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Endoscopic holmium:YAG laser dacryocystorhinostomy-safe and effective as a day-case procedure

S. S. Hehar, N. S. Jones, S. A. Sadiq*, R. N. Downes*

Abstract
Endoscopic holmium laser dacryocystorhinostomy can be used safely and efficiently to relieve symptoms of distal nasolacrimal duct obstruction. It has great advantages over the conventional external approach as it can be done as a day-case procedure under local anaesthesia. The excellent ablation of bone and soft tissue using this type of laser contribute to the fact that the procedure can be performed in a mean time of 20 minutes. We report on the results of our first 50 patients and review the literature on the subject.

Key words: Dacryocystorhinostomy; Endoscopy; Laser surgery; Day care

Introduction

The operation of dacryocystorhinostomy (DCR) is not new, as compared to an endonasal approach with a laser. Addeo Toti described an external approach in 1904 (Toti, 1904). Early results were good but there was late failure due to cicatricial occlusions. To avoid these an edge to edge anastomosis of the lacrimal sac and nasal mucosa was suggested (Dupey-Dutemps and Bourget, 1921). With slight modification, this represents the basis for current DCR and has success rates of 80 to 99 per cent (Romanes, 1955; McPherson and Eglestone, 1959; Moore, 1967, 1968; Iliff, 1971; Pico, 1971; Welham and Henderson, 1973; McLachlan *et al.*, 1980; Burns and Cahill, 1985).

The external approach is not without problems. These include a facial scar, potential injury to medial canthal structures, and bleeding. It also normally requires a general anaesthetic and hospital admission for two days. An intranasal approach was first described in 1893 (Caldwell, 1893), but has been hampered until recently by poor intranasal visualization. The advent of the rigid nasal endoscope has removed this problem and the discovery of the laser has given us a way to create an ostium with minimal trauma. There are different types of laser and initially an argon variety was used (Massaro *et al.*, 1990; Bousch *et al.*, 1994). Later, the carbon dioxide and potassium titanyl phosphate (KTP) lasers were investigated (Gonnering *et al.*, 1991). There have been only three reports on the use of the holmium: YAG laser (Woog *et al.*, 1993; Kong *et al.*, 1994; Metson *et al.*, 1994). The CO_2-Nd:YAG laser has also been used with promising early results (Seppa *et al.*, 1994).

We report our results of a prospective study of the first 50 cases undergoing primary holmium: YAG laser endoscopic DCR (ELDCR) at four months follow-up, and compare it retrospectively with a group undergoing conventional external DCR.

Methods

ELDCR

Consecutive patients who required primary drainage surgery to relieve evidence of nasolacrimal obstruction (epiphora, mucocoele or history of acute dacryocystitis) between July 1993 and March 1994 were recruited to this study. All patients gave written consent to the procedure. Pre-operatively, a history was taken and a routine ophthalmic and rhinologic examination was performed. Syringing of the nasolacrimal system was performed and patients with common canalicular occlusion were excluded.

Age, sex and indications for surgery were noted. All procedures were performed by the same surgeons. Surgery was usually performed under local anaesthesia. Amethocaine one per cent drops were instilled into the conjunctival fornices. Lignocaine one per cent with 1:200,000 adrenaline was then infiltrated into the upper and lower lids around the canaliculi and nasolacrimal sac. The nose was anaesthetized with quarter inch diameter ribbon gauze soaked in six per cent cocaine and eight per cent sodium bicarbonate packed into the nasal cavity for 10 minutes. The canaliculi were then dilated and a vitreo-retinal light probe was inserted in the upper

From the Departments of Otorhinolaryngology–Head and Neck Surgery and Ophthalmology*, University Hospital, Nottingham, UK.
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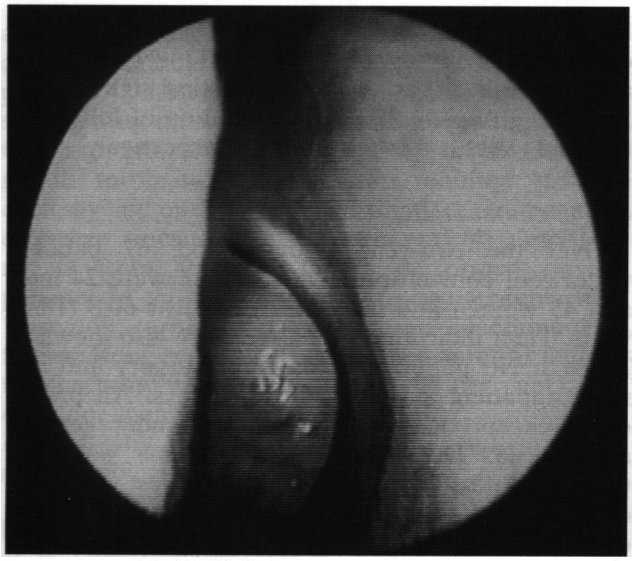

FIG. 1
Intranasal endoscopic view of the transilluminated light from the light-pipe in the nasolacrimal sac.

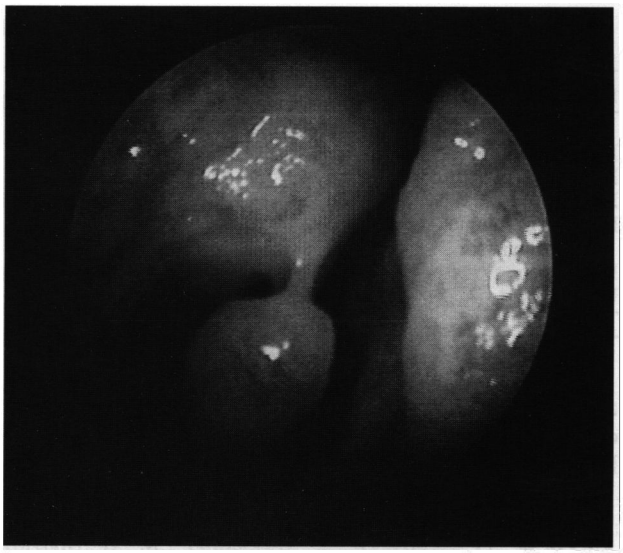

FIG. 2
Appearance of the diffuse illumination from the light-pipe when there is an agger nasi cell.

canaliculus and advanced into the nasolacrimal sac. 0.25 ml of lignocaine one per cent with 1:200,000 adrenaline was injected into the lateral nasal wall just anterior to where the light in the sac was visualized best. The laser was delivered via a 15 degrees probe, aimed at the light (Figure 1). For mucosal ablation, the laser was set at a pulse energy of 0.6 J with a frequency of 10 Hz. When bone was reached, the energy was increased to 1.0 J at the same frequency. Once a rhinostomy had been made, it was enlarged to 0.4–0.5 mm in diameter. Intubation was performed with silicone stents passed with the aid of an Abocath intravenous cannula, and retrieved from the nose with fine nasal forceps. These were then secured with a Watzke sleeve. Operative details (anaesthesia, laser energy, per-operative complications and operative time) were recorded.

The following practical points help:

(1) A high pulse rate reduces splatter from any oozing.

(2) Care should be taken not to follow the reflection of the aiming beam in the mistaken belief that it is the light from the light pipe.

(3) Reducing the illumination from the endoscope will help pinpoint the light from the light pipe.

(4) Suction near the nostril is needed to remove smoke.

(5) The light probe should be passed through the upper canaliculus. This will minimize trauma to the nasolacrimal duct and help position the rhinostomy in the most dependent position.

(6) The laser probe should be cleaned otherwise it cakes with debris and it appears that the probe then becomes hot.

(7) Instruments should be placed into the nasal cavity ahead of the endoscope so their position can be monitored. If instruments are introduced from behind the endoscope then the chance of scuffing the nasal mucosa is much greater. Occasionally the bone is thick and charcoal can accumulate if there is inadequate ablation of bone. This should be curretted off as it cannot be ablated and it simply dissipates heat.

It should also be noted that if the light from the sac is diffuse, there may be a large agger nasi cell (Figure 2), which has to have a window made in it before a rhinostomy can be created. The rhinostomy can be made with a sheathed drill or a 2 mm chisel but this is usually a more bloody procedure and often requires a general anaesthetic and overnight admission.

Post-operatively, patients were treated with a two-week course of topical betnesol. Nasal douches were not employed. Patients were seen at two weeks and thereafter as necessary. At the first post-operative visit, patients were asked their opinion of the procedure, and their symptoms were assessed at the final visit recorded in the case notes. Follow-up was defined as the time from surgery until the final visit.

Conventional DCR

All patients who underwent conventional external DCR in this hospital between January 1991 and December 1992 were identified from theatre records and their casenotes obtained. From these, their age, sex and indications for surgery were noted. Most of the procedures were performed by consultants. Surgical details were recorded as was the length of their hospital stay. The operative time was assessed from the anaesthetic notes. Post-operatively, their symptoms were noted at their final visit and follow-up was defined as the time from surgery until their final attendance.

Results

Results are given as mean and standard deviation in brackets unless otherwise noted. Mean values are compared with the unpaired t-test, and frequencies

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TABLE I
INDICATIONS FOR SURGERY

Indications for surgery	Number		Percentage of total	
	Laser DCR		Conventional DCR	
Epiphora	37	(74)	51	(76)
Epiphora and mucocoele	4	(8)	9	(13)
Epiphora and dacryocystitis	5	(10)	7	(11)
Epiphora, mucocoele and dacryocystitis	1	(2)	0	
Mucocoele alone	2	(4)	0	
Unknown	1	(2)	0	
Total	50	(100)	67	(100)

are analysed with the Chi-squared test (with Yates' correction for small numbers where appropriate) or Fisher's exact probability test.

ELDCR

Forty-nine patients underwent 50 ELDCRs (one had bilateral surgery). There were 20 men and 29 women and their mean age was 65.8 (16.1) years. The indications for surgery are shown in Table I. Forty-six (94 per cent) had their operation performed as a day-case – two required overnight stay because of social reasons and one patient opted for a general anaesthetic, the other 48 (98 per cent) had surgery under local anaesthesia. The average amount of local anaesthetic used was 5.9 ml. The mean operative time was 20.9 (14.8) minutes and the mean energy employed was 0.64 kJ. Per-operative complications occurred in three (six per cent) procedures. Two patients suffered a transient medial rectus palsy as a result of the local anaesthetic and one patient developed a peribulbar haemorrhage with a severe reduction in visual acuity to no perception of light. Fortunately, this resolved rapidly using an ophthalmic tourniquet with no long-term sequelae. This is an idiosyncratic problem which occasionally occurs with the injection of local anaesthetic. There were no cases of per- or post-operative epistaxis.

There was a definite learning curve with ELDCR. The operative time showed a significant fall with time ($r = -0.386$, $p<0.02$), although the laser energy did not demonstrate a similar fall. Neither the time nor the laser energy was related to the patient's age, but there was a significant increase in laser energy with increasing operative time ($r = 0.518$, $p<0.001$).

At the first post-operative visit, 29 patients were asked for their opinion of the procedure. Twenty-six (90 per cent) found it entirely acceptable. Subjective symptoms include the tapping from the laser and the smell of ablated tissue which is not aspirated by suction. After a mean follow-up of 4.0 (1.5) months, 35 (70 per cent) procedures were successful in resolving symptoms.

Twenty-eight (56 per cent) procedures received tubes and 22 (44 per cent) did not. There were no significant differences between these two subgroups for all analyses, apart from a higher volume of local anaesthetic being used in the former subgroup (6.1 (1.6) versus 5.3 (1.0) ml respectively, $p<0.05$). However, more procedures with tubes were successful compared to those without (22 (79 per cent) compared with 13 (59 per cent) respectively), although this did not achieve statistical significance. Both subgroups had a similar duration of follow-up (4.0 (1.1) versus 4.1 (2.0) months respectively).

Conventional DCR

Over the two-year study period, 67 patients underwent conventional DCR. There were 24 men and 43 women and their mean age was 60.8 (18.7) years. Their indications for surgery are also shown in Table I. No patient had day-case surgery and the mean inpatient stay was 2.3 (0.7) days. All procedures except one were performed under general anaesthesia. The mean operation time was 67.4 (25.5) minutes. There were no per- or post-operative complications recorded. No evidence for a learning curve was apparent for conventional DCRs with time, nor was the operative time related to the patient's age.

Fifty-four (81 per cent) cases were successful in relieving symptoms, after a mean follow-up of 4.5 (7.0) months. Ten (15 per cent) patients received tubes and 57 (85 per cent) did not. These two subgroups were also similar for all details, with comparable success rates (seven (70 per cent) and 47 (83 per cent) respectively).

The two groups undergoing either ELDCR or conventional DCR were similar for sex distribution, age, indications for surgery and follow-up. Of note was the significantly lower operative time ($p<0.00001$) and the use of local anaesthesia and day-case surgery in the ELDCR group. However, no per-operative complications were noted for those undergoing conventional DCR.

When comparing the outcomes of the two surgical groups, no differences were noted except for a significantly higher success rate in conventional DCRs without tubes compared to ELDCRs without tubes ($p<0.05$). The mean follow-up was similar in these subgroups.

Discussion

The holmium:YAG laser is an effective tool in performing endonasal DCR. The only previous reports of its use were from Woog *et al.* (1993), Metson *et al.* (1994) and Kong *et al.* (1994), who had an 82 per cent, 85 per cent and 67.3 per cent success rate respectively with all patients receiving stents. We had a 79 per cent success rate where a stent was used. We did not need to use a drill for bone removal when creating the ostium as we found that the laser vapourized bone very well and gave good haemostasis. The size of ostium we aimed for was 0.4–0.5 mm. Linberg *et al.* (1992) measured the diameter of the ostium following conventional DCR and found an average of 1.8 mm, despite the average being 11.8 mm at the time of surgery. All patients were, however, asymptomatic.

Only one of our patients required a submucous resection of the nasal septum to improve access. Woog *et al.* (1993), however, needed to perform septoplasty in two procedures (five per cent),

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anterior ethmoidectomy in 31 procedures (78 per cent), and middle turbinectomy in 13 procedures (33 per cent). Metson (1991) described endoscopic surgery after failed conventional DCR in 12 patients. Of these, four required septoplasty, seven required middle turbinate resection, four required ethmoidectomy and one needed a maxillary antrostomy for extensive sinusitis. Metson *et al.* (1994) described results from 46 laser DCRs performed on 40 patients. In this series there were two septoplasties, 11 middle turbinate resections and 24 ethmoidectomies. Kong *et al.* (1994) performed anterior middle turbinectomy in 12 procedures (24.5 per cent), but does not mention how many required septoplasty. Exactly why these authors experienced so many more problems is not clear.

All but one of our cases were performed under local anaesthesia. This contrasts sharply with Woog *et al.* (1993), where surgery was performed under either general anaesthesia or under local with intravenous sedation. Metson *et al.* (1994) used local anaesthesia in 10 procedures and general anaesthesia for the other 36. Fourteen patients left the hospital on the day of surgery. Kong *et al.* (1994) performed surgery under local anaesthesia. Forty-six (94 per cent) of our cases were performed as day-cases without complication. This is of great importance both for patient satisfaction and for economic use of resources.

Our mean operative time was only 20.9 minutes which compares very favourably with the figure of 116 minutes from Metson *et al.* (1994). As mentioned earlier this series did include 37 secondary procedures performed during the DCRs, but even allowing for these, there is still a large difference in operative time. Seppa *et al.* (1994) reported on a series of 12 patients operated on using the recently developed CO_2-Nd:YAG laser. They placed stents for six months and at an average follow-up of 14.3 months the success rate was 83 per cent. Surgery was performed under general anaesthesia with a range of 18–40 minutes.

Conclusion

Endoscopic holmium laser DCR has the great advantage that it can be performed as a day-case procedure under local anaesthesia. The excellent ablation of bone and soft tissue using this type of laser contributes to the fact that the procedure can be performed in a mean time of 20 minutes under local anaesthesia with high patient satisfaction. We await further follow-up to be able to comment on the long-term results of this technique.

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Address for correspondence:
Mr N. S. Jones,
Department of Otorhinolaryngology–Head and Neck Surgery,
Queens Medical Centre,
Nottingham NG7 2UH.

Fax: 0115-970-9748

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