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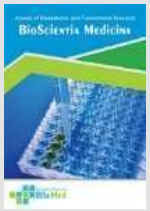

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Clinical Spectrum of Orbital Cellulitis: Case Series From Subperiosteal Abscess to Life-Threatening Cavernous Sinus Thrombosis

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A B S T R A C T

Background: Orbital cellulitis encompasses a range of orbital infections with varying severity. This case series highlights the diverse clinical presentations, management strategies, and outcomes of orbital cellulitis, emphasizing the importance of prompt diagnosis and treatment. **Case presentation:** We present two cases of orbital cellulitis with contrasting presentations. The first case involved a 16-year-old male with acute rhinosinusitis who developed severe orbital cellulitis complicated by cavernous sinus thrombosis (CST), requiring aggressive medical and surgical interventions. The second case involved a 2-month-old female with a subperiosteal abscess secondary to ethmoid and maxillary sinusitis, who responded well to medical management alone. **Conclusion:** Orbital cellulitis presents a wide spectrum of clinical scenarios, ranging from localized infections to life-threatening intracranial involvement. Early recognition, appropriate imaging, and timely intervention are crucial for optimizing outcomes. While CST necessitates aggressive measures, subperiosteal abscesses can often be managed medically, particularly in young children.

1. Introduction

Orbital cellulitis, an acute infection involving the soft tissues of the orbit posterior to the orbital septum, encompasses a spectrum of oculofacial infections ranging from mild preseptal cellulitis to severe orbital cellulitis with its potentially life-threatening complications. The incidence of orbital cellulitis is estimated to be around 0.5-1.5 cases per 100,000 children per year, with a male predominance. The peak incidence occurs in the first decade of life, likely due to the close proximity of the paranasal sinuses to the orbit and the immature immune system in this age group. However, orbital cellulitis can affect individuals of any age, with a second peak observed in the fourth and fifth decades of life. The etiology of orbital cellulitis is predominantly bacterial, with the most common causative organisms being *Streptococcus pneumoniae*, *Haemophilus influenzae* type b, and *Staphylococcus aureus*. In recent years, there has been a shift in the microbiological spectrum, with an increase in methicillin-resistant *S. aureus* (MRSA) infections. Other less common pathogens include *Streptococcus pyogenes*, *Moraxella catarrhalis*, and gram-negative bacteria. In immunocompromised individuals, opportunistic infections caused by fungi or atypical bacteria should also be considered.[1-3]

The pathogenesis of orbital cellulitis typically involves the spread of infection from adjacent

structures, most commonly the paranasal sinuses. The ethmoid sinus is the most frequently involved sinus, followed by the maxillary and frontal sinuses. Other potential sources of infection include the teeth, lacrimal sac, and skin. Direct inoculation of bacteria into the orbit can occur through trauma, surgery, or foreign bodies. Hematogenous spread from a distant focus of infection is less common but can occur in cases of bacteremia or sepsis. The clinical presentation of orbital cellulitis varies depending on the extent and location of the infection. Common signs and symptoms include erythema and edema of the eyelids, chemosis, proptosis, ophthalmoplegia, and pain with eye movements. Visual acuity may be decreased due to corneal involvement, optic nerve compression, or central retinal artery occlusion. Systemic symptoms such as fever, malaise, and headache may also be present. The diagnosis of orbital cellulitis is primarily clinical, based on the characteristic signs and symptoms. Imaging studies, particularly computed tomography (CT) scans, play a crucial role in confirming the diagnosis, assessing the extent of the disease, and identifying any complications. CT scans can help differentiate between preseptal cellulitis, orbital cellulitis, subperiosteal abscess, orbital abscess, and cavernous sinus thrombosis (CST).[4-6]

The management of orbital cellulitis depends on the severity of the infection and the presence of any complications. Mild cases of preseptal cellulitis may be treated with oral antibiotics on an outpatient basis. However, patients with orbital cellulitis or subperiosteal abscess require hospitalization and intravenous antibiotics. The choice of antibiotics should be guided by the likely causative organisms and local antibiotic resistance patterns. Surgical intervention may be necessary in cases of abscess formation, visual compromise, or failure to respond to medical therapy. The surgical approach depends on the location and extent of the infection. Subperiosteal abscesses can often be drained endoscopically, while orbital abscesses may require an external approach. In cases of CST, aggressive medical and surgical management is necessary to prevent life-threatening complications. The prognosis of orbital cellulitis is generally good with prompt and appropriate treatment. However, complications such as vision loss, CST, meningitis, and brain abscess can occur, particularly in cases of delayed or inadequate treatment. The risk of complications is higher in young children, immunocompromised individuals, and those with underlying medical conditions.[7-10] In this case series, we present two cases of orbital cellulitis with contrasting presentations and management approaches. The first case highlights the challenges of managing CST in a teenager, while the second case demonstrates the successful medical management of a subperiosteal abscess in an infant.

2. Case Presentation

Case 1

A 16-year-old male presented with a one-week history of progressively worsening left eye swelling, redness, and blurred vision. He reported a preceding nasal infection two weeks prior, followed by fever, eye swelling, redness, blurred vision, and restricted eye movement. On examination, the patient appeared acutely unwell and febrile (38°C). Ophthalmological examination revealed left eye edema, chemosis, corneal erosion, and restricted extraocular motility in all directions. Proptosis with inferior displacement was also observed in the left eye. Visual acuity was significantly reduced to 2/60 in the left eye. Initial laboratory investigations revealed leukocytosis. A non-contrast computed tomography (CT) scan of the orbits and brain was performed. The orbital CT scan demonstrated soft tissue swelling in the left orbital and periorbital regions, suggestive of orbital and periorbital cellulitis. The findings also indicated extension of the inflammation to the left paranasal sinuses. Furthermore, the CT scan revealed findings suggestive of orbital cellulitis with extension into the nasal cavity, extraconal and peribulbar regions, as well as subdural and epidural areas in the left frontoparietal region. Based on the clinical presentation and imaging findings, an initial diagnosis

of left orbital cellulitis, left exposure keratitis, and acute rhinosinusitis was made. Intravenous broad-spectrum antibiotics were initiated, and the patient was closely monitored. However, the patient's condition deteriorated, with the development of neurological symptoms including headache, vomiting, and altered mental status. A repeat CT scan of the brain was performed, which confirmed the diagnosis of cavernous sinus thrombosis (CST), a life-threatening complication of orbital cellulitis. Due to the severity of the infection and the development of CST, the patient was transferred to the intensive care unit (ICU) for aggressive medical and surgical management. Intravenous antibiotics were escalated to cover a broader range of potential pathogens, including MRSA. In addition to medical therapy, the patient underwent endoscopic sinus surgery to drain the infected paranasal sinuses and decompress the orbit. Following surgery, the patient's condition gradually improved, and he was eventually discharged home on oral antibiotics. Despite the initial severity of the infection and the development of CST, the patient made a full recovery with no long-term sequelae. This case highlights the importance of early recognition and aggressive management of orbital cellulitis, particularly in cases with intracranial extension. A 2-month-old female infant presented with a four-day history of right eye proptosis, redness, purulent nasal discharge, high fever, and right cheek swelling. The proptosis had developed three days prior to the presentation. On examination, the infant was alert and responsive. Ophthalmological examination revealed severe chemosis of the nasal conjunctiva of the right eye and limited eye movement. Proptosis with temporal displacement was observed in the right eye. Visual acuity was difficult to assess due to the infant's age and limited cooperation. Laboratory investigations revealed leukocytosis. A non-contrast CT scan of the orbits was performed, which demonstrated a hypodense lesion in the extraconal region of the right orbit, consistent with a subperiosteal abscess. The CT scan also revealed lesions in the right maxillary and ethmoid sinuses, indicating the source of the infection. Based on the clinical presentation and imaging findings, a diagnosis of right orbital cellulitis, right subperiosteal abscess, ethmoid and maxillary sinusitis was made. The infant was hospitalized and started on intravenous broad-spectrum antibiotics. Due to the patient's young age and the localized nature of the infection, a decision was made to manage the subperiosteal abscess medically without surgical intervention. The infant responded well to intravenous antibiotics, with a significant reduction in proptosis, chemosis, and purulent discharge within 48 hours. The fever also subsided, and the infant's overall condition improved. After completing a course of intravenous antibiotics, the infant was discharged home on oral antibiotics. The infant made a full recovery with no long-term complications. This case demonstrates the successful medical management of a subperiosteal abscess in an infant, highlighting the potential for conservative treatment in selected cases. These two cases illustrate the diverse clinical spectrum of orbital cellulitis, ranging from localized infections to life-threatening intracranial involvement. In Case 1, the adolescent patient developed CST, a rare but serious complication of orbital cellulitis. CST is characterized by the formation of a blood clot in the cavernous sinus, a venous channel located at the base of the brain. This can lead to a variety of neurological symptoms, including headache, vision loss, seizures, and coma. The prompt diagnosis and aggressive management of CST are crucial to prevent life-threatening complications. In contrast, Case 2 demonstrates the successful medical management of a subperiosteal abscess in an infant. A subperiosteal abscess is a collection of pus between the periosteum, the membrane lining the bone, and the bone itself. While subperiosteal abscesses can sometimes be managed medically, surgical drainage may be necessary in cases with large abscesses, visual compromise, or failure to respond to medical therapy. The management of orbital cellulitis depends on several factors, including the severity of the infection, the presence of any complications, and the patient's age and overall health. In general, mild cases of orbital

cellulitis can be treated with oral antibiotics on an outpatient basis. However, patients with severe orbital cellulitis, subperiosteal abscess, or CST require hospitalization and intravenous antibiotics. Surgical intervention may be necessary in cases with abscess formation, visual compromise, or failure to respond to medical therapy. The prognosis of orbital cellulitis is generally good with prompt and appropriate treatment. However, complications such as vision loss, CST, meningitis, and brain abscess can occur, particularly in cases of delayed or inadequate treatment. The risk of complications is higher in young children, immunocompromised individuals, and those with underlying medical conditions.

Table 1. Summary of anamnesis, clinical findings, and diagnostic results of two cases of orbital cellulitis.

Feature	Case 1 (16-year-old male)	Case 2 (2-month-old female)
Anamnesis		
Presenting complaint	Left eye swelling, redness, blurred vision (1 week)	Right eye proptosis, redness, purulent nasal discharge (4 days)
History of present illness	Nasal infection 2 weeks prior, followed by fever, eye swelling, redness, blurred vision, and restricted eye movement	High fever and right cheek swelling 3 days prior to proptosis
Past medical history	No significant past medical history	No significant past medical history
Physical examination		
General appearance	Acutely unwell, febrile (38°C)	Alert and responsive
Ophthalmological examination		
Visual acuity	2/60 (left eye)	Difficult to assess due to limited eye movement
Eyelids	Edema (left eye)	
Conjunctiva	Chemosis (left eye)	Severe chemosis (nasal conjunctiva of the right eye)
Cornea	Erosion (left eye)	
Pupils		Normal light reflex
Extraocular motility	Restricted in all directions (left eye)	Limited eye movement (right eye)
Proptosis	Present with inferior displacement (left eye)	Present with temporal displacement (right eye)
Laboratory investigations		
Complete blood count	Leukocytosis	Leukocytosis
Blood culture	Negative	Not performed
Imaging studies		
Orbital CT scan	Soft tissue swelling in left orbital and periorbital regions, suggestive of orbital and periorbital cellulitis extending to left paranasal sinuses	Hypodense lesion in the extraconal region of the right orbit, consistent with subperiosteal abscess; lesions also noted in right maxillary and ethmoid sinuses
Brain CT scan	Findings suggestive of orbital cellulitis with extension into the nasal cavity, extraconal and peribulbar regions, as well as subdural and epidural areas in the left frontoparietal region	Not performed
Diagnosis		
Initial diagnosis	Left orbital cellulitis, left exposure keratitis, acute rhinosinusitis	Right orbital cellulitis, right subperiosteal abscess, ethmoid and maxillary sinusitis
Final diagnosis	Left orbital cellulitis complicated by cavernous sinus thrombosis	Right subperiosteal abscess secondary to ethmoid and maxillary sinusitis

Case 2

A 16-year-old male presented with a one-week history of progressively worsening left eye swelling, redness, and blurred vision. He reported a preceding nasal infection two weeks prior, followed by fever, eye swelling, redness, blurred vision, and restricted eye movement. On examination, the patient appeared acutely unwell and febrile (38°C). Ophthalmological examination revealed left eye edema, chemosis, corneal erosion, and restricted extraocular motility in all directions. Proptosis with inferior displacement was also observed in the left eye. Visual acuity was significantly reduced to 2/60 in the left eye. Initial laboratory investigations revealed leukocytosis. A non-contrast computed tomography (CT) scan of the orbits and brain was performed. The orbital CT scan demonstrated soft tissue swelling in the left orbital and periorbital regions, suggestive of orbital and periorbital cellulitis. The findings also indicated extension of the inflammation to the left paranasal sinuses. Furthermore, the CT scan revealed findings suggestive of orbital cellulitis with extension into the nasal cavity, extraconal and peribulbar regions, as well as subdural and epidural areas in the left frontoparietal region. Based on the clinical presentation and imaging findings, an initial diagnosis of left orbital cellulitis, left exposure keratitis, and acute rhinosinusitis was made. Intravenous broad-spectrum antibiotics were initiated, and the patient was closely monitored. However, the patient's condition deteriorated, with the development of neurological symptoms including headache, vomiting, and altered mental status. A repeat CT scan of the brain was performed, which confirmed the diagnosis of cavernous sinus thrombosis (CST), a life-threatening complication of orbital cellulitis. Due to the severity of the infection and the development of CST, the patient was transferred to the intensive care unit (ICU) for aggressive medical and surgical management. Intravenous antibiotics were escalated to cover a broader range of potential pathogens, including MRSA. In addition to medical therapy, the patient underwent endoscopic sinus surgery to drain the infected paranasal sinuses and decompress the orbit. Following surgery, the patient's condition gradually improved, and he was eventually discharged home on oral antibiotics. Despite the initial severity of the infection and the development of CST, the patient made a full recovery with no long-term sequelae. This case highlights the importance of early recognition and aggressive management of orbital cellulitis, particularly in cases with intracranial extension. A 2-month-old female infant presented with a four-day history of right eye proptosis, redness, purulent nasal discharge, high fever, and right cheek swelling. The proptosis had developed three days prior to presentation. On examination, the infant was alert and responsive. Ophthalmological examination revealed severe chemosis of the nasal conjunctiva of the right eye and limited eye movement. Proptosis with temporal displacement was observed in the right eye. Visual acuity was difficult to assess due to the infant's age and limited cooperation. Laboratory investigations revealed leukocytosis. A non-contrast CT scan of the orbits was performed, which demonstrated a hypodense lesion in the extraconal region of the right orbit, consistent with a subperiosteal abscess. The CT scan also revealed lesions in the right maxillary and ethmoid sinuses, indicating the source of the infection. Based on the clinical presentation and imaging findings, a diagnosis of right orbital cellulitis, right subperiosteal abscess, ethmoid and maxillary sinusitis was made. The infant was hospitalized and started on intravenous broad-spectrum antibiotics. Due to the patient's young age and the localized nature of the infection, a decision was made to manage the subperiosteal abscess medically without surgical intervention. The infant responded well to intravenous antibiotics, with a significant reduction in proptosis, chemosis, and purulent discharge within 48 hours. The fever also subsided, and the infant's overall condition improved. After completing a course of intravenous antibiotics, the infant was discharged home on oral antibiotics. The infant made a full recovery with no long-term complications. This case demonstrates the successful medical management of

a subperiosteal abscess in an infant, highlighting the potential for conservative treatment in selected cases. These two cases illustrate the diverse clinical spectrum of orbital cellulitis, ranging from localized infections to life-threatening intracranial involvement. In Case 1, the adolescent patient developed CST, a rare but serious complication of orbital cellulitis. CST is characterized by the formation of a blood clot in the cavernous sinus, a venous channel located at the base of the brain. This can lead to a variety of neurological symptoms, including headache, vision loss, seizures, and coma. The prompt diagnosis and aggressive management of CST are crucial to prevent life-threatening complications. In contrast, Case 2 demonstrates the successful medical management of a subperiosteal abscess in an infant. A subperiosteal abscess is a collection of pus between the periosteum, the membrane lining the bone, and the bone itself. While subperiosteal abscesses can sometimes be managed medically, surgical drainage may be necessary in cases with large abscesses, visual compromise, or failure to respond to medical therapy. The management of orbital cellulitis depends on several factors, including the severity of the infection, the presence of any complications, and the patient's age and overall health. In general, mild cases of orbital cellulitis can be treated with oral antibiotics on an outpatient basis. However, patients with severe orbital cellulitis, subperiosteal abscess, or CST require hospitalization and intravenous antibiotics. Surgical intervention may be necessary in cases with abscess formation, visual compromise, or failure to respond to medical therapy. The prognosis of orbital cellulitis is generally good with prompt and appropriate treatment. However, complications such as vision loss, CST, meningitis, and brain abscess can occur, particularly in cases of delayed or inadequate treatment. The risk of complications is higher in young children, immunocompromised individuals, and those with underlying medical conditions.

Table 2. Treatment and follow-up of two cases of orbital cellulitis.

Feature	Case 1 (16-year-old male)	Case 2 (2-month-old female)
Initial treatment		
Antibiotics	Intravenous meropenem, vancomycin, and metronidazole	Intravenous ceftriaxone and metronidazole
Other medications	Intravenous dexamethasone (simulated data)	Paracetamol, topical levofloxacin, Cendolyteers (hyaluronic acid) eye drops, and chloramphenicol eye drops
Surgical intervention		
Procedure	Functional endoscopic sinus surgery (FESS), orbital decompression, eyelid abscess drainage, medial lamellar anterior tibial muscle graft (ML-AMT graft) placement, decompressive craniectomy	None
Timing	FESS and orbital decompression were performed within 48 hours of clinical deterioration; eyelid abscess drainage and ML-AMT graft placement were performed 1 week later; decompressive craniectomy performed after stabilization	-
Follow-up		
Duration	2 months	
Visual acuity	20/30 (left eye), improving to 20/20 with pinhole correction	Light-following (right eye)
Extraocular motility	Full	Full
Proptosis	Resolved	Resolved
Other findings	Paracentral corneal scarring (left eye)	No visual impairment
Outcome		
Overall	Good recovery with residual visual impairment due to corneal scarring	Full recovery with no visual impairment

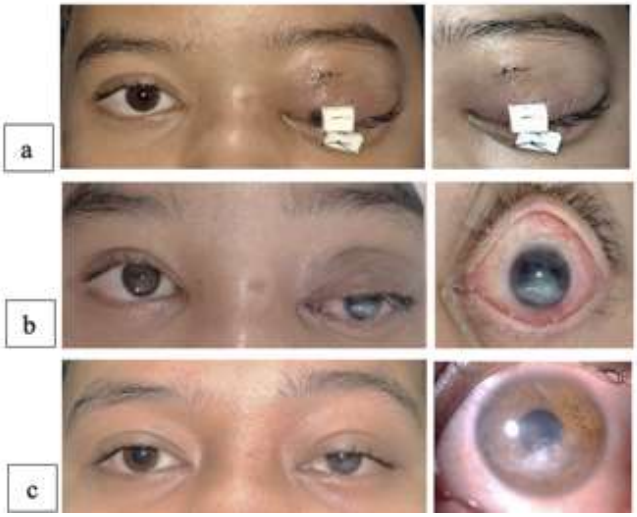

Figure 1. a) Post exploration + incision and drainage of palpebral abscess and ML AMT graft placement day 1. b) Patient on day 9 post-decompressive craniectomy and cerebral abscess evacuation. c) Patient at 2-month follow-up.

Figure 2. a) Case 2 patient presented at first visit. b) Patient presentation when discharged from the hospital.

3. Discussion

Orbital cellulitis, an acute infection involving the soft tissues of the orbit posterior to the orbital septum, encompasses a spectrum of oculofacial infections ranging from mild preseptal cellulitis to severe orbital abscess and even life-threatening cavernous sinus thrombosis (CST). The clinical presentations and outcomes of orbital cellulitis are diverse, as illustrated by the two cases presented in this series. Case 1 highlights the potential severity of orbital cellulitis and the life-threatening complications that can arise if the infection spreads intracranially. The adolescent patient developed CST, a rare but serious complication of orbital cellulitis characterized by the formation of a blood clot in the cavernous sinus, a venous channel located at the base of the brain. CST can lead to a variety of neurological symptoms, including headache, vision loss, seizures, and coma. The prompt diagnosis and aggressive management of CST are crucial to prevent life-threatening complications. In this case,

the patient presented with a one-week history of progressively worsening left eye swelling, redness, and blurred vision. He also reported a preceding nasal infection two weeks prior. On examination, the patient appeared acutely unwell and febrile. Ophthalmological examination revealed left eye edema, chemosis, corneal erosion, and restricted extraocular motility in all directions. Proptosis with inferior displacement was also observed in the left eye. A non-contrast computed tomography (CT) scan of the orbits and brain was performed. The orbital CT scan demonstrated soft tissue swelling in the left orbital and periorbital regions, suggestive of orbital and periorbital cellulitis extending to the left paranasal sinuses. The findings also indicated extension of the inflammation to the nasal cavity, extraconal and peribulbar regions, as well as subdural and epidural areas in the left frontoparietal region. Based on the clinical presentation and imaging findings, an initial diagnosis of left orbital cellulitis, left exposure keratitis, and acute rhinosinusitis was made. Intravenous broad-spectrum antibiotics were initiated, and the patient was closely monitored. However, the patient's condition deteriorated, with the development of neurological symptoms including headache, vomiting, and altered mental status. A repeat CT scan of the brain was performed, which confirmed the diagnosis of CST. Due to the severity of the infection and the development of CST, the patient was transferred to the intensive care unit (ICU) for aggressive medical and surgical management. Intravenous antibiotics were escalated to cover a broader range of potential pathogens, including MRSA. In addition to medical therapy, the patient underwent endoscopic sinus surgery to drain the infected paranasal sinuses and decompress the orbit. Following surgery, the patient's condition gradually improved, and he was eventually discharged home on oral antibiotics. Despite the initial severity of the infection and the development of CST, the patient made a full recovery with no long-term sequelae. In contrast to Case 1, Case 2 demonstrates the successful medical management of a subperiosteal abscess in an infant. A subperiosteal abscess is a collection of pus between the periosteum, the membrane lining the bone, and the bone itself. While subperiosteal abscesses can sometimes be managed medically, surgical drainage may be necessary in cases with large abscesses, visual compromise, or failure to respond to medical therapy. In this case, the patient was a 2-month-old female infant who presented with a four-day history of right eye proptosis, redness, purulent nasal discharge, high fever, and right cheek swelling. The proptosis had developed three days prior to presentation. On examination, the infant was alert and responsive. Ophthalmological examination revealed severe chemosis of the nasal conjunctiva of the right eye and limited eye movement. Proptosis with temporal displacement was observed in the right eye. A non-contrast CT scan of the orbits was performed, which demonstrated a hypodense lesion in the extraconal region of the right orbit, consistent with a subperiosteal abscess. The CT scan also revealed lesions in the right maxillary and ethmoid sinuses, indicating the source of the infection. Based on the clinical presentation and imaging findings, a diagnosis of right orbital cellulitis, right subperiosteal abscess, ethmoid and maxillary sinusitis was made. The infant was hospitalized and started on intravenous broad-spectrum antibiotics. Due to the patient's young age and the localized nature of the infection, a decision was made to manage the subperiosteal abscess medically without surgical intervention. The infant responded well to intravenous antibiotics, with a significant reduction in proptosis, chemosis, and purulent discharge within 48 hours. The fever also subsided, and the infant's overall condition improved. After completing a course of intravenous antibiotics, the infant was discharged home on oral antibiotics. The infant made a full recovery with no long-term complications.[11,12]

The anatomical characteristics of the orbit and surrounding structures play a crucial role in the development and progression of orbital cellulitis. The orbit, a complex anatomical space housing the eye and

its associated structures, is particularly vulnerable to infection due to its intricate network of interconnected spaces and its proximity to potential sources of infection, such as the paranasal sinuses. The orbit is a cone-shaped cavity in the skull that contains the eyeball, extraocular muscles, nerves, blood vessels, and fat. The bony walls of the orbit are formed by seven bones, the frontal, zygomatic, maxillary, sphenoid, ethmoid, lacrimal, and palatine bones. These bones provide structural support and protection for the delicate contents of the orbit. However, the bony walls are relatively thin and can be easily breached by infection, particularly in children whose bones are still developing. The orbital septum, a fibrous membrane that extends from the periosteum of the orbital rim to the tarsal plates of the eyelids, serves as a barrier between the orbit and the eyelids. However, the orbital septum is relatively thin and offers minimal resistance to the spread of infection. Infections can readily traverse this barrier, leading to the involvement of both the orbit and the periorbital tissues. The paranasal sinuses, air-filled cavities within the bones of the face, are a common source of infection in orbital cellulitis. The sinuses are lined with a mucous membrane that is continuous with the lining of the nasal cavity. This continuity allows for the easy spread of infection from the sinuses to the orbit. The ethmoid sinus, located between the orbit and the nasal cavity, is the most frequently involved sinus in orbital cellulitis. The thin lamina papyracea, which forms the medial wall of the orbit and separates the orbit from the ethmoid sinus, is particularly susceptible to erosion by infection. Once the lamina papyracea is breached, bacteria can readily enter the orbit and cause inflammation and infection. The maxillary sinus, located below the orbit, is another common source of infection. The maxillary sinus is the largest of the paranasal sinuses and is in close proximity to the inferior orbital wall. Infections of the maxillary sinus can spread to the orbit through direct extension or through the valveless venous system. The frontal sinus, located above the orbit, is less commonly involved in orbital cellulitis. However, infections of the frontal sinus can spread to the orbit through the frontal bone or through the valveless venous system. The valveless venous system of the orbit further facilitates the spread of infection. The ophthalmic veins, which drain blood from the orbit, communicate directly with the cavernous sinus, a major venous channel located at the base of the brain. This direct venous communication, without the presence of valves to prevent retrograde flow, allows for the easy spread of infection from the orbit to the cavernous sinus, potentially leading to CST. CST is a rare but serious complication of orbital cellulitis, characterized by the formation of a blood clot in the cavernous sinus. The cavernous sinus houses several important structures, including the internal carotid artery, cranial nerves III, IV, V1, V2, and VI, and the pituitary gland. The formation of a blood clot in this region can lead to a variety of neurological symptoms, including headache, vision loss, seizures, and coma. The pathophysiology of orbital cellulitis typically involves the spread of infection from adjacent structures, most commonly the paranasal sinuses. The bacteria that cause orbital cellulitis are typically the same bacteria that cause sinusitis, such as *Streptococcus pneumoniae*, *Haemophilus influenzae* type b, and *Staphylococcus aureus*. Once the bacteria enter the orbit, they can cause inflammation and infection of the orbital tissues. The inflammation can lead to swelling of the eyelids, chemosis (edema of the conjunctiva), proptosis (protrusion of the eyeball), and ophthalmoplegia (paralysis of the extraocular muscles). The infection can also spread to the optic nerve, causing optic neuritis and potentially leading to vision loss. In severe cases, the infection can spread to the cavernous sinus, causing CST. CST is a life-threatening condition that can lead to neurological complications, including stroke, meningitis, and brain abscess.[13,14]

Early recognition and prompt intervention are crucial for optimizing outcomes in orbital cellulitis. In this context, diagnostic imaging and laboratory investigations play a vital role in the accurate and timely diagnosis of orbital cellulitis, enabling the

differentiation between various stages of the disease and guiding appropriate management decisions. Imaging, particularly computed tomography (CT) scans, is considered the gold standard for diagnosing and staging orbital cellulitis. CT scans provide detailed cross-sectional images of the orbit and surrounding structures, allowing for the visualization of soft tissues, bones, and blood vessels. This detailed visualization enables the identification of key features associated with orbital cellulitis, such as inflammation, abscess formation, and sinus involvement. CT scans assist in differentiating between various stages of orbital and periorbital infections, including preseptal cellulitis, orbital cellulitis, subperiosteal abscess, orbital abscess, and cavernous sinus thrombosis (CST). Preseptal cellulitis involves inflammation of the tissues anterior to the orbital septum, while orbital cellulitis extends posterior to the septum. Subperiosteal abscess refers to a collection of pus between the periosteum and the bone, whereas orbital abscess involves pus within the orbit itself. CST, a rare but serious complication, is characterized by the formation of a blood clot in the cavernous sinus. In Case 1, the initial CT scan demonstrated soft tissue swelling in the left orbital and periorbital regions, suggestive of orbital and periorbital cellulitis extending to the left paranasal sinuses. The findings also indicated extension of the inflammation to the nasal cavity, extraconal and peribulbar regions, as well as subdural and epidural areas in the left frontoparietal region. A repeat CT scan of the brain later confirmed the diagnosis of CST, a life-threatening complication of orbital cellulitis. The repeat CT scan likely showed signs of thrombosis in the cavernous sinus, such as filling defects or abnormal enhancement patterns. In Case 2, the CT scan demonstrated a hypodense lesion in the extraconal region of the right orbit, consistent with a subperiosteal abscess. The CT scan also revealed lesions in the right maxillary and ethmoid sinuses, indicating the source of the infection. Laboratory investigations complement imaging studies and aid in the diagnosis and management of orbital cellulitis. A complete blood count (CBC) is often performed to assess the patient's inflammatory response. Leukocytosis, an elevated white blood cell count, is a common finding in patients with orbital cellulitis. Blood cultures can be helpful in identifying the causative organism, although they are often negative in cases of orbital cellulitis. In cases where blood cultures are positive, they can guide antibiotic therapy and improve patient outcomes.[15,16]

The management of orbital cellulitis depends on several factors, including the severity of the infection, the presence of any complications, and the patient's age and overall health. The primary goals of treatment are to eradicate the infection, preserve vision, and prevent complications. Antibiotics are the cornerstone of medical management for orbital cellulitis. The choice of antibiotics should be tailored to the individual patient, considering the likely source of infection, the patient's age and medical history, and local antibiotic resistance patterns. In general, mild cases of orbital cellulitis can be treated with oral antibiotics on an outpatient basis. However, patients with severe orbital cellulitis, subperiosteal abscess, or CST require hospitalization and intravenous antibiotics. Broad-spectrum antibiotics with good penetration into the orbit and central nervous system are typically indicated. Empiric antibiotic therapy should cover the most common causative organisms, including *Streptococcus pneumoniae*, *Haemophilus influenzae* type b, and *Staphylococcus aureus*. In Case 1, the patient was initially treated with intravenous meropenem, vancomycin, and metronidazole. Meropenem is a broad-spectrum carbapenem antibiotic with activity against Gram-positive, Gram-negative, and anaerobic bacteria. Vancomycin is a glycopeptide antibiotic with activity against Gram-positive bacteria, including methicillin-resistant *Staphylococcus aureus* (MRSA). Metronidazole is a nitroimidazole antibiotic with activity against anaerobic bacteria. In Case 2, the infant was treated with intravenous ceftriaxone and metronidazole. Ceftriaxone is a third-generation cephalosporin antibiotic with activity against Gram-positive and

Gram-negative bacteria. Metronidazole is again included for its activity against anaerobic bacteria. In addition to antibiotics, supportive care is important in the management of orbital cellulitis. This may include pain management, fever control, and hydration. Warm compresses applied to the affected eye may also help to reduce swelling and discomfort. Surgical intervention may be necessary in cases of abscess formation, visual compromise, or failure to respond to medical therapy. The surgical approach depends on the location and extent of the infection. Subperiosteal abscesses can often be drained endoscopically. Endoscopic sinus surgery (ESS) is a minimally invasive technique that involves inserting a small endoscope through the nose to access and drain the infected sinuses. ESS can also be used to decompress the orbit, which can help to relieve pressure on the optic nerve and preserve vision. Orbital abscesses may require an external approach. This involves making an incision in the skin and then draining the abscess. In some cases, it may be necessary to remove a portion of the orbital bone to adequately drain the abscess. In Case 1, the patient underwent ESS to drain the infected paranasal sinuses and decompress the orbit. The patient also required eyelid abscess drainage and placement of a medial lamellar anterior tibial muscle graft (ML-AMT graft) to address complications related to the infection.[17,18]

The management of orbital cellulitis often requires a multidisciplinary approach, involving various medical specialists to ensure comprehensive care and optimal outcomes. The complexity of orbital cellulitis, with its potential for vision-threatening and life-threatening complications, necessitates the expertise of different specialties to address the diverse aspects of the disease. Ophthalmologists play a crucial role in the diagnosis and management of orbital cellulitis. Their expertise in ocular health and disease enables them to assess the extent of ocular involvement, monitor visual function, and provide appropriate medical and surgical interventions. Otolaryngologists, also known as ear, nose, and throat (ENT) specialists, are essential members of the multidisciplinary team. Their knowledge of the paranasal sinuses and their expertise in endoscopic sinus surgery (ESS) are crucial for managing sinus involvement, a common source of infection in orbital cellulitis. In cases involving children, pediatricians play a vital role in the overall care of the patient. Their understanding of child development, growth, and common childhood illnesses allows them to provide comprehensive care and address any underlying medical conditions that may predispose the child to infections. In severe cases with intracranial complications, such as cavernous sinus thrombosis (CST), meningitis, or brain abscess, neurosurgeons are consulted for their expertise in managing neurological conditions. They may perform surgical interventions, such as drainage of abscesses or decompression of the brain, to alleviate pressure and prevent further complications. Close collaboration between these specialties is essential to ensure optimal outcomes in patients with orbital cellulitis. Effective communication, shared decision-making, and coordinated care contribute to the successful management of the infection and the prevention of complications. The prognosis of orbital cellulitis is generally good with prompt and appropriate treatment. However, complications can occur, particularly in cases of delayed or inadequate treatment. Vision loss is a potential complication of orbital cellulitis, although it is relatively rare with prompt and appropriate treatment. Vision loss can result from optic neuritis, compression of the optic nerve by an abscess, or central retinal artery occlusion. CST is a rare but serious complication of orbital cellulitis, characterized by the formation of a blood clot in the cavernous sinus. CST can lead to a variety of neurological symptoms, including headache, vision loss, seizures, and coma. Meningitis, an inflammation of the meninges (the membranes surrounding the brain and spinal cord), is another potential complication of orbital cellulitis. Meningitis can cause headache, fever, stiff neck, and altered mental status. A brain abscess is a collection of pus within the brain tissue. Brain abscesses can cause headache, fever, seizures, and focal neurological

deficits. The risk of complications is higher in young children, immunocompromised individuals, and those with underlying medical conditions. Young children are more susceptible to complications due to their immature immune systems and the close proximity of the paranasal sinuses to the orbit. Immunocompromised individuals are at higher risk due to their weakened ability to fight infection. Underlying medical conditions, such as diabetes or chronic sinusitis, can also increase the risk of complications.[19,20]

4. Conclusion

This case series presents two cases of orbital cellulitis with contrasting presentations and outcomes. Case 1 involved a 16-year-old male with acute rhinosinusitis who developed severe orbital cellulitis complicated by cavernous sinus thrombosis (CST), requiring aggressive medical and surgical interventions. Case 2 involved a 2-month-old female with subperiosteal abscess secondary to ethmoid and maxillary sinusitis, who responded well to medical management alone. These cases highlight the diverse clinical spectrum of orbital cellulitis, ranging from localized infections to life-threatening intracranial involvement. Early recognition, appropriate imaging, and timely intervention are crucial for optimizing outcomes in orbital cellulitis. While CST necessitates aggressive measures, subperiosteal abscesses can often be managed medically, particularly in young children. The prognosis of orbital cellulitis is generally good with prompt and appropriate treatment, but complications such as vision loss, CST, meningitis, and brain abscess can occur, particularly in cases of delayed or inadequate treatment. The risk of complications is higher in young children, immunocompromised individuals, and those with underlying medical conditions. Therefore, a high index of suspicion and prompt intervention are essential to minimize morbidity and mortality associated with orbital cellulitis.

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