ORIGINAL ARTICLE

CHRONIC INFLAMMATORY SCORE IN PATIENTS WITH DACRYOCYSTORHINOSTOMY AND CORRELATION WITH SURGICAL OUTCOME

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Background: Dacryocystorhinostomy (DCR) is an ophthalmic surgical procedure for relieving obstruction from chronically inflamed nasolacrimal duct (chronic dacryocystitis). This study was performed to observe the surgical outcome of DCR in patients with chronic dacryocystitis; to grade the inflammation in lacrimal sac biopsies, using the chronic inflammatory score (CIS); and to correlate the CIS with the surgical outcome. **Methods:** Twenty-five patients with chronic dacryocystitis underwent DCR with lacrimal sac biopsies. The biopsies were examined microscopically, and a CIS score was assigned and graded into mild, moderate and severe. The patients were followed up. The success of DCR was evaluated at 6 months post-surgery, by syringing of the lacrimal tract. **Results:** The mean age of the patients was 37.76 years±12.32 SD. The mean duration of watering of the eye was 2.9 years±3.18 years. The right eye was involved in 60% and 80% of the patients were females. Severe inflammation was reported in 72%, moderate angiogenesis in 76% and moderate fibrosis in 72%, squamous metaplasia in 40%, and a reduced number of goblet cells in 72% of the biopsies. CIS was severe in 72% of the patients. At 6 months follow-up, 96% of the patients had a successful DCR. **Conclusion:** Although the chronic inflammatory score was severe, the DCR was successful in most of the patients, suggesting that the success of the surgical procedure is not related to the degree of inflammation. Large-scale studies are recommended for confirmation of our findings.

Keywords: Dacryocystitis; Dacryocystorhinostomy; Lacrimal sac; Histopathology; Chronic inflammatory score

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INTRODUCTION

Chronic dacryocystitis is chronic inflammation of the lacrimal sac with tenderness and erythema of the surrounding structures, due to an obstruction of the nasolacrimal duct.[1] Epiphora, which is the overflow of tears onto the face, and pyorrhoea, which is the discharge of pus from the lacrimal duct, are the most common presenting symptoms of chronic dacryocystitis.[2] Painless swelling at the inner canthus is often a presenting complaint of dacryocystitis.[3] Dacryocystitis is the most common pathology of the lacrimal drainage system representing 79–87% of all the lesions, and is attributable to 3% of the total ophthalmological clinic visits.[4,5]

Repeated infections of the lacrimal duct cause loss of epithelial cells, connective tissue fibrosis in the lamina propria, and destruction of specialized blood vessels causing dysfunction of the tear outflow mechanism, eventually leading to complete fibrous closure of the lumen of the duct.[6]

The standard surgical procedure for chronic dacryocystitis is Dacryocystorhinostomy (DCR), performed to create new tear drainage between the eye and the nose. In external DCR, an incision is made in the skin near the inner canthus to gain access to the lacrimal sac.[7] A small piece of bone is removed, adjacent to the nasolacrimal sac, and the anterior and posterior flaps of the lacrimal sac are sutured with the nasal mucosal flaps, incorporating the lacrimal sac with the lateral nasal mucosa. A silicone tube may be passed in the newly created pathway to keep it patent, allowing the tears to drain directly into the nasal cavity.[7] In endoscopic DCR, an endoscope is used to gain access into the lacrimal sac through the nasal passage.[7]

The success rate of DCR, as reported by international and national studies, is between 70% and 98%.[8,9] A study has reported failure of the DCR procedure in up to 12% of cases.[10] Correlating with the histopathology, it has been reported that the degree of fibrosis and squamous metaplasia

affect the outcome of Dacryocystorhinostomy (DCR).[11] A study concluded that chronic inflammation and excessive fibrosis of the lacrimal sac, may also contribute to post-operative complications of primary acquired nasolacrimal duct obstruction (PANDO) and ostium obstruction.[12]

Although DCR is a routine ophthalmic surgery, the biopsy of the lacrimal sac is generally performed only in those cases which are suspicious for malignancy. According to latest studies, clinical presentation, examination, imaging technique and intraoperative findings cannot reliably identify malignancy, and lacrimal sac biopsy should be advised in all cases of DCR, and should be mandatory in cases of recurrent lacrimal obstruction.[13,14] According to our knowledge, histopathological findings in the lacrimal sac biopsies have not been reported in our population, till date. The objectives of the study were to observe the clinical outcome of external DCR with intubation in patients with chronic dacryocystitis, to grade the inflammation and associated changes using the chronic inflammatory score (CIS) in the lacrimal biopsies, and to correlate the CIS with the outcome of DCR.

MATERIAL AND METHODS

This study was approved by the ethics committee. This was a prospective, descriptive and cross sectional study, conducted in the Department of Ophthalmology, Abbasi Shaeed Hospital and the Department of Histopathology, Dow University of Health Sciences from January to December 2021. The study adheres to the tenants of declaration of Helsinki. A consecutive sampling technique was employed. Patients undergoing external DCR with intubation due to chronic dacryocystitis, primary nasolacrimal duct obstruction, dacryocystocele, above 15 years of age, were included in the study. Patients were followed up for a minimum period of 6 months after the surgery. Patients who had nasal pathologies like nasal polyps**,** untreated sinusitis, deviated nasal septum, canaliculitis, canalicular obstruction, failed dacryocystorhinostomy, those above 60 years of age, and those who were lost to follow up were excluded from the study.

Patients presenting in the Eye, Outpatient Department (OPD), with epiphora were evaluated. Their detailed history was taken regarding duration of watering, discharge, swelling and recurrent episodes of acute dacryocystitis. Lid was inspected for any abnormality like entropion, ectropion, trichiasis, and blephritis. Puncta were examined for their position, agenesis, stenosis, block and canaliculitis. Conjunctiva was examined for chronic conjunctivitis and cornea for any abrasions and dryness. Lacrimal sac was inspected, and palpated, and regurgitation test was performed only in cases of chronic dacryocystitis. Probing and syringing were done to see the level of obstruction in the lacrimal drainage system, before planning the surgery. All the patients were also evaluated by an otolaryngologist for any nasal pathology obstructing lacrimal sac.

Dacryocystectomy (DCR) with intubation was performed under general anaesthesia by the two surgeons ES & UF. Nasal cavity was packed with a gauze piece, soaked in 1% lidocaine with adrenaline 1:100 000, for haemostasis. A vertical incision 10 mm medial to the inner canthus was given in the skin. The medial canthal tendon and lacrimal sac were exposed and reflected. The lacrimal bone adjacent to the lacrimal sac was removed with help of a Kerrison's Rongeurs bone punch to make osteotomy of 1.5 to 2 mm in size. Nasal mucosa was opened with help of a surgical blade to make flaps. The lacrimal sac was incised to make anterior and posterior flaps. Lacrimal sac flaps were attached to the nasal mucosal flaps with help of vicryl 6/0 suture. Intubation was done with a Silicone tube. It was introduced through upper and lower puncta, into the canaliculi, then sac and finally knotted in the nasal cavity. Biopsy of the lacrimal sac was taken from the posterior flap of the sac.

Patients were discharged with systemic antibiotics (co-amoxiclave 1gm twice a day) anti-inflammatory and analgesic medicines for 7 days. Combination of steroid antibiotic eye drops and ointment was prescribed for 2 weeks. Patients were followed up on the first post-operative day, then on the 15th day, at one month, at three and finally at six months post-surgery. Silicone tube was removed at six months. Irrigation of the lacrimal system was done by syringing canaliculi and lacrimal sac with normal saline under topical anaesthesia at each follow up to check the patency of the osteotomy. Recovery of the fluid in the nose on syringing was considered as a successful DCR surgery. The patency was not achieved if the fluid was not recovered from the nose, on irrigation at six months after surgery. It was reflected as a failed DCR procedure. Biopsies derived from the posterior wall of lacrimal sac were fixed in 10% buffered formalin and were transported to the laboratory, where gross examinations of the specimen were performed. Then the specimens were processed in automated processors, embedded in paraffin blocks, and 4–5 μm sections were made. The prepared Haematoxylin and Eosin stained (H&E) slides were examined under light microscope by the pathologist and scored using the following CIS score given in table-1.[5,6]

Table-1: Histopathological grading for chronic inflammatory score

Grade	Inflammatory cells	Fibrosis	Angiogenesis	Chronic inflammatory score
Mild	<50 cells/HPF	<25%	<5 vessels/HPF	< 3
Moderate	50-200 cells/HPF	25-50%	5-10 vessels/HPF	3-6
Severe	>200 cells/ HPF	>50%	>10 vessels/HPF	> 6

HPF: high power field

Table-2: Frequency distribution of features of lacrimal sac and inflammatory scores

Variables examined	Diagnostic criteria	Number of patients (%)
Inflammation Number of lymphocytes, histiocytes and plasma cells in a high-power field (HPF)	Mild: <50 Moderate: 50-200 Severe: >200	2 (8%) 5 (20%) 18 (72%)
Fibrosis Amount of fibrotic tissue in an HPF	Mild: <25% Moderate: 25-50% Severe: >50%	2 (8%) 18 (72%) 5 (20%)
Angiogenesis Number of vessels or capillaries in an HPF	Mild: <5 Moderate: 5-10 Severe: >10	1 (4%) 19 (76%) 5 (20%)
CIS Score Chronic inflammatory score (CIS)	Mild CIS: <3 Moderate: 3-6 Severe: >6	0 7 (28%) 18 (72%)
Ulceration of the lining	Present Absent	12 (48%) 13 (52%)
Number of goblet cells	Normal Decreased	18 (72%) 7 (28%)
Squamous metaplasia	Present Absent	10 (40%) 15 (60%)
Results of Dacryocystorhinostomy (DCR)	Successful DCR Failed DCR	24 (96%) 1 (4%)
Total number of patients		25 (100%)

DCR: dacryocystorhinostomy. HPF: High power field (in a microscope).

These histopathological features were scored individually according to severity as mild, moderate and severe. Total sum was calculated for each case ranging between 3–9 and named as chronic inflammatory score (CIS). Every case was grouped according to its CIS. The sum of less than 3 was categorized as mild chronic inflammation, sum of 3–6 as moderate CIS and the sum of more than 6 as severe CIS.

Data was analyzed on SPSS version 21 (SPSS, Inc, Chicago, Illinois)**.** Means were calculated for the numerical data, including age and duration of watering. Frequencies were computed for the gender, laterality of the eye, primary diagnosis, histopathological features of the sac and the CIS score.

RESULTS

Total number of patients in this study was 25, over a period of one year. Males were 20% (5/25) and females were 80% (20/25). Mean age of the patients was 37.76±12.32 SD, median interquartile range was (IQR) 38 years (27.50–50.0). The minimum age of the patients was 16 years and the maximum age was 55 years. Mean duration of watering was 2.9 years±3.18 SD, median IQR was 2.0 years (1.00–3.75). The minimum duration of symptoms in our patients was 6 months and maximum duration of the symptoms was 16 years. Right eye was involved in 60% (15/25) of the patients. Chronic dacryocystitis was seen in 16 (64%), primary acquire nasolacrimal sac obstruction was seen in 6 (24%) and dacryocystocele was seen in 3 (12%) patients.

On histopathological examination of the lacrimal biopsies, severe inflammation was observed in 72% (18/25) of the patients, moderate angiogenesis in 76% (19/25) and moderate fibrosis in 72% (18/25) of the patients. Squamous metaplasia was present in 40% (10/25) of the biopsies, reduced number of goblet cells in 72% (18/25), and focal ulceration in 48% (12/25). Chronic inflammatory score was severe in 72% (18/25) of the patients. Table 2. Figures .1-4. At 6-month follow up of the patients, successful DCR was achieved in 96% (24/25) of the patient. No statistical test could be applied due to small sample size of the study.

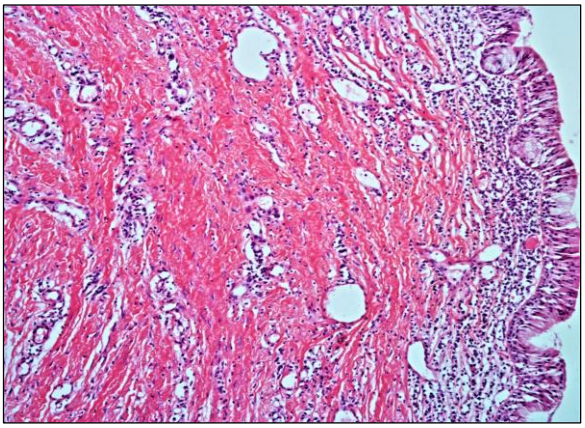

Figure-1: Low power view of the lacrimal sac biopsy showing columnar lining and fibrous and inflamed wall

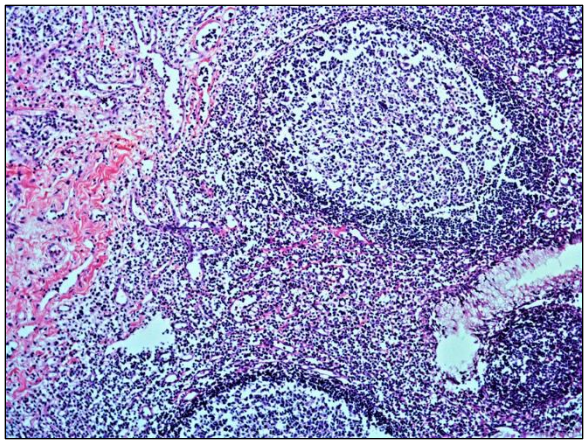

Figure-2: Dense inflammation with lymphoid follicle formation

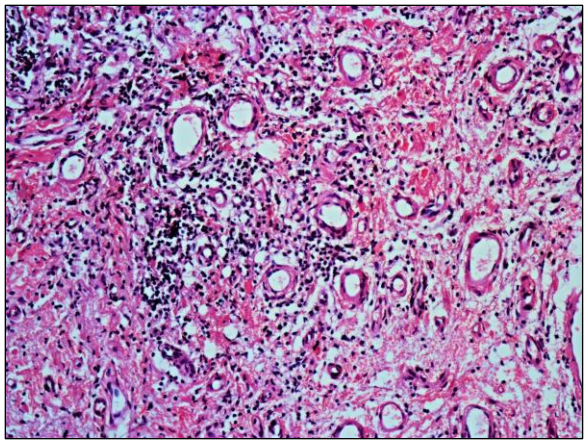

Figure-3: Severe angiogenesis, numerous vessels /high power field, and severe fibrosis

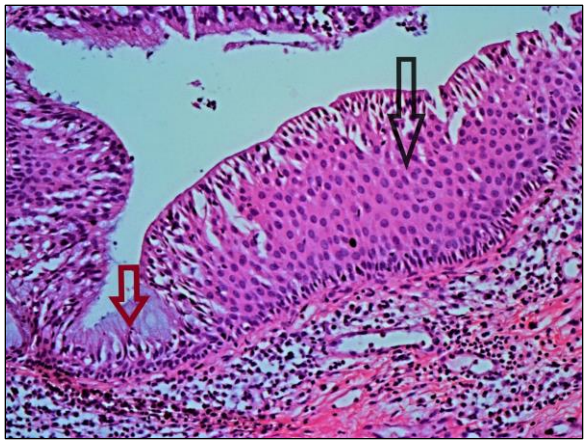

Figure-4: Squamous metaplasia of lining of the cyst wall (black arrow), and some remaining goblet cells (red arrow)

DISCUSSION

In our study the Chronic inflammatory score (CIS) was severe in 72% of patients, with severe inflammation in 72%, moderate angiogenesis in 76% and moderate fibrosis in 72% of the biopsies. (Figures 1-3). Mild CIS was not reported in any of the biopsies. In literature, mild inflammation has been reported in 56%, mild angiogenesis in 64% and severe fibrosis in 62% of the cases, by Eldsoky.[13] Amin *et al* established moderate CIS in 81.8% and severe in 12.1% of his total 33 patients.[5] Chakrabarti *et al* has reported moderate CIS in 52% and mild CIS in 28% of his 50 patients.[6] He reported moderate inflammation in 48%, mild fibrosis 72% and mild angiogenesis in 64%. Moderate CIS was seen in 44.9% of patients and mild CIS in 40.8%, by Mohamed *et al*.[15] Most of the patients in our study had severe CIS. The mean duration of symptoms in our patients was 2.9 years and the maximum duration was 16 years. A median duration of symptoms of 2 years was reported in patients undergoing DCR, by Mohamed *et al*.[15] Other studies have not recorded the duration of symptoms.[5,6,13] One of the possibilities is that the longer duration of symptoms predisposes to severe chronic inflammation and thus a high CIS. In our experience, patients present late to the hospital and have had experienced multiple over-the-counter topical medications to avoid surgery; on the other hand, public sector hospitals are over-burdened, have unsatisfactory health infra-structure and have a long list of patients waiting for the surgery.[16]

In this study, we have checked for the anatomical success of external DCR, by performing syringing and irrigation of the lacrimal system, with normal saline under topical anaesthesia, at each follow up visit. The success rate of our DCR was 96%. Ozer et al has reported 60% success rate after an endoscopic DCR and they checked the patency of osteotomy by fluorescein test.[17] Most of the other studies have categorized DCR success into satisfactory and non-satisfactory surgical outcomes, based on the satisfaction of the patients.[5–7,15] According to the literature, non-satisfactory patients with surgical outcomes were two (9.5%),[15] six (20%),[7] four (12.1%)[5] and 5(10%) in these studies[13]. They did not find any significant correlation between the grade of fibrosis and inflammation with surgical outcome.[15] Ozer *et al* have reported that the most of the unsatisfactory patients in his study had severe degrees of inflammation, fibrosis and angiogenesis.[17] He had suggested a linear relationship between these factors. Our sample size was insufficient for the application of any statistical test.

In our study, squamous metaplasia was noted in 40%, a reduction in the number of goblet cells was identified in 72% (Figure 4), and focal ulceration in 48% of the specimens. One of the studies has reported epithelial hyperplasia with finger-like projections in the lumen of the sac, excess of goblet cells, and denudation of mucosa.[18] Most of the previous studies

have not commented on the number of goblet cells.[5,6,15] Goblet cells are the specialized cells that are present in the conjunctiva, where they produce mucin to the tear film, and in the nasolacrimal duct, where they facilitate drainage of tears to the inferior meatus of the nose.[19] A reduced number of goblet cells has been reported in chronic inflammatory conditions, and animal model studies have linked it to an increased number of CD4+T cells and to inflammatory cytokines, especially Interferon-gamma.[20] The presence of nasolacrimal duct obstruction may lead to secondary infections with chronic inflammation, and secondary reduction in the number of goblet cells, promoting squamous metaplasia. A reduced number of goblet cells has been proposed to have a role in nasolacrimal duct obstruction.[21] However, a few studies have reported that the goblet cell population may increase secondary to obstruction leading to mucin overproduction.[22]

Wegener's granulomatous inflammation, benign or malignant epithelial tumours, lymphoid tumours or leukemic infiltration have also been rarely reported in the histopathology of the lacrimal sac.[2] Histopathology has been recommended for the identification of unforeseen pathologies and early treatment, and Eldosky recommended it to be mandatory in recurrent cases.[13] Bernardini *et al* has opined lacrimal sac biopsy for an abnormal lacrimal sac during surgery and for patients with positive systemic illness, after studying 302 lacrimal sac biopsies.[23] The risk of neoplastic malignant lesions presenting as nasolacrimal duct obstruction, although very low, always exists.[18] Based on the limited sample size of the present study and results, we cannot endorse that histopathology should be performed in only selected cases.

The mean age of our patient was 37 years which is much lower than that reported in other studies. It was 59 years of age in a study from Romania,[18] 53 years of age,[13] 50 years of age,[5] and 40 years of age in other studies[6]. Subtropical climates with monsoons can cause chronic dacryocystitis at an early age.[24] Women were the predominant population in our study, which is compatible with the literature that women are five times more susceptible to developing chronic dacryocystitis than men, due to narrow nasolacrimal duct, hormonal factors, longer duration of work in hot humid kitchens, and frequent use of collyrium (*kajal/surma*).[25]

The limitation of the study is its small sample size, due to which statistical tests for association could not be applied. The strength of the study is that it is the only study from our country in which histopathology of the lacrimal sac was performed, representing our population.

We recommend larger cohort studies with a high number of lacrimal sac biopsies, to identify the disease pattern in our population.

CONCLUSION

The CIS was severe in most of our patients. There was severe inflammation, moderate fibrosis, and moderate angiogenesis in most of the lacrimal sac biopsies. We have identified a reduced number of goblet cells in most of the specimens. DCR was successful in most of our patients, and the success of DCR did not seem to correlate with the degree of inflammation in our patients. Larger cohort studies are recommended in our population, for confirmation of our findings.

AUTHORS' CONTRIBUTION

ES, RS: Concept, data collection, analysis, interpretation, write-up. UF: Concept, literature search, proofreading. ARJ: Concept, Literature search, proofreading.

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