

Prolonged Air Leak, on Table Prevention of Air leaks: A Protocol for Surgical Management

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Received: May 29, 2019; Published: June 19, 2019

Abstract

Post-operative air leak is well recognised complication of Lung surgery and is a recognised complication in up to 50% of all lung resections, with the highest incidence in the immediate post-operative period (approximately 28 - 60%) [1]. Prolonged air leaks (PALs) has been defined as any air leak persisting for ≥ 7 days post-operatively. The development of PAL is associated with considerable mortality and increased length of hospital stay [2].

Factors have been identified and implicated in the development of PAL. Most importantly these factors are anatomical, affecting resection (Example: incomplete or absent interlobar fissure/s), upper lobe lobectomy and a low predicted post-operative FEV1 [2]. Lung Volume Reduction Surgery (LVRS) which is used in specialist centres, more often results in PAL (39 - 45.2%) than lung resection in emphysematous (5.4 - 44%) or non-emphysematous patients (4.2 - 18.2%). Gender also plays an important role, males with emphysema have also been shown to be independent risk factor possibly due to early age smoking habits [2,4].

Keywords: Prolonged Air Leaks (PALs); Lung Volume Reduction Surgery (LVRS)

Prevention and management

A number of strategies have been reported in order to prevent PALs. Traditionally suction drainage has been the mainstream management of choice to prevent PAL, however studies suggest this approach has no benefit over water-sealed drainage [5]. Interestingly, a previous study by the author S Mohiyaddin and colleagues demonstrated a delayed drain removal was associated with an air leak ≥ 427 mL as measured using the anaesthetic apparatus intra-operatively (at a PEEP of 5) [6].

A number of strategies aimed at preventing PAL have been reported in the literature, in addition to meticulous surgical technique and minimal handling of lung tissues. These include the use of fissureless surgical techniques, pulmonary sealants, pericardial patches to mention some.

Materials and Methods

1. To examine the literature currently available for evidence of interventions for the prevention of prolonged air leak.
2. To design a protocol based on this evidence which can be used to prevent prolonged air leak in clinical practice.
3. A search was performed of a number of databases to find studies which examined prevention of PAL post-operatively in patients undergoing wedge resection, lobectomy, anatomic resection or lung volume reduction surgery.
4. A protocol was then designed using best evidence from the available literature and the authors experience.

Potential Interventions at the time of surgery, available.

Fibrin-based glues

Shown to completely resolve air leaks (mean 15.7 post-operative days) within 24 hrs of application in 91.7% of thoracic surgery patients. Poor resolution of air leaks was attributed for by inadequate identification of the site of air leak which the authors identified to be other than just testing the lungs under water [8]. Additionally, autologous blood instillation was shown to successfully obliterate minor alveolar air-leaks [9,10].

Pericardial patch

Buttressing staple lines with bovine pericardium reduces initial air leak by up to 50% in patients undergoing LRVS. This is accompanied by a significant reduction in mean post-operative air leak duration (2.5 ± 0.7 days versus 5.2 ± 0.75 days in the control group). Some studies have found that there is however no impact on the length of hospital stay [12]. Average air leak duration was reduced to 2.3 +/- 0.4 days when the patient’s own pericardial fat was utilised.

Therapeutic pneumoperitoneum

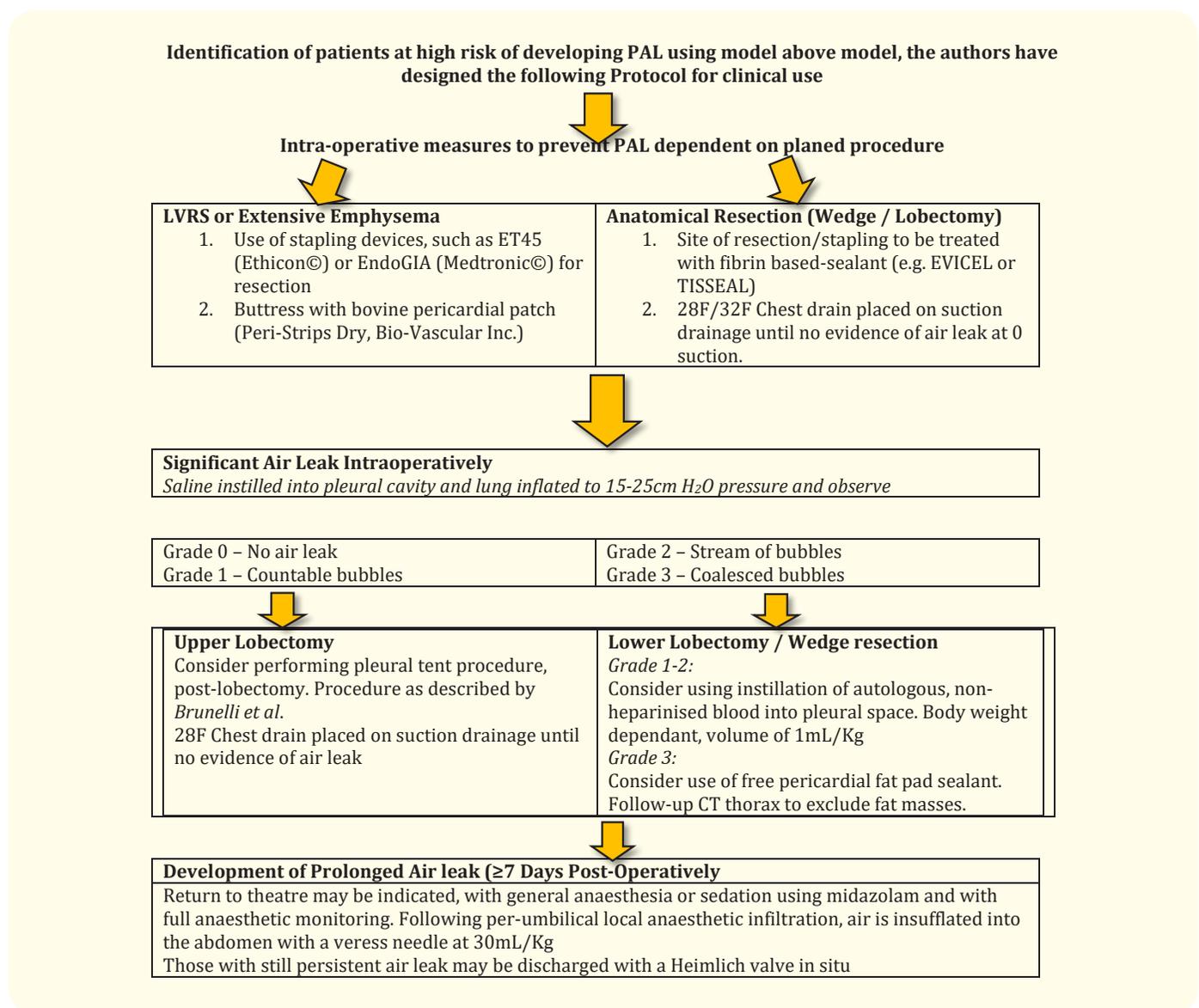
When performed on patients with persistent air leak at post-operative day 7 with subsequent obliteration of the pleural space was observed after 4 days, with no complications or sequelae thereafter [13].

Pleural tent

Upper lobe air- leaks, due to their anatomical location, have been shown to be resolve reasonably well by the formation of pleural tent immediately post lung resection surgery. This technique has previously been described by Brunelli and colleagues [11].

Identifying risk of PAL using available models

It may be useful surgically to identify the patients at risk of PAL. An effective risk prediction model was produced by Lee and colleagues is shown below [3]:



Score	Variable
0 (risk of PAL 4.8%)	Wedge Resection only (Baseline Score)
+2	Presence of Pleural Adhesions
+1 per 10% below 100%	FEV ₁ (% Predicted)
+1 per 10% below 100%	Carbon Monoxide Diffusing Capacity (D _L CO, % Predicted)

Table 1: Score of ≥5 indicates that a patient is at high risk of developing PAL.

Conclusion

The authors recommend a routine use of the above protocol and asking the Anaesthetic colleagues in checking on the air leak on the anaesthetic gas machine after minusing the standard machine leak which we have found to be variable with different makes. Prompt recognition and dealing with the issue should sort the problem. The authors have managed to remove the drains with no leak post operatively in about 2 days if meticulous on-table measures were employed.

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Volume 8 Issue 7 July 2019

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