Endoscopic dacryocystorhinostomy for recurrent epiphora after previous nasolacrimal duct surgery

Mostafa Talaat  
Department of Otorhinolaryngology, Minia University, El-Minia 61519, Egypt, mostafatalaat1981@gmail.com

Balegh H. Abdelhak  
Department of Otorhinolaryngology, Minia University, El-Minia 61519, Egypt

Ayman Samir Megahed  
Department of Otorhinolaryngology, Cairo University, Egypt

Mohamed Esmail Khalil  
Department of Ophthalmology, Minia University, El-Minia 61519, Egypt

Raafat Abdelrahman Abdallah  
Department of Ophthalmology, Minia University, El-Minia 61519, Egypt

See next page for additional authors

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Authors
Mostafa Talaat, Balegh H. Abdelhak, Ayman Samir Megahed, Mohamed Esmail Khalil, Raafat Abdelrahman Abdallah, and Ahmed Abdel Rahman Abdelaziz

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Endoscopic Dacryocystorhinostomy for Recurrent Epiphora After Previous Nasolacrimal Duct Surgery

Mostafa Talaat a,*, Balegh H. Abdelhak a, Ayman S. Megahed b, Mohamed E. Khalil c, Raafat A. Abdallah c, Ahmed A. Abdelaziz a

a Department of Otorhinolaryngology, Minia University, Minia, Egypt
b Department of Otorhinolaryngology, Cairo University, Cairo, Egypt
c Department of Ophthalmology, Minia University, Minia, Egypt

Abstract

Background: Revision of external dacryocystorhinostomy (DCR) may be required due to various factors, including complications of the initial surgery or unaddressed concurrent nasal pathologies. This study focuses on endonasal revision DCR for patients with persistent epiphora symptoms after failed external DCR.

Patients and methods: We included 67 patients (19 male and 48 female), aged 19–45, who had previously undergone primary external DCR and presented with persistent epiphora symptoms after at least 12 months of the primary procedure. All patients were clinically examined for concurrent nasal pathology by exploratory endoscopy and computed tomography of the nose and paranasal sinuses. Revision endonasal DCR was carried out while concomitantly correcting any underlying nasal pathology.

Results: Examination of patients revealed nasal septal deviations in all patients, hypertrophied turbinates in 48 patients, complete nasal obstruction in 25, dacryocystitis in 23, and narrow ostium in 16 patients, besides other lower frequency conditions. All underlying pathologies were corrected surgically in the same surgical setting. Success was achieved in 60 (89.6 %) patients. Failure in seven (10.4 %) patients.

Conclusion: The results of this study highlight the significance of comprehensive preoperative assessment and anatomical evaluation for both primary and revision DCR procedures. Treating epiphora with endonasal endoscopic DCR while correcting the associated nasal pathologies would enhance the success rate.

Keywords: Dacryocystitis, Dacryocystorhinostomy, Endoscopy, Epiphora, Lacrimal abscess

1. Introduction

Dacryocystorhinostomy (DCR) is a surgical intervention to circumvent an obstructed nasolacrimal duct by establishing a patent aperture between the lacrimal sac and the nasal cavity. It is a clinically proven and reliable surgical intervention to manage conditions such as epiphora and dacryocystitis [1].

Surgeons mostly use two techniques in DCR surgery: external DCR and endonasal DCR. The conventional external DCR includes making a minor surgical incision near the medial canthus of the eye. Subsequently, the lacrimal sac is discerned and incised, establishing a novel aperture leading into the nasal cavity. This technique involves the utilization of a chisel or drill to generate an osteotomy within the medial wall of the lacrimal sac. The mucosa of the lacrimal sac is subsequently sutured to the nasal mucosa, establishing a novel conduit for the drainage of tears [2,3].

The procedure of endonasal DCR is a minimally invasive technique that can be executed with endoscopic vision, the nasal endoscope provides visual access to the lacrimal sac, where direct visualization facilitates the osteotomy [4,5].

Surgeon preference and patient clinical presentation determine the external or endonasal DCR
choice [6]. Endonasal DCR is becoming more popular due to its less invasiveness and faster recovery. While most endonasal and external DCR procedures are safe and effective, there is a slight possibility of encountering complications such as bleeding, infection, scarring, and inadequate symptom resolution. In all cases, clear postsurgical instructions are necessary to ensure successful outcomes after DCR. Patients usually receive prescription eye preparations, nasal saline rinses to prevent infection, and analgesics [7]. In addition, patients should avoid vigorous physical activity, keep the surgery site clean, and attend postoperative consultations as instructed by the surgeon [8].

The primary factor leading to the need for revision in external DCR is the inability of the initial surgery to establish a patent ostium. Common causes of such failure include incomplete excision of the obstructed tissue, formation of scar tissue in the ostium, and displacement of the silicone stent. Moreover, concurrent nasal pathologies, such as a deviated septum, hypertrophic turbinites, concha bullosa, nasal polyposis, and enlarged choanal adenoid, might increase the need for revision DCR [9,10]. Additional factors that may contribute to primary DCR failure include recurrent dacryocystitis, granulation tissue formation, dacryolithiasis, trauma, and lacrimal system malignancies [11-13].

In this study, we present the outcomes of endonasal revision DCR in patients suffering from persistent epiphora after failure of external DCR. In addition, this study aimed to address and highlight the possible underlying nasal pathologies that could be the cause of failure of the primary external DCR. The concurrent manifestations, surgical interventions, and treatment outcomes are discussed.

2. Patients and methods

2.1. Study design and population

This study followed a prospective interventional design in 67 patients who had previously undergone primary DCR surgery by an external approach (external DCR) and presented with persistent epiphora symptoms after at least 12 months of the primary procedure. All patients were received in the Departments of ENT and Ophthalmology (Minia University Hospital). Endoscopic revision DCR was performed for all cases between January 2019 and January 2022. All patients provided written informed consent for both the surgical procedure and subsequent follow-up. Ethical approval from the Institutional Review Board, Faculty of Medicine, Minia University (Approval number 330-4-2022).

2.2. Preoperative assessment

Data were collected for each operated eye separately. Preoperative information included demographics (age and sex) and duration of preoperative epiphora complaints after the primary external DCR. All patients with a history of external DCR and prolonged epiphora or positive regurge of mucoid or mucopurulent discharge during or after tube removal were included in this study unless they had neoplastic etiology during primary screening. Nasolacrimal saline irrigation was applied to all patients. Each patient was examined for concurrent nasal pathology by exploratory endoscopy and computed tomography (CT) of the nose and paranasal sinuses.

2.3. Surgical procedures

The first procedure is done by ophthalmologist and revision procedure is done by team of rhinologist and ophthalmologist.

Before the endonasal revision DCR, patients followed a brief regimen (5 days) of oral corticosteroids (1 mg/kg/day). Alternatively, a corticosteroid was applied to the affected area if a granuloma was present. This intervention aimed to mitigate the concurrent inflammation. A team comprising a rhinologist and an oculoplastic surgeon performed the surgical procedures on patients lying in a supine position under general anesthesia. A gauze pack soaked in a mixture of xylometazoline HCl and adrenaline (0.1 % each) was inserted to decongest each nostril for 10 min before the administration of general anesthesia. When the patient was ready for endonasal revision DCR, an additional vasoconstriction treatment was achieved for the superior and inferior maxillary lines. The endoscopic revision surgery was carried out with the help of 0° endoscopic inspection.

Septoplasty was performed in cases suffering blockage due to a deviated septum. A mucoperiosteal incision was done to create a flap that was then elevated above the lacrimal eminence and resected to expose the frontal maxillary process, unveiling the lacrimal sac. The lacrimal bone was lifted using a Freer tool in the lower posterior part of the lacrimal sac, and the maxillary part of the lacrimal duct was dissected using a Kerrison punch until the entire lacrimal sac was fully exposed (Fig. 1a), opened by a sickle knife longitudinally in
an open-book fashion (Fig. 1b) and the medial wall
of the sac was respected by a through-cut forceps.
Finally, the superior punctum was dilated using a
Bowman probe after extensively incising the
lacrimal sac with an 11-blade, a bicanalicular sili-
cone tube was inserted (Fig. 1c and d). A non-
medicated sterile nasal pack was introduced into the
nasal cavity and maintained for 48 h.

The associated nasal pathology was corrected in
the same setting during the endonasal revision DCR
procedure. Patients with hypertrophic turbinates
underwent bilateral turbinoplasty, while those
suffering from concha bullosa received endoscopic
lateral laminectomy. Adenoids obstructing choana
were removed by endoscopic adenoectomy. Cases
with nasal polyposis were corrected with functional
endoscopic sinus surgery. Any synchiae resulting
from the previous operation between the septum and
the inferior turbinate was resected using bipolar
diathermy. Any missed tube (of the prior procedure)
was removed during the surgical procedure before
the revision DCR. Unilateral allergic fungal sinusitis
was treated with unilateral functional endoscopic
sinus surgery. Patients with unilateral maxillary
sinusitis underwent unilateral middle meatal
antrostomy, and those with unilateral choanal atresia
had unilateral endoscopic canalization treatment.

Following the completion of the endonasal revi-
sion DCR procedure, saline irrigation of the supe-
rior and inferior canaliculi under endoscopic
visualization was carried out to ensure patent
drainage.

Standard postoperative medications included
alkaline nasal wash, oral antibiotics, nasal cortico-
steroids, and decongestants. Antibiotics and corti-
costeroid eyedrops were used to reduce the risk of
granuloma formation and to allow a permanent
drainage pathways.

Follow-up regimen: postsurgical follow-up was
carried out for 18 months: weekly in the first month,
monthly until tube removal (additional 5 months),
and then every 3 months for 1 year after tube
removal. In each visit, the outcomes of the endo-
soscopic surgery were evaluated. The observation of
synchiae, the ostium, and the lacrimal sac condition
were meticulously assessed. To avoid possibly pro-
longing the inflammatory response, the silicone
tubes were removed earlier than is customary.

Fig. 1. Representative images from the surgical procedure. (a) The full length of the lacrimal sac was exposed (Sac); (b) sickle knife (*) during opening
of the lacrimal sac; (c) insertion of the silicone tube through the neo-ostium; and (d) position of the silicone tube at the end of the procedure showing
the knob (arrow).
2.4. Statistical analyses

Data entry and statistical analyses were conducted using the SPSS® software for Windows (SPSS Statistics, Version 22.0, IBM Corp., Armonk, NY, USA). The study findings were illustrated using descriptive statistics. Quantitative variables such as the age and duration after external DCR were tested for normality using Kolmogorov–Smirnov and presented as the mean and SD. The qualitative data were depicted through frequencies and percentages. One-sample \( \chi^2 \) tests were used to assess categorical variables. Pearson’s test of independence was used to test the association of different variables, and Spearman’s correlation factor (rho) was determined to assess the correlation between tested variables. Statistical significance was considered when a two-tailed \( P \) value was less than 0.05.

2.5. Study outcomes

The main outcome of this study was the surgical success of the endoscopic approach, defined as anatomical or functional success established in postoperative follow-up visits. Anatomical success was described as a patent lacrimal duct based on free fluid passage and no reflux with lacrimal syringing. Functional success was determined by the absence of symptoms after surgery based on the lack of patient complaints in postoperative clinic visits.

3. Results

This study comprised 48 (71.6 %) females and 19 (28.4 %) males who suffered from chronic epiphora symptoms after 12–36 months of external DCR surgery. We observed no significant difference in age between the female (31.54 ± 7.88; median = 32 years) and male (28.53 ± 7.67; median = 29 years) participants (\( P = 0.160 \), unpaired \( t \) test). Similarly, both sexes showed comparable durations after the primary DCR surgery (Table 1). Moreover, our initial screening results (Table 1) showed that the side of the affected nostril was sex independent.

The nasal endoscopy and CT scan results showed that all patients suffered from underlying pathological condition(s): nasal, ophthalmological, or both, as well as symptoms. This result is summarized in Table 2, whereas representative images of some underlying pathologies are shown in Fig. 2. Although a significant difference existed between the actual total counts in all categories compared with the expected frequencies, further analysis showed no significant association between these underlying pathologies and patient sex (all two-tailed \( P \) values are >0.05, \( \chi^2 \) test, Table 2). Noteworthy is that all cases presented with nasal septal deviation that required septoplasty.

The results in Table 2 show that the most frequently encountered nasal pathology or complaint was hypertrophied turbinate (48 cases), followed by complete nasal obstruction that was either unilateral in 12 cases (one case choanal atresia, 11 deviated septum) or bilateral in 13 patients (three cases with bilateral nasal polyposis and 10 cases with chronic hypertrophic rhinitis).

Further analysis of such association by Spearman’s correlation coefficient showed a negative significant moderate association. Besides, all cases complaining of closed nasality demonstrated hypertrophied turbinates \( (\chi^2 = 4.115, \text{DF } = 1, \text{ } P = 0.042) \). Closed nasality was weak but significantly associated with hypertrophic turbinates. On the other hand, none of the less frequent nasal pathologies such as chronic adenoids (five cases), granuloma tissue (five cases), concha (five cases), nasal polyposis (four patients), or synechia (four cases) showed statistically significant association with hypertrophied turbinates.

Testing the association between hypertrophied turbinates and underlying ophthalmological pathological conditions using the \( \chi^2 \) test of independence revealed a significant association with dacryocystitis and narrow ostium (Table 3). However, these conditions were negatively associated with hypertrophied turbinates, meaning that of the 48 cases, only seven and one patients suffered from dacryocystitis \( (\text{rho } = -0.661, \text{ } P < 0.01) \) and narrow ostium \( (\text{rho } = -0.813, \text{ } P < 0.01) \), respectively (Table 3).

<table>
<thead>
<tr>
<th>Sex</th>
<th>( n )</th>
<th>Mean</th>
<th>SD</th>
<th>( P ) (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>19 (28.4)</td>
<td>25.05</td>
<td>6.996</td>
<td>0.430 (( t ) test)*</td>
</tr>
<tr>
<td>Female</td>
<td>48 (71.6)</td>
<td>23.60</td>
<td>6.636</td>
<td></td>
</tr>
<tr>
<td>Side</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>19 (28.4)</td>
<td>28.53</td>
<td>7.669</td>
<td>0.160 (( t ) test)*</td>
</tr>
<tr>
<td>Female</td>
<td>48 (71.6)</td>
<td>31.54</td>
<td>7.882</td>
<td></td>
</tr>
</tbody>
</table>

\( \text{DCR, dacryocystorhinostomy.} \)

* Unpaired \( t \) test was used to compared means within each category subdivided by sex.

b \( \chi^2 \) test was carried out on the total counts ‘left’ and ‘right’ subdivided by ‘sex’ in comparison with the minimum expected frequency in each case.

Table 1. Duration after primary external dacryocystorhinostomy, age, and side characteristics in male and female patients

Table 2. Age and side characteristics in male and female patients
As this study showed that 11 (16.42%) of the 67 patients complained of sinogenic headache, we tested its relationship with other underlying pathologies using Pearson’s $\chi^2$ test of independence. Data analysis showed that sinogenic headache was significantly associated with concha, complete nasal obstruction, and unilateral maxillary sinusitis (Table 3). Both concha and unilateral maxillary sinusitis were positively correlated with sinogenic headache. At the same time, complete nasal obstruction showed a negative association — no other underlying pathology or complaint associated with the development of sinogenic headache in the studied participants.

On the other hand, we observed dacryocystitis in 23 cases as the most frequent ophthalmologic finding, followed by narrow ostium and lacrimal abscess in 16 and five patients, respectively. A $\chi^2$ test was conducted to test the possible association between these parameters. The results in Table 4 show that dacryocystitis was statistically associated with the presence of narrow ostium (14 out of 16 cases, $P < 0.001$, $\chi^2$ test) and lacrimal abscess (all five cases, $P < 0.001$, $\chi^2$ test). These two parameters were positively associated with dacryocystitis (Spearman’s rho values, Table 5). Table 3 shows a statistically significant but inverse association existed between dacryocystitis and hypertrophied turbinates. Nonetheless, none of the other underlying conditions or symptoms was associated with complaining of sinogenic headache in the study participants.

All patients received endonasal revision DCR with simultaneous correction of associated underlying pathology in the same surgical setting, as described in the Patients and methods section. Sixty patients showed signs of functional and surgical success (15 males and 45 females), with an overall success rate of 89.6%. On the other hand, the endonasal revision DCR procedure was unsuccessful in four male and three female patients (total $n = 7, 10.4\%$). However, failure as an outcome was weakly, but insignificantly, dependent on sex (Fig. 3).

### 3.1. Complications

One case of mild epistaxis postoperative which was controlled by bipolar diathermy (posterior end...
Fig. 2. Representative images of underlying pathologies. (a) A case of nasal polyposis (*); (b) choanal adenoid (*); (c) concha bullosa (*); (d) synechia at multiple sites (arrows) between the inferior turbinate and nasal septum; (e) pus flowing after opening the lacrimal sac denoting a lacrimal abscess (*); and (f) congenital choanal atresia (*).

Table 3. Correlation between the most common nasal and ophthalmological pathologies and complaints

<table>
<thead>
<tr>
<th>Hypertrophied turbinate</th>
<th>Dacryocystitis</th>
<th>Spearman’s rho</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>7&lt;sub&gt;a&lt;/sub&gt;</td>
<td>16&lt;sub&gt;b&lt;/sub&gt;</td>
</tr>
<tr>
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<td>3&lt;sub&gt;b&lt;/sub&gt;</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
<td>19</td>
</tr>
</tbody>
</table>

Narrow ostium

<table>
<thead>
<tr>
<th>Hypertrophied turbinate</th>
<th>Dacryocystitis</th>
<th>Spearman’s rho</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td></td>
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<tr>
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<td>1&lt;sub&gt;a&lt;/sub&gt;</td>
<td>15&lt;sub&gt;b&lt;/sub&gt;</td>
</tr>
<tr>
<td>No</td>
<td>47&lt;sub&gt;a&lt;/sub&gt;</td>
<td>4&lt;sub&gt;b&lt;/sub&gt;</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
<td>19</td>
</tr>
</tbody>
</table>

Each subscript letter denotes a subset of sinogenic headache categories whose column proportions do not differ significantly from each other at the 0.05 significance level.

**Correlation is significant (2-tailed) at the 0.01 level.

Table 4. Association of dacryocystitis with other underlying lacrimal pathology

<table>
<thead>
<tr>
<th>Dacryocystitis</th>
<th>Narrow ostium</th>
<th>Spearman’s rho</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>14&lt;sub&gt;a&lt;/sub&gt;</td>
<td>2&lt;sub&gt;b&lt;/sub&gt;</td>
</tr>
<tr>
<td>No</td>
<td>9&lt;sub&gt;a&lt;/sub&gt;</td>
<td>42&lt;sub&gt;b&lt;/sub&gt;</td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>44</td>
</tr>
</tbody>
</table>

Lacrimal abscess

<table>
<thead>
<tr>
<th>Dacryocystitis</th>
<th>Narrow ostium</th>
<th>Spearman’s rho</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>5&lt;sub&gt;a&lt;/sub&gt;</td>
<td>0&lt;sub&gt;b&lt;/sub&gt;</td>
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<td>18&lt;sub&gt;a&lt;/sub&gt;</td>
<td>44&lt;sub&gt;b&lt;/sub&gt;</td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>44</td>
</tr>
</tbody>
</table>

Each subscript letter denotes a subset of sinogenic headache categories whose column proportions do not differ significantly from each other at the 0.05 significance level.

<sup>a</sup>Correlation is significant (2-tailed) at the 0.01 level.
Two cases of orbital ecchymosis which spontaneously improved within 5 days postoperative.

4. Discussion

This study presented the outcomes of endonasal revision DCR in 67 patients after failure of external DCR surgery. All patients complained of epiphora with underlying nasal or ophthalmological pathology at presentation. All participants underwent nasal septal correction, and 48 instances required turbinoplasty. The success rate of endonasal revision DCR in the current work was 89.6 %, leaving only seven out of 67 operated patients showing persistent epiphora.

Failure due to narrowing of osteotomy in four case and granulation tissue in the site of osteotomy opening in three cases which cause obstruction of lacrimal drainage.

Even though the success rates of primary DCR are high, revision DCR surgery is a relatively frequent procedure. The literature shows that the revision rate after primary DCR roughly ranges between 8 and 16 % [1,9]. Thus, evaluating cases of DCR failure, as we did in the current study, allows for highlighting the underlying factors that significantly impact the results. This knowledge should help realize better-controlled outcomes in primary surgeries. Failure of the initial DCR surgery is likely due to the lacrimal system’s complex anatomy and underlying pathologies that might complicate the outcomes [1,9,14,15].

Endoscopic DCR has gained popularity in the last three decades; however, many surgeons consider external DCR the gold standard in treating epiphora [6,16]. All patients in the current study manifested persistent epiphora symptoms after 12–36 months of primary external DCR surgery. Unfortunately, we did not have access to data showing the exact success rate of their previous external DCR procedure. Recent research efforts compared the success rates and overall outcomes of external versus endonasal DCR [17–20] with mixed results. A recent study showed that endonasal DCR achieved slightly higher success than the external approach [18]. However, these authors observed lower postsurgical complications with endonasal DCR than with external DCR.

On the other hand, another group [19] showed that both external DCR and endonasal DCR achieved high success rates (92.4 and 91.1 %, respectively) but observed higher rates of intraoperative bleeding that required intervention in the endonasal DCR patients and less patient satisfaction in the
same group. Importantly, analysis of clinical trials on the patient revealed comparable results regarding the overall success rates [17,20]. Notwithstanding, many researchers recommended using nasal endoscopy and diagnostic CT scans to rule out underlying nasal pathology before external DCR [18,19].

It is important to note that the success rate of revision DCR can vary depending on the underlying cause of epiphora [14,18]. For example, patients with nasal pathology, such as a deviated septum or enlarged turbinate, are more likely to have a successful revision DCR if the nasal pathology is simultaneously corrected [9,16]. Likewise, a team of expert rhinology and oculoplastic surgeons treated all other nasal and ophthalmological conditions. Carrying out these procedures in the same surgical setting for each patient might have contributed to the high success rate (89.6 %) observed in the current study. In support of this hypothesis, a meta-analysis of more than 3000 cases from 32 studies associated higher success rates with external DCR when nasal pathologies were excluded. Indeed, the collaboration between expert rhinologists and oculoplastic surgeons aided with endoscopic vision, and following a strict follow-up procedure in this study helped improve the outcomes [10,17].

The possible complications of revision DCR are similar to those of the initial surgery, which include bleeding, infection, sinusitis, incomplete improvement in epiphora, and fibrotic occlusion of the neo-ostium [18,19,21–23]. In some cases, such complications may lead to failure of the revision DCR and, ultimately, the need for additional surgery. These complications might have contributed to the failed primary external-DCR surgery in the participants of this study. We observed 25 patients suffering complete nasal obstruction, five with chronic adenoids, five presented with granulomatous tissue, and four patients with nasal polyposis, not to mention 23 cases of dacryocystitis. Other technical issues contributing to the surgical failure of the primary DCR include the inability of the surgery to achieve a patent ostium of suitable size or an early loss of the silicone stent [23]. Here, we operated on 16 cases with narrow ostium, and three patients presented with missed tubes. Moreover, synechiae may occur between the middle turbinate, nasal septum, or the lateral wall [24,25]. The current study included four patients with synechiae.

Our data analysis showed that dacryocystitis (23 cases) was positively correlated with narrow ostium and lacrimal abscesses. A narrow ostium would disturb the normal flow of tears and increase the possibility of infection [26,27]. On the other hand, the results showed that sinogenic headache, observed in 11 patients, was positively correlated with concha and unilateral maxillary sinusitis. However, many other factors may contribute to the development of such complaints, including migraine and other sinus-unrelated conditions [28].

Revision DCR requires special care during and after the procedure. The procedure is more technically challenging than the initial surgery [15,29]. One critical factor is the development of scar tissue from the previous surgery that could obscure the surgical field and make it challenging to identify and dissect the lacrimal sac and nasal cavity. This factor is also one reason revision DCR is more likely to fail than the initial surgery; the scar tissue can also obstruct the newly formed ostium [25,30].

Endonasal DCR has several advantages over external DCR [31,32]. First, it is a minimally invasive procedure performed entirely through the nasal cavity without any external incisions or skin scarring. Thus, endonasal DCR improves cosmetic outcomes and patient satisfaction compared with external DCR, which requires a skin incision. Second, endonasal DCR avoids disrupting the canthal ligament and peristeme, unlike external DCR [33]. Reduced surgical trauma in the case of endonasal DCR ensures reduced postoperative pain and swelling and shortens the recovery time.

Moreover, endonasal DCR is more likely to maintain the integrity of the lacrimal pump system; it involves minimal dissection or manipulation compared with external DCR [33]. Other significant advantages include a lower risk of skin-related complications, shorter operating times, and higher cost-effectiveness [31,34]. However, the surgical approach should be selected on a case-by-case basis. Important patient-related aspects such as comorbidities, anatomical factors, and the surgeon’s experience contribute to such decisions.

In conclusion, the findings of this study further emphasize the importance of thorough presurgical examination and anatomical evaluation of candidates for primary and revision DCR. The success of external DCR will improve if patients with underlying nasal pathology are excluded. Those with nasal comorbidities or abnormal anatomy should be candidates for endonasal endoscopic DCR.

Authors contributions

Mostafa Talaat: diagnosing cases, surgical operations, preparing information, and writing. Balegh H. Abdelhak: reviewing cases and reviewing the scientific material of the article. Ayman S. Megahed: data analysis and preparation of results. Mohamed

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E. Khalil: follow-up, evaluation of cases, and preparation of the results. Raafat A. Abdallah: follow-up, evaluation of cases, preparation of the results. Ahmed A. Abdelaziz: diagnosing cases, surgical operations, and preparing information. All authors reviewed the initial manuscript and approved the final version of the article.

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Conflicts of interest

There are no conflicts of interest.

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[3] Ahmed A. Abdelaziz: diagnosing cases, surgical operations, and preparing information. All authors reviewed the initial manuscript and approved the final version of the article.

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