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Silicone Intubation Versus No Intubation In Dacryocystorhinostomy For Nasolacrimal Duct Obstruction: A Systematic Review

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ABSTRACT

Introduction: Nasolacrimal duct obstruction (NLDO) is the most common cause of impaired tear drainage and typically presents with excessive tearing and/or recurrent infection. Although medical treatment, such as antibiotics may provide symptomatic relief, definitive management, typically external and endonasal dacryocystorhinostomy (DCR) is usually required. Several variations of DCR have been described, including procedures with silicone intubation. However, the role of silicone intubation in DCR remains controversial, with differing opinions regarding its clinical benefit.

Methods: This study was conducted following PRISMA guidelines. A thorough literature search was performed across four electronic databases: PubMed, ScienceDirect, Semantic Scholar,

and Google Scholar. The search strategy was designed to identify studies evaluating DCR performed with and without silicone tube insertion in patients with NLDO. The primary outcomes of interest included anatomical and functional patency and the presence of persistent epiphora.

Result: Fourteen studies were included in the analysis. Symptom improvement occurred in patients with and without silicone intubation, typically within weeks and maintained through follow-up. Patency was assessed by various methods, and tube removal timing varied. Most studies found no statistically significant differences in functional or anatomical outcomes between the two groups.

Conclusion: This review suggests that the role of silicone intubation is similar in both external and endonasal dacryocystorhinostomy. While some studies show a trend toward higher success with intubation, few report statistically significant improvements. Silicone tubes are associated with longer operative times, higher costs, and potential complications, yet high success rates are also achieved without them. Therefore, silicone intubation is recommended only for carefully selected patients, considering the surgical approach, anatomy, and risk of failure.

Keywords: *nasolacrimal duct obstruction;dacryocystorhinostomy; silicone intubation*

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INTRODUCTION

Epiphora or excessive tearing refers to persistent watering of the eye, which can be attributed to either reflex tearing, hypersecretion of the lacrimal gland, or impaired tear outflow. Reflex tearing may be triggered by a variety of factors, including dry eyes, inflammation, allergies, or other surface ocular disorders. Impairment of tear outflow can result from eyelid disorders, dysfunction of the lacrimal pump, or obstruction of any part of the nasolacrimal drainage system.[1] Nasolacrimal duct obstruction (NLDO) is the most common cause of tear outflow impairment, and manifested by the presence of tearing and/or infection (dacryocystitis). NLDO can be classified as as primary acquired nasolacrimal duct obstruction (PANDO) when the cause is idiopathic, or as secondary acquired lacrimal duct obstruction (SALDO) when it results from identifiable causes such as infection, inflammation, trauma, mechanical factors, or neoplastic disease.[1,2] While medical management, including antibiotic therapy, may help relieve symptoms, definitive treatment typically requires a surgical intervention aimed at restoring patency of the lacrimal drainage system.[3]

Dacryocystorhinostomy (DCR) is a surgical procedure designed to bypass obstruction within the nasolacrimal drainage system. It involves creating a 1–2 cm incision along the side of the nose and removing a small segment of bone to form an alternative drainage pathway for tears into the nasal cavity. This procedure is performed in both adults and children with partial or complete nasolacrimal duct obstruction. DCR can be broadly categorized into two main approaches which are external (ExDCR) and endoscopic (EnDCR).[3,4] The aim of the surgery is to form a direct connection between the lacrimal sac and the nasal cavity by removing the intervening bone, creating a bypass of the obstructed downstream nasolacrimal duct. EnDCR generally refers to techniques performed from within the nasal cavity, using either a speculum or an endoscope, whereas ExDCR requires a skin incision at the medial canthus or eyelid. EnDCR were first reported as early as 1893 by Caldwell. Despite this, ExDCR became more widely performed throughout the twentieth century because the open approach provided improved visualization of anatomical structures, as described by Toti and later by Dupuy-Dutemps and Bourguet.[5,6]

DCR has been described in multiple variations, including laser-assisted endoscopic techniques and the use of silicone intubation.[4] In the 1970s, ophthalmologists began to

silicone intubation implanted at the end of the surgery. This technique was intended to improve post-surgery patency by keeping the ostium open. However, other studies have shown increased failure rates associated with silicone intubation due to granulomatous inflammation. As a result, the use of silicone intubation in DCR surgery has been widely debated with conflicting viewpoints. There is also no consensus regarding how long the intubation should be maintained.[7,8,9]

This study is aimed to review he success rate of DCR procedure with silicone intubation in comparison without silicone intubation.

METHODS

The study was conducted by following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure methodological rigor and transparency. This adherence was intended to improve accuracy, consistency, and reliability of the findings and the conclusions.

Search strategy

A comprehensive literature search was conducted using four electronic databases: PubMed, ScienceDirect, Semantic Scholar and Google Scholar. The search was structured to identify studies assessing dacryocystorhinostomy with and without the insertion of silicone tube in patients with nasolacrimal duct obstruction. Titles and abstracts were screened to determine eligibility, and only studies that met the inclusion criteria were advanced for further analysis. Publications that met all requirements and were directly relevant to the topic were included, while those that failed to meet these standards were excluded. Key information including titles, authors, publication years, study settings, methodologies, and study parameters were carefully evaluated during the review process.

The Booelan MeSH keywords inputted on databases for this research are:
("Dacryocystorhinostomy" OR "DCR") AND ("Silicone Intubation" OR "Silastic Tube" OR "Intubation") AND ("Nasolacrimal Duct Obstruction" OR "NLDO" OR "Epiphora")

Table 1.Article search strategy

Database	Keywords	Hits
Pubmed	*("Dacryocystorhinostomy" OR "DCR") AND ("Silicone Intubation" OR "Silastic Tube" OR "Intubation") AND*	229

	("Nasolacrimal Duct Obstruction" OR "NLDO" OR "Epiphora")	
ScienceDirect	*("Dacryocystorhinostomy" OR "DCR") AND ("Silicone Intubation" OR "Silastic Tube" OR "Intubation") AND ("Nasolacrimal Duct Obstruction" OR "NLDO" OR "Epiphora")*	180
Semantic Scholar	*("Dacryocystorhinostomy" OR "DCR") AND ("Silicone Intubation" OR "Silastic Tube" OR "Intubation") AND ("Nasolacrimal Duct Obstruction" OR "NLDO" OR "Epiphora")*	171
Google Scholar	*("Dacryocystorhinostomy" OR "DCR") AND ("Silicone Intubation" OR "Silastic Tube" OR "Intubation") AND ("Nasolacrimal Duct Obstruction" OR "NLDO" OR "Epiphora")*	865

Studies included

Studies were considered eligible if they met the following criteria. The study population consisted of patients diagnosed with primary or secondary nasolacrimal duct obstruction who underwent dacryocystorhinostomy as part of their clinical management. Both adult and paediatric patients diagnosed were considered. The intervention of interest was dacryocystorhinostomy with silicone intubation in comparation of dacryocystorhinostomy without silicone intubation. Studies were required to evaluate the success rate of the procedure, assessed through measures of anatomical and functional patency, the presence of persistent epiphora, and the occurrence of other associated complications. Prospective clinical studies were included. Eligibility was limited to studies published within the past ten years.

Studies were excluded if they were case reports or investigations without a control group, review articles or conference abstracts. Studies involving revision dacryocystorhinostomy procedures were not considered. Articles published in languages other than English were also excluded from the review.

Study Selection and Data Extraction

All identified records were independently screened by title and abstract to determine their potential relevance. Articles deemed suitable were then assessed for eligibility according to the predefined inclusion and exclusion criteria. The overall study selection process is illustrated in the PRISMA flow diagram (Figure 1).

Extracted variables included first author and year of publication, country, number of surgeries, mean age or range, gender, DCR type, pre-surgery workout, follow up duration, post-surgery assessment and success rate. All data were compiled into a single table.

Risk of Bias Assessment

The methodological quality and risk of bias of the included studies were evaluated by using the Joanna Briggs Institute (JBI) Critical Appraisal Tools. Randomized controlled trials (RCTs) were assessed using the JBI Critical Appraisal Checklist for Randomized Controlled Trials, whereas non-randomized comparative studies were appraised using the JBI Critical Appraisal Checklist for Quasi-Experimental Studies. These tools assess several domains, including selection bias, comparability of study groups, reliability of outcome measurements, completeness of follow-up, and appropriateness of statistical analysis.

Data Synthesis

The results were synthesized using a qualitative narrative approach to integrate and interpret the findings. Outcomes were descriptively summarized according to measures of anatomical and functional patency and the presence of persistent epiphora.

Figure 1. Diagram flow of literature search strategy

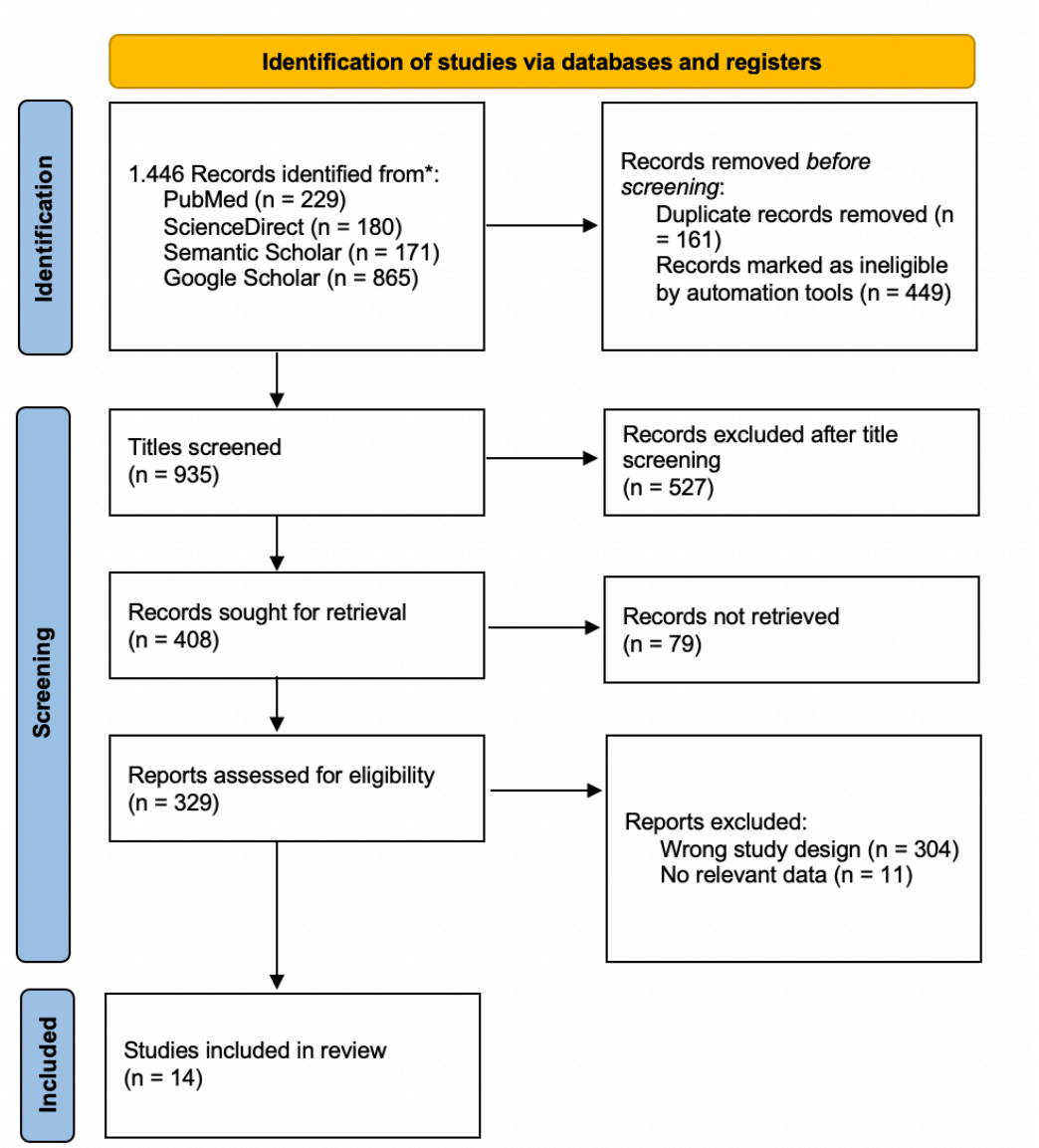

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Table 1. Critical Appraisal

Study	Randomization	Allocation Concealment	Groups similar at baseline	Blinding of outcome assessors	Complete follow up	Reliable outcome measurement	Appropriate statistical analysis
Yu B, et. al	🟢	🟡	🟢	🔴	🟢	🟢	🟢
Salih, et.al	🟢	🟡	🟢	🔴	🟢	🟢	🟢
Fayers & Dolman	🟢	🟡	🟢	🔴	🟢	🟢	🟢
Saeedi, et.al	🟢	🟡	🟢	🔴	🟢	🟢	🟢
Nitin, et.al	🟢	🟡	🟢	🔴	🟢	🟢	🟢
Dalmia, et. al	🟢	🟡	🟢	🔴	🟢	🟢	🟢
Bahner, et.al	🟢	🟡	🟢	🔴	🟢	🟢	🟢
Monga, et.al	🟡	🟡	🟢	🔴	🟢	🟢	🟢
Karkare & Singh	🟡	🟡	🟢	🔴	🟢	🟢	🟢
Study	Clear cause-effect	Similar participant	Control group	Multiple outcome measurement	Complete follow up	Reliable outcome measurement	Appropriate statistical analysis
Raghav, et.al	🟢	🟡	🟢	🟢	🟢	🟢	🟢
Sadaka, et.al	🟢	🟢	🟢	🟢	🟢	🟢	🟢

Parven, et.al	●	●	●	●	●	●	●
Bhat, et.al	●	●	●	●	●	●	●
Fatah, et.al	●	●	●	●	●	●	●

Table 2. Study characteristics of included studies

Study	Country	Number of surgeries	Mean age or range	Gender (Male : Female)	DCR Type	Pre-surgery workout	Follow up	Post-surgery assessment	Success rate (%) (stent/no stent)
Yu B, 2021	China	49	54 (±13.8)	18:31	EnDCR	NA	12 mo	Symptoms, FDDT, NEndosc	91/93
Salih, 2018	Egypt	80	22 - 58	25:55	ExDCR EnDCR	irrigation, probing	6 mo	Symptoms, irrigation, complication	83/77
Raghav, 2019	India	50	NA	NA	EnDCR	irrigation, NEndosc	6 mo	Symptoms, irrigation, complication	92/88
Sadaka, 2021	Egypt	40	20 - 65	19:21	ExDCR	FDDT, Schirmer, irrigation, regurgitation, NEndosc	6 mo	Symptoms, NEndosc, irrigation	90/90

Fayers & Dolman, 2016	Canada	300	60	92:208	EnDCR	NA	12 mo	Symptoms, irrigation, complication	95/89
Saeedi, 2018	Iran	50	46	32:18	EnDCR	Dacryocystography, complication	6 mo	Symptoms, NEndosc, complication	96/88
Nitin, 2022	India	50	18 - 69	6:44	EnDCR	X-ray, NEndosc	5 mo	Symptoms, irrigation, NEndosc, complication	96/92
Dalmia, 2022	India	100	20 - 70	NA	EnDCR	Irrigation, NEndosc	6 mo	Symptoms, NEndosc, complication	92/88
Bahner, 2024	Germany	61	68.65 (±17.65)	11:46	EnDCR	Probing, irrigation, NEndosc	6 mo	Symptoms, probing, irrigation	76/75
Monga, 2017	India	50	50	17:33	EnDCR	Irrigation	3 mo	Symptoms, irrigation, NEndosc,	92/100

								complication	
Parven, 2025	Bangladesh	200	31.2 (±7.50)	80:120	ExDCR	NA	NA	Symptoms, irrigation	96/88
Karkare & Singh, 2024	India	50	20 - 50	NA	EnDCR	NEndosc, CT	6 mo	Symptoms, NEndosc, CT	96/80
Bhat, 2019	India	223	9 - 73	129:72	ExDCR	NA	6 mo	Symptoms, patency	94/86
Fatah, 2023	Iraq	25	15 - 61	19:3	EnDCR	Irrigation, NEndosc	6 mo	Symptoms, NEndosc, complication	100/100

EnDCR: Endonasal DCR; ExDCR: External DCR; FDDT: Fluorescein Dye Disappearance Test; NEndosc: Nasal Endoscopy; NA: Not Available; CT: Computed Tomography

RESULTS

Characteristics of Included Studies

This systematic review included fourteen studies published in the past 10 years collectively assessed patients with nasolacrimal duct obstruction that went through dacryocystorhinostomy with and without the use of silicone intubation. The studies employed a variety of designs, including five prospective randomized clinical trial, four prospective randomized comparative study, and five prospective comparative study. Sample sizes varied widely reflecting differences in study scale.

A total of 1.328 surgeries were analysed, involving 1.170 patients. Silicone intubation was placed in 623 procedures, while no stent was placed in the remaining 705. The characteristics of eligible studies are summarized in Table 2. The studies were conducted in various places, six in India, one in China, two in Egypt, one in Canada, one in Iran, one in Germany, one in Bangladesh and one in Iraq. Patient ages ranged from 9 to 73 years, although one study did not report age data. Female patients constituted the majority in nine studies. Three studies did not provide information on sex distribution. The average follow up period varied between 3 months to 12 months.

Prior to surgery, patients underwent comprehensive evaluation by an ophthalmologist and/or otorhinolaryngologist, with assessment of presenting symptoms, lacrimal irrigation, and nasal endoscopy being the most commonly performed preoperative investigations. The endonasal DCR technique varied, such as using mucosal flap and also transillumination to aid the formation of nasal ostium. External DCR was performed using the standard method with a lacrimal sac flap. In some reports all surgeries were carried out by a single surgeon[14,16]. Anaesthetic practice varied, with both general and local anaesthesia employed. Despite these technique differences, they were considered sufficiently similar to be treated as equivalent. All of the studies clearly specified their success criteria, which generally consisted of both reported symptom relief and objective evidence confirming that the nasolacrimal system remained anatomically open.

Outcomes Findings

The most consistent outcome observed across the included studies was the absence of epiphora. In two studies, patients were also asked to grade their epiphora subjectively using the Munk scale, which classifies epiphora into five grades[16,19]. In several of the included studies, in addition to epiphora, patients were examined for purulent secretion, recurrent inflammation, and satisfaction with surgery.

A notable improvement in symptoms was observed in both patients who used silicone intubation and those who did not, with this improvement becoming evident within weeks after surgery and persisting until the conclusion of the specified follow-up period.

Results showing anatomical and functional patency were measured using a variety of methods. The predominant method employed in the included studies was irrigation, followed by nasal endoscopy. A study was conducted in which the tear meniscus level was measured using a slit lamp.[19] In patients who underwent the procedure with silicone intubation, the silicone tube was removed within a period of five days to twelve weeks. A careful review of the fourteen studies included in the analysis found no statistically significant differences in either functional or anatomical patency outcomes.

A multitude of complications were identified in the included studies. The observed complications included excess fibrous and/or granulation tissue, punctal cheese wiring, infection, adhesion, and chronic irritation. In the group that used silicone tubes, complications such as silicone tube prolapse or incarceration were identified. One study stated that no tube-related complication were present. Three studies also reported intra-operative complications such as bleeding and punctal trauma. Several studies did not include complications in their reports. The complications believed to be related specifically to the silicone intubation are outlined in Table 3.

Table 3. Complications related to silicone intubation

Study	DCR Type	Complications related to silicone intubation
Salih, et.al.[13]	ExDCR EnDCR	Punctal cheese wiring (ExDCR 2/20; EnDCR 3/20), conjunctival irritation (ExDCR 5/20; EnDCR 3/20), stent prolapse (ExDCR 3/20; EnDCR 2/20)
Raghav, et.al.[19]	EnDCR	Infection (1/25), adhesion (1/25), punctal cheese wiring (1/25), stent prolapse (2/25)
Fayers & Dolman[18]	EnDCR	Punctal cheese wiring (4.6%), stent prolapse (4.1%), chronic irritation (2.0%), incarcerated stent (2.0%)
Sadaka, et.al.[10]	ExDCR	No tube related complications
Saeedi, et.al.[15]	EnDCR	Intra-operative bleeding (4/25), difficult stent detection (2/25), canalicular trauma (1/25), granulation tissue (1/25), early stent removal (1/25), post operational adhesion (1/25)
Nitin, et.al.[20]	EnDCR	Intra-operative punctal trauma (2/25), difficult intubation (1/25), stent prolapse (1/25), granulation tissue (1/25), lid edema (1/25)
Dalmia, et.al.[16]	EnDCR	Adhesion (5/20), punctal cheese wiring (2/50), granulation tissue (5/50), persistent watering (4/50)
Monga, et.al.[21]	EnDCR	Synechiae (3/25), granulations and obstruction (4/25)
Karkare & Singh[23]	EnDCR	Intra-operative epistaxis (16/25), post-operative epistaxis (6/25), crusting (2/25)
Fatah, et.al.[22]	EnDCR	Crusting (1/12), granulation tissue (2/12), synechiae (1/12)

Heterogeneity of Included Studies

Substantial clinical and methodological heterogeneity was observed among the included studies. Variations in study design, patient selection, DCR techniques, outcome assessments, and

follow-up periods contributed to varieties in reported outcomes. Because of this heterogeneity, quantitative pooling of results was not appropriate. Therefore, the findings were summarized using a narrative synthesis, allowing the evidence to be interpreted within the limitations of the available data.

DISCUSSION

The use of silicone intubation been a preference for performing DCR with silicone intubation rather than without intubation. This approach was promoted based on reports of higher postoperative patency rates, attributed to the silicone tube's role in maintaining the openness of the surgical ostium.[24] A meta-analysis conducted by Feng, et.al.[25] in 2011 comparing DCR performed with versus without silicone tube intubation for nasolacrimal duct obstruction found similar success rates in both approaches. The analysis concluded that silicone stenting offered no additional advantage in primary DCR. However, an increasing number of prospective comparative studies have suggested that the use of silicone intubation in primary DCR may improve surgical success compared with procedures performed without intubation, although some reported improvements were not statistically significant. A meta-analysis by Xie, et.al.[26] involving 12 RCTs and 1067 eyes demonstrated that DCR performed with silicone intubation achieved a significantly higher success rate than DCR without intubation, particularly within the Ex-DCR subgroup. These findings suggest that silicone intubation provides a clear advantage in managing nasolacrimal duct obstruction during external DCR. Although no significant differences were observed in the EN-DCR subgroup regarding success rates or postoperative complications.

Our study shows that there are many differences in the methods used in the included studies, including differences in the type of DCR performed, sample size, and the duration of follow-up. As a result, there are differences in the interpretation of results, which may or may not be related to the differences in the methods used in each study. In addition, there were also differences in the methods of recruitment and subject group allocation. Some articles used prospective non-randomized clinical trials, while others used RCTs.

The findings across studies remain mixed regarding the benefit of silicone intubation in external DCR. While Sadaka et al.[10] and Bhat, et.al[12] found no meaningful difference between procedures performed with and without silicone intubation, identifying osteotomy obstruction as the main cause of failure, Parven et al.[11] reported higher success rates with silicone intubation. Notably, the study found a statistically significant improvement and a substantially increased likelihood of success with intubation by 5.26 times.

The evidence regarding silicone intubation in endonasal DCR remains inconsistent. Some studies, such as those by Yu et al.[14] and Monga et al.[21], reported comparable or even higher success rates without silicone intubation. Other studies found slightly higher success rates with silicone use, though without statistical significance.[15,16,17,20,23] Notably, Fayers and Dolman[18] demonstrated a statistically significant advantage with silicone intubation, reporting a higher success rate and a markedly lower failure rate. However, several studies also highlighted disadvantages associated with silicone tubes, including longer operative time, increased cost, the need for additional removal procedures, and potential complications such as granulation tissue formation, canalicular obstruction, synechiae, epistaxis, and persistent epiphora while the tube remained in place.[15,16,17,19] Overall, while silicone intubation may offer benefits in certain contexts, endonasal DCR performed without silicone tubes generally maintains acceptable success rates, and the routine use of intubation remains debatable. Our review aimed to clarify whether silicone intubation during DCR is superior for treating nasolacrimal duct obstruction by compiling and analysing the most recent evidence on this topic. However, the review was limited by methodological heterogeneity among the included studies, therefore the findings were interpreted with caution, taking into account the specific methods used in each study.

Limitations

Several limitations of the available evidence should be noted. Most studies involved small sample sizes. Measures used to assess outcomes were also varied, ranging from subjective clinical evaluations to objective tests and imaging, which limited comparability. Follow-up periods were frequently short, limiting assessment of long-term effectiveness and durability of treatment response. In addition, publication bias cannot be ruled out, as studies with positive findings may be

more likely to be published. Together, these issues prevent quantitative analysis and require cautious interpretation of the findings.

CONCLUSION

This review indicates that the role of silicone intubation is largely comparable in both external and endonasal dacryocystorhinostomy. Across both surgical approaches, several studies demonstrated a trend toward higher success rates with silicone intubation, however, only a limited number reported a statistically significant improvement in surgical outcomes. While silicone intubation may offer additional benefit in selected cases, its routine use is not consistently supported by the evidence.

It is also reported that the use of silicone tubes was repeatedly associated with longer operative times, increased procedural costs, and tube-related complications. Importantly, high and clinically acceptable success rates were also achieved in procedures performed without silicone intubation. Therefore, silicone intubation is advised to be used reserved for carefully for selected patients rather than routinely, taking into account the surgical approach, individual anatomical factors, and the overall risk of postoperative failure.

CONFLICT OF INTEREST

We declare that there were no conflict of interest in this study.

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There are no funding resources.

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