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Special Case Study of Exploratory Thoracotomy in Pneumothorax Patients et causa Rupture of Giant Bullae

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ABSTRACT

Background: Pneumothorax is an accumulation of extrapulmonary air in the chest usually due to air leakage from the lungs. Air leaks can be primary or secondary and can be spontaneous, traumatic, iatrogenic, or catamenial. Pneumothorax may occur with pneumonia, usually with empyema; it can also occur secondary to lung abscess, gangrene, infarction, rupture of an emphysematous cyst or bleb (in asthma), or a foreign body in the lung. In infants with staphylococcal pneumonia, the incidence of pneumothorax is relatively high.
Case Description: Baby patient with the initials ZKP, female, aged 0 years 3 months, treated in the emergency room at Dr. RSUD. Chasbullah Abdulmadjid Bekasi City on September 29 2024 with complaints of shortness of breath. The patient was brought by his mother to the emergency room at CAM Bekasi Hospital on September 29 2024 with complaints of shortness of breath. According to the patient's family, complaints of shortness of breath had been felt since 1 day at SMRS. The patient had a WSD installed one week ago. The patient denied complaints of fever and cough. Family history of TB was denied. The patient's immunization is incomplete, the patient has not received the BCG vaccine. Post-inpatient patient at Hermina Jatinegara Hospital with the same complaint with a primary diagnosis of Empyema and secondary diagnoses of Bronchopneumonia, sepsis e.c Staphylococcus capitis MDR, and Diarrhea.
Conclusion: Open thoracotomy provides several advantages in the management of pneumothorax. First, it allows direct visualization and assessment of the underlying pathology. This is especially useful in cases where there is suspicion of significant lung or pleural disease, such as bullae, blebs, or bronchopleural fistulas. By accessing the chest cavity directly, surgeons can identify and address any specific abnormalities that contributed to the pneumothorax, facilitating targeted treatment and reducing the risk of recurrence

Keywords: pneumothorax, thoracotomy, lung disease, shortness of breath

INTRODUCTION

Pneumothorax is an accumulation of extrapulmonary air in the chest usually due to air leakage from within the lungs. Air leaks can be primary or secondary and can be spontaneous, traumatic, iatrogenic, or catamenial.[1] Primary spontaneous pneumothorax occurs without trauma or underlying lung disease. Spontaneous pneumothorax with or without physical

activity occurs occasionally in adolescents and young adults, most often in men who are tall, thin, and suspected of having subpleural blebs. Smoking and asthma are also risk factors for developing pneumothorax. Spontaneous pneumothorax is rare in the age group between neonates and adolescents, because developmental causes are most likely to cause pneumothorax to occur frequently after birth and adolescence.[1,2]

Secondary spontaneous pneumothorax is a pneumothorax that arises as a complication of an underlying lung disorder but without trauma. Pneumothorax may occur with pneumonia, usually with empyema; it can also occur secondary to lung abscess, gangrene, infarction, rupture of an emphysematous cyst or bleb (in asthma), or a foreign body in the lung. In infants with staphylococcal pneumonia, the incidence of pneumothorax is relatively high. It can be found in hospitalized children with asthma exacerbations, and usually resolves without treatment. Pneumothorax is a serious complication of cystic fibrosis.

The clinical manifestations of pneumothorax depend on the degree of lung collapse and the amount of pre-existing lung disease. Symptoms include dyspnea, cough, and chest pain. Respiratory distress may also occur, with retractions, markedly decreased breath sounds, and tympanic percussion tone over the involved hemithorax. The larynx, trachea, and heart may shift to the unaffected side. When fluid is present, there is usually a very limited tympanic area on a flat surface to percussion.[1,3]

Treatment depends on the degree of lung collapse and the nature and severity of the underlying disease. Small or even medium sized pneumothorax in normal children can heal without special treatment, usually within 1 week. Administering 100% oxygen may speed healing, but patients with chronic hypoxemia should be closely monitored while administering supplemental oxygen. Needle aspiration into the second intercostal space at the midclavicular line may be necessary in an emergency for tension pneumothorax and is as effective as tube thoracostomy in the emergency room management of primary spontaneous pneumothorax. If the pneumothorax is recurrent, secondary, or under pressure, or there is more than a small collapse, chest tube drainage may be necessary.[1]

Thoracotomy is described as an incision in the chest wall to reach the thoracic cavity. This operative procedure can be divided into two categories, namely anterolateral thoracotomy and posterolateral thoracotomy.[7] Anterolateral thoracotomy provides access to the upper lobe, right middle lobe and anterior hilum. Anterolateral thoracotomy is our preferred approach for unilateral lung transplantation. [8]

Posterolateral thoracotomy is the most commonly used incision in thoracic surgery. This procedure provides excellent access to the lungs, hilum, middle and posterior mediastinum, endothoracic trachea, and endothoracic esophagus, and allows safe control of the pulmonary vasculature during lung resection.[9] The clinical significance in patients undergoing non-emergent thoracotomy procedures, whether for cardiac or thoracic surgical interventions, indicates the potential for many comorbidities and tends to be weak. Procedures undertaken via a thoracotomy incision will significantly decrease cardiopulmonary reserve and place patients at increased risk of postoperative complications that have the potential to result in higher morbidity and mortality rates.[7]

Emergency room thoracotomy is a procedure intended to slow the injury and stabilize the patient through direct control of the intrathoracic injury, decompression of pericardial tamponade, and control of the aorta to prevent exsanguination. In appropriate populations, this procedure has shown excellent results in reducing mortality under certain conditions. However, overall, morbidity and mortality are high, with survival rates ranging from 7.4-8.5 percent depending on the mechanism of injury.[10]

CASE REPORT

The patient is a baby with the initials ZKP, female, aged 0 years, 3 months, admitted to

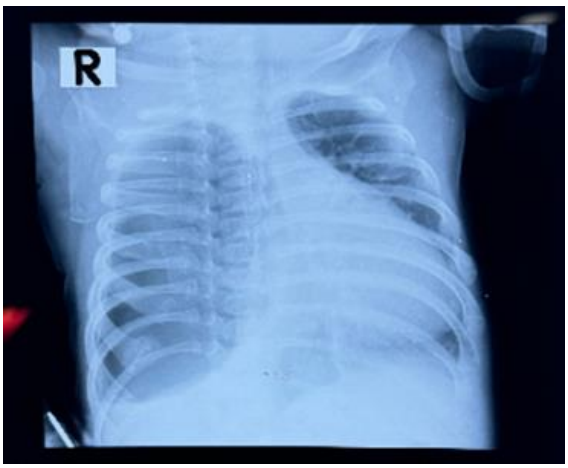
the emergency room at Dr. RSUD. Chasbullah Abdulmadjid Bekasi City on September 29 2024 with complaints of shortness of breath. The patient came to be taken by his mother to the emergency room at CAM Hospital Bekasi on September 29 2024 with complaints of shortness of breath. According to the patient's family, complaints of shortness of breath had been felt since 1 day of SMRS. The patient had a WSD installed one week ago. The patient denied complaints of fever and cough. Family history of TB was denied. The patient's immunization is incomplete, the patient has not had the BCG vaccine. The patient was post-hospitalization at Hermina Jatinegara Hospital with the same complaint with the primary diagnosis of Empyema and secondary diagnoses of bronchopneumonia, sepsis e.c Staphylococcus capitis MDR, and Diarrhea. The patient also underwent WSD installation one week ago. After underwent thoracotomy surgery for about 2 hours with lobectomy procedure, the patient sent to PICU room and find improvement, then the patient was transferred to a regular treatment room with low flow oxygen installed. One month earlier the patient also experienced the same complaint and was treated at Ananda Babelan Hospital with a diagnosis of bronchopneumonia. The patient has a history of surgery for the installation of a WSD for the indication of empyema at Hermina Jatinegara Hospital.

Physical Examination

The inspection was carried out on October 2, 2024

- Body weight: 4 kg
- General Condition: Looks seriously ill
- Awareness: Support
- Vital Signs
  - Blood pressure: 64/28 mmHg
  - Pulse Frequency: 134x/minute
  - Respiratory Frequency: 32x/minute
  - Temperature: 37oC
  - Saturation: 80% on Ventilator mode PAC PIP 12, PEEP 5, FiO2 90%
- Generalist Status
  - Head: Symmetrical, Normocephali
  - Eyes: normal, anemic conjunctiva -/-, hyperemic -/-, sclera icteric -/-, direct light reflex +/+, light reflex indirect +/+
  - Ears: Normotia, symmetrical
  - Nose: Koncha hypertrophy -/-, deviated septum -, discharge -
  - Mouth: Pale mucosa -, dirty tongue -
  - Neck: No enlarged lymph nodes
  - Thorax
    - Inspection: symmetrical chest wall movement, retraction between ribs +
    - Palpation: symmetrical vocal fremitus
    - Percussion: sonor/sonor
    - Auscultation: basic vesicular breath sounds +/+, rhonchi +/+, wheezing -/-
  - Heart
    - Inspection: Ictus cordis is not visible
    - Palpation: Ictus cordis is palpable on 2 fingers
    - Percussion: Right heart border at the level of the dextra sternal line ICS 4, left heart border at the left midaxillary line at the level of ICS 5
    - Auscultation: Regular S2-S2 heart sounds, no heart sounds addition
  - Abdomen: Sore, tenderness -, knocking pain -, bowel sounds +
  - Extremities: no visible fracture/dislocation, edema -/-/-/-, warm acral
  - Skin: cyanosis appears around the lips

Thorax Photo Examination



Description

Cast Impression does not enlarge
Avascular lucent area in the right hemithorax
Dull right sinus
Skeletal intact

Impression

Right pneumothorax

Suspected right pleural effusion, DD/ asymmetrical position

DIAGNOSIS

Respiratory failure e.c Pneumothorax Dextra Giant Bullae Rupture Susp

DISCUSSION

Diagnosis Of Pneumothorax Et Causa Rupture Of Giant Bullae

Spontaneous pneumothorax in most patients occurs due to rupture of the bulla or bleb. Pulmonary blebs are small collections of air between the lungs and the outer surface of the lungs (visceral pleura) that are usually found in the upper lobes of the lungs. When a bleb ruptures, air escapes into the chest cavity, causing a pneumothorax (air between the lung and the chest cavity) which can result in the lung collapsing. If the blebs become larger or merge to form a larger cyst, it is called a bulla. Unless a pneumothorax occurs, or the bulla becomes very large, there are usually no symptoms. Patients with blebs usually suffer from emphysema.[16]

Table 1. Diagnostic Analysis

Case	Theory
History: ● Main complaint: tightness. ● History of disease: post-WSD empyema, bronchopneumonia. ● Family history: father's history of smoking	● The clinical manifestations of pneumothorax depend on the degree of lung collapse and the amount of pre-existing lung disease. Symptoms that arise include dyspnea, cough and chest pain.[1,3] ● ***Giant bullae contribute to respiratory distress with lesions occupying the intrathoracic space, exerting a compressive effect on the underlying lung parenchyma and sometimes the mediastinum. Apart from compression symptoms such as dyspnea, patients can also experience complications, the most common of which is pneumothorax followed by infection, while secondary lung abscess also causes complications of bullae if the cavity is connected to the airway.4***Pneumotoraks spontan yang berkembang pada pasien seperti ini paling sering berespon terhadap drainase selang dada sederhana.[4] ● **Bullous emphysema** is a common obstructive pulmonary disease caused by inhalation of tobacco smoke. Bullae are abnormal collections of air in the lung parenchyma. This can cause several complications such as pneumothorax and superinfection.[17]
Physical examination: • BP: 64/28 mmHg • SpO2: 80% with ventilator • Retraction between ribs (+) • Lung auscultation: right lung sounds disappear	On examination, findings such as: respiratory discomfort, increased respiratory frequency, asymmetric lung expansion, decreased tactile fremitus, hypersonor percussion, and decreased intensity of breath sounds or absence of breath sounds are found. In tension pneumothorax, the following additional findings may be found: tachycardia > 134 beats/minute, hypotension, jugular venous distension, cyanosis, respiratory failure, and heart failure.[18]
Supporting investigation: • Leukocytes: 18.1 thousand/µL • AGD: partially compensated respiratory acidosis • X-Ray: right hemithorax avascular lucent	● Hypoxemia is usually an indication of impending respiratory failure, pneumothorax, or significant mucus obstruction leading to lung collapse. Initially, there may be respiratory alkalosis, but as fatigue progresses, respiratory acidosis occurs. With severe airflow obstruction, metabolic acidosis may occur due to the development of lactic acidosis secondary to tissue hypoxia and lactate production due to muscle fatigue. The combination of hypoxemia, hypercarbia, and acidosis can cause cardiovascular disorders that require immediate intervention.[19] ● Chest x-ray: a small amount of intrapleural air may be seen, with air in the pleural space bordering the visceral pleura. Reduced or no markings on the affected side may be visible due to air. Atelectasis may also be seen on the affected side due to compression by pleural air. Displacement of the mediastinum and trachea away from the affected lung has been documented in moderate to severe pneumothorax.[3]

Thoracotomy Management in Pneumothorax

Management of pneumothorax aims to remove air from the pleural cavity, restore lung expansion, and prevent recurrence. Less invasive techniques, such as needle aspiration and tube thoracostomy, are often the first-line approach for initial management. However, if these methods fail or are contraindicated, open thoracotomy may be necessary[20]

Open thoracotomy provides several advantages in the management of pneumothorax. First, it allows direct visualization and assessment of the underlying pathology. This is especially useful in cases where there is suspicion of significant lung or pleural disease, such as bullae, blebs, or bronchopleural fistulas. By accessing the chest cavity directly, surgeons can identify and address any specific abnormalities contributing to the pneumothorax, facilitating targeted treatment and reducing the risk of recurrence.[20] Second, open thoracotomy allows better bleeding control and the ability to perform concurrent procedures if necessary. In cases where there is significant bleeding, such as in traumatic pneumothorax or in patients undergoing anticoagulant therapy, direct surgical access allows immediate hemostasis and the potential for rapid blood transfusion if necessary. In addition, open thoracotomy provides the opportunity to address associated pathology, such as pulmonary resection for bullae or bronchopleural fistula repair, thereby optimizing overall pneumothorax management.[20]

Additionally, open thoracotomy allows thorough lung exploration and complete lung expansion. This is particularly relevant in cases when there is extensive lung collapse or localized pneumothorax that cannot be adequately treated through less invasive techniques. By manually expanding the lung and ensuring complete re-expansion, open thoracotomy helps restore normal respiratory function and improve oxygenation, ultimately providing better patient outcomes.[20]

CONCLUSION

Pneumothorax is an accumulation of extrapulmonary air in the chest usually due to air leakage from within the lungs. Spontaneous pneumothorax in most patients occurs due to rupture of the bulla or bleb. When a bulla or bleb ruptures, air escapes into the chest cavity, causing a pneumothorax which can result in the lung collapsing. The clinical manifestations of pneumothorax depend on the degree of lung collapse and the amount of pre-existing lung disease. Symptoms include dyspnea, cough, and chest pain. Respiratory distress may also occur, with retractions, markedly decreased breath sounds, and tympanic percussion tone over the involved hemithorax. The larynx, trachea, and heart may shift to the unaffected side. Management of pneumothorax aims to remove air from the pleural cavity, restore lung expansion, and prevent recurrence. Thoracotomy is performed if there are contraindications or failure with WSD therapy. Open thoracotomy provides several advantages in that it allows direct visualization and assessment of the underlying pathology, allows better control of bleeding and the ability to perform concurrent procedures if necessary, and allows thorough lung exploration and complete lung expansion.

Declaration by Authors

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