

Chest Tube Management after Surgery for Pneumothorax



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KEYWORDS

• Pneumothorax • Bullectomy • Chest drainage • Suction • Pleurodesis

KEY POINTS

- Current evidence on the management of chest tubes after surgery for primary spontaneous pneumothorax is scarce.
- Current clinical practice is mostly based on personal experience and background or extrapolated from the literature on lung cancer surgery.
- The presence of a residual pleural space should be minimized to reduce the risk of recurrence.

MANAGEMENT OF CHEST TUBES AFTER LUNG RESECTION

Suction Versus No Suction

There are relative pros and cons in using suction versus no suction. Theoretically, suction promotes pleura-pleural apposition favoring the sealing of air leak and certainly favoring the drainage of large air leaks. However, suction has also been shown to increase the flow through the chest tube proportional to the level of suction applied¹ and it is assumed that this increased airflow increases the duration of drainage. Further, the use of suction has historically been associated with reduced patient mobilization, particularly if wall suction is used. On the other hand, the so-called no suction or alternate suction approaches have been shown to be effective in some circumstances to reduce the duration of air leak,²⁻⁴ presumably by decreasing the air flow, while favoring mobilization (because the patient is not attached to the wall suction). Nonetheless, the absence of suction

makes this approach ineffective in case of medium to large air leaks (particularly in the presence of a large pneumothorax)² and seems to be associated with an increased risk of other complications (particularly pneumonia and arrhythmia).⁵

Table 1 summary of the findings of the randomized trials published on suction versus no suction in lung resection subjects. These trials yielded mixed results. Some investigators found a benefit by using water seal,^{2,3,7} others did not find any difference between the 2 modalities.^{5,6}

The lack of objective data for more sensitive measurement of air leak severity has prevented the standardization of studies, and even test and control groups within studies, resulting in a lack of accurate quantification and reproducibility.

Regulated Suction

Some new electronic chest drainage systems are now able to measure the pleural pressure. There is scant evidence on the role of pleural pressure

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Table 1
Summary of randomized trials comparing suction versus no suction after lung resection surgery

Author	Algorithm	Number of Subjects	Favor No Suction	Benefit
Cerfolio et al, ² 2001	No suction on POD2	33	Yes	Larger air leak seal by POD3
Marshall et al, ³ 2002	No suction on ward arrival	68	Yes	Shorter air leak duration
Brunelli et al, ⁵ 2004	No suction on POD1	145	No	No difference in air leak duration, increased trend of complications
Brunelli et al, ⁴ 2005	Alternate suction	94	Yes to alternate suction	Shorter tube duration, LOS, less PAL vs full-time no suction
Alphonso et al, ⁶ 2005	Immediate no suction	234	No	No difference
Gocyk et al, ⁷ 2016	No suction on POD1	254	Yes	Shorter chest tube duration and reduced incidence of PAL in no suction subjects

Abbreviations: LOS, length of stay; PAL, prolonged air leak, POD, postoperative day.

on the healing of the lung parenchyma after surgery and duration of air leak.

A recent article has shown that the difference between minimum pressure and maximum pressure calculated from measurements taken during the sixth postoperative hour following lobectomy was associated with the duration of air leak and the risk of a prolonged air leak.⁸ More than half of subjects with an airflow greater than 50 mL/min and a differential pressure greater than 10 cm H₂O developed an air leak longer than 3 days. Therefore, there seems to be the potential to influence the duration of air leak by altering the intrapleural pressure.

New digital drainage systems have the capability to deliver a regulated suction, which is a suction variable according to the feedback received from the pressure measurements to maintain the preset level of negative pressure. These machines work to maintain a stable intrapleural pressure regardless the volume of air leak, minimizing the oscillations around the preset value.

Modern chest drain devices, which are able to apply regulated suction to maintain the preset intrapleural pressure, represent the ideal instruments to reliably assess the effect of different level of negative pressures on the duration of air leak.⁹ These may overcome the main limitation of previous trials using traditional devices and comparing suction versus no suction: the impossibility to control whether the preset level of suction was indeed maintained inside the chest.

In this regard, a recent randomized study assessed the effect of different levels of pleural pressure on the duration of air leak under controlled

conditions by using a regulated chest drainage system.¹⁰ One-hundred subjects who submitted to pulmonary lobectomy were randomized to receive 2 different types of chest drainage management. Group 1 received the regulated individualized suction mode, with different pressure levels depending on the type of lobectomy, and ranging from -11 cm H₂O to -20 cm H₂O based on a previous investigation.¹¹ Group 2 received regulated seal mode (-2 cm H₂O). At this low level of suction the system used worked only to compensate the occurrence of values more positive than -2 cm H₂O in case of air leak. Otherwise, it worked passively as a regulated, no-suction device. The average air leak duration and the number of subjects with prolonged air leak were similar between the groups, showing that regulated seal is as effective and safe as regulated suction in managing chest tubes following lobectomy.

More investigations are warranted to further clarify the role of intrapleural pressure on the recovery of lung parenchyma after surgery.

MANAGEMENT OF CHEST TUBES AFTER SURGERY FOR PNEUMOTHORAX

Suction Versus No Suction

There is scant evidence regarding the management of chest tubes after surgery for primary spontaneous pneumothorax (PSP). Although there seems to be consensus on the preferred surgical approach, video-assisted thoracic surgery (VATS), to perform bullectomy and pleurodesis, there are few studies investigating the effect of different drainage modalities on the occurrence

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