PRIMARY ENDOSCOPIC DACRYOCYSTORHINOSTOMY: 6-MONTH OUTCOMES AND ASSOCIATED FACTORS

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Endoscopic dacryocystorhinostomy has nowadays become a good choice in the management of primary acquired nasolacrimal duct obstruction. We conducted this prospective study with two purposes: to describe surgical outcomes after 6-month follow-up and to assess related factors. 76 sides of 59 patients who underwent mechanical endoscopic endonasal dacryocystorhinostomy were enrolled in the study. The associations between several pre-, intra- and post-operative factors and surgical outcomes were analyzed. An overall success rate of 88.2% was recorded. Post-operative complications and dacryocystorhinostomy ostium scores were significantly associated with surgical success. We did not find a significant relationship between age, inflammation status, size of lacrimal sac and surgical bleeding with the overall rate of success.

Keywords: endoscopic dacryocystorhinostomy, associated factors.

I. INTRODUCTION

Epiphora is a common complaint in eye care, caused by nasolacrimal duct obstruction which is relatively popular in working-age patients. Although these disorders are generally not vision-threatening, they greatly affect the quality of life and caused difficulty in patients' social communication. Addressing lacrimal system obstructions helps to reduce the risk factors and provides the necessary conditions for globe protection and intra-ocular diseases management.

Dacryocystorhinostomy has a history of nearly a century since Dupuy - Dutemps and Bourget introduced this procedure with external approach and mucosal sutures. This surgery is now technically refined and achieves excellent results. However, in the recent years, endoscopic approach has received a lot of attention from oculoplastic and rhinolaryngo-surgeons, thanks to the development of endoscopic systems which facilitate less invasive surgeries. Today's digital endoscopic systems enable surgeons to clearly visualize surgical landmarks, thus improve the preciseness of the surgery. Since the early years of the 21st century, technical perfection and additional modalities, including diamond burrs, laser, high frequency waves, piezoelectricity, ultrasound, anti-metabolic agents and trans-canalicular micro-endoscopic systems have changed the prognosis. Endoscopic today is considered to have an equal success rate to external surgery, which varies from 84 - 94%,[1,2] while patient satisfaction is possibly higher.[3] Patients' benefits include direct access to lacrimal system, shortened surgery duration and recovery time, no skin scar and minimal impact on tear pumps.

Although numerous factors associated with surgical success ranging from pre-operative factors to surgical modifications and post-operative care have been suggested and studied, few have shown to significantly improve

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the success rate. Among them, age, gender and inflammation status have been reported to be associated with success in both external and endoscopic approaches.[4-6] Longer follow-up duration and post-operative complications have also been linked with a decrease in success rate.[4,7] Therefore, we conducted this study with two objectives: to describe surgical outcomes after 6-month follow-up and to assess related factors.

II. SUBJECTS AND METHODS

1. Patients and selection criteria

This uncontrolled prospective study involved 59 patients with 76 sides. The sample size was calculated according to the following formulation.

$$n = Z^2_{(1-\alpha/2)} \frac{p(1-p)}{\varepsilon^2}$$

$\alpha = 0,05$ $\quad Z^2_{1-\frac{\alpha}{2}} = 1.96^2$

ε: absolute error (7%)

n: sample size

p: success rate of endoscopic dacryocystorhinostomy according to previous study was 89% [1]

A total number of 76 sides met the selection criteria and underwent endoscopic dacryocystorhinostomy between August 2018 and August 2019 performed by a single surgeon in Vietnam National Eye Hospital. We adopt the whole sampling method: the participants were consecutively selected from the adult patients who were referred to the Eye Trauma Department.

The patients' eligibility criteria were 16 years old or older, scheduled for first-time endoscopic endonasal dacryocystorhinostomy because of primary acquired nasolacrimal duct obstruction and agreed to participate in the study. The exclusion criteria were pre-saccal obstruction, previous lacrimal surgery and nasal pathologies preventing endoscopic visualisation.

2. Surgical technique

All the procedures were performed under local anesthesia assisted with intravenous sedation in a standardized fashion. To provide sufficient topical decongestion and hemostasis, patients received packing gauze soaked with 2% lidocaine hydrochloride and oxymetazolin hydrochloride in the nasal cavity 20 minutes pre-operatively. The nasal mucosa around the anterior root of the middle turbinate was injected with 2% lidocaine hydrochloride mixed with adrenaline 1 : 100 000. Then, under direct visualization from a 0° 4 - mm nasal endoscope, the nasal mucosa over the lacrimal sac fossa was incised and reversed back in order to preserve it maximally. An osteotomy (of at least 10 x 5mm) was created using a Kerrison punch to expose the sac widely from the level of the sac fundus to the junction of lacrimal sac and nasolacrimal duct. The lacrimal sac was tented using a Bowman probe passing through the superior canaliculus and incised vertically using a keratome blade. The two flaps were then trimmed and flattened so that they were adjacent to the nasal mucosa flaps. After intubation with a silicone bicanalicular stent, the nasal cavity was packed when necessary.

3. Postoperative care and outcomes measurements

All patients were given topical antibiotics and steroids, nasal decongestants and steroids for four weeks. The follow-up visits were on day 1, after one week, one month, three months and six months following operation.

Surgical success was defined as anatomic,

functional and overall success at 6 months after surgery. Anatomic success was achieved when the lacrimal system was completely or partially patent upon irrigation. Functional success was achieved when the patient had relieved or reduced epiphora. Functional failure was recorded when the patient still had tearing or chronic discharge. Overall success was achieved when there were both surgical and functional success. Patients with failed results underwent a revision surgery if necessary.

Nasal ostium was assessed using the dacryocystorhinostomy ostium scoring (DOS) recommended by Ali et al.[8] Accordingly, the ostium was assessed by 10 parameters: location (in front and above axilla of middle turbinate/ behind axilla/ other location/ not found), shape (circle or oval with shallow base/ circle or oval with deep base/ crescentric or vertical slit/ not found), size (> 8 x 5 mm/ 5 - 9 x 3 - 5 mm/ 1 - 4 x 1 - 3 mm/ obliterated), cicatrisation (none / pseudo-cicatrix / incomplete cicatricial closure/ complete closure), synechiae (none/ non-ostial or non-interfering/ interfering ostial/ complete closure), internal common opening (ICO) (uncovered by edge and dynamic/ overhanging edge and dynamic/ partially blocked/ not found), silicon stents (move with blink/ lost or removed before 4 weeks/ associated contact granuloma/ entrapped in ostial tissues), functional endoscopic dye test (spontaneous and < 1 minute/ spontaneous and > 1 minute/ only with irrigation/ negative), granuloma (none/ on one or more edges/ peri-ICO/ obstructing ICO) and other ostium pathologies (none/ 1 minor complication/ > 1 minor complications/ major complication) with a score of 1 to 4, where 4 was excellent, 3 was good, 2 was moderate and 1 was poor. The total DOS scores were classified as follows: 36 - 40 was excellent, 31 - 35 was good, 21 - 30 was moderate, and less than 20 was poor.

4. Statistical analysis

Statistical analysis was performed with SPSS version 20.0 software. The continuous variables were presented as mean value. Group differences between categorical variables were tested using Pearson's chi-square or Fisher's exact test. The differences were considered as statistically significant when 2-side-p values < 0.05.

5. Ethical issues

The study was approved by the Research Ethics Committee of Hanoi Medical University (IRB00003121 – Number 97, issued on 30th May 2017) and was conducted in accordance with the Declaration of Helsinki. The patients were given oral and written information about the study protocol and they provided written informed consent.

III. RESULTS

In the present study, 69 out of 76 cases (90.1%) had a remission of symptoms and had functional success. 71/76 cases (93.4%) had a patent lacrimal system or anatomic success. Overall, 88.2% of cases (67/76 cases) had a successful outcome of surgery.

Table 1. Patient's characteristics

Characteristics	Mean (min - max)	n	%
Age	53.32 ± 10.75 (26 - 73)		
< 55		37	48.7
≥ 55		39	51.3
Gender			
Male		4	6.8
Female		55	93.2
Side			
Right		41	53.9
Left		35	46.1
Bilateral		17	28.81
Unilateral		42	71.19
Duration of tearing	58.84 ± 58.04 (1 - 240 months)		
Duration of discharge	28.24 ± 37.17 (1 - 144 months)		
Clinical types			
Without dacryocystitis		23	30.3
With dacryocystitis		53	69.7
Chronic dacryocystitis		44	57.9
Dacryocystocele		5	6.6
Acute dacryocystitis		4	5.3
Lacrimal sac			
Dilated		43	56.6
Not dilated		33	45.4
Intraoperative haemorrhage			
Yes		15	19.7
No		61	81.3
Dacryocystorhinostomy ostium score	34.38 ± 4.00 (19-39)		

No major complications such as blindness or soft tissue necrosis were observed. Among the intranasal minor complications, 12/76 cases (15.8%) had adhesion and 10/76 cases (13.2%) had granuloma around the ostium. All the patients with intranasal adhesion were given a lysis and steroid spray. Intranasal granuloma was treated with steroid drops and spray and eventually steroid injection if needed. List of complications are presented in Table 2.

Table 2. Post-operative complications

Complications	n	%
Punctal laceration	1	1.3
Punctal adhesion	1	1.3
Canalicular stenosis	4	5.3
Intranasal adhesion	12	15.8
Intranasal granuloma	10	13.2
Total	28	36.8

Regarding the patient - relating factors, there were no significant associations between the likelihood of endoscopic dacryocystorhinostomy failure and gender (p = 0.48). Older patients (≥ 55 years) had a lower success rate of 82.1% (32/39) when compared to younger patients (< 55 years) who had 94.6% (35/37 cases), but the difference was not statistically significant (p = 0.15).

Dacryocystitis of various forms (chronic, acute and mucocele) was observed in 69.7% of eyes and was associated with an overall success of 90.6% (48/53 cases), which was not significantly different from that of those patients without dacryocystitis (82.6%, 19/23 cases, p = 0.48). Similarly, cases with dilated lacrimal sac had a higher rate of success (90.7%, 39/43 cases) than those without one (84.8%, 28/33 cases), but without significant differences (p = 0.49). Patients with better prognosis had a shorter duration of symptoms (epiphora and/or discharge) (58.30 ± 58.78 and 27.04 ± 34.54) than those who had failed surgeries (62.40 ± 55.66 and 39.00 ± 60.37), with no significant differences (p = 0.47 and p = 0.87).

Regarding the intraoperative factors, patients who had significant bleeding had a lower rate of overall success (80%, 12/15 eyes) than those who had minimal haemorrhage (90.2%, 55/61 eyes), with no significant differences (p = 0.37).

Finally, a higher success rate was observed in patients with good or excellent ostium (98.5%, 65/66 eyes) than those with worse ostium who had dacryocystorhinostomy ostium scoring of less than 31 (20%, 2/10 eyes), with statistically significant differences (p = 0.00). There was also a significant association between the post-operative complications and the likelihood of failure (p = 0.01). Associated factors are presented in Table 3.

Table 3. Factors asssociating with surgical outcomes

Factors	Success	Failure	n	OR (95% CI)	p
Gender				0.51 (0.50 – 5.13)	0.48
Male	4	1	5		
Female	63	8	71		

Factors	Success	Failure	n	OR (95% CI)	p
Age				3.83 (0.74 – 19.79)	0.15
<55	35	2	37		
>=55	32	7	39		
Clinical forms				0.50 (0.12 – 2.04)	0.44
Without dacryocystitis	19	4	23		
With dacryocystitis	48	5	53		
Lacrimal sac				1.74 (0.43 – 7.07)	0.4
Dilated	39	4	43		
Not dilated	28	5	33		
Duration of tearing (month)	58.30 ± 58.78	62.40 ± 55.66			0.56
Duration of discharge (month)	27.04 ± 34.54	39.00 ± 60.37			0.88
Intraoperative haemorrhage				2.29 (0.50 – 10.48)	0.37
No	55	6	61		
Yes	12	3	15		
Duration of operation (minute)	46.59 ± 6.37	50.00 ± 7.45			0.28
Dacryocystorhinostomy ostium score				**260 (21.12 – 3200.16)**	**0.00**
>30	65	1	66		
≤30	2	8	11		
Post-operative complications				**7.67 (1.47 – 40.08)**	**0.01**
No	46	2	48		
Yes	21	7	28		

IV. DISCUSSION

The first objective of this study was to describe the success rate of primary mechanical endoscopic dacryocystorhinostomy in Vietnamese patients. A recent systematic review of literature from 1966 to 2008 reported success rates of mechanical endoscopic dacryocystorhinostomy of 84% to 94%.[1] Our success rate fell in this range and was similar to the outcomes observed by authors adopting cold-steel techniques (using only Kerrison's

punches or a hammer and chisel).[11,12] By using the conventional technique and avoiding heat-producing devices such as drill and piezoelectric handpiece, we achieved comparable surgical outcomes with cost-effectiveness and possibly shorter operative duration, requiring no additional machines or equipment.

The second objective of our study was to access risk factors for surgical failure, including pre-, intra- and post-operative variables. A wide variety of factors relating to the prognosis of dacryocystorhinostomy has been mentioned in literature, ranging from patient's characteristics, surgical technique modifications, additional modalities including anti-metabolic agents and stents to post-surgical care.[4]

Age has been reported to be a factor in endoscopic dacryocystorhinostomy by many authors.[4-7] Our younger patients tended to have a higher success, but without a significant difference. These results were also found by Nomura et al [5] and Cohen et al [4] in long-term follow-up studies. A possible explanation for this finding may be the prolonged wound healing process in older patients, leading to a higher prevalence of granulation and synechiae. Another explanation is the weakened orbicularis muscles due to the process of aging. However, Mak et al [6] and Lehmann et al [7] suggested an opposite finding, in which the failure group had a significantly younger age, reasoning by the higher degree of fibrosis in younger patients.

A history of chronic inflammation of the lacrimal sac has been reported to increase the rate of failure.[13] You and Fang[14] and Lehmann et al[7] reported that when there were no significant differences in the success rate of two subgroups: those who had simple epiphora with no discharge and those who had chronic dacryocystitis with purulent discharge. However, one report found a trend of higher success rates in patients with acute dacryocystitis than in those without.[15] The trend toward a higher success rate in association with a history of dacryocystitis in our study did not achieve statistical significance due to small number of surgical failures. Nevertheless, this finding opposes to a false belief that patients with purulent discharge are not good candidates for endoscopic dacryocystorhinostomy. Similarly, we had hypothesised that an enlarged lacrimal sac would facilitate a better outcome because with a non-dilated lacrimal sac in which a minimal amount of lacrimal mucosa is available, the endoscopic endonasal technique makes it technically difficult to fashion and marsupialise these delicate flaps. But in fact the association between the size of lacrimal sac and likelihood of success was not significant in our study.

Significant surgical hemorrhage can create difficulties for the surgeon to maneuver, prolong the duration of surgery, increase inflammation reaction of the tissues around the surgical site and can reduce the size of osteotomy. However, the size of osteotomy in our cases was at least 10 x 5 mm whether intra-operative hemorrhage was presented or not. Patients with bleeding during surgery also tend to have stagnated blood clots at the ostium, which is a favorable condition for the formation of adhesion that obstructs the newly created bypass. In this study, patients who had minimal hemorrhage tended to have better prognosis, but the difference was not statistically significant. Cohen et al[4] also found that intraoperative bleeding was significantly associated with surgical failure 10 years following surgery.

In this study, we included intranasal complications (adhesions and granulomas) in the post-operative complications. Therefore, our rate of complications was higher than

those of Cohen et al[4] (4.2%) and Lehmann et al[7] (20%). Patients with no complications had a possibility of having successful outcomes of 7.67 times more than those with post-operative complications. This finding is in agreement with Lehmann et al.[7] Therefore, complications after surgery need to be detected early and treated effectively by medication and minor maneuver.

The dacryocystorhinostomy ostium scoring system suggested by Ali et al[8] was applied in our study as a tool to systematically evaluate the ostium and complications. The strong correlation we found between the high score and the overall success (OR = 260) is a supporting fact to the value of this scoring system in routine clinical follow-up evaluation of ostium after endoscopic dacryocystorhinostomy.

There are some limitations to the study, including the short-term follow-up duration. The size of the study group may be not large enough to achieve a statistical power to establish a significant association for some potential factors. Therefore, a larger study with longer follow-up time may be necessary in the future to evaluate the impact of risks and protective factors.

V. CONCLUSION

The findings of our study suggest that endoscopic dacryocystorhinostomy can be considered an effective treatment with reasonable success rates for primary acquired nasolacrimal duct obstruction in Vietnamese patients. Several post-operative factors, including complications and ostium scores, were found to be significantly associated with surgical success.

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