography-guided biopsy revealed a ganglioneuroma. The child was planned for Robotic Assisted Thoracoscopic Surgery (RATS) excision of the mass.

Surgical technique

The child was positioned in left lateral position with modified prone position and head end raised. We used the Da Vinci surgical robot–Xi system (Intuitive Surgical, Inc., Sunnyvale, CA, USA) using three robotic arms which were placed in the linear fashion. The first 8 mm port for the camera was placed in the 7th intercostal space in the anterior axillary line. Two additional 8 mm ports were placed under vision in the posterior axillary line and the mid-clavicular line in the 8th and 4th intercostal space, respectively. Additional 5 mm assistant port was placed in the 8th intercostal space in the mid axillary line (Fig. 2). Docking was done from the head end. Carbon dioxide (CO_2) was insufflated in the thorax through the accessory port at a flow rate of 1 L/min and maintained throughout the intervention at a positive pressure of 6–8 mmHg. The tumor was visualized in the paravertebral area and was of size approximately 6 × 4 cm (Fig. 3). The parietal pleura over the tumor was incised all around. The dissection was started inferiorly and gradually progressed towards the apex. The dissection was done with monopolar Maryland

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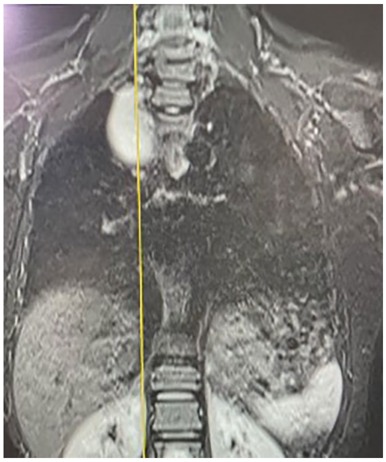

Fig. 1 Magnetic resonance imaging (MRI) chest and spine showing posterior mediastinal mass of size approximately 6×4 cm, extending from the second to upper margin of sixth thoracic vertebrae

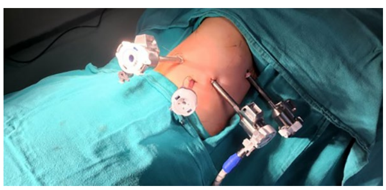

Fig. 2 The port positions

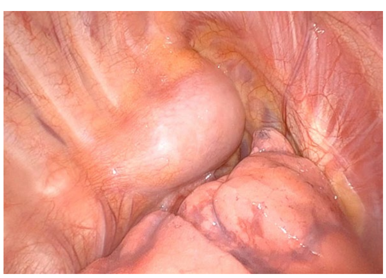

Fig. 3 Intraoperative view of the tumor

forceps and bipolar grasper. The dissection progressed from medial to lateral. The tumor was adherent at the second and third vertebrae; however, with the help of the robotic instruments, the tumor could be dissected completely. The tumor was extracted in an Endo bag from the lower 8th intercostal port. Intercostal drainage was done with 16 French intercostal tube. The total duration of surgery was around 130 min (including the docking time) with a total blood loss of less than 50 mL. Postoperative period was uneventful, the drain was removed on postoperative day 1 and the child was discharged on postoperative day two. The child is on regular follow-up and at 1 year post-surgery, she is asymptomatic.

Discussion

VATS has been traditionally used for the management of mediastinal tumors in both adults and children. RATS provides all the advantages of minimal invasive approach of VATS, but at the same time offers numerous advantages over it. RATS allows dissection in narrow spaces or in remote areas with ease. This is possible due to the advanced features of the robotic system. The robotic instruments have the benefit of 360 degrees freedom of movement, 3D magnified vision, precise instrument movement and improved dexterity. This makes removal of masses in remote areas like posterior mediastinum easier and safe [1, 2, 4, 5]. Most of the literature regarding the excision of posterior mediastinal tumors is for VATS, especially in children, with only a few case reports and case series of robotic assisted excision [2–5], while RATS has been more commonly adopted in the adult population as it allows the excision of these tumors with extreme precision and safety similar to that in open technique but with minimal surgical trauma [1, 2]. Neurogenic tumors account for 75% of all posterior mediastinal tumors [6]. These tumors need to be excised with a clear margin, and until recently, a standard posterolateral thoracotomy was the gold standard [6]. This is traumatic and is associated with significant surgical morbidity like scoliosis [6–8]. VATS has gained acceptance due to the advantages of the minimal access approach [6, 9–11]. Several studies have compared open thoracotomy vs VATS for mediastinal tumors in children as well assessed the feasibility of VATS for resection of neurogenic tumors in children [9–11]; however, due to the use of non-articulating instruments, it has its limitations in the form of size of tumor, malignant lesions or intraspinal extension and also a long learning curve [2, 5]. Meehan and Sandler [4, 5] reported a case series of mediastinal lesions in children, including posterior mediastinal tumors, and emphasized the benefits of articulated robotic instruments for the dissection of solid masses, especially in narrow and fixed spaces as they allow for a better angle to approach the dissection and, therefore, greatly increasing the versatility and variety of mediastinal lesions that can be excised. The robotic instruments filter the human tremors and the motion artifacts, thus allowing precise dissection around vital structures with confidence and ease. Additionally, the ergonomic position of the surgeon greatly enhances the experience not afforded by thoracoscopy. RATS allows adherence to oncological principles and at the same time offering the advantages of minimal access surgery [2, 4, 5]. However, Ballouhey et al. [3] published a series of 11 children with various mediastinal pathologies treated with RATS and concluded that RATS for infants and new-born is challenging and recommended RATS in children weighing more than 20 kg.

Conclusion

RATS excision of posterior mediastinal tumors is evolving fast and is gaining popularity. It incorporates the principles of open conventional and yet gives all the benefits of VATS, although large prospective trials need to be done, especially in children, to validate the safety and efficacy of RATS over VATS.

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Declarations

Conflict of interest The authors declare they have no financial interests.

Ethical approval Not required.

Informed consent Informed consent taken from the parents of the child.

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