

# Comparative Study of External Dacryocystorhinostomy versus Endoscopic Endonasal Dacryocystorhinostomy in Management of Chronic Dacryocystitis

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## Abstract

**Background:** Dacryocystorhinostomy (DCR) is a surgical process done to relieve the epiphora occurring as a result of nasolacrimal duct obstruction. It may be done through both external and endoscopic approaches. Earlier external DCR was the gold standard until the advent of endonasal DCR.

**Objective:** The objective of the study was to study the effectiveness of endonasal DCR compared with external DCR regarding DCR regarding the advantages, patency rate, patient compliance, and intraoperative and post-operative complications.

**Study Design:** This was a prospective, randomized comparative study.

**Results:** A total of 120 cases were evaluated out of which 60 randomly underwent external DCR and 60 underwent endonasal DCR. The study duration for endonasal DCR was less than external DCR with success rate of 86.7% and 66.7%, respectively.

**Conclusion:** Endonasal DCR is better in terms of success rate, short duration of time, and visualized surgery.

**Key words:** Dacryocystorhinostomy, Endonasal dacryocystorhinostomy, Epiphora, External dacryocystorhinostomy

## INTRODUCTION

Chronic dacryocystitis is the common form of dacryocystitis which arises from nasolacrimal duct (NLD) occlusion. While obstruction of the NLD may present with epiphora, it may also present with a mucocele, pyocele, or recurrent acute dacryocystitis.<sup>[1]</sup>

The definitive treatment for chronic dacryocystitis is dacryocystorhinostomy (DCR) surgery in which the

patency of the nasolacrimal pathway is restored. It may be done both by external and endonasal approaches.

External DCR was first described in 1904 by Toti and the modified version by Dupuy-Dutemps and Bourguet in 1921. In this procedure, anastomosis is made between lacrimal sac and nasal mucosa through bony ostium.<sup>[2]</sup> This procedure has some complications in the form of early and late complications. Early complications include wound dehiscence, wound infection, and excessive bleeding. Later complications include granuloma formation, rhinostomy fibrosis, webbed facial scar, medial canthal distortion, and failed DCR.

The most common causes of failure of DCR are obstruction of the osteotomy site and obstruction of the common canaliculus. Endoscopes were first used in the

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1950s as gastroscopes and were initially used in orbital surgery in the 1980s for orbital tumor biopsies.<sup>[3,4]</sup>

Endoscopic endonasal approach came in existence which was first described by Caldwell in 1893 and later in 1911 by West. Although endonasal procedure has a steeper learning curve, the principal advantage of this technique is that it is a minimally invasive approach with increased light optics, magnification, and excellent visualization and does not require an external skin incision.<sup>[5]</sup> Moreover, any concomitant nasal pathology may be dealt. Complications related with endoscopic endonasal DCR are adhesions and fibrosis of lacrimal sac mucosa which causes blockage of lacrimal sac. The study was conducted with the aim to study the effectiveness of endonasal DCR compared with external DCR regarding DCR regarding the advantages, patency rate, patient compliance, intraoperative and post-operative complications, and mean surgical duration.

## MATERIALS AND METHODS

This hospital-based, prospective, randomized comparative study was conducted in the Department of Ophthalmology and ENT, JLN Medical College and Hospital, Ajmer, Rajasthan, from June 2018 to September 2019.

### Sample Size

A total of 120 cases were enrolled for DCR who were diagnosed for primary acquired NLD obstruction (NLDO) or chronic dacryocystitis by an ophthalmologist.

These cases were further randomized into groups: Group I and Group II. There were 60 cases in Group I for endonasal endoscopic DCR with and 60 cases in Group II for external DCR.

All symptomatic epiphora cases diagnosed for primary acquired NLDO or chronic dacryocystitis and those willing to undergo surgery were included in the case study. Cases with ectropion/entropion/lower lid laxity, canalicular and punctal obstruction, post-traumatic bone deformity, history of radiation therapy, some nasal conditions such as atrophic rhinitis, sinonasal malignancy, nasal polyps, and chronic granulomatous conditions, systemic condition such as bleeding manifestations, patient on chronic anticoagulant and aspirin therapy, ischemic heart disease uncontrolled hypertension, and hemodynamically unstable patients were excluded from the study.

A written fully explained consent stating the voluntary participation of subjects in the study was taken before the enrollment of the subjects. A detailed history was taken as to age, sex, socioeconomic status, and nature and

duration of symptoms such as tearing whether constant or intermittent, unilateral or bilateral, clear tears/tears mixed with discharge or blood, any associated mucocele or pyocele, subjective ocular surface discomfort, allergic history, prior sinus disease, midfacial trauma, or episodes of lacrimal sac were taken.

A thorough clinical examination by anterior rhinoscopy was done to rule out any abnormalities such as a deviated nasal septum, polyposis, and hypertrophied turbinates. The ophthalmic examination was done by an ophthalmologist. The eyelids were examined for entropion, ectropion and lid laxity. The puncta were examined for their normal location and size. Any medial canthal swelling was noted.

NLDO was diagnosed by the regurgitation of fluid into the conjunctival sac by applying pressure over the lacrimal sac area. Lacrimal sac syringing and lacrimal scintigraphy were done to confirm the diagnosis and for localization of site of obstruction.

### Syringing

After topical anesthesia, lower punctum is dilated. The irrigating cannula is placed in the canalicular system. To prevent canalicular kinking and difficulty in advancing cannula, lateral traction is applied in lower eyelid. Clear saline is injected and results were noticed. Routine blood investigations were also done.

### Technique of External DCR

All external DCR operations were performed under local anesthesia. After anesthetizing the nasal mucosa with a 10% xylocaine spray, the nasal cavity was packed with a roller gauze which was soaked in 4% xylocaine with adrenaline 1:10,000. All patients were given local anesthesia for the sac region, consisting of 2% xylocaine with adrenaline 1:200,000. A curvilinear incision, 1.5 cm–2 cm in length, was made along the anterior lacrimal crest, lateral to the angular vein, 3 mm from the medial canthus. The orbicularis muscle fibers were separated. The lacrimal fascia was incised 1 mm lateral to the anterior lacrimal crest and the bony attachment of the medial canthal ligament was divided. Periosteum was separated from the anterior lacrimal crest and along with the lacrimal sac is reflected laterally with blunt dissection exposing the lacrimal fossa. The lamina papyracea, the papery thin bone of the posterior half of the lacrimal fossa, was fractured and the nasal mucosa was stripped from the lacrimal bone to avoid damage to it. A bony osteotomy, approximately 10 mm in diameter, was created. A probe was introduced into the sac through lower canaliculus and the sac was incised vertically by converting into H shaped so that anterior and posterior flaps may be created. Nasal mucosal flaps are also fashioned into H shape. Posterior flap of

nasal mucosa is sutured to posterior flap of lacrimal fossa using Vicryl 6-0. Medial palpebral ligament was sutured to periosteum, orbicularis muscle with Vicryl 6-0 and skin was closed using silk 6-0.

Dressing was applied. The duration of surgery was measured from the making of the incision on the skin to the end of the closure of the skin incision by suturing.

### Technique of Endonasal DCR

Some endonasal DCR were performed under local, while others were performed under general anesthesia (especially for children, anxious, and elderly patients). The nose was packed with cotton pledgets soaked in xylocaine and adrenaline. The area anterior to the middle turbinate was infiltrated with xylocaine and adrenaline. An incision was made with sickle knife or cautery in lateral wall of nasal cavity immediately anterior to the middle turbinate extending from upper one-third of the middle to 0.5 cm above the axilla. A posterior nasal mucoperichondrial flap was raised. The flap was reflected against the anterior part of the middle turbinate so as to prevent it from trauma. The anterior lacrimal crest was identified. Starting from inferior aspect, anterior lacrimal crest was removed with the help of Kerrison's punch, so as to expose the lacrimal sac completely. External pressure over sac was applied by as assistant, then corresponding movement of the sac was appreciated intranasally and a vertical slit was made. Microscissors were used then both inferiorly and superiorly so as to create inferior and superior flap which was then excised. Lacrimal sac syringing was done with normal saline and a free flow of the fluid was observed endoscopically. Gel foam was placed over the opened sac on which further nasal packing was placed.

Dressing was applied. The duration of surgery was measured from the making of the incision on the skin to the end of the closure of the skin incision by suturing.

### Post-operative Care

The patient is started on oral antibiotics and analgesics. After the surgery, the patient is seen on the 1<sup>st</sup> post-operative day. The nasal pack if any is gently removed and hemostasis assessed. The wounds are cleaned with 5% betadine, and the patient is discharged on oral antibiotics and analgesics, topical antibiotics, and nasal decongestants. One week post-operative, the sutures are removed, oral medications discontinued, topical steroids are tapered, and nasal medications continued for 2 more weeks.

### Post-Operative Follow-Up

The patient is reviewed at day 2 (48 h), 7<sup>th</sup> day, 1<sup>st</sup> month, 3<sup>rd</sup> month, and 6<sup>th</sup> months after surgery.

## OBSERVATION AND RESULTS

The present study was conducted at the Department of ENT and Head and Neck Surgery, Sawai Man Singh Medical College, Jaipur, from June 2018 to September 2019. The aim of study was to study the effectiveness of endonasal DCR compared with external DCR regarding DCR regarding the advantages, patency rate, patient compliance, and intraoperative and post-operative complications.

A total of 120 cases were enrolled for DCR. These cases were further randomized into groups: Group I and Group II.

1. Group I – those undergoing endonasal endoscopic DCR
2. Group II – those undergoing external DCR.

### Age Distribution of the Patients

Group I had a mean age of  $44.83 \pm 19.16$  years, and Group II had a mean age of  $49.2 \pm 18.81$  years. The two groups were comparable in age-wise distribution [Figure 1].

### Gender Distribution of the Patients

In Group I, 38 cases (63.3%) were female and 22 cases (36.7%) were male, while in Group II, 42 cases (70%) were female and 18 cases (30%) were male. The male-to-female ratio being 1:2 [Figure 2].

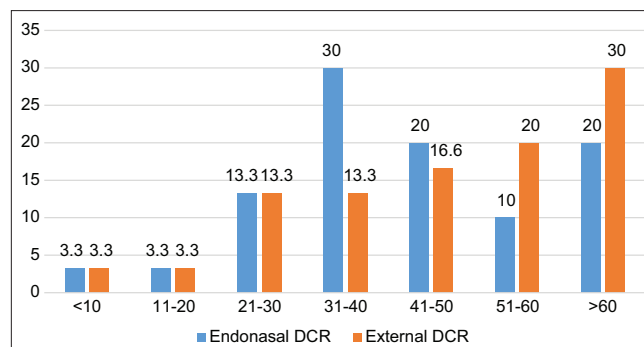


Figure 1: Age distribution

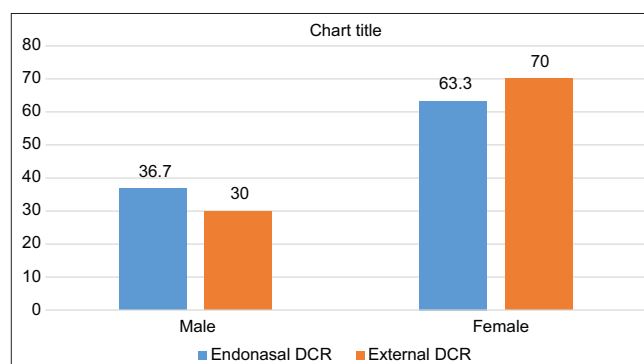


Figure 2: Gender distribution

### Laterality of the Symptoms

Overall, the eyes operated in different age groups showed preponderance of the right eye. Out of 120 cases total, 64 cases (51.75%) were presented with disease on right, and 48 cases (40%) had disease on the left side, and 8 cases (6.6%) had the disease bilaterally. In both the groups, 50% of the patients presented with the right-sided symptomatology, as compared to 40% (8) with the left-sided symptomatology and about 6% with bilateral symptomatology. This result was not statistically significant with respect to the side of the eyes between the groups.

### Etiological Distribution of the Cases

The most common cause of chronic dacryocystitis was found to be idiopathic blockage of the nasolacrimal duct (80%). The rest of the cases were either traumatic or infective such as lacrimal abscess and acute dacryocystitis (20%).

### Clinical Presentation of the Cases

All the cases presented predominantly (100%) with persistent watering of the eye, 14 cases (11.67%) had associated pus discharge with watering, 22 cases (18.33%) presented with swelling in sac area, 14 cases (11.67%) had headache, 54 cases (45%) with itching, and 36 cases (30%) with sticky eye at the time of presentation [Table 1].

### Comparison of Intraoperative Complications between both the Groups

External DCR groups recorded more complication, that is, excessive bleeding in 36 patients (60%) followed by trauma to middle turbinate 24 patients (40%) and accidental injury to anterior ethmoidal air cells in 16 patients (26.6%) while endonasal groups have less complications in 10 patients (16.6%) in the form of excessive bleeding which was statistically significant. Among patients having excessive bleeding in Group I, three patients were known hypertensive, two cases had nasal mucosal inflammation leading to hemorrhage during incision of the lacrimal sac wall, and three cases had excessively thick bone in the frontal process of the maxilla, which required more extensive drilling [Table 2].

### Comparison of Time Taken for Surgery

The surgical duration in Group I was between 30 and 60 min (31 cases, 51.67%), and in Group II, it was between 60 and 90 min (22 cases, 36.67%). The difference between the two groups was found to be statistically significant ( $P = 0.021$ ) [Figure 3].

### Comparison of Post-operative Complications

It was observed that in Group I, the most common complication was excessive crust formation present in 20 cases (33.3%) where in Group II, it was seen among 2 cases (3.3%) only. Synechiae accounted for the second

**Table 1: Etiological comparison between both the groups**

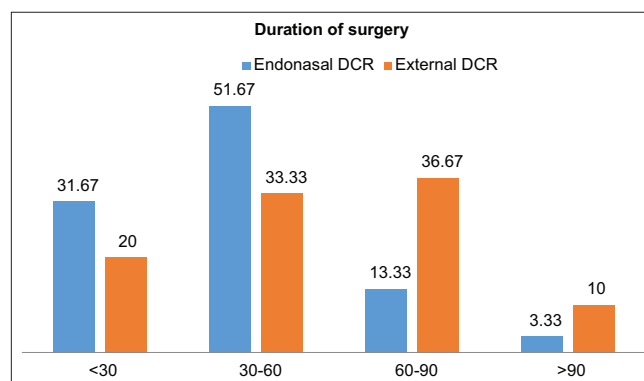
Clinical feature	Endonasal DCR, n (%)	External DCR, n (%)	Total, n (%)
Epiphora	60 (100)	60 (100)	120 (100)
Unilateral	52 (86.67)	54 (90)	106 (88.33)
Bilateral	8 (13.33)	6 (10)	14 (11.67)
Pus discharge	6 (10)	8 (13.33)	14 (11.67)
Swelling in the sac area	12 (20)	10 (16.67)	22 (18.33)
Sticky eye	20 (33.33)	16 (26.67)	36 (30)
Itching	26 (43.33)	28 (46.67)	54 (45)
Headache	8 (13.33)	6 (10)	14 (11.67)
Chronic dacryocystitis	52 (86.67)	52 (86.67)	104 (86.67)
Chronic dacryocystitis with mucocele	4 (6.67)	4 (6.67)	8 (6.67)
Chronic dacryocystitis with pyocele	4(6.67)	4 (6.67)	8 (6.67)

DCR: Dacryocystorhinostomy

**Table 2: Comparison of intraoperative complications between both the groups**

Complications	Endoscopic endonasal DCR	External DCR	Total
Excessive bleeding	10 (16.6)	36 (60)	46 (38.3)
Trauma to middle turbinate	8 (13.3)	24 (40)	32 (26.6)
Accidental injury to anterior ethmoid	4 (6.6)	16 (26.6)	20 (16.6)
Difficulty in bone window formation	0	6 (10)	6 (5)
Loss of nasal mucosa during bone removal	4 (6.6)	8 (13.3)	12 (10)
Orbital injury	0	8 (13.3)	8 (6.6)
Laceration of puncta	0	2 (3.3)	2 (1.7)
No complication	34 (56.6)	0	34 (28.3)
Total	60 (100)	60 (100)	120 (100)

DCR: Dacryocystorhinostomy



**Figure 3: Time taken for surgery**

most common complication constituting 10 cases (16.6%) for Group I.

The most common complication for Group II was external scar seen 34 cases (56.6%) followed by injury to angular vein/medial palpebral ligament in 30 cases (50%). Both these complications were hardly seen in Group I [Table 3].

**Comparison of Post-operative Follow-up for Patency**

Follow-up at 48 h – in Group I, patency rate was 100% (60 cases), whereas in Group II, passage patency was 91.7% (55 cases). The difference between the two groups was non-significant ( $P = 0.068$ ).

Follow-up at the 7<sup>th</sup> day – in Group I, patency rate was 98.3% (59 cases), whereas in Group II, it was 86.7% (52 cases). The difference between the two groups was significant ( $P = 0.038$ ).

Follow-up at the 1<sup>st</sup> month – in Group I, patency rate was 95% (57 cases) in Group I whereas it was 81.7% (49 cases) in Group II. The difference between the two was significant ( $P = 0.047$ ).

Follow-up at the 3<sup>rd</sup> month – in Group I, patency rate was 91.7% (55 cases) whereas it was 75% (45 cases) in Group II. The difference between the two was significant ( $P = 0.027$ ).

**Table 3: Comparison of post-operative complications between both the groups**

Complications	Endoscopic endonasal DCR	External DCR	Total
Obstruction at rhinostomy site	0	0	0
Post-operative infections	1 (1.6)	2 (3.3)	3 (2.5)
Epistaxis	4 (6.6)	0	4 (3.3)
Synechiae formation	10 (16.6)	4 (6.6)	14 (11.6)
Irritation	2 (3.3)	2 (3.3)	4 (3.3)
Excessive crusting	20 (33.3)	2 (3.3)	22 (18.3)
Granulation	6 (10)	6 (10)	12 (10)
Presence of external Scar	0	34 (56.6)	34 (28.3)
Injury to angular vein/ medial palpebral ligament	0	30 (50)	30 (25)
None	17 (28.3)	0	17 (14.1)
Total	60 (100)	60 (100)	120 (100)

DCR: Dacryocystorhinostomy

Follow-up at the 6<sup>th</sup> month – in Group I, patency rate was 86.7% (52 cases) whereas in Group II, it was 66.7% (40 cases). The difference between the two was significant ( $P = 0.018$ ) [Tables 4 and 5].

**DISCUSSION**

Chronic dacryocystitis, a smoldering low-grade infection ultimately leads to total NLDO. DCR is the treatment of choice for chronic dacryocystitis.<sup>[6]</sup> Earlier external DCR remained gold standard to treat the NLDO, however with advancement in the technology, endoscopic DCR is now an emerging treatment of choice and has an increased compliance from the side of patient.

Still the debate about whether external DCR or endoscopic DCR is better remains controversial. Hence, with this aim, our study was conducted to study the effectiveness of endonasal DCR compared with external DCR regarding DCR regarding the advantages, patency rate, patient compliance, and intraoperative and post-operative complications. In our study of total 120 patients, the maximum number of patients 20 cases (33.4%) was in the age group of >60 years followed by 12 cases (20%) in the age group of 41–50 years. The mean age for endoscopic endonasal DCR was  $44.83 \pm 19.16$  years and for external DCR was  $49.2 \pm 18.81$  years which was comparable between both the groups and was similar to Serdar Ozer et al.<sup>[7]</sup>

In our study, the sex ratio of male to female being 1:2. We studied 120 cases (100%) presented with epiphora out of which, 80 cases (66.7%) were female, and 40 cases (33.3%) were male, which was comparable in between both the groups and was similar to Sonkhya and Mishra.<sup>[8]</sup>

**Table 4: Comparison of patency rates by syringing at follow-ups between both the groups**

Follow-ups	Passage patency by syringing	Endoscopic endonasal DCR, n (%)	External DCR, n (%)	Total	P-value
At 48 h (1 <sup>st</sup> follow-up)	Passage patent	60 (100)	55 (91.7)	115 (95.8)	$\chi^2=3.339$ , $P=0.068$ (NS)
	Non-passage patent	0	5 (8.3)	5 (4.2)	
	Total	60 (100)	60 (100)	120 (100)	
At 7 <sup>th</sup> day (2 <sup>nd</sup> follow-up)	Passage patent	59 (98.3)	52 (86.7)	111 (92.5)	$\chi^2=4.324$ , $P=0.038$ (S)
	Non-passage patent	1 (1.7)	8 (13.3)	9 (7.5)	
	Total	60 (100)	60 (100)	120 (100)	
At 1 <sup>st</sup> month (3 <sup>rd</sup> follow-up)	Passage patent	57 (95)	49 (81.7)	106 (88.3)	$\chi^2=3.962$ , $P=0.047$ (S)
	Non-passage patent	3 (5)	11 (18.3)	14 (11.7)	
	Total	60 (100)	60 (100)	120 (100)	
At 3 <sup>rd</sup> month (4 <sup>th</sup> follow-up)	Passage patent	55 (91.7)	45 (75)	100 (83.3)	$\chi^2=4.860$ , $P=0.027$ (S)
	Non-passage patent	5 (8.3)	15 (25)	20 (16.7)	
	Total	60 (100)	60 (100)	120 (100)	
At 6 <sup>th</sup> month (5 <sup>th</sup> follow-up)	Passage patent	52 (86.7)	40 (66.7)	92 (76.7)	$\chi^2=5.637$ , $P=0.018$ (S)
	Non-passage patent	8 (13.3)	20 (33.3)	28 (23.3)	
	Total	60 (100)	60 (100)	120 (100)	

DCR: Dacryocystorhinostomy

**Table 5: Comparison of surgical results in terms of passage patency by syringing at follow-ups of both procedures**

Passage patency	Endoscopic endonasal DCR, n (%)	External DCR, n (%)	Test of significance
Syringing at 48 h	60 (100)	55 (91.7)	Chi-square
Syringing at day 7	59 (98.3)	52 (86.7)	Chi-square
Syringing at 1 month	57 (95)	49 (81.7)	Chi-square
Syringing at 3 months	55 (91.7)	45 (75)	Chi-square
Syringing at 6 months	52 (86.7)	40 (66.7)	Chi-square

DCR: Dacryocystorhinostomy

In our study, 48 cases (40%) were presented with disease on left, and 64 cases (51.75%) had disease on right side, and 8 cases (6.67%) had the disease bilaterally which was similar to the study by Zenk *et al.*<sup>[9]</sup>

The most common cause of chronic dacryocystitis was found to be idiopathic blockage of the nasolacrimal duct (80%) which was comparable to Weidenbecher (1994) who found that 78.5% of the cases had an idiopathic cause.<sup>[10]</sup> The rest of the cases were either traumatic or infective such as lacrimal abscess and acute dacryocystitis.

In the present study, epiphora was found in all 120 cases (100%) and swelling in the sac region was found in 22 cases (18.33%) which was comparable to the study by Vijay Joshi *et al.*<sup>[11]</sup> where 81% presented with epiphora and swelling near medial canthus was seen in 14.3% of patients.

Intraoperative and post-operative complications when compared between both the groups were non-significant. The external DCR groups recorded more complication, that is, excessive bleeding intraoperatively in 36 patients (60%) which was statistically significant.

The surgical duration in Group I was between 30 and 60 min (31 cases, 51.67%), and in Group II, it was between 60 and 90 min (22 cases, 36.67%) which was comparable to Hartikainen *et al.* study.<sup>[12]</sup> The endonasal approach took less dissection time as compared to that in the external approach.

In Group I, patency rate was 86.7% (52 cases) whereas in Group II, it was 66.7% (40 cases) which was significant. Similar outcomes were also reported in the studies by Ben Simon *et al.*<sup>[13]</sup> and Leong *et al.*,<sup>[14]</sup> whereas studies by Cokkeser *et al.*<sup>[15]</sup> and Ibrahim *et al.*<sup>[16]</sup> depicted external DCR to have better success rate than endonasal DCR.

## CONCLUSION

Our study concludes that wide marsupialization of whole lacrimal sac into the nose by endoscopic endonasal DCR approach is a simple, minimally invasive, less time consuming, day care procedure and has better result with conventional external DCR and was more safe. It may be indicated on a primary basis or as revision surgery following failed external DCR.

## REFERENCES

- Pengilly Z. Scott-brown's Otorhinolaryngology: Head and Neck Surgery. 7<sup>th</sup> ed. London, United Kingdom: Hodder Arnold; 2015.
- Agarwal S. Endoscopic dacryocystorhinostomy for acquired nasolacrimal duct obstruction. *J Laryngol Otol* 2009;123:1226-8.
- Metsen R, Pletcher SD. Endoscopic orbital and optic nerve decompression. *Otolaryngol Clin North Am* 2006;39:551-61.
- Norris JL, Cleasby GW. Endoscopic orbital surgery. *Am J Ophthalmol* 1981;91:249-52.
- Prabhakaran VC, Selva D. Orbital endoscopic surgery. *Indian J Ophthalmol* 2008;56:5-8.
- Woog JJ, Kennedy RH, Custer PL, Kaltreider SA, Meyer DR, Camara JG. Endonasal dacryocystorhinostomy: A report by the American academy of ophthalmology. *Ophthalmology* 2001;108:2369-77.
- Caldwell GW. Two new operations for obstruction of the nasolacrimal duct. *N Y Med J* 1893;57:281-2.
- Sonkhya N, Mishra P. Endoscopic transnasal dacryocystorhinostomy with nasal mucosal and posterior lacrimal sac flap. *J Laryngol Otol* 2009;123:320-6.
- Zenk J, Karatzanis AD, Psychogios G, Franzke K, Koch M, Hornung J, *et al.* Long-term results of endonasal dacryocystorhinostomy. *Eur Arch Otorhinolaryngol* 2009;266:1733-8.
- Weidenbecher W. Endoscopic endonasal dacryocystorhinostomy: Results in 56 patients. *Ann Otol Rhino Laryngol* 1994;103:363-6.
- Joshi V, Titiyal GS, Gupta S, Lohani K. External dacryocystorhinostomy versus endoscopic endonasal dacryocystorhinostomy. *J Evol Med Dent Sci* 2014;3:3185-93.
- Hartikainen J, Antila J, Varpula M, Puukka P, Seppä H, Grénman R. Prospective randomized comparison of endonasal endoscopic dacryocystorhinostomy and external dacryocystorhinostomy. *Laryngoscope* 1998;108:1861-6.
- Ben Simon GJ, Joseph J, Lee S, Schwarcz RM, McCann JD, Goldberg RA. External versus endoscopic dacryocystorhinostomy for acquired nasolacrimal duct obstruction in a tertiary referral center. *Ophthalmology* 2005;112:1463-8.
- Leong SC, Karkos PD, Burgess P, Halliwell M, Hampal S. A comparison of outcomes between nonlaser endoscopic endonasal and external dacryocystorhinostomy: Single-center experience and a review of British trends. *Am J Otolaryngol* 2010b;31:32-7.
- Cokkeser Y, Evereklioglu C, Er H. Comparative external versus endoscopic dacryocystorhinostomy: Results in 115 patients (130 eyes). *Otolaryngol Head Neck Surg* 2000;123:488-91.
- Ibrahim HA, Batterbury M, Banhegyi G, McGalliard J. Endonasal laser dacryocystorhinostomy and external dacryocystorhinostomy outcome profile in a general ophthalmic service unit: A comparative retrospective study. *Ophthalmic Surg Lasers* 2001;32:220-7.

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