Complications of Acute Sinusitis in Children

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OBJECTIVE: To review the demographic, microbiologic, and outcome data for children with complications of acute sinusitis.


RESULTS: One hundred four patients were reviewed with the following complications: orbital cellulitis (51), orbital abscesses (44), subdural empyemas (7), intracranial abscesses (2), meningitis (2), cavernous sinus thrombosis (1), and Pott’s puffy tumors (3). Sixty-six percent were males (P < 0.001), and 64.4% presented from November to March (P < 0.001). Patients with isolated orbital complications were younger than patients with intracranial complications (mean, 6.5 versus 12.3 years), had a shorter stay (mean, 4.2 versus 16.6 days), and had shorter duration of symptoms (mean, 5.4 versus 14.3 days; all P < 0.0001). Complete resolution was documented for 54/55 patients with restricted ocular motility, 7/8 with visual loss, 3/3 patients with a nonreactive pupil, 7/7 with neurological deficits, and 2/4 with seizures. The most common organism isolated was Streptococcus milleri (11/36 patients with surgical cultures). No mortalities occurred, and persistent morbidity occurred in 4 patients (3.8%).

CONCLUSIONS: Despite significant deficits on presentation, permanent morbidity was low. Streptococcus milleri is a common pathogen with complications of sinusitis in children.

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Acute sinusitis is a common disorder affecting children, accounting for 21% of pediatric antibiotic prescriptions. Serious complications that may result from acute sinusitis include orbital or intracranial extension secondary to their close proximity to the sinuses. Children with these complications may experience significant morbidity from their infection, including blindness, neurological deficits, and death. We reviewed the children who were treated for a complication of acute sinusitis over the last 7½ years at Children’s Medical Center of Dallas to evaluate the number and type of complications, the bacteria involved, the response to treatment, and the persistent morbidities of these infections.

MATERIAL AND METHODS

We retrospectively reviewed the charts of all patients admitted to Children’s Medical Center of Dallas from January 1995 to July 2002 with complications of acute sinusitis. This study was approved by the university’s institutional review board (IRB 0602-323), and a Health Insurance Portability and Accountability Act waiver was obtained. Charts were identified by searching for ICD-9 codes for acute sinusitis, orbital cellulitis, orbital abscess, intracranial abscess, meningitis, cavernous sinus thrombosis, and thrombosis of intracranial sinuses (324.0, 324.9, 325, 376.0, 376.01, 461.0, 461.1, 461.2, 461.3, 461.8, and 461.9). Patients were included if their charts documented evidence of a complication of acute sinusitis on admission. Charts were excluded if patients had a history of craniofacial trauma, organ transplant, malignancy, or sinusitis secondary to an odontogenic infection.

Charts were evaluated for age, gender, month of admission, type of complication, symptoms, physical exam findings, radiology studies, surgical procedures, culture results, and any follow-up information. Data were entered into a Microsoft Excel spreadsheet (Microsoft Corp., Redmond, WA) and analyzed with Excel and with WinSTAT for Excel (A-Prompt Corp., Lehigh Valley, PA). The Student’s t test was performed to compare groups. Presented at the Annual Meeting of the American Academy of Otolaryngology–Head and Neck Surgery, New York, NY, September 19-22, 2004.


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was used to analyze ordinal data, and the \( \chi^2 \) test was used for dichotomous data except when indicated for nonparametric data. For calculations of percentages of admissions by month, the number of admissions in each month for August to December was multiplied by 1.1429 (8/7). This was implemented to allow comparison of seasonal incidence between months with 7 years of data with months with 8 years of data. Surgical procedures were classified as endoscopic procedures, open drainage of orbital abscesses, open drainage of soft tissue abscesses, and as neurosurgical procedures. For counting the number of operations performed, a single operation was considered to be 1 or more procedures performed in the operating room under a single anesthetic period.

### RESULTS

The ICD-9 search yielded 412 patients. One hundred four patients met the criteria for the study and had available medical records for review. A total of 116 complications of acute sinusitis were diagnosed in the 104 patients (Table 1). Orbital complications occurred in 95 patients and included 51 cases of cellulitis and 44 abscesses. All patients with orbital abscesses also had evidence of orbital cellulitis. These patients were classified solely as orbital abscesses in tabulating the total number of orbital complications. Eighteen intracranial complications occurred in 14 patients and included 7 epidural empyemas, 6 subdural empyemas, 2 intracerebral abscesses, 2 cases of meningitis, and 1 cavernous sinus thrombosis. Five patients were diagnosed with both intraorbital and intracranial complications, including 1 patient with cavernous sinus thrombosis and orbital cellulitis, 1 patient with an orbital abscess and meningitis, 1 orbital cellulitis associated with an epidural abscess, 1 patient with orbital cellulitis and a subdural abscess, and 1 patient with an orbital and epidural abscess. Three patients presented with Pott’s puffy tumor, 2 of whom also presented with an epidural abscess and 1 of whom presented with associated orbital cellulitis.

A 2 to 1 (66.3%) male predominance was observed, \((P = 0.001)\). Races included 46 Caucasians, 39 African Americans, 16 Hispanics, and 3 patients of other races. The average age was 7.3 years (median, 6 years; range, 4 months to 17 years). Patients were symptomatic for an average of 6.7 days before admission (median, 5 days; range, 1 to 42 days). The average length of stay was 5.9 days (median, 4 days; range, 1 to 28 days). Patients with isolated orbital complications were younger (mean, 6.5 versus 12.3 years; median, 5 versus 13 years; range, 0.33 to 17 years versus 2 to 16 years; \(P < 0.0001)\), had shorter duration of symptoms (mean, 5.4 versus 14.3 days; median, 4 versus 14 days; range, 1 to 21 days versus 4 to 42 days; \(P < 0.0001\), and had shorter hospital stays (mean, 4.2 versus 16.6 days; median, 4 versus 16 days; range, 1 to 13 days versus 6 to 28 days; \(P < 0.0001)\) than patients with intracranial complications.

Admissions demonstrated a significant seasonal trend. Twenty admissions (18.3%) occurred in February \((P = 0.0002)\), and 66.9% occurred from November to March \((P < 0.0001)\).

The average maximal temperature on hospital day 1 was 38.0°C (range, 36.2 to 40.7°C). Patients with intracranial complications presented with a higher degree of fever, 38.6 versus 37.9°C \((P = 0.037)\). The average white blood cell count at admission was 16.1 \((10^3\) per cubic millimeters), and there was no significant difference in white blood cell count between patients with orbital and intracranial complications, 15.9 and 17.1 \((P = 0.487)\).

Ocular deficits on presentation for patients with orbital complications are delineated in Table 2. Decreased ocular motility was found in 56 (53.8%) of 104 patients and was secondary to orbital cellulitis (18 patients), orbital abscesses (36 patients), cavernous sinus thrombosis (1 patient), and subdural abscesses with an abducens nerve palsy (1 patient). The difference in the incidence of restricted ocular motility

<table>
<thead>
<tr>
<th>Complication</th>
<th>Number (%)</th>
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<tbody>
<tr>
<td>Orbital cellulitis</td>
<td>51 (49.0)</td>
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<tr>
<td>Orbital abscess</td>
<td>44 (42.3)</td>
</tr>
<tr>
<td>Epidural empyema</td>
<td>7 (6.7)</td>
</tr>
<tr>
<td>Subdural empyema</td>
<td>6 (5.8)</td>
</tr>
<tr>
<td>Intracerebral abscess</td>
<td>2 (1.9)</td>
</tr>
<tr>
<td>Meningitis</td>
<td>2 (1.9)</td>
</tr>
<tr>
<td>Cavernous sinus thrombosis</td>
<td>1 (1.0)</td>
</tr>
<tr>
<td>Pott’s puffy tumor</td>
<td>3 (2.9)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Complication</th>
<th>Patients</th>
<th>Restricted ocular motility, n (%)</th>
<th>Vision loss of 20/40 or worse, n (%)</th>
<th>Nonreactive pupil, n (%)</th>
<th>Resolution of all deficits, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orbital cellulitis</td>
<td>51</td>
<td>18 (35.3)</td>
<td>1 (2.0)</td>
<td>0</td>
<td>54 (100)</td>
</tr>
<tr>
<td>Orbital abscess</td>
<td>44</td>
<td>36 (81.8)</td>
<td>7 (15.9)</td>
<td>2 (4.5)</td>
<td>43 (97.7)</td>
</tr>
<tr>
<td>Total orbital complications</td>
<td>95</td>
<td>54 (56.8)</td>
<td>8 (8.4)</td>
<td>2 (2.1)</td>
<td>94 (98.9)</td>
</tr>
</tbody>
</table>

Table 1

Complications in 104 patients

Table 2

Deficits with ocular complications at admission
for orbital cellulitis (18/51, 35.3%) and orbital abscesses (36/44, 81.8%) was significant (P < 0.0001). Complete resolution was documented for 55 (98.2%) of 56 patients with decreased ocular motility. Only 1 patient had persistence of ocular deficits. He was a 14-year-old male with an orbital abscess who presented with nonreactive pupils, no light perception, no extraocular motility, and an intraocular pressure of 38 mm Hg. He underwent urgent lateral canthotomy and external drainage of the abscess. At his last documented outpatient follow-up at 51 days after admission, he had normal pupillary function, was able to count fingers, and had improved extraocular motility to moderate restriction in all directions.

Eight of 104 patients (7.69%) were diagnosed with vision loss greater than 20/40, including 4 patients with 20/200 or worse. Seven patients had orbital abscesses, and 1 patient had Pott’s puffy tumor and orbital cellulitis. The difference in the incidence of decreased vision for orbital cellulitis (1/51, 2.0%) and orbital abscesses (7/44, 15.9%) was significant (P = 0.015). Complete resolution was documented in 7 (87.5%) of 8 patients. Visual acuity was unable to be assessed in the patient with cavernous sinus thrombosis because of his age (2 years old). He had normal vision at follow-up with ophthalmology 8 months after discharge. Three of 104 patients (2.88%) presented with a nonreactive pupil, including 2 with orbital abscesses and the patient with cavernous sinus thrombosis, and all patients recovered completely.

Seven of 14 patients with intracranial complications presented with neurologic deficits, and 4/14 presented with seizures. Deficits listed in Table 3 included cranial nerve abnormalities in 3, motor deficits in 4, decreased mental status in 2, and aphasia in 1. All deficits resolved and seizure disorder persisted in the 2 patients with intracerebral abscesses.

Ninety-four of 104 patients were evaluated with a CT scan during their hospitalization. All patients diagnosed with an orbital abscess or an intracranial complication received a CT scan, as well as 41/51 patients diagnosed with orbital cellulitis. The 10 patients without a CT scan presented clinically with orbital cellulitis associated with multiple symptoms and signs of acute sinusitis. All 10 had rhinorrhea, orbital edema, and orbital erythema consistent with orbital cellulitis. One of the patients was found to have opacification of bilateral ethmoid and maxillary sinuses on plain radiographs. Five patients with intracranial complications were evaluated with an MRI scan as well. A bone scan was performed in 1 patient with Pott’s puffy tumor and confirmed frontal bone osteomyelitis.

Thirty-nine (37.5%) of 104 patients underwent surgery for complications of sinusitis and included 25 patients with isolated orbital complications, 13 with intracranial complications, and 1 drainage of a Pott’s puffy tumor not associated with an intracranial complication. Of the 25 patients with isolated orbital complications who underwent surgical intervention, 1 was diagnosed with orbital cellulitis, and 24 patients were diagnosed with orbital abscesses. Eighteen (40.9%) of 44 patients diagnosed with orbital abscesses were treated successfully with nonsurgical management. Of the 15 patients with intracranial complications, the only patient who did not receive surgical treatment had cavernous sinus thrombosis. This patient was managed with 6 weeks of anticoagulation and intravenous antibiotics.

A total of 49 operations (mean, 1.26; range, 1 to 2 operations per surgical patient) and 62 operative procedures were performed (mean, 1.59; range, 1 to 4 procedures per surgical patient). Twenty-eight operations (mean, 1.12; range, 1 to 2 operations per patient) and 31 procedures (mean, 1.28; range, 1 to 2 procedures per patient) were performed on the 25 isolated orbital complication patients and included 22 endoscopic procedures and 9 external drainages of orbital abscesses. Twenty operations (mean, 1.54; range, 1 to 2 operations per patient) and 34 procedures (mean, 2.62; range, 1 to 4 procedures per patient) were performed on 13 patients with intracranial complications and included 14 neurosurgical procedures, 9 endoscopic sinus procedures, 1 external drainage of an orbital abscess, 2 drainages of frontal subperiosteal abscesses secondary to Pott’s, 1 drainage of an eyelid abscess, and 7 frontal sinus trephinations. Compared with surgical patients with orbital complications, patients with intracranial complications had a significantly higher mean number of operations (1.54 versus 1.12; P = 0.006) and procedures performed (2.62 versus 1.28; P < 0.001, Mann-Whitney U test).

Positive culture results were obtained in 35 patients, which included 31 patients with a positive surgical culture, 1 patient with a positive blood culture, and 3 patients with positive surgical and blood cultures. Overall, surgical cultures were positive in 34/36 patients (94.44%), and blood cultures were positive in 4/67 patients (5.97%). The 3 patients with positive surgical and blood cultures, all had concordant culture results for a single organism. Organisms isolated included the Streptococcus milleri group (11 patients), α-hemolytic Streptococcus (7), Staphylococcus aureus (6), Staphylococcus coagulase negative (6), Streptococcus pneumonia (4), Prevotella (4), Bacteroides (2),

Table 3
Neurological deficits in 14 patients with intracranial complications

<table>
<thead>
<tr>
<th>Neurological Deficit</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palsies of cranial nerves 2, 3, 4, and 6 with cavernous sinus thrombosis</td>
<td>1 (7.1)</td>
</tr>
<tr>
<td>Isolated abducens nerve palsy</td>
<td>1 (7.1)</td>
</tr>
<tr>
<td>Facial nerve paresis</td>
<td>1 (7.1)</td>
</tr>
<tr>
<td>Hemiparesis</td>
<td>1 (7.1)</td>
</tr>
<tr>
<td>Unilateral lower-extremity paresis</td>
<td>2 (14.2)</td>
</tr>
<tr>
<td>Generalized motor weakness</td>
<td>1 (7.1)</td>
</tr>
<tr>
<td>Aphasia</td>
<td>1 (7.1)</td>
</tr>
<tr>
<td>Altered level of consciousness</td>
<td>2 (14.2)</td>
</tr>
</tbody>
</table>
Eikenella (2), Haemophilus influenza (1), group A Streptococcus (1), Haemophilus aphrophilus (1), Propionobacterium (1), Peptostreptococcus (1), Porphyrocinous (1), and Fusobacterium (1). Multiple unidentified anaerobic organisms included 2 cases of methicillin-resistant Staphylococcus aureus. Anaerobes were present in 11 (30.56%) of 36 surgical cultures, including 6 (24%) of 25 orbital complications and 5 (45%) of 11 intracranial complications. No significant difference was found for positive anaerobic cultures between the 2 groups (P = 0.198, Fisher’s exact test).

Sixty-eight of 104 patients (65.4%) had available outpatient follow-up data, including 27 (52.9%) of 51 with orbital cellulitis, 33 (75.0%) of 44 with orbital abscesses, and 10 (71.4%) of 14 with an intracranial complication. The mean follow-up length was 332.7 days after discharge, with a median of 47.5 days and a range of 1 day to 7.5 years.

Four (3.8%) of 104 patients had persistent morbidities, including 1 patient with decreased vision and extraocular motility, 1 with persistent lid ptosis 8 months after external drainage of an orbital abscess, and 2 with persistent seizure disorder after drainage of intracranial abscesses. No mortalities occurred.

DISCUSSION

The paranasal sinuses are enclosed in bone, which normally acts as a barrier to limit complications from acute sinusitis. Complications may result from osteitic bone destruction, congenital or acquired bony defects, or via thrombophlebitis of communicating veins.2 Orbital complications most commonly result from ethmoid sinus disease,3 whereas intracranial and osteitic complications are most commonly secondary to frontal sinusitis.4,5 Sinusitis complications preferentially affect males and are most common in young adults and children.4-9

Orbital complications are the most common type of complications from acute sinusitis (80%).6 Ethmoid sinusitis may spread to the orbit by defects in the thin lamina papyracea or by the valveless ophthalmologic venous system.7 The Chandler classification describes 5 types of orbital complications that may result from sinusitis (Table 4).11,12 Cavernous sinus thrombosis, group V, is classified by others as an intracranial complication.6 Patients with inflammatory edema, group I, may be treated as outpatients with oral or parenteral antibiotics and topical nasal decongestants. Healy13 recommended hospitalization with intravenous antibiotics, ophthalmology consultation, and cultures for groups II to V.

Intracranial complications are most commonly secondary to acute frontal sinusitis and account for 13% of admissions for complications of sinusitis.6 Complications may include meningitis, cerebritis, epidural empyema, subdural empyema, cerebral abscess, and thrombosis of the cavernous sinus or other venous sinuses.4,13

Pott’s puffy tumor was initially described in 1775 by Percival Pott and presents as a localized swelling of the forehead secondary to a frontal bone subperiosteal abscess. It most commonly occurs as a complication of frontal sinusitis and is often associated with an epidural abscess. Bambakidis and Cohen14 described 7 cases in 2000 and reported that only 21 pediatric cases of Pott’s puffy tumor have been described in the antibiotic era.

In our series, orbital complications occurred in 95 (91.3%) of 104 patients, and intracranial complications occurred in 14 (13.5%) of 104 children. Five (4.8%) of 104 patients presented with both orbital and intracranial complications. Despite the rarity of Pott’s puffy tumor in the antibiotic era,14 3 patients (2.88%) had Pott’s puffy tumors, associated with an epidural abscess in 2 and with orbital cellulitis in 1. Our finding of epidural and subdural empyemas as the 2 most common intracranial complications is similar to findings of Gallagher et al15 and Jones et al.5 The Gallagher et al15 series of 15 cases of intracranial complications in adults and 3 children found epidural and subdural empyemas to be the 2 most common complications. Jones et al5 described subdural empyemas as the most common intracranial complication in 47 patients. Other series involving adult patients have found meningitis7 or frontal lobe abscess4 to be the most common intracranial complication.

Our review also confirmed previous series reporting a higher incidence of sinusitis complications in males (66.3%).4-9 The mean age of patients with orbital complications (6.5) was significantly less than patients with intracranial complications (12.3). This finding was expected given the embryology of the paranasal sinuses, with the ethmoid sinuses present at birth and the frontal sinuses developing during childhood. Previous studies have reported that ethmoid sinusitis is most commonly associated with orbital complications3 and that frontal sinus is most often associated with intracranial complications.6 Two patients developed orbital complications at 4 months of age, and 7 were younger than 1 year old. The youngest child to present with an intracranial complication was a 2-year-old with cavernous sinus thrombosis and orbital cellulitis secondary to ethmoid sinusitis. The remaining patients with intracranial complications were 9 years of age or older.

Complications demonstrated a significant seasonal incidence, with 64.4% of patients admitted from November to March. The highest number of admissions occurred in February (18.3%). The seasonal incidence is likely secondary to the

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Chandler’s classification</th>
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<tbody>
<tr>
<td>Group I: Inflammatory edema (preseptal cellulitis)</td>
<td></td>
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<tr>
<td>Group II: Orbital cellulitis</td>
<td></td>
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<tr>
<td>Group III: Subperiosteal abscess</td>
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<tr>
<td>Group IV: Orbital abscess</td>
<td></td>
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<tr>
<td>Group V: Cavernous sinus thrombosis</td>
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increased incidence of viral upper respiratory infections in the fall and winter, which is the most common predisposing factor for the development of acute sinusitis in children.\textsuperscript{16}

\textit{Streptococcus milleri} group was the most common cultured pathogen (11/34 patients, 32.4%), present in 7/23 of positive orbital complication cultures and 4/11 intracranial cultures. Two recent series of intracranial complications of sinusitis that included adults and children also found \textit{S. milleri} group to be the most common organism.\textsuperscript{5,9} The \textit{S. milleri} group includes three species: \textit{S. intermedias}, \textit{S. constellatus}, and \textit{S. anginosus}, which are commensal organisms present in the oral cavity, gastrointestinal tract, and urogenital system. Unlike other viridans Streptococci, the \textit{S. milleri} group often is associated with abscess formation. Identification to the species level is difficult and is often unreliable with commercial laboratory kits. On blood agar, \textit{S. milleri} organisms may be \(\alpha\)-hemolytic, \(\beta\)-hemolytic, or nonhemolytic. Polymerase chain reaction amplification and sequencing of the 16s rRNA gene may be used to differentiate the species of the group.\textsuperscript{17} \textit{S. intermedias} and \textit{S. constellatus} are more commonly involved with abscess formation, whereas \textit{S. anginosus} is more often associated with endocarditis.\textsuperscript{18} However, there is no significant difference in antibiotic susceptibility of the individual species. Tracy et al\textsuperscript{19} evaluated 44 isolates and demonstrated similar antibiotic susceptibility profiles among the 3 groups. None of the organisms were resistant to penicillin, ampicillin, or ceftriaxone. Clindamycin resistance was found for 14\% of the organisms and included members of each of the 3 species.

The second most common culture result was \(\alpha\)-hemolytic \textit{Streptococcus}. Unfortunately, the culture results in these 7 patients were not further differentiated to identify the species or group. These culture results were obtained early in the study period and were not analyzed with a commercial \textit{Streptococcus} identification kit. There are several species of \textit{Streptococcus} that may be \(\alpha\)-hemolytic on blood agar, including \textit{S. milleri} group, other viridans Streptococci, and \textit{S. pneumonia}.

Anaerobic cultures were positive in 11 (30.56\%) of 36 surgical cultures, which is similar to prior series of complications of sinusitis reporting positive anaerobic cultures in 22\% to 100\% of patients.\textsuperscript{4,10,14,20}

Our morbidity rate of 3.8\% compares favorably to prior series on complications of sinusitis. In the preantibiotic era, Gamble\textsuperscript{21} reported a 17\% mortality and a 20\% incidence of permanent blindness secondary to orbital cellulitis. More recent studies have reported a 6\%–10.5\% permanent morbidity rate with orbital complications of acute sinusitis.\textsuperscript{3,22} Case series of intracranial complications of acute sinusitis have reported a morbidity rate of 13\% to 33\% and a mortality rate of 2\% to 7\%.\textsuperscript{4,5,7,15} In our series, 2 (14.3\%) of 14 patients with intracranial complications experienced persistent seizure disorder. Outpatient follow-up data were available in 10 patients (71.4\%), with a median of 230 days. With longer follow-up, the morbidity rate of the patients with intracranial complications may increase. Buonaguro et al\textsuperscript{24} reported that children treated surgically for brain abscesses may develop late-onset seizures and behavioral and intellectual impairments.

The lower incidence of morbidity and mortality in our series may be secondary to our population, which was limited to children. Despite severe deficits on presentation such as hemiparesis in 1 patient and a nonreactive pupil in 3 patients, the vast majority of patients recovered completely. A series limited to children also was performed by Arjmand et al.\textsuperscript{10} They reported 22 cases of subperiosteal orbital abscesses secondary to sinusitis without any long-term morbidities.

Our approach to management of complications of sinusitis is similar to that in previously reported series. Patients should receive broad-spectrum \(\beta\)-lactamase–resistant intravenous antibiotics, evaluation with a contrasted axial and coronal CT scan, and an otolaryngology consult. Neurosurgical and ophthalmology consults are indicated with intracranial and orbital complications, respectively. The need for surgical intervention is determined by physical exam findings and imaging information.

A CT scan of the paranasal sinuses is recommended by many authors for evaluating a patient with a complication of acute sinusitis.\textsuperscript{12,23} A contrasted coronal CT provides detailed bony anatomy and evaluation of soft tissue complications. MRI with gadolinium contrast provides more detailed evaluation of soft tissues and may be indicated to further detail intracranial or intraorbital extension.\textsuperscript{12,23}

Unlike Healy’s\textsuperscript{12} recommendation to obtain sinus cultures in all patients with Chandler groups II to V orbital complications, sinus cultures only were obtained in 3 (5.88\%) of 51 patients with orbital cellulitis (group II). Given the excellent long-term outcome in our series, it may not be necessary to routinely obtain cultures in pediatric patients with orbital cellulitis. No long-term morbidities occurred in any of the patients with orbital cellulitis.

CONCLUSIONS

In our series of complications of acute sinusitis from a single tertiary children’s hospital, orbital and intracranial complications occurred in 95 (91.3\%) and 14 (13.5\%) of patients, respectively. Complications most commonly involved males in the winter. Patients with orbital complications were younger, had a shorter stay, and had shorter duration of prodromal symptoms. Despite significant deficits on presentation, permanent morbidity was low. \textit{Streptococcus milleri} and anaerobic organisms were commonly isolated pathogens in children with complications of sinusitis in our series.

REFERENCES