PSEUDOMONAS ABSCESS AND EMPYEMA

References

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Pseudomonas Abscess and Empyema of the Lung

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The combination of pulmonary abscess and empyema due to Pseudomonas aeruginosa is presented. Pseudomonas infections of the lungs frequently occur in patients with diminished host resistance, often receiving antibiotics or corticosteroids, and frequently in a hospital. The resistance of Pseudomonas aeruginosa to the more commonly used antibiotics as penicillin, tetracycline, chloromycetin and kanamycin is known. These features are exemplified by the case reported. The empyema was managed by drainage, enzyme instillation into the pleural space and appropriate systemic antibiotics. At autopsy the characteristic pathologic features of Pseudomonas infection were not found. Review of the world literature of Pseudomonas lung abscess and empyema shows their frequent occurrence in persons with underlying diseases, their poor response to medical treatment, and high mortality.

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Pseudomonas aeruginosa is a potential pathogen for man. The infection is frequently hospital-acquired in patients with lowered resistance who are receiving antibiotics or corticosteroids. In patients with pulmonary infection, Pseudomonas aeruginosa is most often cultured from the lung in combination with other organisms. When it is the only organism cultured, it usually causes bronchopneumonia; less often empyema results, and rarely abscess formation occurs. Our purpose is to report a case with empyema and abscess formation due to Pseudomonas aeruginosa.

Case Report

W. P., a 55-year-old Caucasian man, was admitted to the Veterans Administration Hospital, Washington, D. C. on March 17, 1966, because of chills, fever and a cough productive of purulent sputum of two-days' duration. On the day before admission, a chest x-ray film revealed a pulmonary infiltrate: he was treated at home with penicillin.

Pertinent physical findings on admission were: rectal temperature 101°F; pulse 100; regular; blood pressure 120/85; respiratory rate 20 per minute. He was a well-developed, well-nourished man in no acute distress. His mouth was edentulous. The lung field at the left base posteriorly was dull to percussion and moist crepitant rales were heard.

Laboratory findings on admission: white blood cell count, 12,500. 79 per cent polymorphonuclear leukocytes, 10 per cent lymphocytes, 3 per cent monocytes and 8 per cent bands; hematocrit 41 per cent. The results of other routine laboratory studies were within normal limits. A gram stain of the sputum revealed gram positive Diplococcus and numerous white blood cells. The sputum culture grew alpha Streptococcus. Chest x-ray films showed a bronchopneumonic infiltrate of the lower one-third of the posterior left lung field (Fig 1).

Hospital Course: The initial impression was left lower lobe pneumonia. The patient was treated with penicillin. His temperature was 102°F for the first four hospital days with subsequent lysis. Chest x-ray examination on the tenth hospital day showed a significant decrease in the pneumatic infiltrate (Fig 2). Sputum culture on the same day showed Aerobacter aerogenes and Coliform inurencus. With striking improvement of the patient, we felt these organisms were non-pathogenic. On the 12th hospital day, the patient's temperature rose to 101°F with no other change in his clinical condition. The white blood cell count was 10,000 with a normal differential, hematocrit, 35 per cent. Because Gram-negative organisms were cultured from the sputum (Table), penicillin was discontinued on the tenth day of treatment and tetracycline was started. The patient's temperature was normal the following day, but rose to 105.2°F three days later. He was then tachypneic and lethargic. There were scant rales at the left base posteriorly. Portable chest x-ray film showed a dense, homogenous opacification at the lower portion of the left lung with blunting of the costophrenic angle suggesting fluid (Fig 3). At this time, the white blood cell count was 28,000 per mm³ with a shift to the left; hematocrit, 32 per cent. Tracheotomy was performed and nebulization instituted. Three cubic millimeters of tenacious purulent fluid were obtained by thoracentesis. Pneumonia with loculated empyema was diagnosed. Tetracycline was discontinued and
FIGURE 1. Admission film. Bronchopneumonic infiltrate involving the left lower lobe.

ecephalosporin and colistin were given. Because the patient did not improve after eight days of this therapy, the empyema fluid was drained with an intrapleural chest tube. Streptokinase-streptodornase (Varidase) 250,000 units was instilled with retention of the enzyme in the pleural cavity for 12 hours, after which 1,000 ml of transudative fluid was drained through the chest tube. Three days later this treatment was repeated with similar results. Although there was some roentgenographic resolution of the pneumonia and empyema, his general clinical state deteriorated and he expired on the 30th hospital day.

At postmortem examination, the right lung weighed 520 grams and the left lung 750 grams. The pleural surface of the right lung was normal. The surface of the left lung had a thickened and ragged pleura. There was a subpleural abscess at the lateral base of the left lower lobe measuring 2 cm. in diameter. In the vicinity of this abscess were bronchopneumonic foci, many of which showed organization. The right lower lobe also displayed a few small foci of consolidation. There was acute and chronic bronchitis. There were no pathognomonic lesions of Pseudomonas in the lung. There was no evidence of hepatitis, splenitis, nephritis, or myocardial infarction.

FIGURE 2. Tenth hospital day; significant clearing of pneumonia.

FIGURE 3. Portable x-ray film taken on the 24th hospital day after enzyme instillation and before drainage showing considerable pleural fluid.

DISCUSSION

Pseudomonas aeruginosa was first grown in pure culture in 1882 by Gessard from a patient with skin wounds. Since then, Pseudomonas has been cultured from many locations of the body. When Pseudomonas infects the respiratory tract it is usually a superimposed infection occurring in a hospital environment in patients with diminished host resistance. It most often causes a bronchopneumonia and may cause a necrotizing pneumonia. It less often causes empyema and rarely causes lung abscesses. A case is reported of a patient who had hospital-acquired bacterial pneumonia due to Pseu-
PSEUDOMONAS ABSCESS AND EMPYEMA

Table 1.—Significant Cultures with Antibiotic Sensitivities

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<td>SOURCE OF SPECIMEN</td>
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<td>Tetracycline</td>
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<td>Nitrofurantoin</td>
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<td>D-alpha amino benzyl penicillin</td>
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<td>Sodium cephalothin</td>
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S: Sensitive
R: Resistant
S/RV: Sensitive with varying resistance
Tr. Asp.: Tracheal aspirate
Fl. Fl.: Pleural fluid
P. a.: Pseudomonas aeruginosa
A. aeur.: Acrobacar aeuruginosa
C. int.: Coliform intermedius

Pseudomonas aeruginosa resulting in abscess formation and empyema. The patient expired in spite of treatment including systemic antibiotics and pleural enzyme installation with drainage.

A pertinent aspect of this case was our decision not to treat the initial Pseudomonas aeruginosa cultured from the sputum with an appropriate antibiotic, because the patient’s pneumonia was responding to penicillin. We find Pseudomonas frequently in sputum cultures without presence of disease. These are most often subclinical saprophytic infections that clear without antibiotic therapy or persist even with treatment. The pneumonia, abscess and empyema that developed during hospitalization in the case here reported produced Pseudomonas organisms of different sensitivities than that initially cultured. This suggests that the subsequently cultured Pseudomonas was a newly acquired hospital infection or a transformation of the initially cultured Pseudomonas aeruginosa into an organism behaving with more virulence and resistance. However, the changing sensitivities may have been due to the vagaries of the testing method.

In addition to the therapeutic measures utilized in the case presented, other forms of treatment are to be considered in the management of empyema. Continued drainage of the pleural cavity employing a flutter valve in the drainage tube enables ambulation. Instillation of antibiotics into the pleural cavity may be indicated for persistent empyema. When medical management and closed chest tube drainage have failed, thoracotomy and drainage is indicated. Severe infections caused by Pseudomonas aeruginosa that do not respond to antibiotics may be treated with vaccines against strains of Pseudomonas or hyperimmune serum. The organism may show resistance to the more commonly used antibiotics, such as tetracycline, chloromycetin and kanamycin.

With the advent of antibiotic therapy, hospital-acquired, Gram-negative infections are more common. Pseudomonas has been cultured from many places in the hospital environment: hands, soap solutions, stored blood, infusion fluids, urinals, instruments, inhalation therapy equipment and nebulizers. A nursery epidemic of Pseudomonas infection from inhalation therapy has been reported. The air is less often a source of Pseudomonas aeruginosa.

Several specific pathologic lesions have been described in tissues infected with Pseudomonas aeruginosa. Antemortem blood coagulation defects and the Schwartzmann reaction with characteristic renal pathology were considered secondary to Pseudomonas septicemia in a case previously reported. Acute vasculitis in which the walls of small arteries and veins are extensively invaded by Pseudomonas
aeruginosa may occur. This vasculitis was thought to be due to perivascular invasion and was considered to be pathognomonic. Well-demarcated, firm, necrotic nodules characteristically located around blood vessels have recently been reported. Two fatal cases of Pseudomonas pneumonia had hepatitis, splenitis and interstitial nephritis. The patients described died of myocardial infarction. Our case did not show these vascular features, a coagulation defect or pathology as reported by others.

The world literature was reviewed for the incidence and features of lung abscess and empyema due to Pseudomonas aeruginosa. The significant features of these cases are their frequent occurrence in persons with underlying diseases, especially those of the respiratory system. There was poor response to medical treatment and death was frequent. There was no predilection for age groups, sex or localization within the lung of the infection.

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REFERENCES

Reprint requests: Dr. Gluck, Pulmonary Division, Georgetown University Hospital, Washington, D.C.