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Mini Review

Bilateral Primary Spontaneous Pneumothorax: Current Management

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Abstract

Bilateral simultaneous or non-simultaneous primary spontaneous pneumothorax (PSP) is a rare but serious condition. It has no unique risk factor, with a variable clinical presentation ranged from mild chest pain to severe fatal respiratory distress. The plans for management of bilateral PSP include symptomatic conservative treatment, chest drainage, and single-stage or staged surgery. In terms of reduced post-operative pain and better visualization of thoracic cavity, the video-assisted thoracoscopic surgery (VATS) is a preferred procedure over open thoracotomy. A debate exists about the utility of bilateral VATS for non-simultaneous cases, first side to operate, placement of intercostal drains, patient re-positioning, and the use of single versus multiple incisions. There may be a need for respiratory and circulatory support during operations. In a neonate, the resolution of bilateral PSP depends on the availability of oxygen-enriched atmosphere.

Keywords: *Pneumothorax; Lung Bullectomy; Thoracostomy Tube; Video-Assisted Thoracoscopic Surgery*

Introduction

Primary spontaneous pneumothorax (PSP) occurs with no underlying lung disease, usually in young, tall, thin, smoker male patients [1]. Most of the cases with PSP are unilateral, with a rare presentation of bilateral PSP in 1 - 1.5% of all cases with spontaneous pneumothorax [2,3].

Bilateral PSP may be simultaneous when pneumothorax occurs concurrently in both hemi-thoraces, or non-simultaneous when it occurs in the contra-lateral side during hospitalization. Bilateral PSP is often a fatal condition requires an early diagnosis and treatment, especially for cases with simultaneous PSP [3,4].

Risk factors

The etiology of PSP is idiopathic. However, rupture of blebs and bullae plays a pathological role in the most of patients. The characteristic risk profile (Table 1) includes age of 20 - 30 years, male gender, cigarette smoking, and asthenic physiognomy [5].

Clinical features	Risk factors	Indications for surgery*
Sudden onset	Idiopathic	Continuous air leakage after placement of chest tube
Stable: alert, responsive, afebrile with stable vital signs and normal peripheral oxygen saturation	Rupture of blebs and bullae	Recurrence pneumothorax on the same side
Chest pain	Age: 20 - 30 years	Simultaneous bilateral pneumothorax
Unstable: - Respiratory distress - Cardiovascular collapse	Male gender	
	Cigarette smoking	
	Asthenic physiognomy	
	Lower body mass index	

Table 1: *Clinical-etiological features, risk factors, and management of bilateral pneumothorax.*

**: Shields TW. General thoracic surgery. 6th edition. New York: Williams and Wilkins (2005): 794-780.*

The statistically significant predictors of bilateral PSP include lower body mass index (BMI) and smoking [6]. In cases with simultaneous bilateral PSP, lower BMI and the presence of bilateral blebs/bullae have statistically significant importance [4]. However, bilateral PSP has been reported in overweight/obese patients [1]. Also, the history of smoking, illicit drug use, toxic exposure, and significant medical or surgical history may be absent [2,7].

Bilateral PSP has been reported to be induced by a bout of cough, and it may associate with pneumomediastinum and pneumopericardium. Rupture of alveoli in a hemi-thorax leads to retrograde dissection of air along the bronchovascular sheaths of the bronchi and pulmonary vessels, with an end result of pneumomediastinum, pneumopericardium, and contralateral pneumothorax [7].

Clinical Presentation

The symptoms begin suddenly (Table 1), and it may be preceded by a short period of cough and upper respiratory symptoms. At the initial presentation, the patient is usually alert, responsive, afebrile with stable vital signs and normal peripheral oxygen saturation [2]. Chest pain may deteriorate to severe or fatal respiratory distress with increased volume of pneumothorax [5].

The cardiovascular collapse may be initially absent with bilateral PSP, as the patient may have compensated unilateral symptoms followed by acute decompensation after the onset of bilateral PSP [2].

Strategies of management

The symptomatic conservative treatment including bed rest, analgesics, and reassurance is indicated for patients with PSP [7]. Presentation with respiratory distress indicates the initial supplemental oxygen therapy till obtaining of an emergent chest x-ray (Figure 1) [2].

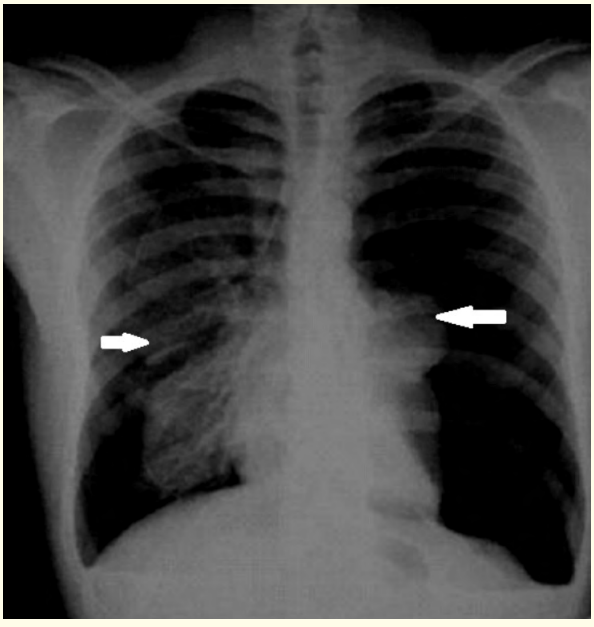

Figure 1: *Postero-lateral view of chest x-ray bilateral primary spontaneous pneumothorax with bilaterally collapsed lung (arrows).*

Chest drainage is the basis of the initial treatment of PSP, using thoracostomy tubes or Heimlich valve (Figure 2). In cases of unilateral PSP, chest tube drainage is generally indicted if > 20% of the hemi-thorax is affected or if the pneumothorax increases during observation. However, this is not the plan in cases of bilateral PSP as drainage of one side is indicated regardless of the extent of pneumothorax, with management of the other side in accordance to the extent of pneumothorax [1]. After chest drainage, computed tomography (CT) should be obtained to determine the presence of underlying blebs/bullae, and to direct the decision-making for further interventions.

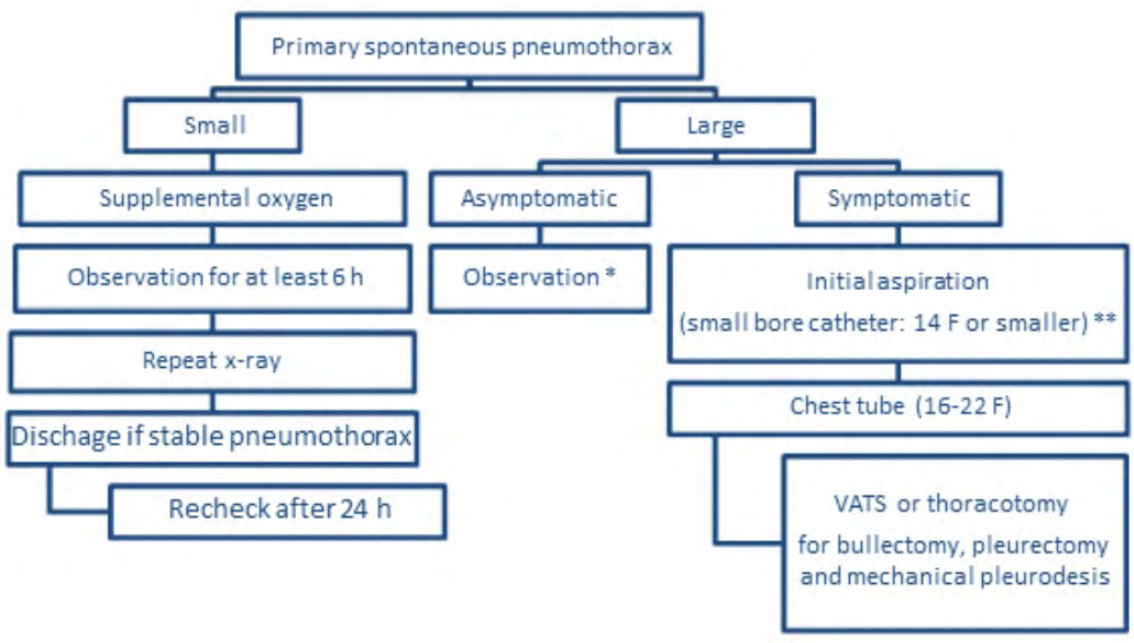

Figure 2: *Algorithm for management of primary spontaneous pneumothorax.*

**: British Thoracic Society Pleural Disease Guideline: MacDuff et al. Thorax. 2010 Aug; 65 Suppl 2:ii18-31.*

***: American College of Chest Physicians: Baumann et al. Chest. 2001 Feb;119(2): 590-602.*

The air leakage after placement of the thoracostomy tube may persist for 48 hours, but its prolongation is the most common indication for surgical intervention after the first episode (Table 1). Surgery may be performed through open procedure or minimally invasive video-assisted thoracoscopic surgery (VATS), as one-stage or staged procedure. Single-stage procedures are preferred by some authors to avoid subsequent anesthetic and operative procedures and to reduce the length of hospital stay [1].

Thoracotomy provides the best access for lung apex where the most of blebs and bullae are found, however, the high degree of postoperative pain associates with impairment of respiratory mechanics [8]. Better visualization of the thoracic cavity and less postoperative pain, increase the preference for VATS (Figure 3). During any procedure, lung and mediastinal pleura should be carefully investigated with a preference to perform bullectomy and apical pleurodesis to prevent recurrence [1].

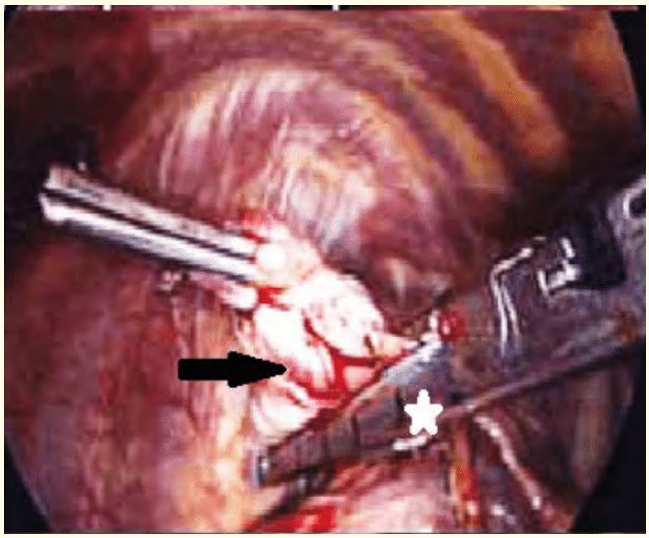

Figure 3: *Operative view during VATS bullectomy (white arrow) for pneumothorax using endo-stapler (white star).*

In cases of unilateral PSP, some authors advocated single-stage pre-emptive VATS for the contralateral blebs or bullae, to reduce the high incidence of contralateral recurrence after unilateral operation [9]. Bilateral application of VATS for management of simultaneous bilateral PSP is usually indicated, however, a controversy remains about its utility for non-simultaneous cases [10].

The important issues during VATS for simultaneous bilateral PSP include the first side to operate, placement of intercostal drains, and patient re-positioning. It is preferred to begin at the side of ongoing air leak and persistent large pneumothorax. Some authors prefer to place the intercostal drain more anteriorly, and not at posterolateral position, to avoid kink of the drain on repositioning in the lateral position to operate on the other side. Some authors preferred bilateral VATS in supine position to avoid patient re-positioning, however, most of the surgeons preferred the sequential standard lateral approach which provides an anatomical spatial orientation of the intra-thoracic structures [8].

The emerging subxiphoid single-incision VATS for simultaneous bilateral PSP has the advantage of lowering postoperative pain as it is performed through one incision away from the intercostal space, in addition to avoiding of patient re-positioning. However, it encounters some disadvantages due to difficultly to access lesions in the posterior aspect of the lung, and the possibility of intra-operative arrhythmia caused by compression on the heart when inserting instruments into the left side [11].

During the surgical intervention for bilateral PSP, there may be a need for respiratory and circulatory support. Some authors used extracorporeal membrane oxygenation (ECMO) device for an elderly patient with severe respiratory distress caused by bilateral PSP, to provide lungs with enough oxygenated blood flow, and to support for intolerable hypoxemia during bilateral operations [3].

Management of bilateral PSP in a newborn

In children, there is a high incidence of spontaneous pneumothorax in newborn up to 1.3%, mostly due to high trans-pulmonary pressures generated with the onset of breathing [12]. The main predisposing factors for PSP in a newborn include rupture of previously uninflated alveoli due to need for high pressure to expand, from uneven distribution of inflating pressures between alveoli. It is important to differentiate PSP in newborn from pneumothorax secondary to cystic fibrosis or familial causes which include folliculin gene disorders or α1-antitrypsin deficiency [13].

The diagnosis of bilateral PSP in a neonate depends on clinical features and presence of predisposing factors. Treatment is based on high flow or 100% oxygen, nitrogen washout therapy, to accelerate the resolution of pneumothorax. Complete recovery of cases with mild to moderate respiratory distress could occur with observation only with placement in atmosphere with moderately high concentration of oxygen, which can be safely provided at a lower FiO_2 between 40 and 60% when the duration of treatment exceeds 48 hours [12,13].

Conclusion

Bilateral PSP is a rare, serious condition. Early diagnosis and subsequent proper intervention with needle decompression, tube thoracostomy or surgery are crucial for the management of bilateral PSP. The use of VATS is safe and effective for bullectomy and pleurodesis particularly for simultaneous bilateral PSP. In a neonate, oxygen therapy may be sufficient for recovery of bilateral PSP.

Conflict of Interest

None.

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