The Success Rate of Endocanalicular Laser Dacryocystorhinostomy with Two Different Mitomycin-C Application

Endokanaliküler Lazer Dakriyosistorinostomide İki Farklı Mitomisin-C Uygulamasının Başarı Oranları

Lazer Dakriyosistorinostomi ve Mitomisin-C / Laser Dacryocystorhinostomy and Mitomycin-C

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Özet

Amaç: Endokanaliküler multidiod lazer dakriyosistorinostomi (ECL-DCR) operasyonlarında farklı iki mitomisin-c (mmc) uygulamasının başarı oranlarının belirlenmesi. Gereç ve Yöntem: ECL-DCR ameliyatı uygulanan primer akkiz nazolakrimal kanal tıkanıklığı olan 89 hasta üzerinde prospektif ve karşılaştırmalı çalışma yapıldı. Grup 1 de 44 hastaya ECL-DCR ameliyatı ve intraoperatif 0.4 mg/ml mmc 2 dakika süreyle, Grup 2 de 45 hastaya ECL-DCR ameliyatı ve intraoperatif 0.4 mg/ml mmc 5 dakika süreyle uygulandı. Hastalar en az 12 ay takip edildi. Epiforanın düzelmesi ve irrigasyonda nazolakrimal kanal açıklığı başarı kriteri olarak kabul edildi. Bulgular: Grup 1 de 44 hastanın 26 sında (%59.1), grup 2 de 45 hastanın 36 sında (%80) başarı elde edildi. Gruplar arasındaki fark istatistiksel olarak anlamlıydı (Ki-kare, p=0.03). Tartışma: Diod lazer ECL-DCR operasyonu, intraoperatif 0.4 mg/ml mmc 5 dakika uygulaması, primer nazolakrimal kanal tıkanıklığının tedavisinde etkili bir yöntem olarak görünmektedir.

Anahtar Kelimeler

Endokanaliküler Multidiod Lazer Dakriyosistorinostomi; Mitomisin-C; Nazolakrimal Kanal Tıkanıklığı

Abstract

Aim: To determine the success rate of different application of mitomycin-c (mmc) in endocanalicular multidiode laser dacryocystorhinostomy (ECL-DCR). Material and Method: A prospective comparative study was conducted on 89 patients with primary acquired nasolacrimal duct obstruction, undergoing ECL-DCR procedures. Group 1 was composed of 44 patients undergoing ECL-DCR with intraoperative 0.4 mg/ml mmc application for 2 minutes and group 2 was composed of 45 patients undergoing ECL-DCR with intraoperative 0.4 mg/ml mmc application for 5 minutes. Patients were followed up for at least 12 months.The main outcome measure for success was resolution or improvement of epiphora and patency of nasolacrimal duct with irrigation. Results: Final success was 26/44(%59.1) for group 1, and 36/45 (%80) for group 2.The difference was statistically significant (Chi-siquare, p=0.03). Discussion: Diode laser ECL-DCR with 0.4 mg /ml intraoperative mmc application for 5 minutes appears to be an effective treatment modality for primary nasolacrimal duct obstruction.

Keywords

Endocanalicular Multidiode Laser Dacryocystorhinostomy; Mitomycin-C; Nasolacrimal Duct Obstruction

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Introduction

Obstruction of the nasolacrimal duct is usually treated by dacryocystorhinostomy (DCR) which is the creation of a surgical anastomosis between the nasolacrimal sac and nasal mucosa. This method was first defined by Toti in 1904 and modified by Dupuy-Dutemps and Bourquet with epithelium-based fistula formation using mucosal flap suturation. Success rate of this surgical method was reported to be 85-90% [1,2].

The appearance of lasers and of the endoscope has permitted modification of the original surgical technique in 1992, Christenburry [3] described the transcanalicular approach for the first time.

Compared to the classic approach, this surgical technique presents a series of advantages such as:

Less tissue trauma,

Absence of cutaneous scarring,

No damage caused to the medial canthal tendon or angular vessels,

No bone fracturing,

Minimal bleeding, intra and postoperative pain,

Shorter surgical time,

Very low post-surgical morbidity,

Quick return to usual activity.

The rhinostomy created by the transcanalicular approach is smaller than that of endonasal and external approach [4]. Fibrous tissue and granulation formation are associated with surgical failure because they diminish ostium size. We assessed the use of endocanalicular multidiode laser to treat nasolacrimal duct obstruction. In our study, mitomycin-C (mmc) is administered to osteotomy site for 2 minutes and 5 minutes at doses of 0.4 mg/mL in order to increase success rates.

Material and Method

One of the authors performed 89 ECL-DCR procedures at one surgical center between May 2009 and May 2010. This study was in accordance with the ethical standards of Declaration of Helsinki. All patients gave their informed consents prior to the operation.

We included the patients who had epiphora only due to complete primary acquired nasolacrimal duct obstruction. Nasolacrimal duct obstruction was confirmed with lacrimal irrigation preoperatively, in each case.

The standard endocanalicular laser DCR procedure was carried out under local anesthesia consisting of lidocaine hydrochloride and epinephrine administered to naso-ciliary region and nasal mucosa.

The superior and inferior punctae were dilated, after removing the probe a 600 µm laser fiber was introduced via either canaliculus, where it was rotated into an oblique orientation resting against the medial lacrimal sac wall, where perforation was going to be performed. The laser was fired until perforation to form an osteotomy. Nasal video endoscope (attached to a TV monitor) was inserted through the nostril to visualize the transilluminated laser light from the lacrimal sac. A 980 nm diode laser (Multidiode S15 OFT, INTERmedik, Spain) was used as the generator, and the energy pulses in continious mode fired at an average 12 W power, until the fiber passed into the nasal cavity. Once the penetration was achieved, an area of coagulation and necrosis was seen at the nasal mucosa surrounding the laser fiber optic. From this position, fiber optic was moved sideways in a circular fashion to enlarge the osteotomy site until 8-10 mm in diameter. After removal of laser fiber, canalicular irrigation was performed with saline and we applied sponge soaked with 0.4 mg/ml mmc solution to osteotomy site for 2 minutes in group 1, and for 5 minutes in group 2. And no irrigation was performed following this application. Regular clinical examinations were carried out at 1 and 7 days, two weeks, 1 month, 3 months, 6 months and 12 months post operatively. Nasal endoscopic guided cleaning of the osteotomy site was done at 1 day, 7 days, two weeks and 1 month postoperatively.

Postoperatively antibiotic-steroid drops four times daily and nasal corticosteroid spray three times daily were administreted. The medications were tapered gradually over a 10-12 weeks. Success was defined as absence or diminishing of symptoms (epifora) and patency of nasolacrimal duct with irrigation.

Comparison of the success rates between the groups were made by using SPSS ®(Statistical Package for Social Sciences, version 15.0) programme. Chi-square was used to compare the percentages of success among the groups, and $p<0.05$ was accepted for statistically significant difference.

Results

Eighty-nine patients underwent 89 endocanalicular laser DCR procedures.

In group 1, there were 44 patients: 30 (69%) women, and 14 (31%) men. Their ages were ranging between 34 to 81 years (mean 46.7 years in age). In group 2, there were 45 patients: 27(60%) women, and 18 (40%) men whose ages were ranging 30 to 65 years (mean 45.1 years in age).

The follow-up period was at least 12 months.

Of 44 procedures in group 1, 26 (59.1%) had no epiphora and patent nasolacrimal duct by irrigation. The procedures were successful in 17 of 30 women (56.6%) and 9 of 14 men (64.2%) in group 1. There was no difference in success rate according to gender in group 1.

In group 2, 36 of 45 cases (80%) had no epiphora and patent nasolacrimal duct. The procedures were successful in 23 of 27 women (85.1%) and 13 of 18 men (72.2%) in group 2. In group 2, the success rates in relation to gender were not different, too. The difference between the success rates of group 1 and group 2 was statistically significant (Chi-square, p=0.03). (Table 1)

Table 1. Success of treatment among the groups.

GROUPS	SUCCESS OF TREATMENT		P
	Success rate (n)	Percentage (%)	
Group 1	26/44	59.1	0.03*
Group 2	36/45	80.0	

* Chi-square, statistically significant.
Group 1 Intraoperative 0.4 mg/ml mitomycine-c application for 2 minutes
Group 2 Intraoperative 0.4 mg/ml mitomycine-c application for 5 minutes

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 lacrimal sac is opened directly into the nasal cav-

ity. Traditionally this operation is done via an external approach with high success rates (82-99%) [4-11]. In spite of such good results, the procedure has various disadvantages like eksternal skin incision and scar, excessive intra-operative bleeding, disruption of the medial canthus anatomy, long surgical time and high morbidity [12].

The availability of small endoscopes reinvigorated interest in endonasal lacrimal surgery in 1980s. One decade later, Levin and Stormo-Gibson [13], and seperately Silkiss et al. [14] recognized that fiberoptic technology permitted delivery of laser energy via the canaliculus. This technique was introduced clinically by Michalos et al. [15] shortly thereafter.

Endocanalicular laser DCR has many advantages including avoidance of the possibility of external scar formation, preservation of the pumping mechanism of orbicularis muscle and avoidance of injury to the medial canthus. Coagulative energy of the laser prevents bleeding and cerebrospinal fluid leak from disruption of the nasoethmoid bone complex.

Furthermore active infection of the lacrimal system is not a contraindication for endocanalicular laser DCR when compared to the external approach. The disadvantage of endocanalicular laser DCR is the requirement of special training and expensive instruments.

Also this endocanalicular approach has several advantages compared with endonasal laser-assisted DCR which includes following:

1. Laser energy is directed from the nasolacrimal sac medially toward the nose, providing increased safety because no laser energy is applied toward the eye or orbit.

2. The endocanalicular technique uses the same basic instrumentation and tactile sensitivity familiar to ophthalmologists who perform any type of lacrimal probing [13].

Restenosis at the site of osteotomy is one of the leading causes of longterm failure in DCR. Tissue travma with subsequent inflamatory response and scarring play important role in the development of restenosis.

Efforts should focus on inhibiting granulation tissue over the osteotomy site. The transcanalicular approach usually creates smaller osteotomy size than external and endonasal approach. The diode laser leaves a lot of debris and charred tissues aroud the osteotomy. Cleaning of the debris from the osteotomy site decreases the inflammation around it, so reducing the chance of closure. In our study nasal endoscopy was performed on 1. day, 7. days, 1 week., 2 weeks., and 1 month visits and residual blood, dried mucus, and debris obstructing the osteotomy site were removed. Also lacrimal irrigation were done to maintain the patency of the osteotomy and to decrease the inflammatory reaction.

Mitomycin-c, an alkyllating antibiotic, acts by inhibiting DNA-dependent RNA synthesis and represents an alternative approach to prevent the development of fibrous tissue formation over the osteotomy site [16,10,17].

Ugurbas et al. [17] studied the histopathologic effects of mmc on transnasal DCR by soaking the osteotomy site in mmc 0.5mg/ml for 2.5 minutes. The specimens were examined under light and electron transmission microscopy and compared with control specimens. Light and electron microscopy findings showed attenuated epithelium and looser hypocellular subepithelial connective tissue in mmc specimens.

Fernandez et al. [18] carried out a double blind study in 200 patients, intraoperative mmc was applied 0.4 mg/ml for 5 minutes over the osteotomy site. The percentages of alterations for excessive scarring were 21.7% in patients without, and 8.03% with mmc group.

A recent study investigating the use of mmc in revision endoscopic dacryocystorhinostomy after scarring of the rhinostomy site, showed that the success rate after revision with mmc was 93% and without mmc was 60%. And the relief of the symptoms between groups was statistically significant. They used, at the end of the revision procedure, a piece of tampon soaked in mmc (0.4 mg/mL) which was placed into the rhinostoma for 5 minutes. Therefore the authors suggested the application of intraoperative mmc to improve the outcome in revision endoscopic dacryocystorhinostomy [19].

Vascularity plays a big role in healing. Because the nasal mucosa is vascular, it heals fastly unlike the sclera which has almost no blood supply. In our study after application of mmc, no irrigation was done to ensure that the mmc adhere to the nasal mucosa on the osteotomy site for as long as possible. Hu et al.[20] proved that the longer application of mmc in human nasal mucosal cells in vitro, the greater the effect of delayed healing within these cells. So that the longer contact time of mmc to the nasal osteotomy mucosa, the greater the chance for mmc to exert its efficacy.

In our study, we had significantly better results from group 2 (5 minutes application of mmc). In conclusion, diode ECL-DCR with intraoperative mmc application (0.4 mg/ml, for 5 minutes) appears to be a safe and effective treatment modality for primary acquired nasolacrimal duct obstruction.

Competing interests

The authors declare that they have no competing interests.

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