

Case Report



A Case Report of a Patient with Breast Cancer along with *Providencia* and *Sphingomonas* Wound Infection and Brain Abscess Caused by *Staphylococcus epidermidis*

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Abstract

Introduction: Infectious wounds and brain abscesses endanger the health of cancer patients. In this review, a case of an infected wound and brain abscess infected by bacteria from a patient with breast cancer is presented.

Case Report: The patient was a 42-year-old woman with a history of breast cancer and brain tumor, and the presence of *Providencia species* and *Sphingomonas* in the breast wound and *Staphylococcus epidermidis* (*S. epidermidis*) in the cerebrospinal fluid (CSF) was identified. The patient was treated with co-amoxiclav, clindamycin, ceftazidime/avibactam, metronidazole, imipenem/cilastatin, ceftazidime, vancomycin, and rifampin and was discharged with a stable and favorable general condition. The patient presented with a breast wound infected with *Providencia* and *Sphingomonas* and a brain abscess infected with *S. epidermidis*.

Conclusion: Due to the susceptibility of cancer patients to infections, it is important to choose appropriate antibiotics and follow up with these types of patients.

Keywords: Breast cancer, Wound infection, Brain abscess

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Introduction

Wound infections, whether occurring in an intentional operative incision, an acute laceration, or a chronic pressure ulcer, may be caused by either native or exogenous bacteria that overcome local and systemic factors of host resistance.^{1,2} Patients admitted to the hospital for extended periods or those with underlying diseases are particularly susceptible to hospital-acquired wound infections, as the number and types of microbes on the skin increase.^{3,4} In a case report, *Providencia rettgeri* (*P. rettgeri*) was isolated from a polymicrobial infection,⁵ and *Sphingomonas paucimobilis* (*S. paucimobilis*) was isolated from the bedsores of a patient with multiple myeloma.⁶ Moreover, wound infections can spread to nearby or distant sites, including the brain. A local purulent lesion in the brain parenchyma, known as a brain abscess, can be caused by various types of microbes, including bacteria. In one case, methicillin-resistant *Staphylococcus epidermidis* (*S. epidermidis*) was isolated from the cerebrospinal fluid of an infant.⁷ Malignant ulcers in cancer patients occur when tumors spread, causing the skin and surrounding blood vessels to become involved and rupture. These wounds are

painful, malodorous, and prone to bleeding, making them particularly problematic and difficult to heal.⁸ In cancer patients, infections can pose a serious threat. Especially if the cancer is in an advanced stage, delays in diagnosis and treatment can worsen the patient's condition and reduce the chances of recovery. Therefore, early detection of infections is important. Considering the importance of quality of life and health of cancer patients, this review presents a rare case report of an infected wound in a cancer patient. From the patient's breast wound, *Providencia* and *Sphingomonas* species were isolated, and from the patient's brain abscess *S. epidermidis* was identified.

Case Presentation

The patient was a 42-year-old woman from a village with a history of high blood pressure, breast cancer (left mastectomy), and a brain tumor (undergoing surgery). She was referred to Ayatollah Rouhani Medical Center (Babol University of Medical Sciences) due to fever, chills, and a purulent wound in the mastectomy breast area, which had started a week before her referral on 2022 June 14. Ultrasonography of the wound revealed increased



echogenicity of the dermis and hypodermis, along with fluid echogenic lines exhibiting a cobblestone appearance. There was evidence of a micro-collection with a volume of approximately 0.3 ml, which was not capable of drainage. Five days later, on 2022 June 18, the patient underwent surgical removal of the pathological breast lesion and sampling. A biopsy was performed using the coaxial technique, promoted to diagnostic accuracy of computed tomography (CT) scan with intravenous injection of anesthetics. The pathology diagnosis for the breast tissue indicated invasive and disseminated malignant neoplasm, characterized by epidermal and subcutaneous involvement, as well as invasive ductal carcinoma of the breast. Culturing the wound sample using clinical laboratory microbiology methods showed the presence of bacteria of the genus *Providencia* (Gram-negative bacillus),⁹ and *Sphingomonas* (Gram-negative bacillus).¹⁰ Disc diffusion testing determined that the *Providencia* and *Sphingomonas* antibiotic susceptibility pattern (Table 1).¹¹

The patient was treated with co-amoxiclav (625 mg), clindamycin (300 mg), ceftazidime-avibactam (2 g/500 mg), and metronidazole (500 mg) and was discharged in stable condition on January 24, 2023. The patient returned on 2022 July 2, complaining of headache, dizziness, nausea, vomiting, and blurred vision. The patient had no history of congenital heart disease or low blood oxygen levels. However, they were diagnosed with cyanotic congenital heart disease. A CT scan of the brain revealed a brain abscess and edema. Cerebrospinal fluid (CSF) culture indicated the presence of *S. epidermidis* (Figure 1).

Laboratory tests showed the following results:

Table 1. *Providencia* and *Sphingomonas* antibiotic susceptibility pattern

Bacteria	AMI	GEN	TRI-SUL	MEM	NA	CTZ	CTZ	CIP
<i>Providencia</i>	S	S	S	S	M	M	M	R
<i>Sphingomonas</i>	S	S	S	Non-use	Non-use	S	S	S

*AMI: Amikacin (30 µg), GEN: Gentamicin (10 µg), TRI-SUL: Trimethoprim-Sulfamethoxazole (1.25-23.75 µg), MEM: Meropenem (10 µg), NA: Nalidixic Acid (30 µg), CTZ: ceftazidime (30 µg), CIP: ciprofloxacin (5 µg), S: sensitive, M: Moderate sensitivity, R: Resistance



Figure 1. Presence of abscess and edema in the brain

hemoglobin 9.5 g/dl, platelets: 229,000 per cubic millimeter (mm³), blood urea nitrogen 7 mg/dL, Creatinine 0.6 mg/dL, Sodium 135 mmol/L, potassium 3.5 mmol/L, red blood cell sedimentation rate 25 mm/h, and C-reactive protein 135 mg/L. The patient underwent a craniectomy and abscess drainage, followed by transfer to the intensive care unit (ICU). Five days later, due to a decrease in the level of consciousness and a diagnosis of hydrocephalus, an external ventricular drainage catheterization was performed. The patient was conscious, with a Glasgow Coma Scale score of 15. They exhibited unilateral mydriasis (pupil dilation), squint, and blurred vision. Ventricular fibrillation had reduced. Sensation and movement on both sides of the face were similar and uniform, with no swallowing disorder, speech issues, or vocal abnormalities. Shoulder and neck movements were normal. The patient's vital signs were as follows: blood pressure: 130/80 mm Hg, heart rate: 89 beats per minute (BPM), blood oxygen saturation: <98%. After one week in the ICU, the patient was transferred to the general ward. A follow-up CT scan of the brain showed evidence of successful abscess drainage. During this period, infectious consultations and antibiotic treatments were administered. The most important medications prescribed included apotel (1 g), depakine (200 mg), dexamethasone (8 mg), midazolam (2 mg), morphine (5 mg), ondansetron (4 mg), acetazolamide (500 mg), phenytoin (100 mg), pantoprazole (20 mg), imipenem/cilastatin (500+500 mg), ceftazidime (30 µg), metronidazole (500 mg), intravenous vancomycin (1 g), and rifampin (600 mg). Finally, the patient was discharged in a favorable general condition with no neurological deficits.

Discussion

This study examined a breast cancer patient with a wound infection in her mastectomized left breast caused by *Providencia* and *Sphingomonas*. To prevent and manage wound infections effectively, it is essential to identify the infectious cause, ensure proper wound repair, and achieve satisfactory healing. In cancer patients, malignant wounds involve the infiltration of tumor cells into the skin tissue, often associated with incurable stages of the disease. These wounds can cause significant discomfort, including unpleasant odors, discharge, and pain.¹ Fromantin et al. conducted a 42-day study on malignant wounds in 40 breast cancer patients under 18 years old, identifying pathogenic bacterial biofilm in 32 wounds and normal bacterial flora in 25 wounds. However, no infections occurred during their evaluation period. In contrast, our patient's initial tests showed an erythrocyte sedimentation rate of 40 mm/h and a white blood cell count of 16,300 per microliter of blood, indicating an infection.¹² Tada et al. reported the isolation of *P. rettgeri* from wound pus resistant to carbapenems (imipenem and meropenem), whereas, in our study, *Providencia* was sensitive to meropenem.¹³ *Providencia* is a rare bacterium in wound infections, typically found in environments such as fresh water, sewage, and contaminated soils. It can cause infections when the immune system is compromised. Surgical wound infection is the most common complication after breast cancer surgery, influenced by various factors including the type of surgery, implants, comorbidities, previous surgeries, chemotherapy, surgical drains, serous fluid accumulation, blood transfusions, surgical department, and length of hospital stay. In this study, the patient later developed a brain abscess, with cerebrospinal fluid culture revealing *Staphylococcus epidermidis*. Brain abscesses, areas of localized necrosis with a surrounding membrane within the brain parenchyma, are typically caused by infections, trauma, or neurosurgery.^{1,14} Bokhari and Mesfin reported that brain abscesses constitute approximately 8% of intracranial masses in developing countries and 1-2% in Western countries, with an incidence of about 4 cases per million population. The most common microbes isolated from brain abscesses are *Staphylococcus* and *Streptococcus*.¹⁴ Moskatel et al. described a 73-year-old woman with a brain abscess caused by *Staphylococcus intermedius* (*S. intermedius*), diagnosed with hereditary hemorrhagic telangiectasia and pulmonary artery malformation. The patient underwent brain abscess resection and received vancomycin, rifampin, and metronidazole, similar to the treatment in our study.² Khullar et al. reviewed a case of a 61-year-old woman with headache, fever, behavior changes, and seizures, diagnosed and treated for left breast cancer five years prior. Their patient, similar to ours, had a headache and fever and was diagnosed with brain metastasis, underwent craniotomy, and abscess drainage. Gram stain showed gram-positive cocci in her cerebrospinal fluid. After a month of treatment, she

was discharged in stable condition. Brain metastasis, a common occurrence in breast cancer patients, involves the spread of neoplasms from other tissues to the central nervous system. Infections are the second leading cause of death in cancer patients, and antibiotic resistance poses a significant threat to cancer treatment success.⁴ Tan et al.'s study found that the most common (9%) postoperative complication was surgical wound infection. Therefore, a review of wound infection history is crucial in the postoperative care of breast cancer patients.¹⁵ In a study by Banuelos et al breast cancer patients with high body mass index (BMI) and hypertension, undergoing neoadjuvant chemotherapy, axillary lymph node dissection, and postoperative seroma, were significantly associated with surgical site infection.¹⁶ This case report emphasizes the impact of infections in cancer patients, underling the need to investigate risk factors and etiology to prevent and treat antibiotic-resistant infections, thereby improving cancer care outcomes. As this study is limited to a single case, it does not capture all clinical features of the patient due to the limitation of words in the short report. Therefore, we recommend that similar cases be examined in larger research articles or case series in future studies.

Conclusion

In the present study, a patient with breast cancer developed a breast wound infection involving *Providencia* and *Sphingomonas*. Subsequently, the female patient also encountered a brain abscess caused by *S. epidermidis*. *Providencia* was found to be resistant to ciprofloxacin; however, all three pathogens—*Providencia*, *Sphingomonas*, and *S. epidermidis*—responded positively to the prescribed antibiotics. The patient was eventually discharged in favorable condition following successful treatment of the infections.

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Competing Interests

The authors declare that they have no conflict of interest.

Ethical Approval

This project has been approved by the Babol University of Medical Sciences (IR.MUBABOL.HRI.REC.1403.001).

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