

# Efficacy of powered endoscopic dacryocystorhinostomy in treatment of nasolacrimal duct obstruction

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## Abstract

**Background and Objectives:** To evaluate the success rate of the therapeutic effectiveness and safety of endoscopic dacryocystorhinostomy to treat obstruction of the lacrimal pathway.

**Methods:** The study involved prospective randomized case series. Operative and postoperative data were prospectively collected on 114 patients (120 eyes) who presented to Rizgary Teaching Hospital (Erbil city – Iraq) with epiphora and obstruction of the nasolacrimal system, from February 2013 until October 2017. All patients consecutively underwent endoscopic dacryocystorhinostomy. The follow-up evaluation included system evaluation and endoscopic assessment of the newly created ostium; the follow-up was done at 1 week, 1 month, and 3 months postoperatively, and results were compared between the different groups.

**Results:** A total of 120 cases of endoscopic dacryocystorhinostomy were performed on 114 patients. Procedure success rate was around 95.8% using powered drill and endoscopic system with minimum complication. Age group of 25-44 years (45.8%) is the higher percentage and the female gender accounts for 83.3%. No complications were recorded in 78.3% of the patients, while 10% had developed granulation tissue at fistula site. Only 5% of the cases suffered from synechia and 5.7% were miscellaneous complications. No statistical significant differences were found between the surgery and age, gender, or side of operation.

**Conclusion:** Powered endoscopic dacryocystorhinostomy is the most suitable treatment for patients at the level of the sac or in the nasolacrimal duct obstruction.

**Keywords:** Endoscopic, Nasolacrimal duct obstruction, dacryocystorhinostomy, Nose.

### **Introduction**

The lacrimal system consists of lacrimal gland, upper and lower canaliculi, common canaliculi, and lacrimal sac. The system ends with nasolacrimal duct that opens in the inferior meatus of nasal cavity<sup>1-4</sup>. The nasolacrimal drainage collects tear fluid from the ocular surface and convey it into the nasal cavity. The lacrimal passage consists of bony passage and membranous lacrimal passage. The bony passage is formed anteriorly by frontal process of maxillary bone and posteriorly by thin lacrimal bone. The membranous lacrimal passage includes the lacrimal canaliculi, lacrimal sac and nasolacrimal duct<sup>5</sup>. The lacrimal drainage system is classically divided into the upper and lower portions for diagnostic and therapeutic reasons. The upper lacrimal drainage system starts at the puncta, upper and lower canaliculi and common canaliculi; the latter drains into the lacrimal sac. The lower lacrimal drainage system consists of the lacrimal sac and the nasolacrimal duct; the nasolacrimal duct drains below the inferior nasal meatus<sup>6</sup>. Nasolacrimal duct obstruction, is a common clinical problem and can result in epiphora and recurrent dacryocystitis<sup>1</sup>. It is a tearing caused by a reduced tear transport or defective drainage outflow<sup>4</sup>. Epiphora occurs

because of blockage in the lacrimal drainage system, which impairs normal tear channeling into the nose, as result of stagnation recurrent infection may also occur<sup>2-4</sup>. Dacryocystorhinostomy (DCR) is a procedure in which lacrimal flow is made to flow through the nasal cavity by making an opening in the lacrimal sac and fistulation of the lacrimal sac into the nasal cavity, thereby creating a fistula that bypasses the obstruction and restores the tear flow<sup>7</sup>. It was first described through an external approach by Addeo Toti in 1904 who interpreted this procedure with success rates consistently above 90%<sup>3</sup>. McDonogh and Meiring were the first to describe endoscopic trans-nasal dacryocystorhinostomy (DCR) in 1989<sup>4</sup>, then in 2002, Wormald PJ reported powered endoscopic DCR with full sac exposure and primary mucosal anastomosis<sup>8</sup>. Although external DCR is still regarded as gold standard, endoscopic DCR is evolving as an equally effective alternative<sup>9</sup>. The endonasal dacryocystorhinostomy is a one-stage procedure that permits correction of associated pathology and anatomical abnormality; the external scar is avoided which leads to a better acceptance by the patients mainly women<sup>5</sup>. Various studies have shown that the success rate for both

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procedures ranges from 63%-97 %<sup>9-11</sup>. In the current article, the aim is to show the success rates of powered endoscopic

### **Patients and methods**

This prospective study included 120 eyes of 114 patients; six of the patients were bilateral. The study was conducted in Rizgary Teaching Hospital from February 2013 until October 2017. All patients were assessed by an ophthalmologist and had repeated probing and sac washouts which failed to improve their symptoms. Patients excluded from the study were those had congenital nasolacrimal duct obstruction, presaccacanalicular obstruction, secondary acquired nasolacrimal duct obstruction due to sinonasal diseases and revisions either external or endoscopic DCR. All the patients had primary acquired nasolacrimal duct obstruction, saccal and post saccal causes included, treated with powered endoscopic dacryocystorhinostomy and listed for surgery. All patients underwent general anesthesia, using zero and 30 degrees rigid endoscope which connected to video system with powered drill. The nose packed with neurosurgical cottonoids soaked in topical anesthetic and adrenaline (1:100000), applied 10-15 minutes prior to surgery in order to achieve a good mucosal

dacryocystorhinostomy include cases with the primary acquired nasolacrimal duct obstruction.

vasoconstriction. A U-shaped incision was made in lateral nasal wall in front of the middle turbinate and 6-8mm above axilla of middle turbinate. A posteriorly based mucosal flap of about 1 cm elevated to expose the maxillary line area which is the landmark for this surgery. This maxillary line bisects the lacrimal sac in which the frontal process of maxillary bone cover the anterior half of the sac and thin lacrimal bone cover the post half. Thick bone from the frontal process of maxillary bone was removed with Kerrison's punch forceps. This was followed by using powered diamond burr high speed drill to remove the bone around the sac which cannot be removed by the Kerson's punch forceps, especially at the axilla and bone that cover upper part of the sac to fully expose the lacrimal sac. Afterwards, the thin lacrimal bone which covers the lacrimal sac in its posterior part was also removed. Therefore, the entire medial wall and most of the anterior wall of lacrimal sac were exposed from the superior aspect, where the common canaliculus enters the sac. Using sickle

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knife, the medial wall of lacrimal sac was incised vertically and then the entire medial wall of the lacrimal sac was removed using powered shaver or using thru-cut forceps. The punctum in the upper and lower eyelids were made to dilate by the punctal dilator. Bowmann lacrimal probe was used to assess the patency of the superior, inferior, and common canaliculus; the silicone tube was inserted through upper and lower canaliculi and taken out through the common canaliculi which open inside the nose then the silicone tube secured. A unilateral nasal pack was applied for 24 hours and antibiotic-steroid eye drops and normal saline nasal douche were applied for one week, for all patients. All patients followed up after 1 week, 1 month, 3 months

### Results

The patients age group belonged to the age group of 25-44 years (45.8%). Male to female ratio was 1:5. More than half

postoperative, respectively, for anatomical and functional results. After 3 months the silicone tube was removed in the clinic office under local anesthesia. Patients were assessed anatomically by nasal endoscopy for the fistula that was created, and functional assessment was done by assessing relief of symptoms completely. Statistical analysis began by entering the data on computer using Microsoft Excel worksheet (Excel 2017). The statistical package for social sciences program (SPSS, version 25) was used for data analysis. The results were analyzed using frequency distribution and Chi square or Fisher's Exact tests if necessary, p-values  $\leq 0.05$  were considered as statistically significant.

(51.7%) of epiphora was encountered on the left nasolacrimal duct, Table( 1).

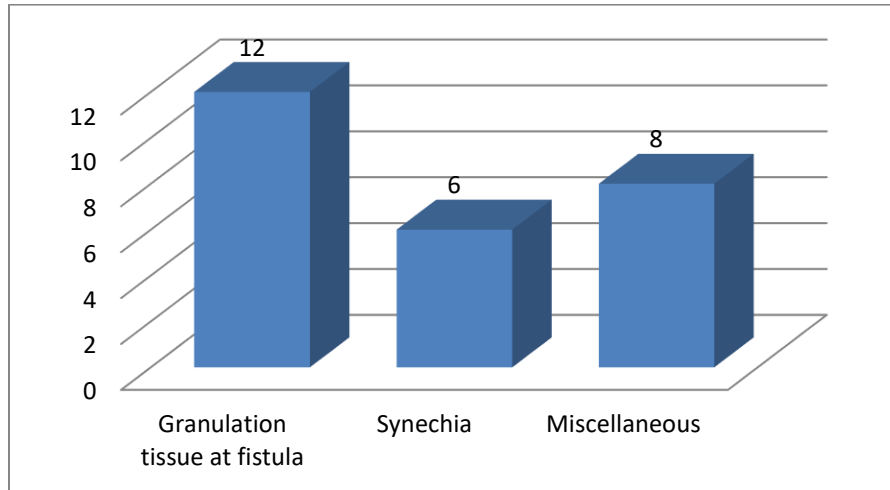
**Table (1):** Age, gender and side of the 120 epiphora cases.

| Variables        | Subcategories   | Frequency | Percent |
|------------------|-----------------|-----------|---------|
| Age groups       | < 25 years      | 29        | 24.2    |
|                  | 25 – 44 years   | 55        | 45.8    |
|                  | 45 – 64 years   | 30        | 25.0    |
|                  | $\geq 65$ years | 6         | 5.0     |
| Gender           | Male            | 20        | 16.7    |
|                  | Female          | 100       | 83.3    |
| Side of epiphora | Right           | 58        | 48.3    |
|                  | Left            | 62        | 51.7    |
| Total            |                 | 120       | 100%    |

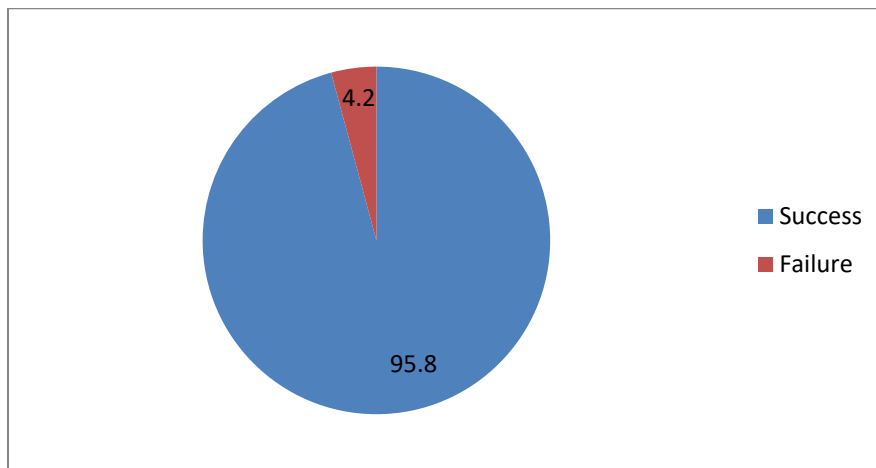
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Most of the cases did not develop any type of post-operative complications (94 patients), while 12 patients had granulation tissue at fistula; only 6 cases suffered from synechia and among 8 of them, the complications after surgery were

miscellaneous including ecchymosis of lower eyelid, exposing the periorbital fat and finally extrusion of the tube (Figure 1). In 95.8% of the cases the operation was successful, while the surgery failed only in 4.2% of the cases, Figure (2).



**Figure (1):** Complications of endoscopic dacryocystorhinostomy



**Figure( 2):** Success rate of endoscopic dacryocystorhinostomy.

According to data of Table2, there was no statistical significant association between success rate and age groups. Majority of cases (83.3-96.7%) all age groups had

successful operations. Chi square test was performed to find out the association and p-value was 0.48. There was a non-significant relationship between successfulness and

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gender of participants. Vast majority of cases (95-96%) had successful operation outcomes. The association between success of the operation outcomes and the side of nasolacrimal duct obstruction was non-

significant p-value 0.19) and there wasn't any difference in the success rate between right or left epiphora cases. Both had very high success rates of more than 90%.

**Table( 2):** Association between success rate and age groups, gender and side of epiphora.

| Variables        | Categories    | Success |       | Total  | p-value |
|------------------|---------------|---------|-------|--------|---------|
|                  |               | Yes     | No    |        |         |
| Age groups       | < 25 years    | 28      | 1     | 29     | 0.48    |
|                  |               | 96.6%   | 3.4%  | 100%   |         |
|                  | 25 – 44 years | 53      | 2     | 55     |         |
|                  |               | 96.4%   | 3.6%  | 100%   |         |
|                  | 45 – 64 years | 29      | 1     | 30     |         |
|                  |               | 96.7%   | 3.3%  | 100%   |         |
|                  | ≥ 65 years    | 5       | 1     | 6      |         |
|                  |               | 83.3%   | 16.7% | 100%   |         |
| Gender           | Male          | 19      | 1     | 20     | 0.83    |
|                  |               | 95%     | 5%    | 100.0% |         |
|                  | Female        | 96      | 4     | 100    |         |
|                  |               | 96%     | 4%    | 100.0% |         |
| Side of epiphora | Right         | 57      | 1     | 58     | 0.19    |
|                  |               | 98.3%   | 1.7%  | 100%   |         |
|                  | Left          | 58      | 4     | 62     |         |
|                  |               | 93.5%   | 6.5%  | 100%   |         |
|                  | Total         | 115     | 5     | 120    |         |
|                  |               | 95.8%   | 4.2%  | 100%   |         |

There was a statistically significant relationship between the success of the surgery outcome and the complications (P-value: 0.001). The majority of patients who had no complications (97.9%) had successful operation; in the same manner all patients with synechia (100%) and majority

of cases with granulation tissue at fistula had a successful operation outcome in contrast to patients with other complications like ecchymosis of lower eyelid, exposing the periorbital fat and finally extrusion of the tube who had a lower success rate of only 75% ,Table( 3).

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**Table (3):** Relationship between success and complications.

| Complications                 | Success |      | Total | p-value |
|-------------------------------|---------|------|-------|---------|
|                               | Yes     | No   |       |         |
| No complications              | 92      | 2    | 94    | 0.001   |
|                               | 97.9%   | 2.1% | 100%  |         |
| Granulation tissue at fistula | 11      | 1    | 12    |         |
|                               | 91.7%   | 8.3% | 100%  |         |
| Synechia                      | 6       | 0    | 6     |         |
|                               | 100%    | 0%   | 100%  |         |
| Others                        | 6       | 2    | 8     |         |
|                               | 75%     | 25%  | 100%  |         |
| Total                         | 115     | 5    | 120   |         |
|                               | 95.8%   | 4.2% | 100%  |         |

### Discussion

Nasolacrimal duct obstruction can result in epiphora and recurrent dacryocystitis, and these symptoms can be troublesome for others and may significantly deteriorate their quality of life. Surgery for dacrocystitis and epiphora through the technique of endoscopic DCR is now advanced with modern powered drill and endoscopic instrument, and this type of surgery has become popular among patients because of the successful outcome of relieving symptoms and improving the quality of life, and lack of external scar. The success rate in our study was high and reached 95.8%. This was compatible with other studies that also used endoscopic powered dacryocystorhinostomy that had also

recorded a success rate of around 90-98%<sup>12-15</sup>. Our study found that there wasn't a significant association between the success rate and age group, which is in line with those reported by Pei-Yuan study<sup>16</sup>, while Mak ST<sup>17</sup> found a significant association between the age group and success rate. Our study found that the side of surgery and the gender do not affect the success rate, which is also compatible with result found by Mak ST<sup>17</sup>. Regarding the success rate and complication that may happen, specifically the granulation tissue around the stoma and synechia, we found that this tissue affects the success rate which is in line with research by Nishi Gupta<sup>18</sup> as these complications affect the outcome result of

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the surgery, while Fayet B et al<sup>19</sup> reported that these complications are simple and do not affect the outcome of the surgery. The removal of mucosal flap of lateral nasal wall, or preserving it in the process of healing at site of operation, did not affect the success rate, which is in line with Ramakrishna et al<sup>15</sup> who performed 80 endoscopic DCR without mucosal flap preservation. Ramakrishna et al<sup>15</sup> concluded that mucosal preservation is not essential to achieve a proper success rate. We believe that the high success rate in

### **Conclusion**

Endoscopic dacryocystorhinostomy is useful, effective, safe and minimally invasive method for treating patients

### **Conflict of interests**

The authors recorded no conflict of interests.

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this study is due to the procedure of removing of mucosal flap by shaver and the bone over the entire medial wall of the lacrimal sac which decreases the rate of adhesion as Singh A et al<sup>2</sup> reported in their study. It was essential to remove a large part of the medial wall of the sac. This was done by carrying out an incision of the medial wall of the sac by the sickle knife and removing the adequate medial wall by powered shaver instrument and any tags, which is compatible with Singh<sup>2</sup>, Tsirbas A<sup>20</sup> and Jo<sup>21</sup>.

complaining from epiphora, with a high success rate, offering a significant improvement in their quality of life.

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