International Surgery Journal
Gajbhiye RN et al. Int Surg J. 2021 Feb;8(2):641-646
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: https://dx.doi.org/10.18203/2349-2902.isj20210377

Original Research Article

Safety and efficacy of video assisted thoracoscopic surgery for non-malignant pathologies: a prospective observational study

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Received: 30 November 2020
Revised: 10 January 2021
Accepted: 15 January 2021

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ABSTRACT

Background: Video-assisted thoracic surgery (VATS) had been widely accepted because of its low complication rate, tolerable postoperative pain and early recovery of pulmonary function. Hence the present study was undertaken to assess safety and efficacy of VATS and also analyze the surgical outcomes of VATS procedures for non-malignant thoracic pathologies.
Methods: A total of 32 patients with non-malignant pathologies of thorax to undergo VATS lobectomy and thoracotomy conversion cases initially approached by VATS lobectomy were enrolled. Demographic data and surgical information were noted and compare between infection and non-infection group. Primary outcomes were thoracotomy conversion rate, period of thoracic drainage, length of hospital stay, and complications.
Results: The majority of patients were in the age group of 36-45 years (28.12%) with female predominance (62.50%). The commonest clinical presentation was hydropneumothorax (28.12%). Most common infective and non-infective aetiology was lung hydatid (28.12%) and benign nodule (18.75%) respectively. The commonest surgical procedures conducted using VATS were lobectomy (34.37%), and decortication (25%). The mean blood loss among the cases was 315.9±36.46 ml. Mean operative time was 157.18±12.37 minutes. Among 6.25% cases thoracotomy was conducted in view of difficult hilar dissection, while among 3.12% cases each of indistinct anatomy and bleeding. Mean duration of thoracic drainage was 6.78±1.69 days and mean hospital stay was 8.2±3.2 days. 6.25% cases had fatal complications while 21.87% cases had milder complications. Only one case recurred while 96.87% cases cured.
Conclusions: VATS lobectomy for benign disease is feasible and effective in selected cases, regardless of the presence of infection.

Keywords: Benign, Hydropneumothorax, Pathology, Lobectomy, Non-malignant, Thoracotomy, Video-assisted thoracic surgery

INTRODUCTION

VATS is a technique in which standard procedures are performed utilizing a video camera in a much less invasive manner than a standard thoracotomy. Although feasibility and safety of VATS becoming a well-established in the thoracic surgery practice hence many surgeons consider that benign lesions should be approached through an open approach. However, several factors should be considered as most patients are young, healthy and symptom free. The intrathoracic lesion is usually discovered in a routine screening and indication for surgery may seem questionable because the long-term evolution is not clear.[1] It is therefore important to minimize chest trauma and its consequences. There are major differences between therapeutic procedures for

benign versus malignant diseases through minimal access. First, adequacy of tumour clearance is not relevant in the former. Second, inflammatory changes may render dissection more difficult in certain diseases like tuberculosis. Third, while tumour seeding is a concern in malignant neoplasm, wound infection is a concern in resections for an infectious cause.[2]

VATS is now a well-established technique in the armamentarium of the thoracic surgeon. Jacobaeus is credited with the technique of thoracoscopy and the first clinical application dates from 1913. He performed adhesiolysis to enhance pneumothorax therapy of tuberculosis via a cystoscope introduced into the pleural cavity.

Before the 1990s thoracoscopic surgery was restricted to biopsy procedures, management of pneumothorax, empyema irrigation, sympathetic chain ablation, and removal of intrathoracic foreign bodies. The introduction of video imaging technology and the wider availability of stapling devices facilitated an increasingly wider use of thoracoscopy for diagnostic and therapeutic procedures.[3]

VATS is principally employed in the management of pulmonary, mediastinal, and pleural pathology. However, the technique is not performed by thoracic and gastrointestinal surgeons only. VATS is now becoming a useful adjunct in specialised orthopaedic and neurosurgical units for minimally invasive approaches to the spine; also, many of the procedures performed in adults are now described in the paediatric population too. "Medical" thoracoscopy (as opposed to video assisted "surgical" thoracoscopy) is used exclusively for diagnostic purposes and has the advantage that it can be carried out under local anaesthesia or conscious sedation in an endoscopy suite.[4]

METHODS

This prospective observational study was conducted in 32 patients with non-malignant pathologies of thorax to undergo VATS lobectomy and thoracotomy conversion cases initially approached by VATS lobectomy in tertiary care hospital during a period of two years from October 2017 to September 2019.

Thoracotomy conversion is defined as a procedure that started with VATS for lobectomy, but was ultimately converted to thoracotomy for any reason. Patients with malignant lung pathologies and lobectomy undergone by open thoracotomy without any attempted VATS were excluded from the study. After selection and after informed consent has been taken, a standard proforma was used to follow up the patient prospectively.

Decortication

The camera port was placed in the 7th or 6th intercostal space in the line of the anterior superior iliac spine or just anterior to this. VATS decortication and/or evacuation of hemothorax can be performed through 2 or 3 ports. The working port should be placed over the 5th intercostal space between the mid and anterior axillary lines. The intercostal incision should allow 3 fingers. A Weitlaner was used to retract the soft tissues. A third port can be placed posteriorly, positioned to allow access to the anterior part of the pleural cavity. The final assessment of the hemothorax was performed using chest computed tomography (CT) with contrast (Image I). This examination was performed in all patients before they were qualified for the VATS procedure.

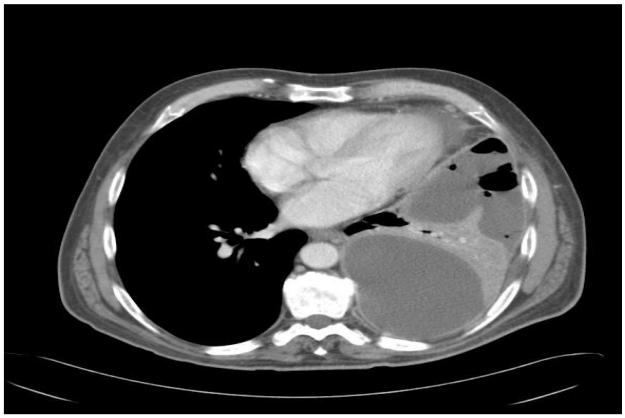

Figure 1: Chest computed tomography: left-sided hemothorax.

VATS Technique

A 15-mm trocar for the 10-mm 30-degree thoracoscope was placed through the sixth intercostal space. A 4 to 5cm utility incision was made through the fourth or fifth intercostal space in the anterior axillary line without rib spreading. Subsequently, an additional 5 to 10mm trocar was placed through the sixth or seventh intercostal space in the posterior scapular line, (Image II). Individual dissection of pulmonary vessels and bronchi was attempted, and they were divided by endoscopic staplers (or surgical clips for vessels).

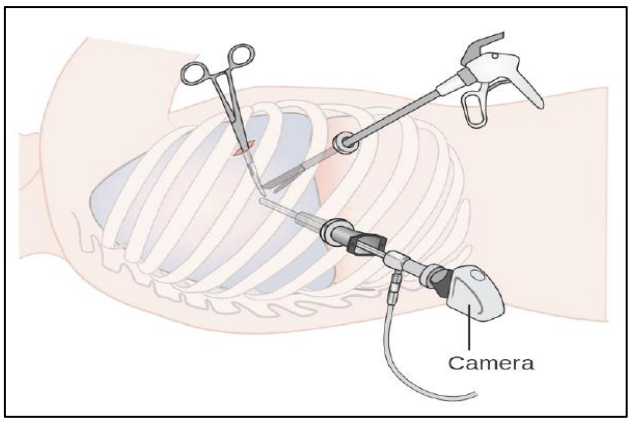

Figure 2: Positioning the patient for video-assisted thoracic surgery.

The surgical procedures conducted using VATS were lobectomy, decortication, thoracoscopic excision of mass, sympathectomy, nuss procedure and rarely oesophagectomy with gastric pull-up was conducted. Thoracotomy conversion was performed by extending the utility incision or by connecting two separate VATS ports.

Data was analyzed and catalogued according to gender, age, and surgical information including diagnosis, pleural adhesion, operative time, and blood loss and thoracotomy conversion.

Then, we compare the data according to the disease entity, defined as: (I) infection group included patients who were diagnosed as having any kind of infection; pulmonary tuberculosis, non-tuberculous mycobacteria, lung hydatid and fungus; (II) non-infection group included congenital disease, congenital cystic adenomatoid malformation or pulmonary sequestration, benign nodule, benign strictures (corrosive acid poisoning), thymoma, sympathectomy or bronchiectasis. Primary outcomes were thoracotomy conversion rate, period of thoracic drainage, length of hospital stay, and complications.

Complications were divided into three categories: (I) none-no complications; (II) fatal-acute lung injury, acute respiratory distress syndrome, and bronchopleural fistula; (III) mild-others not including (I) or (II).

Statistical analysis

Statistical analysis was done using IBM SPSS version 22.0software. Normally distributed variables were analyzed using parametric tests of significance (students't test). Association between categorical/nominal variables was tested using non-parametric tests (Chi-square test). The outcome of interest was calculated within 95% confidence limits. The differences between two observations was considered significant if the calculated P value was <0.05.

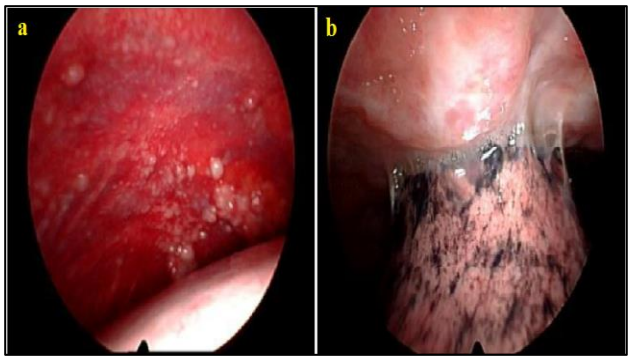

Figure 3: VATS: a) examination for evidence of metastasis, b) pleural adhesions on medical thoracoscopy.

RESULTS

A total of 32 patients with non-malignant pathologies of thorax were enrolled in the study. The majority of the study subjects belonged to the age group of 36-45 years (28.12%), followed by 46-55 years (25% cases) with females predominance (62.50%) as shown in table 1. The male: female ratio was 1:1.66.

Table 1: Demographic profile of the patients.

Parameters		No. of cases	Percentage
Age in years	<25	04	12.50
	26-35	04	12.50
	36-45	09	28.12
	46-55	08	25.00
	56-65	05	15.62
	>66	02	06.25
Gender	Males	12	37.50
	Females	20	62.50

The commonest clinical presentation was hydropneumothorax (28.12%) followed by dyspnea among 25% cases, Heaviness in chest (mediastenal mass) among 18.75% cases, dysphagia among 15.62% cases, (Figure 1).

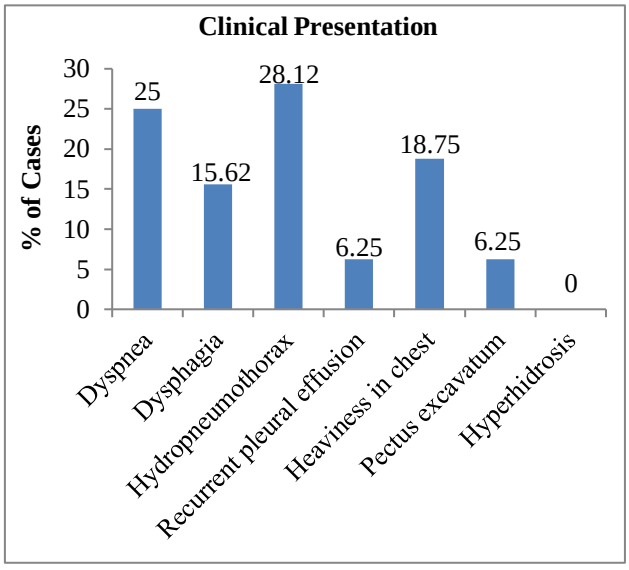

Figure 4: Distribution of study subjects according to their clinical presentation.

In the infection group, the majority were lung hydatis cases (28.12%), followed by 18.75% cases were of pulmonary tuberculosis, while in the non-infection group, majority of the cases presented with benign nodule (18.75%), followed by benign strictures among 15.62% cases, as shown in Table 2.

We observed that 13 (40.62%) cases presented with bilateral/midline involvement, whereas 10 (31.25%)

cases had right sided involvement. 9 (28.12%) cases had left sided involvement.

Table 2: Distribution of study subjects according to their diagnosis.

Causes (Diagnosis)		No. of cases	Percentage
Infection group	Pulmonary TB	06	18.75
	Non-tuberculus Mycobacteria	01	03.12
	Lung hydatid	09	28.12
	Aspergillosis (fungal)	01	03.12
Non-infection group	Pulmonary sequestration	02	06.25
	Benign mass	06	18.75
	Benign strictures	05	15.62
	Sympathectomy	00	00.00
	Congenital malformations	02	06.25

In majority of the cases lobectomy (34.37%) and decortication (25%) was done. Other surgical procedures performed were depicted in figure 2. Among majority of the cases (18; 56.25%) three ports were used, while among 14; 43.75% cases 4 ports were used.

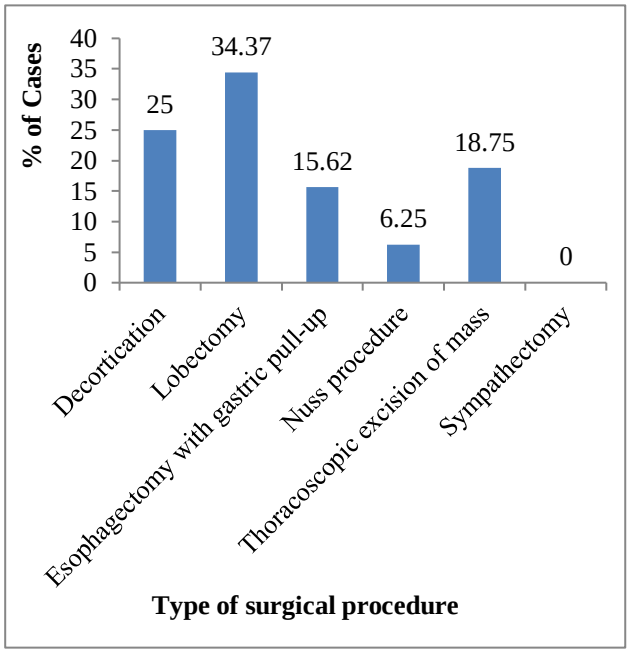

Figure 5: Distribution of study subjects according to surgical procedures performed.

The intraoperative findings showed that the mean blood loss among the cases was 315.9±36.46 ml, while the mean operative time was 157.18±12.37 minutes. Among 6.25% cases thoracotomy was conducted in view of difficult hilar dissection, while among 3.12% cases each of indistinct anatomy and Bleeding. The mean duration of thoracic drainage was 6.78±1.69 days while mean hospital stay was 8.2±3.2 days. We found that 6.25% cases had fatal complications while 21.87% cases had milder complications. Only one cases recurred in the present study, while 96.87% cases cured, (Table 3).

Table 3: Distribution of study subjects according to surgical outcomes.

Surgical outcomes		Mean	SD
Thoracic drainage (Days)		6.78	1.69
Hospital stay (Days)		8.2	3.2
		No. of cases	**Percentage**
Complications	No	23	71.87
	Mild	07	21.87
	Fatal	02	06.25
Follow up results	Cured	31	96.87
	Recurred	01	03.12

DISCUSSION

VATS lobectomy is being performed all over the world. According to Society of Thoracic Surgeons (STSs) (STS-General Thoracic Database) data, the percentage of VATS lobectomy procedures has increased progressively as compared to traditional open approach surgeries, from 10% in 2002 to 29% in 2007.[5]

Several large studies have demonstrated advantages of VATS approach over classical thoracotomy in terms of postoperative pain, post-operative pulmonary function recovery, and post-operative quality of life.[5-10] However, the majority of these reports investigated VATS lobectomy in lung cancer, and they overlooked benign lung diseases requiring lobectomy, such as chronic aspergilloma, mycobacterial diseases, bronchiectasis or emphysema.

Yim first reported the technical feasibility of lobectomy in benign diseases by VATS in 1996, but concluded that its role remains to be defined. Similarly, Weber et al in 2001 confirmed feasibility of VATS lobectomy in bronchiectasis and inflammatory pathologies, but suggested careful patient selection according to radiological signs of severe scarring and adhesions.[11,12]

There is a paucity of reports on VATS lobectomy for benign disease, because benign diseases requiring lobectomy tend to have infection or inflammation. We know from long-standing experience with open lobectomy, that we expect prolonged air leaks, a higher complication rate, and a prolonged hospital stay in such patients. Anticipating intra- and post-operative complications, many surgeons would directly choose open thoracotomy rather than VATS. The few available

publications compare lobectomy performed for benign diseases either by VATS or by thoracotomy, and stress the importance for appropriate patient selection.[13] However, taking into account the burden of comorbidities in patients affected by benign diseases, VATS might be a preferable approach, similarly to patients with peripheral lung cancer.

The goals of this investigation were to describe the surgical outcomes of VATS procedures for non-malignant thoracic pathologies in an Indian scenario and to gain insight into the most suitable surgical conditions for this approach. The majority of study subjects belonged to the age group of 36-45 years (28.12%), followed by 46-55 years (25% cases) with male: female ratio of 1:1.66.

Similar finding reported by Kim and Kumar. [13,14] Most of the cases presented with Hydropneumothorax (28.12%), which is comparable with the study done by Elkhayat. In the infection group, majority of cases were lung hydatis (28.12%) while in non-infection group, majority of the cases presented with benign nodule (18.75%), this is concordance with study conducted by Kim.[15] We observed that 40.62% cases presented with bilateral/midline involvement, while 31.25% cases had right sided involvement. 28.12% cases had left sided involvement. Similar findings are reported by other studies.[15]

Among majority of the cases, lobectomy (34.37%) was done followed by decortication (25%), thoraccic excision of mass (18.75%), esophagectomy with gastric pull-up (15.62%). Nuss procedure was done among 6.25% cases. We observed that among majority of the cases (56.25%) three ports were used, while among 43.75% cases 4 ports were used. These results are correlated with the study carried out by Elkhayat.[14] Moreover, the operation time and blood loss was about 157 minutes and 315 mL, respectively which are comparable with the previous studies.[14,15]

The present study clearly reveals that VATS lobectomy is feasible and effective in selected benign disease cases. Safety of VATS lobectomy for benign disease is demonstrated by similar outcome indicators such as thoracic drainage and hospital stay; the global rate of post-operative complication was comparable in both groups.

The thoracotomy conversion rate was low (3.12%) and the cure rate was high (96.87%). Moreover clinical outcomes were similar regardless of the presence of infection or not. Our results are similar to the findings of Kim and Mazzella.[14,15] Although the slightly long operation time and hospital stay was minor drawbacks, it is certain that many lobectomies for benign disease can be performed successfully by VATS. The increased operative time in benign cases was due to the time-consuming and tedious job of taking down the adhesions.

CONCLUSION

VATS lobectomy for benign disease is feasible and effective in selected cases, regardless of the presence of infection. However, there various technical obstacles may be present during the procedure, therefore, careful patient selection and meticulous operation are both required.

ACKNOWLEDGEMENTS

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Gajbhiye RN, Tirpude BH, Dhahiya A, Akulwar V, Bhanarkar H, Deshpande G, et al. Safety and efficacy of video assisted thoracoscopic surgery for non-malignant pathologies: A prospective observational study. Int Surg J 2021;8:641-6.