

Case Report

Rare Manifestations of Periorbital Cellulitis with Diabetes Caused by Klebsiella Pneumoniae Infection

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Abstract...

Periorbital cellulitis is defined as infection or inflammation of the skin or connective tissue in the periorbital area, mainly caused by group A beta-hemolytic streptococci and Staphylococcus aureus. Klebsiella pneumoniae cellulitis is very rare. We should identify risk factors for K. pneumoniae colonization or overgrowth and possible routes of infection. We report a case of periorbital cellulitis caused by Klebsiella pneumoniae in a 29-year-old woman with uncontrolled diabetes.

Keywords: Periorbital cellulitis; Klebsiella pneumoniae; Diabetes.

Introduction

Periorbital cellulitis is a serious orbital infection, involving the tissues behind the orbital septum and can lead to serious complications including vision loss, cavernous sinus thrombosis, meningitis, carotid artery occlusion, and intracranial abscess [1], which mainly caused by group A beta-hemolytic streptococcus and Staphylococcus aureus. Klebsiella Pneumoniae (KP) is extremely rare in this disease [2], and most KP strains are community-acquired, can cause invasive infection. Its strain genetic material family exists on the mobile genetic element of the chromosome or the large plasmid, respectively, and can also exist on both, including the siderophore system for iron acquisition, capsule, K1 and K2 serotype toxin, which enters the blood will cause bacteremia [3]. When periorbital cellulitis is caused by Klebsiella infection in patients with a history of diabetes, the

disease is more complicated, and the infection is often uncontrollable. If not treated promptly and effectively, patients may develop life-threatening sepsis. Below we report a case of periorbital cellulitis complicated with diabetes caused by community-acquired KP infection.

Case presentation

A 29-year-old woman was referred to the emergency department of otolaryngology at the Second Affiliated Hospital of Harbin Medical University due to swelling and pain in the cheek and periorbital area. The patient underwent left nasal vestibular furuncle resection at the local hospital 25 days ago, and she developed fever and fatigue after surgery. After 20 days of intravenous nodoperazone and sulbactam sodium drug treatment, the right nasal root and right eyelid were swollen and gradually

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enlarged, and then the left eyelid and cheek were involved with pain.

When she was treated at the Second Hospital of Harbin Medical University, her eyes could no longer be opened, but she opened her eyelids with her hands and found that her vision was not affected. She had no history of smoking and drinking. She had a family history of type 2 diabetes (the mother was a type 2 diabetic). Emergency Computer Tomography (CT) showed that the right eye was prominent, multiple periorbital nodules, bilateral orbital fat spaces were blurred, and there was a little inflammation in the left ethmoid sinus. Magnetic resonance imaging showed: abnormal signal in bilateral periorbital soft tissue, nasal subcutaneous and bilateral facial soft tissue, considering infectious disease, right eye proptosis, periorbital and optic nerve signal uneven (Figure 1). Blood test results showed that the white blood cell ($12.6 \times 10^9 /L$, NEUT% 92.8%), fasting serum glucose (19 mmol/L), glycated hemoglobin determination (11.3%) increased sharply, urine protein++, urine ketone bodies and urine glucose were all +++, serum creatinine kinase and myoglobin levels not elevated. In addition, HIV serology tests were negative. Based on these results, we diagnosed periorbital cellulitis caused by nasal furuncles with type 2 diabetes, and initially treated with broad-spectrum antibiotics:(cefoperazone 3.0 g/12 h ornidazole 0.5 g/day); hypoglycemic treatment: aggressive hypoglycemic therapy with saline and continuous intravenous and subcutaneous insulin infusions. The next morning blood test results reported that WBC ($18.1 \times 10^9/L$), C-reactive protein (304.4 mg/L), and serum glucose (19.37 mmol/L) were further increased. The blood culture result was *Klebsiella pneumoniae*. Given this, we changed the antibiotic to imipenem (500 mg/day). The patient's eye color doppler ultrasound showed that there was no abscess formation and could not be incised and drained. At this time, the only treatment options were anti-infection and hypoglycemic ketones. However, the blood sugar remained high and the infection could not be controlled.

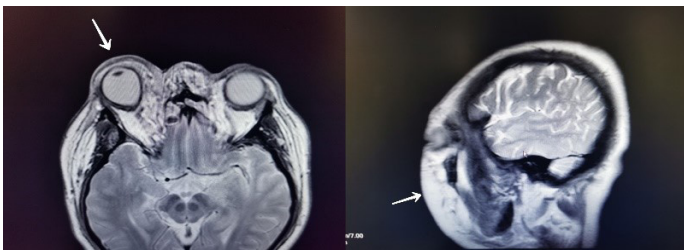


Figure 1: Abnormal signal in bilateral periorbital soft tissue, nasal subcutaneous and bilateral facial soft tissue, right eye proptosis.

During this process, the patient's eye swelling increased and her mental state were sluggish. Because of the serious condition, the patient was transferred to the Intensive Care Unit (ICU) for further treatment. After being transferred to the ICU, the patient developed metabolic alkalosis and ion disturbance (pH 7.51, PaCO₂ 29 mmHg, PaO₂ 137 mmHg, Na⁺ 128 mmol/L, K⁺ decreased from 4.4 to 3.7 mmol/L), and the patient was given to correct the acid-base balance and ion disorder. Although her insulin dose has been increased, her blood sugar has been above 15.3mmol/L. The white blood cells were $17.2 \times 10^9/L$. At this time, the patient's right eye had suppuration. The doctor suggested incision and drainage, but the patient's family

requested to terminate the treatment. At follow-up 3 months later, the patient was completely blind in the right eye and had blurred vision in the left eye, but she did not cause cavernous sinus thrombophlebitis and had no symptoms of nerve involvement (Figure 2).



Figure 2: After the patient was transferred to the ICU, the bilateral eyelids and cheeks were swollen (A). Follow-up 3 months after discharge, the patient was blind in the right eye and blurred vision in the left eye (B).

Discussion

Facial and periorbital cellulitis is a series of complex reactions that often occur after the infection of nasal boils. Usually, the infection of the nasal boils first involves the ipsilateral orbit and cheeks, and then involves bilateral eyelids within 24 hours to 48 hours [4]. We summarize the conventional routes of infection transmission: the anterior and posterior ethmoid veins drain into the cavernous sinus through the ophthalmic vein, and similarly, the medial canthal vein also drains the external nose into the cavernous sinus through the ophthalmic vein, and the left and right cavernous sinuses are connected by the intercavernous veins, from which infection can spread. The sphenopalatine vein drains into the pterygoid plexus, which in turn drains into the internal jugular vein. Venous congestion often leads to the dilation of the Superior Ophthalmic Vein (SOV). The anatomical pathway of SOV through the muscle cone and superior orbital fissure predisposes to the orbital apex and superior orbital fissure syndrome [5]. The lateral wall of the ethmoid sinus is the thinnest bony structure in adults and a likely route for infection to invade the orbit [6].

However, in our case, the patient's left nasal furuncle first involved swelling of the right eyelid after infection, and swelling of the left eyelid occurred 24 hours later. We searched the literature for the transmission route of cross-infection and found that there is no report in this regard. The patient was treated with antibiotics after periorbital cellulitis complicated with diabetes. The infection cannot be effectively controlled, and the white blood cells remain high. The reason is closely related to poor blood sugar control [7,8]. High blood sugar can impair the immune system. On the other hand, poor glycemic control can significantly reduce the phagocytosis of virulent K1/K2 *Klebsiella pneumoniae* by neutrophils. The phagocytosed serotype K1 is in 1 The cellular structure and envelope in the vacuoles remained intact after 1 hour, with no sign of intracellular lysis at all. In well-controlled neutrophils, phagocytosis and partial intracellular lysis of serotype K1 were comparable to that of normal healthy controls, and the attenuation of this phagocytosis became more pronounced with increasing age of patients, further evidence that poor glycemic control leads to impaired neutrophils in patients unable to kill pathogenic bacteria [9]. A current study has shown that dipeptidyl peptidase 4 inhibitor (DPP4i) can inhibit pneumonia caused by *Klebsiella pneumoniae*, two Peptidyl peptidase 4 (DPP4) is a pleiotropic protease with a central role in glucose metabolism, which is responsible

for the degradation of incretins such as GLP-1. DPP4i reduces serum DPP4 activity and pro-inflammatory cytokine levels, thereby improving neutrophil invasion and lung tissue destruction. In the future, DPP4i may be a new weapon for the treatment of periorbital cellulitis caused by *Klebsiella* infection [10].

Conclusion

The fasting blood glucose of the patient was 8.1 mmol/L during follow-up. Although the visual acuity of the right eye was significantly decreased, there were no symptoms of cavernous sinus thrombophlebitis and nerve involvement. We speculate that this is closely related to the control of hyperglycemia to inhibit the further invasion of tissue inflammation, which once again suggests the systemic involvement of our diabetes, which is a tricky "disease promoter" for ENT and all other departments, which requires our close attention. The situation of patients giving up treatment is special, and it is related to the economic situation of patients and the medical insurance policies of various countries, which also increases the difficulty of tracking and in-depth research on difficult cases.

Declarations

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Authors' contributions: Zhaonan Xu and Yanlu Che collected patient information and followed up and wrote the first draft of the manuscript. Jingting Wang conducted preliminary review and guidance of the manuscript. Yanan Sun supervised the study. All authors revised the manuscript and approved the final version.

Declaration of competing interest: The authors have declared that no conflict of interest exists.

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