• Clinical Research •

Treatment of acute dacryocystitis by translacrimal canalicular drainage and D-silicone intubation

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Abstract

● **AIM:** To demonstrate the outcomes of translacrimal canalicular drainage using a lacrimal probe and intranasal drainage by D-silicone intubation for acute dacryocystitis (AD).

● **METHODS:** This retrospective study included 23 patients with AD and had undergone abscess decompression with the use of lacrimal probe and intranasal drainage by D-silicone intubation between January 2019 and December 2022. Patients received abscess decompression and systemic antibiotic-corticosteroid from the time of diagnosis. D-silicone tube was inserted within 10d after diagnosis and removed 3-6mo after intubation. The procedure and outcomes of this method were evaluated.

● **RESULTS:** All patients showed improvement of signs and symptoms of AD within 72h. No intraoperative and postoperative complications were observed. No recurrence of lacrimal sac abscesses occurred after D-silicone tube removed.

● **CONCLUSION:** Lacrimal probe and D-silicone intubation appear to be a feasible, minimally invasive, safe, and effective method, which could be a reasonable choice in the treatment of AD.

● **KEYWORDS:** acute dacryocystitis; treatment; translacrimal canalicular drainage; D-silicone intubation

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INTRODUCTION

Acute dacryocystitis (AD) is a medical emergency characterized by a suppurative inflammation of the lacrimal sac[1]. It commonly presents as a secondary bacterial infection in individuals with nasolacrimal duct obstruction[2-4]. Poor drainage, infection, acute inflammation, and increased pressure form a vicious circle to exacerbated the symptoms. Patients suffer from rapid-onset pain, erythema, and swelling in the lacrimal sac area. If the infection is not well controlled, even vision problems or life-threatening conditions would happen, such as sepsis, orbital cellulitis, and superior ophthalmic thrombosis[5-9].

The conventional treatment for AD involves using systemic antibiotics, performing percutaneous drainage of the abscess, and scheduling external dacryocystorhinostomy (Ex-DCR) once the acute infection has resolved[10]. However, percutaneous abscess drainage can lead to unsightly scarring and fistula formation, and it may take long time for infections subsided due to poor antibiotic abscess penetration and pus drainage.

In recent decades, thanks to advances in surgical technology and equipment, various treatment approaches for AD have been introduced and refined[11-13], including laser-assisted endonasal dacryocystorhinostomy (En-DCR)[14], cold steel En-DCR[15-16], *etc*. However, highly swollen mucosa of the lacrimal duct and hemorrhage are challenge for En-DCR in primary treatment of AD[17]. On the other hand, its technically challenging and equipment requirements determine that it hard to be promoted in undeveloped areas where have high incidence of AD.

Therefore, a more practical and straightforward surgical technique is needed to treat AD. In this study, we describe our experience of treatment of AD using lacrimal probe and intranasal drainage by D-silicone intubation, retrospective evaluating the safety, efficacy and outcome.

SUBJECTS AND METHODS

Ethical Approval The study protocol was approved by the Ethical Committee of Zhejiang Provincial People's Hospital (QT2023094). Informed consent for study participation was

obtained from all subjects.

Patients presenting to Zhejiang Provincial People's Hospital, People's Hospital of Hangzhou Medical College, with AD between January 2019 and December 2022 were selected and reviewed.

The diagnosis of AD was based on the symptoms and signs of lacrimal sac abscess formation on physical examination. Figure 1 shows the representative facial photograph of a 51-year-old woman with AD. Patients who underwent abscess decompression with the use of lacrimal probe and intranasal drainage by D-silicone tube were included. Patients with a history of maxillofacial, lacrimal, or sinus surgery, facial trauma, or a neoplasm involving the lacrimal drainage system, or punctal occlusion, canalicular obstruction, were excluded. The minimum required follow-up period after surgery was 6mo. A single experienced specialist surgeon (Jiang J) performed all procedures.

Upon diagnosis, patients first received a topical instillation of proparacaine hydrochloride, 0.5%. The lacrimal puncta was dilated by a dilator. The surgeon followed the anatomy of the lacrimal canaliculi to probe the lacrimal sac *via* the upper or lower puncta, avoiding blind force to formation of false track. Now the probe was inserted into the lacrimal sac where was filled with pus. The abscess was decompressed and drained through the probe with a 5 mL syringe which piston was pulled back to form negative pressure (Figure 2). All patients received systemic antibiotic and corticosteroid from the time of diagnosis until the clinical signs of inflammation resolved. The initial empirical antibiotic chosen was moxifloxacin 0.5 g once per day. Meanwhile, corticosteroid (8-12 mg methylprednisolone) was oraled to reduce inflammation. The patients were followed up in the outpatient clinic. If there were still apparent signs of much pus, the pus aspiration procedure was repeated.

D-silicone intubation was conducted once the pain and swelling of acute inflammation had subsided (Figure 3). It takes 3-5d after presentation, depending on specific cases and timing. All surgical procedures were performed under local anesthesia. The inferior nasal meatus was packed with a pledget soaked in a solution containing 1:100 000 epinephrine and 2% lidocaine. After dilation of the puncta by a dilator, a probe with 5 mL syringe attempt to through the nasolacrimal duct. After confirming the patency of the lacrimal passage by saline irrigation, a memory wire probe takes the place of the probe with 5 mL syringe. The memory wire probe were previously described (Figure 3G)[18]. Rotate the memory wire probe so that the side engraved with "9" faces upward. Gently push the tail of the memory wire until its tip emerges through the probe and extends into the nasal cavity (Figure 3A). Nasal endoscope could be helped if necessary.

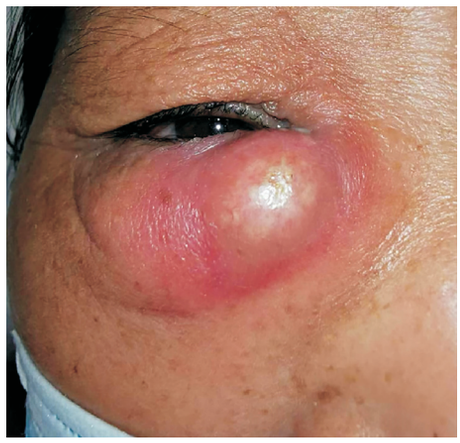

Figure 1 Patient with right acute dacryocystitis.

Figure 2 Abscess decompression by the lacrimal probe with a 5 mL syringe in a patient with AD A: The probe was passed through the inferior canaliculus inserting into the lacrimal sac horizontally. The pus was sucked out by pulling back the piston to create a negative pressure. B: Immediate manifestation after abscess decompression, giving dramatic results. C: Photograph of the lacrimal probe with a closed round tip, hole on two sidewall and a carved "number" on a syringe adapter to mark the diameter size. "9" means diameter 0.9 mm, "8" means diameter 0.8 mm, "7" means diameter 0.7 mm. D: Exaggeration of the marked area of (C). AD: Acute dacryocystitis.

Traction string of D-silicone intubation is threaded through the tip of the memory wire (Figure 3B). The memory wire is retracted into the probe and then pulled along with the D-silicone traction string through the lacrimal passage in a retrograde fashion until it emerges from the punctum (Figure 3C). Pre-coated the head of D-silicone tube with Tobramycin dexamethasone ointment. Adjust the position of the D-silicone tube by traction string (Figure 3D), making the head of D-silicone tube placed in the lacrimal sac and the tail is continuously drained to keep the nasolacrimal duct unobstructed. The lacrimal duct was irrigated again by saline using a probe inserted into the lacrimal sac, observing the

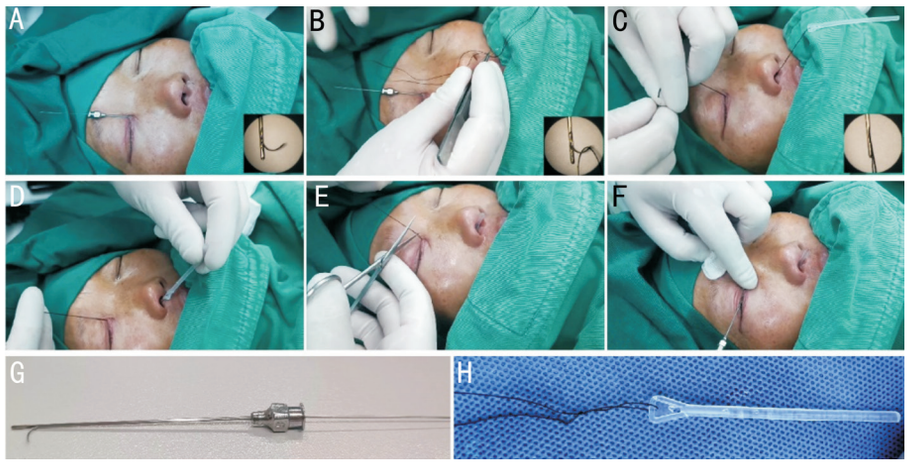

Figure 3 Photograph of D-silicone intubation A: The memory wire's tail is gently pushed through the probe until its tip emerges from the nasal cavity. B: Traction string of D-silicone intubation is threaded through the tip of the memory wire. C: The memory wire is retracted into the probe and then pulled along with the D-silicone traction string through the lacrimal passage in a retrograde fashion until it emerges from the punctum. D: Adjust the position of the D-silicone by traction string, making the head of D-silicone placed in the lacrimal sac and the tail is continuously drained to keep the nasolacrimal duct unobstructed. E: Cut off the traction string of D-silicone. F: Irrigation and the saline was discharged from the hollow pipe of D-silicone tube, demonstrating it was placed in the correct position. G: A memory wire probe comprises a stainless steel syringe needle that houses a memory wire within it. H: D-silicone intubation has a traction string, its head is a triangle-like shape without sharp corners, its tail is a hollow pipe.

drainage ability of D-silicone tube (Figure 3F). The traction string and excess tubing of D-silicone tube was cut off (Figure 3E), and the D-silicone tube was left in the lacrimal passage for at least 3mo.

Postoperatively, the patient received antibiotic-corticosteroid eye drops in the operated eye four times daily for one week, followed by antibiotic eye drops alone for an additional three weeks. Oral systemic antibiotics and corticosteroids were also administered for 3-5d post-surgery. Patients were advised to apply pressure over the lacrimal sac area twice per day, helping to drain the pus if there was any. Blowing nose was forbid to stop the event of D-silicone tube prolapse from nose. Follow-up visits were scheduled weekly for half month, then monthly until the D-silicone tube was removed. At each visit, lacrimal sac irrigation was conducted to confirm the patency of the lacrimal passage and the D-silicone tube. Follow-up examinations were conducted for more than 3mo after the removal of the D-silicone tube. Patients were asked about symptoms of epiphora and the patency of the lacrimal passage was evaluated through irrigation.

RESULTS

Twenty-three patients were studied (mean age: 60.0±11.8y, range: 44-80y, three men and twenty women). Totally 19/23 (82.6%) patients complained of epiphora for years, of which 8 patients had symptoms in both sides. All patients were managed on an outpatient basis. Following translacrimal canalicular drainage of the abscess combined with systemic antibiotic and corticosteroid treatment, all patients showed significant pain relief within 24h. The redness and swelling was relieved within 72h. Then, all of them accepted D-silicone intubation under locoregional anesthesia. The whole surgery process took about ten to fifteen minutes. The edema and inflammation completely resolved in 21 (91.3%) patients within one week after D-silicone intubation. The other two patients remained submuscular pocket abscess, even the drainage ability of D-silicone tube was good and the abscesses in the lacrimal sac was drained completely. The abscess seemed isolated from the lacrimal passage and was not affected by irrigation. It was finally treated by percutaneous abscess drainage without lacrimal sac incision. No severe intraoperative or postoperative complications, such as unusual hemorrhage, punctum dehiscence, acute inflammation, recurrence of AD or fistula formation, occurred in all 23 patients. After removing the D-silicone tube, 19/23 patients (82.6%) were completely free of epiphora, while 4/23 patients (17.4%) reported intermittent symptoms in winter or wind. Of the 4 patients, stenosis of lacrimal canaliculi was found and bicanalicular nasal intubation was chose. All patients had anatomical success, demonstrated as free passage to irrigation at the last follow-up.

DISCUSSION

AD is not an unusual disease in underdeveloped as well as developing[2,19], even in developed countries[3]. Due to unaware of the complications of lacrimal pathway disorders, many patients with epiphora do not seek medical help until the presentation of AD. Once AD happen, it forms an environment where antibiotic penetration is inadequate and progression of infection is favored, making systemic antibiotics probably

futile[20]. So the drainage remains the primary therapy, whether transcutaneous or endonasal. There may be a mechanism by which abscesses tend to be limited to the lacrimal sac during AD, which makes our treatment strategy feasible. The probe with syringe provides negative pressure to purge pus through the original lacrimal passage. It reduces overall bacterial load, provides rapid pain relief. Combined with the systemic antibiotic-corticosteroid, the infection was effectively controlled, that leads to rapid resolution of inflammation and symptoms. In fact, in this study pain relieved in 24h, edema and inflammation resolved around 3d.

Recently, some studies have focused on timing for primary En-DCR in AD[21-23]. It seems that very early En-DCR (≤3d) is associated with quicker disease resolution and a higher long-term success rate. However, patients with AD may costs several even more than 10d to finally referral to tertiary hospitals[24]. During this period, inflammation and edema will further aggravate, increasing the difficulty of surgery and the risk of bleeding in the perioperative[11,25].

Even worse, once the pus breaks through, it fills a suborbicularis pocket. In that case, the pus in suborbicularis pockets should be thoroughly drained by percutaneous drainage. Therefore, adequate drainage by the probe with syringe through the original lacrimal passage is very important and helpful.

In this stage, the probe was inserted into the lacrimal sac horizontally without probing the nasolacrimal duct. Because during an acute phase of inflammation in AD, the mucosa of the lacrimal sac was expected swilling and fragile. We also avoid irrigation, so as not to further increase the pressure of the lacrimal sac. All those attentions were payed to avoiding inadvertent rupture of the lacrimal sac, formation of false track and spillover of bacteria into the suborbicularis pocket[26].

Compared with traditional incision and drainage, drainage by probe through lacrimal canaliculi has more advantages[27]. It is a cosmetically superior approach because the skin incision and scar formation are absent[28]. Since the orbicularis oculi muscle and lacrimal sac are not incised, the function of lacrimal pump is not damaged. This procedure is minimally invasive and repeatable, needing no special instruments and equipment, can be easily mastered and performed by doctors in small or primary hospitals with few complications. And also could be easily accepted by patients. So the severe pain of AD patients can be alleviated during their initial visit to a local hospital, avoiding complications during referral and decreasing the difficulty of subsequent surgery and the risk of bleeding perioperatively.

To correct the causative pathology of nasolacrimal duct obstruction is necessary. We probed nasolacrimal duct and performed D-silicone intubation following the resolution of inflammation when the swilling of the lacrimal duct mucosa subsided. Compared with Crawford tube[29-30], the D-silicone tube is more suitable in the treatment of AD. First, it has larger diameter with hollow pipe which in favor of maintain the drainage. After the head of D-silicone tube placed in the lacrimal sac, irrigation and the saline can be discharged from its hollow pipe, demonstrating the D-silicone tube was placed in the correct position. Second, the head of D-silicone tube is smooth, elastic and deformable, which can be deformed and thinned when it passes through the nasolacrimal duct without mucosal injury. It can restore to the original shape after entering the lacrimal sac to support the shaping of the lacrimal sac preventing the mucosa from adhesion and atrophy. Meanwhile, it can play the role of stutter avoiding the slippage of silicone tube. Third, during the retention of silicone tube, there was no extra pressure on the lacrimal canaliculus to lead to punctum dehiscence.

The limitations of our study should be considered. First, this is a retrospective study with small sample size. Second, it lacks microbiological culture and imaging used. Third, this method is not suitable for patients with lacrimal canaliculi disorder.

In summary, pus suction through lacrimal canaliculi by lacrimal probe, combined with systemic antibiotic-corticosteroid application, following by D-Silicone intubation, appear to be a reasonable option in the treatment of AD. It has potential benefits of minimally invasive, easy-to-master, no expensive instrument requirements, minimal risk of hemorrhage, and repeatability profiles, making it worth taking into consideration in the treatment of AD.

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REFERENCES

1 Hoffmann J, Lipsett S. Acute dacryocystitis. *N Engl J Med* 2018;379(5):474.

2 Khatoon J, Rizvi SAR, Gupta Y, Alam MS. A prospective study on epidemiology of dacryocystitis at a tertiary eye care center in Northern India. *Oman J Ophthalmol* 2021;14(3):169-172.

3 Mills DM, Bodman MG, Meyer DR, Morton AD 3rd, ASOPRS Dacryocystitis Study Group. The microbiologic spectrum of dacryocystitis: a national study of acute versus chronic infection. *Ophthalmic Plast Reconstr Surg* 2007;23(4):302-306.

4 Alaboudi A, Al-Shaikh O, Fatani D, Alsuhaibani AH. Acute dacryocystitis in pediatric patients and frequency of nasolacrimal duct patency. *Orbit* 2021;40(1):18-23.

5 Lowry EA, Kalin-Hajdu E, Kersten RC, Vagefi MR. Acute vision loss from dacryocystitis. *JAMA Ophthalmol* 2018;136(10):1207-1208.

6 Maheshwari R, Maheshwari S, Shah T. Acute dacryocystitis causing orbital cellulitis and abscess. *Orbit* 2009;28(2-3):196-199.

7 Mekni M, Sayadi J, Choura R, Fekih A, Gouider D, Rouatbi A, Zghal I, Malek I, Chebbi A, Nacef L. Orbital cellulitis: diagnostic, therapeutic and prognostic approach in a reference center in Tunis, Tunisia (a retrospective study of 109 cases). *Pan Afr Med J* 2022;43:64

8 Bothra N, Agarwal K, Ali MJ. Panophthalmitis and visual loss as a complication of acute dacryocystitis. *Ophthalmic Plast Reconstr Surg* 2020;36(6):e156-e158.

9 Alsalamah AK, Alkatan HM, Al-Faky YH. Acute dacryocystitis complicated by orbital cellulitis and loss of vision: a case report and review of the literature. *Int J Surg Case Rep* 2018;50:130-134.

10 Cahill KV, Burns JA. Management of acute dacryocystitis in adults. *Ophthalmic Plast Reconstr Surg* 1993;9(1):38-41; discussion 42.

11 Chong KK, Abdulla HAA, Ali MJ. An update on endoscopic mechanical and powered dacryocystorhinostomy in acute dacryocystitis and lacrimal abscess. *Ann Anat* 2020;227:151408.

12 Li J, Wang J, Sun C. Early endonasal dacryocystorhinostomy for acute dacryocystitis: a systematic review and meta-analysis. *Am J Rhinol Allergy* 2024;38(3):185-191.

13 Lombardi D, Mattavelli D, Accorona R, Turano R, Semeraro F, Bozzola A, Nicolai P. Acute dacryocystitis with empyema of the lacrimal sac: is immediate endoscopic dacryocystorhinostomy justified? *Otolaryngol Head Neck Surg* 2014;150(6):1071-1077.

14 Morgan S, Austin M, Whittet H. The treatment of acute dacryocystitis using laser assisted endonasal dacryocystorhinostomy. *Br J Ophthalmol* 2004;88(1):139-141.

15 Wu WC, Yan WT, MacCallum JK, Tu YH, Jiang AC, Yang Y, Xiao TL, Li J, Wang QM, Qu J. Primary treatment of acute dacryocystitis by endoscopic dacryocystorhinostomy with silicone intubation guided by a soft probe. *Ophthalmology* 2009;116(1):116-122.

16 Yu B, Xia Y, Sun JY, Ye Q, Tu YH, Zhou GM, Wu WC. Surgical outcomes in acute dacryocystitis patients undergoing endonasal endoscopic dacryocystorhinostomy with or without silicone tube intubation. *Int J Ophthalmol* 2021;14(6):844-848.

17 Goel R, Sagar C, Gupta SN, Shah S, Agarwal A, Golhait P, Kumar S, Akash R. Outcome of transcanalicular laser dacryocystorhinostomy with endonasal augmentation in acute versus post-acute dacryocystitis. *Eye (Lond)* 2023;37(6):1225-1230.

18 He JJ, Gong JW, Zheng QQ, Jiang J. Repositioning of the severe prolapsed silicone tubes after bicanalicular nasal intubation: a novel technique. *J Ophthalmol* 2021;2021:6669717.

19 Luo B, Li M, Xiang N, Hu WK, Liu R, Yan XQ. The microbiologic spectrum of dacryocystitis. *BMC Ophthalmol* 2021;21:29.

20 Kalin-Hajdu E, Cadet N, Boulos PR. Controversies of the lacrimal system. *Surv Ophthalmol* 2016;61(3):309-313.

21 Yu B, Tu Y, Zhou G, Hong H, Wu W. Immediate endoscopic dacryocystorhinostomy in patients with new onset acute dacryocystitis. *Laryngoscope* 2022;132(2):278-283.

22 Sung JY, Kim JM, Hwang JY, Kim KN, Kim J, Lee SB. Optimal timing for primary early endoscopic dacryocystorhinostomy in acute dacryocystitis. *J Clin Med* 2021;10(10):2161.

23 Pakdel F, Soleimani M, Kasaei A, Ameli K, Pirmarzdashti N, Tari AS, Ghasempour M, Banafsheafshan A. Shifting to very early endoscopic DCR in acute suppurative dacryocystitis. *Eye (Lond)* 2020;34:1648-1653.

24 Bian Y, Han XM, Li ST, Yu B. The effects of silicone tube intubation during endoscopic dacryocystorhinostomy in patients with acute dacryocystitis with acquired skin fistulization. *J Craniofacial Surg* 2023;35(2):e150-e154.

25 Madge SN, Chan W, Malhotra R, Ghabrial R, Floreani S, Wormald PJ, Tsirbas A, Selva D. Endoscopic dacryocystorhinostomy in acute dacryocystitis: a multicenter case series. *Orbit* 2011;30(1):1-6.

26 Boulos PR, Rubin PA. A lacrimal sac abscess incision and drainage technique. *Arch Ophthalmol* 2008;126(9):1297-1300.

27 Gupta A, Saini P, Bothra N, Ali MJ. Acute dacryocystitis: changing practice pattern over the last three decades at a tertiary care setup. *Graefes Arch Clin Exp Ophthalmol* 2024;262(4):1289-1293.

28 Barrett RV, Meyer DR. Acquired lacrimal sac fistula after incision and drainage for dacryocystitis: a multicenter study. *Ophthalmic Plast Reconstr Surg* 2009;25(6):455-457.

29 Lin L, Yang L, Jin XM, Zhao YY, Fan FL. Management lacrimal sac abscesses using lacrimal probe and Crawford silicon tube. *BMC Ophthalmol* 2016;16(1):211.

30 Wu WJ, Li ZW, Yan D, Lin Y, Xu N. Treatment of acute purulent dacryocystitis by early bicanalicular silicone intubation: safety, efficacy, and outcomes. *Semin Ophthalmol* 2017;32(5):607-613.