Chapter Eleven

Endoscopic Dacryocystorhinostomy (DCR)

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Over the past decade, with the advent of the endoscopic sinus surgery there has been renewed interest in the endoscopic DCR. Endoscopic DCR was first described by McDonogh (1). Since then the techniques have improved as the understanding of the anatomy and the ability to achieve reliable and consistent results have improved.

The endoscopic DCR is indicated in the management of epiphora that is associated with primary acquired nasolacrimal duct (NLD) obstruction or NLD obstructions secondary to infiltrate or inflammatory mechanisms and as a complication of previous nasal surgery or facial trauma. The contra-indications for endoscopic DCR are neoplasm obstructing the lacrimal flow, entropion, ectropion, punctal abnormalities and blepharitis

Anatomy

The lacrimal excretory system consists of the main lacrimal glands, 10-12 secretory ducts, puncta, canaliculi, lacrimal sac and nasolacrimal duct. Tears are collected in the medial canthus, where they drain into the upper and lower puncta, 0.3mm opening situated about 5-6 mm from the canthal angle, on the summit of small papillae of the upper and lower eyelids. From each punctum the canaliculus passes vertically about 2mm to a receptacle called ampula. From ampula the canaliculus extends about 6-8 mm medially travelling through the orbicularis muscle before joining the lacrimal sac. The inferior and superior canaliculus formed together to form common canaliculus in 90-94% of the people before joining the lacrimal sac (2). During any probing procedure, the eyelid should be pulled laterally to straighten these channels to prevent injury. The common canaliculus and lacrimal sac are located between the anterior and posterior limbs of the medial canthal ligament. Prior to entry to the lacrimal sac the common canaliculus dilates slightly to form the sinus of Maier. It then enters the posterolateral wall of the lacrimal sac at the common internal punctum, creating an angle to form the valve of Rosenmuller. This prevents retrograde reflux of the tears from the sac (fig 1)

Fig.1: Lacrimal gland and lacrimal system

The lacrimal sac is a membranous conduit lined by modified nonciliated respiratory epithelium. On average it is 12-15 mm in height and extends 3-5 mm superior to the medial canthal ligament to form the fundus. It lies in the depression, the lacrimal sac fossa, formed by the frontal process of the maxillary bone anteriorly and a thin lacrimal bone posteriorly. Intranasally the lacrimal sac lies an average of 8.8 mm above the insertion of the middle turbinate (fig-2) (3).

Fig.2: The middle turbinate and lacrimal sac (dotted line)
The body of the sac extends from the level of canthal tendon down to the opening of the bony nasolacrimal canal. The duct travels within the bony nasolacrimal canal through the maxillary bone for approximately 11 mm, and continues 2-5 mm intranasally into the inferior meatus, 4-6 mm posterior to the beginning of the inferior turbinates (4). A fold of mucosa at the meatal termination of the duct forms the valve of Hanser. This helps to prevent the reflux of nasal material into the nasolacrimal duct.

Surgical Technique

Endoscopic DCR can be performed under local or general anaesthesia. Adequate local anaesthesia is achieved by installation of topical proparacaine or tetracaine in the conjunctival sac. Intravenous short-acting sedatives-hypnotics may enhance patient comfort. 2% xylocaine with 1:200 000 adrenaline or 0.75% bupivacaine is administered to provide an infraorbital nerve block. Local anaesthesia is also administered in the medial canthal region and medial eyelids. The nose is sprayed with 5% lidocaine with 0.5% phenylephrine solution. A ribbon gauze or 2cm neuroplagets soaked in 10% cocaine solution diluted with 10 ml of water is applied anterior to the point of insertion of the middle turbinate, the axilla of the middle turbinate and 1cm area above it. If general anaesthesia is used, decongestion of the nasal mucosa is achieved by spraying 5% lidocaine with 0.5% phenylephrine solution and applying the cocaine soaked ribbon gauze or neuroplagets.

Surgery begins by assessing the nasal septum particularly for any significant deflection in the region of the axilla of middle turbinates, which may need to be corrected by septoplasty for adequate exposure. The point of insertion of the middle turbinates and the lateral nasal wall and maxillary line are important landmarks for identifying the lacrimal sac (fig3).

Fig.3: Visualizing middle turbinate and the lacrimal sac area

This area is identified and infiltrated with 2% xylocaine and 1:200 000 adrenaline. We prefer a 0 degree scope but a 30 degree scope may be used. A flap is raised 5mm posterior and 8-10 mm above the axilla of the middle turbinate, the incision is brought 10 mm anterior to the axilla on to the frontal process of the maxilla. The incision is then turned vertically downwards and backwards towards the insertion of the uncinate under the middle turbinate (fig 4).

Fig.4: Designing the flap.

While raising the flap one should be careful over the junction of the frontal process of the maxilla with the thin lacrimal bone. To expose the lacrimal sac the bony lacrimal fossa needs to be uncovered. The identification of lacrimal fossa can be enhanced by transillumination(Fig 5). The Rosen knife (from ear instruments) is used to fracture the thin lacrimal bone (Fig 6).

Fig.5: Illuminating lacrimal fossa       Fig.6: Fracturing the lacrimal bone
The free frontal process of the maxilla is removed by the Higue punch. The rest of the thick bone is removed by powered endoscopic microdebrider with a rough diamond 2.5 mm DCR bur (Fig 7). Care should be taken not to damage the sac. As the posterior superior bone is removed the mucosa from the agger nasi cell is encountered. The inferior or superior punctum is dilated as the Bowmans lacrimal probe is passed and the tip of the probe is visualised with the endoscope, tenting the lateral wall of the lacrimal sac.

![Fig.7: Bone removal by diamond burr](image1)

![Fig.8: Marsupialisation of the sac](image2)

The lacrimal sac is then incised vertically for the whole length by using the lacrimal spear knife (Fig 8). The marsupialisation of the lacrimal sac is achieved by reflecting the mucosa of the lacrimal sac on the lateral nasal wall. The silastic O'Donaghue tubes are passed through the upper and lower canaliculus (Fig 9&10).

![Fig.9: Insertion of the O'Donaghue tubes](image3)

![Fig.10: Insertion of the O'Donaghue tubes](image4)

We use the Diode laser to open the canaliculi if required, before inserting the O'Donaghue Tubes. The tubes are then tied in the nasal vestibule in such a way to allow the appropriate length and tension of the silicon tubing to loop on the puncta and the medial canthus (Fig11). A neuroplaget soaked in mitomycin C is applied to the operated area in the nose. The flap is then incised to allow it to wrap around the O'Donaghue tube (fig 12) and held in place by rapid rhino packing (fig 13). O'Donaghue tubes are removed after 8-10 weeks.

![Fig.11: O'Donaghue tubes in the Puncta](image5)

![Fig12: Flap draped around O'Donaghue tubes](image6)

![Fig.13: Rapid rhino pack on the flap](image7)

**Results**

A successful outcome is defined as a patient who is asymptomatic and has a healed patent lacrimal ostium with a free
flow of fluorescence from conjunctiva to the nose (5). The success is influenced by the anatomical versus the functional block. Wormald and Tsirbas noted a success of 97% in patients who has anatomical obstruction but only 84% in patients who had functional outflow impairment. The reported outcome of endoscopic DCR is summarised. Our results are comparable with an overall success of 84% with one year follow up (Table 1).

<table>
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<th>Author</th>
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<td>Tripathi et al</td>
<td>46</td>
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<td>Tsirbas Wormald</td>
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<td>Lacrimal and nasal mucosal flap</td>
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<td>Javate, Pamintuan</td>
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<td>Mian et al</td>
<td>62</td>
<td>84%</td>
<td>Mucosal flaps, mitomycin C</td>
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Table 1: Result of endoscopic DCR

Our recent data shows that result have improved over previous years due to ‘the learning curve’ and gained experiences.

Complication

In our series the most common complications we have encountered are infection (17%), followed by displaced tube (7%) (due to internal migration), granuloma and nose bleed.

References

7. Tripathi A, Lesser TH, O'Donwell NP et al. Local anaesthetic endonasal endoscopic laser dacrocystorhinostomy: analysis of patients acceptability and various factors affecting the success of this procedure. Eye 2002; 16 (2): 146-9