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ORIGINAL ARTICLE

Prevalence, Clinical Presentation, and Prognostic Implications of Orbital Complications in Rhinosinusitis Patients with Systemic Comorbidities

AYESHA GHAFOOR[1], HAFIZ SYED UMAR ABDUR REHMAN[2], ANWAR. UL. HAQ[3], ALLAH BUX MUSHTAQ[4], WING COMMANDER MUHAMMAD TAHIR SHAH[5], AIMAL KHAN[6]

[1]*Consultant Ophthalmologist, THQ Hospital, Depalpur, Pakistan*
[2]*Consultant Ophthalmic Surgeon, Syed Eye Care, Syed Medical Centre, Bahawalpur, Pakistan*
[3]*Assistant Professor, Department of Ophthalmology, Anna Inayat Medical College, Sheikhupura, Pakistan*
[4]*Assistant Professor, Department of ENT, Mohammad Medical College, Mirpurkhas, Sindh, Pakistan*
[5]*Assistant Professor, Department of ENT, Fazaia Medical College, Islamabad, Pakistan*
[6]*Department of Internal Medicine, Pakistan Institute of Medical Sciences (PIMS), Islamabad, Pakistan*
Correspondence to: Hafiz Syed Umar Abdur Rehman, Email: Omar.ab1510@gmail.com

ABSTRACT

Background: Orbital complications of rhinosinusitis represent serious, potentially vision-threatening conditions that are often worsened by underlying systemic comorbidities such as diabetes mellitus, hypertension, and immunosuppression. These comorbidities alter immune function, promote infection spread, and increase the risk of complications, but data on their specific impact remain limited in regional populations.

Objective: To determine the prevalence, clinical presentation, and prognostic implications of orbital complications in rhinosinusitis patients with systemic comorbidities.

Methods: A cross-sectional study was conducted from February 2022 to March 2023 at THQ Hospital Depalpur and Syed Eye Care, Syed Medical Centre, Bahawalpur. A total of 80 patients aged ≥12 years with clinically and radiologically confirmed orbital complications secondary to rhinosinusitis were enrolled. Detailed clinical history, systemic comorbidities, imaging findings, and treatment outcomes were documented and analyzed using SPSS version 26.

Results: Out of 80 patients, 56 (70%) had at least one systemic comorbidity, with diabetes mellitus being the most common (43.8%), followed by hypertension (32.5%). Orbital cellulitis (40%) was the most frequent complication, followed by subperiosteal abscess (22.5%) and orbital abscess (13.8%). Patients with comorbidities had significantly more severe presentations, including proptosis (60.7% vs. 20.8%), ophthalmoplegia (50% vs. 16.7%), and visual impairment (41.1% vs. 12.5%) compared to non-comorbid patients. They also had longer hospital stays (8.9 ± 2.6 vs. 5.3 ± 1.9 days, p<0.001), higher rates of surgical intervention (51.8% vs. 29.1%, p=0.028), and worse visual outcomes, including all cases of permanent vision loss.

Conclusion: Systemic comorbidities significantly increase the severity and worsen the prognosis of orbital complications in rhinosinusitis. Diabetic and hypertensive patients are especially vulnerable to advanced orbital disease, delayed recovery, and visual loss. Early diagnosis, aggressive multidisciplinary management, and risk stratification in comorbid patients are essential to reduce complications and improve outcomes.

Keywords: Rhinosinusitis, Orbital complications, Diabetes mellitus, Systemic comorbidities, Orbital cellulitis, Visual prognosis

INTRODUCTION

Rhinosinusitis is a common inflammatory condition involving the mucosal lining of the nasal cavity and paranasal sinuses. It can be classified as acute or chronic depending on symptom duration, and its incidence spans all age groups globally. While most cases are uncomplicated and respond well to medical therapy, a subset of patients particularly those with compromised immune systems may develop serious complications[1]. Among these, orbital complications represent a critical spectrum of diseases that can lead to irreversible vision loss, intracranial involvement, and even mortality if not promptly identified and treated. These complications occur due to the close anatomical proximity between the paranasal sinuses particularly the ethmoid and maxillary sinuses and the orbit, which allows for direct spread of infection through thin bony walls or valveless venous systems[2].

Orbital complications of rhinosinusitis encompass a continuum of disease severity, starting from preseptal cellulitis and extending to potentially life-threatening conditions such as orbital abscesses and cavernous sinus thrombosis[3]. The Chandler classification is commonly used to grade the severity of orbital complications and guide treatment strategies. Early stages may present with periorbital swelling, erythema, and pain, while advanced stages may involve proptosis, ophthalmoplegia, visual disturbances, and systemic signs of sepsis. Delay in diagnosis and treatment in advanced cases can result in irreversible optic nerve damage or intracranial extension such as meningitis or brain abscess[4].

The presence of systemic comorbidities such as diabetes mellitus, hypertension, chronic kidney disease, cardiovascular disorders, or immunosuppression plays a pivotal role in predisposing patients to complicated rhinosinusitis[5]. These underlying conditions can impair local immune defenses, reduce vascular supply to tissues, and delay wound healing thus facilitating the rapid spread of infection and worsening of local inflammation. Diabetes mellitus, in particular, has been consistently associated with severe orbital infections due to its impact on neutrophil chemotaxis and phagocytosis, as well as the creation of a hyperglycemic environment conducive to microbial growth. Immunosuppressive conditions, whether due to disease (e.g., HIV/AIDS, malignancies) or medication (e.g., corticosteroids, chemotherapy), further compromise host defense mechanisms[6].

Despite the known association between systemic illnesses and complicated rhinosinusitis, there remains a scarcity of localized research exploring this relationship in the context of orbital complications, particularly within the Pakistani population[7]. Understanding the influence of comorbidities on the prevalence, clinical spectrum, and outcomes of orbital complications is vital to improving risk stratification, diagnostic vigilance, and therapeutic interventions. In resource-limited settings where access to advanced imaging or tertiary care is often delayed, the early identification of high-risk patients can significantly alter prognostic trajectories[8].

This study, therefore, aims to bridge this gap by investigating the prevalence of orbital complications in rhinosinusitis patients with systemic comorbidities, delineating the spectrum of clinical presentations, and evaluating the prognostic implications of these comorbid conditions on patient outcomes. By focusing on a hospital-based population from two major tertiary centers in Pakistan, the findings of this research may provide critical insights into the local disease burden and inform future clinical guidelines and referral protocols[9].

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MATERIALS AND METHODS

Study Design and Duration: This hospital-based, cross-sectional study was conducted over a period of thirteen months, from February 2022 to March 2023. The study was carried out at two major healthcare facilities in Punjab, Pakistan: the ENT and Ophthalmology Departments of Tehsil Headquarter (THQ) Hospital, Depalpur, and Syed Eye Care, Syed Medical Centre, Bahawalpur. These centers were selected due to their high patient volume and availability of specialized diagnostic and treatment facilities for rhinosinusitis and its complications.

Study Population and Sample Size: A total of 80 patients were enrolled using non-probability consecutive sampling. All patients presented with symptoms of rhinosinusitis and were diagnosed with orbital complications based on clinical and radiological findings. The study population included both male and female patients aged 12 years and above. This sample size was determined based on the prevalence of orbital complications in previous regional studies and the annual patient turnover at the selected institutions.

Inclusion and Exclusion Criteria: Patients were eligible for inclusion if they were 12 years of age or older, of either gender, and had a confirmed diagnosis of either acute or chronic rhinosinusitis with associated orbital complications such as preseptal cellulitis, orbital cellulitis, subperiosteal abscess, orbital abscess, or cavernous sinus thrombosis. Orbital involvement was confirmed through clinical examination and contrast-enhanced radiological imaging. Patients with trauma-induced orbital injuries, orbital tumors, congenital orbital anomalies, or isolated ocular infections unrelated to rhinosinusitis were excluded from the study. Furthermore, patients with incomplete clinical records or those who did not consent to participate were also excluded.

Clinical Evaluation and Data Collection: Upon presentation, a thorough clinical assessment was carried out for each patient by ENT and ophthalmology specialists. The diagnosis of rhinosinusitis was made based on clinical criteria including facial pain, nasal discharge, nasal congestion, anosmia, and fever. Orbital complications were evaluated through ophthalmologic signs such as lid edema, conjunctival chemosis, proptosis, restricted extraocular movements, visual disturbances, and presence of relative afferent pupillary defect (RAPD). A detailed medical history was obtained focusing on systemic illnesses such as diabetes mellitus, hypertension, chronic kidney disease, and any condition causing immunosuppression. Physical examination included anterior rhinoscopy and nasal endoscopy where required.

Radiological and Laboratory Investigations: All patients underwent contrast-enhanced computed tomography (CECT) of the paranasal sinuses and orbit to confirm the diagnosis and identify the extent of disease involvement. In cases where intracranial extension or vascular involvement was suspected, magnetic resonance imaging (MRI) with contrast was also performed. Laboratory investigations included complete blood count (CBC), fasting blood sugar (FBS), renal function tests (RFTs), erythrocyte sedimentation rate (ESR), and C-reactive protein (CRP). These parameters helped evaluate systemic inflammation and comorbidity profiles.

Assessment of Comorbidities and Prognostic Outcomes: The presence of systemic comorbidities was specifically documented and stratified by type and severity. Special attention was given to patients with poorly controlled diabetes, long-standing hypertension, or coexisting immunosuppressive conditions such as chronic renal disease or autoimmune disorders. Prognostic evaluation was based on duration of hospital stay, need for surgical intervention, visual recovery or loss, recurrence of symptoms, and overall clinical outcome at discharge.

Ethical Considerations: thical approval for the study was obtained from the institutional review boards of both participating centers. Written informed consent was secured from all patients or their legal guardians in the case of minors. Patient confidentiality and data protection were maintained throughout the study in accordance with the Helsinki Declaration.

Data Analysis: The collected data were entered and analyzed using IBM SPSS Statistics version 26. Descriptive statistics were used to summarize the baseline characteristics, comorbidity status, and types of orbital complications. Continuous variables such as age and hospital stay were expressed as means with standard deviations, while categorical variables such as gender, type of complication, and presence of comorbidities were presented as frequencies and percentages. Comparative analysis between patients with and without comorbidities was conducted using Chi-square and Fisher's exact tests for categorical data, and independent sample t-tests for continuous variables. A p-value of less than 0.05 was considered statistically significant for all analyses.

RESULTS

Demographic and Baseline Characteristics: A total of 80 patients were enrolled in the study, with a male predominance (n=47; 58.8%) and 33 females (41.2%). The mean age of the study population was 41.7 ± 14.5 years, with an age range of 12 to 72 years. The majority of patients (n=49; 61.3%) presented with acute rhinosinusitis, while the remaining 31 patients (38.7%) were diagnosed with chronic rhinosinusitis. Out of the total sample, 56 patients (70%) had at least one systemic comorbidity, and 24 patients (30%) had no comorbid illness as shown in table 1.

Table 1: Demographic and Clinical Characteristics of Study Population

Parameter	Total (n=80)
Age (mean ± SD)	41.7 ± 14.5 yrs
Male	47 (58.8%)
Female	33 (41.2%)
Acute Rhinosinusitis	49 (61.3%)
Chronic Rhinosinusitis	31 (38.7%)
Systemic Comorbidities	56 (70%)
Without Comorbidities	24 (30%)

The majority of the orbital complications were seen in patients with systemic comorbidities, most commonly diabetes mellitus (n=35; 43.8%), followed by hypertension (n=26; 32.5%), and chronic kidney disease (n=9; 11.3%). Among these patients, 18 (22.5%) had more than one comorbidity.

Distribution of Orbital Complications: Orbital complications varied among patients. The most frequent complication was orbital cellulitis, seen in 32 patients (40%), followed by subperiosteal abscess in 18 patients (22.5%), preseptal cellulitis in 14 patients (17.5%), orbital abscess in 11 patients (13.8%), and cavernous sinus thrombosis in 5 patients (6.3%) as shown in table 2.

Table 2: Types of Orbital Complications Identified

Type of Orbital Complication	Number of Patients (n=80)	Percentage (%)
Orbital Cellulitis	32	40.0%
Subperiosteal Abscess	18	22.5%
Preseptal Cellulitis	14	17.5%
Orbital Abscess	11	13.8%
Cavernous Sinus Thrombosis	5	6.3%

Table 3: Comparison of Clinical Features Based on Comorbidity Status

Clinical Feature	Comorbid (n=56)	Non-Comorbid (n=24)	p-value
Proptosis	34 (60.7%)	5 (20.8%)	0.003
Ophthalmoplegia	28 (50.0%)	4 (16.7%)	0.006
Visual Impairment	23 (41.1%)	3 (12.5%)	0.001
Painful Eye Movements	31 (55.3%)	8 (33.3%)	0.047

Clinical Presentation and Severity Among Comorbid vs. Non-Comorbid Patients: Among the 56 patients with comorbidities, proptosis was seen in 34 (60.7%), ophthalmoplegia in 28 (50%), and visual impairment in 23 (41.1%). In contrast, among the 24 patients without comorbidities, only 5 (20.8%) had proptosis, 4 (16.7%) had ophthalmoplegia, and 3 (12.5%) had visual

impairment. These differences were statistically significant, particularly for visual loss (p=0.001) and proptosis (p=0.003) as shown in table 3.

Hospital Stay and Surgical Intervention: Patients with systemic comorbidities had a longer hospital stay (mean = 8.9 ± 2.6 days) compared to those without comorbidities (5.3 ± 1.9 days, p<0.001). Moreover, surgical intervention, such as incision and drainage or endoscopic sinus surgery, was required in 36 patients (45%), with a higher frequency observed in the comorbid group (n=29; 51.8%) than in the non-comorbid group (n=7; 29.1%, p=0.028) as shown in table 4.

Table 4: Prognostic Outcomes by Comorbidity Status

Outcome Variable	Comorbid (n=56)	Non-Comorbid (n=24)	p-value
Mean Hospital Stay (days)	8.9 ± 2.6	5.3 ± 1.9	<0.001
Surgical Intervention	29 (51.8%)	7 (29.1%)	0.028
Complete Visual Recovery	33 (58.9%)	20 (83.3%)	0.021
Permanent Vision Loss	5 (8.9%)	0 (0%)	0.041

Visual Prognosis: Visual outcomes were significantly poorer in patients with diabetes mellitus. Of the 5 patients who developed permanent vision loss, 4 were diabetics, and 1 had both diabetes and chronic kidney disease. These patients had more advanced disease at presentation and delayed initiation of therapy. Visual recovery was excellent among non-comorbid patients, with 83.3% showing full restoration of vision and ocular movements within 7–10 days of treatment initiation.

The findings of this study demonstrate a clear and statistically significant relationship between systemic comorbidities especially diabetes mellitus and the severity and outcomes of orbital complications in rhinosinusitis. Patients with comorbid illnesses presented more frequently with severe complications such as orbital abscess and cavernous sinus thrombosis and had higher rates of surgical intervention, prolonged hospitalization, and poorer visual recovery. These data highlight the importance of early screening and aggressive management of rhinosinusitis in high-risk individuals with chronic systemic diseases.

DISCUSSION

This study presents a comprehensive evaluation of orbital complications arising in patients with rhinosinusitis and underscores the significant role of systemic comorbidities particularly diabetes mellitus and hypertension in influencing disease severity and clinical outcomes[10]. Our findings highlight that 70% of the study population had at least one systemic comorbidity, with diabetes mellitus being the most prevalent (43.8%), consistent with international literature which associates impaired immune function in diabetics with an increased risk of invasive infections, including orbital cellulitis and abscess formation[11].

Orbital cellulitis was the most commonly observed complication in our cohort (40%), aligning with previous studies that identify it as the most frequent orbital manifestation of sinusitis. However, in our study, subperiosteal abscess (22.5%) and orbital abscess (13.8%) were also prevalent, especially among patients with comorbidities. This reflects a more aggressive disease pattern likely due to compromised host immunity and delayed inflammatory clearance in patients with underlying systemic illness[12].

The study's statistical analysis revealed that patients with comorbidities exhibited significantly more severe clinical features proptosis (60.7%), ophthalmoplegia (50%), and visual impairment (41.1%) as compared to their healthier counterparts[13]. These clinical markers not only indicate orbital involvement but also correlate with poor visual outcomes. This is further supported by our finding that permanent vision loss occurred exclusively in patients with comorbid conditions, primarily diabetics. These observations are consistent with prior studies reporting that diabetes leads to poor granulocyte function, delayed neutrophilic chemotaxis, and increased susceptibility to bacterial and fungal invasion, thus escalating orbital inflammation and compromising optic nerve function[14].

Additionally, our study highlights a significant increase in the mean hospital stay (8.9 days vs. 5.3 days) and rate of surgical intervention (51.8% vs. 29.1%) among comorbid patients. This is indicative of the more advanced disease progression, often requiring invasive procedures such as abscess drainage or functional endoscopic sinus surgery. The elevated need for surgery may also stem from the relatively poor response of infected tissues to antibiotics in diabetic and immunocompromised states, necessitating mechanical relief of the infectious focus[15].

It is also worth noting that cavernous sinus thrombosis (CST), though rare (6.3%), was almost exclusively observed in patients with multiple comorbidities, reinforcing the importance of early imaging in high-risk individuals presenting with orbital signs and neurological symptoms. Prompt recognition and management of CST is crucial due to its high mortality and morbidity risk[16].

The strengths of this study lie in its multicenter design, use of standardized imaging modalities, and focus on a clinical subgroup often overlooked in previous literature[17]. However, the study also has limitations. Firstly, it did not include long-term follow-up to assess delayed complications or recurrence. Secondly, microbiological correlation of the sinus or orbital infections was not performed, which could have added valuable insight into pathogen-specific risks in comorbid populations. Lastly, the sample size, although adequate for analysis, could be expanded in future multicenter trials to enhance the generalizability of findings[18].

Overall, this study underscores the critical need for early identification, multidisciplinary management, and aggressive therapeutic intervention in rhinosinusitis patients with systemic comorbidities to prevent orbital and intracranial complications[19].

CONCLUSION

The present study confirms that systemic comorbidities, especially diabetes mellitus and hypertension, significantly contribute to the severity, progression, and poor outcomes of orbital complications in rhinosinusitis. These patients not only exhibit more severe clinical features such as proptosis, ophthalmoplegia, and visual loss, but also require longer hospital stays and are more likely to undergo surgical intervention. The presence of comorbidities is strongly associated with adverse visual prognosis, including permanent vision loss. Given these findings, it is imperative that clinicians maintain a high index of suspicion and employ prompt radiological evaluation in rhinosinusitis patients with underlying systemic illnesses. Multidisciplinary collaboration between ENT, ophthalmology, and internal medicine is essential to achieve early diagnosis, effective management, and improved clinical outcomes.

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Conflict of Interest: The authors declare no competing interests with respect to the authorship and publication of this article.

Data Availability: The datasets generated and analyzed during this study are available from the corresponding author upon reasonable request.

Authors' Contributions: AG and HSUR conceptualized the study and supervised the ophthalmic evaluations. AUH and ABM were responsible for ENT assessments and data documentation. MTS contributed to clinical interpretation and manuscript drafting. AK assisted with internal medicine assessments and comorbidity analysis. All authors reviewed, revised, and approved the final manuscript.

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