

Suction or Nonsuction How to Manage a Chest Tube After Pulmonary Resection



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KEYWORDS

• Air leak • Chest drain • Chest tube • Lobectomy • Suction

KEY POINTS

- The dilemma as to whether to apply suction after subtotal pulmonary resection has not been solved.
- The problem lies in the poorly understood pathophysiology of the air leak phenomenon and the inadequate quality of the published randomized trials.
- Even digital systems do not seem to have made the difference.
- The authors propose an air leak predictor score as a contributing step toward appropriateness in using intraoperative sealants and chest tube management.

INTRODUCTION

Before wondering whether we should manage air leaks with suction or not, several issues must be taken for granted. As an example, a thorough evaluation of both the imaged and functional profile of the residual lung, the expertise of the surgeon (often related to his or her seniority in practice),¹ as well as the resort to a meticulous intraoperative surgical technique (inclusive of available sealants) to avoid air leaks represent milestones in effecting the quality of lung surgery.^{2,3} If the aforementioned factors are excluded, an air leak developing after an uncomplicated lobectomy is usually a self-limiting phenomenon. This point means that a well-drained chest cavity after subtotal pulmonary resection will eventually lead to full re-expansion of the residual lung. Can this process be made more efficient and rapid to facilitate patient fast-tracking? Can we identify before surgery that 8% to 26% of patients who will end up after day 5 to

7 with a prolonged air leak (PAL)?² When faced with the dilemma of whether to apply suction in the immediate postoperative period, the thoracic surgeon still acts according to the need of preserving his or her peace of mind. Building science around this topic has involved the work of several contributors who have designed clinical research projects but found no real answer to the dilemma.^{4,5} Recent meta-analysis and randomized trials provide suggestions but no real clue as to whether we will be able to one day individualize chest drain management (hence, suction) with an aim to reduce length of stay in the hospital.^{3,5–10} So, what is next?

THE CONCEPT OF SUCTION

Miserocchi and coworkers¹¹ have authoritatively explained the concept of suction applied to a chest drain. In brief, they distinguished the suction generated by the height of the collecting reservoir

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relative to the location of the tip of the chest drain from the suction generated by an external device.¹¹ Accordingly, a water seal provides a suction pressure, the extent of which strictly depends on the described height difference.¹¹ Based on this definition, we should not be comparing suction with no suction but rather external suction-to-suction pressure obtained from a height gradient.¹¹ In other words, the relevant question is as follows: Should we apply additional suction to the collection chamber in the face of a self-limiting phenomenon as routine postoperative air leak?

THE EVIDENCE FOR APPLYING (EXTERNAL/ ADDITIONAL) SUCTION

Since the early 2000s, several randomized controlled trials (RCTs) have been designed to compare suction with water seal.⁷ Interestingly enough, the results did not support suction, showing either no difference or a definitive benefit only from no suction/water seal.⁴⁻⁷ The institutional policy was to apply suction for the first night after surgery in all trials but one in which the suction was not applied at all in the postoperative period.⁴⁻⁷ Based on the described physiology of suction applied to chest drain, the results from these RCTs are consistent with the idea that no additional suction is needed for routine postoperative air leaks.⁴⁻⁷ The issue of whether additional suction is needed for patients at risk of developing PALs is still debated.¹² In fact, increasing the intrapleural negative pressure by applying external/additional suction is seen as potentially detrimental because it may worsen the extent or the duration of an alveolo-pleural fistula.¹² In 2012, Coughlin and associates¹² authored an elegant meta-analysis of the available contributions in the literature comparing external/additional suction plus water seal with a water seal alone in an effort to avoid PALs. The design of this study acknowledged the existence, in the water-seal setting, of an intrathoracic suction pressure originating from the height difference between the tip of the chest drain and the level of the collection chamber and that an external suction device provides, if necessary, additional suction pressure.¹² Overall, 7 RCTs published between 2001 and 2008 were considered, including series ranging between 31 and 254 patients.¹² In spite of a low or very low quality of the studies included in the meta-analysis, the absence of a publication bias was demonstrated by funnel plot symmetry.¹² However, a major source of concern was the different definition of PALs that varied from 3 to more than 7 days.¹² The analysis demonstrated a trend

toward reduction and duration of PALs with a water seal; subgroup analysis, used to avoid heterogeneity, demonstrated that the effect on the air leak incidence could be reliable for air leaks lasting more than 6 days.¹² In addition, if outlier studies were removed from the analysis along with the adoption of a fixed-effects model, other outcomes, such as duration of air leak and time to discharge, favored a water seal.¹² Conversely, additional suction was a major determinant in reducing postoperative pneumothorax, although this did not translate into a decreased duration of chest drain and hospitalization.¹² The investigators concluded that no inference could be drawn from the meta-analysis in terms of comparison of water seal versus suction and that higher-quality and larger-numbered RCTs need to be designed in the future to finally address this issue.¹² Overlapping conclusions were reached by Qiu and coworkers¹³ in a meta-analysis published in 2013 whereby no difference as to primary and secondary outcomes was observed between external suction and water seal. Lang and colleagues³ have more recently published an interesting review on the discordance between clinical practice and literature evidence on the use of suction for postoperative air leaks. This meta-analysis encompassed a larger number of patients and the evaluation of additional RCTs compared with previous studies.³ Compared with previous findings, the striking feature of this article is the detection of a statistically significant difference favoring water seal over external suction in terms of air leak and chest drain duration as well as length of stay in the hospital.³ As expected, no predominance of one treatment over the other was seen when the effect on the incidence of PALs was considered, whereas the value of suction in reducing postoperative pneumothorax was confirmed.³ The same study also included a survey of the clinical use of suction in the postoperative period in the UK thoracic surgical units that demonstrated a significant variability in the clinical practice in the absence of a grade IA evidence to direct the treatment choice.³

THE ROLE OF DIGITAL DRAIN SYSTEMS

Reportedly, digital drain systems contribute to the mobilization of patients who are freed from the wall suction and provide continuous and objective air leak monitoring which, in turn, may facilitate early detection of cessation of the air leak, thereby prompting chest drain removal.^{3,14,15} With these devices, fast-tracking becomes possible, albeit their costs need to be carefully weighed against the aforementioned benefits.³ In 2014, Afoke and

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