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**Case Series**

# Odontogenic Orbital Cellulitis: A Report of Three Cases and Literature Review

## *Les Cellulites Orbitaires Odontogènes : À Propos de Trois Cas et Revue de la Littérature*

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**ABSTRACT**

Orbital cellulitis is a serious condition, usually originating from the eye, skin, sinuses or oral cavity. In the oral area, the infection spreads either by intra-sinus extension, or by contiguity through infection of the adipo-cellular tissues, or by distant swarming via the vascular route. This orbital cellulitis may be pre-septal or retro-septal. The risk of serious complications such as blindness, cavernous sinus thrombosis or intracranial extension requires rapid diagnosis, appropriate antibiotic therapy and often surgical drainage. A multidisciplinary approach is essential for optimal patient care. The objective was to report three cases of odontogenic orbital cellulitis in two hospitals of Yaoundé, Cameroon and the literature review. Three patients with confirmed odontogenic orbital cellulitis, with different clinical aspects and evolutions, managed in a multidisciplinary approach by specialised teams are reported. Odontogenic orbital cellulitis can lead to serious complications, both locoregional and general, and can be life-threatening. They are a medico-surgical emergency, and early multidisciplinary management can improve their prognosis.

**RÉSUMÉ**

Les cellulites orbitaires sont des affections graves, généralement à point de départ oculaire, cutané, sinusien ou bucco-dentaire. Au niveau bucco-dentaire, la propagation de l'infection se fait soit par extension intra sinusienne, soit par voie de contiguïté à travers l'infection des tissus cellulo-adipeux, ou par essaimage à distance par voie vasculaire. Ces cellulites orbitaires peuvent être de localisation pré septale ou rétro septale. Le risque de graves complications comme la cécité, la thrombose du sinus caverneux ou l'extension aux structures intracrâniennes nécessite un diagnostic rapide, une antibiothérapie adaptée et souvent un drainage chirurgical. Une approche multidisciplinaire est indispensable pour une prise en charge optimale du patient. L'objectif était de présenter trois cas de cellulites orbitaires odontogènes dans deux hôpitaux de Yaoundé, Cameroun et faire une revue de la littérature. Trois patients présentant des cellulites orbitaires odontogènes confirmés, d'aspects cliniques et d'évolutions différents, pris en charge en multidisciplinarité par des équipes spécialisées sont rapportés. Les cellulites orbitaires odontogènes peuvent entrainer des complications graves aussi bien locorégionales que générales, pouvant engager le pronostic fonctionnel et vital. Elles constituent une urgence médico-chirurgicale dont la prise en charge pluridisciplinaire et précoce peut améliorer leur pronostic.

## INTRODUCTION

Odontogenic orbital cellulitis is defined as an inflammatory disease of the orbital adipo-cellular tissues caused by a dental infection [1]. The incidence of this condition has fallen sharply in recent years in developed countries, thanks to a more sophisticated healthcare system and better access to treatment [2,3]. However, in developing countries in Africa, and more particularly in Cameroon, this condition is still fairly common.

A distinction is made between periorbital or pre-septal cellulitis, which often progresses favourably, and retro septal cellulitis or true orbital cellulitis, which is rarer but more serious and can be life-threatening or functionally crippling. Diagnosis is mainly based on clinical and paraclinical examinations. Treatment is primarily medical, and surgery is only necessary in the event of abcess formation or management of an oral or dental aetiology [4-6]. Early and appropriate management is a very important prognostic factor. The aim of this study was to present 03 cases of odontogenic orbital cellulitis in two hospitals in Yaoundé, Cameroon, and to review the literature.

## CASE PRESENTATIONS

### Clinical case 1

A 27-year-old female patient with de novo type 2 diabetes was referred to the maxillofacial surgery department of the Yaoundé University Hospital Center by internists for painful swelling of the right half of her face that had been present for three (03) days. She had a history of self-medication with steroidal anti-inflammatory drugs.

On clinical examination, the patient presented with asthenia, a 39°C fever, a right hemiface oedema filling in the skin folds and a right pseudoptosis. There was a shiny, warm, erythematous, painful, firm swelling along the right nasolabial fold, up to the right inner canthus (Fig 1).


Figure 1: Image showing in (A), exo buccal, an orbito-jugal swelling + right ocular pseudoptosis, in (B), endo buccal, a right palate ulceration

The right nasal mucosa showed streaks of pus associated with nasal discharge. Examination of the oral cavity revealed an ulcero-necrotic lesion on the right palate with an erythematous border opposite the root debris of antral teeth (15, 16, 17). The vestibular mucosa of these teeth was erythematous (Figure 1). An ophthalmological examination and a paraclinical workup were requested.

On ophtalmological examination, she presented a right orbital apex syndrome, comprising vision loss, ptosis and ophtalmoplegia. The left eye exam was unremarkable, with a visual acuity of 10/10.

The cytobacteriological examination of the purulent endo oral secretions revealed the presence of streptococcus sp, sensitive to amoxicillin. The full blood count showed a predominantly neutrophilic hyperleukocytosis. A craniofacial CT scan showed a Chandler stage V right orbital collection and inflammation of the right maxillary and ethmoid sinuses (Figure 2).

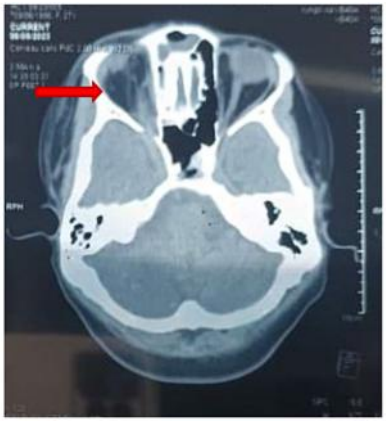

Figure 2: Craniofacial CT scan, axial section, parenchymal window showing a right unilateral orbital abscess (Chandler stage 4) + right ethmoidal sinusitis

The diagnosis of odontogenic, diffuse, suppurative retro-septal orbital cellulitis in a de novo type 2 diabetes patientwas retained.

A multidisciplinary management involving the ophthalmology, ENT, oral surgery and maxillofacial departments was implemented. A triple course of parenteral antibiotics was initiated, combining ceftriaxone (2g q12hr), amoxicillin + clavulanic acid (1g q8hr) and metronidazole (500 mg q8hr) for 10 days. Analgesics were administered (Paracetamol 1g q8hr, Nefopam 20mg q8hr) as well as a local antiseptic (polyvidone iodine).

The Ophthalmological management consisted of a combination of antibiotics and topical corticosteroids. Oral surgery management consisted of incision and vestibular drainage of the 13 and debridement of necrotic tissue on the palate. The causal teeth (15, 16 and 17) were avulsed. The patient was discharged on day 10 with an oral regiment of amoxicillin/clavulanic acid 1g q8hr and metronidazole 500 mg q8hr for a 10-day course. Follow-up was carried out over two months. The evolution was favourable with regression of inflammatory signs (Fig 3).


Figure 3: Image showing in (A) the improvement in the exo-oral clinical signs with progressive opening of the right eyelids and in (B), an endo-oral image showing the ulcerated lesion in the process of healing

However, there was an ophthalmological sequellae, with unilateral right blindness, secondary to right optical atrophy.

**Clinical case 2**

A 45-year-old HIV-positive woman with no follow-up was referred to the ENT and Maxillofacial Surgery Department of the Yaoundé Central Hospital for treatment of a right palpebral and genital swelling. In the past medical history, she recalled a dental surgery consultation 2 months ago, for a 01quadrant dental pain which was managed through multiple dental avulsions. The patient's medical records showed that she had been taking NSAIDs for a long period of time (how long?) and had been suffering from fetid right-sided rhinorrhoea for 01 months.

Facial examination revealed swelling of the right orbital and jugal regions, resulting in facial asymmetry. She presented an Inflammatory right eyelid oedema, leading to significant pseudoptosis, with the presence of a fluctuating collection that was identifiable and painful to palpation. (Figure 4).

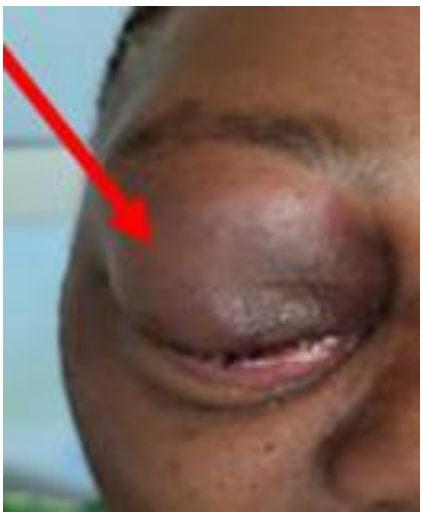

**Figure 4: Periorbital and jugal oedema + chemosis and pseudoptosis of the right eye**

The endo oral examination revealed poor oral hygiene and empty sockets at the site of the right maxillary second molar (tooth 17). On the basis of the clinical data, further investigations were ordered.

Ophthalmological examination revealed a visual acuity of 6/10 in the right eye and 10/10 in the left eye. There was exophthalmos, a purulent discharge, ophthalmoplegia, diffuse haemorrhagic chemosis, and a preserved photomotor reflex in the right eye. The fundus was normal. Examination of the left eye was unremarkable. The ENT examination concluded that there was suspected involvement of several sinuses in the right hemiface.

A craniofacial computed tomography scan revealed a right orbital subperiosteal collection or abscess corresponding to stage III orbital cellulitis in Chandler's classification (Figure 5).

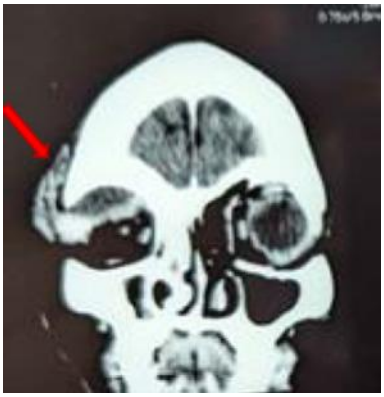

**Figure 5: Craniofacial CT scan, coronal section, parenchymal window, showing a subperiostal collection + inflammation of the right sinus**

Filling of the maxillary sinus, ethmoidal cells and frontal sinus was also observed on the right side. The diagnosis was Chandler stage III right orbital cellulitis, complicating a right odontogenic pansinusitis following dental avulsion. Bacteriological analysis of the right orbital subperiosteal collection revealed ceftriaxone-sensitive Haemophilus influenzae.

The management was medico-surgical, through a multidisciplinary approach, and consisted of triple parenteral antibiotic therapy with Ceftriaxone 1g q12hr, Gentamycin 180 mg q24hr, Metronidazole 500mg q8hr for 08 days. A combination of paracetamol 325 mg and tramadol hydrochloride 37.5 mg 1cp q8hr was given orally for 03 days. The ophthalmologic management consisted of a combination of topical antibiotics and corticosteroids. In collaboration with the ENT specialists, a naso-sinusal permeation was performed via a middle meatotomy, and the purulent collection was drained via a right latero-orbital approach. The clinical evolution was favourable after one week of treatment, with an improvement in the visual acuity (Figure 6).

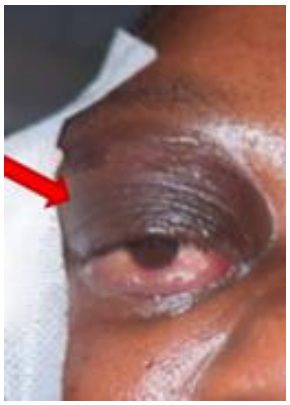

**Figure 6: Day 8, with progressive resorption of the swelling and opening of the right eyelids**

After 10 days of intravenous treatment, she was discharged on an oral regiment of amoxicillin and clavulanic acid. A follow up was carried out on day 15, 30 and 60, wih no particular finding

**Clinical case 3**

A 24-year-old man was admitted to the emergency department of the Yaoundé Central Hospital with an

altered general condition. His past history was relevant for included self-medication with non-steroidal anti-inflammatory drugs, following a dental pain two weeks before.

The patient was unconscious with a Glasgow coma score of 9/15, hyper sudation, Blood Pressure 154/71, pulse 77 beats/min, respiratory rate 35 cycles/min, oxygen saturation 90% and fever 39°C. Facial examination revealed a painful, inflammatory oedema of the left jugal and orbital regions (Figure 7).

**Figure 7: Left orbito-jugal swelling with chemosis and exophthalmos**

Endo buccal examination revealed generalised root debris in the right maxillary posterior region (14, 15, 16, 17, 18) with inflammation of the vestibular mucosa opposite the right maxillary sinus.

On ophthalmological examination, visual acuity could not be assessed due to the patient's coma state. Both eyes showed palpebral oedema with pseudoptosis, exophthalmos, ophthalmoplegia, diffuse chemosis, and mydriasis, which was reactive in the left eye and only slightly reactive in the right. The fundus showed diffuse papilledema with engorgement of the retinal veins in both eyes.

The full blood count showed a predominantly neutrophilic hyperleukocytosis. The complete blood ionogram was normal. Blood culture revealed the presence of Vancomycin-susceptible Streptococcus pneumoniae. Craniofacial computed tomography revealed a grade 1 exophthalmos on the right and grade 2 on the left, areas of collection in the orbital regions, maxillary bone sequestration ranging from 14 to 18 (Figure 8), and maxillary and left ethmoid sinusitis (Figure 4). The diagnosis retained was a Chandler stage V, orbital cellulitis of odontogenic origin.

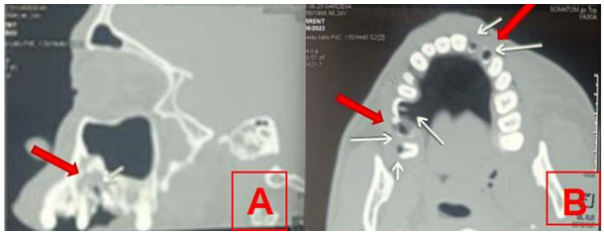


**Figure 8: image (A), sagittal section, showing maxillary bone sequestration, and in (B), transverse section, teeth 14,15,16, 17, 18 in the state of root debris + stripped alveoli at the eruption site of 22,23**

The Medical treatment consisted of oxygen therapy, triple parenteral antibiotic therapy (ceftriaxone 2g q12hr, metronidazole 500mg q8hr, vancomycin 500mg q12hr and low molecular weight heparin) and adjuvant analgesia and gastric dressing.

However, 24 hours after the initiation of the treatment, the outcome was unfavourable, with the onset of motor deficit in the right hemicorpus, thrombophlebitis of the cavernous sinuses and infectious encephalopathy. The patient subsequently died.

## DISCUSSION

Odontogenic orbital cellulitis is defined by the presence of an acute inflammatory/infectious orbital swelling of dental origin [7]. A distinction is made between periorbital or pre septal cellulitis and retro septal cellulitis. Retro septal cellulitis is a rare affection however, its occurrence should raise fears of a serious evolution towards ocular or neurological complications, or even the death of the patient [1,8].

Orbital cellulitis occurs in both adults and children, regardless of gender [8-11]. In children, the factors favouring the occurrence of this pathology are related to the reduced venous return caused by the infection at the origin of the palpebral oedema and the very thin inner wall of the orbit. This thin wall, combined with the complexity of the nearby periorbital venous network, favours the spread of neighbouring infection in the form of septic emboli [12, 13].

Numerous non-odontogenic infectious causes have been reported. However, odontogenic origin account for only 1.3 to 5% of cases of orbital cellulitis. [1,7, 16, 17]. Dental infection can spread by several routes (contiguous, haematogenous): either by intra-sinus extension, or by contiguous route through infection of the cellulo-adiputic tissues, or by distant swarming via the vascular route. More specifically, infections of the upper incisors and canines spread either through the cellulo-fatty subcutaneous layers, or retrogradely along the facial, angular and ophthalmic veins, which have no valvular system. Infections of antral teeth (upper premolars and molars) can cause maxillary sinusitis, which spreads to the orbit through continuity. This sinus route is involved in at least two-thirds of orbital cellulitis in adults and 90% of cellulitis in children [1, 12, 14, 18]. The infection spreads to the orbit by continuity. In the case of more posteriorly located teeth, the infection may spread to the pterygo-maxillary fossa and then reach the orbit via the spheno-maxillary cleft [1, 12, 14, 18].

The diagnosis of odontogenic orbital cellulitis is primarily clinical. The presence or absence of certain clinical signs depends on the location of the infection. The most frequent ophthalmological signs are periorbital oedema, ocular or facial pain, limitation of eye movements and reduced visual acuity [1, 19, 20]. Any inflammatory oedema of the orbital region must be investigated for an entry point and for ophthalmological and neurological complications [1, 19, 20]. Chandler's anatomo-clinical classification, established in 1970, remains valid today. It classifies acute orbital disorders into 5 stages of increasing severity. Class I, the only class to respond to pre-septal

cellulitis, and stages II (orbital inflammation), III (subperiosteal abscess) or stage IV (orbital abscess) correspond to retro-septal forms. Stage V, the retro septal form, involves damage of the cavernous sinuses [1, 13, 19, 20].

At the paraclinical level, biological tests help to establish appropriate antibiotic therapy. The germs most frequently observed in adults are Streptococcus pneumoniae and Staphylococcus aureus. In children, Haemophilius influenzae is more common, but vaccination has considerably reduced this frequency [12, 21]. The search for a possible biological inflammatory syndrome (neutrophil hyperleukocytosis and CRP) is of limited interest, since the positive diagnosis of these complicated forms is essentially clinical and radiological. However, it can be used as a criterion for evaluating treatment [22, 23].

Radiological examinations should be ordered when there are clinical signs pointing to retroseptal cellulitis [1, 19]. Computed tomography can be used to diagnose orbital cellulitis, providing a precise assessment of the lesions. It can be used to rule out suspicion of retro septal or intracranial involvement in the presence of alarming symptoms, such as febrile convulsions or necrotic cellulitis, as in our series. MRI is more sensitive than CT in the evaluation of orbital involvement (soft tissue), but is rarely used in view of our socioeconomic realities. Ultrasound of the orbit is less effective, particularly in the regions of the apex and behind the eyeball, and can only detect abscesses larger than 3 mm. It is therefore mainly useful for monitoring orbital abscesses under medical treatment [1, 24].

There is no consensus on the management of orbital cellulitis. If the neurological and ophthalmological examinations are normal (pre-septal cellulitis), oral medication with regular monitoring is indicated. If progress is favourable, the treatment will be continued for 15 days. If the treatment fails after 48 hours, hospitalisation is required. In general, pre-septal forms do not always require hospitalisation. Conversely, retro septal forms very often require parenteral medication and in-hospital monitoring [25, 26].

Medication is based on broad-spectrum antibiotic therapy. This is most often a combination of penicillin, cephalosporin, aminoglycosides and/or immidazoles in bi- or tritherapy. In the case of cavernous sinus thrombosis, antibiotics are treated with an anticoagulant. Thrombosis of the cavernous sinus is a rare complication. But when it does occur, it is responsible for serious, even fatal, functional sequelae. In our series, it was found in case 3, complicated by neuromeningeal propagation. The spread of the infection, and even the risk of it spreading to the brain, requires antibiotic therapy combining a cephalosporin in a meningeal dose in order to avoid fatal situations [5, 27, 28, 29].

The role of corticosteroid therapy in the treatment of sinusitis-related orbital complications remains controversial [6, 13]. However, some authors believe that the use of high doses of intravenous corticosteroids would lead to a more rapid resolution of symptoms such as fever, orbital pain, periorbital oedema and restricted eye movement [1]. Surgical treatment consists of conservative or radical treatment of the odontogenic aetiology and drainage of orbital collections or abscesses.

Pre-septal forms often have a favourable outcome. However, serious complications may arise in the case of retro-septal involvement: reduction or loss of visual acuity, septic shock, endocranial extension, or even death [1, 5, 27].

All our patients presented with retro septal forms. These forms can lead to serious complications such as blindness (case 1), thrombophlebitis of the cavernous sinus, cerebral empyema and even death, as in case 3. Blindness is secondary to mechanical optic neuropathy due to increased intra-orbital pressure and/or vascular origin due to ischaemia, occlusion of the central retinal artery, thrombophlebitis or inflammatory origin (infectious neuritis) [1, 5, 30].

Retinal and/or choroidal vascular occlusions, which can lead to a drop in visual acuity, have also been described. Lastly, reduced visual acuity may be linked to exposure keratitis due to exophthalmos or, more exceptionally, to retinal haemorrhages and/or exudates [1, 5].

## CONCLUSION

Odontogenic orbital cellulitis is a serious condition that can be life-threatening and functionally crippling, especially when the diagnosis is retarded made late and/or treatment is inappropriate. The management of orbital cellulitis has yet to be codified. A multidisciplinary approach is essential for optimal patient management and follow-up. It requires close collaboration between radiologists, ophthalmologists, ear, nose and throat specialists, paediatricians,

## CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

## AUTHORS' CONTRIBUTIONS

Godja G, Dim Bassi RR, Tamoh FS, Calyssa PMB and Njitung CT contributed to the design of this work, as well as to the collection and analysis of the data in this series. Kwedi KGG participated in the design, interpretation of the data and writing of the report. Edouma BJG and Bengondo MC directed this work. Approval of the version to be submitted was given by Bengondo Messanga C.

## REFERENCES


1. Guichaoua C, Genest-Beucher S and Boisrame S. Odontogenic orbital cellulitis: literature review. J Oral Med Oral Surg 2024 ; 30 : 4.
2. Schwartz G. Etiology, diagnosis, and treatment of orbital infections. Curr Infect Dis Rep 2002;4: 201-5.
3. Tovilla-Canales JL, Nava A, Tovilla, Pomar JL. Orbital and periorbital infections. Curr Opin Ophthalmol 2001;12 : 335-41.
4. Wald ER, Periorbital, orbital infections. Infect Dis Clin North Am 2007;21: 393-408.
5. Mouriaux F, Rysanek B, Cattoir V, Babin E. Infections Orbitaires. Emc Ophtalmologie. 2011;8(4):1-9.
6. Serghini I, El Moqqadem A, Bellasri S, Laayoune J, Hamama J, Boughalem M. Cellulite orbitaire compliquant une pansinusite aigue: à propos d'un cas. Pan African Medical Journal. 2015;22(1).

7. F. Jordana, Y. Fronty, P. Barbrel. Relations pathologiques œil-dent : point de vue du stomatologiste et de l'odontologiste. EMC-Dentisterie 1 (2004) 417–428
8. Belghmaidi S, Belhoucha B, Hajji I, Hssaine K, Rochdi Y, Nouri H, Aderdour L, Raji A, Moutaouakil A. Les cellulites orbitaires : étude prospective à propos de 75 cas. Pan African Medical Journal. 2015 ; 22 :340.
9. Dim Bassi RR, Eloundou Bana S, Badang AFD, Biangoup NP, Wokden S, Embolo C et al. Cellulite Fronto-Orbitaire Gauche Compliquée chez un Enfant Immunocompétent de 12 Ans. Health Sci. Dis: Vol 24 (7) July 2023 pp 137-140
10. Procacci P, Zangani A, Rossetto A, Rizzini A, Zanette G, Albanese M. Odontogenic orbital abscess: a case report and review of literature. Oral Maxillofac Surg 2017;21:271–279.
11. Bekibele CO, Onabanjo OA. Orbital cellulitis: a review of 21 cases from Ibadan, Nigeria. Int J Clin Pract, 2003;57:14-6.
12. De Assis-Costa MDM, Santos GS, Maciel J, Sonoda CK, de Melo WM. Odontogenic infection causing orbital cellulitis in a pediatric patient. J Craniofac Surg 2013;24:526-529.
13. 13 . Barry B, Ameline E, Thuong M, Brunel F, Pichelin C, Gehanno P. Complications orbitaires des sinusitis de l'adulte. Ann Oto-laryngol Chir Cervicofac. 2000;117(1):19-25.
14. Amat F. Complications des sinusites bactériennes du grand enfant. Arch Pediatr 2010;17:258-262
15. Le Bourdon I, Fligny I, Theron HP. A propos d'un cas de cellulite orbitaire à germes anaérobies d'origine dentaire. Bull Soc Ophtalmol, 1995;95:210-3.
16. White M et al. Neonatal tooth infection resulting in subperiosteal orbital abscess: a case report. Int J Pediatric Otorhinolaryngol 2021;140 :110524.
17. Geusens J, Dubron K, Meeus J, Spaey Y, Politis C. Subperiosteal orbital abscess from odontogenic origin: a case report. Int J Surg Case Rep 2020;73:263–267.
18. Schwartz G. Etiology, diagnosis, and treatment of orbital infections. Curr Infect Dis Rep 2002 ; 4 :201-5.
19. Younis RT, Lazar RH, Bustillo A Et Coll. Orbital infection as a complication of sinusitis: are diagnostic and treatment trends Changing? Ear Nose Throat J 2002; 81(11):771-5.
20. Chandler JR, Langenbrunner DJ, Stevens ER. The pathogenesis of orbital complications in acute sinusitis. Laryngoscope 1970 ; 80:1414-28.
21. Spires JR, Smith RJ. Bacterial infections of the orbital and periorbital soft-tissues in children. Laryngoscope 1986 ;96: 763-7.
22. Saadouli D, Yahyaoui S, Ben Mansour K . Masmoudi M , El Afrit M.A, Sammoud A. Les cellulites orbitaires chez l'enfant : à propos de 60 cas. J Fr Ophtalmol . 2019; 42(10):1056-1061.
23. Klossek JM, Quinet B, Bingen E, François M, Gaudelus J, Larnaudie S, et al. Etude actuel de la prise en charge des infections rhino sinusiennes aiguës de l'enfant en France. Med Mal Infect 2007;37:127—52.
24. Mercier-Tacheix V, Ployet MJ, Dutreix JL, Rossazza C. Intérêt de la tomodensitométrie dans les cellulites orbitaires. Bull Soc Ophtalmol Fr 1988 ; 11:1325-8.
25. Starkey CR, Steele RW - Medical management of orbital cellulitis. Pediatr Infect Dis J 2001 ; 20 : 1002-1005.
26. Oxford LE, mcclay J. Medical and surgical management of subperiosteal orbital abscess secondary to acute sinusitis in children. Int J Pediatr Otorhinolaryngol 2006;70:1853-61.
27. Ailal F, Bousfiha A, Jouhadi Z, Bennani M, Abid A. Cellulites orbitaires chez l'enfant A propos d'une étude rétrospective de 33 Cas. Med Trop 2004; 64 : 359-362.
28. Brook I. Microbiology and antimicrobial treatment of orbital and intracranial complications of sinusitis in children and their management. Int J Pediatr Otorhinolaryngol 2009;73: 1183—6.
29. Daoudi A, Ajdakar S, Rada N, Draiss G, Hajji I, Bouskraoui M. Cellulites orbitaires et péri-orbitaires de l'enfant. Profil épidémiologique, clinique, thérapeutique et évolutif. J Fr Ophtalmol . 2016; 39, 609-614.
30. Kopp W, Fotter R, Steiner H, Beaufort F, Stammberger H. Aspergillosis of the paranasal sinuses. Radiology. 1985 ; 156(3) : 715-6.