

# Acute periorbital swelling: Evaluation of management protocol

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**Objective:** Reporting and evaluating a general pediatric unit experience with a simplified protocol based on clinical signs stated on admission used to classify cases of periorbital cellulitis in potential high- and low-risk complication groups.

**Population:** All children under the age of 14 years with acute periorbital swelling not resulting from an immediate direct trauma to the eye and the orbit, referred to the emergency department between December 1, 1986, and December 31, 1992.

**Method:** A high-risk case was defined by: age under two months, meningeal or focal neurologic signs, vision loss, limitation of eye movement, eye malformation or operation in the vicinity, and clinically toxic child on admission. Absence of these elements defined the low-risk case. Initial antibiotic management was the same in both groups, but work-up was different according to the classification of the case.

**Results:** Thirty-four patients were included in the study. Only one (six months old) had a positive blood culture with *Haemophilus influenzae* found in the low-risk group (16 patients), and no serious complication was encountered. In the high-risk group (18 patients), five had positive cerebrospinal fluid and/or blood culture, two had subperiosteal abscesses, and three had intracranial abscesses. In the whole series, "toxicity" was significantly associated with either positive cerebrospinal fluid or blood culture. Fifty percent of positive cultures were due to *H. influenzae*.

**Conclusion:** The protocol is considered practical, safe, and represents a suitable triage tool particularly if the high-risk age was raised to 12 months. There is no necessity to perform lumbar puncture in the low-risk group.

## INTRODUCTION

Periorbital cellulitis (POC) is a term commonly used for both preseptal and orbital cellulitis. Orbital preseptum constitutes a partially effective barrier against the spread of infection from the preseptal to orbital area. Serious complications can result from the extension of the infectious process to the eye and the central nervous system. Early detection of POC is important to avoid these complications. Through this study, we tried to evaluate a simplified protocol to deal safely with this entity in children.

## METHODS AND POPULATIONS

Since the beginning of 1986 a simplified protocol based on clinical data was adopted to deal with cases of acute orbital or periorbital swelling seen in the emergency department (ED). Cases

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caused by immediate direct trauma to the eye and orbit or by insect bite were excluded.

For each patient, age, sex, referring physician, interval between the beginning of symptoms and admission, mild facial or head trauma in the days prior to admission, recent or old operations in the vicinity of the eye, and possible prior oral antibiotic therapy were carefully noted. Complete clinical evaluation focused on the presence of meningeal signs, neurologic deficit, proptosis, loss of vision and eye movement (lateral and vertical), malformation of the eye, minimal traces of recent facial trauma, signs of upper respiratory tract infection, and signs of clinical toxicity. Toxicity is mainly a clinical impression of extreme lethargy associated or not with intermittent irritability and lack of "well being" of the child.

The high-risk group patients were defined by the presence of one of the following elements: age less than two months, clinical toxicity, meningeal irritation signs or neurologic deficit, proptosis, loss of vision or eye movement, or malformation of the eye or operation in the vicinity. The low-risk group patients were defined by the absence of these elements.

In the first group, blood culture (BC) and lumbar puncture (LP), after verification of fundi, were mandatory on admission in all cases. Brain computed tomography (CT) was planned for the following hours in case of proptosis or neurologic deficit.

In the second group, BC was mandatory, and LP was not advised, but the decision was left to the senior resident on call.

Complete blood count and peripheral blood smear were done routinely on all patients. Plain sinus x-rays were done upon clinical suspicion of sinusitis if CT was not indicated.

Reaction of the pupils to light and hand movement perception were evaluated on each eye separately. Visual field testing and color vision were considered nonapplicable in our facility in urgent situations.

Intravenous (iv) antibiotics covering *Staphylococcus aureus* and *H. influenzae* (cefotaxim, ampicillin chloramphenicol, or ampicillin gentamicin for patients under three months age) were immediately initiated after LP and BC in all cases. The decision to discontinue or modify iv antibiotics was taken on the third day after initial culture results and progression of the patient. In the low-risk group, if the BC was negative and the clinical situation improved, patients were discharged on the third day on oral antibiotics for another week. The situation of high-risk patients was evaluated on the fifth day. All patients were given an appointment in the outpatient clinic one week after discharge. All children under the age of 14 years with acute periorbital swellings not resulting from direct immediate trauma referred to the ED during the study period were hospitalized and included in this study.

## RESULTS

Between January 1, 1986, and December 31, 1992, 34 children hospitalized for an acute periorbital swelling met the criteria of

inclusion in the study. Among these patients, 13 were referred by ophthalmologists, six by pediatricians, and 15 were directly brought by their families to the ED. The group included seven girls and 27 boys. Their mean age was 40.4 months (range one month to 14 years). (See Table 1.) The frequency of major clinical signs encountered in the whole group and stated on admission is reported in Table 2.

Seasonal variation showed that 19 cases (56%) were recorded between the first of June and the end of September. In addition, 18 (53%) had upper respiratory tract infection. Mild facial trauma a few days prior to swelling was reported in five patients (15%). One patient had a familial congenital malformation associated with coloboma and pghalmos. Another was operated on for a small nasal encephalocele. Three patients had intracranial abscesses and six had local complications. Six patients had either cerebrospinal fluid (CSF) or positive BC or both (Table 3).

According to the criteria mentioned above, patients were classified either as being in a low-risk complication group or high-risk complication group.

**Low-risk complication group (Table 4).** Sixteen patients were included in this group, five have received oral antibiotics for at least 24 hours prior to admission. The main interval of time between the beginning of the periorbital swelling and admission was 2.2 days (SD = 1.8). BC was done on 15 patients on admission. One case was positive for *H. influenzae*. When the result was received on the third day the patient was in excellent condition, and LP was not performed (Patient 6). BC was not done on Patient 15, who was afebrile on admission and had not received prior oral antibiotics. LP was done on eight patients, and all were negative. In Patient 32, the bilateral periorbital swelling was the revealing sign of acute lymphoblastic leukemia. One patient developed simple febrile seizure during hospitalization (Patient 10), and another developed a superficial periorbital wound abscess (Patient 26). No complications were detected in this group one week after discharge.

**HIGH-RISK COMPLICATION GROUP (TABLE 5)**

Eighteen patients were included in this group, 13 boys and 5 girls. Mean interval between symptoms and admission was 2.8 days (SD = 2). Thirteen were considered clinically "toxic" on admission, five had meningeal signs, and five had serious ocular signs.

Oral antibiotics were given to five patients prior to admission. Positive blood or CSF cultures were reported in five patients (Table 5), and four additional CSF were abnormal but cultures were negative. Local eye swab culture yielded the same results with identical sensitivity organisms as CSF and blood in two cases (20 and 33). In other cases results were noninformative. Patient 23 was

**TABLE 1**  
*Age and sex distribution*

Age (months)	M	F	Total	Percent
0-6	7	1	8	23.5
6-12	6	2	8	23.5
12-18	2	0	2	6
18-24	2	2	4	12
24-48	1	1	2	6
48-96	3	0	3	9
>96	6	1	7	20
Total	27	7	34	100

**TABLE 2**  
*Frequency of clinical signs on admission*

Clinical sign	Total	Percent
Fever >37.8°C	28	82
Toxicity	13	38
Swelling erythema	34	100
Right	13	38
Left	17	50
Bilateral	04	12
Limited eye movement	02	6
Proptosis	04	12
Meningeal signs	05	15

considered initially in this group because he presented on admission with bilateral loss of vision (poor light perception and bilateral mydriasis). Investigation done later showed that he had an undiagnosed infantile osteopetrosis with bilateral optic atrophy.

Complications in this group were common and serious. Patient 5 developed a superficial abscess located in the infraorbital soft tissues of the cheek; Patient 9 developed a pus collection within the upper eyelid which was drained surgically. Patient 30 presented with conjunctivitis and proptosis. CT showed a subperiosteal abscess; it resolved by antibiotic treatment alone. Patient 19 had a mild proptosis after admission, and CT showed medial orbital subperiosteal abscess, in the location of an old operation for what was considered an encephalocele. Antibiotics alone were sufficient to obtain a cure. Patient 29 was convulsing on admission and needed respiratory assistance; the final outcome was poor with severe brain damage.

Three patients developed intracranial abscess. Patient 2 had neck stiffness on admission. CSF analysis showed high protein without cells. Right-sided hemiparesis was noted 36 hours later, and CT showed a small, left-sided epidural abscess and maxillary sinusitis. The patient was operated on and improved rapidly. Patient 18 was mentally retarded and had recent behavioral modification. A brain CT showed frontal abscess, interhemispheric abscess, and frontal sinusitis. One month after the first operation he had recurrence of interhemispheric abscess and was operated on a second time. Patient 20 had proptosis, right eye endophthalmitis, nonreactive mydriasis, and poor light perception. Brain CT showed abnormal right retroorbital tissue and multiple brain abscess. Surgical exploration of the right orbit showed diffuse inflammation without organized pus collection. The brain abscess was cured by antibiotics, and the

**TABLE 3**  
*Associated factors: Positive cultures and complications*

Associated factors	No. of patients	%	BC+	CSF ABN	CSF+	LC	Brain abscess
Rhinopharyngitis (Rp)	8	23	1	2	1		
Rp + sinusitis	2	6				1	1
Rp + otitis media	3	9					
Otitis media	3	9		1			
Sinusitis	2	6		1			1
Facial trauma	5	15	1	1	1	1	
Congenital malformation	2	6		1		1	
Leukemia	1	3					
No associated factor	8	23	3	1	1	3	1
Total	34	100	5	7	3	6	3

BC+, positive blood culture; CSF, ABN, abnormal CSF analysis; CSF+, positive CSF culture; LC, local complications.

**TABLE 4**  
Low-risk complication group

Case	Age	Associated factors	BC	CSF	Complication
1	30	Rp, OM	Ng	Ng	0
4#	120	Facial trauma	Ng	Not done	0
6	6		HI	Not done	0
7#	120	Facial trauma	Ng	Not done	0
10	30	OM	Ng	Ng	0
11	10		Ng	Ng	0
14	12	Rp, OM	Ng	Not done	0
15	13	Rp	Not done	Not done	0
16	18		Ng	Ng	0
21	24	Rp	Ng	Ng	0
24#	24	Facial trauma	Ng	Ng	0
26#	96	Facial trauma	Ng	Ng	Wound abscess
27	7	OM	Ng	Ng	0
28	60	Rp	Ng	Not done	0
32#	24	Rp, ALL	Ng	Not done	0
34	60	Sinusitis	Ng	Not done	0

Ng, no growth; ALL, acute lymphoblastic leukemia; OM, otitis media; Rp, rhinopharyngitis.

vision in the right eye unexpectedly improved two months later.

**Statistical comparison.** The two groups had no significant differences between sex, interval between symptoms and admission, association of mild facial trauma, rhinopharyngitis, otitis media, prior administration of oral antibiotics, or a white blood cell count of >10,000 on admission. These elements were not taken into consideration for the initial classification of the two groups. In the whole series, the clinical impression of "toxic" child was significantly associated with either positive CSF or BC or both (Fischer exact test,  $P = 0.02$ ).

An attempt to evaluate the validity of initial criteria of high risk, and their relation to the final outcome of individual cases, was done in two ways. First, the whole series was divided into two groups as a function of outcome. The first group included those who had positive CSF or BC, and/or who developed orbital cellulitis or

**TABLE 6**  
Studied criteria in function of outcome

Studied criteria	Whole series (n = 34)			Modified series (n = 25)		P
	A (10)	B (24)	P	A (8)	B (17)	
Age = <2 mo	1	3	ns	1	2	ns
Age = <12 mo	4	12	ns	3	10	ns
Proptosis	4	0	0.004	3	0	0.02
Limited eye movement	2	0	0.06	2	0	0.09
Meningeal signs	5	0	0.0009	3	0	0.02
Toxicity	6	7	0.01	5	6	0.02
Facial trauma	1	4	ns			
Fever = >39°C	5	12	ns	4	11	ns
Int = >48 h	5	6	ns	5	4	ns
PAB	4	6	ns	4	6	ns
WBC = >10000	9	18	ns	7	13	ns

INT, interval between symptoms and admission; ns, not significant; PAB, prior administration of antibiotics; WBC, white blood cell count.

intracranial abscesses (10 patients—group A). The second included other cases (24 patients—group B). The same analysis was also done after the exclusion of cases with the notion of mild facial trauma, leukemia, or malformations (marked by # in Tables 4 and 5). Nine cases of group A (serious cases) occurred in the initially high-risk classified patients and only one in the low-risk group (Fischer exact test,  $P = 0.007$ ). The same significant difference was found also after the exclusion of cases of trauma and malformation (Fischer exact test,  $P = 0.04$ ).

Second, individual risk factors such as age = <2 months, age = >2 months, temperature = >39°C, proptosis, toxicity, meningeal signs, interval between the beginning of symptoms and admission, prior administration of antibiotics, and number of leukocytes were studied in function of outcome groups with and without exclusion of facial trauma and malformation cases. Only the presence of proptosis and meningeal signs were significantly related to the serious outcome group (Fischer exact test,  $P = 0.004$  and  $0.02$ , without and with exclusion of facial trauma and malformation

**TABLE 5**  
High-risk complication group

Case	Age	T	Ocular signs	Associated factors	MS	CSF	BC	Complications
2	120	-	P	Sinusitis	+	Ng*	NG	Epidural A
3	9	+	-	Rp	-	Ng	Ng	
5	6	+	-		-	Ng	Ng	Periorbital A
	9	+	-	Rp	-	Ng	Ng	
9	1.5	-	-		-	Ng	Ng	Periorbital A
12	6	+	-	Rp, OM	-	Ng	HI	
13#	1.6	-	Vision loss	Coloboma, cryptophthalmos	-	Ng	Ng	
17	1	+			-	Ng	Ng	
18	160	+		Rp, sinusitis	-	Ng+	Ng	Multiple brain A
19#	144	-		Nasal encephalocele	+	Ng+	Ng	Subperiosteal A
20	108	+	P, L, V		+	SA	SA	Multiple brain A, orbital A
22	12	+			-	Ng	Ng	
23#	5	+	V	Rp, osteopetrosis	-	Ng	Ng	
25	12	+		OM	-	Ng*	Ng	
29	8	+		Rp	+	HI	Ng	Brain damage
30	1.5	-	P, L	Rp, sinusitis	-	Ng	Ng	Subperiosteal A
1	20	+			-	Ng	SP	
33#	96	+	P	Facial trauma	+	SA	SA	

A, abscess; HI, *H. influenzae*; L, limitation of ocular movement; MS, meningeal signs; Ng, no growth, normal CSF analysis; Ng\*, no growth with high CSF protein; Ng+, no growth with increased CSF protein and leukocytes; P, proptosis; SA, *S. aureus*; SP, *Streptococcus pneumoniae*; T, toxicity; V, loss of vision.

cases). The volume of this series is not suitable for further analysis (Table 6).

## DISCUSSION

The swollen eye is a relatively common emergency in the pediatric age group. Anatomic classification in preseptal and orbital cellulitis is useful but can be difficult to use for general practitioners or young pediatricians. Etiologic classification in cases secondary to paranasal sinusitis, or associated with skin disruption or bacteremia<sup>1</sup> can give false security. Our method was based on a comprehensive approach of the child with a defined and limited number of elements in the clinical history and physical examination.

The general characteristics of this series were not different from other reported studies. Boys were encountered more often (79%) in this series, as most of reported series<sup>2-4</sup> except one.<sup>5</sup> Most of published series<sup>2-4</sup> reported a predominance of left involvement. Sixty-five percent of our patients were under two years of age (younger than generally reported in other series). Upper respiratory tract infection was highly reported in association with POC.<sup>2,5</sup> The rate of either positive CSF and/or BC was 17.6% in this series. It ranged between 10 and 29% in other publications.<sup>3,4,6-8</sup> *H. influenzae* was isolated in 50% of positive cultures, relatively lower than reported in other series.<sup>3-6,9</sup>

LP was done in 76% of cases, 50% in the low-risk group and 100% of the high-risk group. In some cases, meningitis may complicate POC in the absence of clinically apparent signs of meningeal irritation.<sup>3,10-12</sup> This could not be excluded in one of our low-risk cases with a positive BC. The main reason for doing LP in low-risk cases given by residents on-call was their difficulty in interpreting the irritability of the patient and the anxiety of the family in the atmosphere of the ED.

Brain and orbital CT scan was very helpful in our experience in diagnosing subperiosteal and intracranial abscesses.<sup>13-17</sup> The difficulty in interpreting plain sinus x-rays in patients under the age of two years is a well known problem.<sup>18</sup> Sinusitis complications in relation to orbital cellulitis have been well documented and seemed more significant in older children.<sup>19,20</sup> Subperiosteal abscess was managed medically in our two cases without surgical drainage, treatment considered as necessity in some reports.<sup>21,22</sup>

The key to limit the unnecessary LP in these patients is a careful clinical examination. No case of meningitis or abnormal CSF suggestive of bacterial meningitis was reported in a patient who had not been toxic looking, had no meningeal signs or impairment of consciousness even in patients one year of age except for the one aged two months with a positive BC. This fact has obliged us to consider any patient of less than 12 months as high-risk where LP must be mandatory as a modification of our protocol since January 1993 in addition to the lack of necessity to do LP in the low-risk group. The notion of toxicity suffers from certain subjectivity and difficult quantitation but proves to be useful in many clinical situations.

Mild facial trauma is common in young children. Sometimes it is ignored by parents and found on careful clinical examination. Its relation with POC might be causal or only temporal. When present, it is taken into consideration in initiating antibiotics, but from our experience there is no justification for separating these cases into a special group.

Prior oral administration of antibiotics (a common abuse) was not taken as an indication to do LP in low-risk group patients. Parenteral antibiotics were initiated in all cases after BC sampling, and patients were safely followed in the hospital for at least 48

hours. Still, this subject is controversial but from our own experience and reports from other studies,<sup>23,24</sup> short administration of oral antibiotics does not really change the course of serious infections. As stated in all previously mentioned data, it is important to initiate iv antibiotics covering for *H. influenzae* and *S. aureus* as a safe and justified practice in the treatment of POC in all suspected cases whatever the associated factors or the presumptive etiologies were.

In conclusion, this protocol can constitute a safe triage tool to deal with all cases of periorbital swelling initially. Increasing the high-risk age to 12 months, an age under which it is often difficult to appreciate meningeal signs, should increase its safety.

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