Management of Chronic Dacryocystitis: Comparative Study of Laser and Endoscopic Dacryocystorhinostomy

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ABSTRACT:

BACKGROUND:

Dacryocystorhinostomy: a surgical procedure to bypass the lacrimal sac and duct to create new path of tear into nose to treat epiphora (tearing due to reduced transport of tear or defective drainage of tear outflow caused by obstruction of nasolacrimal duct).

OBJECTIVE:

Our study's aim was to compare the surgical outcomes between endoscopic DCR and endocanalicular diode laser DCR including pre operative circumstances, type of anesthesia, intraoperative duration and amounts of bleeding, post operative pain and complications, success rates after 9 months of follow up.

PATIENTS AND METHODS:

60 patients were operated; 30 of them as endoscopic DCR group A (28 of them in Al Shaheed Ghazi Al Hariri Teaching Hospital and other 2 in Al Mukhtar Hospital) and 30 as Endocanalicular diode laser DCR group B in Ibn Al-Haithem Teaching Hospital in period between June 2017 to June 2018. All patients were assessed by detailed history and examination included fluoresceine dye, probing, irrigation of Lacrimal system and nasal examination.

RESULTS:

60 patients, mean age was 36.43 ± 17.405 years(5-79 years), 16 males and 44 females, 31 left eyes and 29 right eyes ,the chronicity of symptoms ranged from 6 months to 14 years, CT scans were done for 24 patients (22 in group A and2 in group B). The mean duration of operation was 38.13± 9.51 minutes in group A, 32.63±11.02 in group B. The mean intraoperative bleeding was 68.93±29.49 ml in group A, 56.33±21.57 ml in group B. There is no significant difference in pain and complications in both groups. The success rate in group A was 96.67% while in group B was 63.33%. The results were comparable to other studies.

CONCLUSION:

Both our groups have the advantages of: absence of facial scar, short duration especially in Endocanalicular diode DCR, less bleeding and pain, lacrimal pump preservation with successful rate comparable to the external DCR especially in endoscopic DCR.

KEYWORDS: DCR, endoscopic, diode laser, chronic dacryocystitis

INTRODUCTION:

Chronic dacryocystitis is referred to the inflammatory process that happens in the lacrimal sac after nasolacrimal duct obstruction more than 6 months duration.(1) It may be primary or secondary to anatomical abnormality that has led to stasis of tear flow. Obstructed lacrimal systems are complicated by increased numbers of pathogenic microorganisms colonization. Some patients of PANDO (Primary Acquired Nasolacrimal Duct Obstruction) could be secondary to missed low grade dacryocystitis which leads to inflammation, scarring and obstruction .(2)

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Chronic dacryocystitis is classified into: catarrhal dacryocystitis, lacrimal mucocele, and chronic suppurative form. Catarrhal dacryocystitis is presented as persistent and constant epiphora and angular conjunctivitis. Lacrimal mucocele present as cystic swelling results from the accumulated secretions which cause sac dilation and valve of Rosenmuller collapse. Chronic suppurative dacryocystitis presents as increase epiphora, discharge, and formation of pyocele. There are various indication for treatment of PANDO depend upon patient motivation, their symptoms and impaction on quality of life due to blurred vision, irritation or skin eczema, social embarrassment, frequency of dapping, and presence of discharge or matting of eyelashes in the morning, stage of disease, also whether in some patients there is need

for an intraocular surgery. Although treatment is usually elective, sometimes early surgical intervention indicated for patients with ophthalmic infections and/or those requiring ocular surgery.[3]

Dacryocystorhinostomy(DCR) is a surgical procedure to bypass the lacrimal sac and duct to treat epiphora (tearing due to reduced transport of tear or defective drainage of tear outflow caused by obstruction of nasolacrimal duct).[4].

Types of DCR:

- Primary External Dacryocystorhinostomy[1]
- Aesthetic External DCR:(The Subciliary. [1], Retrocaruncular [5], The Transconjunctival [5])
- Primary Endoscopic Dacryocystorhinostomy[1], Other variants: Endoscopic Radiofrequency-Assisted Dacryocystorhinostomy[6], Powered Endoscopic Dacryocystorhinostomy[7]), Laser-Assisted Endonasal Endoscopic Dacryocystorhinostomy [8] , and Ultrasonic Endoscopic Dacryocystorhinostomy[1]
- Non-endoscopic Endonasal Dacryocystorhinostomy [1].
- Balloon-Assisted Dacryocystorhinostomy [9]
- Endocanalicular Laser Dacryocystorhinostomy[1]
- Conjunctivodacryocystorhinostomy [1]

AIM OF THE STUDY:

The aim of the study is to compare the surgical outcomes between endoscopic DCR and endocanalicular diode laser DCR.

PATIENTS AND METHODS:

This is a comparative study of 60 patients, 30 patients underwent endoscopic dacryocystorhinostomy group A (28 of them at Al-Shaheed Ghazi Al-Hariri Teaching Hospital and 2 of them at Al-Mukhtar Hospital) and 30 patients underwent endocanalicular laser dacryocystorhinostomy group B at Ibn Al-Haithem Teaching Hospital in period between June 2017 to June 2018. All patients were complaining from epiphora for more than 6 months which may be associated with swelling near medial canthus, pus discharge, redness of conjunctiva, and all were assessed by ophthalmologist by careful history; physical examination; FDDT (Fluorescein dye disappearance test); probing and irrigation. The patients were referred (especially who had significant nasal symptoms or suspected to have nasal septal deviation or nasal pathology) to otolaryngologist where further assessments were done by full history and examination focusing on anterior rhinoscopy and rigid nasoendoscopy, some of them were sent for CT scan (the patients who complain from associated nasal symptoms and their examination has shown other abnormalities that may need preceding intervention or those with history of trauma to exclude other deformities). Blood investigations (for all) and CXR; ECG and Echo study (in selected cases of both groups) were sent to evaluate patients' fitness for surgery. Informed consents were taken from patients about the planned surgery, silicon stent, nasal pack, and follow up.

Patient with chronic dacryocystitis whose probing showed hard stop and irrigation showed positive to sac were involved while we excluded children below 5 years old (give chances for healing spontaneously or by simpler methods and waiting for well facial bone growth), patients with nasal pathologies such as malignancy, active granulomatous diseases, nasal polyposis, radiotherapy, functional epiphora, patient unfit for general anesthesia which is preferable in our center (for group A only) and surgery, eye lid malposition (entropion, ectropion), canalicular obstruction for both groups, but patients had history of trauma associated with facial bone fractures especially nasal bone and maxilla, previous DCR, septal deviation, concha bullosa excluded from group B only(surgery was done by ophthalmologist).

For group A

- Using general anesthesia, Reverse Trendlenberg position, sterilization and draping were done. Hopkin-rods rigid nasoendoscope 0,30° 4mm for adult and 2.7mm for pediatric were connected to Storze video monitor by a video camera. Patients who diagnosed to have septal deviation or concha bullosa that interfered with our procedure underwent preceding septoplasty or conchoplasty or both of them accordingly.
- Proper preparation of nasal cavity, using sickled knife or no.15 blade superior incision was made 3mm posterior to axilla of middle turbinate, 8-10mm above it, run forward about 10mm then was dropped inferiorly down to the level of insertion of inferior turbinate, another horizontal Incision was made at the level of inferior turbinate insertion from the uncinate process to the end of existing incision. Elevation of the posteriorly based flap was made with freer and was rolled medially over middle turbinate, hemostasis was done. The frontal process of maxilla was removed by rongeur; a forward biting Kerrison punch, a diamond drill was used to remove any bone that was difficult to remove with the rongeur. A round knife or Freer was used to flake off the very thin lacrimal bone overlying

the posterior portion of lacrimal sac. Full exposure of lacrimal sac was ascertained by finger pressure over medial canthus. Lacrimal punctae were dilated with lacrimal punctum dilator (Nettleship dilator) prior to insertion of multiple size Bowman lacrimal probes. Intranasal inspection would reveal a pinpoint medial tenting of the sac if the probe had passed the common internal punctum. When the lacrimal probe was holding only the medial wall on tension, a sickle knife or no. 15 blade was used to create a vertical incision from the top and bottom of the sac. A ball probe was used to check the full vertical height to ascertain that the entire medial sac has been cleared of bone. Anterior and posterior flaps were released using through cut forceps. The lateral nasal wall flap that was elevated at the beginning of the operation was trimmed to accommodate the new ostium and reinserted.

- The lacrimal tubes (Crawford tubes) were inserted into the superior and inferior punctae and passed into the nasal cavity. They can be secured by tying the tubes together between 7-10 knots. Anterior nasal pack was inserted for not more than 24 hours.

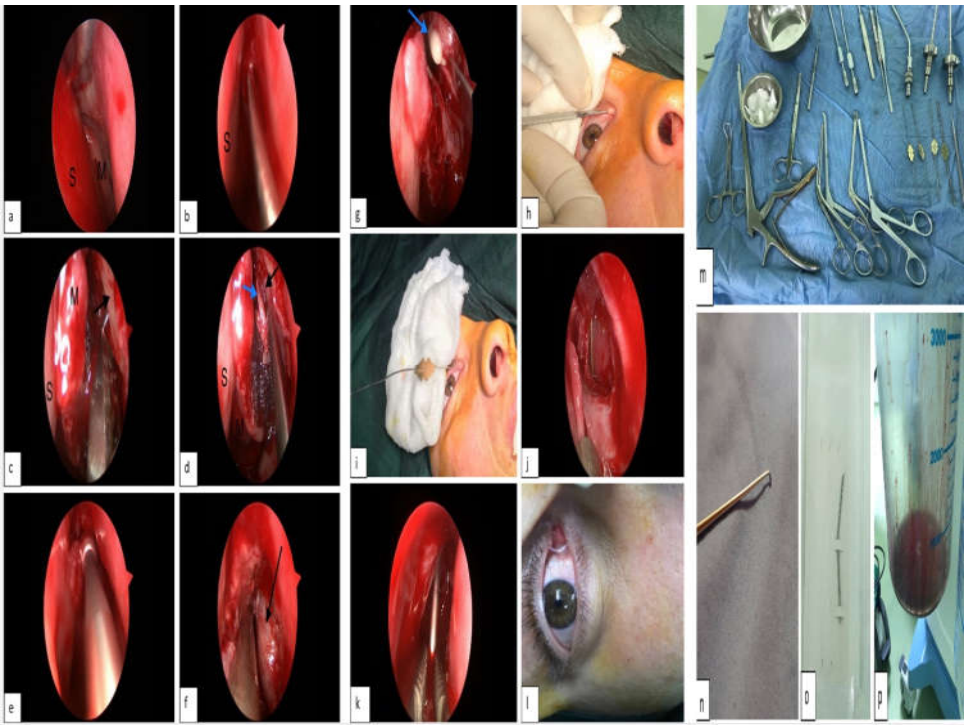

Figure 1: steps of endoscopic DCR (different patients) a: incision ,b: elevation of flap, c:removal of frontal process of maxillary bone(arrow), d:flack off lacrimal bone (blue arrow) black arrow for lacrimal sac, e:diamond drill for unaccessible bone, f:Lacrimal sac(arrow), g:pus come out from incised sac, h: probing, i: dilation, j:Bowman probe in the sac, k:stent is pulled out, l:silicon stent in the eye, m: instruments used in DCR, n: round knife ,o: silicone stent, p: blood loss in one operation mixed with normal saline used for wash. Note: S: septum ,M: middle turbinate.

For group B

- Laser precaution (wearing laser safety glasses, minimizing the medical staffs inside the theater, covering the other eye with wet pads), Preparation of the nose by nasal pack soaked with xylometazoline 0.1 or 0.05% and adrenaline1:1000 for 10 minutes, sterilization, draping.
- For patients who were unfit for general anesthesia or preferred local anesthesia: Tetracaine hydrochloride 1%eye drops; injection of about 5ml of local anesthesia (mixture of epinephrine1:200000 and 2% xylocaine) up to periosteum into infraorbital nerve, above and below medial canthus, infratrochlear area, anterior ethmoidal nerve distribution, lacrimal sac. Some patients received intra venous mixture of propofol 1%, midazolam and ketamine.

- Rigid Hopkin rods nasoendosope 0 degree was connected to XE 50-USB monitor for visualization of nasal cavity. After probing of both superior and inferior punctae first by Nettle ship dilator then different size of Bowman lacrimal probes, laser probe inserted through 23 or 25 gauge metal cannula in the lower punctum often. The ARC FOX laser device was used which is diode laser, 980 nm wave length, continues pulse and 7-9 W power was used, identification of the transilluminated laser light from the lacrimal sac "laser glow" in the area which was anterior and inferior to the Insertion of the middle turbinate. Laser osteotomy was done by first puncturing the laser fiber optic through the lacrimal bone and nasal mucosa via contact energy mode with continuous setting "laser puncture" an area of coagulation and necrosis would be seen on the nasal mucosa surrounding the laser fiber optic. From this position, the fiber optic can be moved sideways, upward, and downward in a circular fashion thereby enlarging the osteotomy.
- Lastly, The lacrimal tubes (Crawford tubes) were inserted as previous group, Anterior nasal pack was inserted for not more than 24 hours, dressing of the eye with eye ointment for 4 hours.

All Patients were followed by admission in the ward and were advised to stay over the night with proper antibiotics and analgesics, the pack was removed next morning and patients were discharged home with nasal spray (local steroid only for group B) and nasal wash for 2weeks, tobramycin eye drops 4times per day and fucithalmic eye ointment twice daily for 2weeks. Follow up which included symptomatic fulfillment and endoscopic examination was done in the first week, first month, second month, fourth month when the stent was removed by cutting looped part near medial canthus and grasping the nasal part and withdrawing out of the nose. Last follow up who determine the success rate was done in the ninth month which included symptomatic evaluation and assessment of new stoma patency with rigid scope, fluorescein dye and lacrimal systems irrigation.

Independent sample t-test and chi square test were used to test the significance of the difference. SPSS (Statistical Package for the Social Sciences) version22 software was used to organize and analyze the data.

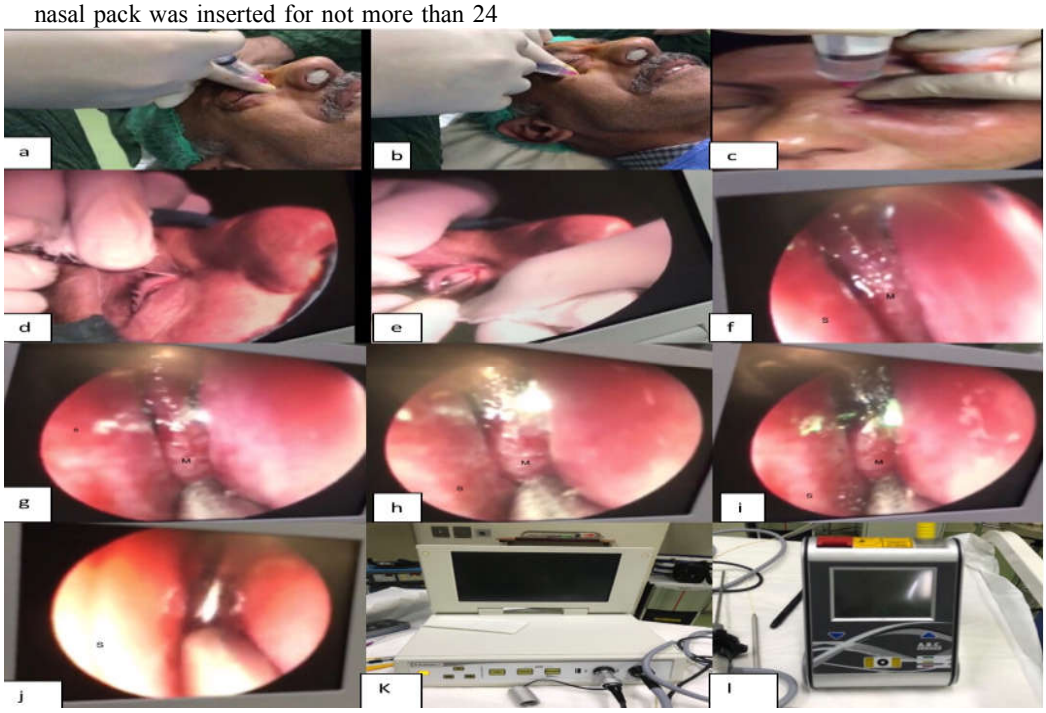

Figure 2: Steps of ECL DCR(different patients) .a, b, c: infiltration of local anasthesia. d, e: probing of upper and lower punctum. f: laser puncture. g, h, i: increasing ostium size. J: probe in the nasal cavity. K: XE 50-USB monitor. l: ARC Fox laser device. M: middle turbinate, S: septum.

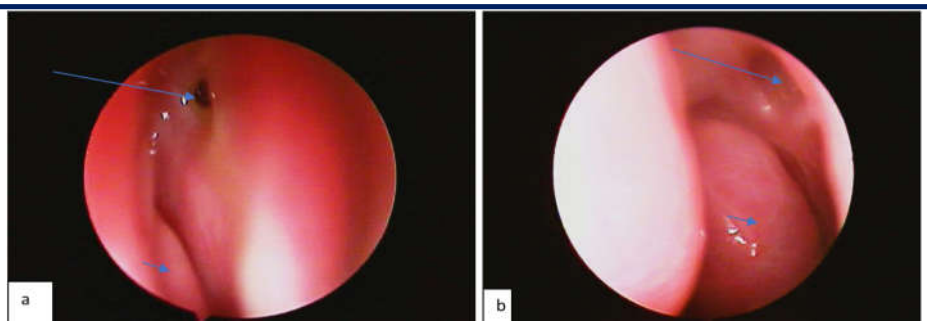

Figure 3 :Endoscopic views of new ostium, a and b show left side with long arrows refer for new ostium while short arrows for middle turbinate, look for fluorescein coming out from ostium.

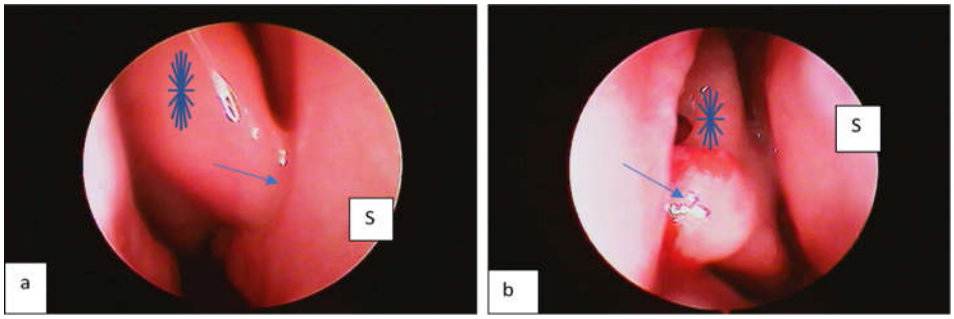

Figure 4: Complications of DCR ,asterisk :middle turbinate, s:septum, the arrows in a: for synechia while in b : granulation tissue both are asymptomatic.

RESULTS:

Sixty patients were operated, 30 patients as endoscopic DCR and 30 patients as endocanalicular laser DCR. The mean **age** was 36.43 ± 17.405 years, the minimum age was 5 years while maximum age was 79 years, Sixteen(26.67%) of the patients were males and 44(73.33%) were females, Most common operated side was left 31 (51.67%) while the right side was 29 (48.33%). All were unilateral. All patients presented with history of epiphora which often associated with intermittent attacks of medial canthus swelling, pus discharge.

The **duration** of symptoms varied, it was ranging from 6 months to 14 years and patients were divided into 5 groups, the most group common was between 1-2 years.

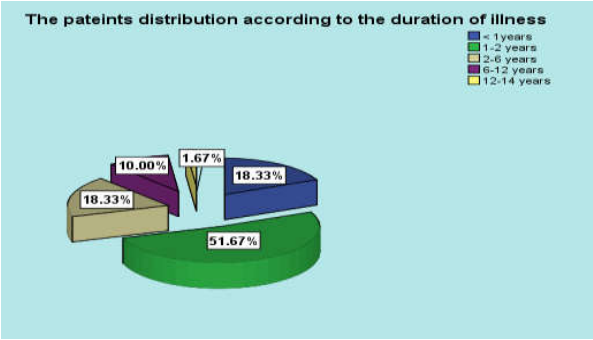

Figure 5: Distribution of patients according to duration of illness.

Table1 :Comparison of preoperative results

Parameters	Group A	Group B
Associated nasal symptoms	14(46.67%)	2(6.67%)
CT scan	22 (73.33%)	2(6.67%)
History of trauma	4(13.33%) only 1 patient had fracture of maxillary bone with internal fixation of maxilla and orbital floor.	4(13.33%)
Previous DCR	4(13.33%) 1 was endoscopic DCR, other 3 were laser DC	Excluded from study
Preceding nasal surgery	11 (36.67%) septoplasty 8(26.67%), conchoplasty 2(6.67%), both of them 1(3.33%)	Excluded from study
Anasthesia	All patients (100%) GA	11(36.667%)GA 19(63.333%)LA

Table 2 :Comparison of intraoperative results.

Inraoperative results	Intraoperative bleeding		Duration	
Parameters	Group A	Group B	Group A	Group B
The mean	68.93 ±29.49 milliliters	56.33 ±21.57 milliliters	38.13± 9.51minutes	32.63± 11.02 minutes
Minimum	10 milliliters	15 milliliters	19 minutes	22 minutes
Maximum	120 milliliters	90 milliliters	65 minute	69 minutes
P-value(t-test)	p -value >0.05		p -value <0.05	

Pain was assessed on day 1 postoperatively using Wong- Baker faces pain rating scale, in group A 11(36.67%) patients had no pain and 19(63.33%) patients had mild pain, while in group B 17(56.67%) had no pain,11(36.67%) had mild pain and2(6.67%) had moderate pain. There is no statistical significant difference of pain between two groups measured by chi square test (P-value >0.05).

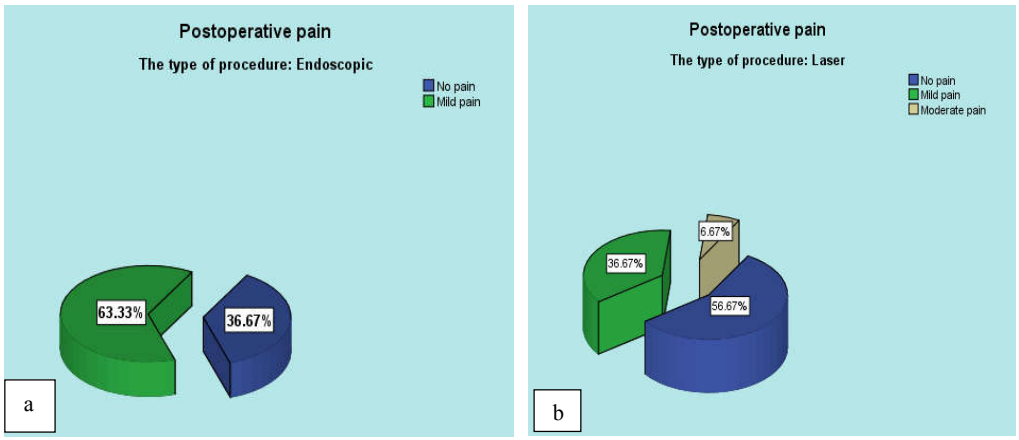

Figure 6 :Percent of postoperative pain in group A, B.

Intraoperative complications like CSF leak, orbital injury, punctal laceration were not documented. **Postoperative complications** were documented during the period of follow up. In group A 2 (6.67%) complications were noticed. In group B 7 (23.33%) complications were noticed. Chi square test was used to test the significance of the difference for the complications in both groups which was not significant (P- value <0.05).

Table 3: Postoperative complications.

Compilations	Endoscopic DCR	Laser DCR
Periorbital swelling	1	2
Synechia	0	3
Granuloma	1	1
Acute dacryocystitis	0	0
Nasocutaneous fistula	0	0
Septal abscess	0	1
Epistaxis	0	0
Total	2(6.67%)	7(23.33%)

During the period of follow up, patients were assessed for both subjective improvement which is defined as satisfied resolution of symptoms described by patients, and objective improvement which was documented by assessment of new ostium with nasoscope, fluoresceine dye and nasolacrimal system irrigation. **Successful surgical outcome** was considered when both subjective and objective success were achieved. In group A success was recorded in 29(96.67%) patients and 1(3.33%) failed surgery were recorded after stent removal. in group B success was recorded in 19(63.33 %) patients and 11(36.67%) failed surgery were recorded [8(26.67%) of them after stent removal and 3(10%) of them before stent removal]. Chi square test was used to test the significance of the difference for the successful rate in both groups which was highly significant (P- value <0.05).

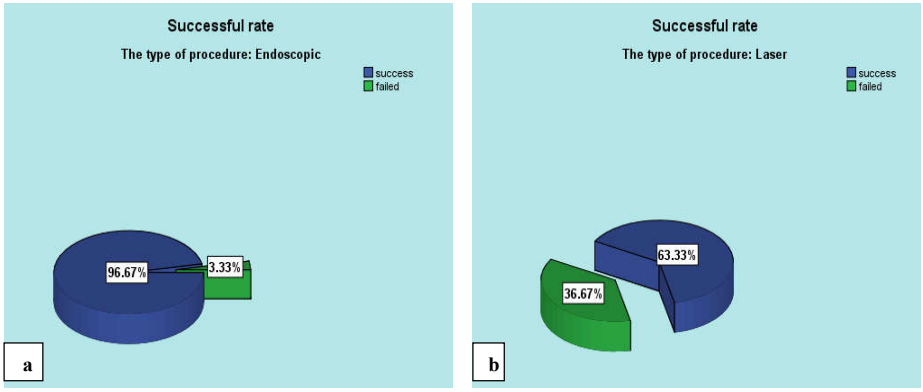

Figure 7: Success Rate.

DISCUSSION:

External DCR is considered the classic and gold standard technique for nasolacrimal system obstruction, but it has the disadvantages of facial scar, long duration, more bleeding and disruption of the lacrimal pump. Another technique (like END-DCR and ECL-DCR) had been developed which may have successful rate comparable to external DCR without its disadvantages.

In our study the mean age was 36.43±17.405 years and the age ranged from 5 years to 79 years with most incidence rates were in people older than 40 years this mostly related to aging.

There are other studies, some of them studied different age groups others studied specific age groups, our mean and range were approximate to them.

The females patients were the most operated in percent of 73.33 % while males percent was 26.67% which was like most studies. The marked predilection for females can be explained by the narrower lumen of bony nasolacrimal canal, it is also possible that endocrine factors may be playing a role in the etiology of chronic dacryocystitis. [10-17]

Most common operated side was left in our study 31 left(51.7%) while the right side was 29 (48.3%), this goes with Antonio Martinez Ruiz - Coello et al [10], 51.3% left and 48.7% right, Remzi Dogan et al[18], 58 were left and 30 were right. While there was similar numbers in both side in Halil Ibrahim Yener et al [13],

Abdulhameed A Hassan et al[15], 15 were right and 13 were left.

Duration ranged from 6months to 14 years, most common presentation was in group with duration ranged from 1year to 2 years and the mean was 2.68 years. Rinky Saha et al[19]found that the mean duration for varies indication were 1.5 ±0.689 years and 1.4±0.74 years in his both groups.

Four (13.33%) patients in group A had DCR as a revision surgery (1 of them was endoscopic DCR, other 3 were laser DCR). Samuel C. Leong et al [17], had 19 of 45 eyes revision DCR(1 external DCR,11 laser DCR,7 endoscopic DCR) and did not affect successful rate (89% in revision and 85% in primary). The size of the remaining lacrimal sac predicts outcomes to be expected with revision surgery. If it is of normal size, the success rate of the revision is similar to the primary procedure, overall outcomes of revision END-DCR tend to still be quite good, and 89% success rates are reported.[4] septoplasty or conchoplasty or both of them were carried in indicated cases in group A and were referred for another technique rather than laser DCR in group B, other studies like Mohit Goel et al [11], Gultekin Ovet et al[20], Dr. Sajad Al-Helo et al[21] concomitant procedures were combined with endoscopic DCR .

General anesthesia was used in all patient in group A, while in group B, local anesthesia (63.34%) was used in patients unfit for general anesthesia and cooperative patients. For patients underwent endoscopic DCR, Antonio Martinez Ruiz -Coello et al [10], Mohit Goel et al [11] general anesthesia was used while Rinky Saha et al[19], local anesthesia was used except in children and uncooperative patients. For patients underwent transcanalicular laser DCR, Abdulhameed A Hassan et al[15], general anesthesia was used , Salah Zuhair Al-Asadi et al [16] (93%), Remzi Dogan et al[18], Most of the operations were carried out under general anesthesia and in unfit patients local anesthesia was used.

Intraoperative bleeding was measured in milliliters and showed no statistical significant difference in both groups and the bleeding ranged from mild to moderate in both groups. This was similar to other studies we compared with [11,14,15,19,22].

Duration of operations were calculated and the mean time of group B (32.63± 11.02 min) was shorter than that of group A (38.13± 9.51min), the result was statistically significant. The duration of group A was within the range of studies while group B was longer than others [11,14,15,18,19,22], may be due to lack of: otolaryngologists's assistance and assistant's training in using endoscopy.

During the periods of follow up, patients were checked for complications as well as the patency of stoma. We noticed 1 case with periorbital swelling resolved before the first visit and 1 with asymptomatic granuloma (not obstructed the stoma) in group A. While in group B: 2 periorbital swelling also resolved before first visit, 1 asymptomatic granuloma, 3 asymptomatic synechia between septum and middle turbinate may be due to trauma to septum and middle turbinate, 1 septal abscess need admission and drainage in our ward. No major complications were documented in both groups as other studies. [13,19,21]

For endoscopic DCR; Mohit Goel et al [11], periorbital oedema, synechia of rhinostomy, granuloma in 4.5% for each complication, Ganesh P. Kulkarni et al [12], synechia in 5% and granulations in 3% in edoscopic group (without mitomycin) for laser DCR; Halil Ibrahim Yener et al [13], crusting and granulation ,inferior canalicular stenosis ,premature prolapse of the tube, stent retraction and punctal deformation were noticed during follow up period of endocanalicular laser DCR, Abdulhameed A Hassan et al[15], swelling of the ipsilateral lower eyelid in 6 cases, and bruising in 4 cases, conjunctival burn has occurred and upper lid burn in another case, synechiae in 2 cases only and released after that and one patient developed granuloma. In 2 patients the silicone stents were removed accidentally while rubbing the eye & cleaning the nose, Remzi Dogan et al[18], also noticed premature tube loss, granulation, synechia, infection, hemorrhage in group with diode laser and stent.

In the first day post operation, pain was assessed using Wong-Baker faces pain rating scale which can be used for patients of 3 years and above and the result showed 3 groups: no pain; mild; moderate, while severe pain was not documented in both groups. Eduardu Damous Feijo et al[14], 86% of patients had minimal pain after laser DCR. Abdulhameed A Hassan et al[15], the patients reported little or no pain postoperatively (laser DCR). Serdar Ozer et al[22], in endoscopic DCR group, all patients had a moderate amount of pain in the first week.

In this study, the success rate for endoscopic DCR was 96.67% and for endocanalicular laser DCR was 63.33% after 9 months of follow up. The success in endoscopic DCR depends on

the amount of bone surrounding the sac can be removed and the marsipulization while in laser DCR it depends on size of stoma can be created. The surgery considered successful when subjective symptomatic improvement and objective ostium patency were documented. In group A, the only failed case had recurrence of symptoms gradually during follow up and stenosis of the stoma after stent removal. In group B the 11 failed cases; 3 of them had recurrence of symptoms and stenosis of stoma before stent removal while the rest 8 developed recurrence of symptoms and fibrosis after removal of stent.

- The success rate for endoscopic DCR in multiple studies ranged from 80.3%-100% with different period of follow up.[10-12,17,19,21,22].
- The success rate for endocanalicular laser DCR in multiple studies ranged from 72% to 93.75% with different period of follow up. [13-16,18,23].

CONCLUSION:

Both endoscopic DCR and endocanalicular laser DCR have the advantages of loss of facial scar, short duration, less bleeding, preservation of the lacrimal pump and less pain with success rate comparable to the conventional technique (external DCR). The success rate is significantly higher in endoscopic DCR. The duration is significantly shorter in laser DCR. There is no significant difference in blood loss intraoperatively, pain and complications in both groups. Revision surgery in endoscopic DCR did not affect the success rate.

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