Management of Spontaneous Pneumothorax

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Introduction

Pneumothorax is defined as the presence of air in the pleural space. Primary and secondary spontaneous pneumothoraces affect more than 20,000 patients per year in the United States, while mortality rates for combined primary and secondary pneumothoraces of 0.62/million per year for females and 1.26/million per year for males had been reported in UK between 1991 and 1995. Although published data from Hong Kong about its incidence are lacking, it is a common clinical condition that can potentially lead to significant morbidity and mortality if not timely or correctly managed.

Types of Pneumothorax

Spontaneous pneumothorax (SP), which occurs without an obvious precipitating event, can be divided into Primary spontaneous pneumothorax (PSP) and Secondary spontaneous pneumothorax (SSP). PSP occurs in patients without pre-existing clinically apparent lung disease, while SSP is found in those with underlying lung disease such as chronic obstructive pulmonary disease. Non-spontaneous pneumothorax can be subdivided iatrogenic and non-iatrogenic traumatic cases. While non-iatrogenic pneumothoraces usually result from trauma, iatrogenic pneumothoraces result from medical interventions. Tension pneumothorax is a medical emergency when intrapleural pressure exceeds atmospheric pressure throughout expiration, and can be developed from any aforementioned types of pneumothoraces. The subsequent discussion would be focused on the general management of spontaneous pneumothorax.

General management options for spontaneous pneumothorax

Treatment of pneumothorax can be broadly divided into the evacuation of air from the pleural cavity and if necessary, the subsequent procedure to prevent its recurrence. While simple aspiration and chest tube drainage have both been employed in the evacuation of air inside pleural cavity, conservative management by simple observation can also be justified in certain cases. The decision is usually being based on the type and the size of the pneumothorax, together with the clinical symptoms and condition of the patient.

Simple aspiration or chest tube drainage?

Simple aspiration has been advocated as the first-line intervention for all symptomatic (and/or > 2cm) PSP. Though regarded less likely to be successful, it can also be considered in selected cases of SSP (age<50) and with a rim smaller than 2 cm in the British guidelines. Similar degree of enthusiasm for the relatively conservative approach has not been equally found on the American side. Although the use of small-bore catheters (≤14F) has also been recommended to treat clinically stable patients with large (≥3cm apex-to-cupola distance) PSP, chest tube drainage was recommended for SSP. Randomised controlled studies revealed similar efficacies, shorter hospital stays and less pain experienced in patients treated with simple aspiration, as compared to chest tube drainage. There has also been some data from Hong Kong, mainly from the Emergency Departments, on the use of simple aspiration in treating spontaneous pneumothoraces, and it was also noted that the procedure, while being safe, was found to be more successful only in relatively small pneumothoraces. Apart from the usual method of using manual aspiration with 50-ml syringe and 3-way valve with a catheter, connection to a negative pressure system via a one-bottle water seal vacuum system has also been described. The availability of relatively new pneumothorax kits like CASP (Catheter Aspiration of Simple Pneumothorax) catheter system using guidewires, with or without the subsequent attachment to a one-way valve (e.g. Heimlich valve) might improve the popularity of the technique in the future. However, chest tube drainage should be considered when such aspiration is ineffective or if there is ongoing air leak.

Observation alone

This can be considered in patients with small PSPs (<2 cm) without significant breathlessness. They can be discharged after observation in emergency department for 3-6 hours and discharged home if a repeated chest radiograph excludes further progression. Early outpatient follow-up, e.g. within 12 hours to 2 days, should be provided with clear written instructions. However, breathless PSP patients should not be left without intervention regardless of the size of the pneumothorax. On the contrary, caution must be exercised for those SSP cases when observation alone is adopted and hospital admission should be advised in these cases. High flow oxygen should be given, though with caution and in a controlled manner in patients with chronic obstructive pulmonary disease (COPD), to hasten the re-expansion process.
unsuccesful or in cases of SSP, especially if the patient is symptomatic or pneumothorax is of a considerable size (>1 cm or not just an “apical” one).3

Size of chest tubes for pneumothorax

Variation of opinions is again witnessed in the choice of the size of chest tubes for those indicated patients. The initial use of large chest tubes (20-24F), being not supported by evidence, has not been recommended by the British Guidelines, except where is a persistent air leak with the use of a smaller tube.5 However, larger tubes (24-28F) are favoured on the American side in managing SSP patients who are unstable or on mechanical ventilation because of the risk for larger air leaks.6

Application of suction to a drainage system

Suction can be applied in cases where there is persistent lung collapse and/or persistent air leakage (e.g. beyond 48 hours), or for the removal of co-existing fluid (e.g. blood or pus) in the pleural cavity. However, immediate suction after drainage is usually not necessary5 and might produce reperfusion pulmonary oedema, especially in younger patients with larger pneumothoraces. A pressure range of -10 to -20 cmH2O is usually sufficient.3

Clamping or not?

Although clamping of chest drains is not absolutely forbidden in international guidelines5,6, it remains a controversial issue with little evidence to support or refute its application.13 However, a “bubbling” chest drain, indicating continuous air leakage, should never be clamped.5 Even if there is no bubbling, a chest tube should not usually be clamped, especially during patient transport. If a chest tube is clamped, the patient should be under close respiratory medical and nursing attention.5 In case there is clinical deterioration with development of increasing dyspnoea, oxygen desaturation or with the development of increasing subcutaneous emphysema, the clamp should be released immediately.5

Prevention of recurrence: pleurodesis

The average recurrence rate after a first episode of PSP is 30%, varying from 16-52%,14 The corresponding rate of SSP is higher, varying from 40-80%, depending on the underlying cause.15 Procedures to prevent recurrence of PSP have usually been recommended for 2nd occurrence, although patients’ preferences and professions should also be taken into consideration.5,8 The occurrence of the first contralateral or bilateral spontaneous pneumothorax should also merit the consideration of pleurodesis.9 On the other hand, such procedures are preferred for the 1st occurrence of SSP, taking into the potentially serious consequences of such pneumothorax.9 Surgical methods (e.g. via video-assisted thoracoscopic surgery) are usually preferred5 with a recurrence rate less than 1%.16 Referral to surgeons has also been recommended when there is persistent air-leak or failure to re-expansion of more than 5-7 days.5,6 Medical pleurodesis, e.g. via the instillation of chemical, is only recommended if the patient is either unwilling or unable to undergo surgery.1 Tetracycline group such as doxycycline or minocycline is the commonest agents used with an overall efficacy of about 70% and is recommended by the British Guidelines as the first-line agents of choice.3 Talc has a higher reported efficacy (about 90%) and is cheaper. Both are associated with pain and fever upon administration, but more severe complications such as respiratory failure and ARDS have been reported with the use of talc.17 While there have been controversies over whether talc should be used for pleurodesis in light of such potential serious side effects,15,19 some recent evidence suggested that those might be related to the particle size of the talc preparation used.20

Concluding remarks

Despite the presence of international guidelines5,6, knowledge about the optimal management of spontaneous pneumothorax has not been supported with sufficient amount of high level evidence. As a result, some of these are based on consensus only6 and it is hardly surprising that variations in practice are still observed.21

References