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Clinical Profile of Thoracoscopic Bullectomy in Treatment of Pneumothorax

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ABSTRACT

Background: In pneumothorax patients requiring surgery for various indications, thoracotomy was the traditional approach until the advent of video-assisted thoracoscopic surgery. In the last decade, role of thoracoscopy in the surgical management of pneumothorax has been consolidated and established. In this study, we aim to report our experience of thoracoscopy in the surgical management of pneumothorax.

Methods: A descriptive review of prospectively maintained data on all the patients undergoing thoracoscopic bullectomy for pneumothorax was done.

Result: Over the period of 9 years, a total of 120 patients underwent thoracoscopic bullectomy. Among them, 95 entered final analysis. Most common age group was 21-40 years, with male predominance (80%); most common diagnosis was primary pneumothorax (67%), first episode (74%), and on the right (65%) side; commonest symptom was shortness of breath (84%) of a median duration of 7 days. A chest tube was placed in 96% of patients before the operation. Commonest radiological finding was multiple bullae (45%) in the apical region (71%). Majority of patients underwent surgery via 3 ports, and a single bulla in the apical region was the most common intraoperative finding. Among the postoperative complications which occurred in 17%, an air leak was present in 9%. The median intensive care stay was 23 hours, the median chest tube duration was 3 days, and the median hospital stay was 9 days.

Conclusions: Thoracoscopy can be used as a safe, feasible, and effective procedure in patients presenting with pneumothorax with minimal postoperative complications.

Keywords: Bullectomy; pneumothorax; video-assisted thoracoscopic surgery.

INTRODUCTION

Spontaneous pneumothorax (SP), a common medical emergency, is classified as primary (PSP) when it results from rupture of small blebs or bullae without any pre-existing lung disease and secondary (SSP) in the presence of underlying lung disease.[1] The specific indications for surgery in these patients are well-defined. Of late, video-assisted thoracoscopic surgery (VATS) is used more often in lieu of thoracotomy for operative treatment of SP.[2, 3]

Since its first use in 1990, VATS has shown greater promise regarding operative time, postoperative stay, chest tube duration, pain, cosmesis, and postoperative inflammatory response.[4-7] Thus, when surgery is indicated for SP, VATS bullectomy/pleurodesis is the treatment of choice.[8]

Since its adoption 9 years ago, VATS has been a regular service in Manmohan Cardio-Thoracic Vascular and Transplant Center (MCTVC). In this paper, we aim to review our experience with thoracoscopic bullectomy in patients with pneumothorax, along with a relevant review of the literature.

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METHODS

An observational descriptive study was carried out in MCTVC, of all patients undergoing surgical management of pneumothorax for the period of nine years from April 2012 to April 2021. Ethical approval was obtained from the Institutional Review Committee (IRC) of the Institute of Medicine, but individual informed consent from the patients were not taken due to the retrospective nature of the study. All adult patients who underwent thoracoscopic bullectomy for pneumothorax were considered eligible for the study. Incomplete patients' records, intraoperative conversion to thoracotomy, and primary thoracotomy were reasons for the exclusion of some of the patients. Patient's medical data including demography, presentation, radiological findings, surgical procedure, and postoperative variables including postoperative complications, duration of chest tube drainage, length of ICU and hospital stay, and in-hospital mortality if any, and follow-up data were gathered and analyzed using R version 3.4 (StataCorp., College Station, TX, USA).

The operation was performed in the lateral position under general anesthesia; lung isolation was achieved by using double-lumen intubation. It would be accomplished using the one, two, or three-port method. Thoracoscopy would be established with a 10mm port in the seventh or eighth intercostal spaces along the mid-axillary line, followed by two additional 10 mm ports which would be generally inserted at the infra-axillary area and posterior axillary area, but could vary as per need.

A thorough examination of the pleural cavity was done with pneumolysis if necessary. If blebs or bullae were found, they were excised with an endoscopic stapling device with the required number of fires encompassing a cuff of the normal lung tissue towards the base. Pleurodesis was done with 200mg of doxycycline with 50 ml of 10% povidone-iodine solution. Mechanical pleurodesis was done by scrapping the costo-parietal pleura as completely as possible. After ensuring satisfactory lung inflation with the Valsalva maneuver, a single drain was left to drain both the base and apex of the pleural cavity, and the wounds closed. Patients were extubated on the table and transferred to ICU for further care.

Continuous low-power suction (20-25cmH_2O) was applied for the first 48 hours. Subsequently, the chest tube would be removed when the underlying lung was fully expanded with no air leak despite provocative tube clamping and fluid drainage of less than 100ml in 24 hours. Patients were discharged from the hospital when they were fully mobile and when their pain was controlled by oral analgesics.

RESULTS

Over a period of 10 years, a total of 95 patients undergoing a VATS bullectomy and pleurodesis for pneumothorax fulfilled the inclusion criteria for this study. Males outnumbered females with a sex ratio of 4:1. The median age was 30 years (range 14 - 83). Primary SP (as opposed to secondary SP) was more common, occurring in 67%. For 70 patients (74%), it was the first episode of pneumothorax. Rest of the patients presented with recurrence. The majority of the patients (65%) had a right pneumothorax, and shortness of breath was the commonest presentation (84%). *(Table 1)*

Chest pain, cough, and fever occurred in 55%, 38%, and 5% respectively. The symptomatology ranged from 1 to 120 days with a median duration of 7 days. Sixty-one (64%) patients had past history compatible with a diagnosis of COPD, although only 35% had a history of smoking with 8% still smoking at the time of presentation.

All of the patients had presented to our center after one or the other primary procedure (chest tube, pigtail catheter, or even VATS). An HRCT of the chest was done in all the cases and showed multiple bullae in 45%, single bullae in 41%, and no bulla in 14%, with the lung apex being the commonest location (75%). *(Table 2)* For patients who were operated on for their first presentation, the commonest reasons were the presence of bullae in CT scans, persistent air leaks, and massive pneumothorax. Eighty-two (86%) patients were operated on via standard 3-ports, one of which utilized the existing chest tube insertion site. The rest were approached via dual or single port technique. In contrast to the CT findings, each patient had at least a bleb/bulla intraoperatively, and the majority of them (63%) had a single bleb/bulla, the commonest location being the lung apex in 88%. The first patient who underwent VATS bullectomy had the bullectomy base plicated with intracorporeal 3-0 polypropylene stitches, due to the unavailability of endoscopic staples. With improvement in endoscopic techniques and reduction of cost, stapling has become routine of late, and the practice has tilted towards one or two ports technique, with all of the 13 such patients being operated on in the last two years.

A median operation time was 90 minutes with a steady reduction in operating time to an average of 30 minutes in the last two years. There were no major

intraoperative complications, with an average blood loss of approximately 50ml. Nine patients (9%) had prolonged air leak postoperatively, and all of them improved with continuous suction. Other complications including wound infection, pleural effusion, and empyema occurred in a minority of the patients. There was no in-hospital mortality or 30-day mortality. None of the patients required an ICU stay of more than a day. The chest tube stayed in for an average of 3 days, and the total duration of hospital stay was 5 days on average.

Table 1. Clinical and Imaging Data.

Characteristic	N (%)
Age (years)	
≤ 20	16 (17)
21-40	39 (41)
41-60	27 (28)
≤60	13 (14)
Diagnosis	
Primary spontaneous pneumothorax	64 (67)
Secondary spontaneous pneumothorax	31 (33)
First episode	70 (74)
Recurrence	25 (26)
Computed tomogram findings	
Single bulla	39 (41)
Multiple bullae	43 (45)
Apical bullae	71 (75)

Table 2. Operative and Postoperative Data.

Characteristic	N (%)
3-port	82 (86)
Bulle	
Single	64 (67)
Multiple	31 (33)
Postoperative air-leak	9 (9)
ICU stay (Hr)	
0	16 (17)
≤24	38 (40)
25-48	35 (37)
≥48	6 (6)

DISCUSSION

First episode of spontaneous pneumothorax is generally managed with observation, needle aspiration, or chest tube drainage, depending on the size. Surgery is generally reserved for recurrence; however, over the years, a number of indications have evolved in favor of surgical management for the first episode of SP. These include a large bulla, bilateral bulla, tension pneumothorax, or prolonged air leak, certain professions where a recurrence would be disastrous (e.g. pilots and divers), and patients unlikely to return for a follow-up for certain reasons, among others.[9]

Smoking not only increases the chance of SP but also increases the chance of recurrence, likely due to airway inflammation. Along with this, male gender and conservative treatment of the 1st episode have been implicated as high-risk factors for recurrence.[10-12] In the current study, all the recurrences (25/95) occurred in males who had been smokers at some point.

Patients who develop pneumothorax usually complain of sudden dyspnea and pleuritic chest pain, the severity related to the volume of air.[13] Dyspnea, chest pain and cough were the commonest presenting complaints in our patients, as is the case with most similar studies.[14-16]

CT scan of the chest has been the most useful investigation, depicting blebs or bullae in various locations and numbers. All of our patients had a CT scan done before surgery. Our study, like many others, has shown that the right lung apex is the commonest site for both, the occurrence and rupture of the bullae.[17,18]

Like most thoracic surgical procedures, VATS has gradually replaced thoracotomy as the approach of choice for a number of reasons. Stapled bullectomy alone via VATS had been questioned for higher risk of recurrence in some of the earlier studies, but the addition of mechanical and/or chemical pleurodesis has been shown to reduce the recurrence rate, in multiple other studies.[19, 20] Moreover, the tendency to avoid surgery in the first episode might have been a result of a fear of high morbidity associated with thoracotomy. With the advent of VATS, more and more 'soft' indications for surgery during the first episode have been exercised. In fact, a meta-analysis of 1121 patients showed that patients with the first episode of PSP have a more significant reduction in the ipsilateral recurrence rate when treated with VATS (irrespective of the type of surgical technique) than when treated conservatively (odd ratio 0.13).[21]

By far, the standard 3-port VATS has been utilized in most of our patients, with some being approached via 2 ports or even a single port. Studies show that all of them are equally efficacious and safe.[22] Intraoperative conversion to thoracotomy has become a rarity in today's practice, as preoperative localization and operative techniques have become better with time.[23]

The operative time, amount of intraoperative bleeding, and the frequency of postoperative complications are all functions of the experience of the surgical team, and ours have been comparable to the studies elsewhere.[1, 24, 25]

The main limitations of our study would be a relatively small patient population and the retrospective nature of the study.

CONCLUSIONS

The use of thoracoscopic bullectomy in the management of spontaneous pneumothorax is safe and efficacious. Its use for the first episode of spontaneous pneumothorax is increasing, with good results.

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