Original Article

Application of High-frequency Electrosurgical Scalpel and Methylene Blue Staining in Endonasal Dacryocystorhinostomy

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Abstract

Purpose: To evaluate the application of a high-frequency electrosurgical scalpel and methylene blue staining in the endonasal dacryocystorhinostomy.

Methods: This retrospective study included 37 patients (43 eyes) undergoing endonasal dacryocystorhinostomy in our hospital between 2011 and 2013 using methylene blue staining of the lacrimal sac and a high-frequency electrosurgical scalpel for cutting nasal mucosa, intraoperative stanch, and fixation of lacrimal sac and nasal mucosal flaps. Surgical efficacy, intraoperative challenges, and corresponding handling methods were evaluated and summarized.

Results: Among 43 eyes, 42 were successfully cured (97.7%) and the symptoms in 1 eye were improved (2.3%). Total efficacy rate was 100%. All surgeries were successfully performed. No severe intraoperative complications were observed.

Conclusion: A high-frequency electrosurgical scalpel, combined with methylene blue staining of the lacrimal sac, is efficacious for nasal mucosal cutting, intraoperative stanch, and fixation of mucosal flap by cauterization, which significantly alleviates intraoperative complications and enhances surgical success rate. It deserves widespread application in clinical practice. (***Eye Science 2014; 29:25-29***)

Keywords: nasal endoscope; dacryocystorhinostomy; high-frequency electrosurgical scalpel; methylene blue; application

Endonasal dacryocystorhinostomy presents with multiple advantages, such as no facial scars, a short surgical pathway, slight tissue injury, and simplicity of the operation. In addition, the cure rate approaches that of the traditional dacryocystorhinostomy. Hence, endonasal dacryocystorhinostomy has been widely applied as an option for chronic dacryocystitis treatment. However, a variety of potential intraoperative events, including intraoperative hemorrhage, excessively small bone hole, deviated bone hole, failure to create a lacrimal sac mucosal flap, and difficulty in the anastomosis of nasal mucosal and lacrimal sac flaps, are inclined to lead to surgical failure[1,2]. These problems have been overcome by applying a combined technique that uses a high-frequency electrosurgical scalpel and methylene blue staining for the treatment of patients with chronic dacryocystitis. This significantly reduces the incidence of intraoperative complications during endonasal dacryocystorhinostomy and improves the surgical success rate and is highly efficacious. We report our surgical outcomes below.

Materials and methods

General information

Thirty-seven patients diagnosed with simple chronic dacryocystitis with a course of disease from 2 to over 10 years, including 13 males (15 eyes) and 24 females (28 eyes), aged from 33 to 67 years and aged 50 years on average, underwent endonasal dacryocystorhinostomy in the Department of Ophthalmology in our hospital between March 2011 and August 2013. Inclusion criteria: no history of nasal and ocular trauma and no apparent deviated nasal septum, turbinate hypertrophy, or acute nasosinusitis, *etc.*

Equipments and materials

A 0°, 2.7-mm Karl Storz rigid nasal endoscope (Karl Storz, St. Louis, Mo.) and S900E high-frequency electrosurgical scalpel (Suzhou Kang Di Electrosurgical Co., Ltd, China) were used. Methylene blue,

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bone rongeur, and surgical devices related to lacrimal sac and nasal operations were also used.

Preoperative preparation

Lacrimal sac angiography with meglumine diatrizoate displayed the size, morphology, and position of the lacrimal sac. CT scans of the nasal sinus and a nasal endoscope examination were performed. Those subjects with other nasal diseases were excluded from this clinical trial by physicians from the Department of Otolaryngology. Physical and laboratory examinations were conducted. Antibiotics eye drops were administered three times a day prior to the surgery.

Surgical procedures

A 1 ml volume of methylene blue was injected into the inferior lacrimal punctum for lacrimal sac staining, followed by irrigation with PBS 1 min later to ensure all the methylene blue dye within the lacrimal sac was thoroughly washed out.

The patients lay in a supine position. Their eyes were conventionally disinfected and covered with clean gauze. Ethmoid nerve, inferior trochlear nerve, and infraorbital nerve block anesthesia was conducted by administering 3 ml 2% lignocaine. The lacrimal sac was treated with topical infiltration anesthesia. A piece of cotton soaked with 20 ml 1% tetracaine and 4 ml 0.1% adrenalin was used for surface anesthesia of the nasal cavity and middle nasal meatus. The agger nasi, attachment of middle turbinate, and anterior mucosa of the uncinate process were subjected to infiltration anesthesia with 2 ml of a mixture of 5 ml 2% lignocaine and 0.01 ml 0.1% adrenalin. Those patients who were sensitive to pain or required long operative time received general anesthesia by tracheal intubation.

Nasal forceps were utilized to locate the lateral wall of the nasal cavity corresponding to the lacrimal sac; most were located at the frontal inferior attachment of the middle turbinate. Using the uncinate process as the base, a U-shaped nasal mucosal flap was created using a high-frequency electrosurgical scalpel. The nasal mucosal flap was handled with blunt separation and rotated backwards. A piece of cotton soaked with adrenalin and tetracaine was inserted into the nasal meatus with pressure. After stanch using a high-frequency electrosurgical scalpel, the processus frontalis of the maxilla and the lacrimal bone were exposed. Using the maxillolacrimal junction as the center, part of the processus frontalis of the maxilla and lacrimal bone were removed by a bone rongeur, exposing the lacrimal sac stained with methylene blue. The bone window was expanded in all directions to a size of approximately 1.2 cm×1.7 cm by referring to the lacrimal sac, but could not exceed the uncinate process, ensuring the full exposure of the blue lacrimal sac.

The lacrimal duct probe was introduced into the superior lacrimal punctum and used to lift the lacrimal sac. The lacrimal sac was cut with a C-shaped incision along with the anterior superior margin of the bone window using a sickle blade, enabling the lacrimal sac flap to rotate backwards. The nasal and lacrimal sac mucosa were extracted from the middle nasal meatus and adhered with cauterization using a high-frequency electrosurgical scalpel. The wound of the nasal and lacrimal sac mucosa was covered with monolayer of Vaseline gauze and the lacrimal duct was irrigated with PBS. Intraoperative hemorrhage was mild and the visual field was explicit. After surgery, nasal secretions and blood clots were removed and the operated eyes were treated with antibiotic ointment.

Postoperative treatment and follow up

Conventional anti-infection and stanch treatments were delivered at 1-2 d postoperatively. Tobramycin eye drops were given 4 times daily. Intranasal rhinocort was delivered once a day. The lacrimal duct was irrigated with PBS once a day for 1 week and subsequently once a week for 5-8 weeks. During the 1st week, nasal secretions and blood clots were removed every other day under a nasal endoscope and then once a week for 5-8 weeks until the mucosal wound was healed, epithelialization was observed, and the nasal cavity was clean. The follow up lasted for 6 to 12 months.

Evaluation criteria of clinical efficacy

Evaluation criteria of curative effect: 1. Cure: hole formation was noted at the lateral wall of the anterior nasal cavity of the middle turbinate under a nasal endoscope, epithelialization was seen, and the symptoms of epiphora and pus disappeared. Lacrimal duct irrigation was unobstructed; 2. Improvement:

hole formation was noted at the same site, epithelialization was seen, and the symptoms were alleviated. Lacrimal duct irrigation was unobstructed or assisted under pressure; 3. Inefficacious: relevant symp toms were not alleviated, lacrimal duct irrigation was not successful even under pressure, and the construction of bone holes was unsuccessful[3].

Results

Preoperative lacrimal duct angiography with meglumine diatrizoate revealed that the horizontal diameter of the lacrimal sac was 3.12±1.43 mm, the vertical diameter was 12.3±2.76 mm, 2 eyes of which had a horizontal diameter < 2 mm and vertical diameter<5 mm. At 1 week after surgery, a few blood clots and a relatively large quantity of secretions were observed within the nasal cavity, which equally decreased at 1 week later. No repeated wound hemorrhage was noted. Mucosal edema started to recover 1 week later and the wound of the anastomosis was healed. Among 43 eyes, 42 were successfully cured (97.7%) and the symptoms in 1 eye were improved (2.3%). Total efficacy rate was as much as 100%. All surgeries were successfully performed. No severe intraoperative complications were observed. The eye with improvement had a horizontal diameter < 2 mm and vertical diameter<5 mm. During the 2nd week postoperatively, backflow occurred during lacrimal duct irrigation, resulting from the loose adhesion between lacrimal sac and nasal mucosa and the opening of the anastomosis covered by lacrimal sac mucosa. The second cauterization was performed to fix the lacrimal sac mucosa using a high-frequency electrosurgical scalpel under surface anesthesia. The silica gel lacrimal duct catheters were inserted into the superior and inferior lacrimal puncta and exited from the nasal anastomosis site and the redundant catheter was cut off. A cone-shaped sponge was placed in the middle of two catheters and PBS containing 40 000 U gentamicin and 3 mg dexametha sone was injected to support the opening of the anastomosis. The expanded sponge was removed. The catheters were removed after unobstructed lacrim al duct irrigation and epithelialization of the anastomosis site. During the subsequent 6-12 month foll ow-up, patients without epiphora or obstructed lacrimal duct were deemed cured.

Discussion

Along with the widespread application of the nasal endoscope and the integration of multiple disciplines, the technique of endonasal dacryocystorhinostomy has been recognized by more and more hospitals. Due to high demand for nasal endoscope operations and to intraoperative complications, the efficacy of endonasal dacryocystorhinostomy remains largely debated when compared with that of traditional external dacryocystorhinostomy[4-8]. A majority of researchers agree that its effectiveness is similar to or slightly lower than traditional external surgery. In addition, intraoperative complications severely affect the success rate of surgery. Li et al[1]. suggested that the common intraoperative complications of endonasal dacryocystorhinostomy included intraoperative hemorrhage, imprecise positioning of lacrimal sac, deviated positions of bone hole, irregular size of bone hole, failure of lacrimal sac flap creation, and nasal illnesses, *etc.* Han et al[2]. reported that common factors affecting surgical efficacy included size of lacrimal sac, intranasal lesions, scar constitution, position and size of bone hole, creation of lacrimal sac and nasal mucosal flaps, handling of anastomosis opening, and postoperative follow-up, *etc.*

Intraoperative hemorrhage is the most common complication of nasal dacryocystorhinostomy. The lateral wall of the nasal cavity contains a large number of blood vessels, mainly including middle and inferior turbinate arteries, constituting an abundant blood vessel network[9]. Cutting the nasal mucosa using a sickle-shaped knife is likely to cut off the arterial branch of the middle turbinate, causing capillary injuries and intraoperative hemorrhage, which makes the visual field blurry, affects the surgical operation, prolongs operative time, and even leads to surgical failure. At present, adrenalin cotton is utilized for conventional hemostasis for capillary hemorrhage, which requires a wide compression range and a long waiting time. However, this technique has poor hemostasis efficacy for small artery hemorrhage. Use of a high-frequency electrosurgical scalpel to cut the nasal mucosa can have a good effect on capillary hemostasis, which makes the visual field explicit and

contributes to the surgical operation within the nasal cavity. Moreover, it also accurately, rapidly, and effectively cauterizes the hemorrhage point of the small arteries, which significantly shortens operative time and improves surgical success rate.

In this study, we adopted nasal forceps to locate the position of lacrimal sac by placing one branch at the nasal inner canthus and the other branch pointed to the upper margin of the constructed hole. The nasal mucosa was cut open below the positioning point. The hole was constructed around the maxillo-lacrimal junction as the center, fully exposing the lacrimal sac. The lacrimal sac was then stained blue, distinguishing it from the surrounding red tissues. The bone hole was further enlarged around the lacrimal sac until the lacrimal sac was fully exposed, which effectively prevented the position shift in the excessively small size of the bone hole.

Unintended cutting of the lacrimal sac mucosal lamella and failure of mucosal flap creation frequently result in surgical failure. Patients with chronic dacryocystitis have thickened lacrimal sac mucosa and even mucosal scars induced by chronic inflammatory stimulus. Hence, the thickened lacrimal sac mucosa may not be completely cut during the surgery, which increases the difficulty of constructing a mucosal flap. The lacrimal sac was explicitly distinguished from the surrounding tissues by methylene blue staining. After cutting the lacrimal sac, the blue inner layer of the lacrimal sac was exposed and appeared significantly different from surrounding tissues, which allowed evaluation of whether the lacrimal sac mucosa was thoroughly cut open and aided in the creation of the lacrimal sac mucosal flap.

The anastomosis of lacrimal sac and nasal mucosal flaps and the unobstructed nasal ostium are the key factors of surgical success. Although much attention has been paid, no effective solutions have been identified. Initially, the lacrimal sac was directly connected to the nasal mucosa[10], which was likely to cause displacement of the mucosa and obstruction of the ostium. Zhou et al[11]. utilized silver clips and Zhang et al[12]. adopted a gelatin sponge to fill in the ostium and smeared hyaluronic acid (MeroGel) around the ostium[13], which both provided certain efficacy. However, the mucosal flap was not stably fixed around the ostium because these materials were foreign bodies and likely to dislocate, eventually leading to surgical failure. In our department, an easy-to-operate high-frequency electrosurgical scalpel was adopted to perform cauterization and fixation. The lacrimal sac and nasal mucosa were tightly adhered. In addition, this did not increase the surgical costs.

The following skills should be mastered during endonasal dacryocystorhinostomy. 1.Prior to surgery, rhinologists should be invited to attend the consultation to exclude certain surgical contraindications. Intraoperatively, rhinologists should participate in the surgery and address nasal events, which can reduce the surgical risk and improve the success rate of surgery. 2. Blunt separation of the nasal mucosa intraoperatively can allay mucosal hemorrhage. 3. Using the upheaval of the processus frontalis of maxilla within the nasal cavity as a pivot can avoid the movement of bone rongeur on the bone wall surface. 4. The opening at the mucosal anastomosis was covered by monolayer Vaseline gauze, which is able to attach easily and stably to the tissue. 5. For patients with small lacrimal sacs, the nasal mucosal flap should be preserved as much as possible to attach to the lacrimal sac mucosa. A lacrimal duct catheter can be inserted to reduce the excessive tension. An expansion sponge should be used for support and fixation.

Proficient skills are required for the endonasal dacryocystorhinostomy to address the surgical complications effectively and rapidly, otherwise, this can lead to surgical failure. In this study, a high-frequency electrosurgical scalpel combined with methylene blue staining of the lacrimal sac were found effica cious for nasal mucosa cutting, intraoperative stanch, and fixation of mucosal flap by cauterization, which significantly alleviates intraoperative complications and enhances surgical success rate. It is worthy of widespread application in clinical settings.

References

1 Li Y, Fan JL, Luo J. Analysis and resolution of common problems in dacryocystorhinostomy under nasal endoscope.*International* Journal of Ophthalmology, 2008, 8 (5): 1042-1043.

2 Han XM, Wu WC. Factors influencing the outcome of

Endoscopical transnasal dacryocystorhinostomy.Chinese Journal of Optometry Ophthalmology and Visual Science, 2012,14(12):766–768.

3 Zhou B, Tang X. Efficacy analysis of 35 patients in dacryocystorhinostomy under nasal endoscope.Chinese Archives of Otolaryngology-Head and Neck Surgery, 1994,1(2):80–83.

4 Hammoudi DS, Tucker NA. Factors associated with outcome of endonasal dacryocystorhinostomy. Ophthal Plast Reconstr Surg,2011,27:266–269.

5 Yang JW, Oh HN. Success rate and complications of endonasal dacryocystorhinostomy with unciformectomy. Graefes Arch ClinExp Ophthalmol,2012,250:1509 – 1513.

6 Garcia Vilaro M, Vásquez L, Marin A, et al. Thermal Damage Influences Endonasal Dacryocystorhinostomy Success. Ophthalmic Res 2013,49:209–214.

7 Wang Q,Chen QG,Chen ZH. Clinical analysis of rhinodacryocystostomy under the endoscope.International Journal of Ophthalmology, 2010,10(6):1220–1221.

8 Ji QS, Zhong JX, Lao W, et al. Influence of nasal mucosal flaps preservation on endonasal endoscopical dacryocystorhinostomy,Recent Advances in Ophthalmology,2013,33(8):751–754.

9 Xiang YY, Zhou XB, Xie W, et al. Anatomic basis of dacryocystorhinostomy with functional nasal endoscope. Anatomy Research,2009,31(6):447–449.

10 Yigit O, Samancioglu M, Taskin U, et al. External and endoscopic dacryocystorhinostomy in chronic dacryocystitis:comparison of results. Eur Arch Otorhinolaryngol, 2007,264:879–885.

11 Zhou B, Han DM, Huang Q. Long-term follow-up for outcomes of intranasal endoscopic dacryocystorhinostomy. Chinese Journal of Otorhinolaryngology Head and Neck Surgery,2008,43(1):13–17.

12 Zhang WD, Zhang W. Application of gelfoam in dacryocystorhinostomy with dacryocyst capsule fixation.Chinese Journal of Ophthalmology and Otorhinolaryngology, 2006,6(5):318.

13 Wu W, Cannon PS, Yan W, et al. Effects of Merogel coverage on wound healing and ostial patency in endonasal endoscopic dacryocystorhinostomy for primary chronic dacryocystitis. Eye(Lond),2011,25(6):746–753.