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Complications in Patients with Chronic Rhino Sinusitis in a Tertiary Hospital in Jazan Province - Saudi Arabia

Alharbi F[1,2], Ahmed MR[1,3], Madkhali YA[1], Sahl HH[1] and Barakat MY[1]*

[1]Faculty of Medicine, Jazan University, Jazan, Saudi Arabia

[2]Department of Otolaryngology-Head & Neck Surgery, Prince Mohammed bin Nasser Hospital, Jazan, Saudi Arabia

[3]Faculty of Medicine, Suez Canal University, Ismailia, Egypt

Abstract

Background: Chronic Rhino Sinusitis (CRS) is one of the most common chronic diseases with an estimated prevalence of 10.4%. Complications of Chronic Rhino Sinusitis (CRS) can be divided into local, orbital (the most common complication), and intracranial that may directly threaten the patient's life and require prompt treatment. Objective of our work to evaluate etiology, clinical manifestations of patients with complications of chronic rhino sinusitis referred to this hospital and to present the diagnostic and therapeutic/surgical approaches used to manage these cases. It is a retrospective study conducted on 94 patients with complications of chronic rhino sinusitis was included in our study subjected to our management protocol.

Results: 46 (49%) patients showed marked improvement with medical treatment for 14 days without needs for surgical intervention while 48 (51%) patients were subjected for surgical interventions including endoscopic sinus surgery and orbitotomy/craniotomy. Morbidity and mortality in post-operative period was observed in 10 (10.7%) patients.

Conclusion: The complications of chronic rhino sinusitis are potentially life threatening. Stage V complications poses a high risk of death. Cooperative consultation between ophthalmologists, neurologists and otorhinolaryngologists offer a favorable outcome. Prompt surgical drainage when indicated are essential to an optimal prognosis and reduced the incidence of morbidity and mortality rates. Physicians are encouraged to follow the clinical guidelines in their treatment protocols instead of making decision based on their own impressions and experience.

Keywords: Complication; Rhino sinusitis; Orbital

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*Correspondence:
Mohamed Rifaat Ahmed, Professor of Otolaryngology, Faculty of Medicine, Suez Canal University, Ismailia, Egypt.
Tel: 01285043825
E-mail: m_rifaat@hotmail.com

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Abbreviations

SD: Standard Deviations; N: Number of patients

Background

Rhino sinusitis is frequently classified into categories depending on the course of illness: acute, recurrent acute, sub-acute (which defined as signs with symptoms lasting between 30 to 90 days) and chronic rhino sinusitis when persisting for at least 12 weeks without completes resolution [1].

Chronic Rhino Sinusitis (CRS) is one of the most common chronic diseases with an estimated prevalence of 10.4% and usually had a significant impact on patients' quality of life [2].

The pathogenesis for developing the CRS is complex and multifactorial. It may be due to either systemic disease (including Wegener's granulomatosis or sarcoidosis) or genetic disease (such as primary ciliary dyskinesia and cystic fbrosis). CRS categorized by two major phenotypes: CRS with or without polyps (CRSwNP or CRSsNP, respectively) [3].

Timperley et al., describe an interacting triad of: intrinsic mucosal inflammation; local microbial community; and mucociliary dysfunction, the persistent mucosal inflammation is the key feature of CRS more localized to the osteomeatal complex leading to its obstruction and impaired of mucociliary function [4].

Complications of CRS can be divided into local, orbital, and intracranial problems and combinations could be occurred because the eyes and the brain neighbor to the para-nasal sinuses [5].

Orbital infection, (the most common complication), occurs when pathogens pass from an infected maxillary, ethmoidal, frontal, or sphenoidal sinus into the orbit, either directly though neurovascular foramina or a congenital or acquired bony dehiscence, or indirectly through valve less veins of the sinuses and orbit and a bony erosion of the lamina papyracea can lead to the formation of an orbital abscess [6].

Osteomyelitis that results from sinusitis is an unusual finding, it is most frequently found after trauma, radiation therapy, or debilitating disease and the frontal sinus is the site most frequently involved, causing edema and swelling of the forehead, called Pott's puffy tumor [7].

Brain abscesses, meningitis and cavernous sinus thrombosis are one of the most severe intracranial complications, most brain abscesses after sinusitis occur in this neurologically relatively silent area [8].

Complications of sinusitis are medical emergencies that may directly threaten the patient's life and require prompt and definitive surgical treatment as array of symptoms associated with these complications during the onset of disease and the extensive use of antibiotics prior to delivering appropriate therapeutic measures can often mask significant symptoms of intracranial complications [9].

Our study aimed to evaluate etiology, clinical manifestations of patients with complications of chronic rhino sinusitis referred to this hospital and to present the diagnostic and therapeutic/surgical approaches used to manage these cases.

Methods

This is retrospective study conducted in a tertiary referral hospital in Saudi Arabia. The period was from January 2015 to January 2020.

The inclusion criteria of our study were inpatients of all age groups presenting with complications of chronic rhino sinusitis were included to our study.

Any patient with history for previous management protocol was excluded from our study.

Some complications of chronic rhino sinusitis were defined as spread of infection outside the sinuses results in complicated sinusitis.

The following data were collected from the patient file:

Demographic data.

Symptoms of complications of CRS justifying immediate referral and hospitalization (Periorbitaledema-Displaced globe -Double vision-Ophthalmoplegia-Reduced visual acuity.

Severe unilateral or bilateral frontal headache -Frontal swelling-Signs of meningitis or focal neurological signs).

Complete ENT examinationincluding cranial nerves examinations.

Nasal endoscopic examination.

Investigations including blood picture.

Radiological data: Computed tomography PNS, chest X ray, and MRI if indicated.

Microbiological investigations(nasal swan for culture & sensitivity).

Ophthalmic examination findings if indicated.

The diagnosis was based on clinical symptoms and signs as well as laboratory tests and radiological investigations. Sinusitis was confirmed by the presence of sinus opacification or air-fluid levels on Computerized Tomography (CT).

The symptoms of both CRS and the complications were recorded, as well as medical history, medical treatment preceding hospitalization; hospital stay durations, course and outcome, management either medical or surgical including the operative findings were collected from patient file. Postoperative follow up data and complications were also collected.

Orbital complications of sinusitis were classified according to Chandler et al., classification as Focal thickening and infiltration of the eyelid anterior to the orbital septum were classified as stage I, pre-septal cellulitis. Edema and inflammation of the orbital contents without evidence of abscess formation were classified as postseptal stage II, orbital cellulitis. Abscess formation between the orbital wall and the peri-orbital was classified as stage III, sub-periosteal abscess. Abscess formation with pus or debris within the orbital content was classified as stage IV, orbital abscess. Additional intracranial extension, including cavernous sinus thrombosis, meningitis, cerebritis, or epidural/subdural/intracerebral abscess or empyema, was classified as stage V [10,11].

All patients were subjected for middle meatal aspiration using fine catheter connected to a suction machine introduced to the nose gently under control of headlight or endoscope then the catheter slightly directed upwards away from the nasal floor looking for secretion from the region of the middle meatus and once a discharge observed in the catheter, the suction stopped and the catheter immediately separated from the suction machine and withdrawn from the nose and the catheter sent to the laboratory for culture and sensitivity test using Kirby Bauer technique for aerobic and anaerobic culture (a fully standardized technique for *in vitro* estimation of sensitivity of a particular bacterium to antibiotics that based on disc diffusion method) with a particular bacterium described to be susceptible, intermediately susceptible or resistant to antibiotics [12].

Statistical analysis

Data collected were processed using SPSS version 21 (SPSS Inc., Chicago, IL, USA).

Ethics approval and consent to participate

The local ethics committee approved the study.

Written consent was obtained from all study participants.

All participants included in the study have been informed about the procedures to be done and the expected results.

All participants agreed for the study with written informed consent obtained from them.

Written Consent for study publication was obtained from all study participants.

Results

A total 94 patients (36 females, 38 % and 58 males, 62%) fulfilling the inclusion criteria were included in the study. Mean age was 39.3 years. All patients had history of chronic rhino sinusitis (nasal obstruction, mucopurulent drainage, headache, fever, post nasal discharge and anosmia).

Figure 1: Showed stage 1 orbital complication (focal thickening and infiltration of the eyelid anterior to the orbital septum - preseptal cellulitis).

Figure 2: Showed stage 2 orbital complication (edema and inflammation of the orbital contents without evidence of abscess formation - postseptal cellulitis).

36 (38.2%) patients had diabetes mellitus and 22 (23.4%) patients were immune-compromised while 41 (43.6%) patients were smokers and 27 (28.7%) patients had history for allergic manifestations.

14 (14.8%) patients had history of previous nasal/para-nasal surgery. No patients had cystic fibrosis, or immotile cilia syndrome.

CT/MRI showed opacification of at least one sinus in all of the patients and pan sinusitis was found in most of the patients, dehiscence of the posterior wall of the frontal sinus was observed in 5 patients while defect in lamina papyracea was found in 16 patients. A defect in the ethmoidal roof was found in two patients and a partial thrombosis of the superior sagittal sinus in another.

Sixteen patients (17%) had been treated with oral antibiotics for 3.5±6.1 days prior to hospitalization amoxicillin/clavulanic acid (7), clarithromycin (3), Ciprofloxacin (2), ceftriaxone (1) or unknown (3).

Culture using Kirby Bauer technique for aerobic and anaerobic showed the most common pathogens was *Streptococcus pneumoniae* in 26.6% then *Moraxeilla catarrhalis* in 19.1%, *Anaerobic streptococci* in 12.7%, *Pseudomonas aeraginosa* in 8.5%, *Haemophilus influenzae* in 8.5%, *Staphylococci* 4.3%, *Klebsiella pneumonia* in 4.3%, *Diphtroid bacilli* in 1.1%, *Staphylococcus pyogens* in 1.1%, Proteus in 3.1%, *E. coli* in 1.1%, Alpha hemolytic strep in 1.1% while sterile culture in 8.5% as seen in Table 1.

Antibiotics sensitivity towards the organisms showed that amoxicillin clavulanate was the most effective antibiotic for most of the bacteria in 70.2% followed by moxifloxacin in 18.1%, ciprofloxacin in 14.9%, cefoperazone and Levofloxacin in 12.7%, cefepime in 8.5%, cefuroxime in 5.3%, cefotaxime in 4.3%, metronidazole-sulperzone and ceftriaxone in 3.1%, azithromycin-sulphamethazol and trimethoprim and streptomycine in 1.1% while sterile culture in 8.5% as seen in Table 2.

Figure 3: Showed stage III orbital complication (subperiosteal abscess between the orbital wall and the periorbita).

Figure 4: Showed stage IV orbital complication (abscess formation with pus or debris within the orbital content - orbital abscess).

Table 1: Cultures for the sinuses pathogens isolated from complicated CRS patients as detected by Kirby Bauer technique.

Bacteria species	Type (gram)	N	%
Strept. Pneumoniae	+	25	0.266
Moraxella catarrhalis	-	18	0.191
Anaerobic streptococci	None	12	0.127
Haemophilus influenzae	-	8	0.085
Staphylococci	+	4	0.043
Diphtroid bacilli	None	1	0.011
Staph.pyogens	+	1	0.011
Pseudomonas aeraginosa	-	8	0.085
Klebsiella pneumonia	-	4	0.043
Proteus	None	3	0.031
E. coli	-	1	0.011
Alpha hemolytic strep	+	1	0.011
Sterile culture	None	8	0.085

N=Number of patients

The observed clinical complications findings were divided according to Chandler et al., classification of the orbital complications [10,11].

Forty-seven (50%) patients had stage I (Figure 1), 13 (13.8%) had stage II (Figure 2), 10 (10.7%) had stage III (Figure 3), 9 (9.6%) had stage IV (Figure 4) and 15 (15.9%) had stage V.

Table 2: Sensitive antibiotics as detected by Kirby Bauer technique.

Antibiotic Sensitivity	N	%
*Amoxicillin clavulanate	66	70.2%
*Cefuroxime	5	5.3%
*Cefotaxime	4	4.3%
*Metronidazole	3	3.1%
*Moxifloxacin	17	18.1%
*Azthromycin	1	1.1%
*Sulphamethazol & trimethoprim	1	1.1%
*Ceftriaxone	3	3.1%
*Ciprofloxacin	14	14.9%
*Cefoperazone	12	12.7%
*Cefepime	8	8.5%
*Streptomycine	1	1.1%
*Levofloxacin	12	12.7%
*Sulperzone	3	3.1%
Sterile culture	8	8.5%

All patients had peri-orbital swelling with limitation of extra-ocular movement proptosis, elevated intraocular pressure, reduced visual acuity, and relative afferent pupillary defect were reviewed with ophthalmological consultant for proper managements.

Fever was present in 88 (93.6%) patients and leukocytosis observed in 92 (97.9%)of cases, while elevated C-reactive protein were seen in 90 (95.7%) patients without any statistically significant difference as seen in Table 3.

33 (35.2%) patients had CRS with Nasal Polyps (CRSwNP) while 61 (64.8%) patients had CRS without Nasal Polyps (CRSsNP) as seen in Table 3.

All patients were treated with intravenous antibiotics (ceftriaxone) with prescribed antibiotic according to the culture and sensitivity results with metronidazole and systemic corticosteroids for 14 days. Stage V patients were managed together with neurosurgical team for proper management control intra cranial complications. Locally treatment with saline nasal douches and/or xylometazolin nose drops prescribed for all the patients with closed follow up for 48 hours for final decision if deterioration occurred, patient subjected for surgical intervention or continue the medical treatment if clinically improvement occurred.

46 (49%) patients were showed marked improvement and continue the medical treatment for 14 days without needs for surgical intervention while 48 (51%) patients showed deterioration with persistence for the complication in 48 hours from start of the mentioned medical treatment and they were subjected for surgical interventions. The goals of surgery for orbital complications of sinusitis are to drain the abscess adequately, release pressure in the orbit, and obtain material for culture. The surgical management includes endoscopic sinus surgery and orbitotomy/craniotomy as seen in Table 3.

Stage I+II (19) patients: 16 needs sinus drainage via endoscopic sinus surgery while 3 patients' needs to add orbital decompression.

Stage III+IV (16) patients: 11 needs Sinus drainage *via* endoscopic sinus surgery while 5 patients' needs to underwent orbital decompression for Drainage abscess.

Stage V (13) patients: all of them needs Sinus drainage *via* endoscopic sinus surgery plus neurosurgical management in 13 patients. The mean hospital stay was 14.4±3.6 days (range 10-25days) significantly longer in cases of Stage V.

Morbidity and mortality in postoperative period was observed in 10 (10.7%) patients that 3 (3.1%) had persistent proptosis in stage III, 2 (2.2) patients lost vision permanently in the affected eye, despite intensive treatment in stage IV, one patient (1.1%) in stage V had recurrent episodes of pneumonia and respiratory failure and needs admission for ICU with mechanical ventilation and die after 6 days from the ICU admission, and another 4 (4.4%) patients with stage V die after admission to ICU due to other conditions related to medical causes.

Discussion

Chronic rhino sinusitis is an inflammatory process that involves the para-nasal sinuses and persists for 12 weeks or longer, the etiology of chronic sinusitis is multi-factorial by interaction between many systemic, local host, and environmental factors contribute to sinus inflammation and to the pathophysiology of the disease in most cases are due to acute sinusitis that either is untreated or does not respond

Table 3: Clinical findings in 94 patients' complications of sinusitis.

	Stage, Number (%)					Total	
	Preseptal	Postseptal			Intracranial		
	I	II	III	IV	V		
Characteristics/finding	47 (50%)	13 (13.8%)	10 (10.7%)	9 (9.5%)	15 (16%)	94 (100)	*P* value
CRSwNP	18 (19.1%)	3 (3.1%)	4 (4.3%)	3 (3.1%)	5 (5.3%)	33 (35.2)	0.07
CRSsNP	29 (30.9%)	10 (10.7%)	6 (6.4%)	6 (6.4%)	10 (10.7%)	61 (64.8)	0.06
Systemic finding							
Fever (>37.5˚C)	41 (43.6%)	13 (13.8%)	10 (10.7%)	9 (9.5%)	15 (16%)	88 (93.6%)	0.41
Leukocytosis (>10,000/mm^3)	45 (47.9%)	13 (13.8%)	10 (10.7%)	9 (9.5%)	15 (16%)	92 (97.9%)	0.91
CRP>10.0 mg/L	43 (45.7%)	13 (13.8%)	10 (10.7%)	9 (9.5%)	15 (16%)	90 (95.7%)	0.69
Treatment							
Response to medical treatment	32 (34%)	9 (9.5%)	2 (2.2)	1 (1.1)	2 (2.2)	46 (49%)	0.11
Surgical intervention	15 (16.9%)	4 (4.3%)	8 (8.5)	8 (8.5)	13 (13.8%)	48 (51%)	0.14

Stage V: Cavernous sinus thrombosis in 4 patients, frontal lobe abscesses in 3, and meningitis in 8 patients.

to treatment in addition allergic rhinitis, anatomic obstruction in the ostiomeatal complex, and immunologic disorders are known risk factors for chronic rhino sinusitis [13].

The complications of rhino sinusitis carried a life-threatening and is considered as medical emergencies condition with high mortality and morbidity rates. The immediate and intense therapy is most important to prevent the dangerous sequels might happen [14].

The complications of CRS are classified into three types: local (osseous), orbital (the most frequent), and intracranial problems or in combinations, the most frequently orbital found symptoms usually swelling of the eye, redness of the eye and pain in the eye [14].

Ethmoid sinusitis is especially prone to complications by acute exacerbation of chronic rhino sinusitis as infection in the ethmoidal sinus may spread directly into the orbit *via* the sub-clinical erosion of the thin bone of the lamina papyracea. Sometimes complications occur through minor bony dehiscence's created either during the surgery or indirectly to the brain via septic thrombophlebitis [15].

In addition, the infection in the frontal sinus spreading to the brain via the thin bone of the anterior cranial fossa, resulting in frontal lobe abscess which is reportedly the most common intracranial complication of sinusitis [16].

Intracranial complications might had a few symptoms, and discordance between symptoms and severity is not uncommon and the first symptoms of an intracranial complication were headache and diminished consciousness and the absence of fever does not exclude severe infection, especially in those with reduced immunity due to aging or chronic disease [17].

CT is also useful in the planning of surgery, because it delineates extra-ocular muscles, the optic nerve, orbital walls, and the bony margins of nearby sinuses [18].

The goals of surgery for orbital complications of sinusitis are to drain the abscess adequately, release pressure in the orbit, and obtain material for culture. The underlying sinus infection should be drained at the same time with endoscopic sinus surgery with advantages over an open procedure, including the negation of an external wound, less postoperative edema, and more rapid recovery [11].

In our study we found sterile culture in 8.5% of cases and this is may be due to allergic condition.

Predisposing factors for developing these complications are multi-factorial, including anatomic derangements, impaired sinus drainage, and inhibition of mucociliary transport, which promote bacterial overgrowth. In addition, immunocompromised patients due to (e.g., diabetes mellitus, chronic renal failure, chronic liver disease, high-dose steroid therapy, or acquired immune deficiency syndrome) reportedly predispose patients to bacterial sinusitis and orbital cellulitis [11].

In our study we found that the diabetes mellitus carried a risk factor and stage V disease can deteriorate rapidly and lead to death. The recommendations of antimicrobial treatment for orbital complications of sinusitis varies and most clinicians suggest multi-drug combinations or a single broad-spectrum antimicrobial, to safe guard against polymicrobial pathogens including anaerobes [19].

We found that 46 (49%) patients in our study respond well to medical treatment while 48 (51%) patients' needs Surgical intervention.

It is generally believed that preseptal cellulitis and orbital cellulitis respond to medical treatment alone, but sub-periosteal/orbital abscess or intracranial complications require surgical drainage with emergency drainage of a subperiosteal abscess [19].

Our study showed that 10 (10.7%) patients had developed serious morbidity and mortality in this was observed in patients stage IV complications.

Orbital complications of sinusitis can lead to blindness. Causes of vision-loss include: (1) optic neuritis resulting from a reaction to an adjacent or nearby infection, (2) ischemia resulting from thrombophlebitis along the valve less orbital veins, and (3) pressure ischemia, possibly causing central retinal artery occlusion and prompt decompression of the orbit in such cases may preserve the patient's vision [17].

Stage V disease can deteriorate rapidly and lead to death, as occurred in the patient in our study.

Our study suggests a multi-disciplinary approach involving otorhinolaryngology together with ophthalmology, neurology and neurosurgery for better assessment of disease stage, management and better prognosis outcomes.

CRS still continue to remain a significant burden, both to individual patients and society, and ongoing research in this area is vital.

Conclusion

The complications of chronic rhino sinusitis are potentially life threatening. Stage V complication poses a risk of death. Cooperative consultation between ophthalmologists, neurologists and otorhinolaryngologists offer a favorable outcome. Prompt surgical intervention when indicated are essential for an optimal prognosis and reduced the incidence of morbidity and mortality rates. Physicians are encouraged to follow the clinical guidelines in their treating protocols instead of making decision based on their own impressions and experience.

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