

## Video Assisted Thoracoscopic Surgery (VATS) Safety and Feasibility in Benign Pathologies?

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Received date: November 26, 2016; Accepted date: January 4, 2017; Published date: January 12, 2017

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### Abstract

**Objectives:** Although feasibility and safety of VATS becoming a well-established, many surgeons still consider benign lesions should preferably be approached through an open approach. literature review shows that thoracoscopy have been used since early 40's for benign pathologies so far we still find some centers using the open approach.

We aim at evaluation of VATS practice for benign thoracic pathologies with the experience we got through years of knowledge and practice since the first report of VATS uses in benign pathologies

**Methods:** A retrospective study of patients admitted with a clinical diagnosis of benign disease in which VATS therapeutic procedures were done.

**Results:** Two hundred and twenty three patients admitted to the service between March 2009-May 2013. 62.8% (140) were males and 37.2% (83) were females. Ten different categories of benign intrathoracic diseases. The most commonly operated was hyperhydrosis (35.9%) followed by pneumothorax (20.6%). Number of port used were 2 ports in most of the cases (49.8%), 31.8% done using 3 ports and 17.9% used only one port. Mean drainage days were 2.9 days. No chest tube drainage applied in 17% of cases. Complication occurs in 3 cases with no intraoperative mortality. Mean duration of operation were 120.76 minutes.

**Conclusion:** VATS procedures still offer safe and feasible option for treating benign disease with even less duration, hospital stay and ports used compared with historical publications. Effort should be made to encourage more thoracic surgery service to adopt VATS techniques for all benign pathologies.

**Keywords:** Thoracoscopy/VATS; Trauma; Lung; Benign or congenital lesions; Pleura; Hyperhidrosis

malignant neoplasm, wound infection is a concern in resections for an infectious cause.

### Introduction

Video Assisted Thoracoscopic Surgery (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: 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 tumor clearance is not relevant in the former. Second, inflammatory changes may render dissection more difficult in certain diseases like tuberculosis. Third, while tumor seeding is a concern in

### Materials and Methods

This work was conducted in Dr. Suat Seren Chest Disease and Thoracic Surgery Research and Training Hospital, Izmir, Turkey. A retrospective study of 223 patient admitted to the service between March 2009–May 2013 with a clinical diagnosis of benign disease.

Inclusion criteria include all patient diagnosed to have intrathoracic benign disease with clinical and radiological assessment included chest radiographs, CT scan of the thorax, upper abdomen and bronchoscopy.

Exclusion criteria include patient diagnosed as having a malignant disease, patient not amenable for surgical resection due to medical conditions and patient who refuse performing thoracoscopic procedure. patient who firstly diagnosed as having benign disease and proven to be malignant on frozen section were excluded from the study.

## Operational Definition

### Therapeutic VATS procedure

Operating using scope and camera for therapeutic intend through ports without putting a rib spreading retractor.

### Benign intrathoracic disease

Any non-malignant lesion involving or caused by pathology within the chest cavity. Histological confirmation of the benign nature of the lesion, if not already available, was obtained by frozen section.

### Feasibility of VATS

The ability of finishing the operation with VATS without the need for doing a thoracotomy, putting a chest retractor or need for early revision.

### Duration of the procedure

It was defined as the time elapsed from patient entry to or to transfer to postoperative ICU.

### Complications and outcome

They were defined as intraoperative bleeding, hemodynamic instability. Need for early reoperation. The need for conversion to open thoracotomy was considered as outcome. Criteria for intraoperative conversion of the VATS procedure to open thoracotomy include uncontrolled bleeding, dense pleural adhesion, extended resection and /or suspicion of unresectability.

## Results

Two hundred and twenty three patient admitted to the service between March 2009–May 2013. 62.8% (140) were males and 37.2% (83) were females. upon looking through the clinical presentation of the patients we found 10 different categories of benign intrathoracic diseases the most commonly operated was hyperhydrosis (35.9%) followed by pneumothorax (20.6%) and pleural effusion (19.3%). Clotted Hemothorax in 8.9% of cases, 5.4% for pectus excavatum, 4.9% for mediastinal mass or cyst, combined benign diseases were found only in one patient (pneumothorax and pectus excavatum) which represent 0.4% of cases.

Operation site were unilateral in 63.2% of cases, right side 34.1% and left side 29.1%. Bilateral operation site were found in 36.8%.

According to the type of operation, 10 types of operation were done including combined operation (pectus excavatum repair and wedge resection, pleurectomy) as a separate entity representing only 0.4%. 38.1% of cases underwent sympathectomy, 23.3% wedge resection, 16.6% drainage of pleural effusion, 7.6% clot evacuation of hemothorax, 5.4% Nuss operation for pectus excavatum repair, 3.6% cyst excision, 2.7% decortication for pleural effusion, 1.8% mediastinal mass excision, 0.4% exploration for diaphragmatic hernia and 0.4% combined procedure (wedge resection with apical pleurectomy + repair of pectus excavatum).

Number of port used were 2 ports in most of the cases (49.8%), 31.8% done using 3 ports and 17.9% used only one port. Uniportal procedure were for repair of pectus excavatum and sympathectomy in

the last 2 years in most cases, exploration, drainage of pleural effusion and evacuation of hemothorax in one case.

Only one case need 4 ports, bullous lung disease counts for 0.4% of cases.

Mean days of drainage were 2.9. Drainage days were further subdivided into 3 groups, 1-2 drainage days in 30.5% of cases, 3-4 days in 32.7% and 5 days and more in 19.7% of case. no chest tube drainage applied in 17% of cases for Nuss operation and cases of sympathectomy from late 2011, longest drainage period were 20 days in 2 cases, one were for bullous lung disease and the other were spontaneous pneumothorax.

Complication occurs in one case of hemothorax who had a cardiac arrest during procedure which necessitate internal massage and continue procedure via open thoracotomy. Conversion to open thoracotomy were done in another 2 cases, one case of diaphragmatic hernia due to difficulty to reduce contents via VATS and one case of hemothorax due to uncontrolled bleeding.

Duration of operation were divided into 3 groups, less than 2 hours operation were 44.8% of cases, from 2 to less than 3 hours were 46.6% of cases and 8.5% of cases were done in 3 or more hours. shortest operation time were 20 minute in 2 case of raynaud's disease underwent unilateral sympathectomy and the longest operation time occur in 2 cases, one case of pleural effusion underwent decortication in 5 hours and the other case was pleural effusion underwent drainage with excision of plural bases small masses in approximately 4 and half hours (268 minute) and were found to be endometriosis. Combined operation (wedge resection and apical pleurectomy + Nuss operation) were also had a long operation time approximately 4 hours (250 minute).

## Discussion

With this dramatic revolution in the thoracoscopic technology most of newly published articles investigating the VATS feasibility and safety in malignant diseases and advanced resections meanwhile all the data we have regarding VATS for benign intrathoracic lesions dated in the early 90's.

No single study demonstrated a collective data of VATS for benign diseases or for a group of diseases other than parenchymal resection. Although it was recommended by articles about learning curves for VATS lobectomy to do more than 100 cases of minor VATS procedure but without mentioning neither the definition nor the types of operation included in this "minor VATS operation" term [2].

Our aim of this study is to evaluate VATS after becoming the standard procedure of most of the benign intrathoracic diseases regarding safety and feasibility and rate of conversion to open thoracotomy using the early publication of using VATS as a reference guide to our practice.

Several studies concern a special diseases entity using VATS technique as a treatment option was present in English literature. Whereas, using thoracoscopic surgery for benign diseases in general were only seen in few studies [3]. Most of it investigating the long term sequel of VATS in those cases which is beyond the scope of this study [3].

Male to female ratio in our study demonstrated a male predominance despite the fact that the most common benign disease in this study, hyperhydrosis, is more common in females [4]. Male

predominance can be explained by male predominance in other diseases as primary spontaneous pneumothorax, pectus excavatum and traumatic clotted hemothorax which together account for 34.98% of the total cases in our study with only 9 female patients (0.04% of the total cases) 2 cases for pectus excavatum, 2 cases for traumatic clotted hemothorax and 5 cases of primary spontaneous pneumothorax.

Among the studied cases 63.8% set for unilateral operation, 36.2% for bilateral operation all of which were for sympathectomy. Most of published data for bilateral VATS were for sympathectomy, bilateral LVRS, bilateral approach for thymectomy and little publication about Synchronous bilateral VATS decortication for pediatric bilateral empyema and single stage minimally invasive bilateral video assisted thoracoscopic surgery for simultaneous bilateral primary spontaneous pneumothorax [5]. Yet to our knowledge, no publications compare unilateral versus bilateral VATS in terms of safety and pain score and management.

Unfortunately in our study no cases were subjected to anatomical lung resection, despite the fact that VATS lung resection for benign diseases is feasible with an accepted rate of conversion to open thoracotomy as stated by Weber et al. [6].

In our study, one case of hydatid cyst underwent wedge resection via VATS using 3 ports and chest tube drainage left for 3 days. Although surgery is the mainstay for treatment of hydatid cyst, yet using minimal invasive approaches for excision is not well established as any large scale studies published so far. Several reports demonstrate the feasibility of minimal invasive approaches for hydatid cyst [7]. Operative techniques were different in each series as some surgeon does wedge resection of the lung parenchyma containing the cyst [7], others used cystotomy and capitonnage technique similar to open thoracotomy [8].

Combined operation using VATS was used in only one case in our study who had pectus excavatum and recurrent primary spontaneous pneumothorax. Simultaneous minimally invasive surgery for pectus excavatum and recurrent pneumothorax were done in a single case report case in the English literature [9]. In our case 3 ports were used and chest tube drainage was removed on the second day. While Bostanci et al. used 2 ports and chest tube drainage for 6 days postoperative until air leak stopped.

Number of ports used in our study were favored 2 ports in most of the cases with increase in interest of uniportal approach in the last 2 years of the study especially in sympathectomy and Nuss cases. This is comparable with increase interest in uniportal approach for sympathectomy [10], pneumothorax [11] and even for VATS lobectomy [12,13].

The duration and unpredictability of surgical time has important inferences for the management of operating sessions and waiting lists. Less patients may get treated per unit time [14].

In our study, mean duration of operation for all patients was about 2 hours (120.76 minute). Duration of operation was divided into 3 groups in our study to categorize operations, less than 2 hours operation were 44.8% of cases, from 2 to less than 3 hours were 46.6% of cases and 8.5% of cases were done in 3 or more hours. Investigating duration groups in our study fail to find a specific operative time for each operation type or a specific operation type for each operative time group. This can be explained by different operators involved in the study with different learning curves. Shortest operation time was 20 minute in 2 case of Raynaud's disease underwent unilateral

sympathectomy and the longest operation time occur in 2 cases, one case of pleural effusion underwent decortication in 5 hours and the other case was pleural effusion underwent drainage with excision of plural bases small masses in approximately 4 and half hours (268 minute) and were found to be endometriosis. Combined operation (wedge resection and apical pleurectomy + Nuss operation) was also had a long operation time approximately 4 hours (250 minute).

Yet duration of operation for VATS procedure is not studied separately in different diseases. Unlike laparoscopic surgery were large studies of 1000 patients were examined for mean operative time and found to be about 76.9 minute for therapeutic procedures [14]. For VATS procedures, small series concern with operative time [15] on 64 patients in 1996 for VATS for plural effusion as they compare VATS and open thoracotomy, they found that mean operative time was 119 minute for VATS in pleural effusion and 123 minute for open thoracotomy. These results were similar to our results for pleural effusion group (mean operative time was 120.7 minute on 43 patients).

Unlike the similarity of our results for pleural effusion group to historical control studies, our pneumothorax group (46 patients) mean operative time was much higher than historical control series as our mean operative time was 123.9 minute compared to 45 minute for VATS group and 37.5 minute for open thoracotomy group in a series conducted in 1994 on 60 patients [16]. Unfortunately in both series they did not mention how they define operative time as there is no standard definition for this term so far, as one may calculate it from skin incision till skin closure or may be calculated from patient entry to operative room till his exit as in our series.

Mean of drainage days in our study were 2.9 for the whole series. With majority of cases fail in the category of 3-4 days of drainage by 32.7% followed by 30.5% of cases in the category of 2-3 days. 17% were done using no chest tube drainage. This technique was favored in cases of Nuss operation and lately in sympathectomy. No reported postoperative need for chest tube drainage in the group of no chest tube. In a series conducted [17] on 251 patients, 4.8% develop pneumothorax requiring postoperative chest tube drainage. In recent study published on 2 articles comparing open correction of pectus excavatum with MIRPE in 11 centers around the world, 284 patients underwent MIRPE with an incidence of significant pneumothorax (more than 20% of the chest cavity) were 4.23% [18].

On a study conducted by Stammberger et al. on 173 patients in 2000 who underwent VATS for pneumothorax, pleural effusion, lung nodule, interstitial lung disease and empyema. They found that mean drainage days were  $6.0 \pm 4.7$  days for the whole study group [19]. Long drainage days in Stammberger et al. series can be explained by patient with interstitial lung disease (n=20) whom included in the study as they usually need prolonged drainage for air leak and difficult lung expansion. Unfortunately the before mentioned authors did not report which patients need long drainage period and for what reason.

Complications and the need for conversion to open thoracotomy reported in our study were all are related to traumatic patients with a total rate of 1.34%. No intraoperative death was reported in this series.

A study of 328 patients with retained hemothorax after chest tube placement from 20 centers conducted by Du Bose et al. thoracotomy was ultimately required in 20.4%. Independent predictors of successful VATS as definitive treatment were absence of an associated diaphragm injury. Although several studies demonstrated the feasibility of repair of diaphragmatic eventeration via VATS [20] and congenital diaphragmatic hernia via VATS [21]. Few old reports demonstrate the

success of VATS in treatment of traumatic diaphragmatic hernia. Kamelgard et al. presented a case of thoracoscopic repair of an incarcerated recurrent diaphragmatic hernia appearing several years after successful open (via laparotomy) repair of an acute blunt traumatic hernia [22].

## Conclusions

Despite the lack of resection cases in the study. Benign intrathoracic pathology should be managed using thoracoscopic surgical procedure owing to its safety and feasibility with even less duration, hospital stay and ports used compared with historical publications in the early times of implementing VATS techniques. More studies need to be conducted concerning benign thoracic pathology involving parenchymal resection.

Initiating a VATS training program using benign intrathoracic pathologies as a minor procedure before proceeding to parenchymal resection is advisable and provide a good knowledge to endoscopists for thoracic surgeons.

It is recommended that Care should be taken while exploring a traumatized patient with VATS as intractable hemorrhage has to be managed with open thoracotomy without hesitations.

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