14 Functional Obstructions of the Lacrimal System

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Introduction

Functional obstructions of lacrimal drainage systems are an underdiagnosed entity. Epiphora in the presence of a patent lacrimal pathway and absence of alternative etiology could be the simplest description. Nomenclature has been confusing since functional issues of the lacrimal system have been poorly defined. Terms used include functional block, physiologic dysfunction, and functional acquired epiphora; however, the most common terminology used is functional nasolacrimal duct obstruction (FNLDO) [1–5]. Few authors have defined FNLDO to also include partial obstructions [5] but would be misleading since there is an anatomical issue rather than a functional one. Functional epiphora can be an alternate and probably a better term [1]. It is of utmost importance to rule out other causes of epiphora before labeling a case as functional. Functional issues can be of the upper or lower lacrimal system. Altered outflow dynamics without anatomical narrowing in the upper system is known to occur in older patients (mean age 57–64 years) with a high incidence of bilaterality (86 %) [6, 7]. These findings in upper system dysfunctions supports the theory of decreasing efficiency of the lacrimal pump secondary to weakening of the orbicularis oculi with increasing age as suggested by Jones in 1957 [8] and later supported by Worst in 1971 [9]. In addition, the lower system dysfunctions also occur more frequently in younger patients. This chapter aims to describe the clinical examinations, investigations, management, and outcomes of functional epiphora.

Clinical Examination

A careful history of epiphora with emphasis on preceding and subsequent events must be noted. Relevant ocular history, periocular surgical events, and drug (chemotherapy) history are important. Functional epiphora is a diagnosis of exclusion, and hence, a careful slit-lamp examination should be done to rule out a number of potential causes of epiphora like ocular surface disorders, lacrimal gland hypersecretion, eyelid malpositions, eyelid laxities, puncta-globe incongruities, punctal stenosis, conjunctivochalasis, dry eyes, and lagophthalmos. Clinical examination should be tailored towards suspects like tear breakup time and Schirmer's test for dry eyes and hypersecretion. Nasal endoscopy can occasionally reveal nasal causes of functional epiphora like rhinitis (Fig. 14.1) [10].

Irrigation and probing should be carefully performed as elucidated in the Chap. 6, to be very sure that there is no anatomical problem (Figs. 14.2 and 14.3). Functional dye disappearance test (FDDT) is also a very reliable adjunctive

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Mohammad Javed Ali (ed.), *Principles and Practice of Lacrimal Surgery*,
DOI 10.1007/978-81-322-2020-6_14, © Springer India 2015

clinical test (Fig. 14.4) to support the diagnosis and must be performed as part of the standard protocol in all cases of functional epiphora (please refer to the Chap. 6) [11, 12]. A survey conducted in Southwest United Kingdom to study the assessment practice by ophthalmologists in cases of FNLDO showed gross variations. Only 41 % used FDDT as an assessment tool and only 51 % performed irrigation themselves. They pointed out that the incomplete assessment resulted in inadequate management and recommended FDDT in all patients, irrigation by experienced staff, and additional use of radiological investigations [12].

Fig. 14.1 Endoscopic view in acute rhinitis

Investigations

Dacryocystography (DCG) has been used to exclude areas of narrowing or stenosis, and if the lacrimal system is patent, dacryoscintigraphy (DCS) is use to define the level of outflow delay [1, 13]. Wearne et al. [14] studied the feasibility of DCG and DCS in patients with FNLDO and showed that when used together, they have a high sensitivity of 98 %. Montanara et al. [3] described outflow difficulties of contrast medium without anatomical narrowing as characteristic features on DCG. Hurwitz and Welham [6] divided the functional abnormalities radiologically at two levels: upper part (orbicularis, puncta, canaliculi) and lower part (sac, duct, inferior meatus). Chan et al. [1] further refined these as those with presac and post-sac delay. Francis et al. [15] showed

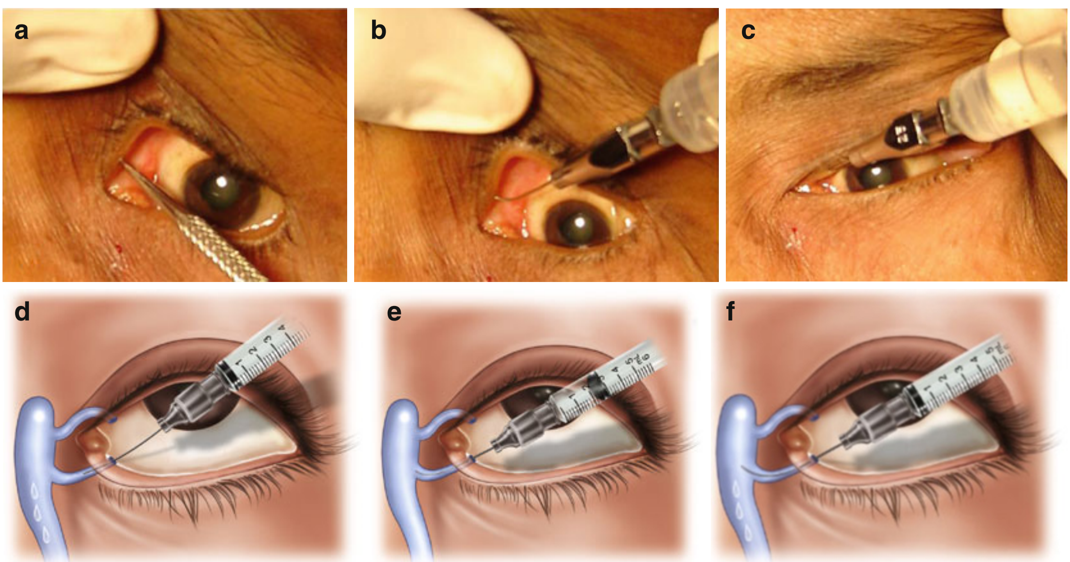

Fig. 14.2 Lacrimal irrigation procedure. Dilatation of punctum with the Nettleship's punctum dilator (**a**). The lacrimal canula inserted into the canaliculus first vertically (**b**) and then in a horizontal direction. Note the lateral traction is given to the eyelid to straighten the canaliculi before the horizontal pass (**c**). Schematic diagram showing intracanalicular irrigation. A very little amount is irrigated to dilate the lacrimal passage to avoid the risk of mucosal trauma (**d**). Intrasac irrigation is the desired goal for better interpretation unless there is a canalicular obstruction (**e**, **f**) (Photo courtesy of Dr. Sima Das)

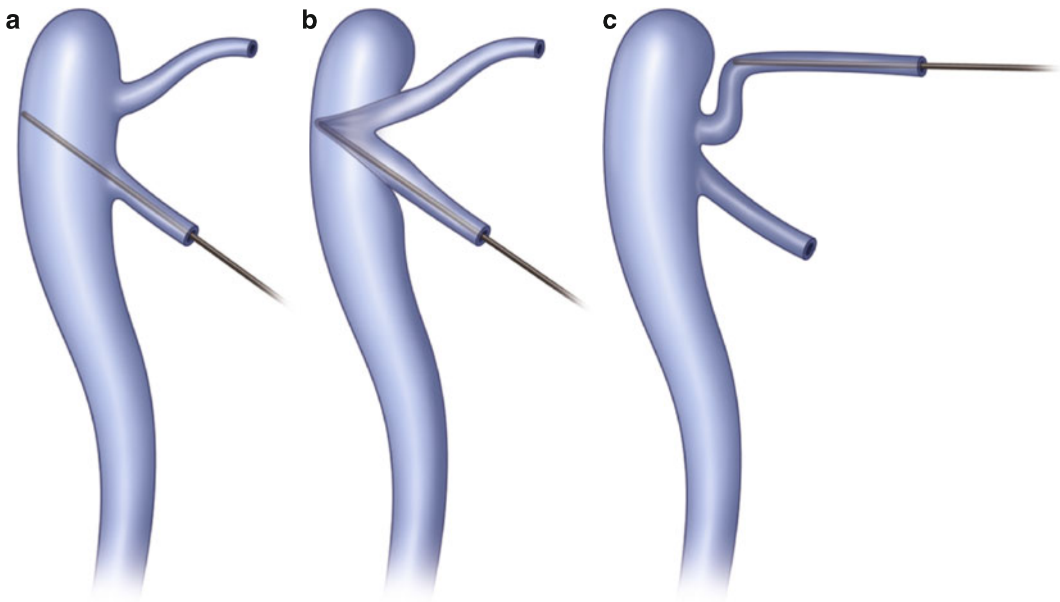

Fig. 14.3 Interpretation of lacrimal probing. Hard stop is felt when the probe hits the medial wall of the sac and underlying bone (**a**). Soft stop is felt when the probe drags the lateral wall of the sac toward the medial wall in cases of canalicular obstructions (**b**). False positive soft stop can be felt if adequate lateral traction is not given on the eyelid to straighten the canaliculi while passing the probe through it and the probe drags the roof or floor of the canaliculi against the sac (**c**) (Photo courtesy of Dr. Sima Das)

Fig. 14.4 Bilaterally retained dye in FDDT (Photo courtesy of Dr. Sima Das)

increased tear meniscus height in FNLDO using videoreflective dacryomeniscometry but found no statistical difference was noted when compared with PANDO, making it a nonspecific diagnostic tool.

The author of this chapter believes that with the advent of dacryoendoscopy, it would be easier to identify any anatomical narrowing or stenosis. Since the management does not differ markedly, exclusion of anatomical abnormalities with demonstrable patent lacrimal passage should be sufficient for a diagnosis in a routine practice.

Management

The management of functional epiphora is controversial, and no consensus has evolved over the last six decades since its first description in 1955 [2]. One of the fundamental reason for this is the variations in terminologies exclusion criteria and management. Do these patients really need treatment? Evidence suggests in the affirmative. Cheung et al. [7] conducted a detailed study on 33 FNLDO patients and studied their symptoms in relation to the vision, reading, driving, moods, work, and embarrassment. All these parameters were affected specifically vision, reading, and embarrassment, resulting in lower quality of life. Overall symptom scores significantly reduced after dacryocystorhinostomy (DCR) from a mean preoperative score of 3.50 (SD = 2.07) to 2.0 (SD = 1.65) in the postoperative period ($p < 0.05$).

Lacrimal pump failures with severe symptoms can be candidates for a conjunctivodacryocystorhinostomy, or CDCR, with Jones tubes [16]. These tubes have also shown to benefit persistent epiphora following a patent DCR [16, 17]. There

Fig. 14.5 Endoscopic view of a silicone tube dilating the nasolacrimal duct

is an increasing evidence of benefits of silicone intubation (SI) in FNLDO patients [4, 18, 19]. Moscato et al. [4] studied 44 eyes of 30 patients diagnosed with FNLDO, who underwent SI for a mean duration of 4 (±4.1) months. They were followed for a mean of 2.6 (±2.0) years from the time of intubation. The overall success for resolution of symptoms was seen in 77 %. Extrapolating the data showed success at 50 % between 5 and 6 years. They concluded that SI has good long-term success in cases of FNLDO.

Multiple mechanisms have been postulated to explain the benefit seen with SI in FNLDO [4, 20, 21]. Stent placement increases the volume and hence reduces resistance to outflow. Poiseuille's law states that resistance to flow is inversely proportional to the fourth power of the radius. Hence, by increasing the diameter of the lumen, the stents reduce resistance to flow (Fig. 14.5). In addition, Moscato et al. [4] proposed the riverbed phenomenon where an increased outflow following reduced resistance helps to maintain the enlarged passage. In addition, the stents may straighten up acute curves impeding outflow as well as help tear outflow by capillary action.

There is good evidence in literature that supports the beneficial effects of DCR in FNLDO patients. Both external DCR (Ex-DCR) and endoscopic DCR (En-DCR) have shown good results. However, these results should be interpreted with caution since few studies did not take into account a strict criteria not to include NLD stenosis, but did demonstrate preoperative patency. The success rates in those with strict criteria ranged from 54 to 84 % [17, 22] and in those without from 50 to 94 % [23–26]. Cho et al. [27] performed a comparative trial between SI ($n=108$), En-DCR ($n=32$), and Ex-DCR ($n=13$) in FNLDO patients. At 6 months' follow-up, complete resolution of symptoms was achieved in 68.5 % of SI, 81.3 % of En-DCR, and 53.9 % of Ex-DCR. However, these results need to be interpreted with caution because of grossly variable number in each group and variable SI duration and SI confounding effects in DCRs.

In conclusion, functional epiphora is a distinct entity with characteristic clinical features, specific investigative modalities for diagnosis, and good outcomes upon management. However, gold-standard diagnostic criteria are unknown, and further work needs to focus on this as well as standardization of nomenclatures for a better understanding that would translate to better patient management.

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