Management of Periorbital and Orbital Cellulitis at the Pediatric Emergency Department

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Abstract

Background : Orbital cellulitis is a diagnostic and therapeutic emergency, jeopardizing the vital and functional prognosis. This study aimed to analyze the epidemiological, therapeutic and evolutionary aspects of orbital cellulitis cases treated at the pediatric emergency unit.

Patients and methods: retrospective study including all the children aged between 1 month and 15 years treated for orbital cellulitis at the pediatric emergency unit of the Mohamed VI University Hospital of Marrakech over a period of 9 years (1st January 2010-31st December 2018).

Results: 129 cases of orbital cellulitis were gathered. Age varied between 1 month and 15 years with a median of age of 4.3 years. Feminine predominance (54%) was noted (sex ratio of 0.84). Preseptal cellulitis had the lead with 101 cases (78.2%). It mainly breaks through sinuses (24%). Fever was present in 101 patients (78.2%). Palpebral edema was constant. Exophthalmia was noted in 18 patients (13.9%), chemosis in 29 cases (22.4%) while ptosis was found in one patient. Bacteriological study conducted in 12 cases was positive in 7 cases. An orbital CT scan was performed in all cases of our study, showing preseptal cellulitis in 101 patients (78.2%), orbital cellulitis in 11 cases (8.5%), subperiosteal abscess in 15 cases (11.6%) and orbital abscess in 2 cases (1.5%). The medical treatment consisted of ceftriaxone, metronidazole and aminoglycoside or amoxicilline clavulanic acid. Surgical treatment was indicated in 8 patients : 3 cases of orbital abscess, 2 cases of periosteal abscess, and 3 cases of abscessed collection of the soft tissues. The evolution was beneficial in all our patients.

Conclusion: The majority of our cases had a positive evolution highlighting the advantage of an early diagnosis, and adapted antibiotic and a multidisciplinary patient care making the need for surgery rarely necessary.

Background:

Orbital cellulitis is a diagnostic and therapeutic emergency, jeopardizing the functional and vital prognosis. It is characterized by the presence of a periorbital acute inflammatory swelling with an infectious origin, that can occur at any age range, but remains more frequent in the pediatric population [1]. There are multiple types of classification for orbital cellulitis Chandler included [2]. The Chandler classification is based on the clinical signs used jointly with the orbito-cerebral CT scan to determine the stage. Moloney simplified this classification by dividing it into a preseptal and a retroseptal form, depending on the penetration of the orbital septum [3]. Its urgent patient care should be global and multidisciplinary involving cooperation amongst pediatricians, radiologists, otorhinolaryngologists and ophthalmologists. The goal of this study was to share our experience in patient care when it comes to orbital or periorbital cellulitis, therefore a group of patients were picked from the Pediatric Emergency Unit of the Mohamed VI University Hospital of Marrakech.

Patients And Methods:

It was a retrospective, descriptive and analytic study concerning children treated for orbital cellulitis. The study took place at the Pediatric Emergency Department and the Pediatric Infectiology Department of the Mohamed VI University Hospital in Marrakech. We included all the children aged between 1 month and 15 years old who were hospitalized, diagnosed and treated for orbital or periorbital cellulitis. The study was conducted over a period of 9 years (1st January 2010-31st December 2018). Uncompleted files, newborns and children of ages superior than 15 years were excluded from the study. Data collection was done using a pre-established exploitation paper with their files as background. This study consisted of the analysis of epidemic, clinical, paraclinical data, therapeutic modalities, the evolution and the complications of patients included in our study.

All our patients underwent systematic ophthalmology and ENT examinations. The orbital CT scan was performed if indicated. This allowed us to classify patients in 5 anatomo-clinical stages of the orbital damage under the Chandler classification. The statistical analysis of data was achieved using Microsoft excel 2010.

Results:

We had 129 reported cases of orbital cellulitis over a period of 9 years, with an annual frequency of 16 cases/year. The mean of the ages was 4.3 years with extremes from 1 month to 15 years. The most affected age range was the group between 1 and 5 years (68%). We noted slight feminine predominance (54%) with a girls/boys sex ratio of 1.18. Most of the children originated from rural areas (59%). Around two-thirds of cases were admitted in the autumn/winter season (63%) (Table 1). Most of the patients were vaccinated for hemophilus influenzae type (Hib) and pneumococcus with the respective rates of 93% and 87%. The means of entry into the host was known in 83% of cases, dominated by sinusitis (20%) especially ethmoid (63%), followed by traumas (17%), ocular (13%) and cutaneous (13%). The immunologic profile was normal in all of our patients with no history of illness, nor long period intake of steroids. Only one case of Trisomy 21 was noted in a 9-month-old infant. The mean period of consultation was 3.5 days. Antibiotic intake before hospitalization was found in 11 patients (8.5%) consisting of amoxicillin or amoxicillin clavulanic acid. The intake of non-steroid anti-inflammatory medication type Ibuprofen was noted in 10 patients (7.7%). The constant reason of consultation among all patients was palpebral edema and periorbital pain (100%). Fever was observed in 101 patients (78.2%). Impaired consciousness was noted in 2 cases. The ophthalmology examination done in all cases revealed the following clinical signs: palpebral edema (100%), conjunctival redness (77%), chemosis (22.4%), exophthalmos (13.9%), impaired ocular mobility (12.4%), ophthalmoplegia (1 case) and associated dacryocystitis (4 cases). The right side was the most frequent (43.4%), left (32.5%) and bilateral in 31 cases (24%) (Table 2).

Table 1
Epidemiological characteristics of patients

VARIABLES	NUMBER	RATE
Gender (ratio girl/boy : 1,18)		
Girl	70	54%
Boy	59	46%
Age (mean age : 4.3 years)		
1 month to 5 years	87	68%
5 to 9 years	22	17%
9 to 15 years	20	15%
Geographic origine		
Rural	76	59%
Urban	48	37%
Suburbain	5	4%
Vaccination status :		
Haemophilus Influenzae type b		120
Pneumococcus	113	87%
Seasonal distribution		
Fall	56	43%
Winter	26	20%
Spring	20	15%
Summer	27	21%
Average consultation time :		3,5 days
Eye damage location		
Right	56	43%
Left	42	32%
Bilateral	31	24%
Predisposing factors		
Sinusitis	37	29%
Traumatic	22	17%

Ocular	17	13%
Dermal	17	13%
Insect bites	2	1%
Respiratory infections	8	6%
Dental	4	3%
Indéterminés	22	17%
Average hospital stay : 5.5 days (range: 2 to 15 days)		

The oral examination noted physical signs of sinusitis in 31 cases (24%), a bad state of the mouth and dentition in 20 cases (15.5%), 4 of which had dental abscess, and acute moderate otitis (14%). The neurological examination was abnormal in 2 patients (meningitis syndrome). We regrouped the orbital cellulitis in 2 big categories: preseptal cellulitis (78%) and retroseptal cellulitis (28%). With regards to the biological tests, Full Blood Count (FBC) was carried out for all the patients. A high total leucocyte count was found in 56% of cases with preseptal cellulitis (the mean was 18112 elements/mm³) and in 69% of cases in the retroseptal form (mean of 14027 elements/mm³). C-reactive protein (CRP) test carried out in 95% of cases was positive in 74% of cases of pre septal cellulitis (mean total 89 mg/l) and in 51% of retro septal cases (mean total 41.3 mg/l). The bacteriological tests consisted of blood culture and pus samples. The blood culture carried out for 12 patients was positive in 7 of them. The isolated germs were coagulase-negative staphylococci (2 cases), methicillin-sensitive staphylococci (2 cases), 1 case of D-penicillin-sensitive streptococci, 1 case of 3rd generation cephalosporin sensitive enterobacteria aeruginosa and 1 case of penicillin-sensitive Hlb. The pus sampling was done in three patients: a case of a sub periosteal abscess, a case of a preseptal cellulitis with starting entry of the infection as an occipital abscess of the scalp, and one case of an extra conical intra-orbital abscess. Lumbar puncture done in 2 patients with meningitis syndrome was normal. Radiology assessment was achieved by an orbital CT scan, carried out for all the cases of our study. This allowed us to classify patients following the Chandler classification (table 3). Control scans were performed in two cases. It was issued to a patient with persistent exophthalmos thereby revealing a sub periosteal abscess that was drained afterwards using external access (Fig. 1). The second one was for a patient that presented a persistent right frontal collected abscess which had a good ulterior evolution. Ocular ultrasound was not performed for any patient.

Table III
Ophtalmological manifestations by cellulitis location

Clinical signs	Preseptal (%)	Retroseptal (%)	Total Number (%)
Periorbital pain	101 (100%)	28 (100%)	129 (100%)
Eyelid edema	101 (100%)	28 (100%)	129 (100%)
Eye redness	79 (78%)	20 (71%)	99 (76,7%)
Purulents exudate	54 (53,4%)	10 (35,7%)	64 (49,6%)
Chemosis	19 (18,8%)	10 (35,7%)	29 (22,4%)
Exophtalmos	0	18 (64,2%)	18 (13,9%)
Ptosis	0	1	1
Eye mobility			
<i>Preserved</i>	101 (100%)	11 (39,2%)	112 (86,8%)
<i>Decreased</i>	0	16 (57%)	16 (12,4%)
<i>Absent</i>	0	1	1
Visual Acuity			
<i>Decreased</i>	0	11 (39,2%)	11 (8,5%)
<i>Preserved</i>	101 (100%)	17 (60,7%)	118 (85,2%)

Table III
Distribution of patients according to
Chandler's classification

Cellulitis Stage	Number of cases (%)
I	101 (78,2 %)
II	11 (8,5 %)
III	15 (11,6 %)
IV	2 (1,5 %)
V	no cases

All the patients were treated and hospitalized initially at the pediatric emergency ward and received intravenous antibiotic treatment. The mean period of hospitalization was three days for the preseptal form, as for the retroseptal forms it reached 8 days with extremes from 2 to 15 days. All of our patients received an intravenous antibiotic treatment for a mean period of three days for preseptal forms. When it comes to retroseptal forms it was a mean period of 8 days. The antibiotic treatment associated ceftriaxone metronidazole and gentamicin in 32% of preseptal cellulitis and 100% of retroseptal cellulitis. It consisted of amoxicillin clavulanic acid for 68% of preseptal cellulitis. The oral relay was mainly done with amoxicillin clavulanic acid (122 cases) with a total rate of 94.5%. The total period of antibiotic treatment was of 10 days for preseptal cellulitis against 15 days for retroseptal cellulitis (Table 4). An oral steroid (prednisolone) was prescribed to 4 patients that presented a persistence or aggravation of the palpebral edema or chemosis. All our patients received a local treatment consisting of antibiotic eye drops, and an ocular and nasal wash in case of sinusitis. The surgical treatment that was indicated in 8 patients consisted of an orbital abscess drain (3 cases), preseptal abscess drain (2 cases) using an external route and a collected abscess of the soft parts (3 cases). On-treatment surveillance was carried out on the basis of general state, temperature, local signs (eyelid edema, ocular motility and visual acuity), neurological (state of consciousness, neurological defect) and biological (CRP). All our patients had a good evolution under a medical treatment and /or surgical. No complication was noted in our study.

Table IV
Distribution of patients according to antibiotic protocols

Antibiotic protocols	Preseptal cellulitis	Orbital cellulitis
Amoxicillin-Clavulanic acid (IV)	68%	-
Ceftriaxone (IV) Metronidazole (IV) Gentamicin (IV)	32%	100%
Amoxicillin-Clavulanic acid (oral relay)	100%	100%
Total duration of antibiotic therapy	10 days	15 days

Discussion:

Orbital cellulitis is a rare affection but more frequent in children than adults. Murphy, through his one year study, reported an incidence of 1.6 for 100000 children [4]. The Cieslak study that lasted 25 years claims that the incidence was stable slightly decreasing from 4.3 to 3.74 for 1000 [5]. During our study’s period, we noted that the number of cases increased from 2 in 2010 to 31 in 2017. In the majority of the pediatric series [6–9], the mean age of children with orbital cellulitis varied between 3 and 6 years old which matched with our study. On the other hand, the frequent age group was the one under 5 years old (68.2%) which is the case for the majority of the series [6, 10, 11]. This affection is more frequent in boys than girls with a variable sex ratio depending on the series [7, 9, 10, 12, 13]. On the contrary, our study reports a slight feminine predominance (sex ratio girl/boys: 1.18). Seasonal variations were described by literature with a winter peak, attributed to the frequency of the upper respiratory tract infections especially sinusitis

[10, 14]. Our data matched literature, with a rate of 63% of admissions in the autumn/winter season. In our study 93% were vaccinated against Hlb (vaccine present in morocco since 2007), only one case of Hlb was isolated. This joined the literature's data that claims a drastic drop of the Hlb incidence in periorbital cellulitis in children after vaccination against Hlb [15, 16]. This was also reported regarding the decrease in the incidence of pneumococcus after the introduction of anti-pneumococcal vaccination [17]. In morocco, the vaccine was introduced in 2011. No case of pneumococcus was isolated in our study.

There are no typical signs of orbital cellulitis, but multiple clinical presentations depending on the exact localization of the infection and its gravity. Concerning the preseptal cellulitis, the signs are often moderate. While they're important in retroseptal cellulitis and that can lead to visual complications even fatal ones. It can be difficult to differentiate the two forms; consequently, paraclinical examinations are necessary to confirm the diagnosis and evaluate the complications [2, 18, 19]. The Chandler classification gives us a benefit of precisising the infection's stage [2]. Stage I constitutes the preseptal cellulitis which is the most frequent in literature. A lot of studies proved the predominance of the preseptal cellulitis with a rate of: 86% [19], 83% [11], 80.3% [20], 75% [9], which matches our rate of 78%. It starts with an edema and inflammation of the lids with no visual alteration nor oculomotricity nor exophthalmos. It's the least severe form, its restricted before the orbital septum. The II grade constitutes the orbital cellulitis or the retroseptal form that is frequently associated with fever. It results from the diffusion of the edema and the inflammation that infiltrates the orbital fat. The ophthalmic examination reveals an exophthalmos, sometimes chemosis, a ptosis and a bulbar conjunctival and episcleral injection. The importance of the orbital infiltration may lead to compression with variable effects affecting the oculomotricity and the ocular tonus. It had a 7% rate in our study against 2.8% in Chang's study [21], 19.7% in Santos study [20], and 13.3% in Botting's study [19]. The sub periosteal abscess constitutes stage III presenting a non-axial painful, inflammatory exophthalmos. The palpation of the eyelids edema may find an intra-orbital, fluctuating lump where the pain is maximal. Different anomalies may entangle: an ocular hypertonia, an intra-orbital hypertension, a decrease in ocular movements. Its rate was 12% in our study against 15.8% in Sciarretta's study [7], 22.8% in Chang's study [21], and 42.3% in Kinis's study [22]. The orbital abscess defines the 4th stage. We therefore find an ophtalmoplegia, a vision alteration and anomalies in the fundus of the eye, often with papillary edema. The chemosis is important. These signs are often associated with an alteration of the general state and a fever. No case was noted in our study against 11.4% and 35% respectively in Chang's study [21] and Singh's study [23]. The 5th stage is characterized by the presence of a thrombosis of the cavernous sinuses which is a severe complication luckily rare. This table lists the appearance of severe neurological signs with oculomotor paralysis, abolition of the oculomotor reflexes, mydriasis, and a drop in the visual acuity sometimes even blindness. No case was found in our study, against 11.4% in Chang's study [21]. On the other hand the affection is mostly unilateral, rarely bilateral. Our study is characterized by a high level of bilateral damage (24%) found in periorbital cellulitis compared to other series [8]. The biological tests allowed us to confirm the diagnosis and follow the evolution. The elevation of the CRP was highly noted in pre septal cellulitis than the retro septal ones in Liu's study [14], which was not the case in our study. In contrast, the high level of leucocytes was more frequent in the retro septal forms than in the pre septal ones (69% versus 56%).

While it was normal in 67% of cases in Fanella's study [10]. *Staphylococcus aureus* followed by the streptococcus were the two main germs in literature which also suggests an evolution in the microbiology of pediatric orbital cellulitis with an increase in the rate of the methicillin resistant *staphylococcus aureus* [9, 14, 24, 25]. In our study, we noted predominance in *staphylococcus aureus* and coagulase negative (28% each).

The CT scan was the first modality of imaging used for diagnosis, for the classification and follow up of orbital cellulitis. It allows us to classify the orbital cellulitis in 5 states using Chandler's classification. The presence of the proptosis and/or pain or a limitation of extra ocular movements would be an urgent indication to do a CT scan due to the high risk of intra orbital abscess [26, 27]. The indication is also set in case of incapacity to differentiate between a pre septal and a retro septal cellulitis. Although it's dominated by the pre septal forms (78%) in our study, orbital CT scan was performed in all cases. This was explained by the lack of experience of residents during shifts asked systematically for a CT scan to be carried out on all the patients. The orbital magnetic resonance imaging (MRI) would be more efficient than the CT scan in diagnosing the intracranial complications. The ocular ultrasound was insufficient for the deeper affections. Nevertheless it can play an important role in the follow up of the evolution of orbital infections [28]. Neither ultrasound nor MRI was prescribed in our study. In majority of the studies, sinusitis especially ethmoidal ones were a main predisposing factor [4, 6, 11, 14, 18, 19, 29]. This matches our study where sinusitis dominated (29%) where ethmoid sinusitis came first (63%). Other causes were reported by literature [11, 14], such as traumas and dacryocystitis found respectively in 17% and 13% of cases in our study. Santos [20] underlines the impact of dental abscess as a predisposing factor of the pre septal cellulitis (20.4%). This cause was found in only 3% of our study.

The treatment of an orbital cellulitis constitutes an emergency. Hospitalization is obligatory if: the age is under 1, presence of altered visual acuity, exophthalmos, proptosis, ophthalmoplegia and neurological signs. At the moment there is no consensus concerning antibiotic protocols. However a conservatory treatment based on empirical antibiotherapy is recommended [30]. In our study, the treatment of choice was amoxicillin clavulanic acid prescribed in the majority of our cases [21]. The total period of antibiotic intake was of 7 to 10 days in the preseptal cellulitis and 10 to 14 days in retroseptal cellulitis. The intravenous route is a general rule in the retroseptal cellulitis. When it comes to pre septal cellulitis, the oral intake was possible in ambulatory care for children aged more than 1 year with no signs of diffuse bacterial infections subject to a narrow surveillance in the next 24 to 48 hours. The intravenous route was used in all patients like a lot of other studies [14]. The use of steroids in the treatment is controversial. It would presumably reduce the inflammation with a decrease of the period of intake of antibiotics and hospitalization [31]. In our study, 3% of our patients received oral corticotherapy against 19.7% in Santos study [20].

In literature, the use of surgery is very rare when it comes to preseptal cellulitis and varies between 0 to 11% in most of the series [30]. However the preseptal cellulitis can be a real danger can alter the visual prognosis necessitating a surgical drain in certain cases [32]. In our study, 3 cases of pre septal cellulitis necessitated a surgical drain. A lot of studies showed that retro spetal cellulitis can also be treated

without the use of surgery (success rate of 77 to 100%) [30]. A recent large cohort (n = 3041 children) in USA showed that age, ophthalmologic comorbidity, and conjunctival edema were significantly associated with surgery [33]. One patient of our study presenting orbital cellulitis (stage II) was treated by decompressive orbitotomy due to his clinical aggravation.

There is no universally agreed protocol for the treatment of subperiosteal abscess. A lot of already done studies showed excellent results in patients treated for sub periosteal abscesses with medical treatment only. Therefore an urgent surgical drain has to be planned in case of the failure of an adequate medical treatment or in case of a visual deterioration [7]. In our study a surgical drain was indicated in 2 out of 12 cases (16.6%) achieved by an external route.

In our study almost all our patients had a positive evolution without complications. This can be explained by rapid care and treatment, a large-spectrum use of antibiotics, a systematically performed CT scan in all stages, and a multidisciplinary collaboration of other specialties.

Conclusion:

Despite its retrospective nature, this study has shown that the preseptal forms remain predominant. It has also shown the interest of having a uniform protocol for the management of orbital cellulitis in Pediatric Emergencies for the choice of antibiotic therapy and the indication of imaging. All our patients had a positive evolution thus highlighting the importance of an early diagnosis, of an adapted antibiotherapy and a multidisciplinary care approach making surgery rarely necessary.

Ethics approval and consent to participate:

This project was approved by the ethics committee of the Faculty of Medicine of the University of Cadi Ayyad in Marrakech. Given the retrospective nature of this study, the project was deemed to be of very low risk for the patients and the anonymity and confidentiality of the patients was respected throughout the study.

Consent for publication:

Not applicable.

Availability of data and material:

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

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Authors' contributions:

- **MB** and **WL** analyzed and corrected all the details of the article. **WL** contributed to study conception and design; data collection, analysis, and interpretation; and manuscript preparation. She approved the final manuscript.
- **MB** conceived the study, reviewed the article, analysis and approved the submission of the manuscript.
- All authors have read and approved the manuscript.

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Figures

Figure 1

Figure 1