Types of Tubes Used In Nasolacrimal Duct Obstruction in Children

Essay

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Index

List of abbreviations

ANLDO	**A**cquired **N**aso**L**acrimal **D**uct **O**bstruction
CNLDO	**C**ongenital **N**aso**l**acrimal **D**uct **O**bstruction
CT	**C**omputed **T**omography
CTDCG	**C**omputed **T**omographic **D**acryo**C**ysto**G**raphy
DCG	**D**acryo**c**ysto**g**raphy
DCR	**D**acryo**c**ysto**r**hinostomy
ELDCR	**E**ndoscopic **l**aser **DCR**
FCT	**F**luorescein **C**learance **T**est
FDT	**F**luorescien Dye **D**isappearance **T**est
MRDCG	**M**agnetic **R**esonance **D**acryo**c**ysto**g**raphy
MRI	**M**agnetic **R**esonance **I**maging
NL	**N**aso**l**acimal
NLD	**N**aso**l**acimal **D**uct
NLS	**N**uclear **L**acrimal **S**can
NST-DSI	**N**unchaku-**s**tyle **T**ube with **D**irect **S**ilicone **I**ntubation
MCI	**M**ono**c**analicular **I**ntubation
BCI	**B**i**c**analicular **I**ntubation

List of Figures

Aim Of The Work

The aim of this study is to compare between the indications, techniques and outcome of different types of Nasolacrimal duct tubes.

Chapter 1 Introduction

Congenital nasolacrimal duct obstruction (NLDO) is a common ocular condition in young children, occurring in as many as 20 - 30% of newborns. But only 1% to 6% of these children become symptomatic. Spontaneous resolution occurs in 80-96% of affected infants by one year of age[1] or with massage early in life[2]. The diagnosis of congenital nasolacrimal duct obstruction (CNLDO) is based upon a history of epiphora beginning during the first few weeks of life , recurrent muco-purulent discharge and reflux of contents of the lacrimal sac on pressure. The fluorescien dye disappearance test (FDDT) is used to confirm the diagnosis with delayed disappearance of fluorescein dye instilled in the conjunctival sac[3].

Because most nasolacrimal duct (NLD) obstructions resolve during the first year of life, urgent treatment of a congenital obstruction is usually unnecessary. Conservative management includes warm compression, massage of the lacrimal sac and intermittent use of topical antibiotic ointment or drops[4]. NLD probing is the intervention of first choice , There is controversy regarding the optimal time of probing and outcome in older children[3], although the success of NLD probing declines with age[4], probing in older children can remain the first line of treatment [1] . A more traditional secondary procedure is the placement of silicone tube that extends from each punctum into the nose , some clinicians have felt that temporary intubation of the nasolacrimal drainage system should be performed under the belief that greater success rates would result, especially in older children or in those having the procedure under general anesthesia. Nasolacrimal intubation involves probing the nasolacrimal duct followed

by placement of a silicone tube stent in one or both canaliculi. This procedure has been popular since its introduction in the late 1960s for the treatment of persistent NLDO after failed probing[5]. Intubation has also been used by clinicians for primary treatment of NLDO in older children or when the duct feels tight during probing[6]. Increasing experience with the technique and the introduction of monocanalicular intubation have led to the use of intubation as a primary procedure for NLDO in younger children[7]. Success rates from 79% to 96% have been reported for intubation as a primary procedure in retrospective case series[7].

The use of silicone intubation in the treatment of congenital and acquired lacrimal drainage disorders has been described. Silicone is soft, relatively inert, and flexible. Many intubation techniques and types of intubation sets have been described. One of the most commonly utilized stents is the bicanalicular Crawford stent[8]. Monocanalicular intubation (MCI) of the nasolacrimal drainage system has been introduced as another potential treatment option in NLDO[9]. The latter technique is less traumatic than bicanalicular intubation (BCI) and relatively simple to perform. In addition, the tube is easily removed in the office setting[7].

More advanced interventions are available as Balloon dilation of the NLD, a new procedure that has proved successful, is similar to probing and uses a special probe with a firmly attached deflated balloon at its tip, forming a loop between the superior and inferior puncta. In patients for whom these procedures fail to establish and maintain patency of NLD or who have a malformation of the lacrimal drainage anatomical structures, dacryocystorhinostomy (DCR) can be performed to bypass the NLD[10].

Chapter 2 Embryology of nasolacrimal system:

Awareness of the development of the excretory lacrimal system is important to the understanding of certain congenital facial malformations[11]. Three stages could be identified in the morphogenesis of the excretory lacrimal system: (1) the formative stage of the lacrimal lamina (Carnegie stages 16–18 weeks) (2) the formative stage of the lacrimal cord (Carnegie stages 19–23weeks) and (3) the maturative stage of the excretory lacrimal system, from the 9th week of development onward [12] .

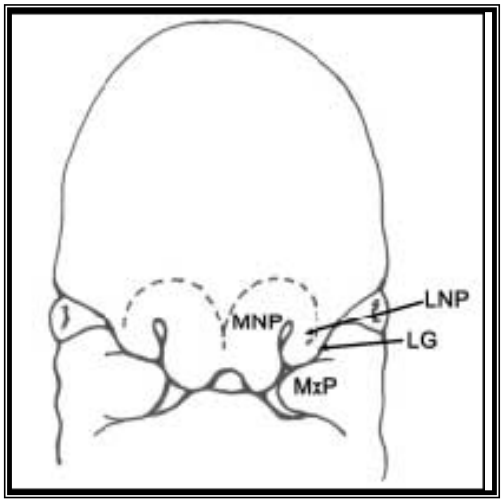

Figure (1) , Lacrimal lamina stage LG: Lacrimal groove LNP: Lateral nasal process MNP: Medial nasal process MxP: Maxillary process[12].

During the 8 to 9 mm (32-day) embryonic stage, the frontonasal and maxillary processes develop as mesenchymal folds extending from the eyes forward to the nasal pit. The groove between them (the naso-optic fissure) contains a thickened cord of ectoderm that becomes buried as the maxillary process grows upward and fuses with frontonasal process.

During the sixth week of gestation, this ectodermal cord forms a solid tract between the nasal cavity and the medial canthus [1]. Two branches arise from the upper tip of this solid ectodermal cord and extend toward the eyelids in the region of the future medial canthus. These will become the

canaliculi. Differential lateral growth of the canliculi results in formation of the medial canthus and caruncle[13]**.** Canalization of the nasolacrimal ectodermal cord begins during the fourth month of gestation and occurs by disintegration of the central cells. The process occurs simultaneously throughout the length of the nasolacrimal apparatus. Remnants of the epithelial cord remain within the lumen as valve-like folds. The proximal and distal ends of the lacrimal drainage system remain occluded by membranes. At the puncta, this membrane is formed by an inner layer of canalicular epithelium and an outer layer of conjunctival epithelium. These membranes usually perforate by the end of the term[12]. The inferior extent of the lacrimal duct extends to the nasal cavity from which it is separated by the thin membrane of Hasner, which is formed by an inner layer of lacrimal epithelium and outer layer of nasal mucosa. At birth this membrane is imperforate in 50% to70% of newborns but generally opens within the first post-partum month. In at least 60% of young children the lacrimal apparatus shows a marked angulation at the sac/duct junction. This bend may be directed laterally, anterioly, or posteriorly and may explain the significant incidence of false passages and failed probing in this age group. In many cases mechanical probing is unnecessary, and forced irrigation alone will perforate Hasner's membrane[13].

Lacrimal outflow dysgenesis can be defined as a congenital maldevelopement of any component of the nasolacrimal drainage system. The focus of the dysgenesis can be proximal (punctum and canaliculus), distal (lacrimal sac and nasolacrimal duct), or a combination of both. Lacrimal outflow dysgenesis can occur as an isolated finding or as a part of a systemic syndrome or dysmorphism. Lacrimal outflow dysgenesis is typically a sporadic finding but autosomal dominant inheritance has been

reported. Systemic syndromes or dysmorphism that involve abnormalities of facial development , such as clefting or malposition of the orbits or midface, can also give rise to maldevelopement of the lacrimal outflow system[14].

Anatomy of the nasolacrimal system:

A precise understanding of the anatomy of the lacrimal canalicular system is necessary for safe canalicular surgery[15].

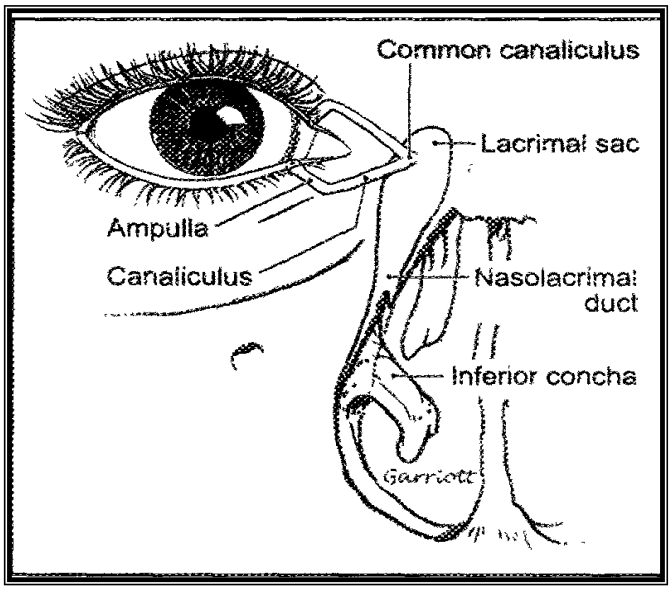

Figure (2), normal anatomy of the nasolacrimal system[16].

The lacrimal drainage system is formed of: the puncti, the canaliculi, the common canaliculus, the lacrimal sac and the nasolacrimal duct (NLD)[17]**.** The nasolacrimal canal is placed at the anterior part of the inferior medial wall of the orbit and opens to the inferior nasal meatus[18]. Morphology, morphometry and characteristics of the NLD have great importance during the exposure of the NLD in acquired and in congenital NLD pathologies[19]**.**

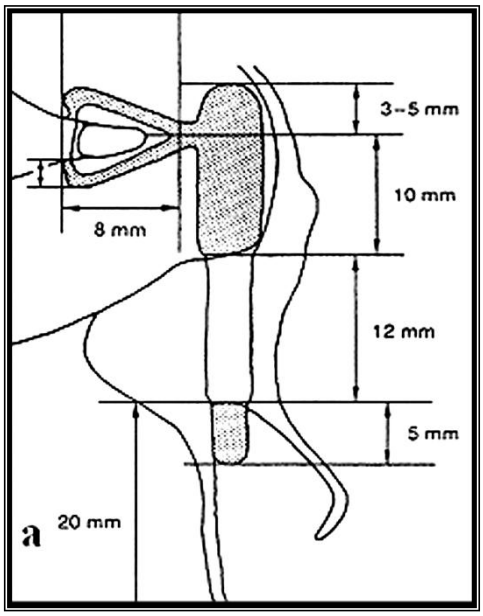

Figure (3) , The nasolacrimal system—right eye: Normal anatomy of the right nasolacrimal system[20].

Each punctum lacrimal is a small, round or oval orifice on the summit of an elevation, the papilla lacrimalis, near the medial end of the lid margin at the junction of its ciliated and non-ciliated parts. It is in a line with the openings of the ducts of the tarsal glands, the nearest of which is within 0.5-1mm. the upper punctum is slight medial to the lower, respective distances from the canthus being 6 and 6.5 mm however, in lid closure the puncta often make contact with each other. Normal puncta are visible only when lids are everted. Fibers of the orbicularis surround and press the punctum towards the lacus lacrimalis. Muscle atrophy makes the papilla more prominent, as commonly seen in elderly[21].

The Lacrimal Canaliculi:

Each canaliculus is first vertical then horizontal, facts of importance in passing a probe. The vertical part is about 2 mm long and turns medially at an almost right angle to become the horizontal part, about 8 mm in length. At the angle is a dilatation or ampulla. Both horizontal parts

converge towards the medial canthus and unite at an angle of about 25 degrees to form a common canaliculus 3 to 4 mm long in 90% of population[22], that opens into a small diverticulum of the sac, the lacrimal sinus of Maier, at a point on the posterolateral surface of the sac about 3 to 5 mm from its apex forming the valve of Rosenmuller[23]. Up to 2% of patients have no common canaliculus, the superior and inferior canaliculi entering the lacrimal sac separately[24]. The canaliculus is surrounded by fibers of orbicularis, and the medial third of the canaliculi are covered in front by the two bands which connect the medial palpebral ligaments to the tarsi, while behind is the deep head of pretarsal orbicularis (the lacrimal part of orbicularis oculi or Horner's muscle)[21].

The Lacrimal Sac:

The lacrimal sac is located in the lacrimal fossa on the anterior medial orbital wall. It lies entirely within the fossa unless expanded by a mucocele or other swelling. Although it is within the bony orbit, it lies anterior to the orbital septum. The sac is 12-15 mm tall and 4-6 mm antero-posteriorly, but only 2-3 mm wide. The entrance of the common canaliculus is 3-5 mm below the apex of the sac, the sac above is called the fundus, and that below, the body. The widest part of the sac is a few millimeters from the apex. The lacrimal fossa is lined by thin orbital periostium, which is continuous with the periostium over the frontal process of maxilla and body of the maxilla. The periostium is easily lifted off the bony fossa during external approach dacryocystorhinostomy (DCR). Surgical approaches to lacrimal fossa are either external, via the nose (transnasal or endonasal) or transcanalicular[25].

The Nasolacrimal Duct (NLD):

The nasolacrimal duct is the continuation of the lacrimal sac that extending through the nasolacrimal bony canal down to the inferior meatus of the nose. It starts at a mild constriction in the lacrimal sac called “the neck”, which is formed by indentation of the lacrimal sac by the superficial and deep heads of the inferior preseptal orbicularis. In its upper part the NLD is easily separable from bone, below it is closely adherent, forming a mucoperiosteum[21].

Some observed that one third of neonates have an angulation at the junction of the sac and duct and the distal NLD bends medially in irregular J shape which account for some difficulties encountered during probing[26]. The intra-osseous part of the NLD is 12 to 15 mm in length with additional membranous or mucosal part that extends for further 3 to 5 mm under the inferior turbinate and opens into the ostium lacrimalis which lie 30 to 35 mm from the external nares and 15 mm from the tip of the inferior turbinate[21]. This ostium is variable in shape and location, may be multiple and sometimes very difficult to find[27].

The bony canal is formed mainly by the maxilla and completed by the lacrimal bone and lacrimal process of the inferior concha. Numerous valves have been described in the NLD. They are folds of mucous membrane mostly with no valvular function. The most constant and important of these mucosal folds is the valve of Hasner (plica lacrimalis) at the lower end, which is a remnant of the fetal septum at the distal end of the lacrimal excretory system. The valve of Hasner can prevent a sudden blast of air (when blowing the nose) from entering the lacrimal sac[21].