

The diagnosis and management of pneumothorax

Pneumothorax is a relatively common presentation in patients under the age of 40 years (approximately, 85% of patients are younger than 40 years). It is described as typically occurring in tall, thin, young men; hence, morbidity and mortality is reduced.¹ However its presentation in the elderly is still an area of further study, with most patients presenting with an underlying respiratory disease. Although the condition is simple to diagnose in young patients, it is often missed during early assessment of dyspnoea in older patients. Pneumothorax should be suspected in elderly patients when they present with dyspnoea that is slow to resolve and for which there is no other clinical explanation. The absence of a history of painful onset does not exclude the diagnosis in the elderly patient.

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Pneumothorax is defined as being air in the pleural space (i.e. between the lung and the chest wall).¹ It can be primary (the patient does not have an underlying lung disease present), secondary (the patient does have an underlying lung disease), iatrogenic, or traumatic according to aetiology. It usually presents at two peaks of age: the first peak is in people in their 20s and the second peak is in people in their 60s. Older patients usually have underlying comorbidities, such as emphysema (with smoking being a risk factor).

The exact incidence of primary spontaneous pneumothorax is uncertain, but the yearly frequency is reported to be 18–28/100,000 for males and 1.2–6/100,000 for females.²

Diagnosis

Diagnosis of pneumothorax can be made on history and

examination alone; however, clinical manifestations are not a reliable indicator of size of the pneumothorax.

Signs of pneumothorax on examination include reduced breath sounds, ipsilateral chest expansion and hyper-resonance on percussion. A tension pneumothorax (when the air in the pleural cavity prevents the lung from inflating fully) exhibits additional features of tachycardia, tachypnoea, tracheal deviation away from the affected side, and hypotension. Typically young patients usually report an episode of sudden onset of pleuritic chest pain and acute dyspnoea, while elderly patients may only report a sudden onset of breathlessness without any chest pain.³

Investigations that are most commonly used in the UK for the diagnosis of pneumothorax include chest x-ray, CT scan and arterial blood gas. To achieve the

greatest clinical and cost efficiency from the available investigations, choice of initial diagnostic test is of the utmost importance. In both primary and spontaneous pneumothorax, the diagnosis is usually established using a plain posterior anterior radiograph. A chest x-ray usually shows absent lung markings extending from the edge of visceral pleura to the chest wall.⁴ Mediastinal shift is usually present in patients with tension pneumothorax.

When diagnosing a pneumothorax, an expiratory radiograph is of little use and is not recommended for routine investigation. However, a lateral or lateral decubitus radiograph should be performed when clinical suspicion is high but the posterior anterior x-ray is normal. According to the British Thoracic Society guidelines for the management of spontaneous pneumothorax,¹

Box 1: Case report

An 81-year-old man presented to the accident and emergency department with a sudden onset of shortness of breath. He had no other presenting complaints. Although it was not uncommon for the patient to have breathlessness on exertion, his past medical history was significant in terms of a suspected pneumothorax. He had pulmonary fibrosis and a right sided pneumothorax three years ago, which was treated with a chest aspirate only. He had a myocardial infarction in 1993 and was a smoker, with a 60-pack year history (approximately 30 cigarettes a day for 40 years). He had no other risk factors.

On examination, he had an elevated respiratory rate, was tachycardic, hypotensive and his oxygen saturations were 88% room air. Further examination revealed diminished breath sounds at the right lung base with no other findings. The differential diagnoses at this point were an exacerbation of pulmonary fibrosis and pneumothorax. Investigations with a chest X-ray revealed a right sided pneumothorax, but all blood tests were unremarkable. At this point, he was admitted to the medical ward and a chest aspirate (draining 2750 ml of air) was performed. Following this procedure, a repeat chest x-ray showed much improvement. His progress was monitored over the next few hours in which he became more breathless, due to further extension of the pneumothorax. Therefore, a chest drain was inserted. The level of water collected in the bottle attached to the chest drain stopped oscillating or “swinging” within six hours.

A repeat chest x-ray showed resolution with apical pneumothoraces and the chest drain was removed the following day. As he was stable and asymptomatic, he was discharged the following day but referred to chest outpatient follow up. The presentation in this elderly patient was atypical in that he did not present with chest pain and only presented with shortness of breath, creating a variety of possible differential diagnoses.

Written informed consent was obtained from the patient for publication of this case report.

such investigations provide additional information in 14% of cases. Furthermore, the lateral decubitus radiograph is felt to be as sensitive as CT scanning.

Lateral or lateral decubitus films are also beneficial when the posterior anterior radiograph is unclear. Although small pneumothoraces are not that clinically relevant in patients with no underlying lung disease, they may have significant implications in patients with underlying lung disease.² Therefore, a lateral or lateral decubitus radiograph may be valuable in these patients.¹

The CT scan is another useful source of imaging, but it is rarely used in everyday practice. It is usually used when there is diagnostic uncertainty; in most cases, this is when the treating

physician is distinguishing between a pneumothorax and large bulla or when a lung field is masked by surgical emphysema. CT scanning is also the most accurate method of assessing the size of a pneumothorax. Finally, arterial blood gases in pneumothorax typically show abnormalities, with an arterial oxygen concentration being less than 10.9 kpa (80 mmhg) in 75% of patients.⁴

Management

The management of a pneumothorax depends heavily upon its size, which the British Thoracic Society guidelines¹ suggest should be categorised as follows (in primary

pneumothorax):

- Small pneumothorax: <2 cm rim present between the lung edge and chest wall
- Large pneumothorax: ≥2 cm rim present between the lung edge and chest wall
- Complete: airless lung, separate from the diaphragm.

Other factors that influence management include presence of underlying disease and severity of symptoms. High flow oxygen (10 L/min) should be administered in individuals to maintain adequate oxygenation, especially those admitted overnight for observation. Care should be taken with those patients suffering from chronic obstructive pulmonary disease (COPD) and patients with breathlessness should not be left untreated.

Box 2: Catheter aspiration kits:

Catheter aspiration involves the use of a small-bore catheter being passed over a guidewire into the pleural space. A three-way stop cock is attached and air may be aspirated using a 50 ml syringe. It can control 59% of pneumothoraces and improve success rates.¹ These are only available in certain hospitals with sufficient resources. Where available, the use of a small-bore catheter aspiration kit should be the catheter of choice when aspirating pneumothoraces as it can be left in-situ until full re-expansion is achieved. They may reduce the need for repeat aspiration.

Primary pneumothorax

A small primary asymptomatic pneumothorax does not usually require active intervention, and it can be

managed with observation alone. Patients with this type of pneumothorax do not need to be admitted to hospital. They should be given appropriate discharge advice (see box 3). The rate recurrence of pneumothorax in patients treated with observation alone is smaller than that of those treated with tubal drainage.¹

For patients with a large primary symptomatic pneumothorax, active intervention is required. All patients need to be hospitalised and should be given oxygen, in addition to needle aspiration and/or chest drain insertion.

Simple aspiration is recommended as the first line treatment in all primary pneumothoraces where there is lung collapse and breathlessness. (59–83% success rate). If this fails, then repeat aspiration is advised unless >2.5 L has been aspirated on first attempt (33% success rate).¹ Harvey et al⁵

Box 3: Discharge advice

- Patients discharged without intervention should avoid air travel until a chest radiograph has confirmed complete resolution
- Patients should be advised to avoid diving unless they have had a bilateral pleurectomy
- Primary pneumothorax patients treated with aspiration should be observed for 24 hours before discharge and should have a follow up chest x-ray in one to two weeks
- Secondary pneumothorax patients treated with aspiration should be admitted for at least 24 hours, with a repeat chest x-ray to prevent recurrence.

showed that simple aspiration was as successful in treating first primary pneumothoraces as immediate intercostal tube drainage (59% versus 63%). Patients treated with simple aspiration were less likely to be hospitalised and less likely to suffer a recurrence of the pneumothorax over the subsequent 12 months. If aspiration is successful then discharge should be considered. Again, patients should be given appropriate discharge advice.

If all of the techniques described above fail, then chest drain insertion is required. If this is successful, it can usually be removed after 24 hours. But should it fail, the patient should be referred to chest physician for possible suction and referred to a thoracic surgeon after five days.³

Secondary pneumothorax

The first line treatment for patients with a small asymptomatic secondary pneumothorax and who are aged <50 years is needle aspiration. This is usually successful; patients will require overnight hospitalisation—24 hours observation with high flow oxygen and a repeat chest x-ray to monitor progression before discharge. If aspiration is unsuccessful, patients will need chest drain insertion.

In contrast to the management of patients with large primary pneumothoraces, aspiration is associated with a high risk of failure in patients with large secondary pneumothoraces (especially in those over 50 years of age).¹ As a result, the first line of treatment for these patients is to insert

a chest drain, in addition to treating the underlying lung disorder. The complications of drain insertion are shown in box 5. If drainage is successful, then the chest drain can be removed after 24 hours after full re-expansion of the lung. If the chest drain fails then referral to a chest physician is made within 48 hours and to a thoracic surgeon within three days.

Chest drain

For both primary and secondary pneumothoraces, an intercostal tube should be inserted when simple aspiration and catheter aspiration have failed. There is little evidence to suggest that smaller tubes are more successful than larger ones; however, the introduction of flutter valves have proved to be of benefit.⁶ A bubbling chest tube should never be clamped; a non bubbling chest tube should be clamped. Clamping should be undertaken under the care of a specialist respiratory physician or thoracic surgeon and patients should be managed in specialist units. A swinging chest drain should rarely be clamped. Re-expansion pulmonary oedema and subcutaneous emphysema are rare complications, but they must be immediately treated.

Suction should only be applied when there is a persistent air leak or failure of the lung to re-expand. Air leak or failure is described as persistent air bubbling through an intercostal tube 48 hours after insertion. Suction should only be performed 48 hours post drain insertion and should be done after referral has been made to a chest physician and only in

Box 4: Successful aspiration depends upon:

- Age <50 years
- No underlying respiratory disease
- Size of pneumothorax (the smaller the pneumothorax, the more likely that the aspiration will be successful).

specialist areas. High pressure low volume suction systems are recommended.¹

Medical chemical pleurodesis

This is used to manage difficult or recurrent pneumothoraces, or used if the patient is unwilling to undergo surgery. It should only be performed by specialists.

This is the injection of a chemical irritant that triggers an inflammatory reaction that leads to the adhesion of the lung to the parietal pleura. Substances used include talc, tetracycline and bleomycin. Tetracycline is the recommended first line treatment. The risk of recurrence with medical pleurodesis is higher than that of surgical pleurodesis.

Surgical management

There are several strategies that

Box 5: Complications of chest drain

- Penetration of major organs, possibly fatal
- Pleural infection
- Chest tube related empyema
- Surgical emphysema.

can be used when managing pneumothoraces through surgery. These include surgical pleurodesis, thoracotomy, pleurectomy, thoracoscopy (VATS) and pleural abrasion. At the moment, open thoracotomy and pleurectomy remain the procedure with the lowest recurrence rate.¹ Surgical pleurodesis is slightly different to medical pleurodesis whereby here pleural fluid is initially removed via thoracostomy then a sclerosant is injected and the procedure follows that of medical pleurodesis.¹

Tension pneumothorax

A tension pneumothorax is a medical emergency. Clinical features include pleuritic chest pain, sweating, rapid cyanosis, laboured breathing and tachycardia. The immediate management for this type of pneumothorax is high flow oxygen and the insertion of a cannula (4 cm) in the second anterior intercostal space, mid clavicular line. A chest x-ray is not necessary. Air should be removed until the patient is no longer compromised and then an intercostal tube inserted into the patient as described above; however, the cannula must remain in-situ until bubbling is seen from the drain.⁷

Conclusion

Pneumothorax is a relatively common presentation in the young and less common in the elderly. It is important that clinical presentations

of pneumothorax are clear to doctors so that they are recognised early in elderly patients. The management principles follow those stated by the British Thoracic Society guidelines;¹ however, in the elderly, special care needs to take into account their comorbidities and many prefer to not have any intervention at all.

The author declares that there are no competing interests.

1. Henry M, Arnold T, Harvey J. BTS guidelines for the management of spontaneous pneumothorax. *Thorax* 2003; **58**: 39–52
2. Tatsuo O, Harumbumi K. Pneumothorax in Elderly Patients. *Japanese Journal of Thoracic Society* 2005; **58**: 704–8
3. Liston R, Mcloughlin R, Clinch D. Acute pneumothorax, a comparison of elderly with young. *Age and Ageing* 1994; **23**(5): 393–95
4. Connor AR, Morgan WE. Radiological review of pneumothorax 2005. *BMJ* (2005); **330**: 1497–8
5. Harvey J, Prescott R. Simple aspiration versus intercostal tubal drainage in patients with normal lungs. *BMJ* 2004; **309**: 1338–89
6. Laws D, Neville E, Duffy J, BTS Guidelines for the insertion of a chest drain. *Thorax* 2003; **58** (suppl 2): ii53–9
7. Chapman S, Robinson G, Stradling J. *Oxford Handbook of Respiratory Medicine*. 5th Ed. Oxford: (2005) Oxford University Press.