Online Appendix 10 Suction and digital chest drain devices

Indications

Suction can be applied to chest drains to apply negative pressure to the pleural cavity with a view to facilitating lung re-expansion or accelerate removal of fluid or air from the pleural cavity (or subcutaneous tissues). Robust data regarding the efficacy of suction is lacking, except post thoracic surgery which is not covered in this statement. The most established indication for suction is in pneumothorax with such a large air leak that there is insufficient flow through the chest wall to keep up.

Institutions should be consistent about the units they use to deliver thoracic suction. In most UK centres, cmH_2O is used, but there is a risk of confusion if different units are used (1 KPa is equivalent to 10.2 cmH_20 and 7.5 mmHg).

There is a concern that applying suction too soon after drain insertion may increase the risk of re-expansion pulmonary oedema (RPO), particularly if the lung has been deflated for some time.[1] In the context of primary spontaneous pneumothorax (PSP), the risk of RPO may be highest in young patients, with a complete pneumothorax.[2] It is therefore advised against the early use of suction after chest drain insertion, given this rare but potentially serious risk and suggest thoracic suction should be prescribed by the medical team before it is commenced.

Some would advocate the use of suction in patients with pneumothorax and persistent air leak to improve visceral and parietal pleural apposition and promote healing, however there are no robust data to support this. To our knowledge the only RCT evaluating the role of suction in pneumothorax included just 29 patients, randomised to a standard underwater seal, 10 cmH_20 or 20cmH_20 suction with no differences in outcome, although clearly the numbers are too small to draw any conclusions from.[3]

There are no published randomised data evaluating whether the use of suction after pleurodesis improves pleurodesis efficacy (by theoretically promoting visceral and parietal pleural apposition). There are also no robust data regarding its use after local anaesthetic thoracoscopy.

Delivery of suction

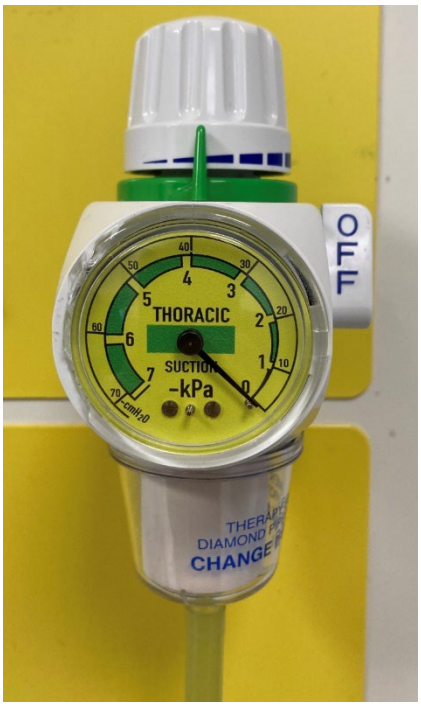
Suction can be delivered by the use of wall suction or a dedicated electronic suction device (which often also provides an accurate digital measurement of air leak). Suction pressures can be measured in cmH2O, KPa or mmHg (1 KPa is equivalent to approximately 10 cmH20 or 7.5 mmHg).

Wall suction

If thoracic suction is to be delivered, a high volume, low pressure (between -10 to -20 cmH_20) system should be used to reduce the risk of barotrauma, air stealing, hypoxaemia and perpetuation of air leaks.[4] Therefore, a high-volume thoracic wall suction with a low pressure adaptor should be used (see Figure 1).

The suction should be applied to a separate chest drain bottle/cannister, connected via tubing to the bottle connected to the patient to eliminate the risk of pleural fluid entering and interrupting the suction regulator (Figure 1).[5] Pressures should be increased gradually to ensure the patient tolerates it. The suction will need to be switched off and disconnected (risk of tension PTX if not disconnected in a patient with continued air leak) if the patient wishes to mobilise or if they need to be moved away from their bedspace and uptitrated gradually when it is reconnected again.

Figure 1: Wall suction unit



Digital suction devices

There are a number of commercially available electronic suction devices in the UK. These devices accurately measure air leak and are also able to deliver suction within the ambulatory device. They have the advantage of allowing patients to ambulate while receiving thoracic suction and do not need to be kept below the level of the patient, which could improve mobility. As they quantify air leak accurately, they may aid clinical decision making.

The majority of data evaluating electronic chest drain devices relate to post-operative patients who have undergone thoracic surgery, which has led to NICE guidance advocating their use as a cost-effective intervention to reduce drainage time, length of hospital stay and improve safety.[6] Their recommendations include patients with pneumothorax, despite minimal data from just one small randomised control trial (RCT) at that time in this patient population.

The clinical statement group agreed that data regarding the use of suction for persisting air leak was beyond the scope of this document.

Two studies comparing an electronic chest drain device with chest drain bottle and wall suction[7], or a water seal drainage bottle[8], for the treatment of spontaneous pneumothorax, have shown that electronic chest drain devices appear to reduce the total duration of drainage and hospital stay. In the first study, patients with symptomatic spontaneous pneumothorax and a persistent air leak one hour after drain insertion, showed similar numbers requiring surgical intervention for persistent air leak in both groups (37% versus 40% respectively).[7] In study two, the primary analysis of patients with PSP found no difference in the duration of drainage, or length of stay. However, in a post hoc evaluation of the patients who did not require a surgical referral for persisting air leak, the digital suction group had a shorter duration of drainage and length of stay compared to the water seal.[8] There are also some observational data that those with an air leak >100/min on day one may help to predict future medical treatment failure and the need for surgery.[9]

In light of these data, the clinical statement group suggest that digital drainage devices are a potentially useful tool, but further data regarding their efficacy in patients with pneumothorax in guiding clinical decision making are warranted.

Clinical practice points

- Suction should be avoided soon after drain insertion to minimise the risk of RPO

- Suction pressures should be prescribed or documented by the medical team before it is commenced and institutions should be consistent about the units of suction they use (KPa/mmHg/cmH20)
- Routine use of thoracic suction should be avoided given a lack of data demonstrating clinical benefit
- If suction is used, low pressure, high volume thoracic suction should be used to minimise complications
- Digital suction devices are an alternative technology that can be used to deliver thoracic suction and measure air leak. This may have a role in patients with pneumothorax.
- Patients receiving suction should have a viral filter or a digital device should be used to minimise the risk of aerosol generation.

References

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