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Clinicopathological and Microbiological Study of Chronic Dacryocystitis

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Abstract: ***Objectives: To study the various modes of presentations of chronic dacryocystitis, to analyse the histopathological picture in the lacrimal sac biopsy in chronic dacryocystitis and to define spectrum of pathogens causing dacryocystitis and their culture sensitivity to different antibiotics. Methodology and Methods: A descriptive study was performed in a tertiary care hospital on 60 patients presenting with chronic dacyocystits. Intraoperatively sample from the mucopurulent material found at the bottom of lacrimal sac and sent for culture and sensitivity. Specimen of the lacrimal sac obtained during dacryocystorhinostomy or dacryocystectomy is sent for histopathological examination. Results: 60 patients underwent the study. Bimodal peak was noted in 31-40 years (23.3%) and 61-70 years (25%), commonly seen in females (60%), Epiphora was the most common presenting complaint (43.3%).83.4% had primary acquired nasolacrimal duct obstruction with chronic dacryocystitis, 8.3% had associated mucocele, 3.3% had associated corneal ulcer while 5% had associated mucocele with fistula. Most common organism isolated was Staphylococcus aureus (46.7%), most of the isolated organisms showed sensitivity to Cephazolin (98%), Gatifloxacin (88%) and were resistant to Ciprofloxacin (36%), Chloramphenicol (44%).75% of the cases showed non specific inflammation of the lacrimal sac while 3.3% had hyperplastic changes, 3.3% had fibrotic changes, 5% had dacryocystitis pseudoglandularis and3.3% showed squamous metaplasia of the sac epithelium. Conclusion: Chronic dacryocystitis exists in various forms of etiology and presentation. Prompt surgical treatment helps in prevention and management of its complications. Microbiological and histopathological study of the sac helps in better understanding and further management of the disease.***

Keywords: Chronic dacryocystitis; Pathology of sac; Bacterial pathogens; Antibacterial susceptibility and resistance.

1. Introduction

Diseases of lacrimal drainage system is common among patients who visits to ophthalmology clinic. Chronic dacryocystitis is frequently encountered disorder among these patients. Disorders of the lacrimal drainage system which cause epiphora, punctal discharge or medial canthus swelling are the most common ophthalmic complaints. The term epiphora refers to the overflow of tears onto the cheek[1]. Epiphora occurs due to imperfect drainage of the tears through the lacrimal passages, whereas, lacrimation occurs due to excessive tear production. Epiphora resulting from nasolacrimal duct obstruction is common and accounts for about one-third of cases.[2]

Symptomatic acquired NLDO has an average annual incidence of 30.47 per 100, 000.3Dacryocystitis represents acute or chronic inflammation of the lacrimal sac. It is the most common cause of epiphora (about 87%).4Dacryocystitis has a worldwide distribution, with higher incidence among people living in the topical countries and under poor hygienic conditions. It can occur in all age groups, with a mean age of 60-70 years.[5, 6]

Chronic dacryocystitis is commonly attributed to effects of stricture of nasolacrimal duct arising from chronic inflammation, usually of nasal origin. This occlusion may be caused by congenital anomaly, chronic sinus disease, naso-orbital trauma, involutional stenosis. Involutional stenosis is caused by nasolacriamal duct obstruction, affects women twice as frequently as men [6] although the inciting process of this etiology is unknown. Clinicopathological study suggests that compression of the lumen of nasolacrimal duct by inflammatory infiltrates and edema precedes development of chronic dacryocystitis. Acquired nasolacrimal duct stenosis is usually seen in middle aged or older women occurs from gradual thickening of facial bones which compromises the canal through which the nasolacrimal duct passes.7 Granulomatous diseases including sarcoidosis, tuberculosis, Wegener's granulomatosis and lethal midline granuloma may also lead to nasolacrimal duct obstruction. Infective causes of chronic dacryocystitis includes bacterial and viral.

Chronic dacryocystitis is a threat to cornea and orbital soft tissues leading to complications like unilateral conjunctivitis, corneal ulcer, acute on chronic dacryocystitis, lacrimal abscess and fistula. Endophthalmitis and panophthalmitis can occur if any intra-ocular surgery is undertaken in unrecognized dacryocystitis.

The epithelial hypertrophy and non-granulomatous inflammation are the most common histological findings in lacrimal sac biopsies in chronic dacryocystitis. The most common bacteria isolated in chronic dacryocystitis were frequently staphylococcus, followed by streptococcus and pneumococcus.

Small number of patients with catarrhal type of chronic dacryocystitis respond to medical line of treatment, which includes broad spectrum antibiotics administered both systematically and locally, syringing of the lacrimal passages with antibiotic solution, pressure syringing etc.

Surgical line of treatment includes dacryocystorhinostomy, the procedure of choice in the management of chronic dacryocystitits which has high success rate. Dacryocystectomy is doneusually in cases of long standing chronic dacryocystitis in elderly people with extensive infrequently, where the whole of the lacrimal sac is excised. Other surgeries include endoscopic dacryocystorhinostomy, endolaser dacryocystorhinostomy.

2. Materials and Methods

The study was conducted on patients presenting with chronic dacryocystitis to ophthalmology of a tertiary care centre after obtaining ethical permission from institutional ethical committee. The methods adhere to the declaration of Helsinki. 60 patients presenting with chronic dacryocystitis attending the outpatient department of ophthalmology between December 2019 to December 2021 were considered for the study.

Inclusion Criteria:
Patients with age more than 20 years, presenting with symptoms of chronic dacryocystitis and medically fit for surgery.

Exclusion Criteria:
Patients with symptoms of acute dacryocystitis, bleeding disorder and patients with uncontrolled comorbidities

3. Procedure

Detailed history was taken from all the patients included in the study like name, age, sex, occupation, nature and duration of symptom etc. Detailed routine clinical examination was done to know the nature of the discharge, fullness in the lacrimal sac area, lacrimal sac patency and other ocular examination were done. Nature of regurgitation was noted, on pressure over lacrimal sac and during lacrimal syringing. Elective surgery was planned and scheduled after relevant systemic investigation, ENT consultation, physician opinion regarding fitness for surgery. Surgical line of treatment for chronic dacryocystitis cases is done either by dacryocystectomy or dacryocystorhinostomy.

Under all aseptic precautions, nasalpacking was done. Skin incision was made 8mm medial to the medial canthus, starting 2mm above the lower border of superficial part of medial palpebral ligament. The skin edges were handled properly and dissection was carried down to the periosteum. The superficial part of medial palpebral ligament was identified and cutor just dissected out. Periosteum was elevated using a periosteum elevator. Sac was reflected from the lacrimal fossa. Suture between ethmoid and lacrimal bone was separated with periosteal elevator. Nasal mucosa was separated from the nasal aspectof the floor and the opening was enlarged with bone punches. Sac lumen identified bypassing a probe through canaliculus. Medial wall of the sac was incised vertically with no.11blade, and using scissors incision was extended upwards till the fundus of the sac and downward till the nasolacrimal duct. Sample was taken from them ucopurulent material found at the bottom of lacrimal sac and sent for culture and sensitivity. Posterior lacrimal sac wall was excised and sent for histopathological examination in 10% formalin solution. Vertical cut was made in the nasal mucosa dividing it into anterior 2/3rd and posterior 1/3rd and the flaps were secured. Anteriormucosal flaps of the lacrimal gland and nasal mucosa were approximated with absorbable sutures. Canalicular probe was left in the position till the anastomosis is complete. Superficial part of the medial palpebral tendon was reattached with a long acting absorbable suture. Skin closed with interrupted sutures.

Statistical Analysis
Data obtained from the study was coded and entered into Microsoft Excel spread sheet. The categorical data was expressed as rate, ratio and percentage. The continuous data was expressed as mean ± S. D.

4. Results

A total of 60 patients, majority of the patients are of age group 61-70 years (15 patients-25.0%) and 14 patients (23.3%) were between 31-40 years. Bimodal peak in presentation is noted in our study (3rd decade and 6th decade of life).36 (60%) patients were females and 24 (40%) patients were males.

21 (35%) had left sided dacryocystitis, 34 (56.6%) had right sided affection and 5 (8.3%) had bilateral affection. Majority of the patients were from low socio economic status (55.0%).46 patients (76.7%) did not have any associated systemic comorbidities, whereas, 8 patients (13.3%) had diabetes, 1 patient (1.7%) had hypertension and 5 patients (8.3%) had both hypertension and diabetes.

26 patients (43.3%) presented with epiphora only, 24 patients (40%) presented with discharge associated with epiphora, 8 patients (13.3%) presented with epiphora and discharge associated with swelling near the medial canthus, and 2 patients (3.3%) had corneal ulcer associated with epiphora and discharge. In 27 patients (45%) the duration of symptoms at presentation tothe hospital was between 1 week to 1 month, whereas 21 patients (35%) presented before 1 week and 12 patients (20%) presented between 1 month to 6 months. In our study 11 patients (18.3%) had deviated nasal septum, 6 patients (10.0%) had inferior turbinate hypertrophy.43 patients (71.7%) had no associated nasal pathology.

37 patients (61.7%) had complete block of nasolacrimal duct, while 23 patients (38.3%) had partial obstruction.33 patients (55.0%) had mucopurulent discharge on sacsy ringing, and 27 patients (45.0%) had clear fluid regurgitation.50 patients (83.4%) had primary acquired nasolacrimal ductobstruction with chronic dacryocystitis–being the most common presentation; 5 patients (8.3%) had primary acquired nasolacrimal duct obstruction with chronic dacryocystitis with associated mucocele, 2 patients (3.3%) had primary acquired nasolacrimal duct obstruction with chronic dacryocystitis with corneal ulcer in the same eye and 3patients (5%) had primary acquired nasolacrimal duct obstruction with chronic dacryocystits along with mucocele and fistula.

54 patients (90%) underwent dacryocystorhinostomy, 3patients (5%) underwent dacryocystectomy and 3 patients (5%) underwent dacryocystorhinostomy with fistulectomy.

On bacteriological study of the sac contents in this study, 28 patients (46.7%) had staphylococcus aureus infection, 8 patients (13.3%) had staphylococcus epidermidis infection, 7 patients (11.7%) had streptococcus pneumoniae infection, 5patients (8.5%) had pseudomonas aeruginosa infection, 2 patients (3.3%) had diphtheroids infection, where 10 patients (16.7%) had no growth of organisms on bacteriological growth. In our study positive growth was seen in 50 patients and the commonly prescribed antibiotics were tested for sensitivity. It was noted that most of the isolated organisms in our study were sensitive to Cephazolin (98%), Gatifloxacin (88%), Ofloxacin (84%), Moxifloxacin (76%), Vancomycin (74%) and were resistant to Ciprofloxacin (36%), Chloramphenicol (44%).

Table 1: Bacteriological study

Organism	No. of cases	Percentage
Staphylococcus aureus	28	46.7
Staphylococcus epidermidis	8	13.3
Streptococcus pneumoniae	7	11.7
Pseudomonas aeruginosa	5	8.3
Diphtheroid	2	3.3
No growth	10	16.7

Table 2: Antibiotic sensitivity

Antibiotics	No of cases sensitive	Percentage
Gentamycin	28	56
Tobramycin	29	58
Ciprofloxacin	18	36
Chloramphenicol	22	44
Amoxicillin	35	70
Gatifloxacin	44	88
Ofloxacin	42	84
Moxifloxacin	38	76
Vancomycin	37	74
Cephazolin	49	98

Histopathological examination of the lacrimal sac wall was done, most of the cases showed non granulomatous features of chronic dacryocystitis.45patients (75%) patients had chronic dacryocystitis changes of non specific type, 3patients (5%) had hyperplastic type, 3 patients (5%) showed dacryocystitis pseudoglandularis, and 2 patients (3.3%) had fibrotic type of chronic dacryocystitis and 2 patients (3.3%) squamous metaplasia of epithelium was noted.5 patients (8.3%) had acute dacryocystitis changes on histopathological examination

Table 3: Histopathology of sac

Sac pathology	No. of cases	Percentage
Chronic dacryocystitis – non specific	45	75
Chronic dacryocystitis – hyperplastic type	3	5
Chronic dacryocystitis – Fibrotic type	2	3.3
Dacryocystitispseudoglandularis	3	5.0
Chronic dacryocystitis – Squamous metaplasia	2	3.3
Acute dacryocystitis	5	8.3

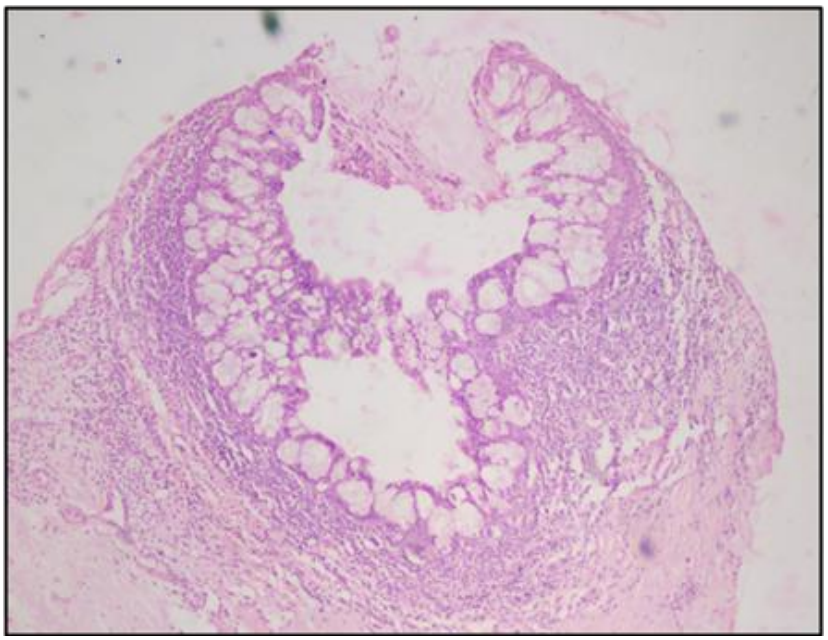

Figure 1: Section of lacrimal sac lined by mucous secreting cells dipping into the submucosa and forming pouches – dacryocystitis pseudoglandularis

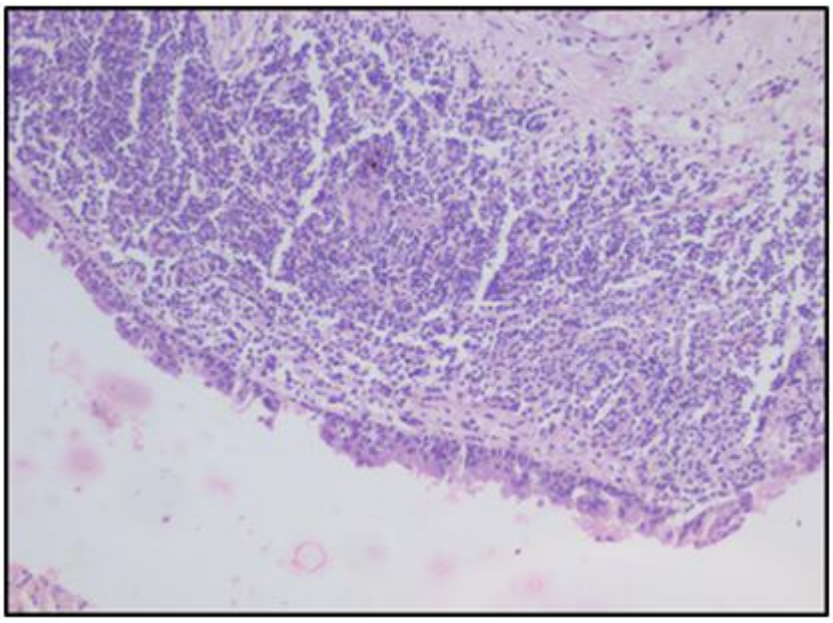

Figure 2: Single layer of columnar epithelium with dense acute inflammatory cell infiltrate – acute dacryocystitis

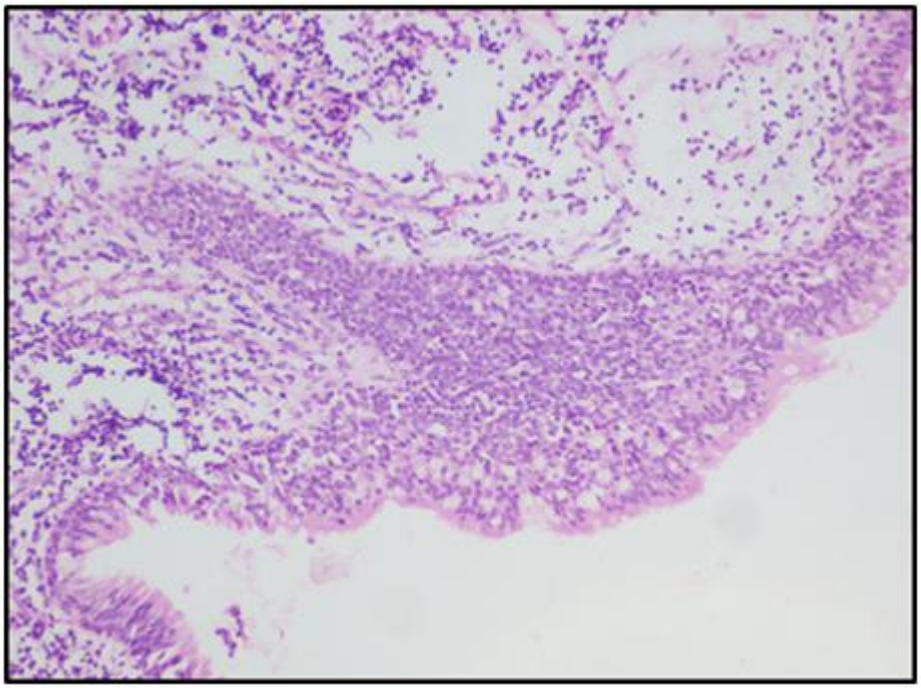

Figure 3: Tall columnar cells with goblet cells with focal squamous metaplasia

5. Discussion

Chronic dacryocystitis is a common problem of lacrimal drainage system and is treated much efficiently in recent years with advances in investigative and operational techniques pertaining to solve the problems associated with it.

In our study, majority of the patients (25.0%) belonged to sixth decade of life. Bimodal peak in presentation is noted in our study (3rd decade and 6th decade of life). Mathew W, et al, [8] reported that the mean age of presentation as 60.7 years. A study by Bale RN, [9] reports that in his study nearly 78% of cases were over the age of 30 years, and amongst this the peak was at 5th decade (26%). Study by Sarda et al, [10] noted that the maximum incidence of chronic dacryocystitis was in third and fourth decade of life. Dalgleish R.[11] stated that 35-40 years was the earliest expected age of onset of acquired idiopathic nasolacrimal duct obstruction.

In our study 60 % of the patients were females and 40% were males. Duke Elder states that the occurrence among adults is 75-80% in females to 25-30% in males.[6] Jacobs Basil H.4 found that incidence of chronic dacryocystitis among female to male ratio is 3: 1. He claimed that it was due to higher vascular congestive factor and narrower bony canal. Dalgeish R.1[1] reported that 54% of cases in his study were females.

In our series of 60 patients, 21 (35%) had left sided dacryocystitis, 34 (56.6%) had right sided affection and 5 (8.3%) had bilateral affection. Jacobs Basil H.[4] found that right side was affected 53 times and left side was affected 37

times in a study of 90 unilateral cases, and 14 cases were bilateral. The affection of side was found by Sood NN, et al[12] as 50 each right and left. Study conducted by Bale RN, [9] found that the incidence was 51.04% in left eye. Dalgleish R.[11] stated that there was no significant difference in right and left sided affection, and the incidence of bilaterality increases with age. Thus there is no predilection to any side and it may affect both sides equally.

In our study, 26 patients (43.3%) had only epiphora has the presenting complaint, being the most common presentation.[24] patients (40%) presented with discharge associated with epiphora, 8 patients (13.3%) presented with epiphora and discharge associated with swelling near the medial canthus, and 2 patients (3.3%) had corneal ulcer associated with epiphora and discharge. A study conducted by Shivareddy P, et al, [13] and Sood et al[14] showed that 80% and 75% of patients presenting with complaints of combined epiphora and epiphora with discharge.

In our study, 50 patients (83.4%) had primary acquired nasolacrimal duct obstruction with chronic dacryocystitis as the most common diagnosis; 5 patients (8.3%) had primary acquired nasolacrimal duct obstruction with chronic dacryocystitis with associated mucocele, 2 patients (3.3%) had primary acquired nasolacrimal duct obstruction with chronic dacryocystitis with corneal ulcer in the same eye and 3 patients (5%) had primary acquired nasolacrimal obstruction with chronic dacryocystits along with mucocele and fistula.

On bacteriological study of the sac contents in this study, 28 patients (46.7%) had staphylococcus aureus infection, 8 patients (13.3%) had staphylococcus epidermidis infection, 7 patients (11.7%) had streptococcus pneumoniae infection, 5 patients (8.5%) had pseudomonas aeruginosa infection, 2 patients (3.3%) had diphtheroid infection, whereas 10 patients (16.7%) had no growth of organisms on bacteriological culture. Our results are similar to a study conducted by Hartikaien J. et al [5]had a positive culture growth in their study, in which Staphylococcus was most commonly isolated organism. Das JK et al [15] report in their study the occurrence of gram positive organisms to be 75% which were predominantly Staphylococcus species. Coden DJ et al [16] observed gram negative organisms in 27% of all isolates, including Pseudomonas in 9%. A study of 62 cases by Brook I and Frazier EH, [17] found that Staphylococcus as the most common organism in 28 (45%) of the patients. In a study conducted by Sexena SP, et al [18] the culture and antibiotic sensitivity done, out of which 55% were sterile, 20%cases isolated staphylococcus, 12.5% streptococcus and 12.5% were pneumococcus.

In this study positive growth was seen in 50 patients and the commonly prescribed antibiotics were tested for sensitivity. It was noted that most of the isolatedorganisms in our study were sensitive to Cephazolin (98%), Gatifloxacin (88%), Ofloxacin (84%), Moxifloxacin (76%), Vancomycin (74%). And were resistant to Ciprofloxacin (36%), Chloramphenicol (44%). The results of our study were similar to the study conducted by Bharathi MJ. et al[19]which showed that the bacterial isolates were susceptible to gatifloxacin (96.5%), ofloxacin (94.8%), and amikacin (91.1%) and were found resistant for gentamicin (45.7%), tobramycin (50.8%), norfloxacin (50.7%), and ciprofloxacin (30.4%). In the study conducted by Assefa Y et al, [20]showed that among the commonly prescribed antibiotics the susceptibility noted was amoxicillin 38.7%, ciprofloxacin 25.8%, chloramphenicol 25.8%, co-trimoxazole 25.8%, and ampicillin 19.4%. Study conducted by Javed Ali M. et al, [21] showed good sensitivity of the organisms to penicillins, cephalosporins, and vancomycin.

In our study, histopathological examination of the lacrimal sac wall was done, most of the cases showed non granulomatous features of chronic dacryocystitis.48patients (80%) patients had chronic dacryocystitis changes of hyperplastic type, 3patients (5%) showed dacryocystitis pseudoglandularis, and 2 patients (3.3%) had fibrotic type of chronic dacryocystitis and patients (3.3%) squamous metaplasia ofepithelium was noted.5 patients (8.3%) had acute dacryocystitis changes. A prospective study by conducted by Sexena et al[18]on 40 patients showed that the epithelial hypertrophy was the most common histological finding followed bysquamous metaplasia and goblet cell formation. A study by Rowayda et al[22], conducted on 33 cases showed non – specific lacrimal gland pathology in all cases and 81.8% of those cases showed moderate chronic inflammation and 6.06% cases showed mild degree inflammation. They concluded that non-specific chronic inflammation with fibrosis is the most common histopathological finding in lacrimal sac wall biopsy specimens. Study conducted by Jyothi et al[23] on Histopathological changes in chronic dacryocystitis showed that the commonest type is non-specific chronic dacryocystitis followed by hyperplastic type, fibrotic type, follicular type, dacryocystitis pseudoglandularis and catarrhal type. A study by Merkonidis C, et al[24], conducted on 193 specimens, 23% showed normal histology, 76% showed varying degrees of non-specific chronic inflammation and 1.2% showed specific pathology like sarcoidosis and transitional cell papilloma. Out of 146 specimens that showed non-specific chronic inflammation also showed other changes in epithelium like erosion, ulceration, hyperplasia, metaplasia, flattening of epithelium, and thickening of basement membrane. A study by Thakur S. et al, [25] showed that out of 40 patients, follicular changes were noted in 35% patients, hyperplastic changes in 32.5% patients, fibrotic changes in 12.5%, dacryocystitis pseudoglandularis 18%, non specific dacryocystitis in 7.5%and chronic catarrhal type in 2.5%.

6. Conclusion

Chronic dacryocystitis being a common clinical diagnosis in routine ophthalmological practice, study on the disease entity helps in better understanding and treatment. The main cause of chronic dacryocystitis is obstruction, which further leads to stasis of secretions and tears in lacrimal sac which leads to growth of organisms within the sac and pathological changes in the sac wall.

Wide range of treatment modalities are available for chronic dacryocystitis and are quite successful. Dacryocystorhinostomy with the highest success rate is the most common surgery done for chronic dacryocystitis.

It can be concluded that the disease exists in various forms of etiology and presentation. Prompt surgical treatment helps in prevention and management of complications of chronic dacryocystitis. Microbiological and histopathological study of the sac helps in better understanding and further management of the disease

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References

[1] Brain Leatherbarrow. The diagnosis and management of epiphora. In: Oculoplastic Surgery. Chapter 20, 2nd edn., London: Informa Healthcare; 2011. pp.445-478.
[2] Sibley D, Norris JH, Malhotra R. Management and outcomes of patients with epiphora referred to a specialist ophthalmic plastic unit. Clin Experiment Ophthalmol 2013; 41: 231–8.
[3] Woog JJ. The incidence of symptomatic acquired lacrimal outflow obstruction among residents of Olmsted County, Minnesota, 1976–2000 (an American Ophthalmological Society thesis). Trans Am Ophthalmol Soc 2007; 105: 649–66.
[4] Jacobs Basil H. Symptomatic epiphora. Br J Ophthalmol 1959 Jul; 43: 415-34.
[5] Hartikainen J, Lehtonen OP, Saari KM. Bacteriology of lacrimal duct obstruction in adults. Br J Ophthalmol 1997; 81 (1): 37-40.
[6] Duke-Elder S, MacFaul PA. Diseases of lacrimal passages. System of Ophthalmology. CV Mosby: St Louis; 1994. pp.674-770.
[7] Malik SR, Gupta AK, Chaterjee S, Bharadwaj OP, Saha M. Dacryocystography of normal and pathological lacrimal passages. Br J Ophthalmol 1969 Mar; 53 (3): 174-9.
[8] Mathew W, Lee Wing, Micheal E, et al. Ophthalmology. Am Academy of Ophthalmology 2001; 108: 2038-2040.
[9] Bale RN. Dacryocystitis. Bacteriological study and its relation with nasal pathology. Indian J Ophthalmol 1987; 35: 178-82.
[10] Sarda RP, Kulshreshta RM. Dacryocystorhinostomy. Br J Ophthl 1961; 45: 138.
[11] Dalgleish R. Idiopathic acquired lacrimal drainage obstruction. Br J Ophth 1967; 51: 463.
[12] Sood NN, Ratnaraj A, Balaraman G, Madhavan HN. Chronic dacryocystitis – a clinic-bacterial study. All India Ophthal Soc 1967; 15: 107-110.
[13] Shivareddy P, Bhaskara Reddy. Dacryocystitis – A clinic-pathological study. J Ind Med Assoc 1955; 24: 413-416.
[14] Sood, Mehrotra. Modified dacryocystorhinostomy. Ind J Ophth 1972; 20: 127.
[15] Das JK, Deka AC, Kuri GC, Bhattacharjee K. Das D, Gogoi K. Bacteriology of chronic dacryocystitis in adult population in North East India. Orbit 2008; 27: 243-247.
[16] Coden DJ, Hornblass A, Hass BD. Clinical bacteriology of dacryocystitis in adults. OphthalPlastReconstrSurg 1993; 9: 125-31.
[17] Brook I, Frazier EH. Aerobic and anaerobic microbiology of dacryocystitis. Am J Ophthalmol 1998; 125 (4): 552-554.
[18] Saxena SP, Gupta SC, Gupta S, Sharma S. Clinicobacterial and histologic study of chronic dacryocystitis
[19] Bharathi MJ, Ramakrishnan R, Maneksha V, Shivakumar C, Nithya V, Mittal S. Comparative bacteriology of acute and chronic dacryocystitis. Eye 2007: 1-8.
[20] Assefa Y, Moges F, Endris M, Zereay B, Amare B, Bekele D, et al. Bacteriological profile and drug susceptibility patterns in dacryocystitis patients attending Gondar University Teaching Hospital, Northwest Ethiopia. BMC Ophthalmology 2015: 15: 34.
[21] Javed Ali M, Swapna RM, Surbhi DJ, Milind NN. The microbiological profile of lacrimal abscess: two decades of experience from a tertiary eye care centre. Journal of Ophthalmic Inflammation and Infection 2013: 3-57-61.
[22] Rowayda Mahmoud Amin, Faten Aly Hussain, Hisham Farouk Idriss, Nesine Fathy Hanafy, Dina Mohamed Abdullah. Pathological, immunohistochemical and microbiological analysis of lacrimal sac biopsies in patients with chronic dacryocystitis. Int J Ophthalmol 2013 Dec 18; 6 (No.6).
[23] Jyothi Bhuyan, Subhajit Das, SK Bhuyan. Clinicobacteriological and histopathological study in chronic dacryocystitis. International Medical Journal 2014 March; 1 (3): 82-85.
[24] Merkonidis C, Brewis C, Myung, Nussbaumer M. Is routine biopsy of lacrimal sac wall indicated at a dacryocystorhiostomy ? A prospective study and literature review. Br J Ophthalmol 2005; 89: 1589-1591.
[25] Thakur S. An observation on pathological changes of lacrimal sac in chronic dacryocystitis. Indian J Ophthalmol 1985; 33: 251-3.