

Orbital Complications of Acute Sinusitis: Evaluation, Management, and Results

Original Investigation

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Abstract

Objective: Even though acute rhinosinusitis orbital complications are not very common, they can appear as very severe complications with high mortality rates, due to infection spreading to orbital and intracranial tissues. The objective of this study is to assess the treatment and its results for patients treated in our clinic due to rhinosinusitis complications.

Methods: Patients who were admitted to our clinic due to acute rhinosinusitis complications between January 2010 and March 2012 were examined. We retrospectively evaluated 11 patients 8 (73%) males and 3 (23%) females with a mean age 12.36 years (range 6-20 years) who were treated for orbital complications of acute rhinosinusitis. Cases were evaluated according to age, sex, etiologic factors, localization, treatment, and outcome.

Results: Preseptal cellulitis was observed in 9 patients (82%), orbital abscess was observed in 1 patient (9%), and subperiosteal abscess was observed in 1 patient

(9%). Ten of 11 patients achieved full recovery through medical treatment, whereas 1 patient was treated with right subperiosteal abscess drainage and right functional endoscopic sinus surgery due to subperiosteal abscess. The patients' average admission duration was 7 days.

Conclusion: The orbita is the area with the most common sinusitis complications, due to its proximity to the paranasal sinuses and especially to ethmoid cells. Early diagnosis and aggressive treatment are important for the reduction of unwanted manifestations. Computed tomography with contrast remains the optimal imaging study for orbital inflammation. Surgical treatment is indicated when subperiosteal orbital abscess and orbital abscess are seen.

Keywords: Acute rhinosinusitis, orbital complications, preseptal cellulitis, orbital cellulitis, subperiosteal abscess

Introduction

Even though orbital complications in acute rhinosinusitis are not very common, they can be very severe complications, with high mortality rates, due to infection spreading to orbital and intracranial tissues (1). Especially due to intracranial complications, acute rhinosinusitis is considered in the life-threatening disease group. As per Chandler et al. (2), orbital complications are classified into five groups according to the severity of complications: preseptal cellulitis, orbital cellulitis, subperiosteal abscess, orbital abscess, and cavernous sinus thrombosis.

Although orbital complications are clinically rare, they are more common in children than in adults. Orbital septum acts as a barrier that prevents the spread of inflammation from the preseptal region towards the orbital space. Along with proptosis, limitation of eye movements, and decrease in vision, the presence of redness, edema, and local temperature increase in the eyelids, i.e., infectious

pathology of orbital region, suggest intraorbital propagation. Especially in the childhood period, compared to adult age groups, infections in the preseptal region that did not receive proper treatment can spread easily in the orbits and cause serious complications such as brain abscess, meningitis, and cavernous sinus thrombosis (1-4).

Although antibiotic use reduces the incidence of sinus infections and complications, acute sinusitis is still the leading cause of orbital inflammation and impaired vision. Particularly after frequent upper respiratory infections during the childhood, the infection that spreads easily to the nose and sinuses sets the ground for orbital complications (4-6).

In our study, accompanied by diagnosis, treatment, and follow-up symptoms of 11 patients who developed orbital complications of rhinosinusitis, treatment and follow-up algorithm of orbital complications have been revised with literature data.



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Table 1. Distribution of orbital complications according to the Chandler classification

| Orbital Complication | Number (%) |
|--|------------|
| Stage I: Inflammatory edema (preseptal cellulitis) | 9.82% |
| Stage II: Subperiosteal phlegmon and abscess | 1.9% |
| Stage III: Orbital cellulitis | - |
| Stage IV: Orbital abscess | 1.9% |
| Stage V: Cavernous sinus thrombosis | - |

Methods

In our clinic, between January 2010 and March 2012, 11 in-patients with orbital complications diagnoses after acute rhinosinusitis were examined retrospectively. Detailed history was taken from the patients' files.

Cases had routine ear–nose–throat examination and nasal endoscopy. For endoscopic examination of the cases, Karl–Storz 4-mm rigid 0°, 30°, and 70° with 18-cm and 30-cm Hopkins lens rigid (Storz; St. Louis, MI, USA) endoscopes were used. During the nasal endoscopic evaluation of the cases, topical anesthesia and oxymetazoline hydrochloride (0.05%) + 2% pantocaine-impregnated cotton were applied to provide relief from nasal congestion. Cottons were removed from both nasal cavities after 10 minutes. Also, in the eye examination, possible pathological appearance on the supraorbital region and eyelids (with the presence of edema, hyperemia, and chemosis) were assessed by an ophthalmologist on the basis of eye movements, visual field, and function.

Cases were evaluated according to age, sex, clinical and etiologic factors, treatment, and possible complications based on the classification suggested by Chandler et al. (2).

For the radiological diagnosis and follow-up of all cases, evaluation with Toshiba, Aquilion 64 Slayst 2012 (Japan) tomography device, including paranasal sinus and orbital sections, by obtaining 4-mm axial and coronal sections, paranasal sinus computed tomography (PNSCT) and orbital computed tomography (CT) were performed.

The medical treatment of patients hospitalized with preseptal cellulitis as the orbital complication of acute rhinosinusitis (9 cases) was intravenous (IV) 4×1.5 grams of ampicillin–sulbactam (adult dose 3–4×1.5–3 g/day, pediatric dose 150 mg/kg/day [50 mg sulbactam and ampicillin]) treatment; with subperiosteal abscess was a combination of IV 4×1.5 g ampicillin–sulbactam and ornidazole (adult dose 2×500 mg/day, pediatric dose 2 doses of 25 mg/kg/day); and with orbital abscess was IV ceftriaxone 2×1 g (adult dose 1–2 g/day, pediatric dose 50–75 mg/kg/day) - ornidazole 2×500 mg (adult dose 2×500 mg/day, pediatric dose 2 doses of 25 mg/kg/day). In addition to antibiotic therapy,

topical decongestants and saline irrigation treatments were also administered.

Patients received medical treatment for approximately 10 days while they were hospitalized; after that, patients' antibiotic treatment continued orally for 2 more weeks.

Results

Of the 11 cases diagnosed with orbital complications of acute rhinosinusitis, there were 8 (73%) males and 3 (23%) females with a mean age of 12.36 years (range 6–20 years). The distribution of complications was preseptal cellulitis (9 cases), orbital abscess (1 case), and subperiosteal abscess (1 case); all were hospitalized in our clinic.

The complication distribution as per Chandler classification is shown in Table 1. Preseptal cellulitis, with 9 cases (82%), was the most common complication in the eye examination; bulbus was not pushed, and eye movements were considered as free (Figure 1).

The main complaints of patients diagnosed with orbital complications were listed as nasal congestion, headache, post-nasal drainage, fever, eye swelling, decrease in visual acuity, and double vision.

The most distinct complaints of the patients diagnosed with preseptal cellulitis were headache, nasal congestion, post-nasal drainage, and eye swelling. The distribution of the findings according to cases is shown in Table 2.

Purulent discharge in the nasal passages was localized to the left in 6 cases (66.6%) and to the right in 3 cases (33.3%). Severe pain, decreased visual acuity, and blurred vision were present simultaneously as orbital complaints in the patients diagnosed with right orbital subperiosteal abscess and right orbital abscess. According to the consultation of patients performed by an ophthalmologist, visual acuity varied from of light perception to -1.0 in the initial evaluation. The mean was 0.4 after systemic antibiotic therapy; increase in visual acuity and decrease in clinical symptoms were observed in an average of 5 days (4–6 days). Despite the visual acuity varied between 0.6 and 1.0, the average was 0.8.

Routine examinations and controls were performed with ENT examination and nasal endoscopic examination, ophthalmology consultation, PNSCT, and orbital CT.

PNSCT and orbital CT images of preseptal cellulitis, orbital abscess, and subperiosteal abscess cases that developed orbital complications are presented in Figures 2, 3, and 4. In the PNSCT images, left maxillary + ethmoid rhinosinusitis was observed in 5 of 11 cases (45%), right maxillary + ethmoid rhinosinusitis in 3 cases (27%), pansinusitis in 2 cases (18%), and isolated frontal rhinosinusitis in 1 case (10%). In 8 cases, ethmoid rhinosinusitis

was observed (in 3 cases on the right and in 5 cases on the left); the results are summarized in Table 3.

Ten of 11 patients achieved full recovery through medical treatment, whereas 1 patient was treated with right subperiosteal abscess drainage and right functional endoscopic sinus surgery due to subperiosteal abscess (Figure 5).

The patients' average duration of hospitalization was 7 days, and the follow-up period varied between 18 and 22 months. No orbital complications were observed in the follow-up period.

Discussion

The incidence of orbital complications of acute rhinosinusitis has decreased significantly because of endoscopic nasal examination and radiological imaging techniques, with appropriate

and accurate antibiotic selection. In cases diagnosed with acute rhinosinusitis, orbital complication incidence rate is 3%. Orbital complications associated with rhinosinusitis are preseptal cellulitis (inflammatory edema), orbital cellulitis, subperiosteal abscess, orbital abscess, and cavernous sinus thrombosis.

In orbital complications, responsible factors are frequently *Haemophilus influenzae*, *Streptococcus pneumoniae*, and *Staphylococcus aureus*. In acute rhinosinusitis infections, infection spreads to the

Table 2. Frequency of orbital complication symptoms

| Symptoms | Number (%) |
|--------------------------------|------------|
| Nasal congestion and discharge | 9.82% |
| Headache | 7.64% |
| Fever | 5.45% |
| Eyelid edema | 11.100% |
| Double vision | 2.18% |
| Vision loss | 2.18% |
| Eye pain | 5.45% |
| Blurred vision | 2.18% |



Figure 1. Case diagnosed with preseptal cellulitis (on ophthalmological examination, bulbus was not pushed and eye movements were free)

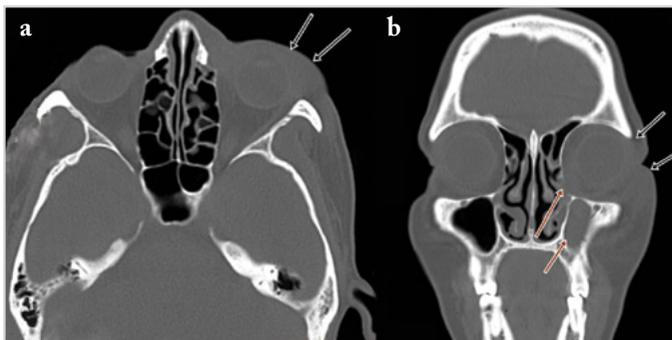


Figure 2. a, b. PNSCT imaging on axial and coronal planes of the case diagnosed with left preseptal cellulitis. Black arrow: soft tissue thickening on the left eyelid (hyperemia and edema), Red arrow: left ethmoid and maxillary sinusitis.

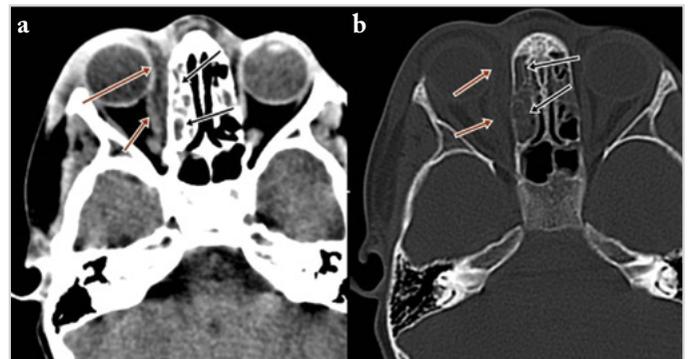


Figure 4. a, b. Orbital CT imaging on the axial plane of the case diagnosed with right subperiosteal abscess. Black arrow: ethmoid sinusitis. Red arrow: subperiosteal abscess formation in the right medial orbital wall.

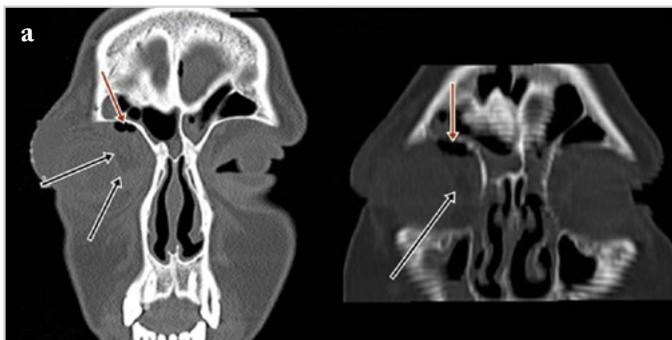


Figure 3. a, b. a. PNSCT imaging on coronal plane of the case diagnosed with orbital abscess. Red arrow: air–fluid level due to 25-mm abscess that is localized in the superior and pushing bulbus oculi towards anterior in the right orbita. Black arrow: abscess formation is observed in the right orbit. b. PNSCT imaging on axial plane of the case diagnosed with orbital abscess. Black arrow: abscess formation is observed in the right orbit.

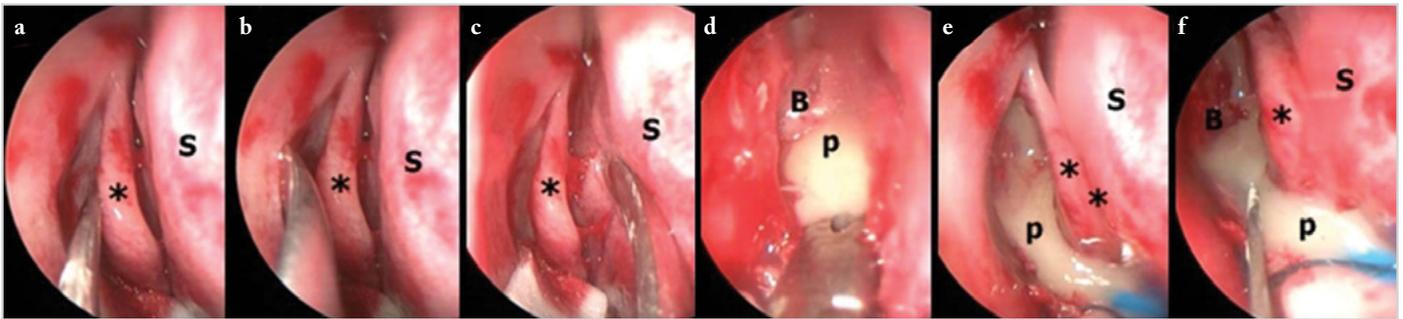


Figure 5. a-f. Endoscopic examination (0° rigid endoscopic view) of the case diagnosed with right subperiosteal abscess. Black star; middle turbinate, S: septum, B: bulla and ethmoid cells, P: purulent drainage of the abscess content. a-c. The examination of the right middle nasal meatus after topical anesthesia and removal of nasal congestion. d, e. Purulent drainage after creating an opening into the ethmoid cell and bulla. f. Taking samples for microbiological culture.

Table 3. Age, sex, complications, and examination findings of the cases

| Case | Age | Sex | Orbital complication | Ear–nose–throat and ophthalmologic examination | PNSCT |
|------|-----|-----|-----------------------|--|--|
| 1 | 8 | M | Preseptal cellulitis | Infected left eye Nasal discharge in the left | Left maxillary + ethmoid rhinosinusitis |
| 2 | 13 | M | Preseptal cellulitis | Infected left eye Nasal discharge (left) | Left maxillary + ethmoid rhinosinusitis |
| 3 | 19 | M | Orbital abscess | Infected right eye Nasal discharge (right) | Right maxillary + ethmoid rhinosinusitis |
| 4 | 20 | M | Preseptal cellulitis | Infected left eye No nasal discharge (left) | Left maxillary + ethmoid rhinosinusitis |
| 5 | 11 | F | Preseptal cellulitis | Infected right eye Nasal discharge (right) | Right maxillary + ethmoid rhinosinusitis |
| 6 | 13 | F | Preseptal cellulitis | Infected right eye No nasal discharge (right) | Left maxillary + ethmoid rhinosinusitis |
| 7 | 9 | F | Subperiosteal abscess | Infected right eye Nasal discharge (right) | Right maxillary + ethmoid rhinosinusitis |
| 8 | 6 | M | Preseptal cellulitis | Infected left eye Nasal discharge (left) | Pansinusitis |
| 9 | 10 | M | Preseptal cellulitis | Infected left eye Nasal discharge (left) | Left maxillary + ethmoid rhinosinusitis |
| 10 | 13 | M | Preseptal cellulitis | Infected left eye Nasal discharge (left) | Pansinusitis |
| 11 | 14 | M | Preseptal cellulitis | Infected left eye Nasal discharge (left) | Frontal rhinosinusitis |

surrounding tissues via direct, venous, lymphatic, and perineural spreading. Direct spread takes place when the infection creates osteomyelitis in the compact bones, osteitis, and diploic bones (3-7).

Eleven patients, 8 (73%) males and 3 (23%) females, with a mean age 12.36 years (range 6–20 years) who were treated for orbital complications of acute rhinosinusitis were evaluated in the study. When the age distribution of orbital complications in the publications is considered, it is seen in the childhood with the rate of 70%–80% and frequently under the age of 16 (7). The average age at complication onset in our study is 12.36, which is consistent with the literature. Furthermore, complication dis-

tribution classified according to Chandler (2) classification revealed preseptal cellulitis in 9 cases, subperiosteal abscess in 1 case, and orbital abscess in 1 case.

In an extensive case study that involved 450 children, Ryan et al. (8) assessed acute cases with orbital complications; 50% of children were diagnosed with periorbital cellulitis and 35% with orbital cellulitis. In our study, on the other hand, 82% (9 cases) of the cases were diagnosed with periorbital cellulitis.

Preseptal cellulitis is inflammatory edema developing as a complication of acute rhinosinusitis. Since the ophthalmic veins that

drain upper and lower eyelids are close to ethmoid sinuses, venous drainage of the eyelid is interrupted.

Periorbital cellulitis is actually a clinical condition that progresses with relatively milder symptoms such as eyelid edema, redness, and increased temperature; but unless it is treated timely and appropriately, the infection can easily spread to the back of the septum (7-10).

In the clinical practice manual of the American Academy of Pediatrics (2013) on the diagnosis, treatment, and management of acute bacterial sinusitis in children between 1 and 18 years of age, Wald et al (11) emphasized that 82% of the cases diagnosed with acute sinusitis in the United States are prescribed antibiotics. Medical treatment of acute sinusitis varies between 10 and 28 days; in case of intraorbital complications, ceftriaxone, ampicillin-sulbactam, or piperacillin tazobactam is recommended, for polymicrobial factors, especially if there is a suspicion of abscess, ceftriaxone, and against anaerobes, metronidazole. Furthermore, for these cases, it is emphasized that in addition to antibiotic therapy, it is necessary to administer decongestants, nasal steroids, and local irrigation (saline) treatment for nasal infection (11).

Also, in the literature, the medical treatment for cases of suspected orbital complications of acute sinusitis is ampicillin-sulbactam, cefuroxime, ceftriaxone, cefotaxime, or clindamycin and the necessity of the medical treatment administration for 4-8 weeks is highlighted (7-14). In our study, for preseptal cellulitis, we administered intravenous (IV) 4x1.5 g of ampicillin-sulbactam (adult dose 3-4x1.5-3 g/day, pediatric dose 150 mg/kg [50 mg sulbactam and ampicillin] in children); for subperiosteal abscess, a combination of IV 4x1.5 g ampicillin-sulbactam and ornidazole (adult dose 2x500 mg/day, pediatric dose 2 doses of 25 mg/kg/day); and for orbital abscess, IV ceftriaxone 2x1 g (adult dose 1-2 g/day, pediatric dose 50-75 mg/kg/day) - ornidazole 2x500 mg (adult dose 2x500 mg/day, pediatric dose 2 doses of 25 mg/kg/day). Patients received medical treatment for approximately 10 days while they were hospitalized, and after that, patients' antibiotic treatment continued orally for 2 more weeks.

In the guideline study by Wald et al (11), for cases diagnosed with acute bacterial sinusitis, clinicians are recommended to assess the cases with contrast paranasal CT and/or MRI especially when they have orbital or intracranial complication suspicion (evidence grade B; strong recommendation). In the same publication, especially for the children under 5 years of age, it is stated that considering clinicians' emphasis on abstaining from requesting paranasal CT imaging because of its radiation risk, even though it provides a quicker and easier result compared to MRI, it should not be forgotten that for MRI, additional sedation is needed and contrast-enhanced imaging should also be required.

Current approach and treatment algorithm for orbital complications that develop after acute rhinosinusitis is schematically depicted with current literature data in Figure 1. According to this, the foundation of the algorithm is related to the prevalence of infection on PNSCT, clinical rhinosinusitis characteristics and the response to medical treatment of the case, and the size of the possible abscess (abscess <10 mm) (8-14).

Radiological imaging methods PNSCT and MRI are important for both confirmation of the acute rhinosinusitis diagnosis and planning the surgical treatment for paranasal sinuses or rhinosinusitis complications. PNSCT is an imaging method that is preferred quite frequently in an effective way in the assessment of the paranasal infections and complications. In the literature, PNSCT is recommend at each step of the diagnosis and treatment of complications, especially in the differential diagnosis or abscess formation process of complications. MRI is also important in the assessment of complications due to sinus infections such as cavernous sinus thrombosis. For the diagnosis, follow-up of treatment, and possible complications of acute rhinosinusitis, as well as for surgical planning of the cases considered, PNSCT is a frequently used imaging method with high sensitivity (7-12). In particular, the location and extent of infection during acute rhinosinusitis is important. Infection is frequently observed in ethmoid sinuses in publications, and in our study, in 10 of 11 cases, ethmoid sinus infection (rhinosinusitis) was detected via PNSCT.

After introduction of antibiotics, although there was no decrease in the number of cases diagnosed with rhinosinusitis, the number of complications relatively decreased. Especially in patients with advanced complications, administration of medical therapy (antibiotics) intravenously is highlighted in publications (Figure 1). The age, prevalence, and general state of the patient presenting with possible complications should be assessed, being constantly vigilant for requirement of medical and/or surgical treatment.

As per the clinical practice manual for diagnosis, treatment, and management of acute bacterial sinusitis, if any of the following symptoms are clinically observed despite antibiotic treatment—vision loss in 24-48 hours, ophthalmoplegia, high intraocular pressure (>20 mm), severe proptosis (> 5 mm), altered consciousness, headache, and vomiting—it is recommended to have a suspicion for possible orbital complications and investigation of the presence of abscess, and consideration of “an emergency surgery for drainage” approach (11).

For each case suspected from orbital complications, in order to assess bulbus oculi movements and vision, eye disease consultation should be required. A potential danger in visual functions constitutes an immediate indication for surgery with en-

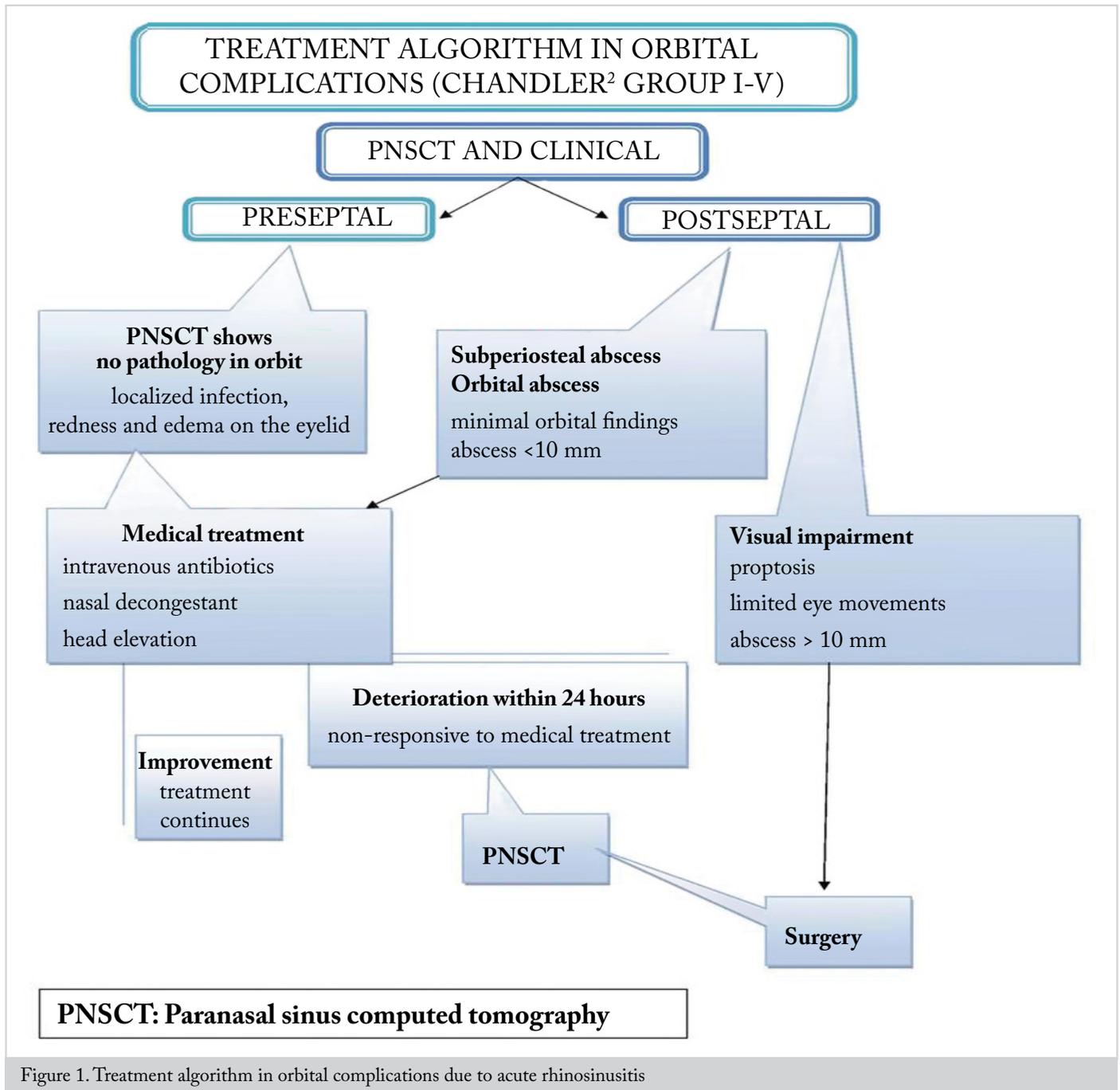


Figure 1. Treatment algorithm in orbital complications due to acute rhinosinusitis

donasal or external approach. Vision loss results from abscess compression; increase in intraorbital pressure due to cellulitis; septic optic neuritis; embolic and thrombotic lesions in vessels supplying optic nerve, retina, or choroid; purulent inflammation of the optic nerve; and corneal ulceration (7-10). Patients should be evaluated ophthalmologically and should be given hourly visual inspection, if necessary. Also, neurosurgery consultation must be requested for cases with suspicion of complications. Immediate surgical treatment should be administered in all patients if there is a decrease in vision, rapid deterioration within 24 hours despite medical treatment, or lack of improvement in patient condition in 48–72 hours (Figure 1).

While subperiosteal abscess creates a relative indication for surgical treatment, orbital abscess requires emergency drainage. Surgical treatment includes the drainage of the infected sinuses and orbital abscess. Traditional surgical approach in subperiosteal abscess is performing drainage via external ethmoidectomy. External approach is also used as a traditional method in the drainage of orbital abscess. In our clinic, the general condition of the patient diagnosed with subperiosteal abscess was moderate, the abscess was larger than 10 mm (about 25 mm) in PNSCT, and endoscopic sinus surgery and drainage of the abscess that was localized superomedially in the right orbit were performed in an external approach be-

cause the case was non-responsive to medical treatment. With a different perspective, particularly for medially or superomedially localized abscess, surgical treatment options, such as endoscopic drainage, can also be considered instead of external drainage. As being different disciplines, especially in ophthalmology and otorhinolaryngology clinics, external and/or endonasal endoscopic surgeries are performed successfully owing to familiarization and experience. Functional endoscopic sinus surgery is successful in the endonasal drainage of the possible abscess and infected sinuses of the cases with orbital complications occurring after rhinosinusitis (14-20). Regarding clinical improvement of patients during follow-up, if the decline in abscess size is around 10 mm and if the medical treatment is successful, surgery is not required. In our study, surgical intervention was not performed on the case with orbital abscess because of the patients' clinical improvement during follow-up, decline in the eye symptoms, the size of the abscess' being around 10 mm, and the success in medical treatment.

Conclusion

Orbital complications are frequently encountered in children and young adults as a complication of sinusitis. About the course of the orbital complications, an opinion can easily be formed by performing nasal endoscopic examination, PNSCT, MRI, and consultation for the relevant complication. Patients who receive treatment with broad-spectrum intravenous antibiotic treatment can be brought substantially under control.

In case of suspicion of complication despite medical treatment, if vision loss within 24–48 hours, ophthalmoplegia, high intraocular pressure (>20 mm), severe proptosis (>5 mm), altered consciousness, headache, vomiting, and rapid deterioration of patient condition within 24 hours are observed or if the patient shows no improvement within 48–72 hours, drainage (removal of the infection with endoscopic sinus surgery) must be considered and administered on all patients. In the event of delay in the initiation of the treatment or insufficient treatment, life-threatening complications or complications (brain abscess, meningitis, cavernous sinus thrombosis, etc.) that may cause vision loss may occur. Therefore, early diagnosis and treatment of orbital complications is of utmost importance.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Tepecik Training and Research Hospital, 2014-3-21.

Informed Consent: Written informed consent was obtained from patients who participated in this study.

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