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Excision of Posterior Mediastinal Neurogenic Tumor: Video Assisted Thoracoscopic versus Thoracotomy

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ABSTRACT

Background: The posterior mediastinal tumors represent different diseases. Most of them are detected incidentally. Regarding difficult anatomic access for mass in the mediastinum, surgical excision remains the best method for diagnosis and therapeutic result. Video-assisted thoracic surgery (VATS) is increasingly used for the management of posterior mediastinal mass. This study aimed at evaluation of the outcomes of VATS compared to conventional thoracotomy in treatment of posterior mediastinal tumors.

Patients and Methods: A retrospective analysis was performed of 22 patients who underwent surgery for posterior mediastinal neurogenic tumors at our Department in Security Force Hospital (SFH), Riyadh, KSA from September 2013 to January 2018. Nine tumors were excised via video- assisted thoracic surgery (VATS) and 13 tumors via surgical thoracotomy.

Results: When compared with the thoracotomy group, patients in the VATS group had a shorter operation time (95±33 min vs. 130±35 min, P=0.023), less blood loss (65±13 mL vs. 180±95 mL, P=0.0005), and shorter time of hospital stay and discharge (2.5±0.7 days vs. 3.6±0.7 days, P = 0. 0023).

Conclusion: VATS is safer and more effective surgical procedure for excision posterior mediastinal neurogenic tumors with good outcomes than conventional thoracotomy.

Keywords: Neurogenic tumors, Posterior mediastinum, Thoracotomy, Video assisted thoracoscopy.

INTRODUCTION

The most common posterior mediastinal tumor is neurogenic tumors. As reported, 95% of thoracic neurogenic tumors occur in the posterior mediastinum are usually asymptomatic. More than 95% of neurogenic tumors are benign [(1)]. There are different surgical approaches to mediastinal masses such as median sternotomy, thoracotomy and video assisted thoracic surgery (VATS) [(2)].

VATS become the procedure of choice in the treatment and diagnosis of intrathoracic tumors in developed countries that previously required sternotomy and open thoracotomy [(3)]. It is done by thoracic surgery by insertion of instruments through small chest incisions under two dimensional video images. The advantage of VATS includes shortened hospital stay, decease postoperative pain, decrease operative complications, and less cost [(4)].

Major advantage of VATS is in the resection of posterior mediastinal tumors as the morbidity associated with VATS is minimal as compared to conventional thoracic surgery. However, due to lack of skilled personnel and decreased facilities, it is not widely practiced in developing countries such as ours [(4)].

So we aimed to compare the outcomes of VATS with thoracotomy for the removal of posterior mediastinal neurogenic tumors.

PATIENT AND METHODS

We collected retrospective clinical data of 22 patients (10 males and 12 females) with neurogenic tumors of the posterior mediastinum undergoing surgical treatment in Security Force Hospital (SFH), Riyadh,

KSA from September 2013 to January 2018. Age of the patients ranged from 16 to 59 years, 13 (59%) patients underwent thoracotomy and 9 (41%) underwent VATS for removing neurogenic tumors.

Pediatric patients or patients presented by mediastinal neurogenic mass or malignant tumors were excluded from this study.

Preoperative investigation and evaluation included computed tomography (CT), in some cases magnetic resonance imaging (MRI), pulmonary function test (PFTS), electrocardiography, and routine blood laboratory evaluation.

Ethical approval:

Approval was obtained from our Institutional Review Board of Al-Azhar univeristy before initiation of the study, and written informed consent was obtained from all patients to authorize data collection.

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Procedure

All procedures were done under general anesthesia with a double-lumen endotracheal tube. All patients were placed in a lateral decubitus position.

In the group of conventional thoracotomy, incision was done through an intercostal space adjacent to the mass in order to avoid entering the mass.

An epidural analgesic device was used and it was left in the patients for 24 hours postoperatively, in patients undergo conventional thoracotomy, but not done in patients underwent VATS.

In the VATS group, three incisions were done; the incision for camera was at the mid axillary line through the 6^{th} to 8^{th} intercostal space and the position of second incision was at the anterior axillary line between first and third one and the third port was according to the tumor location. After isolation of the lung by double lumen endotracheal tube, the tumor was freed from the surrounding structure and pleura by blunt or sharp dissection and the blood vessels feeding the tumor were clipped. The neural tissue was released from the mass after securing the surrounding vessels. The extra pleural dissection of the tumor and resection is difficult technically, the resections and enucleation from sub pleural attachment was performed. Root of the nerve was preserved with difficulty in schwannomas, while, in other tumor such as neurofibromas the root of the nerve was taken as one mass with the tumor. Frozen pathology was performed to exclude malignant lesions in both groups.

After complete resection of the tumor and after complete hemostasis, one intercostal chest tube (ICT) was inserted in both groups of patients and chest X ray was done at the end of the procedure; after that all patients were transferred to recovery room and were observed for about one hour and then transferred to the ward, except one patient was transferred to intensive care unit (ICU) due to history of cardiac disease.

The (ICT) was removed in both groups when the output was less than 100 ml/day and no air leakage from (ICT) was apparent. Patients were discharged the day after removal of the chest tube if their vital signs were stable, chest X-ray unremarkable and no complication emerged. All patients underwent thoracotomy according to size of tumor when the tumor more than (8) centimeter.

Follow up:

Clinical examination and posteroanterior and lateral chest X-ray were performed one day before each patient was discharged and one week and then monthly postoperatively. CT chest was performed after 3, 6, and 12 months postoperatively. Only one patient had recurrence after three months from surgery; this patient was presented by chest wall swelling in the back para spinal and histopathology showed neurofibroma.

Patient's data including age, sex, symptoms, tumor location, histopathology, operative time, blood loss, drainage, intubation duration, complication, hospital stay duration and recurrence were recorded.

Statistical analysis

The data were expressed as number, percentage, mean±standard deviation (M±SD) and range. Comparisons of the difference of qualitative parameters between groups were performed by using the Chi-square test or Fisher's exact test, as applicable. All p values <0.05 were considered to indicate statistical significance. The statistics and analyses were evaluated by using SPSS software, version 23.0 (IBM Corp. Armonk, NY).

RESULTS

Of the 22 studied patients with posterior mediastinum tumors, 10 were male and 12 were female. The mean age of the patients was 43.1±4.26 and 44.9±5.2 years in thoracotomy and VATS groups respectively. Most of patients were asymptomatic. Among the symptomatic patients, the most common complaint was chest discomfort. Three patients in this study were evaluated with thoracic MRI, while the remaining 19 (84.7%) patients were evaluated with thoracic CT scan. None of the 22 patients underwent invasive procedures for preoperative diagnosis. Thirteen of these lesions were treated by thoracotomy and 9 by VATS. The most common pathology in this study was schwannoma in 13 (59%) patients (Figures 1-2). The histopathological distribution of the all operated patient's primary mediastinal lesions and their locations were summarized in table-1 with no significant differences between studied groups.

Table (1): Clinical data for the two groups of patients.

	Thoracotomy(No=13)	VATS (No=9)	Test	P value
Age	43.1±4.26	44.9±5.2	0.891	0.383
Sex Male Female	 6 7	 4 5	 0.127	 0.722
Symptom Chest pain Chest discomfort Chest wall swelling Cough Dyspnea Absent	 2 2 1 1 2 5	 1 1 1 1 2 3	 0.454	 0.994
Location Upper mediastinum Lower mediastinum	 8 5	 6 3	 0.042	 0.838
Affected side Left Right	 6 7	 3 6	 0.026	 0.873
Radiological diagnosis MRI CT chest	 2 11	 1 8	 0.119	 0.730
Pathology Schwannoma Neurofibroma Ganglioneuroma Paraganglioma Neuroenteric cyst	 8 2 1 1 1	 5 2 1 1 1	 0.306	 0.989

VATS, video-assisted thoracoscopic surgery

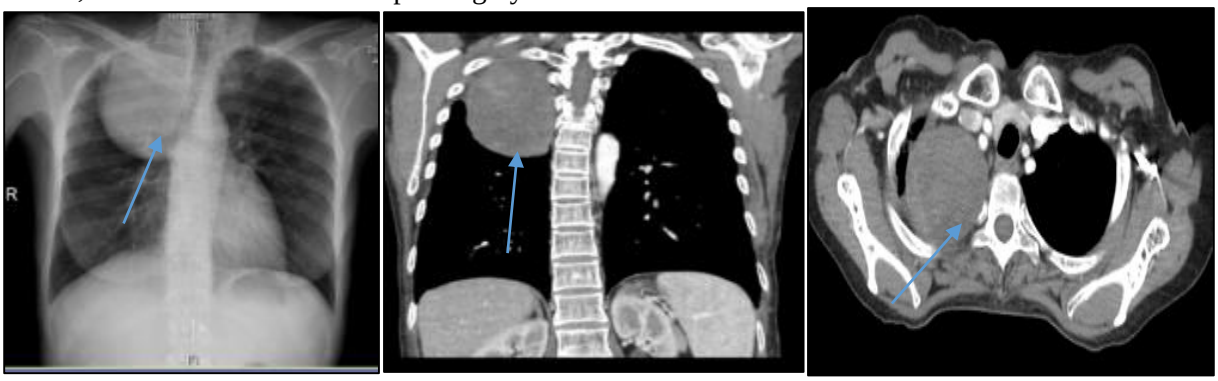

Figure (1): Chest X-ray and CT chest of female patient 47years old presented by repeated attack of cough; histopathology showed schwannoma.

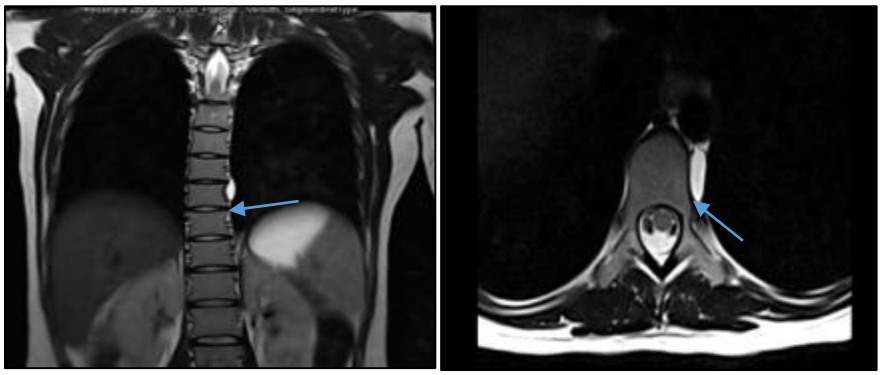

Figure (2): MRI of female patient 22 years old presented by chest pain; histopathology showed neuroenteric cyst.
Perioperative data are shown in table 2.

Table (2): Perioperative and follow-up data from the two groups of patients.

	Thoracotomy No=13	VATS No=9	Test	P
Operation time (min)	90 – 180 (130±37)	70 – 150 (93±31)	2.457	0.023
Blood loss (mL)	200 – 400 (180±98)	25 – 60 (44±13)	4.108	0.0005
Drainage (mL)	200 – 630 (434±154)	120 – 600 (315±120)	1.941	0.066
chest tube removal duration (days)	2 – 5 (3.5±0.7)	2 – 4 (2.5±0.6)	3.485	0.0023
Complication Yes No	 0 13	 1 8	0.036	0.849
Hospital stay	4 – 7 (4.5±1.0)	3 – 5 (3.5±0.6)	2.674	0.015
Recurrence	1	0	0.725	0.394

Postoperative outcomes:

In both groups the surgical and postsurgical outcomes were satisfactory, and no mortality occurred. All preoperative symptoms resolved postoperatively. At the final follow-up, all patients were free of symptoms. Evidence of tumor recurrence was observed in one case of thoracotomy group 3 months after surgery (Figure 3).

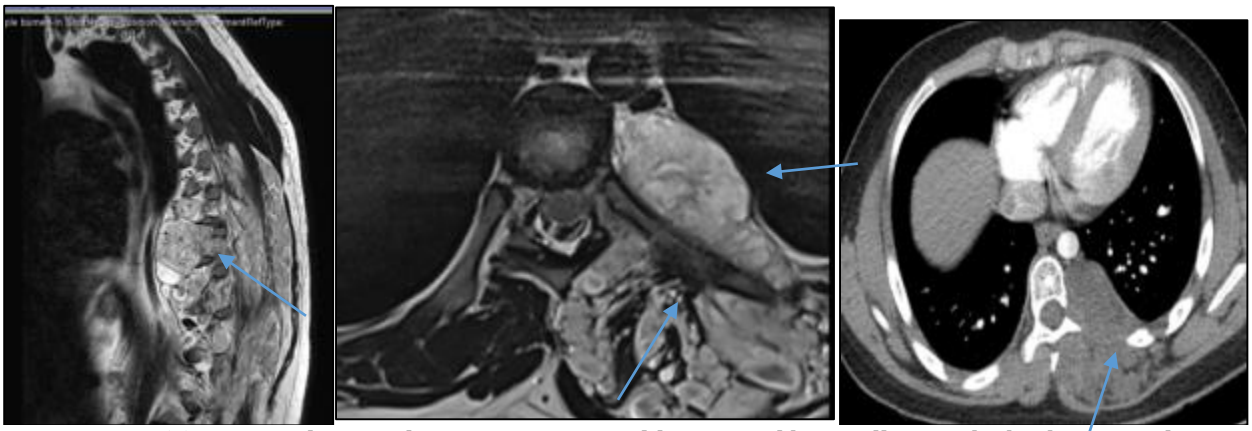

Figure (3): MRI and CT Male patient 18 years old presented by swelling in the back intra and extra thoracic lesion and this was the only case of recurrence and histopathology showed neurofibroma.

DISCUSSION

Treatment of a mediastinal mass is challenging due to a wide variety of the disease process ranging from the thymic lesion to lymphoma, or metastatic tumors from other tumors and limited anatomic space [5]. The benign tumor of the mediastinum mass is more common than malignant. Mediastinal tumors can be seen at any age. The average age of the patients was 43 and 44.9 years in our studied groups; in thoracotomy and VATS groups respectively.

A total of 19 (86.4%) patients were evaluated with chest CT and three patients evaluated by MRI. CT and MRI tests are used to determine the invasive potential of the tumor, its relationship to the surrounding tissues and its invasion to surrounding other structure [6]. The MRI has advantage to show the relations with vascular and neurogenic structures of the tumors located in the posterior mediastinum [7].

In the current study patients in the VATS group had a shorter operation time, less blood loss, shorter time of hospital stay than thoracotomy group.

In agreement with our study, **Cardillo *et al.*** [8] reported that their mean operative time was shorter in the VATS group (111.3 min vs.149 min; P = 0.01), **Cansever's study** [9] showed the same result (82.5min in the VATS group vs. 123.6 min in the thoracotomy group), while **Bousamra *et al.*** [10] went to a different result. They showed that the mean operative time was more in the VATS group (171 min vs. 112 min; P <0.05). However, in their study, all of these lesions were near the stellate ganglion; meticulous dissection for the tumor was used to avoid injury of the ganglion. Moreover, only six patients were done by VATS, including two patient underwent VATS procedures which were finally converted to thoracotomy and the longest operative time was recorded in VATS group (270 min and 210 min).

In our study, the time to chest tube removal duration and discharge were shorter in the VATS group, though the postoperative total drainage showed no difference between the two groups. **Cardillo *et al.*** [8] showed the same results. In the **Cansever's study** [9], they showed shorter duration to discharge (1 day), these duration times were much shorter than other studies. This may have been due to different criteria used in different centers.

In **Yawei *et al.*** [11] study, the mean operating time of mini-open approach was 49.6 ± 15.9 minutes (range, 30-90 minutes), and the mean intraoperative blood loss was 72.6 ± 38.4 mL (range, 50-165 mL). Chest tube removal occurred at an average of 2.8 ± 1.1 days (range, 1-4 days) after surgery, and mean hospital stay was 7.6 ± 2.0 days (range, 5-10 days). No evidence of tumor recurrence was observed in any case at an average of 56.8 ± 39.1 months after surgery.

In **Zhang *et al.*** [12] study, all patients were followed up postoperatively. The mean period follow-up was 78 months (range 3 to 183 months). No recurrence occurred in both group.

In **Sapmaz *et al.*** [2] study, comparing the duration of hospital stay for all patients after surgical procedure, the longest duration of hospital stay was 7.6 days by thoracotomy, followed by sternotomy with 6.5 days and the shortest duration of hospital stay was 2.8 days with robotic surgery.

In surgical excision of such tumors, complications related to the intricate anatomy of the thoracic spine and the surrounding structure of the thoracic organs, and thoracic cage should be considered. The thoracoscopic surgery is difficult. In addition, inadequate room for maneuverability can cause injury to the surrounding structure or uncontrollable bleeding, or injury to the nerves associated with electrocoagulation [8,13]. **Yang *et al.*** [13] reported high incidence of injury for brachial plexus in patients undergoing thoracoscopic surgery (21.1%; 4/19) compared with thoracotomy (2.3%; 1/44). **Takeda *et al.*** [14] **and Han *et al.*** [15] reported that postoperative Horner's syndrome occurred in same patients because of the proximity to the sympathetic ganglion. However, in our series, none of the above complications occurred.

CONCLUSION

VATS approach can provide a simple, safe, minimally invasive, and practical treatment option for patients with posterior mediastinal tumors. This approach has the advantages of decreased risk reduction of complication, minimal trauma and shortened recovery time.

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