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RESEARCH ARTICLE
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TO STUDY THE ANATOMICAL VARIATION ENCOUNTERED DURING ENDOSCOPIC DACRYOCYSTORHINOSTOMY

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ABSTRACT:-

Background: Endoscopic DCR (EnDCR) has emerged as a minimally invasive alternative to external DCR, offering superior visualization and cosmetic outcomes. The present analysis aims to evaluate the anatomical variations encountered during the EnDCR.

Methods: A prospective observational study on 70 participants was conducted to assess the effectiveness and safety of EnDCR. The surgical success rate, intraoperative anatomical variations, and pre-, intra-, and postoperative complications were recorded. Adjunct nasal surgeries were performed as needed to address anatomical obstructions.

Results: EnDCR achieved a high success rate of 97.14% at six weeks postoperatively. Complication rates were low: preoperative (8.57%), intraoperative (31.43%), and postoperative (4.29%). Common anatomical variations included gross deviated nasal septum, concha bullosa, and thick lacrimal bone, necessitating procedures such as septoplasty or partial turbinectomy in selected cases. Surgical success was attributed to accurate sac localization, adequate bone removal, full sac marsupialization, and mucosal apposition. Postoperative nasal irrigation was emphasized to prevent neo-ostium obstruction.

Conclusion: EnDCR is safe, and cosmetically superior approach for managing nasolacrimal duct obstruction. Success is enhanced by addressing anatomical variations, ensuring wide osteotomy and complete sac exposure, and promoting primary intention healing through mucosal alignment and postoperative care.

Keywords:-Dacryocystorhinostomy, endoscopic, nasolacrimal, success rate, nasal septum, sac localization.

INTRODUCTION:-

Nasolacrimal duct (NLD) obstruction is a well-recognized cause of epiphora, particularly affecting middle-aged and elderly individuals. Dacryocystorhinostomy (DCR), a procedure that creates a direct anastomosis between the lacrimal sac and the nasal cavity, remains the gold standard for managing post-canalicular obstruction. [1] Historically, external DCR was the treatment of choice

throughout the 20th century. However, with the advent and refinement of endoscopic technology, the surgical landscape has evolved, opening new horizons in the management of NLD obstruction.[2] Endonasal DCR offers a range of advantages over the traditional external approach, including superior intranasal visualization, a minimally invasive technique and preservation of the orbicularis oculi lacrimal pump mechanism. [3] Additionally, absence of cutaneous scarring, reduced operative time, and faster postoperative recovery, all of which translate into improved patient satisfaction and quality of life. Despite these benefits, the endonasal approach is not without limitations; a steeper learning curve and the higher cost of specialized equipment may pose initial barriers to widespread adoption.[4-5] Both external and endoscopic DCR have been extensively described in the literature, demonstrating variable success rates and inherent procedural challenges. Reported success rates for endoscopic DCR range from 63% to 93.5%, while those for external DCR span from 70% to 95.8%. [6] However, failure rates of endonasal DCR have been reported between 4% and 13%.[8–10] As the saying goes, "forewarned is forearmed, and many of these failures can be mitigated by a thorough preoperative understanding and intraoperative identification of anatomical variations that influence surgical access and visualization. [7]

Key anatomical factors contributing to technical difficulty include the presence of aggernasi cells, deviations of the nasal septum, concha bullosa, an enlarged or medially displaced uncinate process, and variations in the size and position of the lacrimal sac. These deviations may necessitate real-time surgical adjustments, impacting operative strategy, success rates, and complication risks.

Despite the growing preference for endonasal DCR, dedicated literature addressing the anatomical variations encountered during this procedure remains limited. [8] A comprehensive evaluation of these anatomical nuances is indispensable for enhancing surgical precision, minimizing intraoperative hurdles, and ultimately improving patient outcomes. Therefore, the present study aims to systematically assess and document the anatomical variations observed during endoscopic dacryocystorhinostomy, laying the groundwork for more individualized, safe, and effective surgical planning in patients with NLD obstruction.

Aims and Objectives:-

The primary objectives of this study were:

✓ To evaluate the anatomical variations encountered during endoscopic dacryocystorhinostomy (ENDCR).

✓ To assess the preoperative, intraoperative, and postoperative difficulties associated with the procedure.

MATERIAL AND METHOD

Ethical Considerations:-

This prospective observational study was conducted following approval from the Institutional Ethics Committee and in accordance with the principles of Good Clinical Practice (GCP).

Study Design and Patient Selection:-

A total of 70 adult patients who underwent 70 endoscopic dacryocystorhinostomy procedures between September 2017 and September 2019 were included in the study. Patients were consecutively recruited from those attending the outpatient clinic of the Department of Otorhinolaryngology for symptoms related to nasolacrimal duct obstruction. Patients were also referred from the Eye Outpatient Department for surgical evaluation. All participants were thoroughly informed about the nature of the study, and written informed consent was obtained.

Inclusion and exclusion criteria:-

Patients were eligible for inclusion if they had a clinical diagnosis of chronic dacryocystitis with distal nasolacrimal duct obstruction (unilateral or bilateral) and were willing to undergo endoscopic dacryocystorhinostomy. Exclusion criteria included refusal to undergo the surgical procedure and the presence of a common canalicular block.

Preoperative Assessment:-
Demographic details including name, age, and sex were recorded. A detailed history was obtained, focusing on key symptoms such as epiphora, swelling over the medial canthus, and discharge of pus or mucus on applying pressure over the inner canthus. Clinical examination included local ocular examination, nasal endoscopy, otologic evaluation, throat and neck examination, and ophthalmolo gical assessment to confirm nasolacrimal duct patency.

Operative procedure:-
All surgeries were performed under general anaesthesia. Nasal mucosal preparation was done using 10% xylocaine and 1:1,000 adrenaline or 1% ephedrine solution. Local infiltration was administered using 2% xylocaine with 1:10,000 adrenaline at the region of the frontal process of the maxilla and the superior attachment of the middle turbinate to minimize intraoperative bleeding and facilitate mucosal flap elevation. In patients with a grossly deviated nasal septum, conventional septoplasty was performed to allow better access to the surgical site. In cases of concha bullosa, partial middle turbinectomy was carried out. The posterior border of the frontal process of the maxilla served as the initial landmark, identified as a depression anterior to the middle turbinate. A posteriorly based U-shaped mucoperiosteal flap was elevated from the lateral nasal wall anterior to the middle turbinate, over the presumed location of the lacrimal sac. The thin lacrimal bone covering the sac was removed, and in some cases, the overhanging frontal process of the maxilla was excised using a Kerrisonrongeur punch to gain adequate exposure. Following removal of the lacrimal bone, the nasolacrimal sac was visualized and incised using a keratotome or sickle knife to create a wide mucosal window. Patency of the nasolacrimal drainage system was confirmed intraoperatively by syringing. After ensuring haemostasis, nasal packing was placed and removed after 24 hours. As with endoscopic sinus surgery, meticulous postoperative care was undertaken to clean crusts, granulation tissue, and secretions, ensuring the patency of the rhinostoma.

Assessment of Anatomical Variations and Surgical Difficulties:-
Intraoperative findings were documented with particular attention to anatomical variations such as deviated nasal septum and concha bullosa. Preoperative, intraoperative, and postoperative difficulties were systematically recorded. Immediate postoperative complications were noted, and delayed complications were evaluated during the sixth-week follow-up visit.

Statistical Analysis:-
All collected data were entered into a Microsoft Excel database. During data entry, the information was verified for completeness and accuracy. After resolving missing data or discrepancies, the final dataset was analysed. Categorical variables such as gender, presenting symptoms, anatomical variations, preoperative, intraoperative, and postoperative challenges, and surgical outcomes were presented as frequencies and percentages.

RESULT AND OBSERVATIONS

Table No. 1:- Demographic and Clinical Characteristics

Parameter	Category	No. of Patients (%)
Total Patients		70 (100%)
Gender	Male	20 (28.57%)
	Female	50 (71.43%)
Age Group (years)	21–30	8 (11.43%)
	31–40	16 (22.86%)
	41–50	24 (34.29%)
	51–60	14 (20%)
	61–70	8 (11.43%)
Mean Age ± SD		45.68 ± 11.64 years
Age Range		22–69 years

Laterality	Right	24 (34.29%)
	Left	35 (50%)
	Bilateral	11 (15.71%)

The study included 70 patients with a female predominance (71.43%). The most affected age group was 41–50 years (34.29%), with a mean age of approximately 46 years. The left side was more commonly involved (50%) compared to the right side (34.29%) and bilateral cases (15.71%). This demographic profile indicates that middle-aged females are more commonly affected in nasolacrimal duct obstruction treated with endoscopic dacryocystorhinostomy.

Gender-wise Laterality

No statistically significant difference was found between gender and the side of involvement (right, left, or bilateral), indicating that laterality is independent of patient sex in this cohort.

Table No. 2:-Symptom Profile and Clinical Nasal Findings

Parameter	Finding	No. of Patients (%)
Ocular Symptoms	Epiphora	70 (100%)
	Mucopurulent Conjunctival Swelling (MCS)	28 (40%)
	Swelling over sac area (SE)	63 (90%)
	Fistula (F)	0 (0%)
Anterior Rhinoscopy	Grade 1 DNS	41 (58.57%)
	Grade 2 DNS	11 (15.71%)
	Grade 3 DNS	6 (8.57%)
	No DNS	12 (17.14%)
Endoscopic Findings	Hypertrophied Turbinate (HT)	9 (12.9%)
	Concha Bullosa (CB)	3 (4.3%)

Epiphora was present in all patients, confirming it as the primary symptom. Mucopurulent conjunctival swelling and swelling over the lacrimal sac area were common, observed in 40% and 90% of cases, respectively.

Nasal examination revealed that more than half of the patients (58.57%) had Grade 1 deviated nasal septum, indicating that mild septal deviation is common in this patient population. Endoscopic findings showed hypertrophied turbinates and concha bullosa in a minority of patients, which may have implications for surgical planning

Table No. 3:- Distribution of Patients According to Anatomical Variations and Associated Nasal Surgeries

Parameter	Finding	No. of Patients (%)
Anatomical Variations	Enlarged Bulla Ethmoidalis	4 (5.71%)
	Posteriorly located lacrimal fossa	3 (4.29%)
	Flat anterior lacrimal crest	4 (5.71%)
Associated Surgeries	Septoplasty	6 (8.57%)
	Partial Turbinectomy	3 (4.29%)
	None	61 (87.14%)

Anatomical variations were found in 15.71% of patients, including enlarged bulla ethmoidalis, posteriorly located lacrimal fossa, and flat anterior lacrimal crest. These variations can pose surgical challenges during DCR. A small percentage of patients (approximately 12.86%) required associated nasal surgeries such as septoplasty or partial turbinectomy, likely to improve surgical access and outcomes.

Table No.4:- Distribution of Patients According to Operative Difficulties and Postoperative Complications

Parameter	Specific Finding	No. of Patients (%)
Pre-Operative Difficulties	Gross DNS	6 (8.57%)
	None	64 (91.43%)
Intra-Operative Difficulties	Thick lacrimal bone	4 (5.71%)
	Concha Bullosa	3 (4.29%)
	Enlarged ethmoidal bulla	4 (5.71%)
	Bleeding	5 (7.14%)
	Difficulty getting first grip	4 (5.71%)
	Opening sac before incision	2 (2.86%)
Post-Operative Complications	Bleeding	2 (2.86%)
	Surgical Emphysema	1 (1.43%)
Delayed Complications (6 weeks)	Absent flow on syringing	2 (2.86%)
	Synechiae	1 (1.43%)

Pre-operative difficulties were infrequent, noted in only 8.57% of cases as gross deviated nasal septum. Intra-operative challenges occurred in nearly one-third (31.43%) of patients, with the most common issues being bleeding, thick lacrimal bone, and anatomical variations such as concha bullosa and enlarged ethmoidal bulla. Post-operative complications were rare (4.29%) and included minor bleeding and surgical emphysema. Delayed complications like synechiae and absent lacrimal flow on syringing were also minimal, indicating that endoscopic DCR is a relatively safe procedure with low complication rates.

Table No. 5:- Postoperative Surgical Outcome at 6 Weeks Based on Syringing Test

Outcome	No. of Patients (%)
Present flow on syringing	68 (97.14%)
Absent flow on syringing	2 (2.86%)
Total	70 (100%

The surgical success rate was excellent, with 97.14% of patients demonstrating patent flow on syringing at 6 weeks postoperatively. Only 2.86% showed absent flow, suggesting a high efficacy of the procedure in resolving nasolacrimal duct obstruction.

DISCUSSION:-

Endoscopic dacryocystorhinostomy (EnDCR) has emerged as an effective surgical intervention for the management of nasolacrimal duct (NLD) obstruction and its associated symptoms. [9] This minimally invasive approach offers the distinct advantage of eliminating the need for external skin incisions, thereby improving cosmetic outcomes and reducing postoperative morbidity. Moreover, the endonasal route allows for the simultaneous identification and correction of coexisting intranasal pathologies, such as deviated nasal septum and nasal polyposis, which may contribute to the pathogenesis or persistence of nasolacrimal obstruction. [10-11] Additionally, endoscopic DCR facilitates the intraoperative visualization and management of potential causes of surgical failure, including granulation tissue formation and adhesions, thereby enhancing surgical success rates and long-term patency of the nasolacrimal drainage system.

The present study evaluated 70 patients undergoing endoscopic dacryocystorhinostomy (ENDCR), with a female predominance (71.43%) and a mean age of 45.68 ± 11.64 years, most commonly affecting the 41–50-year age group. The left side was more frequently involved (50%) compared to the right (34.29%) and bilateral cases (15.71%). Epiphora was the universal presenting symptom (100%), with associated swelling over the sac area in 90% and mucopurulentconjunctival swelling in 40% of cases. Anatomical variations such as enlarged bulla ethmoidalis, flat anterior lacrimal crest, and posteriorly located lacrimal fossa were observed in 15.71% of patients, and 12.86%

required additional nasal procedures like septoplasty or turbinectomy. Intraoperative difficulties were encountered in 31.43% of cases, including bleeding (7.14%), thick lacrimal bone (5.71%), and concha bullosa (4.29%). Postoperative complications were minimal, with minor bleeding (2.86%) and surgical emphysema (1.43%), while delayed complications like synechiae and absent syringing flow occurred in only 4.29%. At six weeks postoperatively, 97.14% of patients exhibited successful outcomes with patent syringing flow, confirming the high safety and efficacy of ENDCR in managing nasolacrimal duct obstruction.

The findings of the present study, which reported a high success rate of 97.14% in patients undergoing EnDCR without significant complications, closely correlate with those of Prinja S et al., who also observed a higher success rate in the non-stented group (100%) compared to the stented group (86.6%), though the difference was not statistically significant. This trend aligns with previous studies by Smirnov et al. (78% with stent vs. 100% without), Unlu et al. (84.2% vs. 94.7%), Monga et al. (92% vs. 100%), Pandey et al. (85.7% vs. 90.9%), Chowdhury et al. (88% vs. 92%), and Maldhure et al. (90% vs. 93.3%), all of which reported comparable or superior outcomes in non-stented cases. Furthermore, consistent with Prinja S et al. and others, our study also demonstrated a female predominance and epiphora as the most common presenting symptom. Collectively, these findings suggest that EnDCR without stenting is a safe, effective, and reliable technique for treating nasolacrimal duct obstruction, with fewer postoperative complications and high patient satisfaction. [11-16]

CONCLUSION:-

Successful endoscopic DCR relies on precise localization and complete marsupialization of the lacrimal sac, wide osteotomy, and mucosa-to-mucosa healing. Anatomical variations of the lateral nasal wall significantly influence sac anatomy, reinforcing the advantage of endoscopic visualization. Preoperative correction of nasal anomalies and postoperative care, including nasal irrigation, are crucial to ensure patency and minimize complications. Compared to external DCR, the endoscopic approach offers superior cosmetic and functional outcomes with less trauma, though challenges like limited surgical field and risk of granulation tissue remain.

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