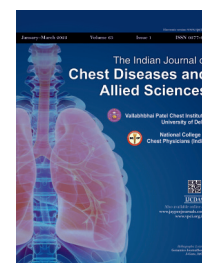


# Primary Spontaneous Pneumothorax: Surgery for the First Occurrence? An Early Experience from Nepal

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## ABSTRACT

**Background:** Primary spontaneous pneumothorax (PSP) is a common thoracic surgical emergency affecting otherwise healthy young individuals. Its treatment options range from observation to surgery in the form of video-assisted thoracoscopic surgery (VATS). Surgery, generally reserved for recurrence, is gradually being utilized for certain patients presenting with PSP for the first time. In this study, we aim to report our experience of VATS in the surgical management of first episodes of PSP.

**Methods:** A retrospective review of prospectively maintained data on all the patients undergoing surgical management during the first presentation of PSP, over a period of 10 years, was done.

**Results:** Over the period of 10 years, out of 95 patients who underwent thoracoscopic bullectomy for pneumothorax, a total of 42 patients had presented with PSP for the first time. Most (54%) were aged 20–40 years, with male predominance (83%); right-sided (69%); commonest symptom was shortness of breath (83.3%) with a median duration of symptoms of 5.9 days. Apical bullae were the commonest computed tomographic finding (88%). Majority of the patients underwent VATS via three ports, and multiple apical bullae were the most common intraoperative findings. Four patients (9.5%) had an air leak postoperatively, managed conservatively. Average intensive care unit stay was 23 hours; average chest tube duration was 3.6 days; and the average hospital stay was 8.2 days. There was no 30-day mortality and no recurrences were noted during a median follow-up of 2 years.

**Conclusion:** Our initial experience with surgery for the first episode of PSP has been shown to be safe and effective. Larger and more robust studies with longer follow-ups would be necessary to better delineate the role of surgery in such patients.

**Keywords:** Bullectomy, First episode, Pneumothorax, Video-assisted thoracoscopic surgery.

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## ABBREVIATIONS USED IN THIS ARTICLE

HRCT = High-resolution computed tomogram; ICU = Intensive care unit; PSP = Primary spontaneous pneumothorax; VATS = Video-assisted thoracoscopic surgery.

## INTRODUCTION

Primary spontaneous pneumothorax (PSP) is a global health problem and a common medical/surgical emergency occurring in otherwise healthy young males with otherwise healthy lungs. However, the presence of small blebs, bullae, or pleural porosity is commonly implicated in its causation. Tall thin individuals, males and smokers are commonly affected.<sup>1</sup>

Since its first use in 1990, video-assisted thoracoscopic surgery (VATS) has shown greater promise in regards to operative time, postoperative stay, chest tube duration, and postoperative pain, better cosmesis, and attenuating postoperative inflammatory response.<sup>2–5</sup> Thus, when surgery is indicated for PSP, VATS bullectomy/pleurodesis is the treatment of choice.<sup>6</sup> The significant reduction of untoward events has enabled thoracic surgeons to push boundaries when it comes to operating on borderline patients.

Various guidelines advise that PSP be managed surgically when it recurs. Historically, the management of its first occurrence has been elusive at best, and the optimum management of “first-timers” has largely been “left at the discretion” of the treating physician. A recent review of clinicians’ practice revealed a variety

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of approaches being taken.<sup>7</sup> Recently, however, there have been attempts to find an answer to this question. Any intervention is likely to give rise to complications, and a patient receiving a chest tube is most likely to require an admission. On one hand, these facts are being used as a pretext to find out whether a PSP can be managed conservatively with impunity; with one such study demonstrating “non-inferiority” of conservative management.<sup>8</sup> On the other hand,

the role of surgery at the first episode itself has also been studied, on the pretext of likelihood of recurrence of PSP. The likelihood of recurrence has been variously estimated over the decades. A recent systematic review studied 13,548 patients and found that the overall recurrence rate was 32%, with maximum recurrence occurring in the first year. Various risk factors for recurrence after conservative management have been postulated, and there have been weak recommendations to pursue surgery for the first episodes of PSP.<sup>9,10</sup> Some studies have claimed that there are no identifiable risk factors for recurrence.<sup>11</sup> Similarly, recurrence rates after VATS have also been examined.<sup>12</sup> Since the adoption of VATS in thoracic surgery 10 years ago in Manmohan Cardio-Thoracic Vascular and Transplant Center, surgical treatment for PSP has been a regular service. As surgery for the first occurrence continues to be a contentious issue, this study aims to review our experience with the use of surgery in the treatment of patients with PSP, along with a relevant review of the literature.

## METHODS

### Patient Selection

All surgically managed PSP patients in Manmohan Cardio-Thoracic Vascular and Transplant Centre (MCVTC) between April 2012 and April 2021 were included in this retrospective observational study. Some of the patients had to be excluded from the final analysis for the lack of complete data, intraoperative conversion to thoracotomy, and primary thoracotomy. Patient's medical records including demography, clinicoradiological findings, surgical and postoperative variables, and follow-up data were gathered and analyzed using simple statistical tools.

### The Surgery

The operation was performed in the lateral position with single-lung ventilation using double-lumen endotracheal tube. One, two, or three ports were used, guided by feasibility and preference at the time. Thoracoscopy would be established with a 10-mm port in the seventh or eighth intercostal spaces along the mid-axillary line, followed by two additional ports that 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 toward the base. Pleurodesis was done with 200 mg of doxycycline with a 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 the apex of the pleural cavity and the wounds closed. Patients were extubated on table and transferred to intensive care unit (ICU) for further care.

### Postoperative Management

Continuous low-power suction (20–25 cm H<sub>2</sub>O) was applied for the first 48 hours. Subsequently, chest tube would be removed when the underlying lung was fully expanded with no air leak despite provocative tube clamping, and a fluid drainage of less than 100 mL in 24 hours. Patients were discharged from the hospital when they were fully mobile and when their pain was controlled by oral analgesics.

## Statistical Analysis

Data were recorded and statistical analysis was done using R version 3.4 (StataCorp. College Station, TX, USA).

## RESULTS

Over a period of 10 years, a total of 42 patients, ranging from 15 to 60 years (mean 30.88 years) underwent a VATS bullectomy and pleurodesis for PSP. Most of them (23; 54%) were aged 20–40 years. Men outnumbered women with a sex ratio of 5:1. The majority of the patients (69%) had a right pneumothorax, and shortness of breath was the commonest symptom, being present in 83.3% of the patients. Chest pain (66.6%) and cough (38%) were the next common symptoms. Only five patients had all the three symptoms at presentation. The patients presented after an average of 5.9 days of symptoms (range: 1–18 days).

None of the patients had a past history compatible with a diagnosis of chronic obstructive pulmonary disease. Only 21.4% had a history of smoking with a mere 4.8% still smoking at the time of presentation. Majority (69%) had a right-sided pneumothorax, and only two patients had it bilaterally.

A high-resolution computed tomogram (HRCT) of the chest was done in all the cases, and showed blebs/bullae in 39 patients (92.8%). The three patients who had no blebs/bullae in their CT scans were operated for persistent air leaks (in two) and massive pneumothorax (in one). Thirty-seven (88%) patients were operated on via standard three-port technique including the existing chest tube insertion site. Four underwent a two-port technique, and the uniportal technique was utilized in one patient. The intraoperative findings were in congruence with the CT findings. The three patients with no evidence of blebs/bullae in HRCT, too, had multiple apical blebs intraoperatively. Thus, in total, there were multiple blebs/bullae in 22 (52.3%) and single in 20 (47.6%); apical in 37 (88%), and non-apical in 5 patients. With improvement in endoscopic techniques, the practice has tilted toward one- or two-port technique, with all of five such patients being operated on in the last two years.

The mean operative time was 96 minutes (range: 45–180) 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 50 mL. Four patients (9.5%) had prolonged air leak postoperatively, and all of them improved with continuous suction. Two had pleural effusion after removal of tubes, and were managed successfully with therapeutic aspiration. There was no in-hospital 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 3.6 days (3.2 excluding patients with air leaks), and the total duration of hospital stay was 8.2 days on average (7.7 excluding patients with air leaks).

None of the patients had any evidence of recurrence until a median follow-up duration of two years (range: 9 months to 5 years).

## DISCUSSION

First episode of PSP is generally managed with observation, needle aspiration, or chest tube drainage, depending on the size. As noted above, 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 bullae, 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.<sup>13</sup>

Conservative treatment of the first episode has been implicated as one of the risk factors for recurrence.<sup>14–16</sup> Likewise, the presence of large bullae have been demonstrated to give rise to higher risk for recurrence.<sup>17</sup> In an unreported study in the same department, all the recurrences (25 of 95) were seen in male patients who had been smokers at some point. However, in the current study, more than 3/4th of the PSPs occurred in never-smokers, as has been well known.

Patients who develop pneumothorax usually complain of sudden dyspnea and pleuritic chest pain, the severity related to the volume of air.<sup>18</sup> Dyspnea, chest pain, and cough were the commonest presenting complaints in our patients, as is the case with most similar studies.<sup>19–21</sup>

Computed tomographic 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.<sup>22,23</sup>

Like most thoracic surgical procedures, VATS has gradually replaced thoracotomy as the approach of choice for a number of reasons. Principally all of our patients were approached via VATS, and there were no conversions. In fact, intraoperative conversion has become a rarity in today's practice, as preoperative localization and operative techniques have become better with time.<sup>24</sup> A higher risk of recurrence observed with bullectomy alone has been mitigated with the addition of mechanical and/or chemical pleurodesis.<sup>25,26</sup> It has been our policy to institute both the techniques of pleurodesis at the end of surgery. Moreover, the earlier tendency to avoid surgery in the first episode had its roots in the fear of high morbidity associated with thoracotomy. With the advent and advancement of VATS, more and more "soft" indications for surgery during the first episode have been exercised. Olesen and his coworkers have recently shown that five patients need to be operated during the first occurrence of PSP to prevent recurrence in one. They have demonstrated in a multicenter randomized trial that recurrence after VATS was significantly lower than those treated with chest tube alone for the first episode, and go on to recommend that any PSP first episode must undergo a "preventive surgery" if the blebs/bullae are 2 cm or more.<sup>27</sup> Reduction in the number of ports, like in five of our cases operated via double- or single-port technique, can be expected to be in favor of surgery for the first episode, as they are equally efficacious and safe.<sup>28</sup> Of note, a recent meta-analysis showed a significant reduction in the recurrence rate with VATS than when treated conservatively.<sup>10</sup>

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.<sup>29–31</sup>

## LIMITATIONS

The main limitations of our study would be its retrospective nature, a relatively small patient population and lack of a longer follow-up data.

## CONCLUSION

Our initial experience with surgical management of the first occurrence of PSP has been encouraging in view of the demonstrated

safety and efficacy. Larger and more robust studies with longer follow-ups would be necessary to better delineate the role of surgery in such patients.

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