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Approaches of Surgical Treatment for Pneumothorax

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Abstract: **We aimed by this review to discuss and overview the surgical procedures for treatment of pneumothorax, also we intended to discuss the pathogenesis and classification of pneumothorax. Databases were searched, including EMBASE, MEDLINE/ PubMed, for relevant articles reviewing and evaluating the surgical procedures for pneumothorax, as well as reference lists of included in included studies were also searched for more relevant studies published up to January 2017, with English language restriction and human subjects. The treatment algorithm is now shown on a single flowchart for pneumothorax and locations somewhat less focus on the size of the pneumothorax and more on the medical functions. The pattern to more conservative management is maintained, with observation for lots of patients with pneumothorax, aspiration for the rest, and small-bore chest drains pipes for relentless air leaks. The imaging of pneumothorax has actually undergone a major modification due to the introduction of Digital radiography innovation, and the implications of this are now described. Surgical practice has actually likewise established with the extensive adoption of less intrusive (VATS) procedures instead of open thoracotomies.**

Keywords: **pneumothorax, surgical procedures, VATS.**

1. INTRODUCTION

Pneumothorax is the presence of air between the parietal and visceral pleura. It is a reasonably common respiratory disorder and can occur in a variety of medical settings and in individuals of any age. The discussion of a pneumothorax varies between very little pleuritic chest discomfort and breathlessness to a life-threatening medical emergency with cardiorespiratory collapse requiring immediate intervention and subsequent prevention (1,2). Secondary pneumothorax (SSP) is associated with underlying lung disease, in distinction to PSP, although tuberculosis is not the commonest hidden lung disease in the developed world. The repercussions of a pneumothorax in patients with pre-existing lung disease are significantly greater, and the management is possibly harder. Combined hospital admission rates for PSP and SSP in the UK have been reported as 16.7/ 100 000 for guys and 5.8/ 100 000 for females, with matching death rates of 1.26/ million and 0.62/ million per annum between 1991 and 1995 (3). With regard to the aetiology of pneumothorax, anatomical irregularities have been demonstrated, even in the lack of overt underlying lung disease. Subpleural blebs and bullae are found at the lung pinnacles at thoracoscopy and on CT scanning in as much as 90% of cases of PSP, (4,5) and are thought to play a role. More current autofluorescence studies (6) have actually exposed pleural porosities in adjacent areas that were invisible with white light. Little air passages obstruction, moderated by an influx of inflammatory cells, frequently characterises pneumothorax and might end up being manifest in the smaller respiratory tracts at an earlier phase with 'em physema-like modifications' (ELCs) (7). Smoking cigarettes has been implicated in this aetiological pathway, the cigarette smoking habit being connected with a 12% risk of establishing pneumothorax in healthy smoking men compared to 0.1% in non-smokers. Patients with PSP tend to be taller than control patients (8). The gradient of unfavorable pleural pressure increases from the lung base to the apex, so that alveoli at the lung pinnacle in tall people undergo significantly greater distending pressure than those at the base of the lung, and the vectors in theory predispose to the advancement of apical subpleural blebs (9).

The treatment concepts of pneumothorax consist of 5 concepts: air removal, decreasing air leakage, recovering the pleural fistula, promoting re-expand and preventing future reoccurrences, however treating underlying diseases, preventing and dealing issues are likewise important. The core of treatment is based on various etiology and pathogenesis. Breathing failure would be most hazardous if patients did not get quickly and entirely treatment that were integrated with pneumothorax or underlying diseases. Maintaining required respiratory function and stable hemodynamics are the very first step of treatment (10,11,12).

We aimed by this review to discuss and overview the surgical procedures for treatment of pneumothorax, also we intended to discuss the pathogenesis and classification of pneumothorax.

2. METHODOLOGY

Databases were searched, including EMBASE, MEDLINE/ PubMed, for relevant articles reviewing and evaluating the surgical procedures for pneumothorax, as well as reference lists of included in included studies were also searched for more relevant studies published up to January 2017, with English language restriction and human subjects.

3. RESULTS

- **Classification According to Etiology:**

Pneumothorax can be categorised as primary, secondary, distressing or iatrogenic according to aetiology. Sometimes, people might develop a concomitant haemothorax due to bleeding triggered by shearing of nearby subpleural vessels when the lung collapses. Primary spontaneous pneumothoraces take place most typically in young, tall, thin males without any inclining lung disease or history of thoracic injury, although rupture of an underlying little subpleural bleb or bulla is believed to be responsible oftentimes (**Figure 1**) (13,14). Existing cigarette smoking considerably increases the risk of establishing a pneumothorax by as much as 9 times, with evidence of a dose-- reaction relationship (15). Secondary pneumothoraces happen when there is an underlying lung abnormality. Conditions predisposing to the development of a secondary pneumothorax are displayed in **(Table 1)**, although chronic obstructive pulmonary disease is the most typical.

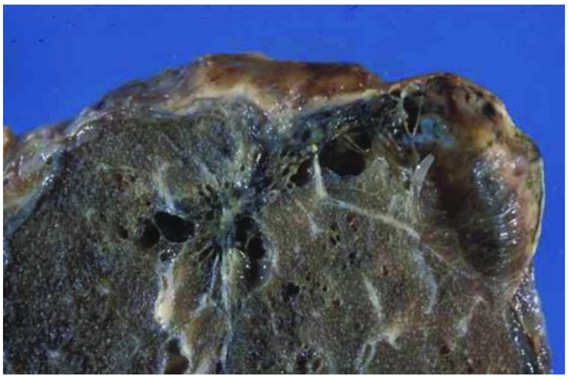

Figure 1: A lung bleb.

Table 1: Factors contributing in secondary pneumothorax

• Obstructive airway disease
chronic obstructive pulmonary disease
asthma
• Suppurative lung disease
bronchiectasis
cystic fibrosis
• Malignant disease
lung cancer
• Interstitial lung disease
pulmonary fibrosis
extrinsic allergic alveolitis
sarcoidosis

lymphangioleiomyomatosis
histiocytosis X
• Infections
pneumonia (for example, due to *Staphylococcus aureus* or *Pneumocystis jiroveci*)
tuberculosis
• Miscellaneous
adult respiratory distress syndrome
Marfan syndrome
Ehlors Danlos syndrome
catamenial
rheumatoid arthritis and other connective tissue diseases

An iatrogenic pneumothorax is most frequently caused by main vein cannulation (subclavian more commonly so than internal jugular vein), pleural tap or biopsy, transbronchial biopsy, fine needle goal, and has occasionally been caused by acupuncture. Intravenous drug users who attempt and locate central veins are likewise at risk of establishing a pneumothorax in the community [16]. Intubated patients being mechanically aerated might develop an iatrogenic pneumothorax due to high inspiratory inflation pressures triggering pulmonary barotrauma. Before the prevalent use of efficient chemotherapy, synthetic pneumothoraces were developed by clinicians dealing with tuberculosis in an attempt to collapse and "rest" the affected lung and help recover cavitating disease. Distressing pneumothorax occurs following direct injury to the thorax; common causes consist of penetrating chest injury or a fractured rib lacerating the visceral pleura. Stress pneumothorax can happen due to any etiology and is specified as any size of pneumothorax triggering mediastinal shift and cardiovascular collapse. In people with sophisticated lung disease, even a little pneumothorax can trigger significant breathing failure and cardiovascular instability [5].

➢ **Diagnostic approaches & Clinical features of pneumothorax:**

Air removal is the first and essential treatment of pneumothorax through needle aspiration and catheter drain. Their improvements are based upon the advancements of the product and operation on special positions/circumstances. Needle aspiration is required to exhaust air entirely at the first time. In order to approach the target, aspiration should be performed in any position of the chest cavity even in some traditional dangerous positions such as the supraclavicular fossa and subclavicular area, guiding by Ultrasound or CT scanning. In addition, new damage caused by the needle needs to be avoided throughout the re-expansion. The existing approach is to utilize cannula or vine remaining needlleiv, even linked to one-way Heimlich valve device to boost the efficacy and are convenient for patients to activities. In the future there may have sensitive detection method or use the non-metallic needle. Secondary pneumothorax patients particularly with pre-existing structuredness lung diseases such as chronic obstructive pulmonary disease (COPD) or tuberculosis, needle aspiration treatment success rate is usually low [17,18,19]. It is often possible to detect a pneumothorax or include it in a list of possible diagnoses on the basis of a consistent history and examination findings. Patients generally report an abrupt beginning of pleuritic pain and shortness of breath. Evaluation findings may vary inning accordance with the size of the pneumothorax and presence of minimal cardiorespiratory reserve. Normal indications consist of minimized breath sounds, decreased ipsilateral chest growth and hyperresonant percussion note. Tracheal move far from the afflicted side, tachycardia, tachypnoea and hypotension take place in a tension pneumothorax. Contrary to conventional teaching, it has been just recently suggested that in tension, lateralising indications are an irregular finding, although basic features such as acute onset and fast cardiovascular instability are universal [20].

➢ **Imaging techniques in diagnosis of Pneumothorax:**

The postero-anterior chest radiograph shows absent lung markings extending from the edge of visceral pleura to chest wall, although it is possible to puzzle a pneumothorax with a lung bulla, edge of the scapula or artefact such as a piece of clothes. Care ought to be taken in the examination of the chest radiograph, particularly portable movies taken in accident and emergency. There is generally not have to request an expiratory film, although lateral views can sometimes provide additional information if it is uncertain whether a pneumothorax exists or not [21]. Mediastinal shift is normally apparent in individuals with a tension pneumothorax (**Figure 2**). In patients going through transbronchial needle biopsy, transthoracic ultrasound has been proposed as being a sensitive and helpful bedside test to detect a post-intervention pneumothorax or hydropneumothorax [22].

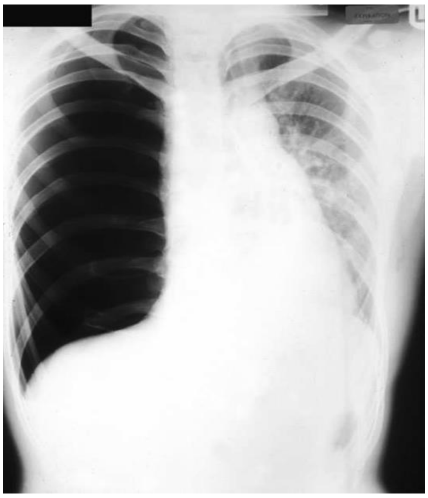

Figure 2: Chest radiograph showing a tension pneumothorax.

- **Surgical management of pneumothorax:**

The functional of surgical treatment for the future prevention of pneumothorax in the contralateral and ipsilateral lung for high risk patients has actually likewise been divided. The concern of whether radiological evidence of lung bulla can predict pneumothorax incident or recurrence, and consequently select patients for "prophylactic" Video-assisted thoracoscopic surgical treatment (VATS) treatment, stays unanswered. Numerous are sceptical of the causal relation in between bulla and pneumothorax, nevertheless, videoscopic findings have revealed that a big percentage (78%- 89%) of patients presenting with pneumothorax in presumable normal lungs have endoscopically noticeable blebs or bullae. Previously, it was revealed that the existence of bullae by CT scan and during thoracoscopy at the preliminary discussion of pneumothorax did not predict recurrence [(21)].

Video-assisted thoracoscopic surgery (VATS) for Pneumothorax:

Surgical access for the management of pneumothorax can be carried out through open strategies (generally axillary or lateral thoracotomy) or by very little access VATS. The success of VATS in the treatment of pneumothorax has led to earlier recommendation by physicians and increased acceptance by patients for surgical treatment [(23)]. The experience so far shows that VATS treatments in elderly (> 75 years) patients are safe with low postoperative pulmonary issues [(24)]. In addition, VATS can also be a beneficial method in picked cases in the paediatric population for a range of endoscopic treatments [(25)]. There is increasing evidence to associate VATS with less access injury and quicker healing, with numerous realising that injury from gain access to is typically even worse than the surgical treatment for correction [(26)]. Postoperative proinflammatory cytokine levels were lower, [(27)] and T cell subgroups along with natural killer cells were less suppressed after VATS compared with their open counterparts [(28)]. In addition, patients undergoing VATS needed considerably less postoperative parenteral narcotics and pain medications than the open techniques [(27,29)]. The occurrence of chronic sequels (chronic pain, pins and needles, or disaesthesia) after thoracoscopic procedures were present in 25% to 31% of patients and the rate of chronic pain was equivalent for VATS and thoracotomy [(30,31,32)]. When compared with normal controls, lung function tests carried out postoperatively after VATS for SP showed little wear and tear. In contrast, patients who went through thoracotomy and parietal pleurectomy for SP had a 7.5% to 16% reduction in important capacity before going back to preoperative worths after five months [(33)]. The difference is most likely attributed to gain access to trauma from rib dispersing in thoracotomy. We discovered patients undergoing VATS to have substantially less shoulder mobility dysfunction in the early postoperative duration when compared with posterolateral thoracotomy [(29)].

Endoscopic stapled bullectomy approach in management of Penumothorax:

The existence of subpleural bullae has actually been reported to be present in 76% to 100% of PSP patients during VATS [(34)] (**Figure 3A**) Endoscopic stapled bullectomy stays the preferred procedure for bullectomy (**Figure 3B**) [(35)] and ought to be accompanied by some kind of pleural symphysis [(24,25)]. Evidence recommends that even when no bleb or bulla is recognized intraoperatively, stapled apical lung wedge resection should be performed to reduce recurrence. Issues connected with the strategy consist of air leakage from the staple line, specifically in emphysematous patients, which can be greatly reduced by pericardial uphold support. Essential cutter malfunctioning has also been reported [(25,27,28)].

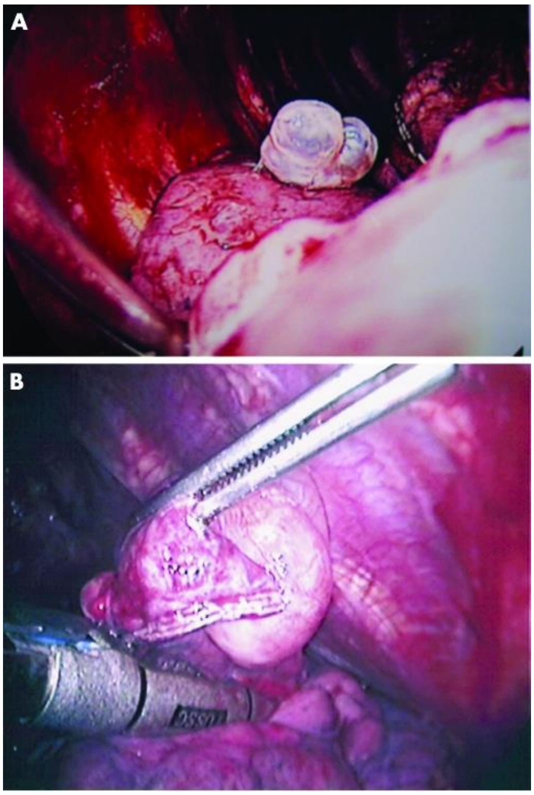

Figure 3: (A) Bulla at the apical segment of right lower lobe in a patient with PSP. (B) Endoscopic stapled bullectomy.

Needle aspiration for chest drainage:

Needle aspiration (NA) was suggested in the previous guidelines (16,17) as the preliminary intervention for Pneumothorax on the basis of studiesshowing comparable success to the insertion of large-bore chest drains, although this was disappointed in another research study. Seldinger (catheter over guide wire) chest drains have gone into prevalent usage since then and further studies have actually been released. A randomised regulated trial in a Kuwaiti population has confirmed equivalence between NA and chest drains (16 Fr), plus a reduction in medical facility admission and length of stay for NA. A smaller sized study in India has also confirmed equivalence. 2 recent case series have actually reported NA success rates of 69% and 50.5%. Numerous meta-analyses were limited by the small numbers of patients and studies but verify equivalence, with NA success rates varying from 30% to 80% If carried out, NA must cease after 2.5 l of air has actually been aspirated (36,37,38,39,40,41).

4. CONCLUSION

The treatment algorithm is now shown on a single flowchart for pneumothorax and locations somewhat less focus on the size of the pneumothorax and more on the medical functions. The pattern to more conservative management is maintained, with observation for lots of patients with pneumothorax, aspiration for the rest, and small-bore chest drains pipes for relentless air leaks. The imaging of pneumothorax has actually undergone a major modification due to the introduction of Digital radiography innovation, and the implications of this are now described. Surgical practice has actually likewise established with the extensive adoption of less intrusive (VATS) procedures instead of open thoracotomies.

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