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Carrier State of Streptococcus Pneumoniae in Lung Cancer with Thoracic Empyema

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Abstract

Introduction

Streptococcus pneumoniae is the most common cause of community-acquired pneumonia and can exist as an asymptomatic carrier. Streptococcus pneumoniae is a commensal bacterium of the upper respiratory tract, specifically the nasopharynx. Streptococcus pneumoniae can cause 20-30% of all community-acquired pneumonia cases in Indonesia, and approximately 50% of patients with pneumonia will develop pleural effusion, with 5-10% of patients with pleural effusion progressing to thoracic empyema. Pleural effusion is one of the disseminations caused by lung cancer.

Case Report

A 26-year-old male was admitted to Arifin Achmad General Hospital with left lung empyema, a history of left lung adenocarcinoma, and had undergone 6 cycles of chemotherapy. Clinical manifestations included shortness of breath, cough, and chest pain, which had been experienced for 5 months and worsened one week prior to hospital admission. The patient underwent intercostal drain (ICD) insertion for pus evacuation. There was no ICU care or surgical intervention. The patient's outcome was death after 18 days of hospitalization. Nasopharyngeal culture examination revealed Streptococcus pneumoniae serotype 19F, while empyema fluid culture showed no bacterial growth.

Conclusion

A carrier state of Streptococcus pneumoniae was found in lung cancer with thoracic empyema.

Keywords: Streptococcus Pneumoniae Carrier, Lung Cancer, Thoracic Empyema

1. Introduction

According to the Indonesian Society of Pulmonology (2021), thoracic empyema is defined as the presence of pus within the pleural cavity. Despite advancements in antibiotic therapy, pleural drainage, and decortication surgery, thoracic empyema remains a significant public health concern in the field of pulmonary diseases due to its persistently high mortality and morbidity rates. Streptococcus pneumoniae is the most common cause of community-acquired pneumonia and can be carried asymptomatically. This bacterium is a commensal organism of the upper respiratory tract, specifically the nasopharynx and oropharynx, in approximately 5-40% of individuals. In Indonesia, Streptococcus pneumoniae is responsible for 20-30% of all community-acquired pneumonia cases Approximately 50% of patients with pneumonia will develop pleural effusion, and 5-10% of those with pleural effusion will progress to thoracic empyema . A study by Zhou et al. on Streptococcus pneumoniae infections identified serotypes 23F, 19A, 19F, 3, and 14 as the most prevalent. Serotype 3 exhibits high virulence but low antibiotic resistance, whereas serotypes 23F, 19A, 19F, and 14 show low virulence but high resistance. Based on statistical data from the Global Cancer Observatory (GLOBOCAN) in 2020, the global incidence of lung cancer ranks second after breast cancer (11.7%), accounting for 11.4% of all cancer cases. In Indonesia, new lung cancer cases rank third after breast cancer and cervical cancer, at 8.8%. Notably, lung cancer accounts for the highest mortality rate in Indonesia, at 13.2% of the total 30,843 cases. Lung cancer accounts for one-third of all cancer-related deaths in men and is the most common cancer among men. It ranks as the fifth most frequent cancer among women. Pleural effusion often complicates lung cancer and is a significant factor in its management [1-6].

2. Case Report

A 26-year-old male presented to the emergency department of Arifin Achmad General Hospital with complaints of

shortness of breath (dyspnea) that had been ongoing for five months and worsened over the past week prior to admission. The dyspnea progressively intensified, becoming almost constant throughout the day and worsening with ambulation and activity. The patient also reported left -sided chest pain upon inspiration, which started concurrently with the shortness of breath and was intermittent in nature. He also reported a productive cough for seven days prior to admission, with whitish sputum. The patient denied any prior fever. He found it more comfortable to sleep in a left lateral decubitus position. The patient has a medical history of left lung adenocarcinoma with pleural effusion, for which routine thoracentesis has been performed, and they have completed six cycles of chemotherapy. The patient denies a history of asthma, kidney disease, diabetes mellitus, hypertension, heart disease, tuberculosis, or allergies. Family history is negative for similar conditions, lung disease, diabetes mellitus, hypertension, heart disease, and allergies. Regarding social history, the patient reports smoking 24 cigarettes daily since the age of 18, which is categorized as a light Brinkman Index. Physical examination revealed the patient's general condition was good, consciousness was compos mentis E4V5M6. Blood pressure 123/74 mmHg, heart rate 115x/minute, respiratory rate 25x/minute, temperature 36.7 C, oxygen saturation 97% with nasal cannula 4 liters/minute. Head examination revealed normocephalic, no icteric sclera or anemic conjunctiva. Neck examination showed no thyroid enlargement, no lymphadenopathy (KGB enlargement), and no elevated JVP. Thoracic examination revealed normal chest shape (+), lagging respiratory movement of the left chest, regular breathing pattern, decreased fremitus on the left hemithorax, dullness on percussion of the left hemithorax, and on lung auscultation, diminished vesicular breath sounds in the left lung, with no rhonchi or wheezing. Heart sounds I-II regular, no murmurs or heart bruits heard. Abdominal examination was within normal limits. Lower extremities showed CRT <2 seconds, warm acral. Ancillary investigations included a complete blood count, which revealed no abnormalities. The sole oncologic emergency identified was left pleural effusion. Supportive imaging with a chest X-ray (Figure 1) showed a homogeneous opacity in the mediobasal region of the left hemithorax. Additionally, both the right and left costophrenic angles were blunted.

Figure 1: Chest Xray

A CT scan of the thorax (Figure 2) was also performed, revealing a suspicious left lung mass, paratracheal, bilateral perihilar, subcarinal, and para-aortic lymphadenopathy, bilateral pleural effusion, and minimal pericardial effusion.

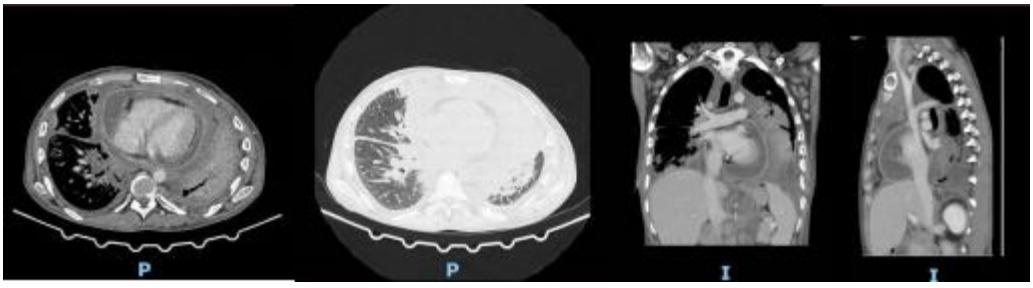

Figure 2: CT Scan Thorax

The patient had previously undergone Abram's biopsy with histopathological examination, which concluded a malignant tumor, adenocarcinoma type (non-small cell lung carcinoma). They had completed six cycles of chemotherapy with a carboplatin-paclitaxel regimen. During the current hospitalization, an intercostal drainage (ICD) procedure was performed, yielding thick, reddish, odorless pus. The patient received antibiotic therapy. Pleural fluid culture showed no bacterial growth, but a nasopharyngeal swab yielded *Streptococcus pneumoniae* serotype 19F (Figure 3). Despite medical efforts, the patient's condition deteriorated, and they succumbed after 18 days of hospitalization.

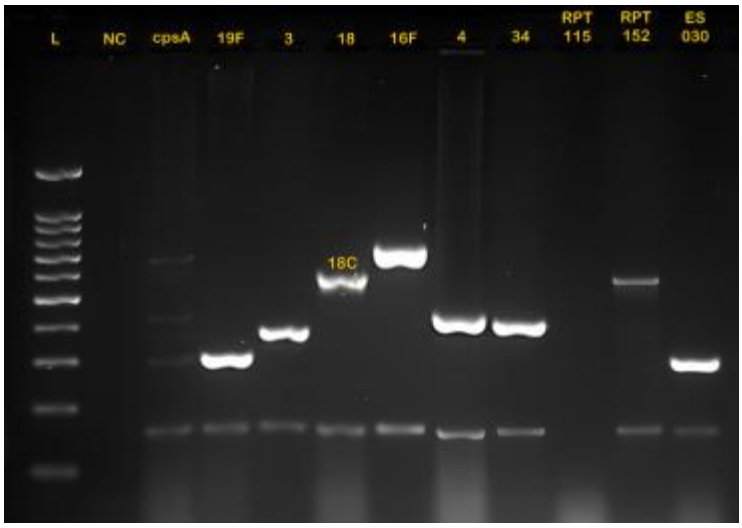

Figure 3: Streptococcus Pneumoniae Serotype 19

3. Discussion

Based on the patient's anamnesis, clinical manifestations, and ancillary investigations, the diagnosis in this case is adenocarcinoma lung cancer with thoracic empyema, and the patient is a Streptococcus pneumoniae carrier. Lung cancer is a malignancy originating from the bronchial epithelium, also known as bronchial carcinoma. According to Light (2013), thoracic empyema refers to the accumulation of purulent fluid within the pleural cavity. Pleural effusion is a common manifestation of lung cancer spread. Streptococcus pneumoniae is the most frequent cause of community-acquired pneumonia and can be carried asymptomatically. More than 80 serotypes of Streptococcus pneumoniae were identified by 1940, and this number has continued to grow [7,8].

In this case, the patient was a Streptococcus pneumoniae carrier, confirmed by a nasopharyngeal swab that isolated serotype 19F. However, no bacterial growth was found in the culture of the thoracic empyema fluid. The patient had a history of lung cancer chemotherapy and was a 26-year-old male with a light Brinkman Index smoking history. The higher incidence of this condition in male patients is attributed to their greater prevalence of smoking habits, which is a significant risk factor for thoracic empyema. Research by Marks et al. (2012) identified smoking as a risk factor for thoracic empyema, present in 118 patients (29.1%) in their study. Other research indicates that males are more frequently affected by thoracic empyema than females. A study by Imran B et al. (2014) reported the mean age of patients with empyema as 33.32 ± 13.62 years, with a range of 18-67. The clinical manifestations observed included shortness of breath, cough, and chest pain, which had been present for five months and worsened one week prior to hospital admission [9-13].

Consistent with the research by Wen et al. (2019: 9), cough was the most common symptom experienced by patients (71.1%), followed by fever, shortness of breath, and chest pain. In this case, an Intercostal Drainage (ICD) was performed for pus evacuation, but the patient's condition worsened, and they passed away after 18 days of hospitalization. A study by Akio Y. et al. (2019) indicated that most empyema patients underwent ICD placement (63.89%). Several studies on empyema cases reported varying lengths of hospital stay, including approximately 13 days, 23 days (range 18-32 days), and 9 days (range 6-19 days) (Marks et al., 2012). In this specific case, Streptococcus pneumoniae serotype 19F was isolated from the nasopharyngeal swab, but no bacterial growth was found in the thoracic empyema fluid culture. Previous epidemiological studies have shown that dominant Streptococcus pneumoniae serotypes can vary across different age groups. For instance, children tend to be infected by specific serotypes commonly targeted by pneumococcal vaccines, such as serotypes 6B, 9V, 19F, and 23F, while other serotypes, such as serotypes 3 and 19A, are more frequently found in adults [15].

A study in Malaysia found that serotypes 19F and 6A/B were the most common causes in children. Streptococcus pneumoniae serotype 19F is one of the frequently encountered serotypes in humans and exhibits higher resistance compared to other serotypes. Another study in Vietnam reported that serotype 19F was associated with multidrug resistance to beta-lactam antibiotics in children with acute respiratory infections. A study in Jakarta found serotype 3 to be the most dominant in adults with community-acquired pneumonia, followed by serotypes 6A, 6B, and 7. Research in Semarang reported that serotypes 6A/6B, 15B/C, 11A, 23F, and 19F were most commonly found in healthy individuals. The discrepancies in these research findings may be attributed to differences in bacterial patterns based on geographical location and regional antibiotic usage patterns. Additionally, several studies suggest that Streptococcus pneumoniae has become a less common etiological agent for thoracic empyema cases. This shift in patterns could be due to the global accessibility of broad-spectrum antibiotics. In contrast to the negative culture results from the thoracic empyema fluid in this case,

a study by Marks et al. (2012) reported that Pseudomonas aeruginosa was isolated in 27.8% of cases as the cause of hospital-acquired empyema. A study by Corcoran JP et al. (2015) identified Klebsiella pneumoniae in 25% of all Gram-negative bacterial findings, with Gram-negative bacteria accounting for 45% of total isolates (Corcoran et al., 2020). The dominance of Gram-negative bacteria, particularly Klebsiella pneumoniae and Pseudomonas aeruginosa, as causes of pneumonia at Arifin Achmad General Hospital and in Indonesia generally, does not align with the findings in this particular case. A study by Marks et al. (2012) explained that pleural fluid cultures have a low positivity rate, averaging less than 50% (Marks et al., 2012). Another study that also identified microorganisms using conventional cultures found a positivity rate of 54.9%. Based on these findings, the absence of microbial detection in pleural fluid does not rule out the possibility of an infection

4. Conclusion

Streptococcus pneumoniae serotype 19F carriage was identified in a lung cancer patient with thoracic empyema. Further examination and research are needed to ascertain if there's a correlation between morbidity and mortality in patients who carry Streptococcus pneumoniae.

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