ENDONASAL CARBON-DIOXIDE LASER ASSISTED DACRYOCYSTORHINOSTOMY VERSES EXTERNAL DACRYOCYSTORHINOSTOMY

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ABSTRACT: This is a prospective, non- randomized study to evaluate and compare the results, morbidity and surgical time for endonasal carbon-dioxide laser assisted dacryocystorhinostomy and external dacryocystorhinostomy. 70 consecutive patients of chronic dacryocystitis with nasolacrimal duct obstruction were selected for the study. 36 patients under went endonasal CO₂ laser assisted dacryocystorhinostomy and 34 had external dacryocystorhinostomy. Selection of the type of operation was left to the patient's choice. All the patients had preoperative counseling and both the procedures were explained in detail with their advantages and disadvantages. Patients not willing for the external incision were selected for endonasal laser assisted dacryocystorhinostomy and others were operated via external approach. Silicone tubes were put in all the patients for three months after surgery. The final follow up was 12 months after the removal of silicone tubes. The patency of the lacrimal passage was confirmed by irrigation, and patients were questioned about their symptoms. The success rates, 12 months after removal of silicone tubes were 100% in endonasal CO₂ laser assisted dacryocystorhinostomy and 88.24% in external dacryocystorhinostomy. The surgical time of endonasal laser assisted dacryocystorhinostomy was 38 minutes as compared to 62 in external dacryocystorhinostomy. Complication rate in both groups was almost equal. Thus, we came to the conclusion that Endonasal CO₂ laser assisted dacryocystorhinostomy is a better surgical option to external dacryocystorhinostomy in cases of chronic dacryocystitis with nasolacrimal duct obstruction, with shorter surgical time.

Key Words: Dacryocystorhinostomy, Endonasal, Laser

INTRODUCTION

The traditional treatment of nasolacrimal duct obstruction is external dacryocystorhinostomy. Its success rate varies from 82-99%.^[1-10] But has the disadvantage of facial scar, excessive intra-operative bleeding and disruption of medial canthus anatomy.^[11] Endonasal laser assisted dacryocystorhinostomy is an alternative to the standard external dacryocystorhinostomy because it avoids the cutaneous incision, excessive tissue trauma and postoperative morbidity.^[12,13] Over all results of this procedure varies from 58% to 100%.^[9-11,14-25] [Table 1] Caldwell^[26] in 1893 described endonasal approach to nasolacrimal sac but because of poor visualization of the endonasal anatomy it did not gain popularity. In 1990 for the first time, a window between the nasal cavity and lacrimal sac using Argon laser and operating microscope was created.^[27] Site of entry was visualized by introducing a fiber-optic light needle into the lacrimal sac through the canaliculus. Subsequently, various types of lasers

KTP/CO₂,^[14] KTP,^[15] Holmium: YAG^[16,17] Argon,^[18] Ho: yAG and Nd: YAG,^[19] CO₂-Nd: YAG^[11,20] and ND: YAG^[21] were used to create the bony window with varying results. We used CO₂ laser to ablate the mucus membrane of the nose and medial wall of the sac and diamond bur to make the bony window.

To compare the results, surgical time and morbidity of endonasal CO₂ laser assisted dacryocystorhinostomy and external dacryocystorhinostomy, we evaluated the results of 70 consecutive patients, who underwent dacryocystorhinostomy operations for the treatment of nasolacrimal obstruction from November 1999 to December 2001.

Patient selection

70 consecutive patients with primary diagnosis of chronic dacryocystitis with nasolacrimal duct obstruction were

Table 1: Use of various lasers in dacryocystorhinostomy and their results

Name of the Author	Year	No. of cases	Results %	Laser used
Gonnering RS, Lyond DB, Fisher JC. ^[14]	1991	18	100	KTP-CO2
Reifler DM ^[15] .	1993	19	68.4	KTP
Woog JJ, Metson R, Puliafito CA. ^[16]	1993	40	82	Ho:YAG
Metson R, Woog JJ, Puliafito CA. ^[17]	1994	46	85	Ho:YAG
Boush GA, Lemke BM, Dortzbach RK ^[18]	1994	46	70	Argon
Kong YT, Kim TI, Kong BW ^[19]	1994	131	77.2	Ho:YAG and Nd: YAG
Seppa H, Grnman R, Hartikainen J. ^[20]	1994	12	83	CO2-Nd YAG
Tutton MK, O'Donnell NP. ^[21]	1995	6	100	ND: YAG
J Hartikainen, R Grenman , Pauli P, H Seppa. ^[11]	1998	32	63	CO2-Nd YAG
Szubin L, PapageorgeA, Sacks.E. ^[22]	1999	31	97	Ho:YAG and Argon:HGM
Piaton Jm, Keller P, LimonS, Quenot S. ^[23]	2001	289	63.32	ND: YAG and Ho: YAG
Ibrahim HA, Batterbury M, Banhegyi G, McGalliard J ^[9]	2001	53	58	Not mentioned
Mirza S, Al- Barmani A, Douglas SA, Bearn MA, Robson AK. ^[10]	2002	76	64	KTP
Piaton Jm, Keller P, LimonS, Quenot S ^[24]	2002	363	91.94	Diode laser
Hofman T, Lacker A, Muellner K, Luxenberger W, Wolf G ^[25]	2003	78	83	KTP

selected for the study. Diagnosis was established by syringing of the lacrimal passage and dacryocystogram. Patients with common canaliculi block and punctual stenosis were excluded. All these patients had preoperative counseling and both the procedures (External dacryocystorhinostomy and Endonasal CO₂ laser assisted dacryocystorhinostomy) were explained in detail with their advantages and disadvantages. Patients not willing to get the skin scar in the postoperative period were selected for endonasal CO₂ laser assisted dacryocystorhinostomy. In rest of the patients external dacryocystorhinostomy was performed. Of the total 70 procedures, 34 were external dacryocystorhinostomy and 36 were endonasal CO₂ laser assisted dacryocystorhinostomy.

MATERIALS

Age of the patient ranged from 15 to 69 years with mean age of 30.1 years. 17 patients were male and 53 were female. 32 procedures were on right side, 38 on left side. 40 cases had only watering from eye as a symptom, 16 complained of purulent discharge, 13 presented with swelling at the medial aspect of the eye and one case had fistula connecting the lacrimal sac and skin. Duration of symptoms ranged from 1 year to 18 years with mean duration of 7.6 years. 16 patients had past history of syringing and probing, 8 had failed external dacryocystorhinostomy and 1 had failed external as well as

endonasal dacryocystorhinostomy [Table 2].

METHODS

All operations were performed under general anesthesia. Nose was packed with 1:10000 saline with adrenaline soaked packs, half an hour before surgery. Intravenous injection of Clavulanate potentiated amoxycillin 1.2 grams was given at the time of induction of anesthesia as antibiotic prophylaxis. In all patients, Dobkins silicon tube stent was inserted in the lacrimal passage and chlormphenicol + dexamethasone eye drops were given for 10 days. Nasal douching with hypertonic saline was started 24 hours after surgery for 10 days along with Beclomethasone and decongestant nasal sprays. First follow up was after 7 days in the out patient department. Skin sutures of external dacryocystorhinostomy were removed and nasal cavities of all patients were cleaned of crusts and positions of the tubes were checked. Subsequent follow-ups were 1 month and at the end of 3 months after operation. Silicon tubes were removed after 3 months by cutting between the superior and inferior puncti and delivered from the nasal cavities. Patients were further followed up after every 3 months for 12 months.

Surgical techniques

Otolaryngologist performed the endonasal CO₂ laser assisted

Table 2: Details of the patients

Characteristics	Total	Ext. DCR	ENL. DCR
No. of operations / Patients	70	34	36
Age (yrs.)			
Mean	30.1	30.8	31.3
Range	15—69	19—60	15—69
Sex			
Male / Female	17/53	7/27	10/26
Side			
Right / Left	32/38	14/18	18/20
Symptoms			
Epiphora	40/70	18/34	22/36
Pus discharge	16/70	06/34	10/36
Swelling at medial side of eye	13/70	10/34	03/36
Fistula at the medial side of eye	01/70	00/34	01/36
Duration of symptoms (yr.)			
Mean	7.6	7.3	8.1
Range	1—18	1—18	1—18
Previous surgery			
Multiple syringing & Probing	16/70	10/34	06/36
Ext. DCR	08/70	03/34	05/36
Ext. DCR & Rev. Endo DCR.	01/70	00/34	01/36

dacryocystorhinostomy operations in collaboration with Ophthalmologist. Otolaryngologist visualised the area of lacrimal bone endoscopically by using 30 degree Storz nasal endoscope under the camera and T.V monitor control. Any structural or developmental abnormalities like deflected nasal septum or concha bullosa were taken care of at the start of the surgery. CO₂ laser 10 watts power in continuous mode was used to ablate the nasal mucous membrane at the site of operation. Lacrimal bone was exposed and drilled with 4mm diamond burr using electric drill. Bony window of approximately 8-10mm diameter was created and medial wall of lacrimal sac was exposed. At this stage ophthalmologist passed the lacrimal probe from one of the canaliculi and tented the medial wall of the lacrimal sac in the nasal cavity. The tenting was visualized on the TV monitor and medial wall of the lacrimal sac was ablated with CO₂ laser at 6 watts-power setting. The eye was protected with multiple layers of gauze packs soaked in saline. All the charred tissue was removed at this stage and free flow of normal saline was checked in the nasal cavity by syringing. Dobkins double-ended silicon tubes were inserted from both superior and inferior canaliculi and tied in the nasal cavities with multiple knots. Nose was packed with Vaseline gauze pack, only, if there was any bleeding. Patient was discharged next day. Average surgical time was 38 minutes.

Ophthalmology team performed the external dacryocystorhinostomy operations. A curved skin incision starting at the lower end of medial canthus ligament and conforming to the anterior lacrimal crest was made deep up to the lacrimal fascia. Rake retractors were used for undermining the orbicularis muscle. The lacrimal fascia was incised 1 mm lateral to the anterior lacrimal crest. With blunt dissection sac was separated from the lacrimal fossa and periosteum was elevated with a periosteal elevator. A bony ostium of about 1 cm was created with dental drill. As far as possible the nasal mucosa was kept intact during the procedure. A lacrimal probe was passed from the lacrimal canaliculus into the lacrimal sac and the sac was incised to create two flaps. Similar flaps were fashioned from the nasal mucosa. The lacrimal flaps and the nasal mucosal flaps were sutured to each other with interrupted 6/0 ploygalactan sutures. Dobkins double-ended silicon tubes were passed from the upper and lower canaliculi, through the new ostium and tied in the nasal cavity with multiple knots. The orbicularis incision was closed with interrupted 5/0 absorbable sutures and skin incision was closed with interrupted 7/0 silk suture. Average surgical time was 62 minutes.

RESULTS

Final results were assessed 12 months after removal of silicon

tubes in all cases. Success of surgery was determined by free flow of normal saline in the nasal cavity after syringing and also by direct questionnaire to the patient regarding his/her symptoms. Success rate of 88.24% (30/34) was achieved in cases with external dacryocystorhinostomy and 100% (36/36) in endonasal CO₂ laser assisted dacryocystorhinostomy.

Complications

We encountered immediate as well late complications in both the groups. In endonasal CO₂ laser assisted dacryocystorhinostomy group, 1 patient had intra operative prolapsed orbital fat at the site of bony window and 2 had swelling of lower eye lids in the immediate post operative period. These patients were treated conservatively with oral antibiotic and additional hospital stay for one more day. 3 patients removed their silicone tube from the nose with in 2 weeks of operation, which were replaced within 24 hours. 2 patients had foreign body granuloma at the inner canthus 2 months after surgery. These granulomas were excised under local anesthesia in the out patient department and were treated with dexamethasone and chlormphenicol eye drops for 5 days. 2 patients developed nasal synechia between the nasal septum and inferior turbinate; these were excised under local anesthesia in the clinic [Table 3].

In cases of external dacryocystorhinostomy, 2 patients had excessive bleeding during surgery, 2 had post- operative wound infection and other 1 developed foreign body granuloma at the inner canthus. 1 patient developed

Table 3: Complications of endonasal laser assisted dacryocystorhinostomy

Complications	No. of Patients
Orbital fat prolapse	1
Swelling of lower eye lids	2
Self removal of silicone tubes	3
Foreign body granuloma at inner canthus	2
Nasal synechiae	2

Table 4: Complications in external dacryocystorhinostomy

Complications	No. of Patients
Intra operative excessive bleeding	2
Post operative wound infection	2
Foreign Body granuloma at inner canthus	1
Hypertrophied cutaneous scar	1
Pseudo- epicanthal fold	1

hypertrophied skin scar at the site of incision 6 months after surgery and one patient developed pseudo epi-canthal fold [Table 4].

Failures

We had no failure in endonasal CO₂ laser assisted dacryocystorhinostomy group where as in patients of external dacryocystorhinostomy, 4 patients had recurrence of symptoms. Of these, 2 had recurrence of symptoms within 2 months after the removal of the tube and other 2 patients had recurrence after 6 months. Cause of the failure was excessive scarring and closure of the lacrimal passage in the nasal cavity. Of these, 2 patients under went revision surgery with endonasal CO₂ laser assisted dacryocystorhinostomy. Follow up 12 months after removal of tubes had shown no recurrence. Other 2 patients did not give consent for revision operation.

DISCUSSION

Dacryocystorhinostomy is an operation done for chronic dacryocystitis with nasolacrimal duct obstruction. Basically, it is a bypass surgery in which obliterated nasolacrimal duct is bypassed and the lacrimal sac is opened directly into the nasal cavity. Traditionally, this operation is done via an external approach (External dacryocystorhinostomy) by Ophthalmologists with high success rates i.e. 82-99%.^[1-10] In spite of such high results, the procedure has various disadvantages like external skin incision and scar, excessive intra operative bleeding, disruption of the medial canthus anatomy, long surgical time and high morbidity.^[11] With the advent of the nasal endoscopes and better understanding of the intranasal anatomy of the lacrimal system, many authors prefer the endonasal approach. Advantages of endonasal approach are: no external scar, better hemostasis, minimal operative morbidity, less surgical time and preservation of the medial canthus anatomy.^[12,13] In addition, the revision surgery can be performed under short acting anesthesia with no cutaneous incision.^[28] This procedure is also not devoid of certain disadvantages, like high equipment cost and procedure is difficult to learn.^[17,29] Endonasal procedures can be preformed either by using the micro drill / Roungeur / hammer and chisel to create a bony opening between the nasal cavity and lacrimal sac^[13,30,31] or various types of lasers.^[9,10,11,14-25] Bone removal with laser is tedious and has been associated with high recurrence rates due to scarring of the soft tissues secondary to the thermal injuries while ablating the bone.^[16,32]

The success rates of external dacryocystorhinostomy described in the literature range from 82 to 99%.^[1-10] Our results in this series are 88.24%, which are comparable to these values. On the other hand, results of Endonasal dacryocystorhinostomy with use of various types of lasers to create the bony window range from 58 to 100%^[9-11,14-25] and

without laser with micro drill/hammer chisel, 88.2% to 96%.^[13,30,32] We used CO₂ laser to ablate the mucous membrane of the nasal cavity and the medial wall of lacrimal sac. 4 mm diamond drill was used to remove the bone with 100% results. These results are better than the results of other series^[9-11,15-21] and comparable with the results of Gonnering et al^[14] who used KTP and CO₂ lasers in 18 patients with 100% results. We feel our high results are attributed to the use of low power CO₂ laser for the soft tissues and diamond burr to remove the bone. As these factors do not cause much soft tissue trauma. Thus, resulting in less scarring and achievement of high success rates.

The average surgical time in cases of external dacryocystorhinostomy in our series was 62 minutes as compared to 38 minutes in endonasal CO₂ laser assisted dacryocystorhinostomy. Reported surgical time for external dacryocystorhinostomy range from 52 minutes to 100 minutes,^[7] 78 minutes^[11] and 50 to 120 minutes.^[13] In endonasal dacryocystorhinostomy duration of surgery by using CO₂ and Nd: YAG laser to create the bony window was 23 minutes^[11], KTP and Ho: YAG ranged 89 minutes to 116 minutes^[15,17] and hammer and chisel 15 to 105 minutes.^[13]

We encountered few complications in both the groups. In endonasal CO₂ laser assisted dacryocystorhinostomy group, 1 patient had prolapsed orbital fat and 2 had swollen lower eyelids. These were our initial patients. Such complications, in early stages of learning of this procedure have been reported in the literature.^[33] 3 of our patients removed their silicone tubes from the nose within 2 weeks. Brookes et al^[34] in a retrospective study of 205 patients have reported such complaints with in first month after surgery. Foreign body granuloma as reaction to the silicon tubes as encountered in our series has also been reported in the literature.^[35]

CONCLUSION

Endonasal CO₂ laser assisted dacryocystorhinostomy is a better surgical option to the external dacryocystorhinostomy in cases of chronic dacryocystitis with nasolacrimal duct obstruction with shorter surgical time. We recommend the use of Co₂ laser at lower power for soft tissues and diamond drill for bone work to achieve the best result.

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