

The occasional Heimlich valve chest tube placement for pneumothoraces

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INTRODUCTION

Pneumothorax occurs when air finds its way into the pleural space. There are many causes for this, but those that occur spontaneously can be divided into categories of primary and secondary.[1] Primary spontaneous pneumothorax (PSP) occurs in the absence of obvious lung pathology, and secondary spontaneous pneumothorax occurs with clinical lung pathology. Causes of secondary spontaneous pneumothorax are largely related to smoking habits, but other acquired and congenital conditions may be present. Secondary spontaneous pneumothoraces are commonly associated with chronic obstructive pulmonary disease and asthma. This article will deal only with the management of PSP.

Primary spontaneous pneumothoraces typically occur in adults aged 20–40, with a male prevalence.[2] Smoking does increase the risk proportional to the amount smoked, up to 2-fold.[3] The patient typically presents with a sudden pleuritic unilateral chest pain and variable degrees of dyspnea and hypoxia, dependent on the size of the collapse. If the symptoms are significant then presentation is often prompt, but presentation several days later is not uncommon.[4] Examination may demonstrate decreased breath sounds, mild to moderate hypoxia (oxygen saturation > 90%) but not hypercapnia. The diagnosis is made by chest radiography. Occasionally expiration and/or lordotic views are required.

The determination of the size of the PSP can be misleading based on the fact that a 2-dimensional image (chest radiograph) is used to estimate a 3-dimensional volume. For this reason, pneumothorax size is often underestimated.[5] Many protocols have been developed for accurate determination, but clinically the use of the "rim measurement" is common. For example, a 1 cm–rim PSP in a 70-kg adult represents about a 21% pneumothorax. This is the basis of many of the clinical management protocols developed.[1,6]

The management of PSP has been discussed by the American College of Chest Physicians,[6] the British Thoracic Society[6] and a systematic review.[7] Management options include observation, aspiration and various forms of chest tube placements with and without admission to hospital. However, there is a role for evacuation of a stable PSP with the use of a Heimlich valve procedure and good outpatient follow-up. Small to moderate PSP (≤ 4-cm apical rim) have been managed this way.[8–10] The following is a description of such a technique.

MATERIALS REQUIRED

- Heimlich valve pneumothorax kit (Fig. 1)
- 1% lidocaine
- povidone-iodine
- 50-mL Luer-Loc syringe (Becton, Dickinson and Company)
- waterproof tape
- skin tape
- monitoring equipment

TECHNIQUE

Place the patient in a semi-upright sitting position and with supplemental

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oxygen. Monitoring should include oxygen saturation with heart rate and blood pressure cuff in place. Prepare the area to be entered, in the usual sterile fashion. The standard auxiliary approach is adequate; however, an anterior approach can also be used if the patient will accept the small scarring.

In the midclavicular line select the second or third intercostal space. Take care to avoid the internal mammary artery 2–3 cm lateral of the sternum (Fig. 2). Place a #8 catheter over the needle apparatus, from a standard Heimlich valve kit, in the selected line superior to the chosen rib and angled cranially about 30 degrees toward the lung apex. Perform a small skin nick if required, and then advance the catheter unit with gentle negative pressure until air is aspirated. At this point advance the catheter over the needle toward the apex, and remove the needle syringe (Fig. 3).

Once the catheter is in place attach the stopcock and turn it off. Aspiration of the pneumothorax, with stopcock control, is recommended using a large Luer-Loc syringe. Maintain sterility, as several aspiration cycles will be necessary. The patient will often be uncomfortable as the lung is manipulated, and should be informed accordingly.

Once aspiration is complete, turn the stopcock off again and disconnect the syringe. The kit typically includes a sterile length of tubing: attach it to the stopcock and the other end to the Heimlich valve. Pay particular attention to the direction of airflow as indicated on the valve. The stopcock can now be turned on. With inspiration the valve should seal upon itself, and with expiration (increase of intrapleuritic pressure) a small amount of air will be seen escaping from the valve (Fig. 4).

Suture the catheter in place and seal the area with a sterile dressing. Leave the distal end of the stopcock free, as it should be sealed with waterproof tape. Also tape the Heimlich valve connection to the tubing to prevent loosening. It is convenient to loop the tubing under the axilla and place over the same area as the catheter placement (Fig. 5). Loosely



Fig. 1. Commercial pneumothorax kit.

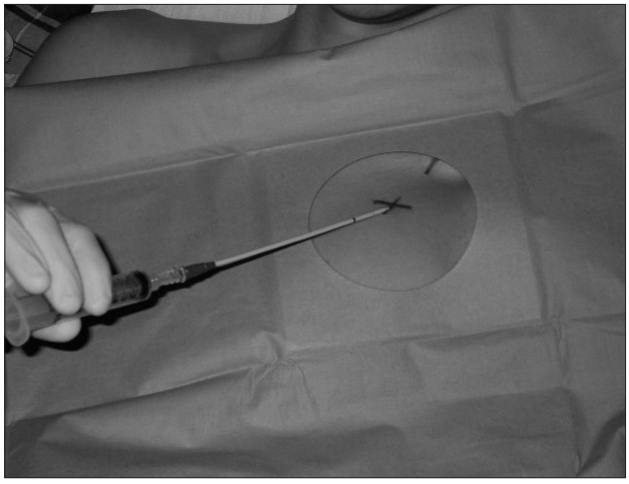


Fig. 3. Proper angle of the needle and catheter with syringe.

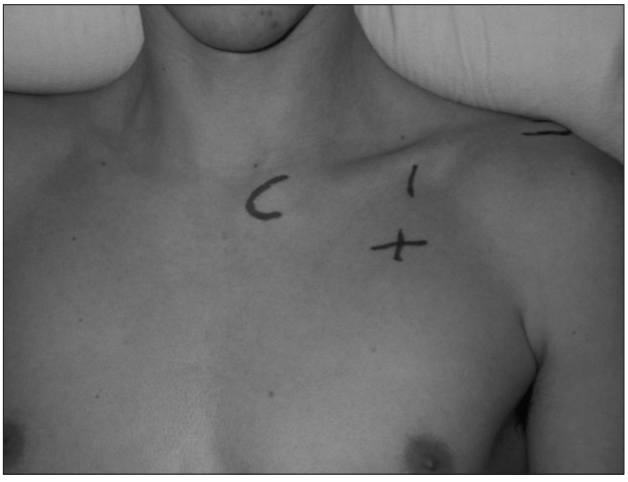


Fig. 2. Proper site selection in the second or third intercostal space in the midclavicular line.

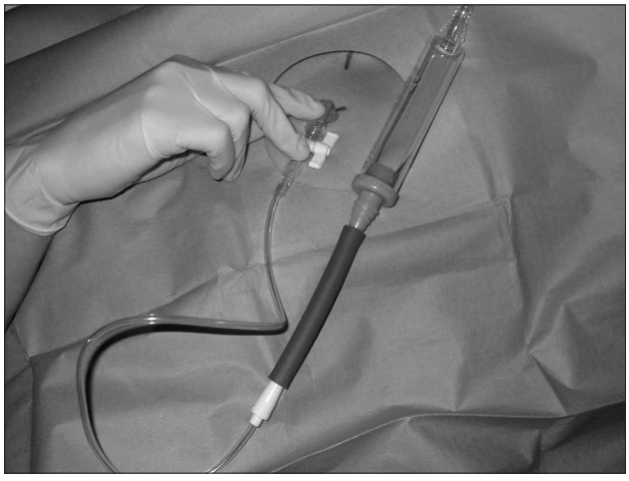


Fig. 4. Tube in place, stopcock open and attached to the Heimlich valve.

secure it with skin tape. The patient can wear a nonocclusive garment, which is generally well tolerated. Before discharging the patient, obtain a chest radiograph to confirm good lung re-expansion and satisfactory catheter placement.

Perform radiography of the patient daily. After a minimum of 2 days of follow-up (longer with larger or recurrent PSPs, or if incomplete early re-expansion is evident), turn off the stopcock and perform repeat radiography in 4–6 hours. If re-expansion is maintained remove the catheter. Check the patient the next day, with or without radiography, before final discharge.

As smoking is strongly associated with PSP, this habit should be addressed if present. Furthermore, PSP is recurrent in up to 50% of patients, especially smokers.[1,6] Finally, this technique is best used in the tall, slender patient who will accept a small anterior scar. The same outpatient technique can be used with an axillary approach. However, patients who are obese, or who have significant chronic obstructive pulmonary disease should probably be managed with a large chest tube and admitted to hospital.

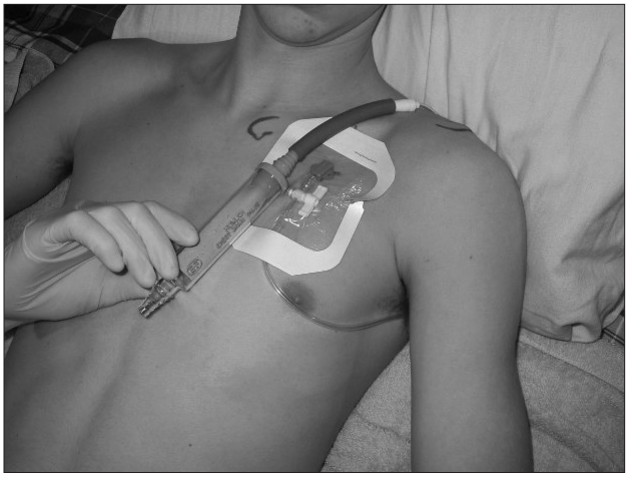


Fig. 5. Final preparation and positioning of the tubing and Heimlich valve.

SUMMARY

Primary spontaneous pneumothorax can often be managed safely in a rural outpatient setting using a simple Heimlich valve procedure.

Competing interests: None declared.

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