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Endonasal dacryocystorhinostomy: Indications, technique and results*†

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SUMMARY *Dacryocystorhinostomy (DCR) allows an obstructed lachrymal drainage system to be drained into the nasal fossa. Since the development of endonasal microsurgical techniques, the endonasal approach presents itself as an alternative choice to the conventional external approach. It is far less traumatic, yet as efficacious as the conventional approach, and avoids the need for a skin incision and the disruption of the medial canthal structures. Twenty-six patients suffering from lachrymal system obstruction underwent 28 endonasal dacryocystorhinostomies under microscopical (n=25) or endoscopic control (n=3). Pre-operative assessment included clinical symptoms (sac swelling, purulent secretions, epiphora) and outflow obstruction on X-rays (conventional dacryocystography and/or subtraction macrodacryocystography). Post-operatively, 23 DCR were free of symptoms. Two presented occasional epiphora and three were unsuccessful. The presence of pre-operative purulent secretions was significantly correlated with post-operative success and with lachrymal sac patency, which is also confirmed by X-ray examination (p <0.001). Thus in cases of purulent secretion with epiphora, X-ray examination is redundant and may be avoided. On the contrary, when epiphora is an isolated symptom, X-rays must be performed in order to determine where the obstruction is located and to provide information on lachrymal sac morphology.*

Key words: lachrymal duct, endoscopic surgery, microscopical surgery, dacryocystorhinostomy, dacryocystography

INTRODUCTION

Dacryocystorhinostomy consists of diverting the lachrymal flow into the nasal fossa through an artificial opening made as a standard practice at the level of the lachrymal bone. This can be carried out by an external or endonasal surgical approach. Toti described the external approach in 1904. This surgical route is the best known, the most frequently performed and primarily, the first choice for ophtalmologists. However, it produces a facial scar and disruption of the medial canthal ligaments which may lead to dysfunction of the lachrymal pump (Jones, 1961). The endonasal approach was proposed by Caldwell (1893) at the end of the last century and by Polyak (1913), Halle (1916), Mosher (1921) and West (1926) between 1910 and 1926. Unfortunately, the lack of adequate optical devices was the cause of inaccurate surgical procedures at that time and subsequently led to poor post-operative results. Nowadays, since the development of the endonasal microsurgical techniques (Rouvier et al., 1981; Kennedy, 1985; McDonogh, 1992; El Khoury and Rouvier, 1992) and owing to the thorough knowledge of sino-orbito-nasal anatomy, endonasal dacryocystorhinostomy (EDCR) presents itself as an alternative choice to the conventional approach. Besides conventional clinical assessment of lachrymal duct obstruction, X-ray investigations such as dacryocystography and/or subtraction macrodacryocystography (SMDG; Amonat et al., 1979; Jenny et al., 1984) may show where in the nasolachrymal duct (LD) the obstruction lies and whether the lachrymal sac (LS) is free or occluded by fibrosis. This retrospective study of our three-year experience in EDCR technique is aimed at defining the efficiency of dacryocystography in predicting EDCR post-operative results and at facilitating the surgical procedure, compared to more simple pre-operative assessments such as LS swelling and the presence of purulent secretions.

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MATERIAL AND METHODS

Since May 1990, 26 patients (8 male and 18 female) underwent 28 EDCR (17 left sides and 11 right sides) for chronic epiphora amongst other ophtalmological complaints. Patients' ages ranged from 3 and 85 years (mean: 47.5 years), amongst them three children (3, 6 and 7 years).

Patients were examined by an ophtalmologist and underwent conventional dacryocystography and/or SMDG (Figures 1-2) in 23 out of 28 sides for pre-operative assessment, according to the technique described by Amonat et al. (1979).

No X-ray examination was performed in two children (3 and 6 years) to avoid irradiation and in three cases of acute dacryocystitis with huge external swelling of the LS. Table 1 summarizes causes of LD obstruction. EDCR were performed under general anaesthesia, without hypotension, after nasal fossa packing with neurosurgical swabs soaked in 5% naphtazoline/xylocaine and after the head of the middle turbinate and the mucosa surrounding the lachrymal bone were infiltrated with 0.001% adrenalin/xylocaine. The patient lay in dorsal decubitus with the head on a headrest upon which an orthostatic arm was fixed. In 25 procedures, a binocular operating microscope (300-mm focal lens) was used; in three procedures, EDCR was performed under endoscopic control (Wolf Panoview Plus, 4 mm, 30°). Operating steps are displayed in Figures 3 to 6. In the first step the lachrymal bone is exposed by in-fracturing the middle turbinate, which is retained in its new position by a self-retaining surgical nasal speculum with two blades of different length. The speculum is fixed upon the orthostatic arm attached to the operating table. A posterior pediculed flap of nasal mucosa is made using a coagulating tip (Figure 3) and dissected backwards off the lachrymal bone up to the uncinate process. The lachrymal bone is then gently drilled (Figure 4) until the LS is widely uncovered. When infected and swollen, the sac can be immediately incised lengthwise (Figure 5). In the case of fibrosis and stenosis involving the LS proper, a metallic lachrymal probe can be passed through medially via one of the canaliculi and gently pushed to tent the sac thus localizing the exact position of sac lumen. An incision is then made with electrocautery avoiding any contact with the lachrymal probe which may cause iatrogenic cauterization of the lachrymal punctum or canaliculus. Both nasal and lachrymal flaps are adjusted in size and stapled together with titanium neurosurgical clips (Figure 6). A teflon bicanalicular nasal probe may be put in place for three or four months in exceptional circumstances, mostly in case of severe fibrosis of the sac and in case of associated obstruction between

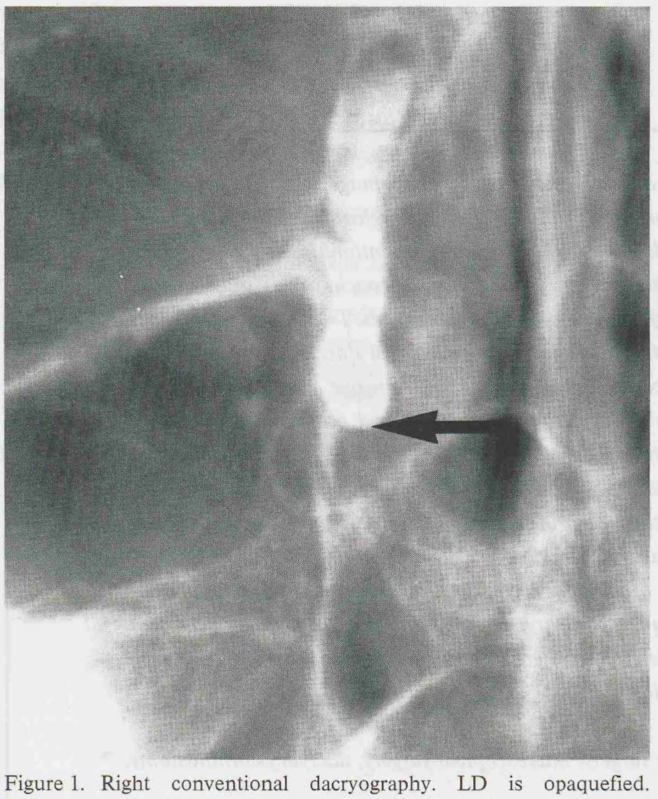

Figure 1. Right conventional dacryography. LD is opaquefied. Blockage in the LD (arrow) is situated near to the lachrymal opening in the inferior meatus.

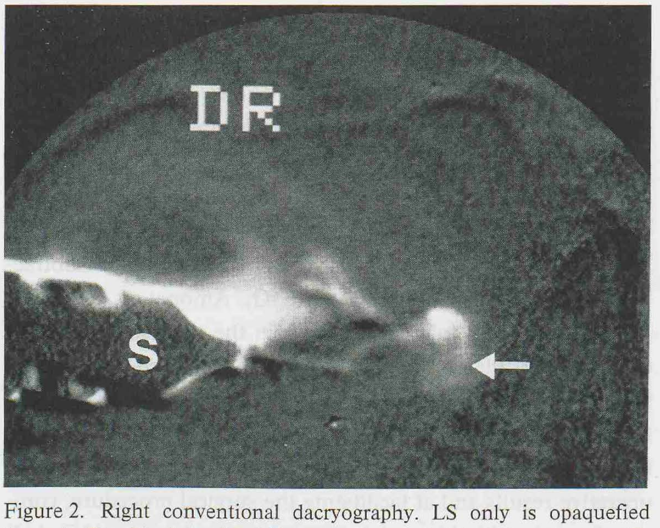

Figure 2. Right conventional dacryography. LS only is opaquefied (arrow). The block in the LD occurs immediately below the sac (S: syringe and catheter).

Table 1. Causes of lachrymal duct occlusion (n=28 sides).

	children	adults
TRAUMATIC		
- Lefort	–	3*
- orbitofacial fracture	–	1(a)
POST-SURGICAL		
- inferior antrostomy	–	1*
- lateral rhinotomy	–	1*
- De Lima	–	1*
- unsuccessful external DCR	1(b)	1(b)
INFECTIONS		
- recurring	2*	4(c)*
- chronic	–	8*
- dacryolith	–	2*
ISOLATED EPIPHORA	–	3(d)

(a) with eyeball enucleation.
(b) unsuccessfull external DCR performed for chronic infection.
(c) 1 case associated with facial cellulitis; 1 bilateral case with residual swelling of the LS; skin fistula.
(d) 3 cases of isolated epiphora with full permanent obstacle of the whole the LD.
* purulent secretion.

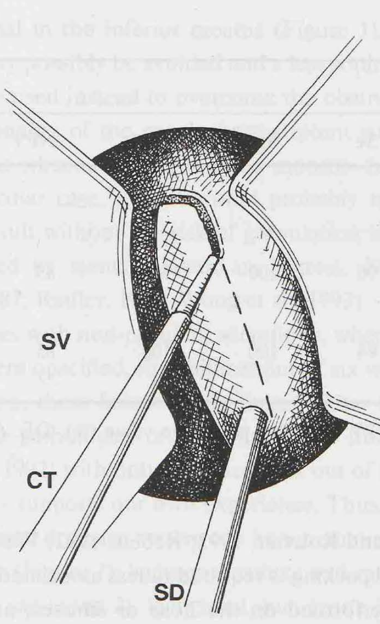

Figure 3. Left nasal fossa. A posterior pediculed flap of nasal mucosa is made and turned backwards (SV: nasal speculum valves; CT: coagulating tip; SD: suction device).

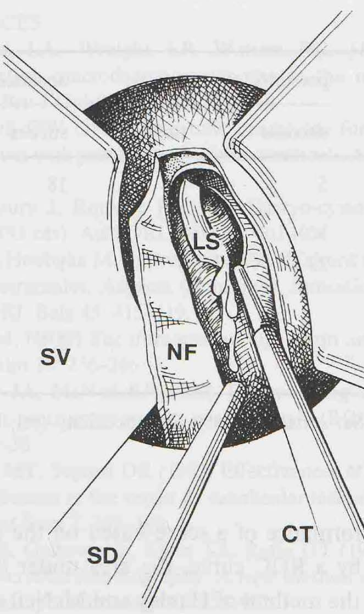

Figure 5. Left nasal fossa. LD and LS are opened (SV: nasal speculum valves; SD: suction device; CT: coagulating tip; NF: nasal flap; LS: lachrymal sac).

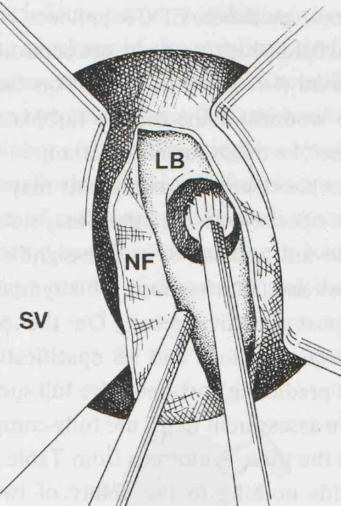

Figure 4. Left nasal fossa. The lachrymal bone is gently drilled to uncover widely the mucosa of the LD and the LS (SV: nasal speculum valves; SD: suction device; NF: nasal flap; LB: lachrymal bone).

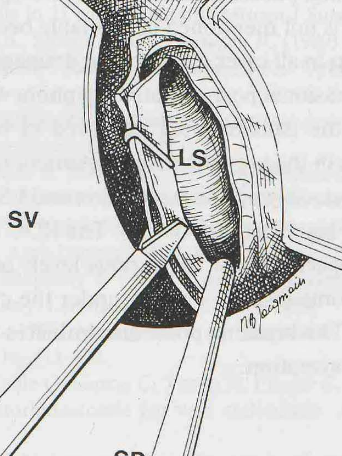

Figure 6. Left nasal fossa. Both nasal and lachrymal flaps are carefully adjusted in size, and stapled together with titanium clips. (SV: nasal speculum valves; SD: suction device; LS: lachrymal sac).

the lachrymal punctum and the external wall of the LS. No nasal packing is required unless there has been associated nasal surgery (i.e. septoplasty). Syringing of the LD is carried out at the end of the operation and on the first post-operative day.

Post-operative results were evaluated on the basis of: (1) persistent or occasional epiphora; (2) LS swelling, and (3) persistent or recurrent infection. Absence of these three symptoms was considered as a full post-operative success. Post-operative occasional epiphora which can be considered as a clinically reasonable result, was nevertheless classified as a failure in the statistical analysis.

In order to distinguish pre-operative factors which might be involved in determining the success rate, pre-operative assessment of the LD was recorded as follows: (1) epiphora, (2) purulent secretion, (3) clinical swelling of the LS, and (4) opacification of the LS by SMDG or conventional dacryocystography.

A Fisher Exact Test was used for comparing frequencies of pre-operative symptoms in the success and failure groups. In case of a statistically significant difference, the performance of the symptom for predicting post-operative results was assessed by sensitivity, specificity, positive and negative predictive values and diagnostic efficiency (i.e., percentage of correct predictions).

Table 2. Results.

	presence of symptoms		absence of symptoms							
	success	failure	succes	failure	p-value	Se	Sp	PPV	NPV	DE
clinical sac swelling (n=28)	5	0	18	5	NS					
purulent secretions (n=28)	22	0	1	5	p <0.001	96	100	100	83	96
LS opacification/ X-ray (n=23)	17	0	1	5	p <0.001	94	100	100	83	96

NS: non-significant; Se: sensitivity (%); Sp: specificity (%); PPV: positive predictive value (%); NPV: negative predictive value (%); DE: diagnostic efficiency (%).

The prognostic performance of a score based on the scores of items was studied by a ROC curve, the area under the curve being estimated by the method of Hanley and McNeil (1982).

RESULTS

Based on a 6 to 39 months' follow-up (mean: 18.3 months), 23 out of 28 EDCR are free of any symptoms. Two EDCR experience occasional epiphora without infection. Three are unsuccessful cases, with persistant epiphora.

Table 2 displays results according to pre-operative assessment for clinical swelling, purulent secretion and LS opacification by X-ray. Epiphora is not mentioned in this table because it is present by definition in all cases of lachrymal drainage obstruction. Two cases of occasional post-operative epiphora were classified as failures, but the patients were improved in both cases. In comparing items in the pre-operative assessment relative to successes and failures, only purulent secretion and LS opacification were statistically significant ($p < 0.001$). The ROC curve relating sensitivity to 1-specificity for the various levels of the score of the three symptoms displays an area under the curve equal to 0.97 ± 0.03 (SE). The breaking point discriminates between zero and at least one symptom.

DISCUSSION

EDCR enables the drainage of the lachrymal flow into the nasal fossa with a high success rate of 23/28 in this series. Twenty-five procedures were conducted under binocular operating microscope control versus three under endoscopic control. Both techniques are very safe, but telescopes are frequently spotted by blood, bone dust and nasal secretion during the drilling procedure. This fact may produce some delay. Microscopical control allows the surgeon to use both hands, which makes it easier to protect the mucosal flap when drilling, and enables the nasal and lachrymal mucosa to be clipped together accurately.

The endonasal approach has several advantages over the external approach (Woog et al., 1993): (1) it is far less traumatic; (2) a facial scar is avoided, which most patients do prefer; (3) there is no disruption of the medial palpebral ligaments and of the angular facial vessels, and thus the effect of Jones' lachrymal pump is preserved; (4) access to LS is direct through the lachrymal bone, avoiding double-side dissection of the sac (Eloy et al., 1991; El Khoury and Rouvier, 1992; Rebeir, 1992; Woog et al., 1993); (5) no nasal packing is required unless associated surgical procedures are performed on the nose or sinuses; and (6) it enables acute dacryocystitis unresponsive to the medical treatment to be drained into the nose.

The conventional external route for DCR gives a 3–15% reported failure rate which is mainly due to scar and synechiae between the DCR stoma, the septum and/or the head of the middle turbinate (Welham et al., 1987; McLachlan et al., 1980). Under endoscopic or microscopic guidance, EDCR provides control of the nasal inner surgical field which is usually not controlled when the external route is used (Orcutt et al., 1990). This lack of control may induce more wounds at the middle turbinate and at the septum (e.g., in case of a major septal deviation).

Some items in the pre-operative assessment may be useful in predicting the post-operative result, others may not. Clinical sac swelling is not relevant because of its non-significant distribution in both success and failure groups. This symptom can thus not predict the post-operative result. On the contrary, the presence of purulent secretions and LS opacification by X-ray were significant in predicting post-operative full successes. Both these pre-operative assessment items are fully comparable. The ROC curve scores the three symptoms from Table 2 and shows that this score adds nothing to the ability of two individual symptoms (purulent secretions, LS opacification by X-ray) to predict success or failure.

This means that in the cases with clinically purulent secretions, X-ray assessment of the LD and LS may be therefore redundant. In all the cases with purulent secretions, LD obstruction was seen on dacryocystography and confirmed by surgery. Therefore, X-ray may be avoided without consequence upon the surgical procedure and post-operative prognosis. However, in a few cases of non-purulent secretions, SMDG may be of interest in providing information on sac morphology when partially fibrosed. In two cases, SMDG facilitates access to the LS lumen by offering information on sac thickness to the surgeon. Furthermore, X-ray assessment may suggest pathology of the canaliculi which might explain some of the failures in the group with non-purulent secretions. SMDG or dacryocystography may also give information about the level of the LD obstruction e.g. iatrogenic stenosis of LD near the opening of the nasolachrymal canal in the inferior meatus (Figure 1). In these cases, EDCR may possibly be avoided and a less sophisticated surgical procedure used instead to overcome the obstruction, such as a simple opening of the nasolachrymal point sustained by a bicanalicular silicone stent for three months duration. Even in this particular case, EDCR would probably have produced a similar result without the risk of granulation tissue which may be induced by stents (Hawes an Segrest, 1985; Jordan and Nerad, 1987; Reifler, 1991; Woog et al., 1993).

In the cases with non-purulent secretions, when neither the LD nor LS were opacified, five failures out of six were observed. In our opinion, these failures were linked either to misdiagnosed canalicular pathologies or to complete LS fibrosis. Data from Mannon (1992) with only two successes out of seven cases with LS fibrosis supports our own experience. Thus, in our opinion, the lachrymal drainage system can be schematically divided into four zones (Figure 7): lachrymal puncta and canaliculi (zone 1), lachrymal sac (zone 2), lachrymal duct (zone 3) and the nasolachrymal point (zone 4) for diagnosis and operating purposes. In the case of purulent secretions, zones 1 and 2 are always patent and free; blockage can occur in either zones 3 or 4. In the case of obstruction in zone 4, alternative surgery may be chosen, but EDCR should theoretically provide the same surgical outcome. In the absence of purulent secretions, an X-ray is useful in providing information on blockages in zone 1 and zone 2, but incomplete blockage of the canaliculi can be by-passed by the catheterization manoeuvre which is need for X-ray opacification. In these rare cases, zones 2, 3 and 4 will be clearly opacified. Thus, epiphora with radiologically normal tearways raises suspicion of canalicular pathology which is not an indication for EDCR. In case of pathological canaliculi associated with poor opacification or no opacification in zone 2, 3 and 4, the diagnosis still remains a matter of discussion and the source for bad surgical results.

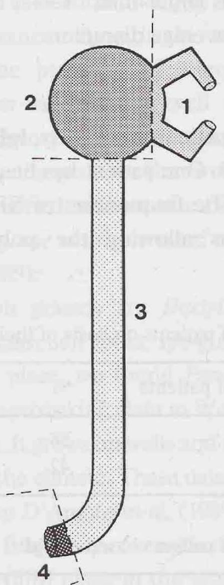

Figure 7. Lachrymal drainage apparatus divided into four zones. Zone 1: lachrymal puncta and canaliculi; zone 2: lachrymal sac; zone 3: lachrymal duct; zone 4: nasolachrymal point in the inferior meatus.

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