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Case report

Staphylococcal pneumonia as a complication of cellulitis

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ABSTRACT

Introduction: Cellulitis is less common local infection caused by staphylococci but may be accompanied by severe symptoms.

Aim: The authors present a case of a 25-year-old woman with cellulitis in the lower jaw area, who had a complication in the form of purulent pneumonia with numerous abscesses and pleurisy.

Case study: The patient, 25-year-old woman, was admitted to Clinic of Dermatology in Olsztyn due to painful swelling of her cheek, jaw and chin on the right side. The physical examination revealed crackles in the lung base and the chest X-ray image showed numerous circular shadows in the lung fields. In addition, there was fluid in the left pleural cavity. Intensive antibiotic therapy was used in the treatment for 14 days and improvement in the skin lesion was achieved. Cough and radiological changes also subsided.

Results and discussion: Pneumonia usually develops as a result of the aspiration of the microorganism from the upper respiratory tract or through the bloodstream. Staphylococcal methicillin resistant *Staphylococcus aureus* (MRSA) infections are a particular problem. Poor hygiene conditions, close contact, contaminated material and damaged skin are some of the risk factors for the spread of MRSA infection in the population of non-hospitalized patients. In this patient, such a predisposing factor was alcohol and an attempt to remove a purulent lesion on her own in unsanitary conditions.

Conclusions: It should be remembered that skin infections may lead to complications in the form of staphylococcal pneumonia.

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1. INTRODUCTION

Staphylococcal (*Staphylococcus aureus*) infections may be local or systemic. In addition, there are characteristic diseases caused by staphylococcal toxins. Staphylococcal infections can be acquired both in and out of hospital. The most common local infections include: impetigo, folliculitis, furunculus, furunculosis and abscesses. On the other hand, cellulitis, fasciitis and erysipelas are less common local infections caused by staphylococci but are accompanied by severe symptoms.

One of the most severe local infections is necrotizing fasciitis, which is a special type of cellulitis with a fulminant course that requires immediate surgical intervention. The strains causing them often produce a leukocidin-like toxin (Panton–Valentine leukocidin – PVL), which is probably responsible for the rapid clinical features. These toxins are also responsible for the general symptoms that often accompany surgical site infections.[1]

In addition, *Staphylococcus* often causes bacterial conjunctivitis, upper respiratory infections such as otitis media and sinusitis. It is usually isolated from throat swabs, however it requires no treatment. It is estimated that at least 10% of healthy people are permanent carriers of *Staphylococcus aureus*, and 70%–90% are transient carriers.[2]

Blood infection can lead to secondary blood-borne infection in various organs such as locomotor system, kidneys, lungs and central nervous system. In these cases, the mortality rate is high, reaching even 50%.[3,4]

2. AIM

The authors present a case of a 25-year-old woman with inflammation of the subcutaneous tissue in the lower jaw area, who had a complication in the form of purulent pneumonia with numerous abscesses and pleurisy.

3. CASE STUDY

A patient, 25-year-old woman, was referred to Clinic of Dermatology in Olsztyn due to painful swelling of her cheek, jaw and chin on the right side that was growing for several days. The examination revealed not clearly defined erythema in this area. The skin was swollen and painful. In addition, there were single papules and comedones typical of adult acne in the area of the right corner of the mouth. The patient did not have atopic dermatitis or other factors promoting staphylococcal colonization (Figure 1).

A week earlier, the patient emptied the furuncle/pustule in this area on her own, which gradually worsened the swelling and pain. She had a temperature of up to 39°C for 2 days. For 3 days the patient had been taking clindamycin in a dose of 2 × 300 mg orally without any improvement.

The patient had a surgical consultation. Ultrasound examination of cheek and neck soft tissues showed reactive lymph nodes, without pathological vascularization (upper cervical, chin) and signs of subcutaneous tissue inflammation in the area of mouth, chin and lower lip on the right side. No purulent content was obtained in the exploratory puncture and the surgeon did not perform a bacteriological examination due to the lack of material.

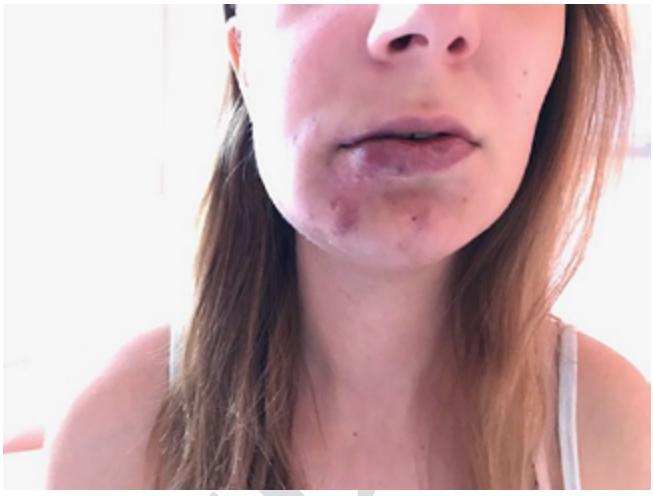

Figure 1. A 25-year-old woman with swelling of her cheek, jaw and chin on the right side with not clearly defined erythema in this area. There were single papules and comedones too.

The patient has not been treated for any reason so far. She reported drinking alcohol, sometimes in large amounts. She had no fever, cough and shortness of breath on the day of admission to the hospital. Physical examination revealed significant tenderness of her cheek, chin and neck on the right side. The heart rate was slightly accelerated (90 bpm) but regular and the tones were correctly accented. Normal alveolar murmur was found above the lung fields.

Laboratory tests showed high inflammatory markers on admission: CRP 435 mg/L, ESR 88 mm/h, procalcitonin 2.78 ng/mL. In addition, there were features of liver damage: AST 94.5 U/L, ALT 51 U/L. Virology tests (HIV, HCV, HBV and PCR testing for COVID19) were negative. During hospitalization, mild normocytic anaemia (Hb 11.6 g/dL, then 11.2 g/dL and 10.3 g/dL) was observed. The doctor admitting the patient to the clinic did not take a smear from the skin lesion due to lack of exudate. The blood culture was negative.

Initially, crystalline penicillin 4 × 6 mL i.v. was used, which was replaced with Biofuroxime 1500 mg twice a day i.v. and clindamycin 2 × 600 mg i.v. on the 2nd day. In addition, a prophylactic dose of low molecular weight heparin (Clexane 0.4 s.c.), Heparegen, intensive fluid therapy, Hydoxyzine 25 mg daily, Relanium 5 mg per night, Kalipoz prolongatum and Lacto DR were used.

There was a gradual improvement: erythema, swelling, soreness in the cheek and mandible areas subsided. In laboratory tests, a decrease in the level of acute phase protein (CRP) was observed, successively from 425 mg/L, 135 mg/L and 103 mg/L. On the 4th day of hospitalization, the patient

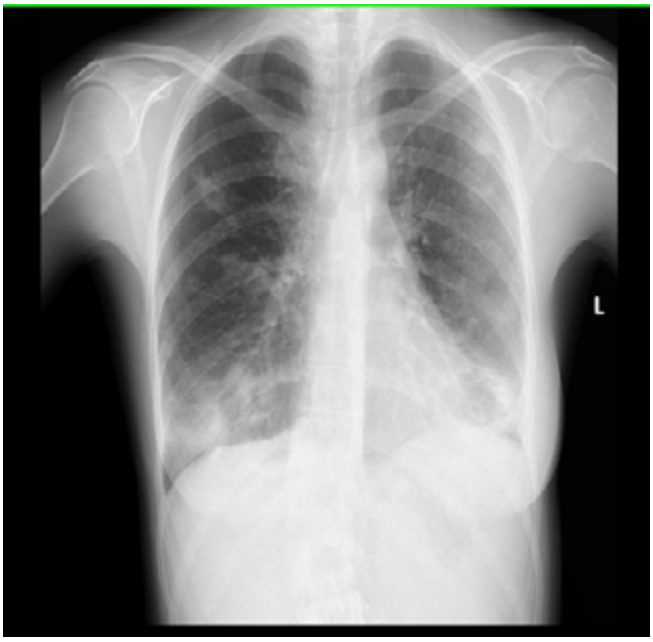

Figure 2. Chest X-ray image on the 4th day of hospitalization. Numerous circular shadows in the lung fields up to 24 mm in diameter, and fluid in the left pleural cavity reaching the anterior segment of the 4th rib.

developed a fever (38.2°C) and began to complain of a dry cough and pain in the left subscapular area. The physical examination revealed crackles in the lung base and the chest X-ray image showed numerous circular shadows in the lung fields up to 24 mm in diameter, in the shadow part of the cavity. In addition, there was fluid in the left pleural cavity reaching the anterior segment of the 4th rib (Figure 2). Therefore, the patient was transferred to the Centre for Pulmonary Diseases in Olsztyn.

Lung CT scan revealed: numerous disseminated lesions located mainly in subpleural area and along the interlobular fissures in both lungs, mostly with thick-walled gas-filled cavities, with some thick-walled cystic, some fluid, and in the basal parts passing into partially encysted fluid spaces in pleural cavities with a clearly thickened pleura. It was high-density (protein-rich) fluid, with clearly contrasting pseudo cyst walls and thickened pleura. Most of the lesions were surrounded by zones of heterogeneous densities of the pulmonary parenchyma with shades of a matte glass type, and interstitial small nodules or streaked thickenings of interlobular septa. The focal lesions in the lungs were about 20–29 mm, and the thickness of the reservoirs in the pleural cavities – about 25 mm (especially on the left side). In the mediastinum, there were paratracheal and subcranial lymph nodes (quite numerous, spherical, without breakdown) up to 10–11 mm in size and up to 13 mm in the armpits. The liver was partially enlarged and its left lobe reached the middle clavicle line of the left (Figure 3).

Pleural puncture was performed to obtain 800 mL of fluid from which the staphylococcus, strain methicillin-resistant *S. aureus* (MRSA) was cultured. Cardiac ultrasound showed no abnormalities. In laboratory tests, apart from mild neutropenia of 1200–1300 cells/μL and high inflammatory markers, no significant abnormalities were found. ANA, ANCA were negative and levels of immunoglobulins IgM, IgG, IgA were normal.

Intensive antibiotic therapy was used in the treatment: initially empirical Ceftazidime at a dose of 3 × 2.0 g i.v. (14 days) and Ciprofloxacin 2 × 400mg i.v. (7 days). After receiving pleural fluid cultures results, vancomycin 2 × 1.0 g i.v. was used according to the antibiogram test for 14 days, achieving further improvement in the area of the infiltrative skin lesion in the mandible area. Cough and radiological changes also subsided.

In the follow-up CT examination of the lungs after 13 days of treatment: the parenchyma of both lungs with diffuse, macular lesions (diffuse abscesses) and empty cavities of a similar number and location as in the initial examination, but smaller: maximally 15 mm. In addition, banded fibrosis in the basal segments without fluid in both pleural cavities were found.

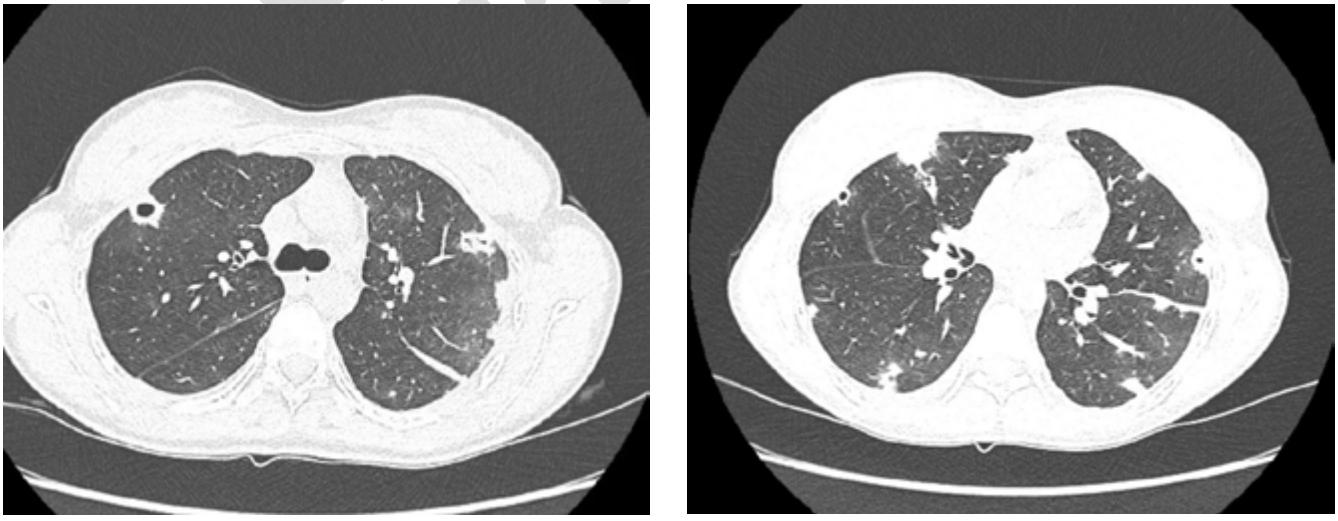

Figure 3. Selected CT scans of the lungs. Numerous disseminated lesions located mainly in subpleural area and along the interlobular fissures in both lungs, mostly with thick-walled gas-filled cavities, with some thick-walled cystic and some fluid.

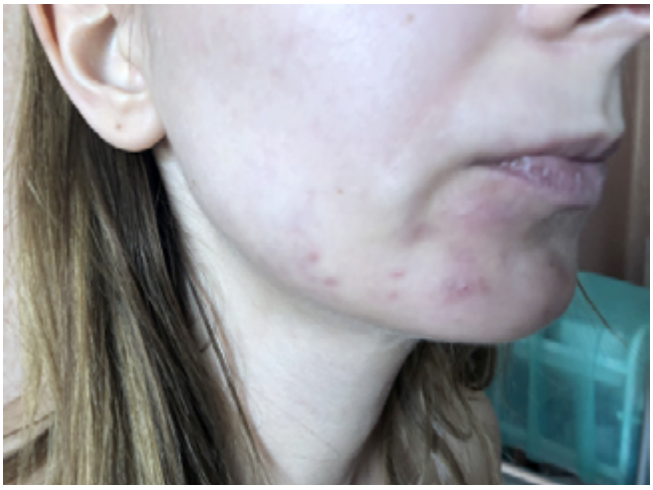

Figure 4. Improvement in skin lesions. Visible reduction of inflammation and swelling.

One month after hospitalization, during the follow-up visit in pulmonary clinic, complete regression of skin lesions was observed, and a lung X-ray image showed a slight hypopnea in the left diaphragmatic-costal angle (Figures 4 and 5). Laboratory tests showed normalization of all parameters except persistent neutropenia. Therefore, the patient was referred to a haematologist.

4. RESULTS AND DISCUSSION

Local infections caused by *S. aureus* are the commonest infectious diseases that patients report to dermatologists and general practitioners. It seems that in most cases the diagnosis allows to initiate appropriate treatment. However, the Infectious Diseases Society of America recommends smears for all patients treated with antibiotics for skin infections.[5] It should be remembered that in some situations a trivial skin infection can cause serious complications that can be life threatening. This is especially true of immunocompromised or debilitated patients and drug addicts.[6] Unfortunately, in our patients the swab from the lesion was not taken. The short time from the onset of skin lesions to symptoms of pulmonary inflammation suggests a possible common infectious agent.

Bacteria can reach the blood directly, especially during trauma, surgery or primary infections – including local ones. Endocarditis complicated by lung abscesses has been reported in drug addicts injecting drugs.[6] Pneumonia usually develops as a result of the aspiration of the microorganism from the upper respiratory tract or through the bloodstream. Although staphylococcal pneumonia is rare, it is one of the most severe infections of this type. They are more common in hospitalized, mechanically ventilated, immunocompromised patients as well as patients with cystic fibrosis, hyper-IgE syndrome and during epidemic periods of influenza. The influenza virus increases the frequency of *S. aureus* in throat and interferes with the function of the cilia, which impairs the elimination of bacteria. Local skin infections can cause bacteremia and blood-borne pneumonia. Lung infections often appear within two weeks after developing sepsis.[6,7]

However, haematogenic pneumonia most often affects patients with infected vascular catheters, and its frequent complication is lung abscess. Diabetes mellitus, positive skin and soft tissue culture, alcoholism and chronic obstructive pulmonary disease are also risk factors for the development of sepsis.[8,9] In our patient, excessive alcohol use could be a factor that lowered her immunity. Alcoholics are particularly susceptible to bacterial pneumonia of all types, including Gram-positive and Gram-negative bacteria, aerobic and anaerobic bacteria, mycobacterial bacteria.[10] There are many factors that likely contribute to the increased incidence of pneumonia in the alcoholics. It is well documented that alcohol affects phagocytic cell function in many ways. In addition to affecting tissue macrophages, alcohol negatively affects many neutrophil functions. Among other things, it inhibits their chemotaxis and causes abnormal adhesion of neutrophils to the vascular endothelium. Moreover, alcohol consumption alters the expression of tumor necrosis factor (TNF), a cytokine that initiates a proinflammatory response. There is an increase in the level of circulating TNF, as well as IL-1 and IL-6.[11] T-cell proliferation is also inhibited by alcohol, though the mechanism responsible for this observation remains unclear. Therefore, once the bacteria reach the alveolar spaces, they are less likely to be successfully cleared in these patients due to changes in both the innate and acquired immune responses.[12]

Although streptococci seems to be a typical pathogen in cellulitis, MRSA (35.7%) was the most common isolated

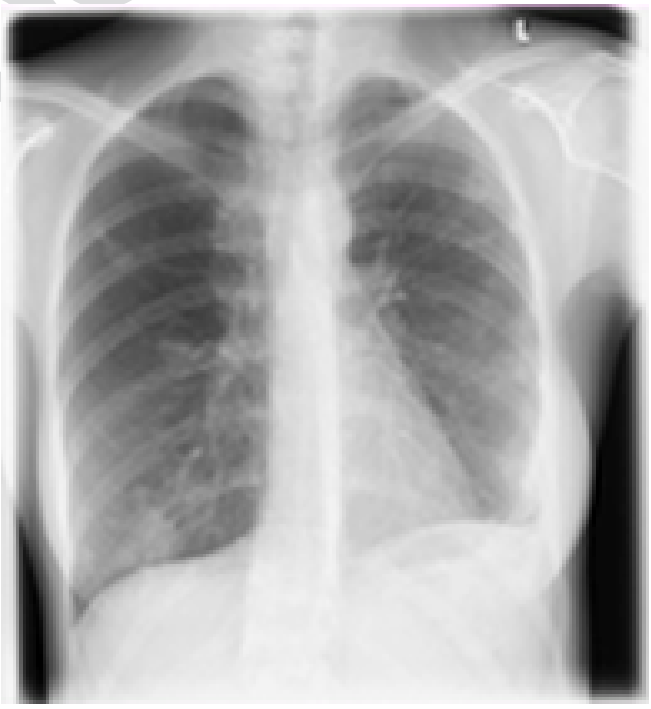

Figure 5. Improvement in lung changes in chest X-ray. A slight hypopnea in the left diaphragmatic-costal angle.

pathogen in the Lasa study of 140 hospitalized patients with this diagnosis. However, in case of accompanying bacteremia, the most frequently isolated bacteria were the group G haemolytic streptococci (33%).[8]

Staphylococcal MRSA infections are a particular problem. Over the last two decades, an increasing incidence of skin and soft tissue infections, head and neck infections and bacteremia has been reported in 5%–10% of people.[13,14] This strain is usually associated with nosocomial infections (occurs more than 48 h after hospitalization), and in patients who have been hospitalized in the last 12 months, or in people who are residents of long-term health care centers. The third category is MRSA infections outside health care centers among people who have not been previously hospitalized, which applies to our patient.[14] American studies have shown an increase in infection with this strain in patients in the latter group. It was found that poor hygiene conditions, close contact, contaminated material and damaged skin are some of the risk factors for the spread of MRSA infection in the population of non-hospitalized patients.[14] In our patient, such a predisposing factor was alcohol and an attempt to remove a purulent lesion on her own in unsanitary conditions.

Our patient had a MRSA-pneumonia, and possibly a community-acquired (CA)-MRSA expressing the PVL gene. PVL is present in majority of community associated MRSA isolates and rarely present in hospital isolates, therefore it is recognized as marker of community acquired strains.[15] PVL is a cytotoxin that causes leukocyte destruction and tissue necrosis. Clinical data indicate in particular a correlation between PVL-positive *S. aureus* strains and severe, including fatal, cases of CA-MRSA necrotizing pneumonia.[16] Typical patients have a predisposing viral infection, leukopenia, blood cultures positive for *S. aureus*, and a chest radiograph showing pneumatoceles or patchy infiltrates over the lungs.[17,18] By contrast, hospital-acquired staphylococcal pneumonia is rarely associated with a necrotic process. Cases secondary to hematogenous dissemination from another focus such as an indwelling intravenous device were not associated with PVL gene-positive *S. aureus* strains either. There is no explanation for the lack of typical nosocomial pneumonia with necrotic lesions associated with PVL-producing strains.[19]

The case of our patient shows how important it is to monitor the condition of a patient with local skin infection for possible complications. Our case shows how confusing the symptoms of clinical improvement in the skin can be. Additionally, she had a negative blood culture and a gradual decrease in inflammatory parameters. Fortunately, the doctor on duty was concerned about the patient's coughing, which led to performing a chest X-ray.

The importance of early implementation of antibiotic therapy is confirmed by the case of a 17-year-old patient described by Buwald and Speelberg, in whom a trivial skin infection led to staphylococcal pneumonia and death.[20]

5. CONCLUSIONS

It should be remembered that skin infections may lead to complications in the form of staphylococcal pneumonia. It is a life-threatening condition, therefore a prompt antibiotic therapy in case of staphylococcal skin infections is very important, especially if the infection affects deeper layers of the skin and subcutaneous tissue.

Conflict of interest

None declared.

Funding

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