

Original Article



A Case of Chronic Cranial Osteomyelitis Caused by *Klebsiella Aerogenes*

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Abstract:

Background: *Klebsiella aerogenes* is an opportunistic pathogen that can cause respiratory, gastrointestinal, and urinary tract infections; however, chronic osteomyelitis caused by this pathogen has not been reported in the literature.

Case Presentation: In this article, we report a case of a patient who presented with symptoms of chronic osteomyelitis after craniocerebral trauma and was diagnosed with chronic cranial osteomyelitis of *K. aerogenes* on the basis of imaging and wound secretion culture.

Conclusions: For patients with a history of previous fracture, bacterial culture should be carried out promptly when the wound does not heal and pus forms in the sinus tract. Antibiotics should be targeted according to the results of bacterial culture to avoid delaying the condition.

Keywords: *Klebsiella aerogenes*; skull; chronic osteomyelitis; secretion culture

1. Introduction

Klebsiella aerogenes belongs to Enterobacteriaceae, which is a group of facultative anaerobic Gram-negative bacilli, and mainly infects the intestinal tract, respiratory tract, and urinary tract through wounds, instruments, and other pathways; it is a common pathogen in nosocomial infections of patients in the Department of Critical Care Medicine after mechanical ventilation and is susceptible to infective shock at the initial stage of infection, with a high mortality rate¹⁻³. Wesevich et al⁴. showed that bloodstream infections caused by *K. aerogenes* have poor clinical prognosis. Common causative agents of chronic osteomyelitis are *Staphylococcus*, *Streptococcus*, *Escherichia coli*, and *Enterobacter cloacae*⁵⁻⁷. Chronic osteomyelitis caused by *K. aerogenes* is extremely rare. This paper reports a case of chronic skull osteomyelitis caused by *K. aerogenes*.

Case Report

A 23-year-old female was admitted to our hospital due to "repeated pus discharge after brain trauma for more than 5 months." On August 16, 2018, she underwent "intracranial hematoma debridement and cranial bone fragment removal under general anesthesia" at the Second Affiliated Hospital of Lanzhou University due to an intracranial hematoma. After the operation, the patient's wound repeatedly flowed pus. On September 26, 2018, she was transferred to the Burns and Plastic Surgery Department of our hospital for VSD and was given symptomatic treatment with wound dressing change. After being discharged from the hospital, the wound was still discharging pus repeatedly, and the patient and her family were admitted to our hospital for further diagnosis and treatment as "chronic osteomyelitis of the skull after craniocerebral trauma surgery."

Physical examination was performed on admission, with the following findings: temperature of 36.4 °C, blood pressure of 99/73 mmHg, respiration of 18 times/min, and pulse of 91 times/min.

Blood routine on admission had the following results: leukocyte count of $3.83 \times 10^9/L$, neutrophil count of $1.86 \times 10^9/L$, neutrophil percentage of 48.6%, lymphocyte percentage of 41.0%, erythrocyte count of $4.24 \times 10^{12}/L$, hemoglobin level of 102 g/L, C-reactive protein level of 18.14 mg/L, and calcitoninogen level of 0.177 ng/mL.

Imaging examination was conducted at the time of admission. The patient's cranial X-ray showed the following: the right side of the skull has metal internal fixation, missing a local bone, irregular morphology, and bone density

reduction; the rest of the skull inside and outside the plate and plate obstacle bone structure is complete, no bone damage and fracture signs, the pterygoid saddle bony structure and size is normal, pathological calcification is not seen within the skull. Cranial CT scanning showed normal cranium morphology and size, the right side of the parietal bone of the temporal bone was partial. Bone was absent, and high-density internal fixator shadow was seen; local bone erosion, destruction, absence, and broken bone fragment shadow were seen; local bone in the right temporal lobe was lost in normal form and patchy low density shadow was seen with blurred edges; and the soft tissue of the scalp of the right temporal parietal was thickened and the corresponding part of the cranial plate was rough; the findings are consistent with changes in chronic osteomyelitis (Fig. 1).

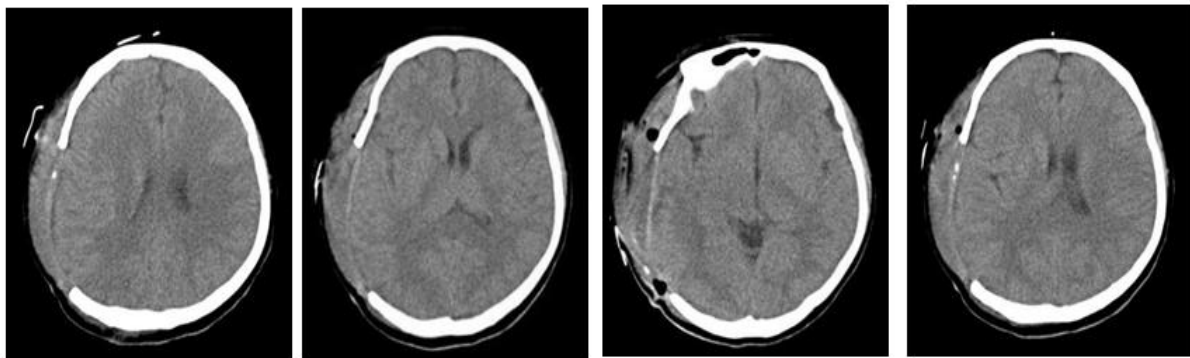


Figure 1: Cranial CT scanning showed bone was absent, and high-density internal fixator shadow was seen; local bone erosion, destruction, absence, and broken bone fragment shadow were seen; local bone in the right temporal lobe was lost in normal form and patchy low density shadow was seen with blurred edges.

The patient's wound had repeated pus flow for more than 5 months, and sinus tracts and outflow of dead bone were detected, with redness and swelling around the wound; these results are consistent with the clinical manifestations of chronic osteomyelitis. After admission, the patient was given ceftriaxone sodium (2 g/12 h) intravenously. At 3 days after admission, she

underwent 1. craniectomy for chronic suppurative cranial osteomyelitis; 2. subcutaneous and epidural abscess debridement; 3. intraoperative pathologic examination and secretion culture; and 4. scalp infection and scar revision surgery. Intraoperative culture of secretions taken indicated the growth of *K. aerogenes* (Figure 2).



Figure 2 *Klebsiella aerogenes* colonies

Drug sensitivity test showed that *K. aerogenes* was sensitive to tigecycline, amikacin, cotrimoxazole, gentamicin, ceftriaxone, imipenem, ertapenem, piperacillin, amitrazine, ciprofloxacin, cefepime, tobramycin, and levofloxacin. Pathological examination results showed the following: a pile of grayish–white brown crushed

tissue, size of 7 cm×3.5 cm×0.6 cm, six pieces of bone tissue, volume of 2.4 cm×2.3 cm×0.5 cm, fibrous tissue proliferation between bone trabeculae, inflammatory cell infiltration, peripheral inflammatory granulomatous tissue hyperplasia, and more local neutrophilic infiltration (Figure 3A and B).

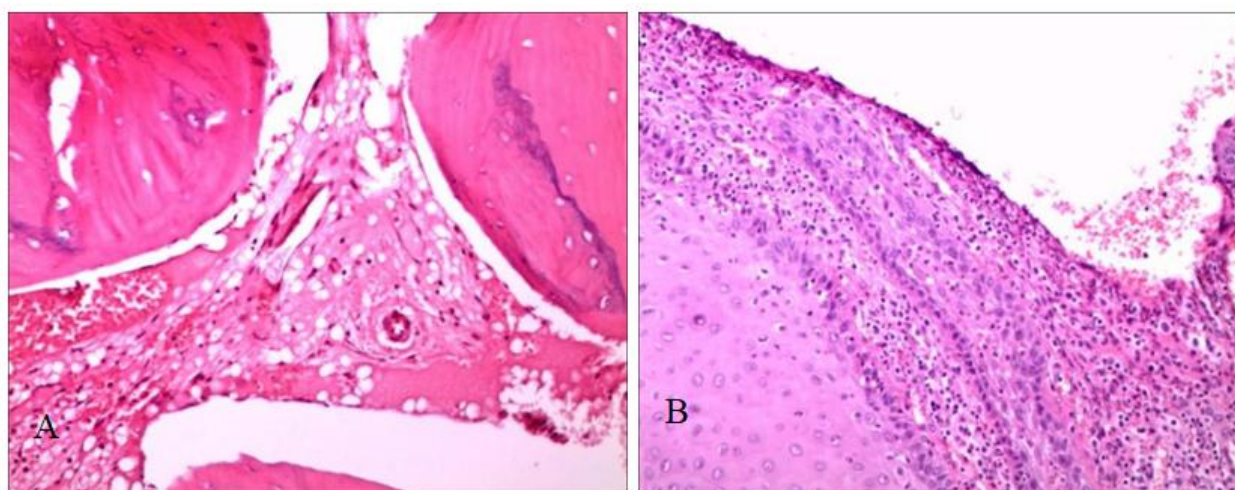


Figure 3 A, B (Lesion tissue section):Preliminary diagnosis suggests Chronic inflammation (HE, × 400)

Postoperative drops cefoperazone sodium sulbactam sodium (3 g/12 h) were given as anti-infection treatment for 1 week. The patient recovered well. She and her family asked to be discharged from the hospital. The wound healing was good at the time of discharge, with a small amount of bloody secretion. The patient was re-examined 1 month after and found to have good wound healing and had no secretion, pain, swelling, and discomfort.

Discussion and Conclusions

Chronic osteomyelitis is commonly caused by infection by *Staphylococcus*, *E. coli*, and *E. cloacae* infections but rarely by *K. aerogenes*. *K. aerogenes*, also known as *Enterobacter*

aerogenes, belongs to the Enterobacteriaceae family^{4, 8-10}. It is a facultative anaerobic Gram-negative bacillus that can metabolize a variety of sugars to produce acid and gas and belongs to the normal digestive flora, which is mainly colonized in water, soil, and human intestinal tracts. It is an opportunistic causative agent for colonization and infection of hospitalized patients and is more common with nosocomial infections^{11, 12}. It can cause blood, respiratory tract, gastrointestinal, and urinary tract infections¹³. Wesevich et al⁴. showed that the clinical prognosis of bloodstream infections caused by *K. aerogenes* is worse than that of other enterobacteria. Only one case of intracranial infection caused by *K. aerogenes*

has been reported in China. Guedes et al³. found that *E. cloacae* had an in-hospital infection rate of 71.4%, which is higher than that of *K. aerogenes* (41.1%); the mortality rates were 19.5% for the former and 6.9% for the latter. However, chronic osteomyelitis caused by *K. aerogenes* has not been reported yet. After admission, the patient was treated with ceftriaxone according to the antibacterial spectrum caused by bacteria in our hospital and cefoperazone after surgery. Remarkable results were obtained, and the patient recovered well. The drug sensitivity test showed that *K. aerogenes* was sensitive to most of β -lactams; however, Gheldre et al¹¹. found that most *K. aerogenes* were resistant to β -lactams, except for cefepime and carbapenems. Limaye et al¹⁴. reported a case of liver abscess combined with sepsis that was given cefepime treatment; after a period of time, cefepime-resistant *K. aerogenes* was produced, which was initially susceptible to ceftazidime but became resistant at a later stage. Drug sensitivity test for *K. aerogenes* in foreign countries showed different results from the present study. Therefore, antibiotics for patients with chronic osteomyelitis should be carefully selected. At present, thorough debridement is the key to the treatment of chronic osteomyelitis, and antibacterial drugs should be adjusted according to the results of bacterial culture and drug sensitivity test. The concentration of the drugs in the bone tissue should be monitored to improve the therapeutic effect of the patients.

Conflict of Interests Statement: The authors declared no conflict of interests.

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Authors' contributions: LWS ,LTT and JY analyzed the data and were the primary author of the manuscript.,They are the co-first authors of this article.SPS acquired the CT scan

images. LWB analyzed patient data. SZQ and DXW confirm the authenticity of the data .GQM assisted in writing the manuscript. All authors have read and approved the final manuscript.

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