

The Spontaneous pneumothorax port of call consultation

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Abstract

Smokers have an approximately 12% lifetime risk of developing a primary spontaneous pneumothorax. It is rarely life-threatening and is mainly treated by aspiration. Secondary spontaneous pneumothoraces occur mostly in patients with chronic obstructive pulmonary disease, they have a mortality rate of approximately 1% and most patients require a tube thoracostomy with instillation of a sclerosing agent. Successful prevention of recurring secondary pneumothoraces requires more invasive surgical procedures. This article provides a short overview of spontaneous pneumothorax and its treatment.

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Introduction

Spontaneous pneumothorax is the presence of air in the pleural space in the absence of an apparent precipitating event. Primary spontaneous pneumothorax occurs in otherwise healthy people without any clinically apparent underlying lung disease. Secondary pneumothoraces arise in subjects with underlying disease, e.g., chronic obstructive pulmonary disease (COPD), AIDS, tuberculosis, and cystic fibrosis.

It is estimated that > 20 000 new cases of spontaneous pneumothoraces occur each year in the United States.¹ When appropriate treatment for any given patient is selected, a primary pneumothorax is rarely a life-threatening condition. The mortality rate for a secondary spontaneous pneumothorax is approximately 1%.²

Pathogenesis

Primary spontaneous pneumothoraces are believed to be the result of rupture of sub-pleural blebs. Sub-pleural blebs and bullae are found in up to 90% of cases at thoracoscopy or thoracotomy and in up to 80% on computerised tomography (CT) scanning of the thorax, despite the absence of underlying pulmonary disease.³ The pathogenesis of the blebs remains unclear. There are suggestions that they may be congenital or inflammatory in origin or the result of disturbance of collateral ventilation.³ There is a strong association between smoking and the development of primary spontaneous pneumothorax, with the lifetime risk of developing a pneumothorax in healthy smoking men estimated at approximately 12%, compared to a risk of 0,1% in non-smoking men.^{4,5} Patients with primary pneumothoraces tend to be taller than control patients.⁶ The gradient in pleural pressure is known to increase from the lung base to the apex, thus in tall individuals the alveoli at the lung apex are subject to a significantly greater distending pressure than those at the base of

the lung and are, theoretically, more predisposed to the development of sub-pleural blebs.

Clinical presentation

The common clinical signs of a pneumothorax have been described elsewhere and will not be the subject of this review.⁷ In general, the clinical symptoms associated with a secondary spontaneous pneumothorax are more severe than those associated with a primary spontaneous pneumothorax. Most patients with a secondary spontaneous pneumothorax complain of breathlessness that is out of proportion to the size of the pneumothorax, probably because the pneumothorax compromises further an already diminished pulmonary reserve.

The physical examination of a patient with a secondary spontaneous pneumothorax is less helpful than it is with a primary spontaneous pneumothorax. Side-to-side differences in the physical examination may not be apparent.

Many patients with a primary pneumothorax do not seek medical attention for several days: 46% with symptoms wait more than 2 days.⁸ This feature is important because the occurrence of re-expansion pulmonary oedema after re-inflation may be related to the length of time the lung has been collapsed.^{9,10}

Diagnosis

The diagnosis is normally established by demonstrating a visceral pleural line on a plain chest radiograph. The presence of a pneumothorax may be easily overlooked in patients with secondary spontaneous pneumothoraces, particularly where the underlying disease is COPD. The radiographic appearance is often altered by the underlying lung disease.

When a pneumothorax is suspected, but not confirmed by standard postero-anterior chest radiographs, lateral radiographs provide added information in up to 14% of cases.¹¹ The lateral decubitus film is superior to the erect or supine chest radiograph and is considered to be as sensitive as CT scanning in pneumothorax detection.¹² In patients with suspected secondary pneumothoraces even small pneumothoraces may have significant implications, and here lateral or decubitus radiographs are probably valuable. In patients with severe bullous lung disease CT scanning will differentiate emphysematous bullae from pneumothoraces and save the unnecessary and potentially dangerous aspiration.¹¹ Expiratory films are not useful.¹³

Treatment of spontaneous pneumothoraces

Treatment of spontaneous pneumothorax involves the following:

1. Observation
2. Supplemental oxygen
3. Simple aspiration
4. Simple tube thoracostomy
5. Tube thoracostomy with instillation of a sclerosing agent
6. Thoracoscopy with oversewing of the blebs and pleurodesis
7. Open thoracotomy
8. Smoking cessation where applicable

Observation alone is advised for small, closed, mildly symptomatic primary spontaneous pneumothoraces. The majority of those estimated to be smaller than 15% have no persistent air leak and recurrence in those managed with observation alone is less than in patients treated with intercostal tube drainage.⁵ Observation alone is only recommended in patients with small secondary pneumothoraces of less than 1 cm depth or isolated apical pneumothoraces in asymptomatic patients. All other cases will require active intervention (aspiration or chest drain insertion). Supplemental high flow (10 L/min) oxygen should be given where feasible. Inhalation of high concentrations of oxygen reduces the total pressure of gases in the pleural capillaries by reducing the partial pressure of nitrogen. This should increase the pressure gradient between the pleural capillaries and the pleural cavity, thereby increasing absorption of air from the pleural cavity. The addition of high flow oxygen has been shown to result in a fourfold increase in the rate of pneumothorax reabsorption during periods of oxygen supplementation.

Observation alone is inappropriate and active intervention is required for symptomatic pneumothoraces, whether primary or secondary. Marked breathlessness in a patient with a small (< 2 cm) primary pneumothorax may herald tension pneumothorax.

Simple aspiration is recommended as first line treatment for all primary spontaneous pneumothoraces requiring intervention.¹⁴⁻¹⁶ Air is manually withdrawn until no more can be aspirated. The catheter is then occluded for several hours. If the chest radiograph confirms there has been no recurrence, the catheter is removed and the patient may be observed overnight. Post discharge, the patient should return after 72 hours for a follow-up chest X-ray. If the total volume of air aspirated exceeds four litres and no resistance is felt, it can be assumed that there has been no re-expansion, and an alternative procedure is initiated.

Simple aspiration is less likely to succeed in a secondary pneumothorax, and, in this situation, is only recommended as an initial treatment in small (less than 2 cm) pneumothoraces in minimally breathless patients. Some authors recommend tube thoracostomy as the initial treatment for every patient with a secondary spontaneous pneumothorax.⁸

Large secondary pneumothoraces (≥ 2 cm), particularly in patients over the age of 50, should be considered a high risk of failure of simple aspiration, and recurrence, and therefore tube drainage is recommended as appropriate initial treatment.³ Relatively small tubes (10-14F) appear as effective as larger tubes. Because of the risk of re-expansion, pulmonary oedema is greater when the lung is re-expanded rapidly. It is probably better to use water seal. Active management of the underlying disorder is also necessary. After the lung has re-expanded, and the air leak has ceased for 24 hours, the chest tube can be removed.

There is no evidence to support the routine use of suction applied to chest drain in the treatment of a spontaneous pneumothorax.⁵ The addition of suction too early after insertion of a chest tube, particularly in the case of a primary spontaneous pneumothorax that may have been present for a few days, may precipitate re-expansion pulmonary oedema. A persistent air leak, with or without incomplete re-expansion of the pneumothorax on a chest radiograph after 48 hours, is the usual reason for applying suction to an intercostal tube system. High volume, low pressure systems are recommended. If the lung remains unexpanded or if the air leak persists beyond 5-7 days post tube thoracostomy and suction, consideration should be given to performing thoracoscopy or thoracotomy.

The recurrence rate of primary and secondary pneumothoraces is high, and efforts to reduce these rates are regularly undertaken. Pleurodesis has been advocated by chest physicians experienced in thoracoscopy for the control of difficult or recurrent pneumothoraces. It is the instillation of substances into the pleural space that leads to aseptic inflammation with dense adhesions, leading ultimately to pleural symphysis. In the majority of cases, when appropriate, the prevention of further pneumothoraces should be undertaken by surgical means. The rate of recurrence of pneumothoraces after surgical intervention either by thoracotomy or video-assisted thoracoscopic surgery (VATS), with or without surgical pleurodesis is far lower than after medical pleurodesis.^{17,18}

A small number of individuals are either too frail or are unwilling to undergo any definitive surgical treatment to prevent recurrence of their pneumothoraces and in these instances medical pleurodesis may be appropriate.

Definitive management after a spontaneous pneumothorax is recommended under the following circumstances:

1. Second ipsilateral pneumothorax
2. First contra lateral pneumothorax
3. Bilateral spontaneous pneumothoraces
4. Professions at risk (pilots, divers)
5. First spontaneous pneumothorax associated with AIDS19 or cystic fibrosis²⁰

Recurrence

Following a primary spontaneous pneumothorax there is an increased risk of a recurrence, particularly in the months immediately after the first episode.⁶ The recurrence is somewhat higher for secondary pneumothoraces.²¹ Smokers are also more likely to have a recurrence.²² Once a patient has one recurrence the risk of another recurrence increases to more than 50%.^{6,23} There is also an increased risk of developing a pneumothorax on the contra lateral side.

Patients with spontaneous pneumothoraces should be counselled against flying until a follow-up chest radiograph confirms resolution of the pneumothorax. Recurrence during a flight may have serious repercussions. Diving should be discouraged permanently unless a very secure definitive prevention strategy has been performed.

References

- Baumann MH, Strange C, Heffner JE, et al. Management of spontaneous pneumothorax. An American College of Chest Physicians Delphi Consensus Statement. *Chest* 2001;119:590–602.
- Light RW, O'Hara VS, Moritz TE, et al. Intrapleural tetracycline for the prevention of recurrent spontaneous pneumothorax. *JAMA* 1990;264:2224–30.
- Schramel JFMN, Postmus PE, Vanderschueren RG. Current aspects of spontaneous pneumothorax. *Eur Respir J* 1997;10:1372–79.
- Bense L, Eklund G, Odont D, et al. Smoking and the increased risk of contracting pneumothorax. *Chest* 1987;92:1009–12.
- Henry MT, Arnold T, Harvey J. BTS guidelines for the management of spontaneous pneumothorax. *Thorax* 2003;58(Suppl. 2):39ii–58ii.
- Sadikot RT, Greene T, Meadows K, Arnold AG. Recurrence of primary pneumothorax. *Thorax* 1997;52:805–9.
- Light RW. Pneumothorax. In: *Pleural disease*. 3rd ed. Baltimore: Williams and Wilkins 1995; 242–77.
- Murray JF. Pneumothorax. In: Murray JF, Nadel JA, editors. *Textbook of respiratory medicine*. Philadelphia: WB Saunders; 2000, p. 2043–55.
- Fitzpatrick S, Acheson J, Curran P. Re-expansion pulmonary oedema and circulatory shock in a 20-year old man. *Eur J Emerg Med* 2003;10:146–8.
- Beng ST, Mahadevan M. An uncommon life-threatening complication after chest tube drainage of pneumothorax in ED. *Am J Emerg Med* 2004;22:615–9.
- O'Connor AR, Morgan WE. Radiological review of pneumothorax. *BMJ* 2005;330:1493–7.
- Murphy FB, Small WC, Wichman RD, Chalif M, Bernadine ME. CT and chest radiography are equally sensitive in the detection of pneumothorax after CT-guided pulmonary aspiration. *Am J Roentgenol* 1990;154:45–6.
- Schramel FM, Golding RP, Haakman CD, Sutedia TG, de Jong KA, Postmus PE. Expiratory chest radiographs do not improve visibility of small apical pneumothoraces by enhanced contrast. *Eur Respir J* 1996;9:406–9.
- Henry MT. Simple sequential treatment for primary spontaneous pneumothorax: one step closer. *Eur Respir J* 2006;27: 448–50.
- Camuset J, Lagamier J, Brugiere O, et al. Needle aspiration as first-line treatment for primary spontaneous pneumothorax. *Press Med* 2006;35:765–8.
- Ayed AK, Chandrasekaran C, Sukumar. M. Aspiration versus tube drainage in primary spontaneous pneumothorax: a randomised study. *Eur Respir J* 2006;27:477–82.
- Massard G, Thomas P, Wihlm J-M. Minimally invasive management for first and recurrent pneumothorax. *Ann Thorac Surg* 1998;66: 592–9.
- Schonenberger RA, Haefeli HA, Weis P, et al. Timing of invasive procedures for primary and secondary spontaneous pneumothorax. *Arch Surg* 1991;126:764–6.
- Wait MA, Dal Nogare AR. Treatment of AIDS-related spontaneous pneumothorax: a decade of experience. *Chest* 1994;106:693–6.
- Noyes BE, Orenstein DM. Treatment of pneumothorax in cystic fibrosis in the era of lung transplantation. *Chest* 1991;101:1187–8.
- Lippert HL, Lund O, Blegard S, Larsen HV. Independent risk factors for cumulative recurrence rate after first spontaneous pneumothorax. *Eur Respir J* 1991;4:324–31.
- Guo Y, Xie C, Rodriguez RM, Light RW. Factors related to recurrence of spontaneous pneumothorax. *Respirology* 2005;10:378–84.
- Chann SS, Rainer TH. Primary spontaneous pneumothorax: 1 year recurrence rate after simple aspiration. *Eur J Emerg Med* 2006;13:88–91.

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