Thoracoscopic pleural tenting following bullectomy to reduce postoperative air leak

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Abstract: Chronic obstructive pulmonary disease (COPD) is a worldwide problem and poses a significant respiratory morbidity and mortality. Surgery has a definite beneficial role in the management of COPD in the right patient. Bullectomy has been shown to improve quality of life and survival in the patients with giant pulmonary bulla. Though thoracoscopic bullectomy has significantly reduced perioperative complications, prolonged postoperative air leak remains a major complication. We hereby describe a simple technique of pleural tenting to buttress the staple line following thoracoscopic bullectomy to lower the risk of air leak.

Keywords: Thoracoscopic bullectomy; pleural tenting; video assisted thoracic surgery (VATS); chronic obstructive pulmonary disease (COPD); pulmonary bulla

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Problem

Bullectomy is a well-established surgical procedure which has shown to improve lung function in a well-selected patient (1-3). Though there has not been any randomized controlled trial to show the effectiveness of the bullectomy, all the data stemming from case reports and case series clearly suggest that bullectomy should be considered in a patient with a bulla occupying at least one-third of the hemithorax in the presence of compressed lung adjacent to bulla on CT imaging, and significant dyspnoea that has not responded to aggressive medical therapy (4). Still, bullectomy has not gained sufficient popularity due to the associated postoperative complications resulting in significant morbidity. Common postoperative complications include air leak, re-intubation, cardiac arrhythmia, pneumonia, and haemorrhage. Though video assisted thoracic surgery (VATS) has lowered the risk of postoperative complications and duration of hospital stay, prolonged air-leak continues to haunt the thoracic surgeon.

Solution

A number of options including coverage over a staple line using a pleural tent or an absorbable material (such as a polyglycolic acid sheet or nitrocellulose sheet), mechanical pleurodesis (mechanical or chemical), or reinforcement of the resection line by suturing or using staple line buttressing material wrappings (Peristrips Dry® Synovis Surgical Innovations, St. Paul, MN, USA), are available to lower the risk of postoperative air leak (5,6). Here, we describe a simple and inexpensive method of pleural tenting over the staple line to lower the risk of air leak. The beneficial effect of pleural tent to prevent air leak is likely to be due to the healing process to seal air leaks from staple lines (7). Though there is paucity of literature in assessing the beneficial effect of pleural tenting in thoracoscopic bullectomy, a meta-analysis of five trials comparing outcomes of upper lobectomies with or without pleural tenting showed a significant reduction in number of patients with prolonged air leak (for more than seven days) in pleural tenting group (7).

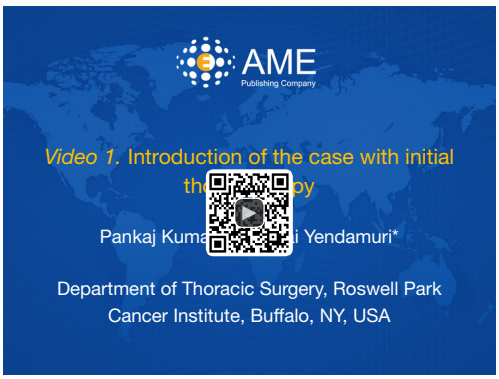

Figure 1 Introduction of the case with initial thoracoscopy (8). Available online: http://www.asvide.com/articles/1775

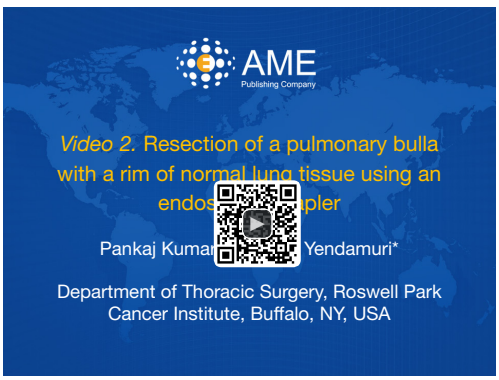

Figure 2 Resection of a pulmonary bulla with a rim of normal lung tissue using an endoscopic stapler (9). Available online: http://www.asvide.com/articles/1776

Special equipment required

No special equipment is required for fashioning the pleural tent.

Operative technique

The patent is placed in a classical lateral decubitus position with the non-operated side to be in dependent position. Two incisions are usually made—first 15 mm incision posteriorly in 7th intercostal space; the second incision of 5 mm is made in the 5th or 6th intercostal space anteriorly under direct vision following local anaesthetic infiltration. The final position of the incisions can be tailored to the position of the bullae, pleural adhesions, and intra-thoracic anatomy. Ports are dilated manually to accommodate the thoracoscopic instruments. Usually 5 mm thoracoscopic instruments are used so as to place multiple instruments through the same port. The position and number of the bullae are identified. At times, bullae may disappear as the lung is deflated. A gentle inflation of the lung to be operated upon would then help in the identification of the bullae. Bulla, once identified, is deflated and any adhesions with the parietal pleura are released using some electrosurgical device (either a simple monopolar diathermy or an electro-thermal bipolar vessel-sealing device like LigaSure^{TM} (Covidien, CO, USA). The junction of the bulla and the normal lung tissue is demarcated as the stapler needs to be applied on the normal lung tissue. Thereafter, the bulla is resected with a rim of normal lung tissue using an endoscopic stapler.

After the bulla is resected, a pleural tent is fashioned to cover the staple line to prevent the air-leak. The parietal pleura is incised in line with the upper port using a monopolar diathermy down to the level of the intercostal muscle. The pleural incision extends anteriorly till the port and posteriorly till just lateral to the descending aorta on the left and the spine on the right. An extra-pleural pocket is created anterior to the superior edge of the pleura using a peanut dissector and suction-tip. The pleural edge is further held with a traction clamp and carefully teased off from the chest wall till the apex anteriorly, posteriorly and laterally. This pleural stripping has to be done gently, meticulously, and patiently to avoid any tearing as it affects the quality of the pleural tent. Any tough adhesions between the pleura and the chest wall, though rarely present, are divided using monopolar diathermy or LigaSure^{TM}. Once the pleura is completely dissected off the chest wall, it is spread over the stapler line. Haemostasis is secured over the pleural tent using monopolar diathermy. In authors' experience, Aquamantys® System (Medtronic, Minneapolis, MN, USA), a combination of radio frequency energy and saline, is quite useful in achieving haemostasis from the raw surface of the chest wall. A single thoracostomy tube is placed underneath the pleural tent (and not over the pleural tent). The lung is then inflated ensuring that pleural tent covers the staple line adequately.

Thoracic epidural catheters can be used for postoperative pain relief. However, the authors prefer to give intercostal block and port-site infiltration (pre-emptive analgesia) using liposomal bupivacaine for postoperative analgesia.

Video

Figures 1-5 demonstrate the surgical procedure of

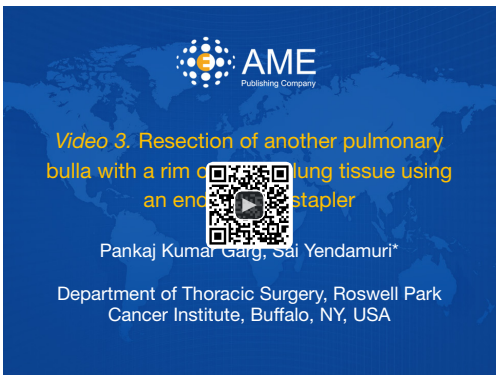

Figure 3 Resection of another pulmonary bulla with a rim of normal lung tissue using an endoscopic stapler (10).
Available online: http://www.asvide.com/articles/1777

Figure 4 Fashioning of pleural tent (11).
Available online: http://www.asvide.com/articles/1778

Figure 5 Coverage of staple line with pleural tent (12).
Available online: http://www.asvide.com/articles/1779

thoracoscopic bullectomy followed by pleural stenting to cover the staple line.

Results of series

We are in the process of publishing the results of our series.

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Footnote

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient for publication of this manuscript and any accompanying images.

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