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ORIGINAL ARTICLE

Evaluation of Nasolacrimal Duct Obstruction in Chronic Rhinosinusitis Patients: A Clinical Study

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ABSTRACT

Background: Chronic rhinosinusitis (CRS) is a persistent inflammatory disorder of the nasal and paranasal sinuses that may extend toward adjacent anatomical structures, including the nasolacrimal drainage system. Secondary nasolacrimal duct obstruction (NLDO) is increasingly recognized as a potential complication of CRS, yet regional data remain limited.

Objective: To evaluate the frequency, patterns, and clinical associations of nasolacrimal duct obstruction among patients with chronic rhinosinusitis presenting to tertiary eye care hospitals in Pakistan.

Methods: This cross-sectional study was conducted at Al-Shifa Trust Eye Hospital, Rawalpindi, and Mughal Eye Hospital, Lahore, from January 2022 to May 2023. A total of 100 CRS patients aged 18–70 years were assessed through detailed ophthalmic examination, nasal endoscopy, fluorescein dye disappearance test, lacrimal syringing, and CT-PNS imaging. NLDO was categorized as partial or complete. Statistical analysis was performed using SPSS 26, with $p < 0.05$ considered significant.

Results: NLDO was identified in 29% of CRS patients, of whom 48.3% had partial obstruction and 51.7% had complete obstruction. Patients with nasal polyps demonstrated a significantly higher prevalence of NLDO (43.7%) than those without polyps (22.1%; $p = 0.01$). Longer disease duration was also associated with increased obstruction, with 42.1% of patients symptomatic for >24 weeks affected. Radiological findings, including deviated nasal septum and concha bullosa, were more frequently observed in NLDO patients.

Conclusion: Nasolacrimal duct obstruction is a common yet under-recognized complication in chronic rhinosinusitis. Its strong association with nasal polyposis, prolonged disease duration, and anatomical variations highlights the necessity for routine lacrimal assessment in CRS patients to ensure timely diagnosis and multidisciplinary management.

Keywords: Chronic rhinosinusitis, Nasolacrimal duct obstruction, Epiphora, Nasal polyps, Dacryocystitis.

INTRODUCTION

Chronic rhinosinusitis (CRS) is a persistent inflammatory disorder of the paranasal sinus mucosa lasting more than 12 weeks and is recognized globally as a significant cause of morbidity. It affects approximately 10–15% of the adult population and is associated with nasal obstruction, mucopurulent discharge, facial pressure, and impaired olfaction[1]. Because of its chronicity, CRS often leads to ongoing mucosal edema, epithelial remodeling, and structural changes within the nasal and paranasal regions. The close anatomical relationship between the sinonasal compartments and the nasolacrimal drainage system means that persistent inflammation within the sinuses can extend to adjacent structures, including the nasolacrimal duct[2].

The nasolacrimal duct serves as the primary channel for tear drainage into the inferior meatus of the nasal cavity. Obstruction at any point along this pathway results in impaired tear flow, epiphora, recurrent conjunctivitis, or dacryocystitis[3]. While primary nasolacrimal duct obstruction (NLDO) is usually idiopathic, secondary NLDO may arise from chronic inflammatory conditions such as CRS, trauma, facial infections, structural deformities, or postoperative scarring. Persistent sinonasal inflammation can contribute to mucosal thickening, narrowing of the osteomeatal complex, and mechanical compression of the nasolacrimal duct, making CRS an important etiological factor for acquired NLDO[4].

Despite the anatomical and physiological overlap between these two conditions, NLDO remains an under-recognized complication in CRS patients, particularly in South Asian populations where data are limited[5]. Understanding this association is crucial, as undiagnosed obstruction may lead to chronic ocular discomfort, recurrent infections, and reduced quality of life. Moreover, early identification of NLDO in CRS patients can guide timely ophthalmologic or otolaryngologic intervention, preventing progression to complications such as acute or chronic dacryocystitis[6].

Therefore, this study aims to evaluate the frequency, patterns, and associated clinical features of nasolacrimal duct obstruction among patients presenting with chronic rhinosinusitis at tertiary care hospitals. By characterizing the extent of NLDO in this population, the study seeks to highlight the importance of routine lacrimal system assessment in CRS management and contribute to improved multidisciplinary care[7].

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MATERIALS AND METHODS

Study Design and Setting: This cross-sectional clinical study was carried out at two major ophthalmology centers in Pakistan: Al-Shifa Trust Eye Hospital, Rawalpindi, and Mughal Eye Hospital, Lahore. The study was conducted over a period of sixteen months from January 2022 to May 2023, during which patients presenting with symptoms of chronic rhinosinusitis (CRS) were evaluated for nasolacrimal duct obstruction (NLDO). Both hospitals serve as high-volume tertiary care facilities, ensuring a diverse patient population and standardized ophthalmic and ENT evaluation protocols.

Sample Size and Sampling Technique: A total of 100 patients were recruited using consecutive non-probability sampling. All eligible patients who presented during the study period and fulfilled the diagnostic criteria for CRS were included until the desired sample size was reached. This approach ensured comprehensive coverage of CRS cases presenting to both institutions during the study duration.

Eligibility Criteria: Patients aged between 18 and 70 years who had clinically and radiologically confirmed chronic rhinosinusitis, based on the European Position Paper on Rhinosinusitis and Nasal Polyps (EPOS) guidelines, were considered eligible. CRS was defined as the persistence of sinonasal symptoms lasting more than 12 weeks along with endoscopic or imaging evidence of mucosal disease. Patients with a history of previous lacrimal surgery, sinonasal surgery, facial trauma, congenital anomalies of the nasolacrimal duct, systemic granulomatous disorders, or acute

ocular infections unrelated to CRS were excluded to avoid confounding factors that could independently cause NLDO.

Clinical and Ophthalmic Assessment: Each participant underwent a detailed clinical evaluation that included recording demographic information, symptom duration, history of nasal allergies, presence of nasal polyps, and complaints of excessive tearing. A comprehensive ophthalmic examination was performed for all patients, including visual acuity testing, slit-lamp biomicroscopy, evaluation of the puncta and canaliculi, and inspection of the lacrimal sac area. Particular attention was paid to signs of lacrimal sac tenderness, swelling, or discharge, which could indicate secondary infections associated with nasolacrimal obstruction.

ENT Examination and Endoscopic Assessment: All patients were assessed by an otolaryngologist to confirm CRS and to evaluate structural or inflammatory changes within the nasal cavity. Anterior rhinoscopy was followed by rigid nasal endoscopy to directly visualize the nasal mucosa, middle meatus, osteomeatal complex, and any polypoidal or hypertrophic changes. Endoscopic findings were documented systematically and correlated with lacrimal drainage status to explore potential anatomical or inflammatory causes of obstruction.

Evaluation of Nasolacrimal Duct Patency: Nasolacrimal duct function was assessed using standard clinical tests. The fluorescein dye disappearance test (FDDT) was performed initially to assess tear clearance time. This was followed by lacrimal syringing to determine the degree of patency. Patients demonstrating delayed dye clearance or partial resistance to saline flow were categorized as having partial obstruction, whereas those showing complete reflux of saline with no dye passage into the nasal cavity were classified as having complete obstruction. The sac compression test was used to assess for mucopurulent discharge, further supporting the diagnosis of obstruction when present.

Radiological Evaluation: All patients underwent a CT scan of the paranasal sinuses (CT-PNS) to confirm the diagnosis of chronic rhinosinusitis and to identify mucosal thickening, sinus opacification, septal deviation, concha bullosa, or other anatomical variations that could contribute to nasolacrimal duct narrowing or obstruction. Radiological findings were interpreted by experienced radiologists at both centers, and results were correlated with clinical lacrimal patency outcomes.

Statistical Analysis: Data from both centers were compiled and analyzed using SPSS version 26. Continuous variables, such as age and duration of symptoms, were summarized as mean ± standard deviation. Categorical variables, including gender, presence of nasal polyps, and types of nasolacrimal duct obstruction, were presented as frequencies and percentages. Associations between CRS characteristics and nasolacrimal obstruction were evaluated using the chi-square test. A p-value of less than 0.05 was considered statistically significant, and all analyses were conducted with a confidence level of 95%.

RESULTS

A total of 100 patients diagnosed with chronic rhinosinusitis (CRS) were included in the study. The mean age of the participants was 42.6 ± 13.1 years, ranging from 18 to 70 years. Of the total sample, 54 (54%) were females and 46 (46%) were males, reflecting a slightly higher female predominance. The majority of patients, 62 (62%), reported symptom duration exceeding 12 weeks, while 38 (38%) had chronic symptoms extending beyond 24 weeks, indicating a substantial burden of long-standing disease in the studied population. Baseline clinical characteristics are summarized in Table 1. A significant proportion of patients also reported associated allergic symptoms such as sneezing, pruritus, and rhinorrhea, while nasal obstruction remained the most commonly reported complaint across the sample.

When evaluated for nasolacrimal duct obstruction (NLDO), 29 patients (29%) were found to have some degree of obstruction. Among these, 14 (48.3%) had partial obstruction, while 15 (51.7%) demonstrated complete obstruction, indicating that complete obstruction was slightly more common. These findings are detailed in Table 2. Most patients with NLDO presented with persistent epiphora, while a smaller subset reported intermittent mucopurulent discharge on sac compression, suggestive of secondary infection. Notably, lacrimal syringing demonstrated firm resistance in patients with complete obstruction, while those with partial obstruction displayed delayed flow or partial reflux.

Table 1: Baseline Characteristics of CRS Patients (N = 100)

Variable	n (%)
Age (Mean ± SD)	42.6 ± 13.1 years
Gender (Male/Female)	46 (46%) / 54 (54%)
Duration of CRS 12–24 weeks	62 (62%)
Duration of CRS >24 weeks	38 (38%)
Presence of nasal polyps	32 (32%)
History of allergic rhinitis	28 (28%)
Complaint of epiphora	30 (30%)

Table 2: Distribution of Nasolacrimal Duct Obstruction (N = 29)

Type of NLDO	n (%)
Partial obstruction	14 (48.3%)
Complete obstruction	15 (51.7%)

A further analysis of clinical subgroups demonstrated that NLDO was significantly more common among CRS patients who also had nasal polyps, with 14 out of 32 patients (43.7%) showing obstruction, compared to 15 out of 68 patients (22.1%) without polyps. This association was statistically significant ($p = 0.01$), highlighting the contribution of polypoidal mucosal disease to lacrimal pathway compromise. This comparison is summarized in Table 3. Similarly, patients with longer disease duration (>24 weeks) exhibited a markedly higher prevalence of NLDO (16 out of 38 patients; 42.1%) compared to those with shorter but chronic symptoms (13 out of 62 patients; 20.9%), indicating that cumulative mucosal inflammation may worsen lacrimal duct patency.

Table 3: Association of NLDO with CRS Characteristics

CRS Feature	Total Patients	NLDO Present n (%)	p-value
With nasal polyps	32	14 (43.7%)	0.01
Without nasal polyps	68	15 (22.1%)	
CRS >24 weeks	38	16 (42.1%)	0.03
CRS 12–24 weeks	62	13 (20.9%)	

Radiological evaluation using CT-PNS further revealed that patients with osteomeatal complex obstruction, ethmoidal mucosal thickening, or maxillary sinus opacification had a higher tendency toward NLDO, although the association did not reach statistical significance when analyzed collectively. However, patients who demonstrated structural anomalies such as deviated nasal septum (DNS) or concha bullosa were found to have proportionally higher rates of NLDO, suggesting that anatomical variations may influence nasolacrimal drainage dynamics. These imaging findings are summarized in Table 4.

Table 4: CT-PNS Findings in Relation to NLDO

CT-PNS Finding	Total (N = 100)	NLDO Present n (%)
Maxillary sinus opacification	44	12 (27.3%)
Ethmoidal sinus disease	36	10 (27.7%)
OMC obstruction	28	9 (32.1%)
Deviated nasal septum	40	14 (35.0%)
Concha bullosa	22	7 (31.8%)

Overall, the results demonstrate that NLDO is a relatively frequent comorbidity in patients suffering from chronic rhinosinusitis, with nearly one-third of the population exhibiting either partial or complete obstruction. The strong association with nasal polyposis and prolonged disease duration underscores the role of persistent sinonasal inflammation in the development of lacrimal pathway obstruction. The consistent trends observed

across clinical examination, lacrimal testing, and radiological findings indicate that CRS exerts a substantial impact on the nasolacrimal drainage system, warranting routine lacrimal evaluation in these patients. The integration of both ophthalmic and ENT assessments provided a comprehensive understanding of NLDO patterns, allowing this study to highlight clinical predictors of obstruction and establish correlations essential for guiding multidisciplinary management strategies.

DISCUSSION

The present study evaluated the prevalence and clinical significance of nasolacrimal duct obstruction (NLDO) in patients suffering from chronic rhinosinusitis (CRS) across two major tertiary eye care centers in Pakistan. The findings demonstrate that NLDO is a relatively common comorbidity in CRS, affecting nearly one-third of the studied population[8]. This aligns closely with the anatomical and physiological continuity between the paranasal sinus system and the lacrimal drainage apparatus. The nasolacrimal duct opens into the inferior meatus of the nasal cavity, and chronic inflammation within the sinonasal mucosa may extend toward the duct, causing mucosal edema, narrowing, and eventual obstruction. In this study, 29% of CRS patients showed either partial or complete obstruction, which is consistent with previously reported studies suggesting that CRS may predispose to secondary NLDO due to chronic inflammatory burden, mucostasis, or anatomical compression[9,10].

A notable finding in the current research was the significant association between nasal polyposis and NLDO. Patients with nasal polyps had almost double the prevalence of NLDO compared to those without polyps[11]. Nasal polyps are known to represent advanced mucosal inflammation and remodeling, often accompanied by edema, obstruction of sinus outflow tracts, and thickened secretions. Such pathological changes may also extend toward the lacrimal pathway, increasing the likelihood of impaired tear drainage. The results of this study support the concept that CRS with nasal polyps represents a more severe inflammatory phenotype, thus contributing to higher rates of lacrimal duct obstruction. This finding emphasizes the importance of routine lacrimal evaluation in patients with polypoidal disease, especially in those presenting with persistent epiphora or recurrent ocular irritation[12].

The duration of CRS symptoms also demonstrated a significant relationship with NLDO. Patients experiencing symptoms beyond 24 weeks showed a substantially higher risk of obstruction compared to those with shorter disease duration[13]. Chronicity may lead to progressive mucosal hypertrophy, fibrosis, and structural remodeling within the nasal cavity and adjacent drainage pathways. This prolonged inflammatory state may compromise nasolacrimal duct patency more severely over time. These findings underscore the importance of early diagnosis and timely management of CRS to prevent secondary complications, including lacrimal drainage impairment[14].

Radiological findings provided additional insight into the underlying mechanisms contributing to NLDO. CT-PNS imaging revealed that anatomical variations such as deviated nasal septum and concha bullosa were more prevalent among patients with NLDO[15]. These variations may contribute to altered airflow dynamics, impaired mucociliary clearance, and secondary mucosal thickening, all of which can affect the adjacent nasolacrimal duct. Although maxillary and ethmoidal sinus opacification also showed higher rates of NLDO, the association was not statistically significant, possibly due to sample size limits. Nevertheless, the overall trend supports the understanding that CRS-related mucosal disease, whether structural or inflammatory, can exert direct or indirect pressure on the nasolacrimal drainage system[16].

The clinical relevance of these findings cannot be overstated. NLDO can significantly impact quality of life due to chronic tearing, recurrent conjunctivitis, and dacryocystitis, leading many patients to seek ophthalmic care[17]. When CRS is the underlying cause, treating ophthalmic symptoms alone may yield temporary relief without addressing the primary pathology. The integration of ENT evaluation into the management of patients presenting with epiphora is therefore crucial, especially in populations with high CRS prevalence. Additionally, the presence of NLDO may influence surgical planning, as concurrent endoscopic sinus surgery and dacryocystorhinostomy (DCR) may be beneficial in selected patients. The multidisciplinary nature of this pathology highlights the importance of collaboration between ophthalmologists and otolaryngologists for optimal patient outcomes[18,19].

Overall, this study contributes valuable local data to the limited regional literature on NLDO in CRS patients[20]. The findings highlight key clinical predictors including nasal polyposis, prolonged disease duration, and anatomical variations that may indicate a higher likelihood of obstruction. Future research with larger sample sizes and longitudinal follow-up may help determine whether effective CRS treatment, either medical or surgical, can reverse NLDO or prevent its progression. Furthermore, evaluating inflammatory markers, mucosal biopsies, and tear cytokine profiles may help delineate the shared inflammatory pathways contributing to both CRS and NLDO[21-25].

CONCLUSION

This study demonstrates that nasolacrimal duct obstruction is a significant and under-recognized clinical complication among patients with chronic rhinosinusitis. Nearly one-third of CRS patients exhibited partial or complete obstruction, with higher prevalence observed in those with nasal polyposis, prolonged disease duration, and specific anatomical variations. These findings reinforce the concept that persistent sinonasal inflammation can extend beyond the paranasal sinuses to involve the nasolacrimal drainage system, resulting in clinically significant tear flow impairment.

Routine assessment of the lacrimal apparatus should therefore be incorporated into the evaluation of CRS patients, particularly those presenting with epiphora or recurrent ocular infections. Early diagnosis and multidisciplinary management can prevent the progression of obstruction and improve overall patient outcomes. The study underscores the need for heightened clinical awareness and cooperation between ENT and ophthalmology specialists to ensure comprehensive care for patients affected by both CRS and NLDO.

Availability of Data and Materials: Data supporting the findings of this study are available from the corresponding author upon reasonable request.

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Authors' Contributions:

A.N.S contributed to study conception, data acquisition, and manuscript drafting.

D.A.K performed ophthalmic assessments and contributed to data interpretation.

R.M.S supervised clinical processes and assisted in statistical analysis.

A.Q. performed ENT evaluation, radiological correlation, and literature review.

M.S.A contributed to data analysis and manuscript refinement.

M.S.S reviewed, edited, and finalized the manuscript.

All authors approved the final version and agree to be responsible for its content.

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