



Case reports

LUNG ABSCESS—A RARE COMPLICATION IN HEMODIALYSIS PATIENTS WITH A CENTRAL VENOUS CATHETER

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SUMMARY:

Nowadays, lung abscess is a rare purulent infection of the lung. In recent decades, its frequency has significantly decreased in connection with the widespread use of antibiotics.

Recently, the number of patients with end-stage renal disease undergoing hemodialysis with central venous catheters has increased significantly. One of the most common complications in these patients is catheter-associated infections. Although rare, cases of metastatic infectious foci have also been described.

We report two clinical cases of pulmonary abscess secondary to catheter-associated infection in hemodialysis patients with a tunneled catheter and provide a brief overview of the problem.

Keywords: lung abscess, hemodialysis treatment, central venous catheters, catheter-associated sepsis

BACKGROUND:

Lung abscess is a purulent-inflammatory disease of the lung with the formation of one or more cavities larger than 2 cm in size, containing remnants of necrotic tissue or fluid caused by microbial infection [1]. Mortality from lung abscess has historically been too high; approximately 3/4 of untreated patients were fatal. In recent years, lung abscess mortality has been less than 10% due to the widespread use of antibiotics and the introduction of percutaneous drainage as a treatment method [2].

Hospitalized patients with lung abscess in the United States in 1974 were 40 to 55 per 100,000 [3].

Lung abscess is classified according to different signs:

1. According to the duration:

- Acute (less than 6 weeks)
- Chronic (more than 6 weeks)

2. According to the distribution path:

- Bronchogenic (aspiration of oropharyngeal secretion, bronchial obstruction from a tumor or foreign body)

- Hematogenous (abdominal sepsis, infective endocarditis, infected central venous catheters, septic thromboembolism)

3. According to the etiology:

- Primary (aspiration of oropharyngeal secretions, necrotizing pneumonia, immune deficiency)

- Secondary (in case of bronchial obstruction, hematogenous dissemination, mediastinal infection, underlying lung diseases) [1].

The most common causes of lung abscess are anaerobic bacteria. The role of Gram negative [G (-)] and Gram positive [G (+)] bacteria is smaller.

In recent years, the number of patients with end-stage renal disease undergoing hemodialysis has increased significantly. In dialysis patients, the choice of vascular access is still an existing problem. One of the main vascular accesses for hemodialysis treatment is through central venous catheters (CVCs).

Despite the efforts of specialists to reduce up to 10% the use of CVCs for hemodialysis treatment, their use in recent years has significantly increased - up to 20% - 30% in European countries, and in the USA and Canada, up to 40% of vascular access. Catheter-related bloodstream infection (CRBSI) is one of the most common late complications of CVC use as hemodialysis vascular access. It is defined as a condition in which microorganisms are isolated from the blood of the patient with CVC with/without clinical manifestations. Catheter-associated sepsis is the clinical manifestation of catheter-related infection and is characterized by fever, febrile condition, hypotension, and a positive blood culture [4]. The incidence of bacteremia was estimated to be 1.8 to 6.2/1000 catheter-days (CD) for tunneled and non-tunneled catheters, respectively [5]. Metastatic complications such as endocarditis [6], osteomyelitis, abdominal abscess [7], infectious ar-

thrititis, catheter sepsis, etc., have an incidence of about 1.1/1000 CD [5].

In a retrospective study of 2168 patients undergoing hemodialysis treatment at Chang Gung Memorial Hospital in Kaohsiung, Taiwan, for the period October 1986 to January 2000, sixteen cases of metastatic abscesses of various locations were found - liver (8 cases), lung (5), spleen (1), perianal region (1), psoas muscle (1) and prostate (1) [8].

We hereby describe two clinical cases of pulmonary abscess in hemodialysis patients with tunneled catheters and provide a brief overview of the problem.

DESCRIPTION OF CASES:

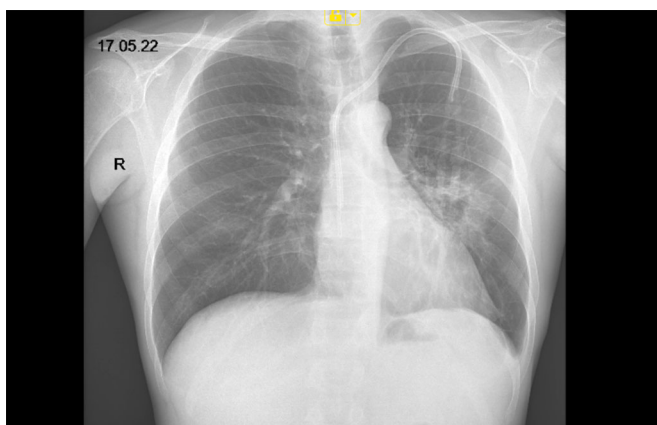
CASE 1

A 35-year-old man, Caucasian race with biopsy-proven chronic mesangiocapillary glomerulonephritis was treated pathogenetically with corticosteroids and immunosuppressants. He has a history of drug addiction, chronic viral hepatitis, episode of acute pancreatitis, and has twice treated for phlegmon of the lower extremities.

Due to the end stage of renal disease, hemodialysis treatment was started in 2021. Dialysis is performed through a tunneled catheter placed in v. subclavia sinistra due to exhausted vascular access.

In May 2022, he was hospitalized with complaints of asthenodynamia, fever and febrility after another hemodialysis session. Empirical therapy with gentamicin was initiated. Three days after the onset of the complaints, a lung x-ray showed an abscess with pneumonia in the left lung (Figure 1).

Fig. 1. Chest radiography with an abscess on the left lung.



Subsequent computed axial tomography (CAT) confirmed a left lung abscess (Figures 2 and 3)

Fig. 2. CAT data of lung cavity in the left lung (longitudinal section).

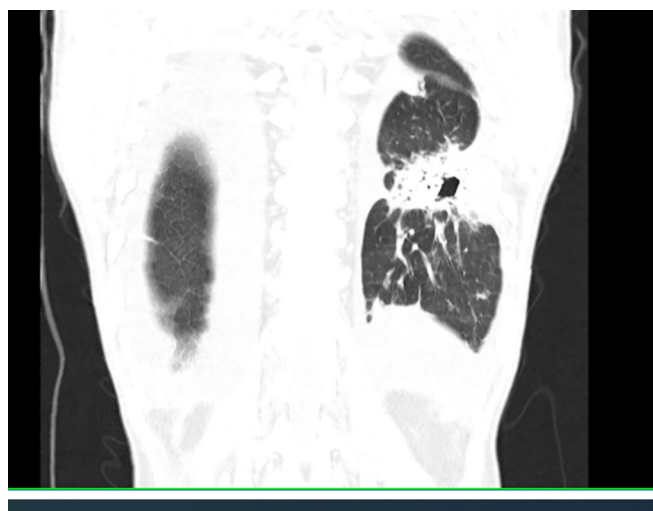
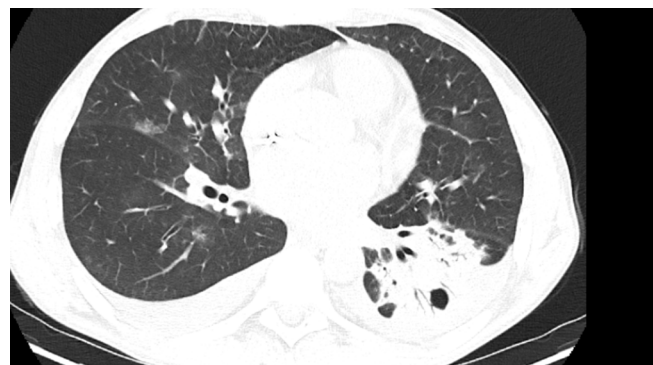


Fig. 3. CAT data of lung cavity in left lung (cross section).



From the blood tests: ESR-76/110 mm.; Hemoglobin-72, 75, 82 g/L.; Erythrocytes- $2.21-2.34-2.44 \times 10^{12}$; Leukocytes- $1.6-2.3-8.9 \times 10^9$; Platelets-71-60-114 $\times 10^9$; MCV-97, 96, 95; MCH -33, 34, 33; MCHC-336, 332, 344. CRP-117 mg/L.

Staphylococcus aureus was isolated from the blood culture through the catheter. Microbiological examination of the catheter tip revealed no bacterial growth.

Ultrasound examination of abdominal organs showed no evidence of a metastatic focus in the liver, spleen, pancreas, kidneys and abdominal cavity.

Echocardiography: intact valve apparatus, no evidence of vegetations.

The patient received parenteral therapy sequentially with vancomycin, linezolid, and reduced-dose colistin for 6 weeks. The use of potent antibiotic therapy was necessitated by the patient's septic condition, blood test results for pancytopenia, and the severe course of the pulmonary process.

The tunneled catheter was removed immediately, and a temporary one was placed. After two weeks of treat-

ment, a new tunneled catheter was implanted in the right subclavian vein with a supraclavicular approach.

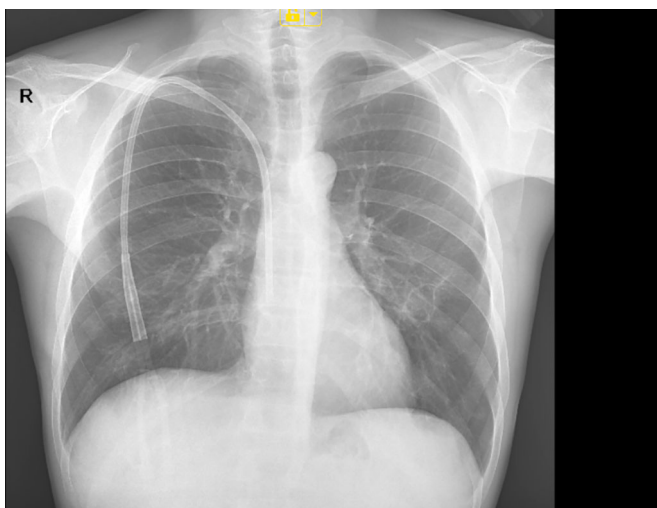
The therapy additionally included treatment with immunovenin, as well as infusions with water-salt solutions, a short seven-day course with methylprednisolone at a dose of 20 mg/daily. The patient also took an anti-fungal medication throughout the course of the antibiotic treatment.

As a result of the therapy, the clinical symptoms subsided on the fifth day; on the fifteenth day of treatment, the blood culture was negative.

Six months after the incident, the patient has no complaints.

The radiograph of the lung showed no abscess cavity (Figure 4).

Fig. 4. Without an abscess cavity.



CASE 2

A 40-year-old Caucasian male on hemodialysis treatment since 2016 due to diabetic nephropathy. The vascular access is a tunneled catheter. Accompanying diseases: hypertensive heart disease, insulin-dependent diabetes mellitus, secondary anemia. Risk factors: 40 pack-year smoker.

In October 2018, he was hospitalized due to fever, temperature up to 38°C, general fatigue, stabbing pain in the chest and cough with scanty expectoration.

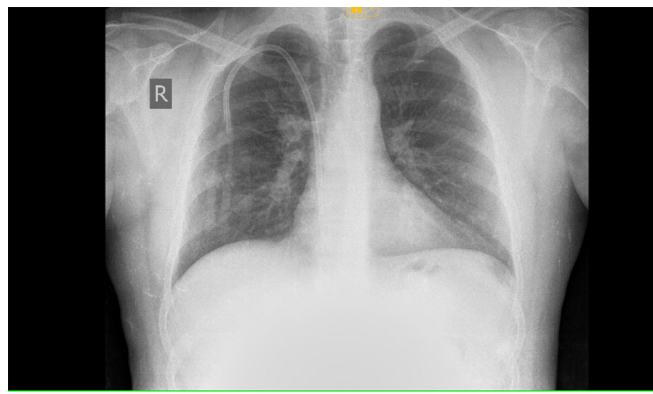
From the physical examination: poor condition, pale skin and visible mucous membranes, fever up to 37.8°C. Blood pressure 160/90 mmHg. No other pathological abnormalities.

From the blood tests: Leukocytes – 14.8-8.9x10⁹; Erythrocytes -3.5-3.57x10¹²; Hemoglobin-109-113 g/L; Hematocrit-0.316-0.319; MCV-88-89.2; MSH-30.6-31.5; MSNS-343-356; Platelets-183-242x10⁹; Differential count: Lymphocytes-7% Monocytes-3%; Granulocytes-90%.

Pseudomonas putida was isolated from a blood culture. Microbiological examination of the catheter tip revealed no bacterial growth.

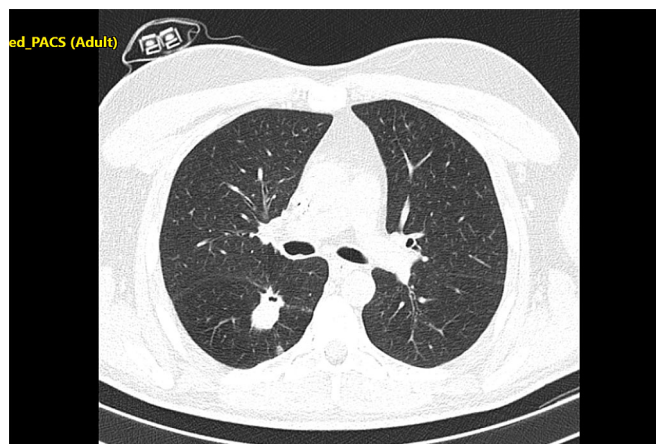
From the X-ray of the lung, a hollow shadow with sharp outlines, scalloped in places, dimensions 21/19 mm, is projected in the region of the right hilus. (Figure 5).

Fig. 5. Abscess cavity in the area of the right lung hilus.



Computed tomographic examination revealed a heterodense infiltrative lesion with axial dimensions of 60/23 mm and a centrally located cavity with an area of necrosis and decay (Figure 6).

Fig. 6. CAT data of an abscess cavity in the right lung.



Fibro-bronchoscopy revealed strong hyperemia of the 6th segment on the right with a flow of purulent discharge.

Echocardiography: intact valve apparatus, no evidence of vegetations.

From the performed ultrasound examination of abdominal organs - no other metastatic foci were found.

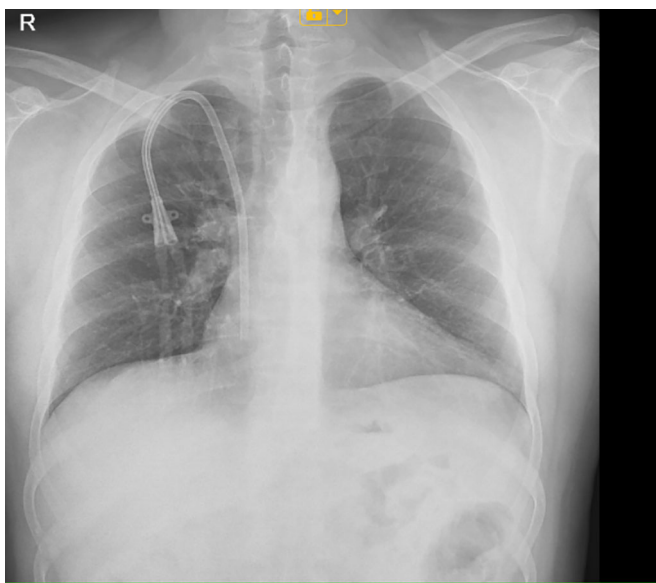
Conducted a two-week course with ceftazidime and metronidazole. After the fever was controlled, the tunneled catheter was replaced over the metal guidewire. Due to

the rapid and favorable effect on the general condition, the patient was discharged on the second week and continued treatment with levofloxacin for another four weeks in an outpatient setting. Simultaneously with the antibiotics, the patient was also taking an antifungal medication.

At a follow-up examination after six months, the patient feels well, but on the X-ray, there is a rounded shadow in the area of the right lung hilus without evidence of a cavity, which was also confirmed after CAT, but the follow-up bronchoscopy did not find evidence of a residual cavity, tumor process or inflammation.

Four years later, the patient is doing well, with persistent residual fibrotic changes on chest X-ray (Figure 7).

Fig. 7. Control roentgenography of the fourth year.



DISCUSSION:

The clinical description and treatment of lung abscess cases dates back to the time of Hippocrates. In the past, the mortality rate was very high compared to the last decades, when the use of antibiotics was widely used in medical practice [1, 2]. However, reported fatal outcomes are highly variable across regions [9, 10]. In almost all publications, male gender is indicated as a significant risk factor for the development of lung abscess [12, 13].

The frequency of lung abscesses in patients over 40 years of age is greater, caused primarily by anaerobes, followed by Gram (-) microorganisms, polymicrobial flora and less often by Gram (+) microorganisms. Regarding the size of the abscess cavity, cases with a size of 40/50 mm are frequently reported [2]. The clinical presentation can be variable in different types of abscesses, but the main signs are fever, febrility, chest pain, cough with or without expectoration. Radiography and/or computed tomography with data on an abscess cavity, as well as micro-

biological examination, are of utmost importance for establishing the diagnosis [14].

In recent years, the number of patients with end-stage renal disease undergoing dialysis treatment with CVC has been increasing. Their longer use leads to complications – catheter-associated sepsis [15] and metastatic septic foci of different localization. The incidence of metastatic complications in catheter-associated sepsis has varied in different initial reports. Hematogenous lung abscesses as a result of an infected CVC differ to a certain extent from bronchogenic ones. They are rarer and smaller in size but affect patients at a younger age and are more often caused by Gram (+) microorganisms [2].

The treatment of the lung abscess should be carried out according to the result of the microbiological examination and the antibiogram obtained from it. Empiric therapy is provided only in cases where there is no isolated pathogenic microorganism. In this case, treatment should be tailored to the type of abscess, the route of spread, risk factors and concomitant diseases. Treatment with clindamycin and amoxicillin/clavulanic acid is recommended.

In recent years, treatment with clindamycin as empiric therapy has been used less frequently due to the risk of *Clostridium difficile* infection [16]. β -lactam antibiotics with β -lactamase inhibitors - ticarcilin-clavulanate, ampicillin-sulbactam, amoxicillin-clavulanate, piperacilin-tazobactam - are playing an increasingly important role in the treatment of lung abscess. In recent years, there have been reports of a good effect when using quinolones of the third generation - moxifloxacin, levofloxacin. Treatment with metronidazole as monotherapy is not recommended, but in combination, it has a very good effect, especially in cases with the participation of anaerobic flora. For the treatment of methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin and linezolid have a very good effect [1]. In the presence of polymicrobial flora, very good effects are reported with meropenem therapy [1].

Tunneled catheters should be removed immediately in patients with CRBSI associated with any of the following conditions: severe sepsis; purulent thrombophlebitis; endocarditis; a septic condition that persists for >72 hours despite adequate antimicrobial therapy or infections due to *S. aureus*, *P. aeruginosa*, fungi, or mycobacteria. Recommendations are for at least 6 weeks of antibiotic treatment in the presence of metastatic infections [17].

With an unsatisfactory effect of antibiotic therapy, it is necessary to think about a complication and discuss the need for surgical intervention [18].

Failure of lung abscess treatment can be associated with death, chronicity of the process with a residual abscess cavity, or fibrotic lung changes [2].

Hematogenous lung abscesses are less fatal than bronchogenic ones and respond better to antibiotic treatment.

CONCLUSION:

We present two clinical cases of lung abscess as a metastatic infectious complication of catheter-associated

sepsis in patients undergoing hemodialysis with a tunneled catheter.

In our opinion, the search for metastatic inflammatory foci in these cases should become part of good clinical practice because it will lead to an improvement in treatment strategy and the outcome of the disease.

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