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Stent versus non stent endoscopic dacryocystorhinostomy: A comparative study

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Short title*:* Stent versus non stent endoscopic dacryocystorhinostomy.

ABSTRACT

Objective: To compare the success rate of endoscopic dacryocystorhinostomy (DCR) with and without bicanalicular silicone intubation.

Patients and Methods: This study included 56 eyes of 56 patients with unilateral NLDO. They were classified into two equal groups each include 28 eyes; group (I) was managed by endoscopic DCR (endo-DCR) with silicone tube stent and group (II) was managed by endo-DCR) without stent.

Results: Comparison of postoperative outcome between the two groups showed that patients with silicone tube stent had better outcome than those without stenting but this difference was insignificant. Failure of the operation was noticed in two patients in group (II) that required reoperation with stent and no failure reported in the group (I). Two cases of group (I) had tube cut during the operation and one case had fistula, while in group (II), two cases had adhesions of nasal wall (synechia) and required additional surgery. Postoperative bleeding was found in one case in group (I) and two cases in group (II), while granulation tissue was found in 3 cases in group (I) and two cases in group (II).

Conclusion: Endoscopic DCR with stent placement had a better result compared to the non-stent cases. However, the outcomes were nearly similar. Future studies are recommended on a large-scale cohort and longer follow-up.

Keywords: Endoscopic dacryocystorhinostomy, silicone tube stent, DCR with stent.

INTRODUCTION:

Dacryocystitis is characterized by inflammation of the lacrimal sac (dacryocyst), classically induced by an obstruction within the nasolacrimal duct (NLD), and a consequent stagnation of tears[1]. Chronic dacryocystitis could be due to systemic diseases, recurrent infections, dacryoliths, and chronic inflammation of NLD[2-3].

Dacryocystorhinostomy (DCR) is the best therapeutic modality in the context of nasolacrimal duct obstruction (NLDO) and is conducted by utilizing external DCR (EX-DCR) or endonasal endoscopic (EN-DCR) technique[4].

EX-DCR is performed by standard skin incision and creating a connection between the lacrimal sac and nasal cavity by excision of the intervening bone[5]. This technique was modified by using the modern external flap DCR approach. The primary complication of such approach is the presence of an external scar[6]. On the other hand, EN-DCR is technically challenging and higher adoption of such approach happened following the emerging of endoscopic approach[7].

In the context of, the EN-DCR a nasal mucosal flap is first formed, then endonasal bone osteotomy to expose the lacrimal sac and its marsupialization within the nasal cavity. Success frequency of such technique by the external and the endoscopic, are greater than 90% in most of the studies[8].

Furthermore, being minimally invasive, it has many benefits, which include; short surgical time, minimal blood loss, absence of an external scar and not associated with medial canthus trauma. The success ratio of endo-DCR has been recorded to be within the range from 70% to 98%[9].

Retrospective researches have recorded no change in the success rate with or without stent[10-13]. Some studies have

reported better outcome with stent placment, mainly for cases of atrophic lacrimal sac or for revision cases[14-15]. In contrast, others reported higher success rates without stent placment **(placement)**, due to the assumption that stents have been associated with fibrosis, infections and adhesions, and possibility of canalicular laceration, which ultimately ends in low success rates [16-18].

Due to this controversy, we performed the study to compare the success frequency of endo-DCR with and without bicanalicular silicone intubation.

PATIENTS AND METHODS

This prospective clinical trial carried out between march 2020 to march 2023 at the Ophthalmology Department, Mansoura University, Egypt. Institutional Review Board approved the study and it was adherent to the tenets of the Declaration of Helsinki and a written informed consent was acquired from entire members before their contribution.

All included patients were adults (>18 years) having primary NLDO, while recurrent dacryocystitis, patients with bone deformity after trauma, congenital malformation of the nose or eyelids, and malignancy were excluded from the study.

Methodology:

Medical history of the complaint and full ophthalmological examination was conducted in all cases. SL examination of the eyelids, puncti, exclusion of ectropion, evaluation of the tear meniscus and regurgitation test. Dye disappearance test was performed in all cases.

Probing and irrigation of the upper lacrimal drainage system was done to determine the obstruction level. After topical anesthesia, the upper punctum was dilated by a Nettleship dilator. Then the lacrimal cannula with saline-filled syringe was advanced through the upper punctum, then through the canaliculus after traction of the eyelid at the outer canthus. Reflux across the contralateral punctum denotes an obstruction in the common canaliculus or NLD however, fluid coming directly back across the same punctum indicates a canalicular obstruction, irrigation into the nose indicates an anatomically patent system.

Surgical approach

all cases were operated under general anesthesia. Decongestion of the nasal cavity with 1/100000 epinephrine-soaked swabs was performed, injection of 1/100000 epinephrine into the lateral nasal wall, cutarization (cauterization) of hypertrophied turbinate (Fig.1) a U-shaped mucosal incision was done in front of the middle turbinate and the mucosal flap was elevated (Fig.2), removal of bone window with a bone rongure (rongeur) removing the uncinate process and a part anterior to it (Fig.3) introduction of a Bowman probe was done to tent the medial wall of the sac and an incision was performed in the medial wall of the sac and the medial wall flaps were removed (Fig.4) dye injection using trypan blue stain (Fig.5)

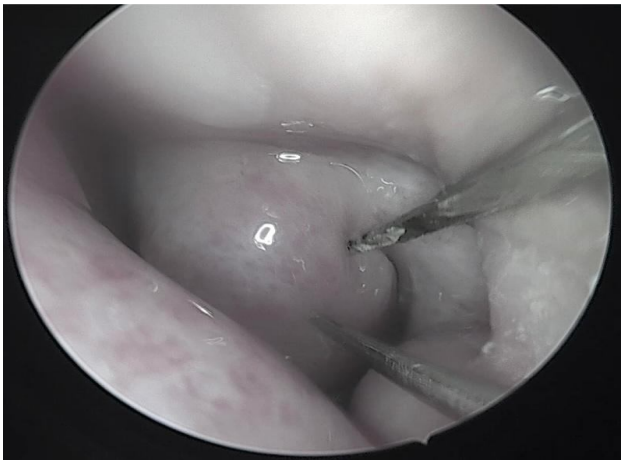

Fig.1 cutarization of hypertrophied turbinate

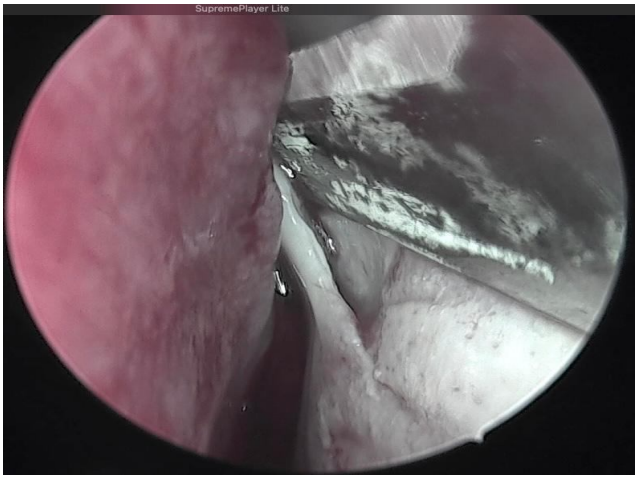

Fig.2 incision over lateral nasal wall for elevation of posteriorly based mucosal flap

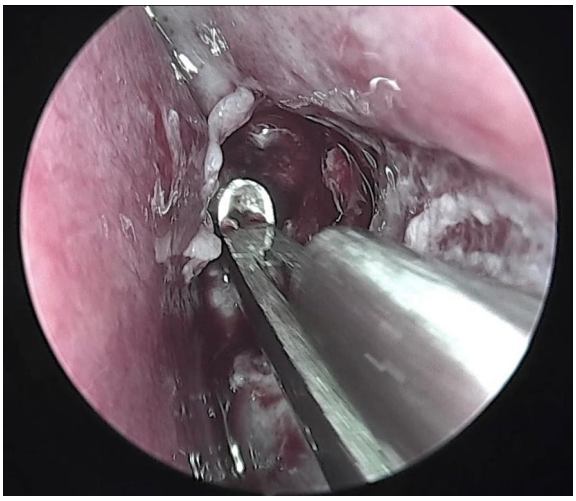

Fig.3 bone removal using kerrison'punch forceps with removal of lacrimal bone

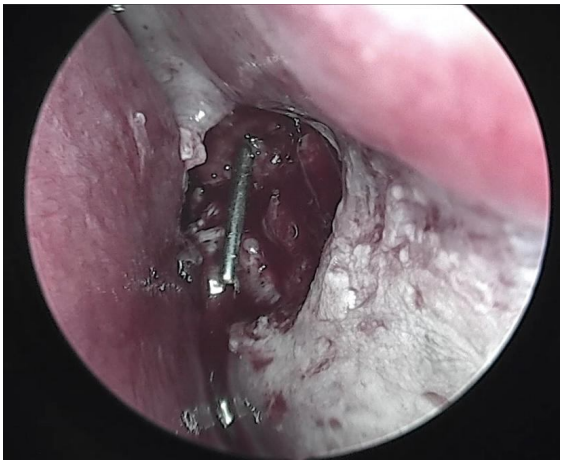

Fig.4 exposed bowman probe after full bone removal and removal of lateral wall of lacrimal sac

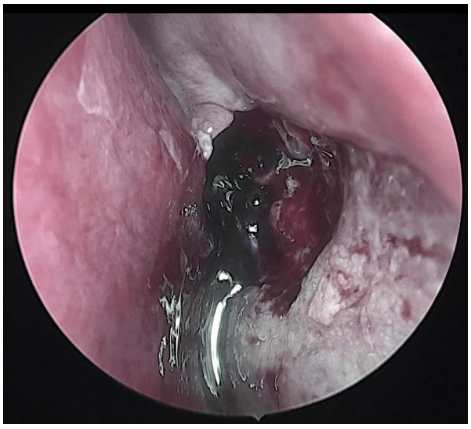

Fig.5 dye injection using trypan blue stain

Following this phase of the surgery, half of the patients were intubated with bicanalicular silicone tube group (I) (Fig.6), where the other group (II) left without insertion of silicone tube.

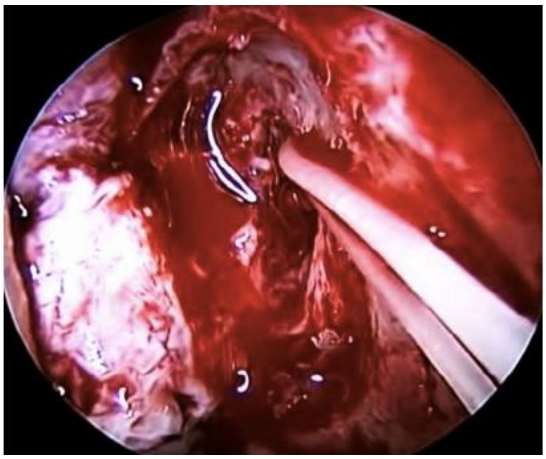

Fig.6 bicanalicular silicone stent seen in nasal cavity through lacrimal sac opening

Bicanalicular intubation set was used in group (I) where both the upper and lower puncti were dilated using a Nettleship dilator and the silicone tube probe was advanced from the upper and lower puncti, canaliculi, sac and NLD and retrieved from the nose and tied inside the nose.

Postoperative assessment:

Postoperative systemic antibiotic for one week, combined antibiotic/steroid eye drops and nasal decongestants were used for two weeks. Follow up visits were done at 1, 2 weeks; 1, 3 and 6 months. Successful outcomes were defined by complete resolution of symptoms, patent osteotomy on endoscopic examination, DDT and irrigation.

Statistical analysis

Statistical analyses were carried out by utilizing SPSS v23 statistical software. Descriptive statistics were measured for quantitative variables. Chi-square, student-t and ANOVA test were utilized when needed for parametric data, and Mann-Whitney U was utilized in the context of non-parametric variables. With regard to all the previous testes, $P \leq 0.05$ was considered significant.

RESULTS

This study included 56 eyes of 56 patients with NLDO, they were classified into two equal groups each included 28 eyes; group (I) operated by endo-DCR with bicanalicular silicone intubation and group (II) operated by endo-DCR without stent. They were 26 females (92.9 %) and 2 males (7.14 %) in group (I) and 25 females (89.3 %) and 3 males (10.7 %) in group (II). The ages in group (I) ranged from 24 to 75 years with mean ± SD of 45.64 ± 11.28 years and the

ages in group (II) ranged from 24 to 74 years with mean of 46.61 ± 12.04 years. Both groups were age and sex matched ($p > 0.05$) (Table 1).

Table (1): Demographic data of the two studied groups.

	Group (I) With stent		Group (II) Without stent		Test of Significance	
Gender	**No.**	**%**	**No.**	**%**	**χ^2**	**P**
• Males	2	7.14	3	10.7	0.718	0.149
• Females	26	92.9	25	89.3	0.965	0.117
Total:	**28**	**100**	**28**	**100**	**χ^2**	**P**
• Right eye	15	53.6	12	42.9	0.834	0.356
• Left eye	13	46.4	16	57.1	0.867	0.325
Age (years)	**Min**	**Max**	**Min**	**Max**	**t**	**P**
Range	24	75	24	74		
Mean ± SD	45.64 ± 11.28		46.61 ± 12.04		0.558	0.524

χ^2 = Chi square, t: paired t-test, SD: standard deviation.

The operation time was more in group (I) than group (II), with mean ± SD of 34.7 ± 2.68 minutes and 24.5±3.61 minutes in group (I) and (2) respectively with significant difference between the two groups.

Comparison of postoperative outcome in the two groups showed that patients with silicone tube stent had better outcome than those without tube stent (89.3% versus 85.7%) but this difference was insignificant ($p > 0.05$). However, regarding failure of the operation after 6 month of treatment it was observed in two cases in non-stent group that required reoperation with stent and no failure in the first group with stent ($p < 0.001$), (table 2).

Table (2): Comparison of postoperative outcomes for 6 months of follow-up between the two studied groups

Findings	**Group (I)**		**Group (II)**		**Significance**	
	No.	**%**	**No.**	**%**	**χ^2**	**P**
Epiphora	3	10.7	4	14.3	0.754	0.122
Discharge	3	10.7	4	14.3	0.754	0.122
DDT positive	3	10.7	4	14.3	0.754	0.122
Regurge	3	10.7	4	14.3	0.754	0.122
Complete relief	25	89.3	24	85.7	0.139	0.826
Partial relief	3	10.7	2	7.14	0.718	0.149
Failure (no relief)	0	0.00	2	7.14	4.651	0.000*

χ^2 = Chi square, $p > 0.05$ = statistically non-significant, *$p < 0.001$ = statistically highly significant. DDT: dye disappearance test.

Comparison of complications between the two groups showed two cases in group (I) had cutting of the tube during the operation and one case had fistula, while in group (II), two cases had adhesions of nasal wall (synechia) required additional surgery. Bleeding was found in one case in group (I) and two cases in group (II), while granulation tissue was found in 3 cases in group (I) and two cases in group (II), (table 3).

Table (3): Postoperative complications of the two studied groups

Complication	Group (I)		Group (II)		Significance	
	No.	%	No.	%	χ^2	P
Tube cut	2	7.14	0	0.00	N/A	N/A
Fistula	1	3.57	0	0.00	N/A	N/A
Synechia	0	0.00	2	7.14	4.651	0.000*
Bleeding	1	3.57	2	7.14	3.245	0.000*
Granulation tissue	3	10.7	2	7.14	0.718	0.149
Additional surgery	0	0.00	2	7.14	4.651	0.000*

χ^2 = Chi square, p >0.05 = non-significant, *p <0.001 = highly significant.

DISCUSSION

The En-DCR is a minimally invasive operation used in management of NLDO and chronic dacryocystitis management. It involves the induction of fistula in the lacrimal sac into the nasal cavity. It has many benefits including; short surgical time, minimal blood loss, absence of external scar and not associated with injuries to medial canthal anatomy[19].

The study included 56 eyes of 56 patients with NLDO, they were classified into two groups each included 28 eyes; group (I) was managed by endo-DCR with silicone tube stent and group (II) was managed by endo-DCR without tube stent. Comparison of postoperative outcome between the two groups in our study showed that patients with silicone tube stent had a better outcome and the operation time was more in group (I) than group (II). In the current study, DCR success was evaluated according to the absence of excessive tearing and normal lacrimal irrigations as well as to negative DDT, and patent fistula on endoscopic examination (at least 6 months). With regard to failure of the operation after 6 months of follow up it was noticed in two patients in non-stent group that require reoperation with stent and no failures in the first group (p <0.001).

In addition, Unlu et al. in their study on NLDO have reported success ratio of 81.3% and 85.7 in group stenting free group and the stenting group respectively[17].

A recent study by Allam et al. compared between silicone and polypropylene in terms of stenting in En-DCR and found high success rate with the group of silicone stenting, with marked change between both groups[19].

Such outcomes came in the same line with that of Viswanatha et al. who have demonstrated that the success frequency with polypropylene stenting in endo-DCR approaches was 80%, while the success frequency with silicone stenting was 90%. On the other hand, the study displayed no significant changes between the utilization of silicone and proline stenting with regard to En-DCR (p>0.05)[20].

In the same line, Sadaka et al. had 20 patients with DCR surgery with prolonged intubation (3 months) the success rate was 99.3% with failure of a single case complaining from persistent epiphora postoperative with prolonged FDDT. In addition, they had 20 cases with DCR without intubation the success rate was 86.6% with failure of two patients. No tubal adverse events were recorded[21].

A previous literature demonstrates a success ratio ranging from 75% to 100% of endo-DCR utilizing various approaches in presence or absence of silicone tubing and recorded a higher success ratio with the intubated group[16-22]. On the other hand, Smirnov et al. recorded a success ratio of 100% in the non-stent group in comparison with 78% in the stent group[23]. Ozay et al. have displayed a success ratio of 84% and 42 patients hadn't perfumed intubation with success rate approximately 88%[24].

Walland and Rose carried out their study on 388 DCR cases and demonstrated no significant differences in failure rate for primary or secondary operations between silicone intubated and non-intubated groups[25]. In addition, in agreement with our results Ambani et al. observed a higher failure of endo-DCR particularly among patients in which

no stents were utilized due to granulations and scarring near the osteotomy site[26].

Buttanri et al. used silicone intubation in 69 cases with NLDO in EX-DCR surgeries. They reported that the success rate was 76% and they demonstrated that silicone intubation has to be utilized with regard to cases with distal or common canalicular obstructions. Even though the majority of the cases relived following tubal removal, excessive tearing was returned in about 20% of the cases[27].

Choung and Khwarg carried out their study on 166 patients of which 74 cases were undergone silicone tubal insertion whose lacrimal sacs and nasal spaces were large for tear drainage. They have displayed that, although whole passages were patent, excessive tearing was detected in about7%[28].

Bazzazi et al. in a randomized clinical trial that was done on 80 cases with NLDO who were divided into 2 groups of EX-DCR in presence or absence of silicone tube. They have demonstrated that the success ratio was 77.5% in EX-DCR and 90% in EX-DCR with silicone stenting with statistically significant difference[29]. Ozkaya et al. have inserted silicone tube in about 1/2 of the cases and recorded that the success rate were 87.5% in-group with silicone intubation group and 86.3% in silicone free one[30].

Saiju et al. studied 100 cases and used silicone tube in 44 cases. Following six months, the success rate were 90% in silicone intubation group, and 87% in group without intubation, and the change between both groups wasn't significant. In addition, they recorded that silicone intubation raised the charges of the surgeries up to 20%[31]. This came in the same line with another meta-analysis which comprised five RCTs and four cohort researches and demonstrated no advantages of using of silicone intubation in the context of primary DCR[32].

Additional research demonstrated that, success ratio between 84% and 94% in endo-DCR with minimal suggestion to reinforce the usage of silicone stenting to enhance surgical outcomes[33]. Numerous surgeons favor silicone intubation; on the other hand, it could be associated with granulation tissue formation, infection or canalicular laceration[23].

Stenting duration following endo-DCR is a matter of debate. In a previously documented researches, the mean duration before stent removal is from one month to 6 months[34].

Comparison of the complications between the two groups showed; Two cases of group (I) had tube cutting during the operation and one case had fistula, while in group (II), two cases had adhesions of nasal wall (synechia) that required additional surgery. Bleeding was found in one case in group (I) and two cases in group (II), while granulation tissue was found in 3 cases in group (I) and two cases in group (II).

These complications coincide with Allam et al. who reported that the complication rate was significantly greater in-group II (prolene stent). On the other hand, orbital adverse events comprising orbital injuries, Conjunctivitis, and canalicular laceration were insignificantly greater in prolene in comparison with silicon intubation. Such results didn't come in the same line with a study conducted by Roithmann et al.[8] in which the efficiency of Silicone, Polypropylene, and T-tube Stents in En-DCR were compared and displayed that the complication rate wasn't significantly different among the stents ($P>0.05$). On the other hand, Prolene had significantly higher orbital adverse events in comparison with other stent materials ($P<0.05$)[19].

Al-Qahtani considered the benefits of no usage of stent over the potential complication, which includes infections, or canalicular laceration, and prolapse of tube, in association with economic charge, time of surgery, and patient discomfort, endo-DCR without stenting could appear a better modality in comparison with endo-DCR with a stent[35].

CONCLUSION

Endoscopic DCR with bicanalicular silicone stent placement had a good result. Although endo-DCR with stent has many advantages over DCR without stent, the outcomes were nearly similar. Future studies are recommended in a large-scale cohort and longer follow-up period.

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Data Availability: The authors declare that all data supporting the findings of this study are available within the article and its supplementary information file.

Competing interests: The authors declare no competing interests.

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Ethics declarations: All procedures performed in the study followed the 1964 Helsinki declaration and its later amendments, University Ethics Committee approved the project.

Conflict of interest

Ayman E Abd El Ghafar, Mohamed A Elsehsah, Hossam T El-Sharqawy, Ahmed A El Zihzahi. All authors have no conflicts of interest that are directly relevant to the content of this review.

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