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REVISION TRANSCANICULAR LASER DACRYOCYSTORHINOSTOMY

ABSTRACT

Background: Dacryocystorhinostomy (DCR) is a surgical operation performed to treat recurrent dacryostenosis and epiphora in which an anastomosis is created between the lacrimal sac and the nasal cavity.

Aims & Objectives: The present study aimed to present the results of revision transcanalicular laser DCR.

Methods: The key to successful endoscopic revision surgery is creating an appropriate-sized and accurately positioned nasal ostium and a healthy lacrimal sac mucosa. An appropriate-sized and optimally located nasal ostium ensures complete exposure of the lacrimal sac and intraoperative visual assessment of the common canalicular patency

Results: In our study, we analyzed the causes and results of reoperation of 7 patients according to the area of obstruction before the surgery. Six(85,7%) of our patients had complete resolution of epiphora after stent removal, and 1 patient required reoperation after 2 months of follow-up.

Keywords:

Dacryocystorhinostomy, laser, transcanalicular approach, revision

INTRODUCTION

The present study aimed to present the results of revision transcanalicular laser DCR.

Laser DCR is a minimally invasive surgical procedure. It does not leave surgical marks and is well tolerated with local and general anesthesia.

Dacryocystorhinostomy (DCR) is a surgical operation performed to treat recurrent dacryostenosis and epiphora in which an anastomosis is created between the lacrimal sac and the nasal cavity [1]. DCR is carried out by external, endonasal or transcanalicular approach.

External DCR is a frequently performed surgical procedure first described by Toti in 1904 [2]. The endonasal approach was first described by Caldwell in 1893, followed by its popularity after 1990[3].

The success rate of the external and endonasal DCR is over 90%. The remaining 10% of patients require revision surgery. These cases can be operated with either external, endonasal or transcanalicular diode-laser approaches [4]. Although rhinostomy formed by diode laser is smaller compared to the rhinostomy formed endonasal [5], it is laborious to locate the obstructed segment with the endonasal approach.

These advantages make laser DCR a preferential approach especially in old patients unable to tolerate general anesthesia [1]. Success rates of laser DCR vary from 59% to 100% in different studies [5].

One of the most important reasons for failure in DCR is nasal synechia which results from the formation of granulation tissue and fibrosis in the surgical site. Septal deviation, concha bullosa, inferior turbinate hyperplasia and hyperpneumatized Agger nasi cells increase this possibility [6]. New bone formation following DCR is either non-existent or very limited at the site of rhinostomy; therefore, there is no need for the removal of bony structure [7].

Short-term failure of DCR is associated with the difficulty of forming a rhinostomy in a lateral nasal bony wall, formation of fibrosis in the applied region and inflammatory fibrosis obstructing the region of the rhinostomy. Wrong localization of the lacrimal sac, granulation, regrowth of bony tissue and bony spicules in the ostium are other reasons for failure[8].

Diode laser enables an effective tissue dissection with minimal tissue damage. Mucosal incisions performed with diode laser also reduce intraoperative bleeding, thereby, providing a perfect intraoperative endoscopic view.

The success rate of endoscopic DCR has been reported to be between 75% and 94% (20-25). In a study conducted by *Zilelioglu et al*., 34 primary and 30 revision DCR were performed, and the success rates were reported as 79.4% and 80%, respectively[9]. *Leong et al* demonstrated that endo-

scopic DCR performed as a revision procedure was associated with a better success rate (89%) compared to the primary treatment (85%)[10].

MATERIALS AND METHODS

The main reason for failure in primary DCR surgery is mainly due to aberrant soft tissue regeneration at the surgical site, therefore, revision DCR with endonasal ,transcanalicular or external approaches are applicable methods.

The mean follow-up period was 10.2 months, since the standard deviation was 7 months, the follow-up period varied greatly among the patients. This variation could be explained by two factors.

It was not a short period if we checked the follow-up period in each operation. The second factor was that, in the present study, patients who were satisfied with the surgery did not visit the hospital for follow-up despite having appointments for the same. Moreover, patients with symptoms of epiphora could easily visit the hospital without the need for an appointment.

All of the patients who underwent revision surgery in the present study were inserted with silicone tubes.

The key to successful endoscopic revision surgery is creating an appropriate-sized and accurately positioned nasal ostium and a healthy lacrimal sac mucosa. An appropriate-sized and optimally located nasal ostium ensures complete exposure of the lacrimal sac and intraoperative visual assessment of the common canalicular patency. Healthy lacrimal sac mucosa can encourage the normal healing processes of the nasal ostium and help tear flow to the ostium.

Although the surgical technique is the same in revision surgeries, the different rates of failure is presumably due to previously formed inadequate bony window in DCR. Higher rates of failure due to granulation, fibrosis and scar formation in the primarily DCR also be attributed to a higher tendency for obstruction due to inadequately enlarged bony windows.

The method involves the use of diode lasers. A few studies have shown that DCR using diode laser is effective and has the shortest surgical time, with success rates similar to those of external or endonasal DCR. Surgery using diode laser is a simple, rapid, and bloodless method for revision surgery to remove the cause of obstruction of the nasal ostium. A diode laser is a semiconductor that converts electrical energy into light energy that is mainly absorbed by the soft tissues.

With this technique, the laser is inserted into the lacrimal sac and points toward the lateral nasal wall, which means that penetration into the orbit and protrusion of fat can be avoided. In all our patients we were able to create a bony window of 5×5 mm with 6-7 W of energy. No complications, such as bleeding or infection, occurred. The technique can be performed under general anesthesia as

day-case surgery. This procedure is faster than conventional endonasal DCR. Eighty-three per cent of our patients had complete resolution of epiphora, and 6 patients required reoperation after 12 months of follow-up. The success rate of 83% must however be compared with a 90% success rate of the conventional external DCR, but in our opinion justifies the use of this newly developed surgical technique to gain more experience and a larger patient collective. As described by *Hartikainen et al, t*he initial success rate decreases from 90% to 60% after 1-year follow-up; therefore, a longer follow-up is necessary for a final judgment of this

RESULTS

In our study, we analyzed the causes and results of reoperation of 7 patients according to the area of obstruction before the surgery. The membranous obstruction of the nasal ostium was a most common cause of failure of endonasal DCR, followed by granuloma formation in the nasal ostium, and formation in the nasal ostium.5 of the patients were women and the others were men.

In the present study, we analyzed 4 patients with membranous obstruction *FIG1* patients with granuloma formation around the nasal ostium, and 1 patient with synechiae formation and membranous obstruction of the nasal ostium. These results suggest that granuloma formation around the nasal ostium after primary endonasal DCR might be associated with the failure of primary DCR.

Two of these patients were operated on twice. *FIG1*

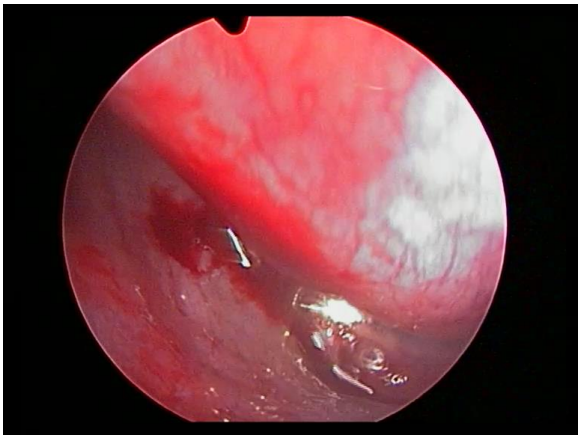

FIG1

Six (85,7%) of our patients had complete resolution of epiphora after stent removal, and 1 patient required reoperation after 2 months of follow-up.

The reoperation was done with an external approach.

DISCUSSION

Our success rates with revision diode laser DCR following primary DCR are similar to another published study. Although the surgical technique is the same in revision surgeries, the different rates of failure is presumably due to previously formed inadequate bony window in DCR. Higher rates of failure due to granulation, fibrosis and scar formation in the primarily DCR also be attributed to a higher tendency for obstruction due to inadequately enlarged bony windows. This presumption is concomitant with a published study, in which patients operated with diode laser DCR were compared to patients operated with enlargement of the neoostium via drilling in addition to diode laser DCR. The success rates of the two groups were 71% and 93% respectively. These dramatic differences in success rates show the importance of widening the bony window in the diode laser DCR technique[11].

Previously reported success rates of endoscopic revision surgery ranged from 60% to 94%[12]. However, the criteria for success differed among the studies, and not all of the studies considered both anatomical and functional criteria for the success of the surgery.

The cause of failed endonasal DCR is multifactorial, with the most common cause being granuloma in the nasal ostium due to excess scar tissue formation during the wound healing process. In addition, adhesion of the nasal ostium with the middle turbinate or the nasal septum, and common canalicular obstruction are known to cause the failure of endonasal DCR.

The use of diode lasers avoids damage caused by beam escape to the adjacent structures such as the canaliculus, which makes it safer compared to the other lasers; it also can cut tissue and perform coagulation and hemostasis[13].

The key to successful endoscopic revision surgery is creating an appropriate-sized and accurately positioned nasal ostium and a healthy lacrimal sac mucosa. An appropriate-sized and optimally located nasal ostium ensures complete exposure of the lacrimal sac and intraoperative visual assessment of the common canalicular patency. Healthy lacrimal sac mucosa can encourage the normal healing processes of the nasal ostium and help tear flow to the ostium.

Currently, there are no known methods to enhance the lacrimal pump function; however, lacrimal silicone tube intubation is known to encourage lacrimal pump function. The exact mechanism by which lacrimal silicone tube intubation relieves epiphora is unclear.

Our results are similar to those of other publications with success rates generally ranging from 74 to 85%[15]. To improve results, additional steps are often taken. As is common in the majority of protocols, we used silicon intubation after creating an osteotomy[15]. This step is still the subject of debate and solid evidence of the assumed benefit remains to be delivered. In a recent study comparing patients undergoing endonasal DCR with and without silicone intubation, a significant benefit

could be shown for the group receiving silicon intubation [8]. This allows the assumption that the benefit of silicon intubation might, in part, depend on the surgical procedure chosen. Additionally, some authors apply the anti-metabolite MMC after creating the osteotomy to further inhibit scarring. However, recent studies have shown no significant difference in success rates between patients treated with and without MMC, respectively[16].

The current gold standard, external DCR, provides functional success rates above 82–90% depending on the study [15]. Several possible reasons for its slightly higher effectiveness compared to laser-assisted DCR have to be debated. Firstly, in external DCR, the osteotomy created by the drill is bigger than those created in any other procedure including endonasal DCR. Obviously, the bigger the osteotomy, the less likely it is to be obstructed by newly formed scar tissue postoperatively.

One major advantage of external DCR is the opportunity to fully examine the lacrimal sac and, in case of suspected secondary obstruction (atypical findings, e.g., granulomatous or neoplastic disease), take a sample for further analysis [17]. Likewise, endonasal DCR allows for biopsies to be taken where needed. In these cases, either external or endonasal DCR is unavoidable.

Even though functional success rates are higher for external DCR (and, partly, endonasal DCR) [2, 3, 15, 17] than for laser-assisted transcanalicular DCR [15], the reported difference is not enormous and several advantages that the minimally invasive procedure has over its invasive counterpart have to be taken into account. Both procedures usually require general anesthesia, however. Finally and most importantly, the minimally invasive procedure can to spare the anatomical structures of the medial lid including the medial canthal tendon and the part of the Horner's muscle that stretches to the lacrimal sac. These structures are essential for the function of the physiological lacrimal pump mechanism that ensures adequate tear passage. This is evidenced by the fact that after external DCR, even if there is a patent, irrigatable ostium, delayed filling of the lacrimal sac can be observed [15].

We assumed that the possibility of obstruction of the nasal ostium by granuloma caused by lacrimal sac fibrosis was higher in endoscopic revision surgery compared to primary DCR, especially in patients who showed obstruction of the nasal ostium by granuloma after the primary DCR. Therefore, we believed that silicone tubing would help maintain the osteotomy site during the healing process. Moreover, even if granulation tissue was found to have formed during the follow-up period because of the silicone tubing, we could have removed the tissue easily in an outpatient clinic while still

maintaining the osteotomy site. Further study about the effect of the silicone tubing in endoscopic revision surgery is required.

Nevertheless, laser-assisted DCR is not without its drawbacks. For one thing, the total amount of laser energy applied should be kept to the minimum required as over-exposure can cause scarring, thus leading to secondary occlusion. Possibly, the application of heat, in particular, as a means of vaporizing the bone might provoke the formation of granulation tissue that has been accused of being responsible for secondary obstruction.

Unfortunately, precise specifications on laser energy, pulse duration and pause duration have not yet been defined. Also, there is a certain risk of thermal injury.

CONCLUSIONS

Our results showed that it is a suitable method and can be preferred as the treatment of choice in revision DCR patients, especially in patients previously operated with the endonasal or external approach.

The procedure can be performed relatively quickly, all the while sparing skin and medial lid structures, thus protecting the physiological lacrimal pump mechanism. Furthermore, even in case of failure, external DCR is still an option. Therefore, laser-assisted DCR is a viable option serving as a "second-step procedure" to close the gap between recanalizing procedures. In conclusion, membranous obstruction is the most common cause of failed DCR. The overall success rate of the revision surgeries in our study was 85%. Additionally, our results indicate that lacrimal silicone tube intubation is an effective treatment procedure for patients with functional epiphora. In patients with failed endonasal DCR, it is important to identify the cause of surgical failure, because surgeons should decide the method for revision surgery based on this cause. Appropriate revision surgery might increase the final success rate of endonasal DCR.

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