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Research Article

Orbital complications of acute rhinosinusitis: A Study on Clinical profile, Surgical management and outcome.

Rosa OKDST[1],Warnasuriya N[2], Kirihene R[3]

[1]Senior registrar (ENT), National Hospital of Sri lanka (NHSL), Sri Lanka
[2] Registrar (ENT), National Hospital of Sri lanka (NHSL), Sri Lanka
[3] Consultant ENT and Head & Neck Surgeon National Hospital of Sri lanka (NHSL), Sri Lanka

Abstract

Objectives

1. Evaluate the clinical signs and their correlation to Computed Tomography(CT) findings
2. Assess the correlation between CT and intra-operative findings.
3. To identify implicated micro-organisms.
4. Evaluate the current practice in surgical management.

Methodology

A descriptive retrospective study conducted at Lady Ridgeway Hospital (LRH) on 19 patients who underwent endoscopic sinus surgery, drainage of pus and orbital decompression for radiologically suspected orbital complications of acute rhinosinusitis from 01/01/2015 to 31/12/2018.

Results

Clinical features were fever (73.7%), peri-orbital swelling (100%), chemosis(68.4%), proptosis(57.9%) and ophthalmoplegia(42.1%). Chemosis and ophthalmoplegia were found in 62% and 37% of the patients with intra-orbital abscesses, with only chemosis showing a statistically significant association.

CT was suggestive of subperiosteal abscess or inflammation in all. Intra-operatively abscesses were found in 16 (84.2%). Of these 6 had both subperiosteal and intra-orbital abscesses. Eight had subperiosteal abscesses. Two had only intra-orbital abscesses. The CT scan failed to predict the presence of abscess within the orbital fat in 3 out of 8. The positive predictive value was 89.4% for CT to detect orbital abscesses. An Intra-operative bony defect was noted in 15.8%. The mean surgery duration was 2.04 hours. Cultures revealed MRSA(21.1%), MSSA(15.8%), Pseudomonas(10.5%), mixed growth(10.6%) and *Streptococcus viridans*(5.3%).

Conclusion

The commonest presentations were peri-orbital swelling, fever, chemosis. MRSA and pseudomonas being the commonest organism, the appropriate empirical therapy needs further discussion. Endoscopic surgery is safe, reliable and cosmetic. As patients with intra-orbital abscesses may not be detected clinically or radiologically, we recommend routine incision of the orbital periosteum for suspected orbital complications of acute rhinosinusitis when undergoing endoscopic surgery.

Keywords:acute rhinosinusitis, endoscopic sinus surgery, orbital decompression, orbital abscess, subperiosteal abscess

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Corresponding: Rosa OKDST (sharmdm@gmail.com)

https://orcid.org/0000-0002-1587-3352

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Introduction

Orbital complications are known to occur in sinusitis, more commonly in children. The proposed predisposing factors include thin lamina papyracea, unossified suture lines, absent lymphatics in the orbit and the relative immune deficiency in children less than 5 years old. Orbital complications have been classified by Chandler in to preseptal cellulitis, orbital cellulitis, subperiosteal abscess, orbital abscess and cavernous sinus thrombosis. Symptoms and signs occurring in each stage may aid in differentiation, but definitive diagnosis requires imaging and surgery. In preseptal cellulitis, there is oedema of the eyelid, usually without pain, chemosis, ophthalmoplegia or visual derangement.

Orbital cellulitis may lead to proptosis, ophthalmoplegia and chemosisusually without visual derangement. Subperiosteal abscess which commonly occurs in the medial or superior orbital wall leads to proptosis, ophthalmoplegia and chemosis but vision is not usually affected. Orbital abscess which is usually extraconal leads to severe proptosis, ophthalmoplegia and often loss of vision. Classical features of cavernous sinus thrombosis are ptosis, proptosis, chemosis and cranial nerve palsies.

In literature there are only a few studies looking in to orbital complications secondary to acute rhinosinusitis in children. There were no locally carried out studies in this regard. Therefore, we hope that the current study will bring in to light the current practices, common presentations and the offending organisms (including methicillin resistant *Staphylococcus aureus*(MRSA) and methicillin *sensitive Staphylococcus aureus* (MSSA)) in orbital complications secondary to acute rhinosinusitis.

Material

A descriptive retrospective study was conducted in Lady Ridgeway Hospital on 19 patients who underwent orbital decompression and abscess drainage for radiologically suspected orbital complications secondary to acute rhinosinusitis from 01/01/2015 to 31/12/2018 at the paediatric ENT Unit. The inclusion criteria were patients presenting with clinical and radiological suspicion of orbital abscess secondary to acute rhinosinusitis.Exclusion criteria were underlying malignancy and immunodeficiency states.All the patients meeting the inclusion and exclusion criteria were included in the study.

Objectives

1. Evaluate the clinical signs and their correlation to Computed Tomography findings
2. Assess the correlation between Computed Tomography findings and intra-operative findings.
3. To identify the micro-organisms implicated.
4. Evaluate the current practice in surgical management.

Results

The age range of the participants varied from 1.5 months to 10 yrs. The gender distribution showed that 47.4%(9) of the population to be male and 52.6% (10) female.

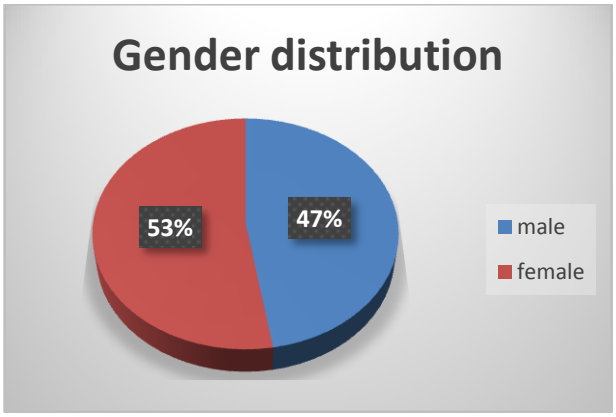

Figure 1- Gender distribution

The majority of patients were admitted to a paediatric ward (14). The others were admitted to eye hospital (3) and ENT unit (2). There were 4 transfers from peripheral hospitals, but only one was directly to the ENT unit. The mean interval between admission to Lady Ridgeway Hospital and transfer to the ENT unit of LRH was 1.8 days.

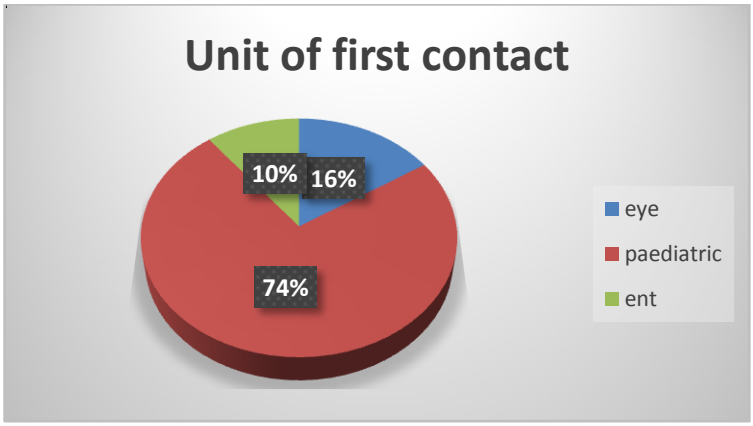

Figure 2- Unit of first contact

The mean interval between admission to ENT unit and surgical intervention was 1.26 days.The symptoms at presentation included fever in 73.7% (14), periorbital swelling in 90% (16), eye pain in 63.2% (12), history of upper respiratory tract infection in 68.4% (13) and epiphora in 63.2% (12). Visual loss or a relative afferent papillary defect was not present in any of the patients.Signs included chemosis in 68.4% (13), proptosis in 57.9% (11) and ophthalmoplegia in 42.1%(8).Chemosis was found in 62% of the patients with intra-orbital abscesses, showing a statistically significant association. Ophthalmoplegia was seen in 37% of the patients with intra-orbital abscesses, but did not show a statistically significant association.

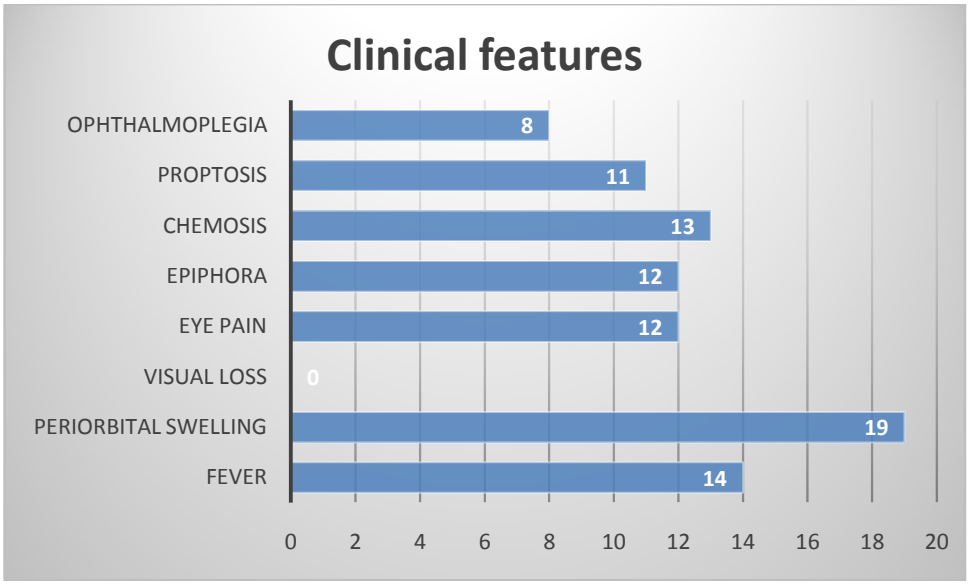

Figure3- Clinical features

Leucocytosis was seen in 83.3% (15) of the population. There was no significant correlation between leucocytosis and the presence of an abscess. CT was suggestive of subperiosteal abscess or inflammation in all the patients. There was intra-orbital gas formation in one patient.

Radiological features of sinusitis were present in the ipsilateral maxillary sinus in 4, bilateral maxillary sinuses in 2 and contralateral maxillary sinusitis only in 1 patient.3 patients did not have any radiological features of sinusitis. Similarly, radiological features of sinusitis were present in the ipsilateral ethmoid sinuses in 6and bilateral ethmoid sinuses in 2. Furthermore 2 patients did not have any radiological features of sinusitis in ethmoids.Radiological features of sinusitis were present in the ipsilateral frontal sinus in 3, bilateral frontal sinuses in 2 patients. 4 did not have any radiological features of frontal sinusitis.Radiological features of

sinusitis were present in the ipsilateral sphenoid sinus in 3, bilateral sphenoid sinuses in 1 and only contralateral sphenoid sinusitis in 1. Radiological features of sphenoid sinusitis were absent in 4 patients.Intra-operatively abscess was found only in 16 out of 19 patients. Of these 6 patients had abscesses in both the subperiosteal as well as within the orbital fat. Eight patients had only subperiosteal abscesses. In 2 patients there was orbital cellulitis in addition to subperiosteal abscess. Two patients had pus only within the orbital fat. The CT scan failed to predict the presence of abscess within the orbital fat in 3 out of 8 patients.

Hence the current study shows a positive predictive value of 89.4% for Computed Tomography in detection of orbital abscesses.

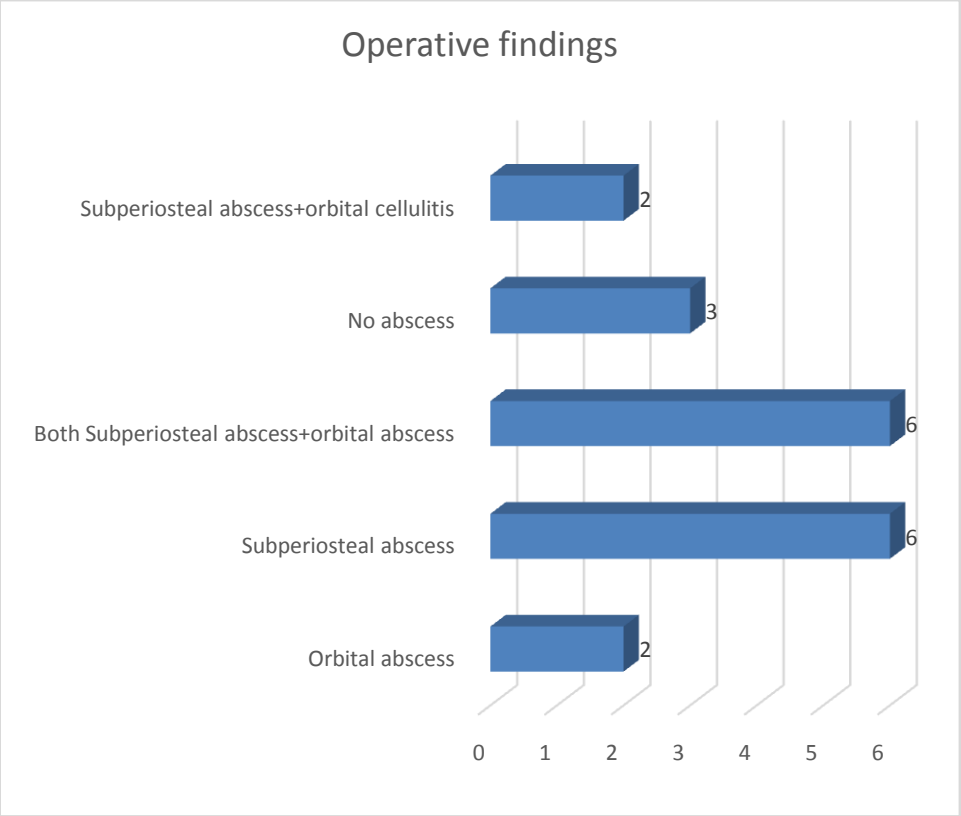

Figure 4- Operative findings

Intra-operative bony defectsin the orbit were noted in 3 patients. There was no statistically significant correlation between abony defect and presence of abscess.There was no statistically significant correlation between steroid use and duration of post-operative hospital stay.
Patterns of sinusitis noted intraoperatively include ipsilateral maxillary only in 3, ipsilateral ethmoid only in 1, ipsilateral maxillary, ethmoid, frontal and sphenoid in 2, ethmoid and sphenoid in 1, ipsilateral maxillary and frontal in 1, ipsilateral maxillary and ethmoid in 3, ipsilateral maxillary, ethmoid and frontal in 7 patients.Inferior turbinate hypertrophy was noted in 15 of patients (Right-8, Left-3 and Bilateral- 4) during surgery. Middle turbinate hypertrophy was noted in 12patients (Right-7, Left-5) during surgery. Mucosal oedema was found in 18. All procedures were done endoscopically.

All the patients underwent middle meatal antrostomy, anterior and posterior ethmoidectomy, orbital decompression and drainage of abscess with or without frontal sinus clearance and sphenoidotomy. After removal of the lamina papyracea, the orbital periosteum was routinely incised.
One patient underwent septoplasty in addition to orbital decompression. Three patients underwent turbinate surgery in addition. One patient underwent adenoidectomy for 90% adenoid enlargement. The mean duration of surgery was 2.04 hours.

Pus cultures revealed methicillin resistant *Staphylococcus aureus* (MRSA) in 4, methicillin *sensitive Staphylococcus aureus*(MSSA) in 2, *Pseudomonas aeruginosa* in 5, mixed growth in 2 and*Viridans* group of

Streptococci in 1. The mixed flora cultured were*Pseudomonas aeruginosa* and *Staphylococcus aureus* which was methicillin resistant in one case.

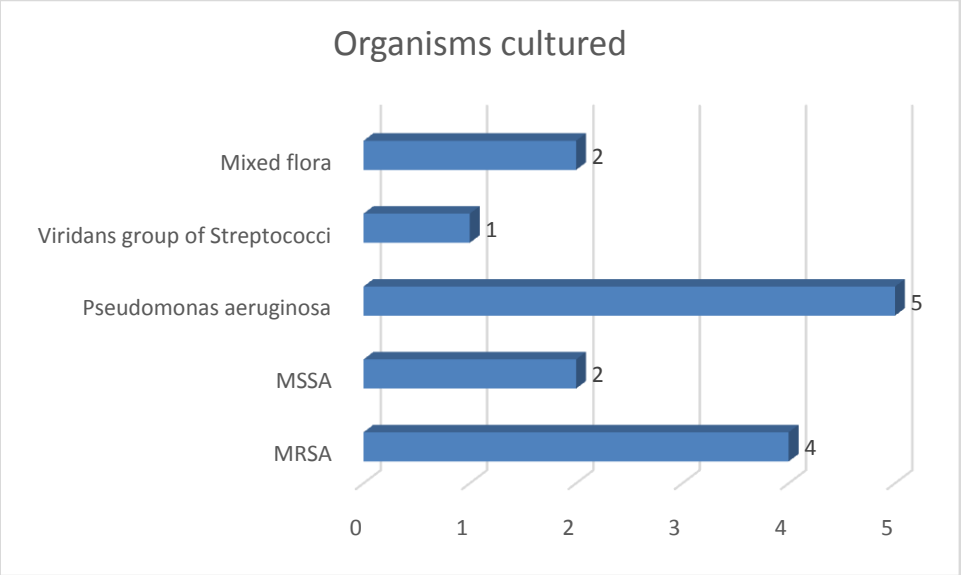

Figure 5- Micro-organisms cultured

All patients had nasal packing after the surgery with methyl cellulose packs, neuropatties or antibiotic-steroid cream impregnated ribbon packs.The mean duration of hospital stay was 11.78 days.Mean duration of post-operative stay for intravenous antibiotic was 9.05 days. Mean durationfrom onset of symptoms to surgery was 6.42 days with a range of 2 to 14 days.Vancomycin, Linezolid and Teicoplanin were given to 3, 1 and 2 patients respectively. Steroids were given to 17 of patients. The mean duration of steroid administration was 6.88 days.

Discussion

Several studies have shown a slight male predilection[1,2]. The present study has shown a slight female predilection, may be owing to the different population characteristics. In the literature and also in the present study,all the patients presented with eye symptoms rather than nasal symptoms and shows the importance of close collaboration between eye surgeons, paediatricians and otorhinolaryngologists. The first contact of 15.8% of patients were the eye surgeon and 73.7% were the paediatrician and importance of awareness about possible orbital complications secondary to acute rhinosinusitis among these specialities cannot be overemphasized. Literature has also shown similar finding[3].A study done in China revealed that fever and proptosis were independent factors predicting subperiosteal abscess formation[4].There was no such correlation in the current study.However, chemosis was found in 62% of the patients with intra-orbital abscesses, showing a statistically significant association.

The microbial flora responsible has changed from study to study, but MRSA was shown to be an important emerging aetiology. In a study done on neonates it was shown that *Staphylococcus aureus* is the predominant organism affecting 14 out of 17 patients[5]. In another study, done in the US, *Staphylococcus aureus* had been the commonest organism with 73% being MRSA. *Streptococci* and *Hemophilus*were next commonest respectively. Flora noted in other studies include *Streptococcus viridans*, coagulase negative *Staphylococcus*andpolymicrobial isolates[6].
Pus cultures of the present study revealed MRSA in 21.1%, MSSA in 15.8%, *Pseudomonas aeruginosa*in 10.5%, mixed growth in 10.6%, *Streptococcus viridans* in 5.3%. The commonest mixed flora was Pseudomonas and staphylococcus aureus. 36.8% cases had no microbial growth probably owing to the administration of prior antibiotics. Since anaerobic cultures are not routinely performed in our unit, any occult anaerobic infections may have been missed.

Computer tomography and magnetic resonance imaging are the commonly utilized imaging techniques. Studies have shown that addition of radiological features like bony destruction and size of subperiosteal abscess to chandler classification increases the accuracy of predicting necessity of surgical intervention[10]. Another study found no statistical correlation between and sinonasal bony or cartilaginous anatomical variants on Computed Tomography and orbital complications of rhinosinusitis[11]. In the present study 3 patients had bony defects in the orbit identified intra-operatively, whereas only two of them were detected in the Computed Tomography scan. However, the present study too failed to show a statistical correlation between bony defects of orbit and orbital abscess formation secondary to sinusitis.

Various studies have suggested criteria for conservative management including age less than 9 years, medially located small subperiosteal abscess (less than 10mm), no suspicion for anaerobic infection or dental origin, no suspicion of frontal sinusitis, no chronic sinusitis and normal vision, pupil & retina, no ophthalmoplegia, intraocular pressure < 20mmhg and proptosis of less 5mm[12, 13, 14, 15].

Criteria for surgical management have been extensive in studies. In summary these are treatment failure defined as deterioration of vision or development continued fever for longer than 36 hours after initiation of treatment, clinical deterioration after 48 hours and no improvement after 72 hours. Studies have also shown that Old age and leucocytosis were associated with surgical intervention[12]. In the present study all patients had radiological subperiosteal and intraorbital abscess formation with suspicion of anaerobic infection in one patients due to presence of intraorbital gas. The size of the abscesses could not be identified owing to absence of retrospective data[12, 13, 14, 15,16]. In the present study 55.5% had features of frontal sinusitis on Computed Tomography, but these values may be misleading as the frontal sinuses are often underdeveloped in the paediatric population. All patients had normal vision and proptosis was found in 57.9% and ophthalmoplegia in 42.1%.In the present study, 68.42% of the patients received intravenous antibiotics for more than 48 hours without significant improvement.

Surgical intervention can be carried out endoscopically, open or by using both methods. Which technique to use depends on the characteristics of the patient and the experience of the surgical team. However endoscopic sinus surgery is the preferred modality in our unit and it is a safe and a reliable method of treatment and avoids a facial scar[17]. The main disadvantage in endoscopic approach is longer duration taken for the procedure which may not be acceptable if there is visual compromise as there is only golden 100 minutes from the onsetto avoid permanent visual deficit[16, 17]. The mean surgery duration was 2.04 hours in the present study and the estimated time to orbital decompression after induction of anaesthesia and decongestion was 60 minutes.All the patients underwent middle meatal antrostomy, anterior and posterior ethmoidectomy, orbital decompression and drainage of abscess with or without frontal sinus clearance and sphenoidotomy. After removal of the lamina papyracea, the orbital periosteum was routinely incised. This was done to further relieve the elevated intra-orbital pressure as a result of inflammatory oedema, to identify any additional pathology such as intra-orbital abscesses and also as a prophylactic measure to avoid elevation of intra-orbital pressure if inadvertent damage to anterior ethmoidal artery occurred during surgery.

There were 3 patients with CT negative for intra-orbital abscess, in whom intra-orbital abscess was found during surgery after incision of the orbital periosteum. Furthermore,there were 5 patients without ophthalmoplegia and 3 patients without chemosis in whom intra-orbital abscesses were found. This shows the importance of routine incision of the orbital periosteum in all patients with suspected orbital complications secondary to acute rhinosinusitis who are undergoing endoscopic surgery. Intra-orbital abscesses which are not drained can not only lead to delayed recovery, increased hospital stay and return to theatre but can progress to further complications like visual loss. This practice has not been studied in the literature.

The empirical antibiotics started in our patients were cefotaxime and co-amoxyclav. The antibiotic was later changed according to sensitivity of the offending organism. Vancomycin, Linezolid and Teicoplanin was given to 15.8%, 5.3% and 10.5% of our patients respectively. The literature suggests to use antibiotics rationally depending on the local sensitivity patterns and usage of simple antibiotics aids in limiting development of resistance and allows transition to oral antibiotic[5, 6, 7, 8, 9].

Steroids were given to 89.5% of patients. The mean duration of steroid administration was 6.88 days. The present study along with several studies in the literature have failed to show a correlation between administration of steroids and duration of hospital stay[19].

Conclusion

As first contact of majority of patients were the eye surgeons and the paediatricians, these specialities should have high vigilance regarding possible orbital complications secondary to acute rhinosinusitis.Computed Tomography has a positive predictive value of 89.4% in detection of subperiosteal and intra-orbital abscesses. MRSA was shown to be the commonest organism responsible.

Endoscopic orbital decompression was the preferred modality in our unit and it is a safe and a reliable method of treatment which is more cosmetically acceptable. As patients with intra-orbital abscesses may not be detected clinically or radiologically, we recommend routine incision of the orbital periosteum in all patients with suspected orbital complications secondary to acute rhinosinusitis who are undergoing endoscopic surgery. This will also relieve the elevated intra-orbital pressure as a result of inflammatory oedema further, identify any additional pathology such as intra-orbital abscesses and also as a prophylactic measure to avoid elevation of intra-orbital pressure if inadvertent damage to anterior ethmoidal artery occurred during surgery.

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