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Comparison of Surgical Approaches of Subperiosteal Abscess in Children

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Abstract

Background: Orbital subperiosteal abscesses (SPOAs) in children requires timely treatment for potential complications. The best surgical approaches for SPOAs were non-conclusive. In this study, we analyzed the treatment outcomes comparing different surgical approaches.

Methodology: The medical records of children less than18 years old hospitalized from 1996 through 2007, at the Chang Gung Memorial Hospital, with a diagnosis of SPOAs confirmed by computed tomography scan were reviewed. Surgical intervention was indicated only with failed medical therapy, progression of symptoms, or onset of complications. For SPOAs located in the medial aspect of orbit, we use transnasal endoscopic (TNE) approach; SPOAs in the superior aspect of orbit, we use external (EXT) approach; and SPOAs in both the medial and superior aspects of orbit, we use combined approach.

Results: Twenty-two patients, 14 boys and 8 girls, were identified (mean age, 5.45 years [range, 12 days to 18 years). Ten patients were treated with a TNE approach, 8 patients required an EXT approach and 4 patients received combined approach. The age of patients receiving EXT approach is significantly younger than other groups (ANOVA: P = 0.023). The most frequent symptoms were fever (100%) and the most involved sinus was maxillary sinus. The most frequently isolated organisms were Staphylococcus aureus, Streptococcus viridans, and Klebsiella pneumonia. One patient required repeated aspiration externally. All patients had eventual resolution of their disease without any surgical complications.

Conclusion: The selection of surgical approach for pediatric SPOAs according to their radiographic location was proved successful in all our patients.

Keywords: Surgical; Subperiosteal; Children

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Introduction

Orbital subperiosteal abscesses with resulting eyelid and periorbital skin cellulites in children, inclusively termed orbital (or postseptal) cellulites, have always been considered acute surgical emergencies by pediatricians [1]. Pediatric subperiosteal orbital abscesses (SPOAs) and orbital cellulites are infectious process in which the abscess pocket is described as lying between the periorbita and the lamina papyracea. The source of the infection is believed to originate most frequently from ethmoid and maxillary sinusitis, although vascular spread from the adjacent orbital, cranial, and facial structures is also possible [2-4]. A SPOA requires timely treatment for the potential complications, which include visual loss, endophthalmitis, cavernous sinus thrombosis, intracranial spread (e.g. meningitis, cerebritis, brain abscess), and ultimately death [3,5-7].

While medical treatment of pediatric orbital cellulitis results in excellent outcomes [8], surgical drainage has traditionally been recommended for SPOA secondary to sinusitis [9,10]. There are several reports of the successful management of selected SPOA solely with medical therapy [4,11-17]. Generally, nonsurgical treatment is reserved for patients without signs of significant ocular deficits such as vision loss. Patients with CT-confirmed PSOA who had orbital or intracranial complications or who failed to respond to antibiotic treatment would need surgical drainage to prevent morbidities [12,18].

Table 1: Clinical data of all the patients (n=22).

Characteristic	
Age (year)	
Mean ± SD	5.45 ± 1.21
Range	12 days old -18 y/o
Side [No. of patients (%)]	
Right	11 (50.0)
Left	10 (45.5)
Bilateral	1 (4.5)
Sex [No. of patients (%)]	
Male	14 (63.6)
Female	8 (36.4)
Surgery	
Endoscopic surgery	10 (45.5)
External Approach	8 (36.4)
Combined endoscopic and external approach	4 (18.2)

Traditionally, orbital abscesses were treated with external surgical drainage [9,10]. Surgical options include traditional external approaches to the orbit, and more cosmetically appealing procedures including the transcaruncular external approach (EXT) [19]. and endoscopic drainage [20,21]. While EXT approach providing direct access to medial SPOA, the cutaneous incision may result in cosmetic complications such as webbing [22]. Recent techniques including transnasal endoscopic surgery (TNE) [20,21,23] could provide a safe way for drainage. However, in the situation that SPOA extends superiorly and laterally, TNE has some limitations in this situation. The EXT approach [19] provide access to medial abscesses without cosmetic morbidity. In patients that the abscesses are not adequately drained through the above 2 approaches, we used an alternative approach that combined TNE and EXT for SPOA. In this study, we retrospectively reviewed 22 SPOAs receiving drainage through the above 3 methods and analyzed the clinically relevant results.

Methods and Material

A retrospective medical chart review of all patients 18 years or younger surgically treated for a subperiosteal abscess (SPOA) at Chang Gung Memorial Hospital from 1996 to 2007 was performed. Clinical examinations confirmed the presence of a SPOA in all patients. All the patients received orbital or sinus computed tomographic (CT) scans confirming the diagnosis of SPOA and concomitant sinusitis. The orbital abscesses secondary to trauma or surgery and those with anatomic abnormalities of the eye, malignancy or other immune suppressed states were excluded. All patients initially received parenteral antibiotics and supportive measures. Surgical intervention was indicated only with failed medical therapy, progression of symptoms, or onset of complications (e.g. visual changes, cavernous sinus thrombosis, and intracranial involvement). Those patients receiving surgeries were determined according to the location of SPOA. (I) If the SPOAs were localized in the medial aspect of orbit, then surgery would be transnasal endoscopic approach (TNE). (II) If the SPOA involves the superior orbital region and most part of SPOAs were in the periphery of superior region which could not be successfully drained endoscopically, an EXT approach would be chosen. (III) If the abscess involved both medial and superior and extends more laterally, then a combined approach would be done. The presenting signs and clinical course of each patient were reviewed.

Medical charts were reviewed specifically for age at presentation, presentation duration of periorbital edema before presentation, and white blood cell (WBC) count and temperature at initial presentation. Preoperative CT scans were reviewed for the location of the SPOA. Possible descriptors included medial, superior, or laterally based SPOAs.

In our hospital, patients presenting with significant ocular findings, progression of ocular signs or failure to improve after 48 h of medical therapy should be treated with surgical drainage.

TNE approach

During operation, decongestion of the inferior turbinate and middle turbinate was achieved by using 2% oxymetazoline–soaked cotton pledgets. The inferior portion of the uncinate process was uniformly excised. Using curettage, the ethmoid sinus air cells were opened and diseased mucosa was removed. Identification and incision of lamina papyracea were done and part of the bone was removed until most of the pus discharged. Usually we compressed gently over ipsilateral eyelids to ensure the abscess was adequately drained. After surgery, small pieces of Surgical® were paved over the surgical wounds and a long piece of Vaseline loosely packed over the wound. The packing's were removed 2 days later.

External approach

An injection with 2~3 ml of 2% xylocaine with 1:100000 adrenaline was given in the medial bulbar conjunctiva and plica. After retraction of lids with speculum, a Westcott scissors was used to make the incision through caruncle. The traction sutures on each side of the caruncle incision wound were made by 4-0 silk. Gentle dissection with the tips of Stevens scissors in an anteroposterior

Table 2: Comparison between 3 surgical approaches.

	Surgical approaches			
	TNE [Mean(±S.D.)]	EXT [Mean(±S.D.)]	Combined [Mean(±S.D.)]	P value*
Mean age (yrs)	8.83 (±6.87)	1.92 (±1.86)	4.04 (±1.29)	0.023
Symptoms prior to admission (days)	2.90 (±1.10)	4.13 (±2.23)	5.00 (±2.71)	0.157
Hospitalization (days)	13.00 (±5.01)	16.25 (±13.60)	21.00 (±23.37)	0.578
WBC count	15550 (±2301.81)	13100 (±2092.16)	14600 (±3159.11)	0.123
CRP (18 pts)	129.53 (±79.37)	60.28 (±60.25)	61.26(±53.13)	0.143
Sinusitis score	13.00 (±5.01)	16.25 (±13.60)	21.00 (±23.37)	0.079

TNE: Transnasal Endoscopic Approach
EXT: External Approach
Combined: combined TNE and EXT approach
*One way ANOVA

Table 3: Frequency of involved sinuses.

	R't	L't	Total (Bilateral)
Frontal sinus	3	1	4
Maxillary sinus	14	14	28
Ethmoid sinus	12	13	25
Sphenoid sinus	2	1	3

Table 4: Organism isolated from pus culture.

	Isolates from Pus Culture	Isolates from Blood Culture
Staphylococcus aureus†	8	1‡
Streptococcus viridans	5	
Coag (-) Staphylococcus	3	
Klebsiella pneumonia	2	
Eikenella corredens	2	
Streptococcus pneumonia	1	
Group A ß-hemolytic Streptococcus	1	
Acinebacter sp.	1	
Peptostreptococcus micros	1	
Propion avidum	1	

†Including 4 oxacillin-resistant *Staphylococcus aureus* (ORSA)
‡ The isolate was ORSA

direction helped to identify the posterior side of the posterior lacrimal crest and prevent the iatrogenic injury of lacrimal sac. Scissors were used to bluntly dissect a plane to the medial orbital wall. A Desmarres vein retraction and a narrow Sewall retractor could be used to provide a better surgical view. The periobita was cut and elevated with a freer elevator. The wall of abscess could be incised with 11# knife and turbid pus was drained out with suction tube. The wound closure only required continuous conjunctival sutures with 8-0 vicryl.

Twenty-two patients met the criteria for the study and had available medical records for review (Table 1). Overall, 14/22 patients were male (63.6%), and 8/22 were female (36.4%, p = 0.201, Chi square test). The average age was 5.45 years (median 3.58, range 12 days -18 years). Patients were symptomatic for an average of 3.73 days prior to admission (median 3, range 1-7). The mean length of hospitalization was 15.64 days (median 11, range 7-56). In 22 patients, 10 in group I, 8 in group II and 4 in group III.

The mean ages in 3 groups of patients were 8.83 yrs, 1.92 yrs and 4.04 yrs (Table 2). The age of group 2 is significantly younger than group I (t test: P = 0.012). The mean duration of symptoms prior to admission in 3 groups of patients were 2.90 (range 2-5) days, 4.13 (range 1-7) days and 5.00 (range 1-7) days respectively. No significantly different exists between 3 groups (ANOVA, P = 0.157). The hospitalization in 3 groups of patients was 13.00 days, 16.25 days and 21.00 days respectively. No significantly difference exists between 3 groups (ANOVA, P = 0.578) The WBC count 3 groups of patients were 15550/µl, 13100/µl and 14600/µl respectively. No significantly different exists between 3 groups (ANOVA, P = 0.123).

Physical exam findings in the 22 patients included fever in 22 (100%), chemosis in 14 (63.6%), proptosis in 15 (68.2%), diplopia in 11 (50%), purulent rhinorrhea in 10 (45.5%) and visual acuity affected in 3 (13.6%). The frequency of involved sinuses was greater in the order of maxillary sinus, ethmoid sinus, frontal sinus and sphenoid sinus (Table 3).

Surgical cultures were obtained in 19 patients and were positive in 16 patients (84.2%). Organisms isolated are listed in (Table 4). The most frequent isolates were *Staphylococcus aureus, Streptococcus viridans, Klebsiella pneumonia* and *Eikenella corredens*. Coag (-) Staphylococcus was considered to be contaminant. Blood cultures was positive in 1/17 (5.88%).The positive culture was concordant with the surgical culture for *Staphylococcus aureus* (ORSA).

One patient receiving combined approach underwent repeated aspiration of orbital abscess. All of patients resolved without sequelae or mortalities.

Discussion

Occular complications from rhinosinusitis arise from close anatomic relationships shared by the orbits, paranasal sinuses, and facial venous system [2]. The reason why orbital involvement is usually unilateral is probably related to asymmetry in the dehiscence of the lamina papyracea, the so-called Zuckerkandl dehiscence [24]. Retrograde thrombophlebitis through valveless channels could cause infection spreading to the brain or cavernous sinus thrombosis.

In Tanna N et al. [18] study, 6 patients treated initially as TNE recurred and received an EXT approach later [18]. The other patient received external approach recurred. The overall recurrence rate in that study was 7/13 (53.85%). In Oxford's study, 3 in 25 (12%) patients receiving surgery (endoscopic or external approach) recurred [25]. In the above 2 studies, the authors approached the SPOA either endoscopically or externally. For endoscopic drainage of orbital abscesses, Mann et al. [26] found 23% (6/26) of children required revision procedures. In our study, the overall recurrence rate was 4.55% (1/22) and the recurrent patient needed repeated aspiration externally. The most common reason of recurrence was either inadequate removal of the lamina papyracea or an abscess that was positioned superiorly or laterally in the orbit which was difficult to drain endoscopically [27]. SPOAs which lie superiorly in the orbits are difficult to reach intranasally. Combined FESS and drainage through the eyelids externally is the procedure of choice in these patients. We have 4 patients received combined approach. This prevents the residual abscess from either approaches and thus lowered the overall recurrence rate.

Given the medically successful cases in the literature, it appears that many SPOAs seen on CT scan s are in fact curable by antibiotics [8,28]. However, in Eustis's study, patients receiving surgery resolved promptly, whereas patients who were treated medically need a longer hospitalization [29]. Surgeries did not increase the risks of complications. In our study, all the patients recovered without morbidities even in one patient with concomitant frontal lobe abscess. In Oxford's study, 2 patients after external approach had complications of persistent proptosis and restriction of extraocular motility [25]. In other studies, no complications were reported [18]. Drainage of these abscess in SPOAs was "a safe effective means to quick recovery" [29].

Blood culture has a low yield of positive culture [18,22,25]. On the contrary, pus culture gives clinician microbiologic information and can thus switch to appropriate antibiotics. The most frequent isolates from our study is *Staphylococcus aureus* and *Streptococcus viridans* which is similar to previous reports [25]. From our data, most antibiotics could be chosen from our isolates. The recently proposed treatment for SPOAs is medications alone and our data could give clinicians a good guidance for choosing appropriate antibiotics.

From our experience, our paradigm of treating pediatric SPOA is reasonable. No evident sequelae or complication rate were met if treating these patients promptly and appropriately. Cosmetic concerns could be overcome in external approach patients by experienced ophthalmologists.

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