

Uniportal video assisted thoracoscopic surgery bullectomy and double pleurodesis for primary spontaneous pneumothorax

Adrian Ooi¹, Zhu Ling²

¹Department of Cardiothoracic Surgery, Gleneagles Hospital Kuala Lumpur, Kuala Lumpur, Malaysia; ²Department of Cardiothoracic Surgery, National Heart Centre Singapore, Singapore

Contributions: (I) Conception and design: A Ooi; (II) Administrative support: Z Ling; (III) Provision of study materials or patients: A Ooi; (IV) Collection and assembly of data: Z Ling; (V) Data analysis and interpretation: A Ooi; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Adrian Ooi, MD. Department of Cardiothoracic Surgery, Gleneagles Hospital Kuala Lumpur, Kuala Lumpur, Malaysia.

Email: adrianooisw@yahoo.co.uk.

Background: Primary spontaneous pneumothorax (PSP) usually occurs in young adults, with higher incidence in smoker, and patients with narrow chest frame and slim body habitus. Surgery is indicated in the cases of recurrence episodes or persistent lung collapse, and failed conservative management by chest drain insertion. Video assisted thoracoscopic surgery (VATS) bullectomy and pleurodesis is the surgical treatment of choice but uniportal approach has been utilised to further minimise surgical trauma, improve cosmesis without compromising the efficacy of the procedure.

Methods: This video demonstrated the uniportal procedure for bullectomy and double pleurodesis for PSP. A 2.5 cm incision was made at 4th intercostal space, anterior axillary line. Extra small size wound protector was used and CO₂ insufflation was not needed. Adhesion divided with diathermy and visible apical bullae was resected using endoscopic stapler. Abrasive pleurodesis performed by using scratch patch mounted on Robert clamp, gently running along the parietal pleura within the chest wall. In addition, 5 grams of pure talc was delivered into pleural space. Single drain inserted via the port and lung fully inflated upon resuming ventilation by anaesthetist. Drain remained for 48 hours under negative pressure of -20 mmHg and patient usually went home on day 3 post-operatively.

Results: During the period from 2009 to 2015, over 160 cases of PSP were treated using this method by the author. To date, there is no recurrence reported upon follow up at outpatient clinic. There was no mortality and patients resumed active physical activity 8 weeks after the procedure.

Conclusions: Uniportal VATS bullectomy and double pleurodesis is a safe procedure for treating PSP and effective in preventing future recurrence of lung collapse. This simple approach should be encouraged and performed by all enthusiastic VATS thoracic surgeons.

Keywords: Uniportal; bullectomy; pleurodesis; primary spontaneous pneumothorax (PSP)

Received: 18 December 2015; Accepted: 27 December 2015; Published 26 January 2016.

doi: [10.3978/j.issn.2221-2965.2016.01.07](https://doi.org/10.3978/j.issn.2221-2965.2016.01.07)

View this article at: <http://dx.doi.org/10.3978/j.issn.2221-2965.2016.01.07>

Introduction

Primary spontaneous pneumothorax (PSP) usually occurs in young male adults, with higher incidence in smoker, a family history and with narrow chest frame or slim body habitus (1-3). The aetiology is yet to be established and usually causes limited symptoms. Chest pain and mild

breathlessness are the usual predominant presenting features and it is rare for PSPs to develop into tension pneumothorax (4,5). However, patients who are affected by PSPs are often unaware of potential danger and may wait for several days until worsening of pneumothorax before seeking medical attention (6). PSP is more commonly occur



Figure 1 Peri-operative video showing right uniportal VATS bullectomy and double pleurodesis for primary spontaneous pneumothorax (9). VATS, video assisted thoracoscopic surgery. Available online: <http://www.asvide.com/articles/780>

during changes in atmospheric pressure, explaining to some extent why episodes of pneumothorax may happen in clusters (5).

Small spontaneous pneumothorax typically resolves without any intervention. It requires only monitoring by the respiratory physicians, especially for those who have no significant underlying lung disease. In larger pneumothorax, or when there are marked symptoms, aspiration maybe attempted by extracting the air with a syringe or a chest tube connected to a one-way valve system or under water sealed drainage system. Occasionally, surgical interventions are required when conservative measurements proved unsuccessful, such as persistent air leak more than 3–5 days or as a preventive measure, if there have been repeated episodes. Hence, surgery is indicated in the cases of recurrence episodes or persistent lung collapse, haemopneumothorax, bilateral pneumothorax, failed conservative management by chest drain insertion (7). Patients with their professions at risk such as aircraft personnel, divers and professional sport persons are also considered for surgery (8).

Surgical treatments usually involve bullectomy (resection of the apical bullae which is responsible for the air leak in pleural space) and pleurodesis (in which the layers of pleura are induced to stick together by either chemical which consists of talc/tetracycline/blood, or mechanical which consists of abrasive or partial pleurectomy). The approach had been performed via thoracotomy until the advent of video assisted thoracoscopic surgery (VATS) which minimised the surgical trauma to this commonly occur condition. VATS bullectomy and pleurodesis is now the surgical treatment of choice (7) and uniportal approach

has been utilised to further minimise surgical trauma, improve cosmesis without compromising the efficacy of the procedure.

Methods

General anaesthesia and lung isolation achieved with a double lumen endotracheal intubation. Lateral positioned with hip down to facilitate widening of intercostal space. Cleaned and draped as for sterile procedure. The following instruments were used:

- 10 mm 30 Degree Endoscope;
- 5 mm Maryland, Bowel Graspers and Hock Diathermy;
- Endoscopic stapler, 5 g talc and insufflator, scratch patch mounted on Robert clamp.

This video (*Figure 1*) demonstrated the uniportal procedure for bullectomy and double pleurodesis for PSP. A 2.5 cm incision was made at 4th intercostal space, anterior axillary line. Extra small size wound protector was used and CO₂ insufflation was not needed.

General inspection of the entire hemi-thorax was carried out initially. Any adhesion band found was carefully divided to achieve good operating field, avoiding injury to the subclavian vessels close by and haemostasis secured with diathermy. The visible apical bullae which was expected to be found in 76–100% of the cases (7), was resected using endoscopic stapler. It is vital to staple across the healthy lung tissue at the base of the bullae, and to ensure that there is continuity of the staple line to prevent air leak. The entire lung surface and the lung edges should also be carefully searched for additional blebs and bullae. If unintentionally left behind, these blebs could lead to recurrence.

Mechanical pleurodesis by abrasion was performed by using a scratch patch mounted on a Robert clamp, gently running along the parietal pleura on the entire inner chest wall. It is advisable to avoid and to prevent injury to the subclavian vessels apically and the sympathetic chain posteriorly. Further pleurodesis was performed with the addition of 5 grams of pure talc, insufflated or sprayed into pleural space. The typical “snow storm” appearance created indicates the evenly distributed talc onto the pleural cavity which activates an inflammatory reaction that causes the lung adhesion to the chest wall. A single drain was inserted via the port and the lung was fully inflated upon resuming ventilation by anaesthetist. Before reversal of anaesthesia, a brief suction on the intubation tube to clear any bronchial secretion is usually helpful, followed by a

gentle and carefully controlled “Valsalva” manoeuvre by the anaesthetist maybe required to re-inflate the collapsed lung fully. In our practise, we would use a new chest tube in every procedure to prevent wound or pleural sepsis. The newly inserted tube would remain for 48 hours under negative pressure of -20 mmHg for pleurodesis to be stabilised. However, this is only a “traditional” practise without much evidence to support the duration of chest tube to be remained in the chest. The patient went home on day 3 post-operatively after confirmation of full lung expansion on chest X-ray (CXR).

Results

During the period from 2009 to 2015, 160 cases of PSP were treated using this method by the author. There was one case of morbidity when excessive abrasion was performed resulting in post-operative intra-pleural haematoma which required evacuation. All patients returned for follow up at outpatient clinic and to date, there is no recurrence reported. There was no mortality and all patients resumed active physical activity 8 weeks after the procedure as instructed.

Discussion

The aetiology of PSP remains unknown. The annual age-adjusted incidence rate (AAIR) of PSP is reported to be 3–6 times higher in males, with the occurrence of 7.4 and 1.2 cases per 100,000 person-years in males and females respectively. Significantly above-average height is also reported with increased risk of PSP in people who are at least 76 inches (1.93 meters) tall in the Western society, where the AAIR is about 200 cases per 100,000 person-years. Slim build habitus also has been reported to increase the risk of PSP (1,2).

Smoking is a major risk factor in developing PSP, and the risk is also elevated among smokers of both sexes by factors of approximately 22 and 9 respectively, compared to matched non-smokers of the same sex. Smoking at higher intensity is also associated with higher risk, with a “greater-than-linear” effect; men who smoke 10 cigarettes per day have an approximate 20-fold increased risk over comparable non-smokers, while smokers consuming 20 cigarettes per day show an estimated 100-fold increase in risk (3).

Very often when patient presents with PSP and a chest tube is already in place, pulmonologists would instil various agents through the tube to achieve chemical pleurodesis, such as talc, tetracycline, minocycline or doxycycline. Even

using patient’s own blood as the pleuritic agent has been attempted (10). However, the results of utilising chemical pleurodesis alone tend to be worse than when using surgical approaches, and when conservative measurements have failed, patient is eventually referred for surgery (6).

Bullectomy consists of identifying and stopping the air leak, is an essential procedure itself to prevent future air leak from lung parenchyma. Pleurodesis which results in a permanent obliteration of the pleural space and attaches the lung to the chest wall is to further prevent lung collapsed from the chest wall. Therefore, best results are achieved when both procedures are combined when operating on PSP. Although no long-term study has been performed on its consequences, it has reduced the recurrence of future pneumothorax to approximately 1% by either open or minimal invasive approaches. Nevertheless, both surgical approaches have long been debated but the consensus of minimal invasive technique for PSP is widely accepted (11,12). In 2004, Chen *et al.* published a non-randomised trial of adding chemical pleurodesis following VATS apical bullectomy and mechanical pleurodesis. They found significantly lower rate of recurrent and improved outcome (13). In 2011, the author Ooi *et al.* presented the technique of apical bullectomy and double pleurodesis (apical pleurectomy and talc pleurodesis) at the Asian Societies joint meeting in Phuket, and later at the 6th Asian Thoracic Surgical Club meeting in Busan. The approach was by 3-port VATS and the short term result of no recurrence was promising. Concerns were raised regarding the use of talc in young patients but talc pleurodesis has been found to have few negative long-term consequences and is safe in younger people (4,14,15). Again, Chen *et al.* mentioned a slightly less traumatic method of treating patients with PSP which consists of VATS apical bullectomy, abrasive and talc pleurodesis without the pleurectomy. They found it to be as effective to prevent recurrence without pleurectomy (16). The bullectomy and double pleurodesis surgery was further refined and now it is largely being performed by uniportal VATS which would be the least invasive approach so far.

Interestingly, thoracoscopy was first being performed with only local anaesthesia, not by a surgeon but by a European pulmonologist in 1937 and this was being performed without the video assistance (17). The development of micro-camera in the 1980’s and the development of endoscopic stapler have both greatly propelled the advent of VATS. Compared to open thoracotomy, VATS offers all the known benefits of minimal invasive surgery (4-6) and uniportal approach

has been utilised to further minimise surgical trauma, improve cosmesis without compromising the efficacy of this procedure.

Conclusions

Uniportal VATS apical bullectomy and double pleurodesis is feasible. It is a safe procedure for treating PSP and effective in preventing future recurrence of lung collapse. This simple approach should be encouraged and performed by all enthusiastic VATS thoracic surgeons.

Acknowledgements

None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Ethical Statement: The work was approved by the ethical committee. Written informed consent was obtained from the patient for publication. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

References

- Levine DJ, Sako EY, Peters J. Pneumothorax. In: Fishman AP, Elias JA, Fishman JA, et al., editors. *Fishman's Pulmonary Diseases and Disorders*, 4th ed. New York: McGraw-Hill Professional, 2008:1519.
- Light RW. *Pleural Diseases*, 5th ed. Philadelphia: Lippincott Williams & Wilkins, 2007.
- Bense L, Eklund G, Wiman LG. Smoking and the increased risk of contracting spontaneous pneumothorax. *Chest* 1987;92:1009-12.
- Tschopp JM, Rami-Porta R, Noppen M, et al. Management of spontaneous pneumothorax: state of the art. *Eur Respir J* 2006;28:637-50.
- Noppen M, De Keukeleire T. Pneumothorax. *Respiration* 2008;76:121-7.
- MacDuff A, Arnold A, Harvey J, et al. Management of spontaneous pneumothorax: British Thoracic Society Pleural Disease Guideline 2010. *Thorax* 2010;65 Suppl 2:ii18-31.
- Yim AP, Ng CS. Thoracoscopy in the management of pneumothorax. *Curr Opin Pulm Med* 2001;7:210-4.
- Tschopp JM, Bintcliffe O, Astoul P, et al. ERS task force statement: diagnosis and treatment of primary spontaneous pneumothorax. *Eur Respir J* 2015;46:321-35.
- Ooi A, Ling Z. Peri-operative video showing right uniportal VATS bullectomy and double pleurodesis for primary spontaneous pneumothorax. *Asvide* 2016;3:029. Available online: <http://www.asvide.com/articles/780>
- Chambers A, Routledge T, Billè A, et al. Is blood pleurodesis effective for determining the cessation of persistent air leak? *Interact Cardiovasc Thorac Surg* 2010;11:468-72.
- Ng CS, Rocco G, Yim AP. Video-assisted thoracoscopic surgery (VATS) pleurodesis for pneumothorax. *Multimed Man Cardiothorac Surg* 2005;2005:mmcts.2004.000349.
- Freixinet JL, Canalís E, Juliá G, et al. Axillary thoracotomy versus videothoracoscopy for the treatment of primary spontaneous pneumothorax. *Ann Thorac Surg* 2004;78:417-20.
- Chen JS, Hsu HH, Kuo SW, et al. Effects of additional minocycline pleurodesis after thoracoscopic procedures for primary spontaneous pneumothorax. *Chest* 2004;125:50-5.
- Hunt I, Barber B, Southon R, et al. Is talc pleurodesis safe for young patients following primary spontaneous pneumothorax? *Interact Cardiovasc Thorac Surg* 2007;6:117-20.
- Györik S, Erni S, Studler U, et al. Long-term follow-up of thoracoscopic talc pleurodesis for primary spontaneous pneumothorax. *Eur Respir J* 2007;29:757-60.
- Chen JS, Hsu HH, Huang PM, et al. Thoracoscopic pleurodesis for primary spontaneous pneumothorax with high recurrence risk: a prospective randomized trial. *Ann Surg* 2012;255:440-5.
- Sattler A. Zur Behandlung der Spontanpneumothorax mit besonnener Berücksichtigung der Thorakoskopie. *Beitr Klin Tuberk Spezif Tuberkuloseforsch* 1937;89:394-408.

doi: 10.3978/j.issn.2221-2965.2016.01.07

Cite this article as: Ooi A, Ling Z. Uniportal video assisted thoracoscopic surgery bullectomy and double pleurodesis for primary spontaneous pneumothorax. *J Vis Surg* 2016;2:17.