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ReviewArticle

Congenital Nasolacrimal Duct Obstruction – An Updated Review

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Abstract: Congenital nasolacrimal duct obstruction is the blockage of the lacrimal drainage system. It occurs in approximately 5 to 20% of normal newborn infants. A history of tearing and mucous or mucopurulent discharge and recurrent pink eye in a young child should alert the physician to the presence of nasolacrimal duct obstruction. Usually this condition is diagnosed clinically, though there are some investigations for precise diagnosis. Treatment is supportive and non surgical in 90 to 95% of cases, only 5 to 10% patients need surgical intervention. Outcome is good with minimal complications.

Keywords: Congenital Nasolacrimal Duct Obstruction, Lacrimal Apparatus, Tears, Sac Massage, Probing, Stenting, Dacryocystorhinostomy

1. Introduction

Master X, a 3 months old baby boy was taken to a local health centre with the complaints of watering of both eyes since birth, and occasional discharge from both eyes. Watering used to increase while crying or having common cold.The baby had sticky eyes, matted eyelashes and thick yellowish discharge on the medial side of the eyes. He was otherwise healthy. He was managed by some antibiotic eye drop, was not informed about sac massage. This episode became recurrent with the same management. At 11 months of age, his eyes became dark red, watering increased, used to start crying whenever eye drop was applied and also there was peri-orbital redness. At that stage he developed keratoconjunctivitiswith orbital cellulitis which is very painful and a threat for normal vision.

This condition could be avoided by having a basic knowledge on epiphora, its common cause, importance and technique of sac massage and timely referral to an ophthalmologist.

Epiphora, or tearing, is a common symptom of many ophthalmic conditions that can originate from the eyelid, anterior segment or lacrimal system. Most of these conditions are not vision-threatening, but patients often find tearing a serious problem causing blurred vision, ocular discomfort, skin irritation and social embarrassment [1].

Epiphora can develop at any age. It is more common among babies aged under 12 months of age. The condition may present symptoms in just one or both eyes and it is multifactorial [2]. The most common cause of epiphora in newborn and young infants is the congenital nasolacrimal duct obstruction, which occurs in approximately 5 to20% of normal newborn infants [3, 4].

Till date, there exists very few updated review regarding such a common paediatric health problem. So, this effort was aiming at the enrichment of knowledge in the particular field. A stepwise approach to treatment in this condition can lead to a ‘tear of joy’.

2. Embryology, Anatomy and Physiology of Nasolacrimal Apparatus

The lacrimal drainage structures begin to form during the

fifth week of gestation as the nasolacrimal groove. Canalization begins around the eighth week of gestation and continues until birth [5].

The nasolacrimal duct (also called the tear duct) carries tears from the lacrimal sac of the eye into the nasal cavity. The duct begins in the orbital cavity, from where it passes downwards and backwards. The opening of the nasolacrimal duct into the inferior nasal meatus is covered by a mucosal fold called valve of Hasner or plicalacrimalis [6].

Tears are produced in the lacrimal gland. They cross the eye, enter the upper and lower eyelid punctum, and travel through the canaliculi to the lacrimal sac and then into the nares via the nasolacrimal duct. Contraction of the orbicularis muscles creates a pumping action that facilitates the flow of tears through the lacrimal system [7]. This is the reason of runny nose during crying or having watery eyes from an allergy, and why one can sometimes taste eye drops. For the same reason when applying some eye drops it is often advised to close the nasolacrimal duct by pressing it with a finger to prevent the medicine from escaping the eye and having unwanted side effects elsewhere in the body [8].

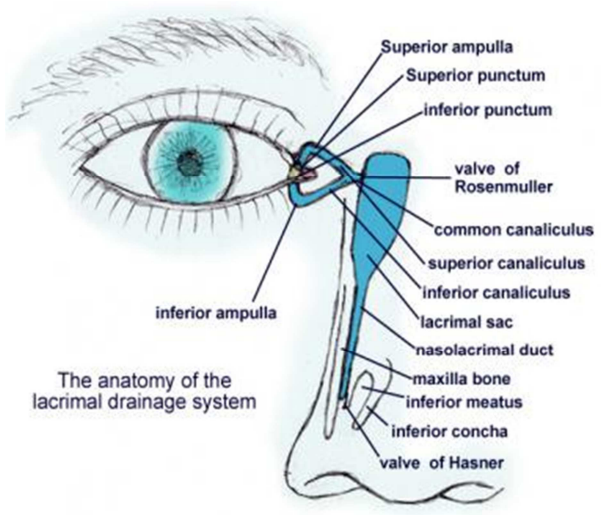

Figure 1. *Anatomy of lacrimal drainage system.*

The tear film is a complex and important entity that provides corneal lubrication, nourishment and immunological protection. The air/tear interface is also the most important site of light ray refraction. Tears are needed to keep the front surface of the eye healthy and maintain clear vision. But, too many tears can make it difficult to see. So, extra tears are called 'reflex' or 'irritant' tears[9].

3. Congenital Nasolacrimal Duct Obstruction

Nasolacrimal duct obstruction is a blockage of the lacrimal drainage system, majority of which is congenital. It occurs in approximately 5 to 20% of normal newborn infants, most commonly at the valve of Hasner. There is no sex predilection and no genetic predisposition. The blockage can be unilateral or bilateral.The rate of spontaneous resolution is estimated to be 90% within the first year of life [11].This condition is also termed as dacryostenosis or infantile epiphora.

3.1. Etiology

The most common cause is a membranous obstruction at the valve of Hasner at the distal end of the nasolacrimal duct. General stenosis of the duct is the second most common cause. The nasolacrimal duct sac is filled at birth with clear amniotic fluid. The fluid becomes purulent within days of birth and neonatal dacryocystitis occurs [11].

3.2. Risk Factors

Children with Down syndrome, Craniosynostosis, Goldenhar syndrome, clefting syndromes, hemifacialmicrosomia, or any midline facial anomaly are at an increased risk for congenital nasolacrimal duct obstruction [11].

3.3. History

A history of tearing and mucous or mucopurulent discharge is typical. A history of recurrent "pink eye" in an infant or young child should alert the investigator to the presence of nasolacrimal duct obstruction [11].

3.4. Clinical Features

Usually clinical features may not become evident until the production of normal tears.At birth, tear production by the lacrimal gland is minimal. Normal tearing develops several days to 2 weeks after birth, sometimes even longer [12]. So, epiphora is noticed during the first month of life in 80 to 90 percent of cases. If the obstruction is partial, the nasolacrimal duct is capable of draining the basal tears. The peri-ocular skin may be chapped from continual exposure to tears.The globe is usually white [12].

3.5. Clinical Diagnosis and Exclusion of Differentials

When pressure is applied over the lacrimal sac there is a reflux of mucoid or mucopurulent material from the punctum. Proximal lacrimal outflow blockage or dysgenesis tends to present with an increased tear lake and epiphora without mattering. A congenital lacrimal sac mucocele presents as an initially clear bluish mass overlying the lacrimal sac. When the mucocele becomes infected and dacryocystitis occurs, there is swelling and erythema over the lacrimal sac with a palpable mass. The mass can sometimes be decompressed with digital pressure resulting in an egress of purulent material through the lacrimal puncta. If the dacryocystitis is severe, rupture of the abscessed sac through skin can occur.In conjunctivitis, lacrimal sac is not palpable or no reflux of fluid. Blepharitis has high crusting of eye lid margin. In congenital glaucoma, there should be corneal enlargement or clouding [12].

4. Diagnostic Procedures

A fluorescein dye disappearance test can be helpful in

confirming the diagnosis of nasolacrimal duct obstruction. A drop of fluorescein is instilled into the eyes. The disappearance of dye from the tear film after 5 minutes is observed. Retained dye in a thickened tear strip is diagnostic of an obstruction. The test is most useful if the disease is unilateral and the findings of the affected eye can be compared to those of the normal eye [13].

High-resolution dacryoendoscopy enables a clearer visualization of pediatric lacrimal duct obstructions, leading to an improved understanding of their features [14]. Computed tomography is useful for delineation of anatomical characteristics of the nasolacrimal canal and to diagnose nasolacrimal canal malformation [15].

5. Management

5.1. General Treatment

Treatment of congenital lacrimal duct obstruction consists of initial observation for resolution followed by probing of children with persistent duct obstruction. Probing failures are treated with more aggressive surgical procedures including balloon dacryoplasty and nasolacrimal duct intubation. Endoscopic dacryocystorhinostomy is generally reserved for intubation and balloon dacryoplasty failures [16].

5.2. Non-surgical Therapy

Medical management of nasolacrimal duct obstruction consists of lacrimal massage and treatment with topical antibiotics. Supportive medication and hydrostatic massage provide 95% cure [17]. The antimicrobial agent should cover a broad spectrum of bacteria. To create sufficient pressure, parents should be instructed to place a finger above the medial canthus to occlude the canaliculi and then press firmly and slide downwards. Massaging serves several purposes. It empties the sac, reduces bacterial growth and applies hydrostatic pressure to the obstruction to open the duct [18].Kushner et al reported that lacrimal massage performed with occlusion of the common canaliculus and firm downward pressure on the lacrimal sac was more effective than gentle lacrimal massage or no massage [19]. Fifteen such strokes should be applied three times a day [18].Published series has shown canalization without the necessity of probing in 50-90% of infants during first 6 months of life, and 70% by the age of 1 year. For this reason, the timing for surgery for congenital nasolacrimal duct obstruction is controversial [18].In 2014, onestudy was conducted in the Diabetic Association Medical College & Hospital, Faridpur, Bangladesh among100 casesof newborn baby of watering with or without discharge. In this study, 95 patients (95%) were cured [17].Dacryocystitis in association with neonatal nasolacrimal duct obstruction should be treated with systemic antibiotics and urgent probing of the nasolacrimal duct [20].

5.3. Surgical Management

The primary surgical measure for nasolacrimal duct obstruction isnasolacrimal duct probing. Several investigators have reported a decliningsuccess rate of probing with increased age [21].A prospective observational study of primary nasolacrimal duct probing showed an overall success rate of 78% [20]. Robb et al has reported > 90% success rates with initial probing beyond 36 months of age [22]. Bilateral obstructions, complex obstructions in the proximal part of the duct and repeat probing have a poorer success rate [23]. A cochrane database systematic review,July 2017 has supported these findings [24].

Nasolacrimal duct stent insertion is used as a primary procedure or following failure of simple probing. This procedure includes passage of a nasolacrimal duct probe that has a stent swedged to one end. The success of nasolacrimal duct stent insertion as a primary procedure is estimated to be between 79 to 96%.Stents are left in place for a variable period time [25].

Balloon catheter dilation is used as a primary procedure or following failure of a simple probing.Standard nasolacrimal duct probing is followed by the introduction of a balloon catheter into the duct.The balloon is inflated according to the manufacturer's specifications and withdrawn.Success of balloon catheter dilation as a primary or secondary procedure has been estimated between 53 and 95% [26]. A retrospective comparison between balloon catheter dilation and simple probing as a primary procedure for treatment of nasolacrimal duct obstruction showed no treatment advantage for balloon catheter dilation [27].

Nasal endoscopy is sometimes used in conjunction with probing, stent insertion and balloon catheter dilation in the treatment of persistent nasolacrimal duct obstruction [28].

Dacryocystorhinostomy (DCR) is generally reserved for children who have failed other procedures.External DCR has a reportedly excellent success rate in children (96%) [29]. Endoscopic dacryocystorhinostomy has success rate approaching that of external DCR in children (82-94%). The endoscopic approach is preferred by most pediatric ophthalmologists because there is no external scar, the medial canthus is not disrupted, and nasal endoscopy can help identify intranasal abnormalities that can be rectified at the time of surgery.The use of adjunctive mitomycin C at the osteomy site in endoscopic DCR has been reported to be safe and effective in children [29].

In August 2017, a review on use ofBotulinum toxin (BTX) for intractable lacrimal drainage disorders was published. The authors performed a Pub Med search of all articles published in English on BTX injection into lacrimal gland for epiphora secondary to lacrimal drainage disorders. Animal experiments of BTX into lacrimal gland were included and analyzed separately. They concluded that, Botulinum toxin into the lacrimal gland is a minimally invasive alternative in cases of refractory epiphora secondary to lacrimal drainage disorders. In these subsets of patients, the reported concentrations, dosage and outcome measures are variable and need larger studies for standardization [30].

Complications

If untreated

Regurgitation of purulent material into the eye can cause

conjunctivitis, dacryocystitis, pericystitis, orbital cellulitis, amblyopia. All these conditions may lead to visual loss [31].

Surgical complications

Complications following surgical procedures include nasal bleeding, re-stenosis of the duct, creation of a false passage of the duct, early loss of stents, re-closure of the surgically created osteomy [31].

6. Conclusion

The diagnosis of congenital nasolacrimal duct obstruction is based upon history, clinical appearance and, if possible, the dye disappearance test. If the child is under 1 year of age, and discharge is present, a topical antibiotic should be prescribed for one week and then as needed. The child should be seen after 1week and thereafter followed every six to eight weeks to monitor for resolution. If the condition worsens, the patient should be seen more frequently. Parents need to be educated on the proper method of massage and should be made aware of the high rate of spontaneous resolution within the first year. This will often make them more patient and willing to comply with conservative management. However, if the child is 1 year of age or older and the problem persists, referral to a pediatric ophthalmologist for nasolacrimal probing is appropriate.

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