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Original Article

Comparison of Endoscopic Laser Assisted Dacryocystorhinostomy with Conventional External Dacryocystorhinostomy Surgery

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ABSTRACT

Objective: To compare the effectiveness and outcomes of endoscopic laser assisted dacryocystorhinostomy (DCR) with conventional external dacryocystorhinostomy (DCR) for symptomatic nasolacrimal duct occlusion (NLDO).

Study Design: Quasi-experimental study.

Place and Duration of Study: Ophthalmology department at Combined Military Hospital, Multan from March 2023 to Feb 2024.

Methodology: 40 participants (n=40) were included in this study through non-probability convenience sampling technique. Twenty participants (n=20) were treated by conventional external DCR surgery (Group A), while the other twenty (n=20) underwent laser endoscopic DCR surgery (Group B). Primary outcomes included overall success rate, defined as absence of symptoms when accompanied by functioning tear drainage system; and secondary outcomes measures which were complication rates, cosmesis and patient satisfaction. Data was collected through preoperative examination as well as postoperative follow-up for up to 3 months.

Results: Among the total 40 patients, 52.5% were male & 47.5% were female. Average age in group A and group B was 47.25± 8.1 years and 46.5±6.8 years respectively. Both Group A and Group B exhibited significant success rates (p=0.543), with lower complication rates in Group B (p=0.217). Additionally, higher patient satisfaction scores were observed in Group B (p=0.659), with comparable cosmesis outcomes between the two groups (p=0.423).

Conclusion: Both endoscopic laser assisted DCR and conventional external DCR were relatively equal in terms of relieving NLDO. However, laser endoscopic DCR offered additional merits which included time saving, low invasiveness, no need for general anesthesia, good cosmetic effect, higher patient satisfaction, lower complication rates and relatively bloodless surgery.

Keywords: Comparative study, conventional, Dacryocystorhinostomy, Endoscopic, external, laser, Nasolacrimal duct obstruction.

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INTRODUCTION

Nasolacrimal duct obstruction (NLDO) is an eye disease in the nasolacrimal passage where its blockage or constriction causes excessive tearing.[1] Congenital defects, acquired ductal stenosis, injury, inflammation and neoplasms may cause NLDO.[2,3] In most cases, it is surgically managed. NLDO can be cured through an operation called dacryocystorhinostomy (DCR).[4] A little cut on one side of the nose renders possible accessibility to the lacrimal sac. Then an opening is made into it and another path for drainage between the lacrimal sac and nose cavity is created normally through a bony ostium.[5]

Conventional external DCR has shown good results in terms of symptom resolution and patient satisfaction; thus widely accepted in clinical practice.[6] Nonetheless, endoscopic laser DCR has found acceptance as an alternative approach to the management of NLDO instead of using the traditional way.[7] A laser beam is transmitted through laser probe via the drainage system of tears to and beyond the puncta, allowing for precise tissue ablation and creation of a patent pathway for fluid drainage.[8]

Although the techniques of conventional external and laser DCR are widely performed, their efficacy, safety and patient outcomes have only recently been compared.[9,10] With the increasing requirements for minimal invasive substitutes amid changing trends in eye operations, we conducted a study to compare these two surgical methods. The surgeons in our country are still skeptical about laser assisted DCR surgery technique because of apprehensions of low

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success rate and significant learning curve. This has led to the majority of patients in our country not being offered this latest surgical option by most eye surgeons which is otherwise widely available and offered to the patients worldwide. This research paper has examined the success rates, complications, cosmesis and patient satisfaction post procedure for these two surgical methods.

METHODOLOGY

This Quasi-experimental study was conducted at the Eye Department of Combined Military Hospital Multan, a tertiary care medical facility, from Mar 2023 to Feb 2024, after approval from the Ethical Review Committee (ERC No. 145/2023 dated 18th Feb 2023). This study compared conventional dacryocystorhinostomy (DCR) and laser endoscopic DCR in managing symptomatic nasolacrimal duct obstruction (NLDO). Therefore, data was collected at two different time points, before and after surgery, for use in assessing parameters such as success rate, complication rate, cosmesis and patient satisfaction. Participants who met clinical indications and preferences were recruited into either group where they underwent conventional DCR or laser assisted endoscopic DCR surgery, ensuring comprehensive comparison. The sample size was determined based on the prevalence of symptomatic nasolacrimal duct obstruction (NLDO). A global prevalence of NLDO ranging from 3% to 5% was considered for adults, with reference to the study by Zafar *et al*., (2018), which reported a prevalence of 4.2% among adults in South Asia.[11] Using the WHO sample size calculator, with an alpha error of 0.05 and a power of 80%, the minimum sample size calculated was 20 participants per group. This sample size was deemed sufficient to detect significant differences between the two surgical methods for primary and secondary outcome measures.

Inclusion Criteria: Patients suffering from symptomatic NLDO had been qualified for participation if they had excessive tearing that affected their eyes, recurrent infections or discomfort due to the obstruction of the lacrimal system.

Exclusion Criteria: Patients on current anti-infection medication, having major bleeding disorders, dacryocystitis with fistula or having a history of previously performed DCR surgery were excluded from the study.

Conventional DCR surgery was performed under general anaesthesia. A tiny opening was made on the side of the nose next to the lacrimal sac. To connect the lacrimal sac to the nasal cavity, the surgeon removed a small part of the bone. An opening was made in the lacrimal sac, and an alternative drainage pathway was formed. A stent or tube was placed inside to keep this new passage open. Sutures were used to close up the incision. Whereas trans canalicular endo laser endoscopic DCR surgery was performed exclusively under local anaesthesia. The tear duct (canaliculus) was accessed using a laser probe. A new drainage pathway was formed after laser-ablated obstructive tissue within the nasolacrimal duct. The path patency was augmented by placing a stent or tube in place of the newly created passage. No cuts were made outside during this procedure. The same surgeon carried out both procedures guaranteeing uniformity in surgical technique and reducing variance in outcomes. The tubes were removed under topical anaesthesia in both groups 6 months postoperatively.

Statistical considerations defined the sample size for this study in order to achieve enough power to detect clinically significant differences between the two surgical methods. A total number of 40 patients were recruited, where 20 were treated through conventional DCR surgery and another count of 20 underwent laser endoscopic DCR surgery, determined as adequate towards distinguishing significant differences about primary outcomes having a power of 80% at α=0.05 significance level. The primary outcome measures of this study were each procedure's success rate in resolving symptoms (i.e. improvement in epiphora) and restoring patency within the lacrimal ducts as assessed clinically and by using lacrimal irrigation. Secondary outcome measures included complication rates (e.g., bleeding, infection), cosmesis (e.g., scar formation), and patient satisfaction measured by standardized questionnaires or subjective assessment. Precise patient history taking, ophthalmic examination (e.g., visual acuity, slit lamp examination), nasal endoscopy and evaluation of the lacrimal system using probing and sac syringing were performed during the preoperative investigation. After surgical intervention, patients were followed at different intervals, such as 1 week, one month and later at 3 months for assessments.

Data was analyzed in Microsoft Excel. Variables for age included are standard deviation and mean, while for gender and ethnicity percentages are done. Independent samples t-test was used for

quantitative variables, whereas qualitative variables were compared using a Chi-square test, $p<0.05$ being significant.

RESULTS

The study population comprised 40 patients diagnosed with symptomatic nasolacrimal duct obstruction (NLDO). The Conventional external DCR group (Group A) had an average age of 47.25±8.1 years, while the endoscopic laser DCR group (Group B) had an average age of 46.5±6.8 years. In Group A, the male-to-female ratio was 45% and 55%. In comparison, the same ratio was approximately 60% and 40% in Group B. All participants were Asians, reflecting the study's demographic consistency. The demographic characteristics of the patients are summarized in Table-I. Primary and secondary outcomes were compared between the two groups. The results are presented in Table-II.

Table-I: Demographic Characteristics of Study Population (n=40)

Characteristic	Conventional DCR Group (n=20) (Group A)	Endoscopic Laser DCR Group (n=20) (Group B)
Age (years) Average±SD	47.25±8.1	46.5±6.8
Males	9(45%)	12(60%)
Females	11(55%)	8(40%)
Asian	20(100%)	20(100%)

Table II: Comparison of Outcomes Between Conventional DCR and Endoscopic Laser DCR Groups (n=40)

Outcome Measure	Group A Conventional external DCR Group (n=20)	Group B Endoscopic Laser DCR Group (n=20)	*p*-value
Success Rate (%)	84±7.85	85.3±10	0.098
Complication Rate (%)	10.0±3.1	5.0±2.6	<0.0001
Patient Satisfaction (Score 0-10)	7.8±1.2	8.9±1.1	0.0045
Cosmesis (%)	20(100%)	20(100%)	1

The success rate was high (approx. 85%) in both the groups. Success rate in endoscopic laser DCR group was slightly high but not statistically significant, with a *p*-value of 0.098. The complication rate, however, showed a statistically significant difference between the two groups, with the endoscopic laser DCR group having fewer complications, with a *p*-value of <0.0001. Patient satisfaction scores were also slightly better for group B but with no statistically significant difference (p = 0.275). Cosmesis was comparable in both groups, with no significant difference ($p=1$).

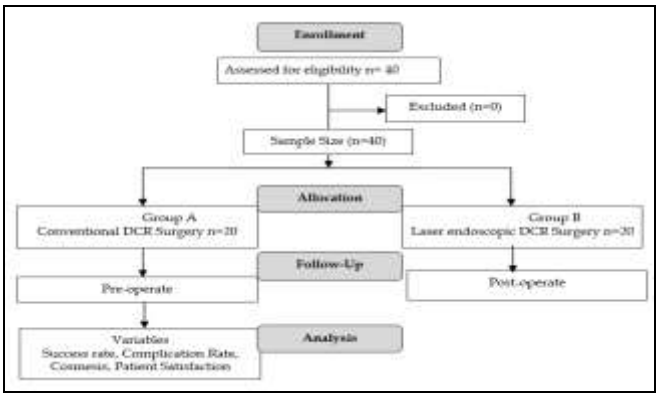

Figure-1: Flowchart of the Study Methodology (n=40)

DISCUSSION

Nasolacrimal duct obstruction is a major challenge to patient care, given its impact on tear drainage and the resulting symptoms of constant tearing and recurrent infections. Although both conventional external DCR and endoscopic laser DCR are major surgical interventions performed to restore patency in the nasolacrimal duct, they differ significantly from one another. Conventional DCR involves opening up from the outside of the eye and removing bone to create a new channel for tear formation, a method long advocated for its high success rate and patient satisfaction. However, endoscopic laser DCR involves introducing a laser probe inside the duct to ablate obstructive tissues and create an internal drainage passage. This development in laser technology necessitates a critical analysis of these two operations to provide insights into their relative merits regarding treatment outcomes and effects on patients' well-being.[12-14]

Our study findings indicate that both conventional external DCR and endoscopic laser DCR are effective surgical techniques for treating symptomatic nasolacrimal duct obstruction (NLDO) among Asian patients. A study by Su PY published in 2018 demonstrated similar levels of effectiveness between both methods, suggesting that endoscopic laser DCR, despite being a relatively newer technique, can achieve outcomes similar to those of conventional DCR in the treatment of NLDO.[15] Tariq M *et al.*, in their study published in 2021 also noted that endoscopic laser DCR offers similar clinical outcomes to conventional methods, providing a less invasive

alternative without compromising the long-term success of treatment.156 These studies support and validate our study results.

In our study complication rate in laser assisted DCR group was less than group conventional DCR group because of less invasive surgery. Because of less invasive surgery, bleeding per operative was quite less compared to conventional DCR surgery along with shorter recovery time. Also patient satisfaction was higher for laser assisted DCR patients because of less surgical time, surgery being performed as a day care procedure under local anaesthesia and no need for hospital stay causing increased patient comfort and decrease in hospital bill. Post operative comparable cosmetic results between the two groups were observed. Many published studies support and validate our findings, like a study by Syeed Mehbub Ul Kadir *et al*., in 2022 highlights how laser-assisted endoscopic DCR has emerged as a less invasive alternative to traditional DCR, offering advantages such as smaller incisions and shorter recovery times.[17] In 2023, another study by Panda BB *et al*., discussed the benefits of laser endoscopic DCR, emphasizing its minimally invasive nature and its potential as a preferred method for treating NLDO compared to the conventional external DCR.[18] Furthermore, another article by Różycki *et al*., in 2024 highlights that endoscopic laser-assisted dacryocystorhinostomy (DCR) offers a highly effective and minimally invasive alternative to conventional DCR for treating nasolacrimal duct obstruction (NLDO). It emphasizes benefits such as smaller incisions, faster recovery, and reduced invasiveness, while showing comparable success rates to traditional methods.[19] Feijo ED *et al*., (2024) reported similar findings, confirming that laser DCR provides a safe and effective approach for treating nasolacrimal duct obstruction, with fewer complications and shorter recovery times compared to traditional methods.[20] Al Awady *et al*., (2021) and the British Oculoplastic Surgery Society have reported improved appearance and shorter surgery durations when comparing laser-assisted interventions to other surgical techniques.[21,22]

However, there are technical obstacles and steep learning curves associated with laser-assisted interventions, as identified by Ela Araz Server *et al*., in their study which addresses the technical obstacles and steep learning curves associated with laser-assisted DCR procedures.[23] Despite its benefits, such as reduced invasiveness, the adoption of laser technology requires careful training and experience due to the precision required and potential complications.

Our study suggests that laser-assisted DCR is a promising choice for patients seeking a less invasive treatment with favorable outcomes in terms of efficacy, fewer complications and patient satisfaction. Findings of this study have a significant impact on the clinical setting. This study shows that endoscopic laser DCR may be used to replace conventional DCR for the treatment of NLDO. Proper training should be given to the surgeons before starting this new surgical technique so as to get best possible results post operatively. Equivalent results from either technique indicate that surgeon and patient preferences, as well as resource constraints, are relevant when considering the surgical approach. It is also important to emphasize a patient-centered approach and shared decision-making when dealing with NLDO, with individual patients' attributes and preferences taking precedence in choosing among alternatives.

LIMITATIONS OF STUDY

The study focuses on a specific demographic and may limit generalizability to other populations with more diversity. Furthermore, the relatively short follow-up duration of up to 3 months might fail to cover long-term outcomes or novel complications. Likewise, lack of blinding procedures can create biases in subjective evaluations. These reasons call for further inquiry to overcome these limitations towards a better overview of the topic.

CONCLUSION

This research compared conventional dacryocystorhinostomy (DCR) and endoscopic laser DCR regarding symptomatic nasolacrimal duct obstruction (NLDO). The results showed that these two methods had very similar success rates, fewer complication rates and higher patient satisfaction in laser assisted DCR surgery group along with comparable cosmesis post surgery in both groups. Therefore it can be concluded that advantages of endoscopic laser DCR are time saving, low invasiveness leading to relatively bloodless surgery, no need for general anesthesia, less complications, higher patient satisfaction and good cosmetic effect which makes it a better choice than traditional DCR surgery.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

SMM & SJ: Data acquisition, data analysis, critical review, approval of the final version to be published.

KA & MKN: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

FA & SH: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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