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Comparison of Surgical Outcomes in External Dacryocystorhinostomy: Conventional Approach versus Viscoelastic-assisted Approach

Eksternal Dakriyosistorinostomide Cerrahi Sonuçların Karşılaştırılması: Konvansiyonel Yaklaşıma Karşı Viskoelastik Destekli Yaklaşım

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Abstract

Objective: To compare the surgical success rate between viscoelastic-facilitated external dacryocystorhinostomy (DCR) surgery and conventional external DCR surgery in patients with acquired nasolacrimal duct obstruction.

Materials and Methods: In this retrospective, comparative cohort study, data of patients who underwent external DCR surgery and silicone tube intubation between 2017 and 2023 were evaluated. Among the 99 cases with no prior surgical history, 46 cases were allocated to the viscoelastic group (viscoelastic substance was used to fill the lacrimal sac just before creating the mucosal flaps), while 53 cases were allocated to the conventional group. All surgeries were performed by the same surgeon. Surgical success was defined as the presence of an open lacrimal drainage system confirmed by a lacrimal irrigation test and/or relief of epiphora.

Results: There were no significant differences observed between the groups with regards to age, gender, DCR tube extubation time, and side of the surgery (right/left lacrimal sac) (p>0.05). The mean follow-up was 27.8±20.9 (6-66) months in the viscoelastic group and 22.9±20.2 (6-64) months in the conventional group (p=0.35). Two cases in the viscoelastic group and four cases in the conventional group experienced recurrence during the follow-up period. Surgical success rates were calculated as 95.7% and 92.5% for the viscoelastic group and the conventional group, respectively (p=0.68).

Conclusion: Viscoelastic-assisted external DCR surgery is as successful as conventional external DCR surgery. We are particularly of the opinion that this approach would enhance surgical success, especially in cases where the lacrimal sac is small and fibrotic.

Keywords: Dacryocystorhinostomy, dacryocystitis, epiphora, nasolacrimal duct, viscoelastic substance

Öz

Amaç: Çalışmanın amacı edinilmiş nazolakrimal kanal tıkanıklığı olan olgularda, viskoelastik ile kolaylaştırılmış eksternal dakriyosistorinostomi (DSR) cerrahisi ile konvansiyonel eksternal DSR cerrahisi başarı oranlarını karşılaştırmaktır.

Gereç ve Yöntemler: Bu retrospektif, karşılaştırmalı kohort çalışmasında 2017-2023 yılları arasında eksternal DSR cerrahisi ve silikon tüp entübasyonu uygulanın hastaların verileri değerlendirildi. Daha önce cerrahi geçirmemiş toplam 99 olgudan 46'sı viskoelastik grubuna (mukozal flepler oluşturulmadan hemen önce, lakrimal kese, viskolelastik madde ile dolduruldu), 53'ü konvansiyonal gruba dahil edildi. Bütün cerrahiler aynı hekim tarafından gerçekleştirildi. Lavaj ile nazolakrimal kanalın açık olması ve/veya hastanın epifora şikayetlerinin geçmesi cerrahi başarı olarak kabul edildi.

Bulgular: Gruplar arasında yaş, cinsiyet, silikon DSR tüpünün alınma zamanı ve cerrahi taraf açısından anlamlı fark yoktu (p>0,05). Ortalama izlem süresi viskoelastik grubunda 27,8±20,9 (6-66) ay, konvansiyonel grupta 22,9±20,2 (6-64) ay idi (p=0,35). Viskoelastik grubunda 2 hastada, konvansiyonel grupta 4 hastada nüks gelişti. Cerrahi başarı oranları viskoelastik grup ve konvansiyonel grup için sırasıyla %95,7 ve %92,5 olarak hesaplandı (p=0,68).

Sonuç: Viskoelastik madde yardımı ile kolaylaştırılmış eksternal DSR cerrahisi en az standart eksternal DSR cerrahisi kadar başarılıdır. Özellikle lakrimal kesenin küçük ve fibrotik olduğu olgularda bu yöntemin cerrahi başarıyı artırabileceği kanaatindeyiz.

Anahtar Kelimeler: Dakriyosistorinostomi, dakriyosistit, epifora, nazolakrimal kanal, viskoelastik madde

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Introduction

External dacryocystorhinostomy (DCR) and/or silicone tube intubation is currently the most frequently employed surgical method for the treatment of acquired nasolacrimal duct obstruction or stenosis. It was first described by Toti (1) and further developed by Dupuy-Dutemps and Bourguet (2,3). While external DCR is a surgical technique known for its high success rates, achieving the desired outcomes may not always be guaranteed, even in the hands of experienced surgeons. Therefore, in pursuit of improved surgical outcomes, there is an ongoing endeavor to explore innovative techniques or make modifications to existing approaches.

Ophthalmic viscosurgical devices (OVDs) were introduced for the purpose of creating and maintaining adequate intraocular space during phacoemulsification surgery and intraocular lens implantation (4). As various OVDs have evolved, their applications have expanded beyond maintaining intraocular space during intraocular surgery. These devices are now utilized for additional purposes, including safeguarding the corneal endothelium, enlarging and stabilizing pupil size, and addressing specific challenges such as small pupils or intraoperative floppy iris syndrome.

In addition to their established role in intraocular surgery, to our knowledge, this is the first report of the use of OVDs to facilitate the preparation of lacrimal sac flaps in DCR surgery. In this framework, our objective was to present the outcomes of viscoelastic-facilitated external DCR surgery compared to conventional external DCR surgery in patients with acquired nasolacrimal duct obstruction.

Materials and Methods

The research protocol of this retrospective comparative study was reviewed and approved by the Ethical Committee and Review Board of İzmir Bakırçay University, ensuring compliance with the ethical guidelines stated in the Declaration of Helsinki (decision number: 1072, date: 07.06.2023). The retrospective evaluation involved the medical records of patients who underwent external DCR surgery and silicone tube intubation at the Department of Ophthalmology, İzmir Bakırçay University Çiğli Training and Research Hospital, between January 2017 and July 2023. The cases in which a viscoelastic substance was used to fill the lacrimal sac and to create mucosal flaps during the surgery were included in the viscoelastic study group. The remaining cases were assigned to the conventional study group. The nasolacrimal duct obstruction diagnosis was confirmed through the performance of the lacrimal washout test. All surgical procedures were conducted by the same surgeon under general anesthesia. Surgical success was determined based on the criteria of an unobstructed lacrimal drainage system, as evidenced by a lacrimal irrigation test and/or relief of epiphora. The exclusion criteria for this study encompassed patients under the age of 15, a postoperative follow-up period of less than 6 months, previous lacrimal surgery with a history of failed DCR, the presence of canalicular or common canalicular obstruction, bony deformities, punctal stenosis, evident lid laxity, entropion, and ectropion.

Surgical Procedure

After placing an adrenaline-soaked tamponade in the nasal cavity for hemostasis control, a 15-20 mm long incision was made on the skin and subcutaneous tissue, 10 mm away from the medial canthus. While preserving the angular vein, blunt dissection was made. The periosteum was exposed and incised parallel to the anterior lacrimal crest. Using the periosteal elevator, the periosteum was gently elevated from the underlying bone, and the lacrimal sac was positioned laterally, then, the lacrimal fossa was exposed. A 15x15 mm nasal osteotomy was created over the lacrimal fossa, using a Kerrison bone punch. In the conventional study group, an H-shaped full-thickness lacrimal sac mucosal incision was then made to the medial wall of the lacrimal sac to create anterior and posterior lacrimal mucosal flaps. On the other hand, in the viscoelastic study group, the cannula of a cohesive ophthalmic viscoelastic substance [DisCoVisc (Alcon Laboratories, Inc.) or Healon GV (Johnson & Johnson surgical vision, Inc.) was used in this study] was inserted into the inferior punctum. The viscoelastic substance was injected through the inferior canaliculus until it was observed coming from the superior punctum and the lacrimal sac was distended before its incisions (Image 1). Then, lacrimal sac anterior and posterior mucosal flaps were created with an H-shaped full-thickness lacrimal sac mucosal incision same as the conventional study group. The remaining surgical steps were identical in both study groups. After removing intranasal tamponade, nasal anterior and posterior mucosal flaps were prepared and posterior

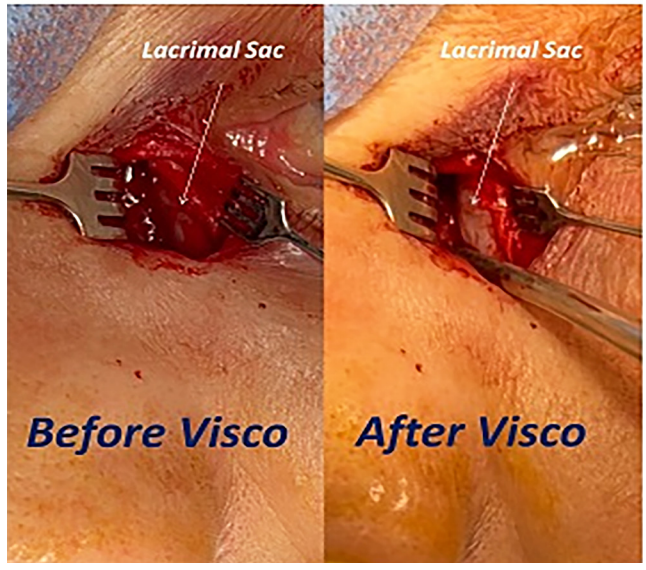

Image 1. The appearance of the lacrimal sac before and after filling with viscoelastic substance. After injection into the lacrimal sac, viscoelastic material leads to noticeable distention of the sac

flaps of the nasal and the sac mucosa were sutured with 6-0 surgical vicryl suture. A bicanalicular silicone DCR tube intubation was performed and then anterior mucosal flap anastomosis was made using a 6-0 vicryl suture. After the DCR silicone tube was secured in the nasal cavity, the periosteum and subcutaneous tissues were meticulously sutured using 6-0 vicryl, and the skin was subsequently closed with a 5-0 prolene suture.

Statistical Analysis

Before conducting statistical analysis, the assumption of normality for numerical variables was evaluated using the Kolmogorov-Smirnov test. Descriptive statistics were presented as mean ± standard deviation (minimum-maximum) for continuous variables and frequency (%) for categorical variables. To compare continuous variables between the two independent groups, it was conducted Mann-Whitney U test for non-parametric data and the Independent Samples t-test for parametric data. The chi-square test and Fisher's exact test were employed to assess the association between categorical variables. The significance level was set at $p<0.05$ to determine the statistical significance.

Results

A total of 99 out of 105 cases who underwent external DCR surgery and silicone tube intubation over a period of approximately 5 years were included in this study. The demographic properties of these cases are given in Table 1. There were 46 cases in the viscoelastic group and 53 cases in the conventional group. No statistically significant differences were found between the groups in terms of age, gender, side of the surgery, DCR silicone tube extubation time, and postoperative follow-up duration (Table 1). There were no reported complications during the surgical procedures. At the final examination, recurrence was observed in 2 patients from the viscoelastic group and 4 patients from the conventional group. The calculated surgical success rates were 95.7% for the viscoelastic group and 92.5% for the conventional group, with no statistically significant difference observed between the two groups (p=0.68).

Discussion

Although endonasal DCR has gained popularity in recent years due to its advantages, including an absence of cutaneous scar and a shorter operation time, comparative studies have shown that its outcomes may not match those achieved with the traditional external approach, highlighting the external DCR surgery remains the established and widely accepted treatment modality for acquired nasolacrimal duct obstruction (5). In this retrospective comparative cohort study, we described a different approach to the lacrimal sac in external DCR surgery and compared the outcomes with the conventional approach. To the extent of our knowledge, this study represents the first investigation in the literature to examine the potential superiority of using a viscoelastic substance during the procedure compared to the conventional technique. The findings of the present study demonstrated a slightly elevated rate of success in the viscoelastic group as an effective technique for the treatment of acquired nasolacrimal duct obstruction, with 95.7% of patients achieving a successful resolution of symptoms at the mean 28 months follow-up period. However, the observed variation in success rates between the groups did not reach statistical significance.

In the literature, success rates of external DCR range from 73% to 100% (6). The success rates of DCR can be influenced by various factors, such as the insufficient bony aperture between the nasal cavity and the lacrimal sac, the presence of membranous occlusion due to scarring at the rhinostomy site, intranasal adhesions, scar tissue involving the middle turbinate and nasal septum, canalicular stenosis, and multiple surgeries (7). In other words, the development of excessive granulation tissue, and fibrotic scarring during the wound healing process can lead to stenosis of the common canaliculus or closure of the nasal osteotomy, ultimately resulting in the failure of DCR surgery (8). Although recent studies have described the use of only anterior flaps, referred to as the single-flap technique, and yield comparable results to conventional double-flap surgery, a review study highlighted that preserving anterior and posterior flaps of the nasal mucosa and lacrimal sac and performing double-flap technique can contribute to reducing granulation tissue formation and result in better

Table 1. Demographic properties and surgical success rates of the groups

	Viscoelastic group n=46	Conventional group n=53	p-value
Age (years)	60.7±11.9 (23-80)	59.6±12.4 (34-77)	0.84*
Gender (female/male)	34 (73.9%)/12 (26.1%)	44 (83.0%)/9 (17.0%)	0.33†
Side (right/left)	21 (45.7%)/25 (54.3%)	23 (43.4%)/30 (56.6%)	0.84†
DCR silicone tube extubation (months)	3.5±1.7 (2-6)	3.9±1.7 (2-6)	0.14*
Follow-up (months)	27.8±20.9 (6-66)	22.9±20.2 (6-64)	0.35*
Surgical success	44/46 (95.7%)	49/53 (92.5%)	0.68‡

n: number of cases, *Mann-Withney U test, †Chi-square test, ‡Fisher's exact test

ostium opening when conducting DCR procedures as a routine practice (9,10). Therefore, lacrimal sac manipulation and preparation of lacrimal flaps play a pivotal role in the overall success of DCR surgery. However, it is often regarded as one of the most critical and intricate steps in the procedure. Particularly challenging is the management of a fibrosed or anatomically altered lacrimal sac, as H-shaped incisional manipulations to create lacrimal mucosal flaps in such cases may result in iatrogenic damage not only to the mucosa but also the common canaliculus, contributing to poorer surgical outcomes. Additionally, it is well known that minimizing mucosal trauma plays a crucial role in minimizing wound contraction and scar formation (10,11). Some authors suggested that this is also the case in DCR, therefore, the atraumatic manipulations and careful apposition of the nasal mucosa and lacrimal flaps during surgery facilitate the process of primary intention healing, leading to a decreased incidence of granulation tissue formation (12).

In the current study, a more secure and controlled opening of the lacrimal sac is achieved by using a cohesive viscoelastic substance. The concept of filling the lacrimal sac with a viscoelastic substance was initially introduced in the literature by Baddeley et al. (13). However, their study focused on a patient with Wegener's granulomatosis undergoing dacryocystectomy. They described a technique involving canalicular clamping and the injection of a viscoelastic substance into the lacrimal sac aiming to enhance dissection ease during the dacryocystectomy procedure. Based on this study reported by Baddeley et al. (13), we have considered that viscoelastic substances can be utilized not only in dacryocystectomy surgery but also in DCR surgery, during the stage of lacrimal sac incision and flaps creation, which is known as the most challenging and critical step of the surgery. Through the application of a cohesive viscoelastic substance, the medial wall of the lacrimal sac is gently elevated, resulting in enhanced visual clarity during the specific phase of making incisions of the medial wall in the surgical procedure. Simultaneously, it creates a separation between the medial and lateral walls of the lacrimal sac, facilitating a safer entry into the lacrimal sac, reducing the risk of canalicular communis damage, and minimizing potential complications. The distention of the lacrimal sac and the displacement of the medial wall away from the lateral wall where the opening of common canaliculus is located, are particularly crucial in cases of small and fibrotic lacrimal sacs with lower surgical success rates.

The present study has several strengths that contribute to its robustness and reliability. This study's primary strength lies in the implementation and evaluation of a modified technique for external DCR surgery in a considerable number of patients conducted at a single center under the expertise of a single surgeon. The study also demonstrates a noteworthy strength in its extensive mean follow-up period of approximately 2 years across the study cohorts, providing valuable insights into the long-term outcomes of the intervention. On the contrary, there are certain limitations that should be taken into consideration when interpreting the findings of this study. A significant drawback of this study is its retrospective design, which may introduce biases and limitations in data collection and analysis. Because of the lack of data about intraoperative measurements of lacrimal sac sizes, we were not able to evaluate the patients with fibrotic or small lacrimal sacs, which is the other limitation of this study. Therefore, randomized, controlled studies that include the evaluation of these patients are needed to further investigate the findings.

Conclusion

In conclusion, this study demonstrated the safety and comparable efficacy of the viscoelastic-assisted approach in external DCR surgery when compared to conventional DCR surgery in adult patients diagnosed with acquired nasolacrimal duct obstruction. We believe that this modified approach, incorporating the use of a cohesive viscoelastic substance can enhance the safe opening of the lacrimal sac during the surgery, particularly, in cases with smaller or fibrotic lacrimal sacs.

Ethics

Ethics Committee Approval: The research protocol of this retrospective comparative study was reviewed and approved by the Ethical Committee and Review Board of İzmir Bakırçay University (decision number: 1072, date: 07.06.2023).

Informed Consent: Retrospective study.

Peer-review: Externally peer-reviewed.

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