International Journal of Medical and Health Research
ISSN: 2454-9142; Impact Factor: RJIF 5.54
Received: 19-12-2019; Accepted: 22-01-2020
www.medicalsciencejournal.com
Volume 6; Issue 2; February 2020; Page No. 72-77

Prospective randomized comparitive study between external and endonasal endoscopic dacryocystorhinostomy

Dr. Girish F Hongal[1], Dr. Sathyalakshmi MH[2*]
[1] Professor, Department of ENT, the Oxford Medical College, Bangalore, Karnataka, India
[2] Associate Professor, Department of Ophthalmology, the Oxford Medical College, Bangalore Karnataka, India
Corresponding author: **Dr. Sathyalakshmi MH**

Abstract
The increasing use of endoscopic techniques for performance of functional intranasal and sinus surgery has allowed unrivalled visualization of nasal cavity and has awakened interest in transnasal approach to the nasolacrimal apparatus. The nasolacrimal apparatus being intimately related to lateral nasal wall may readily be approached using an endoscopic technique that minimizes functional interference with physiological action of the lacrimal pump. The study include 40 patients with 47 eyes affected were diagnosed as primary nasolacrimal sac or duct obstruction or chronic dacryocystitis. One patient with bilateral chronic dacryocystitis was randomized for bilateral external dacryocystorhinostomy. All 44 cases (100%0[21 cases (100%) in group I and 23 cases (100%) in group II] were patent on lacrimal syringing at the end of the 1st dat and 1st week. 19 cases (90.47%) in group I and 21 cases (91.3%) in group II were patent to lacrimal sac syringing at the end of 3rd week, 3rd month and 6th month. Among the 2 failure cases in group I one patient undergone revision endoscopic DCR with stenting and was successful.
Both the failed cases of primary endoscopic DCR underwent revision endoscopic DCR with stenting and were successful.

Keywords: endonasal endoscopy, dacryocystorhinostomy, bilateral chronic dacryocystitis

Introduction
The traditional surgical approach to distal obstruction of the nasolacrimal duct system has been by an external skin incision. Introduction of nasal endoscope has now been able to provide an alternative approach to the treatment of epiphora where the cause is an obstruction distal to the common canaliculus [1].
The external dacryocystorhinostomy has remained the gold standard by which all newer methods of dacryocystorhinostomy (DCR) must be judged. Post-operative morbidity, including periorbital bruising, epistaxis and late dacryocystorhinostomy failure have led to the search for a less invasive approach to the operation. Furthermore, the questions have arisen regarding the need for extensive dissection required in external dacryocystorhinostomy and the advantages of smaller ostium made in a direct manner have been suggested. The increasing use of endoscopic techniques for performance of functional intranasal and sinus surgery has allowed unrivalled visualization of nasal cavity and has awakened interest in transnasal approach to the nasolacrimal apparatus. The nasolacrimal apparatus being intimately related to lateral nasal wall may readily be approached using an endoscopic technique that minimizes functional interference with physiological action of the lacrimal pump. The endonasal DCR also has other advantages over the conventional DCR in the following ways [2, 3].

- Avoidance of external cutaneous scar there by eliminating the disadvantage of hampered cosmesis along with the limitation of tissue injury and post-operative adhesions
- Avoids a potential injury to the medial canthal structures thus retaining the pump mechanism.
- Co-existing factors like nasal sepatal deviation, hypertrophied turbinates and paranasal sinus diseases can simultaneously be dealt in the same procedure.
- In addition there is a possibility of operating in cases of acute dacryocysistis when it is contraindicated for external dacrystorhinostomy.
- Reduced operative time.
- Reduced patient morbidity.
- Excellent hemostasis.

In previous reports, the success rate for endonasal endoscopic DCR has remained lower than the success rate for external DCR. The higher primary success rate for external DCR is probably due to the creation of a controlled epithelial lined mucosal anastomosis. Both of these DCR techniques have a minimal risk of complications and since the secondary success rates are equal for endonasal endoscopic DCR and external DCR, it has been concluded that they represent good alternatives for the treatment of primary acquired nasalacrimal sac or duct obstruction [4].
As the technique gets refined, the endonasal DCR may slowly and surely be replacing the external DCR as visible alternative operation provided the expertise and technology reaches many practitioners and may even become an outpatient procedure one day.
Hence this prospective randomized study compares endonasal endoscopic DCR with traditional external DCR for their intraoperative surgical duration, postoperative success rate and complications.

Methodology
Source of Data
Patients attending otorhinolaryngogly and ophthalmology OPD.

Sample Size

The study include 40 patients with 47 eyes affected were diagnosed as primary nasolacrimal sac or duct obstruction or chronic dacryocystitis. One patient with bilateral chronic dacryocystitis was randomized for bilateral external dacryocystorhinostomy.

Inclusion Critria

1. All the symptomatic epiphora cases diagnosed as primary acquired nasolacrimal sac or duct obstruction or chronic dacryocystotis.
2. Those who are willing to undergo syrgery.

Exclusion criteria

1. Canalicular or punctual obstruction
2. Ectropion / entropion /lower lid laxity
3. Post traumatis bone deformity
4. History of previous radition therapy
5. Suspicion of malignancy
6. Bone disease affecting the nose and orbit

The patients were evaluated as follows:

Cases selected were subjected to a complete examination according to a defined proforma.

1. Detaied ocular and systemic history is taken. Patients were examined with particular reference to the lacrimal apparatus. A detailed ocular examination was done by opthamologist. Rhinoscopy was done to look for any significant nasal pathology.
2. The patency of the nasolacrimal duct was identified by lacrimal sac syringing with normal saline.
3. Routine blood investigations like Hb%, B. T, C. T, T. C, D. C, H. I. V, Hbs Ag, urine for albumin, sugar and other relevant investigations like dacryocystograph were done when required.
4. Acute dacryocystitis cases were treated on medical line and then was subjected for surgery later.
5. All patients received a course of antibiotic starting one day prior to surgey for 5 days.

All the selected patients were randomly divided into two operative groups.

Group I patients underwent external dacryocystorhinostomy and endonasal endoscopic dacryocystorhinostomy was done for the other group.

Group I – External Dacryocystorhinostomy

Group II – Endoscopic Endonasl Dacryocystorhinostomy

Technique of External Dacryocystorhinostomy

All external dacryocystorhinostomy operations wereperformed under local anesthesia.

After anaesthetizing nasal mucosa with swab sticks dipped in 4% xylocaine with adrenaline. Packing of the ipisilateral nasal cavity was done with haif a meter of roller gauze soaked in 5 ml of 4% xylocaine with adrenaline 1:2, 00,000 xylocaine with adrenaline.

Lacrimal and periorbital area painted with betadine and spirit and parts draped.

A curvilinear incision of 1 to 1.5 cm in length was made in front of the medial canthus.

The orbicularis muscle filter were separated. Rake retractors inserted into each side of the incision. The lacrimal fascia is incised 1 mm lateral to the anterior lacrimal crest and the bony attachment of the medial canthal ligment was divided. With a blunt dissector the sac was separated from the lacrimal fossa.

The periosteum overlying and medial to the anterior lacrimal crest was exposed and elevated with the help of Traquair's periosteal elevator. Lamina papyracae, parchment like bone of the posterior half of the lacrimal fossa was fractured with smaller end of the blunt dissector. Nasal mucosa was separated from the lacrimal bone to avoid damage to the nasal mucosa. Bony osteotomy approximately 10 to 12 mm in diameter was created with successive size of Citelli's punch. Bleeding was minimized with 4% xylocaine with adrenaline or by a suction tip. After anaesthetizing the eye with 4% xylocaine drops lower punctum was dilated with punctum dilator. Bowman's probe passed through the lower canaliculus by tenting the medial sac wall and confirming the position of common canaliculus and the related parts of the medial sac wall.

With the help of a #11 No. Bard Parker blade, first lacrimal sac and then nasal mucosa were opened in "H" shaped fashion to form larger anterior and smaller posterior flaps, the Bowman's Probe was removed.

In present study only anterior flaps of the nasal mucosa and lacrimal sac were sutured by interrupted sutures with 6-0 vicryl suture material.

The incision in the orbucularis muscle closed with 3 to 4 interrupted sutures of 6 -0 vicryl suture material and skin incision was closed with running 6 – 0 vicryl subcuticular suture. Antibiotic drops were instilled into the eye, antibiotic ointment applied to the operated site and dressing done.

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

Results

Table 1: ENT Pathology

	Group I		Group II		Total	
	No.	Percentage	No.	Percentage	No.	Percentage
Minimal to Moderate DNS	2	10	5	25	7	17.5
Gross DNS	2	10	4	20	6	15.0
Middle Turbinate Hypertophy	0	0	1	5	1	2.5
Inferior Turbinate Hypertrophy	2	10	3	15	5	12.5
Nasal Spur	0	0	0	0	0	0
Atropihic Rhinitis	1	5	0	0	1	2.5
Total cases with nasal pathology	7	35	13	65	20	50

There were 7 cases (17.5%) [2 cases (10%) in group I and 5 cases (25%) in group II] with mild to moderate deviated nasal septum.

There were 6 cases (15.0%) [2 cases (10%) in group 14 cases (20%) in group II with gross deviated nasal septum.

There was one patient (25%) in group II with middle

turbinate hypertrophy.
There were 5 cases (12.5%) [2 cases (10%) in group 13 cases (15%) in group II] with hypertropic inferior turbinate.
There was one patient (2.5%) in group I with atrophic rhinitis.
Overall there were 20 cases (50%) [7 cases (35%) in group I and 13 cases (65%) in group II] with otorhinolaryngological pathology.

Table 2: Intraoperative Complications in Group I

	Group I	
	No.	Percentage
Moderate Bleeding	5	23.8
Severe Bleeding	1	4.76
Tearing of anterior nasal flap	0	0
Accidental cut on medical sac wall	0	0
Laceration of punctum	0	0
Accidental entry of Ethmoidal aircells	0	0

There were 5 cases (23.8%) with moderate bleeding and one case (4.76%) with severe bleeding.

Table 3: Intraoperative Complications in Group II

	Group I	
	No.	Percentage
Moderate Bleeding	1	4.34
Severe Bleeding	0	0
Resection of Middle Turbinate	0	0
Accidental entry to ethmodial air cells or to orbital area	0	0
Resection of uncinate process	0	0
Difficulty in sac localization	1	4.34

There was one case (4.34%) bwith moderate bleeding.
There was one case (4.34%) with difficulty in localization of the sac.

Table 4: Surgical Duration in Two Groups

Surgical duration	Group I		Group II	
Duration in Minutes	No.	Percentage	No.	Percentage
Upto 45 minutes	0	0	13	65
45 - 60 minutes	15	75	4	20
60 – 75 minutes	5	25	1	5
75 – 90 minutes	0	0	1	5
> 90 minutes	0	0	0	0

13 cases (65%) in group II were operated with surgical duration less than 45 minutes.
15 cases (7%) in group I and 4 cases (20%) in group II were operated with average duration between 45 – 0 min.
5 cases (25%) in group I and one case (5%) in group took surgical duration between 60 – 75 minutes.
One case (5%) in group II took surgical duration between 75 – 90 min.

Table 5: Surgical Duration in Group II

Pathology corrected	No. cases	Average time taken (min)
Unilateral End DCR	14	39.28
Bilateral End DCR	2	67.5
Unilateral End DCR with SMR	3	51.66
Bilateral End DCR with SMR	1	90.00

The average time taken for unilateral endoscopic endonasal dacryocystorhinostomy was 39.28min
The average time taken for bilateral endoscopic endonasal dacryocystorhinostomy was 67.5 min.
The average time taken for unilateral endoscopic DCR with correction of the deviated nasal septum was 51.66min.
Bilateral endoscopic DCR with correction of septal deviation took 90 min.
Hence nasal pathology is corrected in 4 cases (17.39) in group II.

Table 6: Post-Operative Complication in Group I

Complications	Group I	
	No.	Percentage
Epistaxis	1	4.76
Gaping of Wound	0	0
Wound Infections	0	0
Obstruction at rhinostomy site	1	4.76
Complaints about cutaneous scar	5	23.8
Synechae	1	4.76

There was 1case (4.76%) with epistaxis
There was one case (4.76%) with obstruction at rhinostomy site.
There were about 12cases (57.14%) with complaints about post-operative scar
There was 1 case (4.76%) with synechae.

Table 7: Postoperative Complications in Group II

Complications	Group I	
	No.	Percentage
Epistaxis	0	0
Upper lip injury	0	0
Vestibular Injury	0	0
Infection	0	0
Obstruction at rhinostomy site	2	8.69
Crustings	11	47.82

There were 2 cases (8.69%) with obstruction at rhinostomy site.
There were 11 cases (47.83%) with crusting.
Post-operative irrigation patency rates at scheduled follow ups.

Table 8: Patency at Scheduled Post-Operative Follow Up

Post-Operative Period	Group I		Group II		Total	
	No.	Percentage	No.	Percentage	No.	Percentage
1st post-operative day	21	100	23	100	44	100
1st week	21	100	23	100	44	100
3rd week	19	90.47	21	91.3	40	90.9
3rd month	19	90.47	21	91.3	40	90.9
6th month	19	90.47	21	91.3	40	90.9

All 44 cases (100%0[21 cases (100%) in group I and 23 cases (100%) in group II] were patent on lacrimal syringing at the end of the 1st dat and 1st week.
19 cases (90.47%) in group I and 21 cases (91.3%) in group II were patent to lacrimal sac syringing at the end of 3rd week, 3rd month and 6th month

Results

Table 9

	Group I		Group II		Total	
	No.	Percentage	No.	Percentage	No.	Percentage
Success	19	90.47	21	91.3	40	90.9
Failure	2	9.52	2	8.69	4	9.09

The primary success rate in group I was 19 cases (90.47%)
The primary success rate in group II was 212 cases (91.3%)
There were 2 cases (9.52%) in group I and 2 cases (8.69%) in group II wit failure.

Table 10: Revision Endoscopic DCR

	Primary Failure	Revision End DCR	Results
Group I	2	1	Success
Group II	2	2	Success

- Among the 2 failure cases in group I one patient undergone revision endoscopic DCR with stenting and was successful.
- Both the failed cases of primary endoscopic DCR underwent revision endoscopic DCR with stenting and were successful.

Table 11: Characteristics of Failures after Surgery

Failure No	Age (Years)	Sex	Group	Post-operative problems
1	35	F	I	Discharge
2	35	F	I	Watering
3	36	F	II	Watering
4	45	F	II	Watering Irritation

Table XIII shows the characteristics of patients with failed surgery
First failed patient in group I, had discharge problem
Second failed patient in group I had watering
Third failed patient in group II also had watering
Fourth failed patient in group II has watering and irritation.

Discussion

Early studies have proven that ocular origin for inflammation of the lacrimal system is less common than a nasal origin. The chronic infections of the maxillary sinus and ethmoidal cells, high septal deviation, and acute infection in the nasal cavity may lead to an ascending infection via Hasner's fold. This results in a inflammatory reaction of the nasolacrimal duct, followed by swelling, ulceration, scar formation and stenosis. The same pathologic process may occur from recurrent infections desending from the conjunctiva. The pathogenesis of so called idiopathic stenosis is unknown and is subject of controversy. Manfred Weidenbecher *et al.*, [5] in his study noted detached 72% of septal deviation, 32% of maxillary sinusitis, 20% hyperplasia of turbinates, 14%, nasal polyposis and none of these in16% of patients.
In our study 7 cases (175%) had mild to moderate deviated nasal septum and 6 cases (15%) with gross deviated nasal septum. There was one patient (2.5%) with middle turbinate hypertrophy and 5 cases (12.5%) with inferior turbinate hypertrophy. There was one patient (2.5%) with atrophic rhinitis. Hence in accordance stenosis. Our study als showed nearly 50% had idiopathic etiology.

Group I (External DCR)

In external dacryocystorhinostomy, though majority of operative interventions go well, most of them are complicated by haemorrhage creating exposure difficulties.
In our study 5 cases (23.8%) had moderate bleeding and one case (4.76%) had severe bleeding.
It was either during punching of the lacrimal bone or while making incision of the nasal mucosa. The bleeding was stopped with ribbon gauze soaked in 2% xylocaine with adrenaline. After maintaining perfect haemostasis, surgery was continued. One patient had severe bleeding while making skin incision due to injury to angular vein, which may have been due to varied anatomical position or accessory vein. Haemostasis was attained by clamping and ligating the vein.
Tarbet and Custer [6] exparted haemorrhage in early 4 % of the patients who underwent external dacryocystorhinostomy, but 50% of those patients had pre-existing history of epistaxis or bleeding diathesis.
Hartikainen *et al.*, [7] did not observe any intra operative bleeding as troublesome in their study.
In our study none of the cases had accidental entry into the anterior ethmoidal air cells, tearing of the anterior nasal flap or damage to the medial surface of the lacrimal sac.

Group II (Endonasal Endoscopic DCR)

In our study one patient (4.35%) had moderate bleeding. Haemostasis was attained with cotton pledgets soaked in 4% xylocaine with adrenaline, visualization was the problem in this case.
In a study conducted by Hartiainen *et al.* [7] one patient required anterior nasal tamponage after the anterior resection of the middle turbinate.
In our study one case (4.34%) had difficulty in localization of the sac. The sac being placed posteriorly and slightly superiorly.
None of the patients had accidental entry into the ethmoidal air cells and damage to the uncinate process orresection of middle turbinate.

Surgical duration

Group I

Surgical duration in our study was between 45-60 minutes in 15 cases (75%) and 60-75 minutes for cases (25%).
Tarbet and Custer[6] reported that exernal DCR is an efficient procedure that typically can be performed in less than one hour. They reported a significant decline in surgical duration occurring with increasing experience of the surgical team; the duration on an average was 100 minutes in 1988, declining to 52 minutes in 1992.

Group II

In the present study, the surgical duration of the patients who underwent simple unilateral endoscopic endonasal DCR was on an average 39.28 minutes in 14 cases (60.86%).
And in 2 cases (8.69%) who underwent bilateral endonasal endoscopic DCR the average surgical duration was 67.5% minutes.
Also 3 cases (13.04%) underwent unilateral endonasal endoscopic DCR along with correction of septal deviation took average time of 51.66 minutes.
One case (43.34%) who underwent bilateral endoscopic endonasal DCR with correction of septal deviation took 90 minutes.
Hence our study correlates well Hartikainen *et al.*, [7] study, who noticed surgical duration for endonasal endoscopic DCR was 38 minutes on an average.

Thus the average time taken for endonasal endoscopic DCR is considerably less than that of the External DCR. This difference in surgical duration between both groups, is based on the more physiological acess to the rhinostomy site, while performing the surgery endonasally.

Post-operative complications

Group I (External DCR)

In our study, one patient (4.76%) developed bleeding per nose after the removal of the first nasal pack, which was controlled with anterior nasal packing for 36 hours. Post-operative nasal haemorrhage, in the study by Hartikaeinen *et al*., [7] occurred in a one patient of external DCR group who required anterior nasal tampon age and hospitalization for 3 days.

One patient (4.76%) developed obstruction at rhinostomy site who underwent revision endoscopic DCR later.

Also one patient (4.76%) developed synechae which was released under local anaesthesia.

5 patients (23.8%) complained about the scar and discoloration around the scar.

Only one patient in a study conducted by Hartikainen *et al*., [7] complained about colour difference between the scar and the skin around the scar. This is mostly due to high level of cosmetic awareness among the patients.

None of the cases had sutural problem, gaping of wound or wound infection.

Group II (Endscopic DCR)

2 patient (8.69%) had obstruction at rhinostomy sites and subsequently failed. Once again subjected for revision endoscopic DCR which were successful.

Seven patients had obstruction at rhinostomy site in endonasal group and one case in external group in a study by Hartikainen *et al*., [7]

11 patients (47.82%) had a problem of crusting which wascleaned under endoscopic guidance and patients were advised for alkaline nasal douching to prevent further crusting.

Hartikainen *et al*., [7] came to the conclusion that the most important modification necessary to improve the success rate for endonasal DCR is a weekly postoperative intranasal cleaning of crusts and mucus at the rhinostomy site, which was true in our study too.

Irrigation patency rates and success

In our study, patients had four follow up visits scheduled at theend of 1st week, 3rd week, 3rd month, 6th month.

At the end of 3rd week 4 patients, two in each group were found to be having block with clear regurgitation on lacrimal syringing.

In our study, success rate wa defined byan anatomically patent nasolacrimal system ascertained by nasolacrimal irrigation at 6 months after surgery.

Success rate in group I was 90.47 % (19 cases) and that in Group II was 91.3% (21 cases). Failure rate in group I was 9.52% (2 cases). Failure rate in group II was 8.69% (2 cases) our success rates are comparable with the success rates of the previously done studies.

Hartikainen *et al*., [7] in their study reported that success rate for endoscopic dacrystorhinostomy was 75% and for external DCR was 91%.

S David *et al*.,[8] in their study reported 93.8% success rate for external DCR and 100% success rate for endonasal endoscopic DCR.

Cokkese Y *et al*., [9] reported success rate of external and endonasal endoscopic DCR to be 89.8% and 88.2% respectively.

4 patients (20%) in group II with a nasal septal deviation underwent correction of the septum along with endoscopic DCR in the same sitting.

In a study conducted by Weidendecher *et al*., [10] 9% patients required a correction of the anterior nasal septum in order to get a wide operative exposure.

Woog *et al*., [11] reported that 5%of the patients underwent septoplasty during their endonasal procedure.

Causes for failure

Cases in which the lacrimal passage remained blocked and showed persisting epiphora were regarded as failure. Regurgitation on pressure over lacrimal sac area was positive in most of these cases.

In our study there were failure of 2 cases in group I and 2 cases in group II.

In group I out of 2 failure cases one patient developed blockage of sac patency with mucous discharge on lacrimal pressure. The cause for failure was attributed to severe intraoperative bleeding that hampered visualization and left an inadequate bony opening. Patient was advised, resurgery but was lost for follow up.

The other patient of failure in group II had granulations at the rhinistomy site causing obstruction and underwent Endoscopic DCR and was successful.

Among the two patients with failed endoscopic DCR of group II. One patient had moderate degree of bleeding intraoperatively causing difficulty in proper visualization and post operatively had crusting which may have caused obstruction at rhinostomy site. She underwent revision endoscopic DCR and was successful.

Second patient had difficult in localization of the sac interoperatively the lacrimal sac was placed higher up, hence the patient developed obstruction at 3rd week dueto inadequate bony opening. The patient is subjected for revision endoscopic DCR and was successful. Secondary success rate in revision surgery by endonasal endoscopic dacryocystorhinostomy.

Metin Onerci *et al*., [12] quoted, false localization of the lacrimal sac, granulation tissue formation around the tubes, retained bony spicles, in adequate removal of the medial wall of the sac and the synechae between the lateral wall and the middle turbinate are the most common causes of failure.

Out of 4 failure cases in both grous 3 underwent revision endonasal endoscopic DCR with stenting had a success rate of 100%.

Hartikainen *et al*., [7] had 97.22 % of secondary success rate with both procedures. However in our study we did not have revision external DCR.

Advantages of external dacryocystorhinostomy

- Can be done comfortably under local anaesthesia.
- Good intraoperative visibility inside the lacrimal sac, allowing unrestricted insepection of the internal punctum and lacrimal sac mucosa.
- The possibility of detecting and removing dacryoliths in the lacrimal sac and in the nasolacrimal duct. Tarbet and Custer [6] encountered dacryoliths in 14% of patients undergoing lacrimal surgery.
- The cost containment value of using relatively simple

instrumentation.
- The post-operative care of the external dacryocystorhinostomy patient is more simple and easy.

Conclusion

In conclusion, both the procedures External dacrocystorhinostomy and Endonasal endoscopic dacrocystorhinostomy have comparable success rates. The surgical duration on the other hand was shorter with minimal tissue damage in endonasal endoscopic dacrocystorhinostomy, hence can be done as a day care procedure. An endonasal procedure has the advantages of operating in acute cases, lacrimal abscess and any intranasal pathology can be dealt in the same sitting. Both the external and the endonasal approaches have a minimal risk if intraoperative and postoperative complications. They would thus represent good alternatives for each other, for the treatment of primary nasilacrimal sac or duct obstruction or chronic dacryocystitis.

Endonasal endoscopic dacrocystorhinostomy holds good in such patients who have intranasal pathology, acute cases with lacrimal abscess and also those who are keen about their cosmetic appearance, otherwise Exernal dacrocystorhinostomy is as good as other one.

References

1. Venkatachalam P, Sanjay Agarwal. "Endoscopic Dacryocystorhinostomy". Indian Journal of Otolaryngol Head and Neck Surg. 2000; 52(4):371-372.
2. Dipak Ranjan Nayak, Sathish KR, Parul Shah, *et al*. "Endoscopic Dacryocystorhinostomy and retrograde nasolacrimal duct dilatation with cannulation: our experience" Indian Journal of Otolaryngol Head and Neck Surg. 2000; 52(1):23-27.
3. Jokinen K, Karja J. Endonasal Dacryocystorhinostomy. Arch Otolaryngol 100: 41-44.
4. Thorton SP, Batchelor ED. Dacryocystorhinostomy with nasolacrimal prosthesis. Ophthalmic Surg. 1974; 6:50-52.
5. Man Fred Weidenbecher, Werner Housemann, Wolfgnang Buhr. Endoscopic endonasal dacryocystorhinostomy: results in 56 patients. Ann Otol Rhinol Laryngol, 1994; 103:363-367.
6. Tarbet KJ, Custer PL. "External Dacryocystorhinostomy: Surgical success, patient satisfaction and economic cost". Ophthalmology, 1995; 102:1065-1070.
7. Hartikainen J, Antila J, Matti V, *et al*., "Prospective Randomized comparison of endonasal endoscopic and external Dacryocystorhinostomy" Laryngoscope, 1998; 108:1861-1866.
8. David S, Raju R, Job A, *et al*., "A comparative study of external and endoscopic endonasal dacryocystorhinostomy_ A preliminary report". Indian Journal of Otolaryngol Head Neck Surg. 2000; 52(1):32-37.
9. Cokkesser Y, Everekliogl C, Er H. "Comparative external versus endoscopic dacryocystorhinostomy: results in 115 patients (130 Eyes)". Otolaryngol Head Neck Surg. 2000; 123(4):488-91.
10. Weidenbecher M, Housemann W, Barh W. "Endoscopic endonasal Dacryocystorhinostomy: results in 56 patients". Ann Otol Rhinol Laryngol, 1994; 103:363-376.
11. Wong JJ *et al*. "Holmium YAG endonasal laser dacryocystorhinostomy" Am J Ophthalmol, 1993; 116:1-10.
12. Metin Onerci, Mehmet Orhan, Oguz Ogretmenoglu *et al*., "Long term results and reasons for failure of intranasal endoscopic dacryocystorhinostomy" Acta Otolaryngol, 2000; 120:319-322.