



RAT BITE: AN UNUSUAL CAUSE OF PERIORBITAL CELLULITIS, A CASE REPORT

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ABSTRACT

Pediatric preseptal (periorbital) and orbital cellulitis are infectious disorders that result in periorbital inflammation. Periorbital cellulitis is an inflammation of the lids and periorbital tissues without signs of true orbital involvement, generally referred to as periorbital or preseptal cellulitis.^[1] It is a form of facial cellulitis, common in young children. Rat bite is rarely reported in the literature. Herein, we report a 3 years old girl who was bitten by a rat on her right upper eyelid leading to a diagnosis of periorbital cellulitis, and summarize the definition, manifestations, pathogenesis, complications and treatment. Early diagnosis is necessary due to the compromised prognosis of this disease and the necessity of rapid prompt therapeutic management.

KEYWORDS: Rat bite, periorbital cellulitis, inflammation, abscess.

INTRODUCTION

Periorbital cellulitis also called preseptal cellulitis is an inflammation of the lids and periorbital tissues without signs of true orbital involvement (such as proptosis or limitation of eye movement). This is a common orbital infection in young children and may be caused by bacteremia, trauma, an infected wound, or an abscess of the lid and periorbital region (pyoderma, conjunctivitis, dacryocystitis, insect bite). Periorbital cellulitis represents the first of the five nonprogressive types of orbital infections: 1. Preseptal Cellulitis, 2. Orbital Cellulitis, 3. Subperiosteal Abscesses, 4. Orbital Abscess, and 5. Cavernous Sinus Thrombosis.^[2]

Early treatment is a must to prevent any possible fatal complications. Herein we report a 3 years old girl with history of right periorbital swelling and erythema with high grade fever after a rat bite and not responding to a trial of oral antibiotic therapy (Amoxicillin/Clavulanic Acid), also summarize the definition, manifestations, pathogenesis, complication and treatment.

CASE REPORT

A three years old girl, with no previous medical history, not vaccinated, presenting for two days history of right periorbital erythema and edema, exacerbated to be spread quickly and involve the entire face. One day prior to presentation, she developed high grade fever, reaching 39 °C, associated with fatigue and bloody right eye discharge. Family reported no change in mental status,

no vomiting, and no respiratory or genitourinary symptoms. She was prescribed home Topical Ofloxacin, Amoxicillin/Clavulanic Acid and Paracetamol.

On physical examination, she looked somnolent with severe bilateral facial edema and erythema, more on the right side, indurated on palpation, and hot with bilateral bloody eye discharge. (Figure 1)



Figure 1: Patient upon Admission: Bilateral Periorbital Swelling with Erythema Mainly at the Right Side.

There was normal ocular movement and preserved visual acuity. There was no neck stiffness, no palpable lymphadenopathy, no abdominal organomegaly; lungs were clear on auscultation, no S1-S2 changes and no additional heart murmur.

As for her neonatal history she was born by NVD at term, vigorous, with no perinatal complications or ICN admission upon birth. Family history was negative for such cases.

Laboratory data upon admission revealed Hemoglobin of 10, 4 g/dl with WBC count of 15.500 (89% Neutrophils and 7% Lymphocytes) and Platelet count of 313×10^9 . CRP: 412 mg/L, INR= 2.16 for which she was given Vitamin K 2mg IV once. Electrolytes and Creatinine were normal.

On the day of admission, CT brain was done, to reveal pneumatization of the ethmoid cells, and the maxillary sinuses. There is soft tissue swelling in the periorbital lesion more prominent in the right side. (Figure 2)



Figure 1: First CT scan of Brain

Eye swab, blood and urine cultures with urine specimen studies for leptospirosis were ordered before starting on empirical antibiotics.

Patient was started on Piperacillin and Tazobactam (Tazocin: 400 mg/kg/day), Vancomycin (15 mg/kg/dose) and Clindamycin (30 mg/kg/day). Also Tetagam (Human Tetanus Immunoglobulin 250 IU/vial) 2 ampoules administered IM once, and Tetracycline local ointment was added to the treatment.

On the second day of admission, Diphtheria, Tetanus and acellular Pertussis vaccine (DTaP) vaccine 0,5 ml IM was administered once.

MRI brain showed severe bilateral swelling in the periorbital sites, and there is negative extension neither to the orbit nor to the brain, suggestive of preseptal cellulitis. There is reticular aspect of the adjacent facial skin. Enlarged lymph nodes are noted in the posterior triangle of the upper neck with enlarged adenoids. (Figure 3)



Figure 3: MRI Brain

On the third day of admission, the girl had worsening of her swelling that increased to reach the neck ... (Figure 4)



Figure 4: Worsening of Erythema and Edema Reaching the Neck

MRI orbit was repeated and done as well MRI brain, cerebral MRA and MRV that showed: bilateral soft tissue swelling in the peri-orbital regions more on the right with no extension into the orbits or to the brain.

The eye globes, optic nerves and retro-ocular muscles and fat are normally outlined. No collections, no areas of thrombosis, occlusions, stenosis or focal dilatations in the major intracranial arteries and veins.

Then Metronidazole was added to the treatment to cover anaerobic infections could be causative.

On the fourth day of admission, eye culture was positive for Beta-Hemolytic Streptococcus group A sensitive to Penicillin and Amoxicillin/Clavulanate Acid. So, Targocid and Clindamycin were discontinued and Amoxicillin-Clavulanate Acid IV was started (30mg/kg/dose).

On the fifth day of admission, the patient had worsening facial edema, so MethylPrednisolone started (2mg/kg/day for 2 days) and facial ultrasound showed bilateral subcutaneous edema with bilateral cellulitis more on the right side and no underlying collection.

On the eleventh day of admission, patient had newly low grade fever (38 °C), left conjunctiva edema. (Figure 7)



Figure 7: Left Conjunctiva Edema

CXR done and was normal as well as CT sinus. Ophthalmologist recommended shifting from Tobramycin to Ofloxacin eye drops. Patient was kept on Amoxicillin-Clavulanate IV with eye care (Oflox) than observed marked improvement of her cellulitis.

Her hospital stay was for 26 days, repeated CBCD before discharge (WBC: $9.1 \times 10^9/L$ with 38% Neutrophils, eye culture was negative and the girl was discharged home without antibiotics. (Figure 8)



(Figure 8): Patient before Discharge

DISCUSSION

Human rat bites are rare in literature. It is possible that these cases are more frequent but they are not recognized and reported. Most of these traumas occur in the poor

areas and by lack of hygiene also occur usually during hot season. In the literature, only one case of orbital cellulitis due to rat bite in a 33 years old female was reported.

In our case, the rat bite led to a diagnosis of periorbital cellulitis or preseptal cellulitis in a three years old girl where the causative agent was a Beta Hemolytic Streptococcus isolated by culture, with a good evolution with Amoxicillin/Clavulanate treatment.

Preseptal cellulitis is a common infection of the eyelid and periorbital soft tissues that is characterized by acute eyelid erythema and edema. This bacterial infection usually results from local spread of an adjacent sinusitis or dacryocystitis, from an external ocular infection, or following trauma to the eyelids. Preseptal cellulitis tends to be a less severe disease than orbital cellulitis, which can present in a similar manner. It differs from the latter in that it is confined to the soft tissues that are anterior to the orbital septum.

There are three main routes for pathogen inoculation in the periorbital tissues: 1. Direct inoculation: after eyelid trauma and infected insect bites, 2. Spread from contiguous structures: paranasal sinuses are the most common (specially the ethmoids, since nerves and vessels traverse the lamina papyracea that divides the ethmoids sinuses from the orbit), chalazia/hordeolum, dacryocystitis, dacryoadenitis, canaliculitis, impetigo, erysipelas, and herpes simplex and herpes zoster skin lesions, as well as endophthalmitis. 3. Hematogenous: via blood vessels from an upper respiratory tract or a middle ear infection. The venous drainage of the orbit, eyelids and sinuses goes primarily to the superior and inferior orbital veins, which drain the cavernous sinus. Because these veins are devoid of valves, infection easily can spread to preseptal and postseptal space, and can also lead to cavernous sinus thrombosis.

Preseptal cellulitis may spread posterior to the septum and progress to form subperiosteal and orbital abscesses. Infection in the orbit can spread posterior and cause cavernous sinus thrombosis or meningitis.

Upper respiratory tract infections, especially paranasal sinusitis, commonly precede preseptal cellulitis. In two large case series, nearly two thirds of cases of cellulitis were associated with upper respiratory tract infection. One half of these cases were from sinusitis [3, 4, 5, and 6].

The most common organisms are Staphylococcus Aureus, Staphylococcus Epidermidis, Streptococcus species such as our case, and Anaerobes, reflecting the organisms that commonly cause upper respiratory tract infections and external eyelid infections. Blood and skin culture results tend to be negative.

Prior to the introduction of the Haemophilus Influenza Type b (Hib) polysaccharide vaccine, in

1985, H Influenza was the most common organism isolated in blood cultures [3, 4, 5, and 6]. One study prior to the introduction of the vaccine noted that blood culture results were more likely to be positive (42%) if the patient had an upper respiratory infection and that subcutaneous aspirates were more likely to be positive (44%) if the patient had eyelid trauma or external ocular infection.

Since the vaccine came into widespread use, the rate of Haemophilus-positive blood cultures has dropped; studies have reported that the rate of any positive blood culture is now less than 4%. The reason that the rates for bacteremia for all organisms have dropped is unclear.

However, possible etiologies of preseptal cellulitis may include recent eyelid lesions such as chalazia, bug bites^[7], trauma-related lesions^[7 and 8], lesions caused by a recent surgical procedure near the eyelids^[8], lesions caused by oral procedures and dacryocystitis.

An upper respiratory tract infection as well, especially sinusitis may be present concurrently with preseptal cellulitis or may have recently occurred. Many systemic diseases have also been reported with concurrent preseptal cellulitis, including Varicella, Asthma, Nasal Polyposis and Neutropenia^[9].

According to the National Center for Disease Statistics, in 1995, approximately 5000 inpatients in the United States had a primary discharge diagnosis of deep inflammation of the eyelid, as specified in the International Classification of Diseases, 9th revision (ICD-9).

Preseptal cellulitis is primarily a pediatric disease, with approximately 80% of patients being younger than 10 years and most patients being younger than 5 years. Patients with preseptal cellulitis tend to be younger than patients with orbital cellulitis.

Concerning manifestations of peri-orbital cellulitis, patients may have mild to moderate temperature elevation. Although it has been suggested that orbital cellulitis generates a greater Leukocytosis and febrile response than preseptal cellulitis does, it is widely believed that these responses cannot be used to differentiate the two conditions from each other. Patients may also complain of pain, conjunctivitis or blurred vision. Signs of preseptal cellulitis include periorbital erythema and edema (sometimes so severe that patients cannot voluntarily open the eye).

On physical examination, preseptal cellulitis can present with eyelid inflammation that also occurs in orbital cellulitis so it is important to perform a complete ocular examination and be alert for signs of systemic illness, especially in children.

The eyelids and ocular adnexa should be inspected for signs of local trauma. Cervical, submandibular, or preauricular lymphadenopathy may be present. A tender preauricular lymph node may be suggestive of adenoviral conjunctivitis. Conjunctivitis may be present, and the quality of conjunctiva drainage should be noted.

Test vision and pupillary reactions in all patients who present with eyelid inflammation, as evidence of limited motility or impaired vision suggests that the inflammation has spread to the orbit. An afferent pupillary defect suggests optic nerve compression, and immediate surgical drainage should be performed.

Resistance to retropulsion and proptosis suggest orbital involvement. An eyelid speculum may be needed to examine the eye and ocular movements.

The ocular fundus should be examined carefully for signs of optic nerve swelling and venous engorgement.

Sinus tenderness, rhinorrhea, adenopathy, and other hallmarks of upper respiratory tract infection may be present^[8].

About approach considerations, blood culture should be taken; it is positive in less than 10% of cases of preseptal cellulitis. Prior to the introduction of the Hib vaccine, blood cultures were positive in up to one third of patients. Blood cultures are rarely necessary in preseptal and even orbital cellulitis, unless sepsis is suspected. WBC counts tend to be elevated.

Samples of conjunctiva discharge, eyelid lesions, and lacrimal sac material should be sent for culture.

Imaging may be necessary in some cases. A computed tomography (CT) scan can delineate the extent of orbital involvement but is not necessary in all patients with preseptal cellulitis^[10], it is indicated when findings on examination include pain on eye movement, afferent papillary defect, limited extra ocular motions, resistance on retropulsion, and arterializations of conjunctiva blood vessels. Orbital ultrasonography can be a useful tool to help in diagnosing orbital inflammation, although it requires experienced observers and specialized equipment that may not be available at most institutions. An appropriate CT scan would include thin axial sections through the orbits and sinuses and either true coronal sections or coronal reconstructions. A CT scan of the head is also indicated for any neurologic symptoms or neurologic findings on examination.

CT scan findings in preseptal cellulitis include the following: 1. Swelling of the eyelid and adjacent preseptal soft tissues, 2. Obliteration of the fat planes or details of the preseptal soft tissues, and 3. Absence of orbital inflammation.

According to the extent of orbital involvement, a spectrum of disease was described (Chandler staging) it includes ^[11]: Stage I - Preseptal cellulitis, Stage II - Inflammatory orbital edema, Stage III - Subperiosteal abscess, Stage IV - Orbital abscess, and Stage V - Cavernous sinus thrombosis.

To be noted that we should consider lumbar puncture in all neonates and in patients with signs or symptoms of meningitis. Eyelid abscesses should be incised and drained if present.

Biopsy in pre-orbital cellulitis shows edema and polymorphonuclear leukocytes infiltrating tissue planes.

Prognosis of preseptal cellulitis is usually good when this entity is promptly diagnosed and treated. However, complications can develop even with prompt treatment and include: Orbital extension and its complications such as, orbital cellulitis, subperiosteal abscess, orbital abscess, cavernous sinus thrombosis; CNS involvement (after orbital extension): meningitis, abscesses (brain, extradural or subdural); necrotizing fasciitis: it is a rare complication caused by Beta-hemolytic streptococcus. It presents as a rapidly progressive cellulitis with poorly demarcated borders and violaceous skin discoloration, which can lead to necrosis and toxic shock syndrome. The patient must be admitted to the hospital, intravenous fluids should be replenished, IV broad spectrum antibiotics must be prescribed and surgical debridement could be necessary.

Earlier diagnosis, expeditious treatment, and improved antibiotics have led to a reduction of serious ocular and CNS complications in patients with preseptal cellulitis. Treatment involves management of predisposing conditions, antibiotic therapy, and close observation. ^[12]

Initial antibiotic therapy is empiric, and, in most cases, a pathogen will not be identified. Given the predisposing factors, antibiotic choice should be directed toward the organisms that cause upper respiratory infections, particularly sinusitis. Specific organisms include *Streptococcus Pneumoniae*, *Nontypable H. Influenza*, and *Moraxella Catarrhalis*. In cases due to focal trauma, treatment should include coverage for *Staphylococcus Aureus*.

Surgical drainage is indicated only for eyelid abscesses^[8] and usually is not needed for uncomplicated preseptal cellulitis. Drainage is also indicated in acute dacryocystitis.

Consultation should be considered in cases in which the eye cannot be evaluated or if orbital spread is suspected. Ophthalmic consultation and evaluation is recommended for all pediatric patients ^[13]. Otorhinolaryngology consultation is suggested for medical and surgical treatment of sinusitis and if fungal infection is suspected.

Infectious disease consultation is also needed in all cases not responding to conservative management.

Only once diagnosed, preseptal cellulitis can be treated in an outpatient or inpatient basis depending on the characteristics of the patient. If the patient is afebrile with a mild preseptal cellulitis he can be followed as an outpatient with oral antibiotics and daily visits to monitor the progress of the disease. However, if the patient does not respond to oral antibiotics within 48 hours or if extension of the infectious process into the orbit is suspected, he should be admitted to the hospital: a CT scan must be performed and intravenous antibiotics must be initiated. Usually children under two years of age or febrile patients with a severe cellulitis are managed with intravenous antibiotics during hospitalization, with follow-up visits twice a day. Hospitalization is also recommended in patients who cannot be followed up as outpatients. Intravenous antibiotics are usually indicated during two or three days, if the condition of the patient improves in this period, he can be switched to oral antibiotics.

Medications used in the treatment of preseptal cellulitis include the following: 1. Amoxicillin/Clavulanic Acid or intramuscular Ceftriaxone - Considered for outpatient treatment in selected patients, 2. Second- or third-generation Cephalosporin Possible choice for initial empiric therapy, 3. Penicillinase-resistant synthetic penicillin (eg, Nafcillin or Oxacillin) - If *Staphylococcus Aureus* is suspected.

For patients on IV antibiotics, clinical improvement after 48-72 hours of IV administration means that a 24-hour trial of oral antibiotics can be employed.

In adult patients who are nontoxic and can be assured of appropriate follow-up, treatment can be with oral antibiotics on an outpatient basis. However, most pediatric patients require admission; intravenous (IV) antibiotics should be started.

Empiric therapeutic regimens for periorbital cellulitis are outlined below, including those for outpatient and inpatient treatment. ^[14, 15, 16]

Outpatient treatment recommendations: 1. Amoxicillin-Clavulanate 875 mg/125 mg (20-40 mg/kg) PO q12h for 10-14d ^[14,15] to cover Gram Positive and Gram Negative bacteria or Cefpodoxime 200 mg (5 mg/kg) PO q12h for 10-14d or Cefdinir 600 mg (14 mg/kg) PO daily for 10-14d.

Inpatient treatment recommendations: 1. Ampicillin-Sulbactam 1.5-3 g IV q6h ^[14,15,17] or Cefuroxime 1.5 g IV q8h or Ceftriaxone 1 g IV daily (less sensitive to Beta-Lactamase producing bacteria such as *Staphylococcus Aureus*) or Piperacillin-Tazobactam 4.5 g IV q8h. If Methicillin-resistant *Staphylococcus Aureus* (MRSA) is suspected, add Vancomycin 1 g (15 mg/kg) IV q12h to

the above regimens. Once clinical improvement is noted, the patient can be switched to oral antibiotics.^[18]

The results of antibiotic sensitivities should guide the treatment whenever possible. When the cultures reveal a Methicillin-Resistant *Staphylococcus Aureus* (MRSA) the therapy choice must be reevaluated.

Community associated MRSA is susceptible to these antibiotics administered in an oral route: Trimethoprim-Sulfamethoxazole, Rifampin, Clindamycin, Fluoroquinolones.

Hospital-associated MRSA is susceptible only to: intravenous Vancomycin, PO Linezolid.

If there was a penetrating eyelid injury with organic material or a human bite, antibiotics should also cover anaerobic organisms: Metronidazole, Clindamycin.

If an abscess localized in the preseptal space develops, it should be incised and drained. The surgeon must not open the orbital septum during the procedure, since this may spread the infection to the postseptal space and aggravate the infection. The contents of the abscess should be cultured to determine appropriate antibiotic therapy.

CONCLUSION

Preseptal cellulitis is a common infection of the eyelid and periorbital soft tissues that is characterized by acute eyelid erythema and edema.

It is a form of facial cellulitis, common in young children.

Diagnosis is mainly based on history and physical examination that revealed eyelid inflammation.

The reported case, showed a preseptal cellulitis caused by a rat bite that is a rare cause of the disease according to literature. The patient was treated by Tazocin and Vancomycin then shifted to Amoxicillin-Clavulanate after eye culture discharge result with very good improvement.

Earlier diagnosis, expeditious treatment, and improved antibiotics have led to a reduction of serious ocular and CNS complications in patients with preseptal cellulitis. Treatment involves management of predisposing conditions, antibiotic therapy and close observation.

If preseptal cellulitis is identified and treated promptly, the prognosis for complete recovery without complication is excellent. Morbidity occurs from the spread of pathogens to the orbit, which can threaten vision and result in central nervous system (CNS) spread. Untreated orbital cellulitis can lead to the development of an orbital abscess or can spread posterior to cause

cavernous sinus thrombosis. Systemic spread of bacteria may lead to meningitis and sepsis.

REFERENCES

1. Robert M. Kliegman, MD. Professor and Chair, Department of Pediatrics, Medical College of Wisconsin; Pediatrician-in-Chief, Pamela and Leslie Muma Chair in Pediatrics, Children's Hospital of Wisconsin; Executive Vice President, Children's Research Institute, Milwaukee, Wisconsin, Nelson textbook of pediatrics, 19th edition.
2. Chandler JR, Langenbrunner DJ, Stevens ER. The pathogenesis of orbital complications in acute sinusitis. *Laryngoscope*. 1970 Sep.; 80(9): 1414-28.
3. Adams WG, Deaver KA, Cochi SL, Plikaytis BD, Zell ER, Broome CV, et al. Decline of childhood *Haemophilus influenzae* type b (Hib) disease in the Hib vaccine era. *JAMA*. 1993 Jan 13; 269(2): 221-6.
4. Ambati BK, Ambati J, Azar N, Stratton L, Schmidt EV. Periorbital and orbital cellulitis before and after the advent of *Haemophilus influenzae* type B vaccination. *Ophthalmology*. 2000 Aug; 107(8): 1450-3.
5. Barone SR, Aiuto LT. Periorbital and orbital cellulitis in the *Haemophilus Influenzae* vaccine era. *J Pediatr Ophthalmol Strabismus*. 1997 Sep-Oct.; 34(5): 293-6.
6. Donahue SP, Schwartz G. Preseptal and orbital cellulitis in childhood. A changing microbiologic spectrum. *Ophthalmology*. 1998 Oct.; 105(10): 1902-5; discussion 1905-6.
7. Babar TF, Zaman M, Khan MN, Khan MD. Risk factors of preseptal and orbital cellulitis. *J Coll Physicians Surg Pak*. 2009 Jan.; 19(1): 39-42.
8. Chaudhry IA, Shamsi FA, Elzaridi E, Al-Rashed W, Al-Amri A, Arat YO. Inpatient preseptal cellulitis: experience from a tertiary eye care centre. *Br J Ophthalmol*. 2008 Oct.; 92(10): 1337-41.
9. McCarty ML, Wilson MW, Fleming JC, Thompson JW, Sandlund JT, Flynn PM, et al. Manifestations of fungal cellulitis of the orbit in children with neutropenia and fever. *OphthalPlastReconstr Surg*. 2004 May.; 20(3): 217-23.
10. Ho CF, Huang YC, Wang CJ, Chiu CH, Lin TY. Clinical analysis of computed tomography-staged orbital cellulitis in children. *J Microbiol Immunol Infect*. 2007 Dec.; 40(6): 518-24.
11. Eustis HS, Armstrong DC, Buncic JR, Morin JD. Staging of orbital cellulitis in children: computerized tomography characteristics and treatment guidelines. *J Pediatr Ophthalmol Strabismus*. 1986 Sep-Oct.; 23(5): 246-51.
12. Liu IT, Kao SC, Wang AG, Tsai CC, Liang CK, Hsu WM. Preseptal and orbital cellulitis: a 10-year review of hospitalized patients. *J Chin Med Assoc*. 2006 Sep.; 69(9): 415-22.
13. Yang M, Quah BL, Seah LL, Looi A. Orbital cellulitis in children-medical treatment versus surgical management. *Orbit*. 2009.; 28(2-3): 124-36.

14. Brook I. Microbiology of acute sinusitis of odontogenic origin presenting with periorbital cellulitis in children. *Ann Oto-Rhino-Laryngol.* 2007 May.; 116(5): 386-8.
15. Wald ER. Periorbital and orbital infections. *Infect Dis Clin North Am.* 2007 Jun.; 21(2): 393-408.
16. Lazzeri D, Lazzeri S, Figus M, et al. Periorbital necrotising fasciitis. *Br J Ophthalmol.* 2010 Dec.; 94(12): 1577-85.
17. Charalampidou S, Connell P, Fennell J, et al. Preseptal cellulitis caused by community acquired methicillin resistant *Staphylococcus aureus* (CAMRSA). *Br J Ophthalmol.* 2007 Dec.; 91(12): 1723-4.
18. Wald ER. Periorbital and orbital infections. *Pediatr Rev.* 2004 Sep.; 25(9): 312-20.