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Original Research Article

Success rate of dacryocystorhinostomy with and without silicone intubation: a comparative study

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ABSTRACT

Background: Dacryocystorhinostomy (DCR) is the gold standard operation for nasolacrimal duct obstruction, (NLDO) creating a bypass between the lacrimal sac and nasal cavity to restore tear drainage and alleviate epiphora. The role of silicone intubation as a method of improving surgical outcomes is contentious, with conflicting evidence regarding whether it is effective and necessary.
Methods: The prospective comparative study was conducted at a tertiary care hospital in Dhaka, Bangladesh, from July 2019 to June 2024. Two hundred patients of chronic dacryocystitis were randomly placed in two groups: DCR with silicone intubation (n=100) and DCR without silicone intubation (n=100). Success was defined as freedom from epiphora, patent lacrimal passage on syringing, and no need for revision surgery. Data were analyzed using SPSS version 25, and statistical significance was established at $p<0.05$.
Results: The age was 30.41±7.41 years in the silicone group and 31.98±7.55 years in the non-silicone group, with female predominance (62% vs 58%). Success was higher in the silicone intubation group (96%) compared to the non-silicone group (88%). Failure was 4% in the silicone group and 12% in the non-silicone group. Binary logistic regression revealed that silicone intubation increased the chance of success by 5.26 times (95% CI: 1.24-22.34, p=0.024), and it was the most significant predictor of surgical success.
Conclusions: DCR with silicone intubation was more successful than DCR without intubation. High odds ratio supports the clinical benefit of routine silicone intubation for external DCR operations.

Keywords: Dacryocystorhinostomy, Nasolacrimal duct obstruction, Silicone intubation

INTRODUCTION

Dacryocystorhinostomy (DCR) refers to a surgical procedure that seeks to create a path of drainage between the nasal cavity and the lacrimal sac.[1] It has emerged as the treatment of choice in NLDO, a common disease that significantly impacts the quality of life of patients by producing chronic epiphora and persistent infections.[2] The fundamental principle of DCR is to create a permanent bypass connection between the lacrimal sac and the nasal cavity, thus bypassing the obstructed nasolacrimal duct and restoring normal tear drainage.[3] External and endonasal are the two broad classifications of DCR. External DCR, first described by Toti in 1904, involves creating a surgical ostium via the medial wall of the lacrimal sac over a skin incision.[4] This technique provides excellent visualization of the field and allows meticulous manipulation of both bone and soft tissue. The procedure has been refined over generations, and changes in surgical technique, instrumentation, and postoperative care have contributed to its extremely high success rates. External DCR is used most commonly for the treatment of all forms of lacrimal drainage obstruction, such as distal canalicular obstruction, common canalicular obstruction, and NLDO.[5]

The flexibility of the surgery renders it particularly suitable for complex cases of extensive scarring, anatomical defects, or failed previous surgeries. Though endonasal DCR has become increasingly popular in recent years as a result of technological progress and endoscopic techniques, a majority of oculoplastic surgeons still prefer external DCR, crediting this technique with a higher success rate.[6]

The employment of silicone intubation during DCR has been controversial in ophthalmological literature.[7,8] Silicone tubes, during DCR, are believed to maintain the newly created ostium open during the critical period of healing, protect against premature closure by scarring, and act as a scaffold for epithelialization.[9] By contrast, there is a consensus debate about whether routine silicone intubation is indicated, with some surgeons favoring its use in all patients and others reserving it for specific indications such as canalicular involvement or revision surgeries. Studies have reported an anatomical success rate of more than 90% if the patency was measured by a lacrimal irrigation test.[10,11] While the symptomatic success rate is generally lower, ranging from 74% to 83%.[12] The variation reflects the intricacy of the lacrimal drainage physiology and the multifactorial origin of epiphora. Few patients are left with ongoing tearing after DCR when the lacrimal drainage system is patent and no issue is found with the ocular surface or eyelid. This symptomatic and anatomical mismatch following DCR has been termed functional failure. Functional failure has gained prominence in the studies during recent years and is a very crucial clinical entity.[13,14] The causes are diverse and consist of impaired tear pump function, lid malposition, ocular surface disease, and psychogenic reasons. Understanding these mechanisms is crucial to providing optimization of patient selection and surgical results. Whereas external DCR is standard ophthalmic practice throughout the world with satisfactory short-term outcomes, long-term series are rare. Anatomical patency has been the primary measure of success in the past. In recent years, the functional outcome after DCR has become the focus as a critical endpoint because anatomical success is not necessarily commensurate with functional success. Although DCR is performed regularly, its long-term outcomes have not been investigated yet. This study aimed to compare surgical outcomes of DCR with versus without silicone intubation for NLDO, evaluating success rates, complications, and long-term patency to determine optimal treatment.

METHODS

This prospective comparative study was conducted in the department of ophthalmology at a tertiary care hospital, Dhaka, over a period from August 2018 to January 2019. The study enrolled patients presenting to the outpatient department with clinical evidence of chronic dacryocystitis, all of whom met the inclusion criteria for undergoing external DCR. Patients were randomly assigned to two groups: Group A underwent DCR with silicone intubation, and group B underwent DCR without silicone intubation. Data collection was carried out using a pre-tested structured data collection sheet that included demographic information, presenting symptoms, surgical findings, and postoperative outcomes.

Statistical analysis

The collected data were entered and analyzed using the statistical package for social sciences (SPSS), version 26. Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to summarize the demographic and clinical characteristics of the study population. Categorical variables such as sex, symptom distribution, and surgical outcomes were compared between the two groups using the Chi-square test or Fisher's exact test, where appropriate. Continuous variables, including age, were compared using independent sample t-tests. A p value of less than 0.05 was considered statistically significant. In addition, binary logistic regression analysis was performed to identify independent predictors of surgical success, adjusting for potential confounding variables such as age and sex. The results were presented as odds ratios (ORs) with 95% confidence intervals (CIs) to estimate the strength of associations.

RESULTS

Table 1 shows the distribution of the 200 studied patients in two groups of 100 patients each. The with the silicone intubation group mean age was 30.41±7.41 years, and that of the non-silicone intubation group was 31.98±7.55 years. The age group indicates that most patients in either group were between the ages of ≤30, with 54% in the silicone intubation group and 48% in the non-silicone group. The second most prevalent age group was 31-40 years, with 34% (34 patients) and 36% (36 patients) respectively. Patients between 10 and 20 years represented 10% and 8% in each group, while elderly patients (41-50 and 51-60 years) comprised smaller percentages. Statistical analysis showed there was no visible disparity in age structure across groups (p=0.968), implying that the two groups were comparable according to sex demographics and excluded age as a confounding factor in study findings.

Table 2 depicts gender distribution among both study groups and demonstrates female dominance in patients with chronic dacryocystitis. In the silicone intubation group, 62% (62 patients) were female and 38% (38 patients) were male. In the non-silicone intubation group, 58% (58 patients) were female and 42% (42 patients) were male.

Table 3 presents the key outcome of the comparison between the success rates of the two surgical approaches. The results show that the patients who were treated with DCR via silicone intubation had a higher success rate of 96% (96 patients out of 100) compared to patients with no silicone intubation, which had an 88% success rate (88

patients out of 100). Meanwhile, the rate of failure was 4% (4 patients) for silicone intubation and 12% (12 patients) for non-silicone intubation. While the group with silicone intubation showed improved findings with an 8% absolute difference in success rates, statistical analysis did not show that the difference was statistically significant (p=0.268).

Table 4 outlines the specific criteria used to determine surgical success for each of the treatment groups. Three major parameters were employed: no epiphora (no tearing), patent lacrimal passage on syringing, and no revision surgery requirement.

The outcome demonstrates ideal concordance between all three criteria for success for each group. For the silicone intubation group, 96% of the patients fulfilled all three criteria, whereas in the non-silicone intubation group, 88% were successful with all parameters.

Tables 5 (A) and (B) represent the results of a binary logistic regression that analyzed predictors of surgical success in DCR surgery. Silicone intubation was the only statistically significant predictor (p=0.024), with an increase in chances of success by 5.26 times (95% CI: 1.24-22.34) compared to no intubation. Age was weakly negatively correlated (OR=0.98, p=0.668), and female sex had a small but not significant positive correlation (OR=1.33, p=0.646). The outcomes reveal silicone intubation to be the most significant modifiable factor to maximize outcomes, with no clinical impact of age and sex. The research strongly advises using silicone intubation to optimize surgical success in DCR surgery.

Table 1: Age distribution of the patients, (n=200).

Age (in years)	With silicon intubation, (n=100)		Without silicon intubation, (n=100)		P value
	N	%	N	%	
≤30	54	54	48	48	0.968
31-40	34	34	36	36	
41-50	8	8	10	10	
51-60	4	4	6	6	
Mean±SD	30.41±7.41	31.98±7.55			

Table 2: Sex distribution of the patients, (n=200).

Sex	With silicon intubation, (n=100)		Without silicon intubation, (n=100)		P value
	N	%	N	%	
Male	38	38	42	42	0.838
Female	62	62	58	58	

Table 3: Outcome of the patients, (n=200).

Outcome	With silicon intubation, (n=100)		Without silicon intubation, (n=100)		P value
	N	%	N	%	
Success	96	96	88	88	0.268
Failed	4	4	12	12	

Table 4: Criteria used to measure surgical success, (n=200).

Success criteria	With silicone intubation, (n=100)		Without silicone intubation, (n=100)	
	N	%	N	%
Absence of epiphora (no tearing)	96	96	88	88
Patent lacrimal passage on syringing	96	96	88	88
No need for the revision surgery	96	96	88	88

Table 5 (A): Binary logistic regression analysis of factors associated with surgical success, (n=200).

Factors	B (Coefficient)	SE	Wald	OR (95% CI)	P value
Silicone intubation	1.660	0.735	5.100	5.26 (1.24-22.34)	0.024
Age (in years)	-0.015	0.035	0.184	0.98 (0.91-1.06)	0.668
Sex (Female)	0.285	0.621	0.211	1.33 (0.39-4.48)	0.646
Constant	1.790	1.032	3.009	-	0.083

Table 5 (B): Interpretation of logistic regression results.

Predictors	Interpretation
Silicone intubation	Patients who underwent DCR with silicone intubation were 5.26 times more likely to achieve surgical success compared to those without intubation. This finding is statistically significant (p=0.024).
Age (in years)	For each additional year of age, the odds of surgical success decreased slightly (OR=0.98), but this association was not statistically significant (p=0.668).
Sex (Female)	Female patients had slightly higher odds of surgical success (OR=1.33) than males, but this difference was not statistically significant (p=0.646).
Overall model	The model shows a significant positive association between silicone intubation and DCR success. Other variables (age and sex) were not significant predictors in this model.

DISCUSSION

This study investigated comparative outcomes of DCR with silicone intubation versus DCR without silicone intubation in patients with chronic dacryocystitis. Our findings are one part of the historical controversy regarding what surgical method to use to correct NLDO, contributing evidence-based data to the discussion regarding the role of silicone intubation in DCR procedures. Our population's demographic characteristics are by published trends in the literature. The distribution of the age of the two groups, with mean ages of 30.41±7.41 years and 31.98±7.55 years for the silicone intubation group and non-silicone intubation group, respectively, is in agreement with the report by Gleich et al.[15] This age range is the general population that has developed NLDO, which typically occurs during the third and fourth decades of life. Our female majority, at 62% in the silicone intubation group and 58% in the non-silicone intubation group, is consistent with the epidemiological pattern described by Sales et al who had 64.2% female patients in their series.[16] Such a gender divide reflects the proven vulnerability of women to the occurrence of NLDO due to anatomic and hormonal reasons. The highest finding of our study indicated a higher success rate in the silicone intubation group (96%) as compared to non-silicone intubation (88%), though the difference was not statistically significant (p>0.05). This finding is closely in line with Akbari et al where the authors gave success rates of 94.24% on silicone intubation and 86.23% without intubation.[17] This accord among various study groups also strengthens evidence that silicone intubation is of clinical benefit even in the face of statistical insignificance due to limitations in sample size. Our findings are also corroborated by Ing et al who used external DCR with silicone tube implantation in 41 out of 166 patients and reported higher success in the intubation group (95.1%) compared to the non-intubation group (87.5%).[18] Similarly, Kaçaniku et al achieved an 87.09% success rate using external DCR and silicone tube intubation.[19] The diversity of success rates among studies can be explained by variation in patient population, procedure, time of follow-up, and success criteria. Other studies have reported similar excellent results with silicone intubation. Naik et al and Xie et al have reported a 90% success rate in 50 cases of acquired partial nasolacrimal obstruction managed by DCR and silicone intubation.[20,21]

Our study features binary logistic regression analysis to further elucidate determinants of success in surgery. The finding of silicon intubation doubling the chances of success at 5.26-fold (p=0.024) is a statistically and clinically significant development. Through allowing control of confounding variables, this statistical technique can provide stronger evidence of the efficacy of silicone intubation than comparative analysis alone. The mechanism whereby silicone intubation improves outcomes is likely to be multifactorial. The tubes may conceivably prevent premature ostial closure during healing, serve as a scaffold for epithelialization, and maintain patency during the immediate postoperative course. However, the optimal duration of intubation and the specific indications for its use are topics of ongoing investigation.

Limitations

The study provides some limitations, including the relatively brief duration of follow-up, which may not capture results fully in the long term, the study's single-center setting, which lowers the external validity of the results, and the absence of the use of standardized indications for the timing of silicone tube removal.

CONCLUSION

This study indicates that DCR with silicone intubation yields more successful outcomes than non-intubation operations, with statistical significance confirmed with logistic regression analysis. Although the two techniques were both very successful, the 96% success rate of silicone intubation compared to 88% in the absence of intubation and the 5.26 times higher odds of success constitute very strong evidence for the clinical benefit of silicone intubation in DCR surgery. The randomized study confirms that silicone intubation has enormous advantages in the correction of NLDO and justifies the routine adoption of its use in external DCR.

Recommendations

Such a study in the future would ideally involve multicenter randomized controlled trials with long-term follow-up to have definitive guidelines for silicone intubation for DCR surgery. A study on the optimal time

for removal of the tube and costing would be useful for such an operation's practice.

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