Original Article

Results of a new "mirror tuck technique" for fixation of lacrimal bypass tube in conjunctivodacryocystorhinostomy

Ruchi Goel, Divya Kishore, Smriti Nagpal, Sushil Kumar, Neha Rathie

Context: Conjunctivodacryocystorhinostomy (CDCR) is the procedure of choice for proximal canalicular blocks. However, the complications of tube migration and extrusion limit its widespread practice. **Aim:** The aim of this study is to evaluate the efficacy and complications of the new "mirror tuck technique" for fixation of lacrimal bypass glass tube without holes in proximal canalicular blocks in laser CDCR. **Materials and Methods:** A prospective interventional study was conducted in forty consecutive eyes of adult patients, undergoing 980 nm diode laser CDCR for proximal canalicular blocks. After creating the tract under endoscopic guidance, the collar of the glass tube was fixed to the conjunctiva with 6-0 prolene suture by "mirror tuck technique." Success was defined as the absence of extrusion of tube with patent tract and relief in epiphora at 1 year of follow-up. **Results:** Both anatomical and functional success was achieved in 39 (97.5%) cases. Tube displacement occurred in one patient suffering from allergic conjunctivitis in which the tube had to be removed. A temporary heaviness was reported by 5 (12.5%) patients till about 2 weeks. Conjunctival overgrowth over the tube occurred in 1 (2.5%) eye at 5 months which was excised and treated with application of 0.02% mitomycin C with no subsequent recurrence. There were no cases of suture abscess or suture intolerance warranting tube removal. **Conclusion:** "Mirror tuck technique" is an effective method for tube fixation (for tube without holes) in CDCR. However, it is important to position the conjunctival opening so as to leave sufficient space for passage of sutures for anchorage medially.

Key words: Bypass tube, canalicular obstruction, conjunctivodacryocystorhinostomy, extrusion, proximal blocks

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Epiphora due to the absence or secondary proximal canalicular obstruction (<8 mm from the punctum) is treated by conjunctivodacryocystorhinostomy (CDCR) with the insertion of bypass tube. The technique of CDCR has undergone numerous modifications since its initial description by Von Hoffman in 1904.[1] The original tube was described in 1962 by Jones.[2] The most commonly reported complication with Jones tube is extrusion with published rates varying from 28% to 51%.[3-6]

Various types of bypass tubes have been subsequently tried based on the material, design, length, and shape.[1] Fixation is easy in soft tubes (polyethylene, polypropylene, silicone, and Teflon) where suture can be passed directly through the flange[7] or in Pyrex tube with holes. The soft tubes, though less likely than Pyrex to extrude or malposition,[8] have a poor capillary attraction with slow flow and a higher likelihood of obstruction. On the other hand, the cost is a prohibitive factor in the acquisition of Pyrex tubes.[9,10] Glass tubes are thus a cheaper alternative. In glass tubes, without holes, the suture is looped around the collar that can slip postoperatively leading to tube extrusion. In this article, we describe and evaluate the results of fixing the glass tube without holes by "the mirror tuck technique" using 6-0 polypropylene following laser CDCR.

Materials and Methods

A prospective interventional case series was conducted at a tertiary care center from May 2012 to April 2013 after obtaining the Institutional Ethical Committee clearance and informed consent. Forty consecutive eyes of forty adult patients suffering from epiphora due to both upper and lower canalicular blocks (<8 mm functional passage) were treated with 980 nm diode laser CDCR with glass tube fixation by mirror tuck technique. Exclusion criteria included nasal cavity abnormalities precluding endoscopy such as a "high" deviated nasal septum, polyps, tumors, Wegener's granulomatosis, sarcoidosis, uncontrolled systemic diseases (diabetes, hypertension, coronary artery disease, bleeding diathesis, malignancy, or bone disease), and patients unwilling for follow-up. Furthermore, patients with coexisting abnormalities of the lid and dry eye were excluded from the study. Patients with associated posttraumatic telecanthus were included 1 month after primary repair.

All patients were evaluated preoperatively by lacrimal irrigation, probing, and nasal examination. Blood investigations included hemogram, sugar, bleeding, and clotting time. The

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anatomical success was defined as the absence of tube extrusion with patent tract and functional success as relief in epiphora at 1 year of follow-up.

The surgeries were performed by a single surgeon, the first author, under local anesthesia. The patients received nasal decongestant drops (xylometazoline) thrice a day for a week and antibiotic eye drops ofloxacin 0.3% four times a day for a week. Injection diclofenac 75 mg i.m. and injection promethazine 25 mg i.m. were given immediately before the surgery. Ipsilateral nasal cavity was packed with ribbon gauze soaked in 15 ml of 4% lignocaine with 1 ml of 1:1000 adrenaline. Topical proparacaine hydrochloride 0.5% was instilled in the affected eye. Local infiltration of the operative site, skin around the medial canthus and at the nasal mucosa overlying the base of the lacrimal sac was performed with 2% lignocaine with 1:80,000 adrenaline, 0.75% bupivacaine, and 25 IU/ml hyaluronidase. The nasal pack was then removed, and nasal cavity was visualized with 0° 4 mm nasal endoscope.

The caruncle was partially excised, and a tract was created using von Graefe's knife from caruncular area to nasal cavity at the root of the middle turbinate. The fiber-optic cable of the 980 nm diode laser was inserted through this tract, and laser energy was delivered at 8 W in continuous mode to create an opening of 6 mm × 6 mm. Any loose overhanging tissue or charred pieces were removed with 45° Weil–Blakesley forceps.

A Bowman's probe was then passed through the caruncle into the tract created till it hits the nasal septum. The distal end of the probe was grasped with a forceps, and the probe was withdrawn. The length of this segment was measured against a scale. A straight glass tube with 4 mm flange without holes and length 2 mm less than the measured segment length was introduced into the tract under endoscopic visualization (the glass tube used costed Rs. 500 each and was manufactured by J-SIL Scientific Industries, 48-B, Industrial estate, Nunhai, Agra, Uttar Pradesh - 282 006; website: www.j-sil.com; E-mail: jslindia@gmail.com).

The flange was then secured to the surrounding conjunctiva using 6-0 prolene suture by "mirror tuck technique." A loop was first tied around the tube and then a net was created on top of the flange taking bites from adjacent conjunctiva and episclera. Interlocking suturing was then performed all around the flange which pulled the net to the periphery holding the tube in place [Figs. 1-9].

Postoperatively, nasal packing was done. The patients received oral ciprofloxacin 500 mg 12 hourly for 5 days, ibuprofen 400 mg 8 hourly for 3 days, xylometazoline nasal drops thrice a day for 2 weeks, and ofloxacin 0.3% eye drops 6 hourly for 2 weeks.

On the first postoperative day, the nasal pack was removed and syringing was done. The patients were told to avoid forceful blowing of the nose for 2 weeks and to keep a finger over the canthal end while sneezing. In addition, detailed instructions were given regarding cleaning of the tube and regular sniffing to maintain patency.

The patients were followed up on day 1, day 7, every 2 weeks for the first 2 months, and every month for the next 10 months. The patients were evaluated to note patency, position complications related to the tube, and relief in epiphora.

Results

A total of forty eyes of forty patients were treated with CDCR using glass tube secured by "mirror tuck technique." The age varied from 19 to 40 years, with the mean age being 34 years. There were 26 males and 14 females with presenting complaint of epiphora. The various etiologies of obstruction were idiopathic in ten eyes, trauma in 15 eyes, congenital agenesis of punctum in seven eyes, and infection in eight eyes. The length of the bypass tube ranged from 21 mm to 24 mm.

Both anatomical and functional success was achieved in 39 (97.5%) cases with retention of tube and patency on syringing at the final visit, 1 year after surgery [Fig. 10]. One patient suffering from allergic conjunctivitis had a displacement of tube while rubbing vigorously [Figs. 11 and 12]. The tube was removed, and the patient refused any further intervention. Localized discomfort was reported by 5 (12.5%) patients till about 2 weeks. Conjunctival overgrowth over the tube occurred in 1 (2.5%) case at 5 months which was excised and treated with application of 0.02% mitomycin C for 3 min, and there were no further recurrences [Figs. 13 and 14].

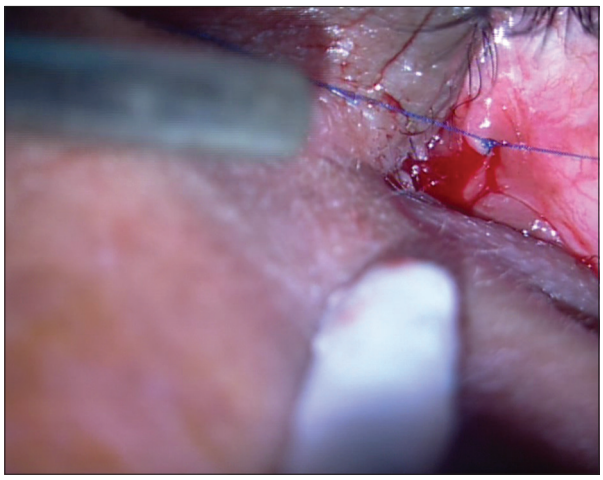

Figure 1: The 6-0 prolene is passed adjacent to the tract created for the glass tube

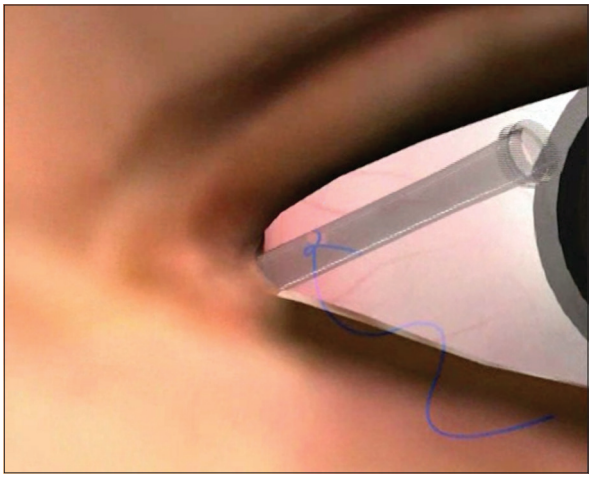

Figure 2: The glass tube is inserted in the tract

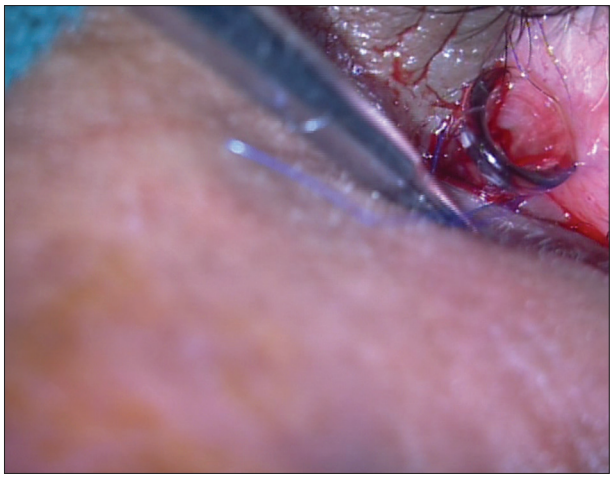

Figure 3: A tie is taken around the tube just below the flange

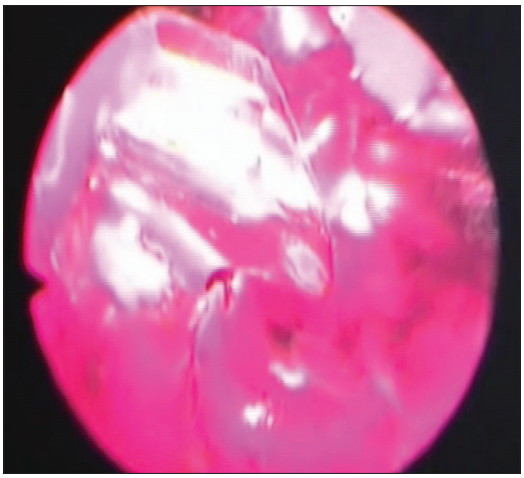

Figure 4: The correct positioning of the tube visualized endoscopically

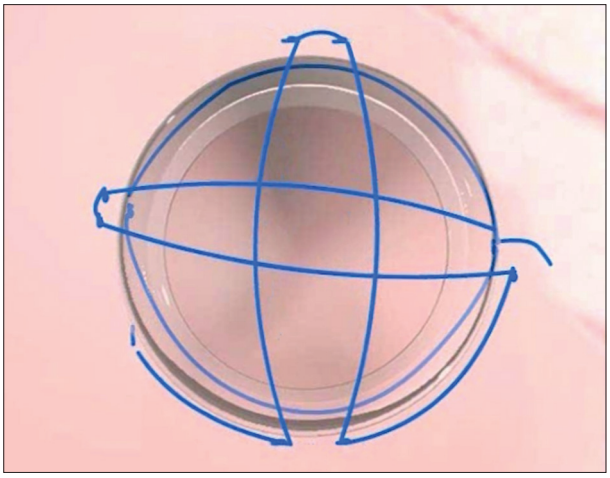

Figure 5: A cross mesh is created on the surface of the flange by taking bites from the conjunctiva

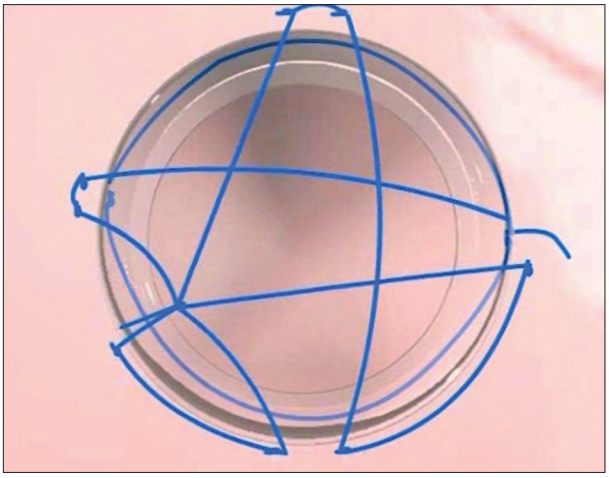

Figure 6: Interlocking pattern of suturing started by passing the needle from center of the cross mesh toward the flange

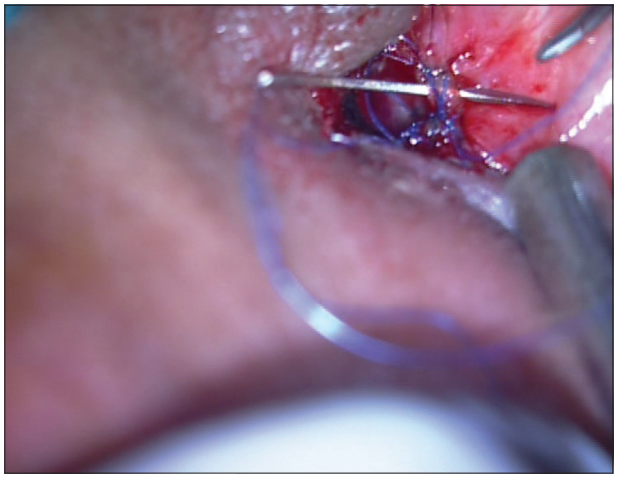

Figure 7: Interlocking pattern of suturing continued all around the flange

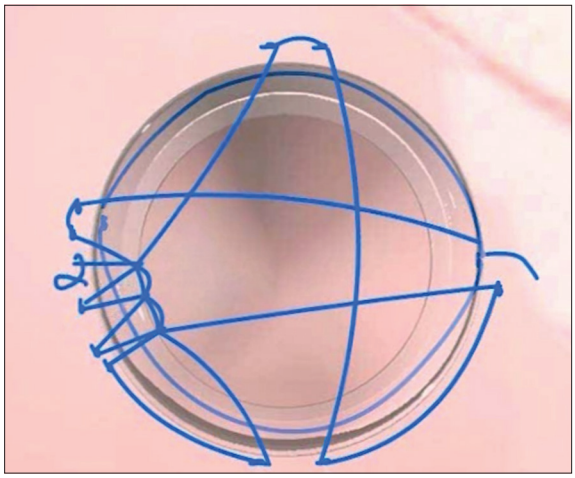

Figure 8: Diagrammatic representation of interlocking pattern of suturing around the flange

There were no cases of suture abscess or suture intolerance warranting tube removal. There was no case of tube malposition, nasal mucosal granuloma, or conjunctival granuloma.

Discussion

CDCR with bypass tube is the procedure practiced for the management of proximal canalicular obstruction with <8 mm

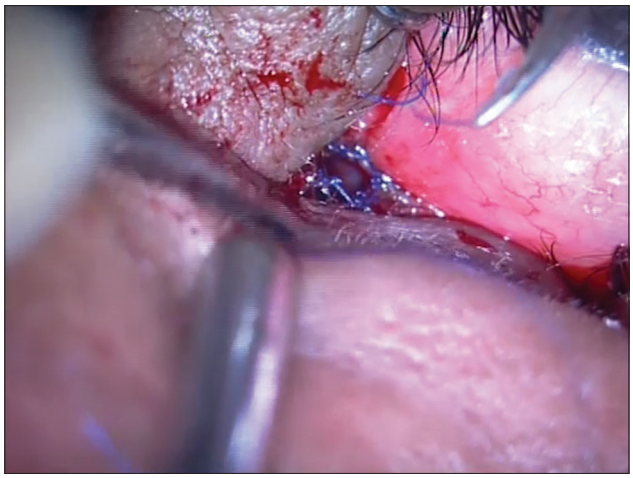

Figure 9: Interlocking pattern of suturing around the flange of the bypass tube completed

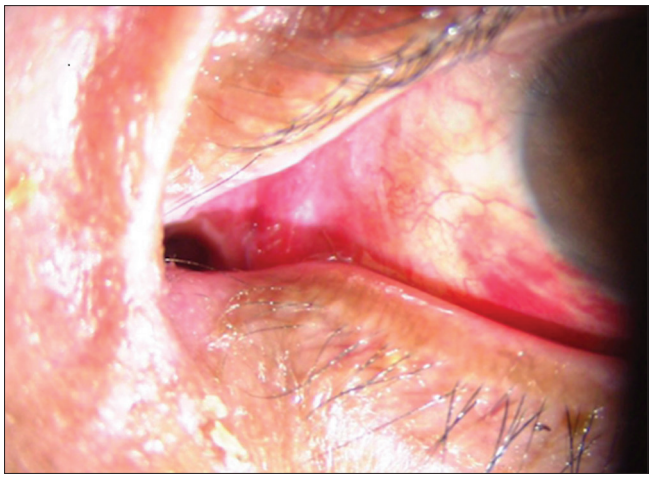

Figure 10: The prolene suture gets buried under the conjunctiva by 6 months

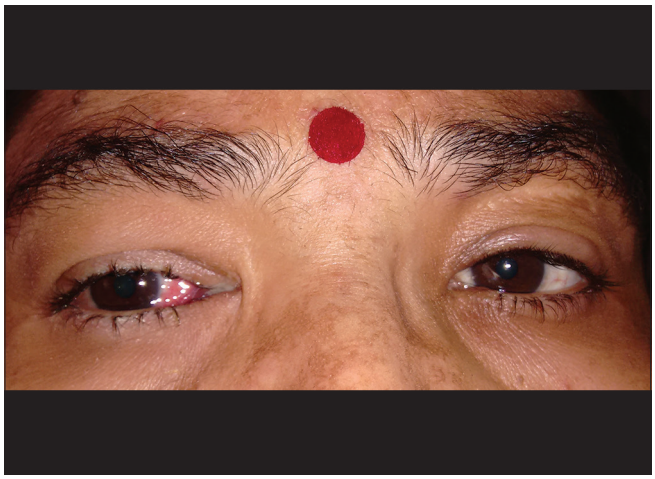

Figure 11: Patient with allergic conjunctivitis where tube had to be explanted in the right eye

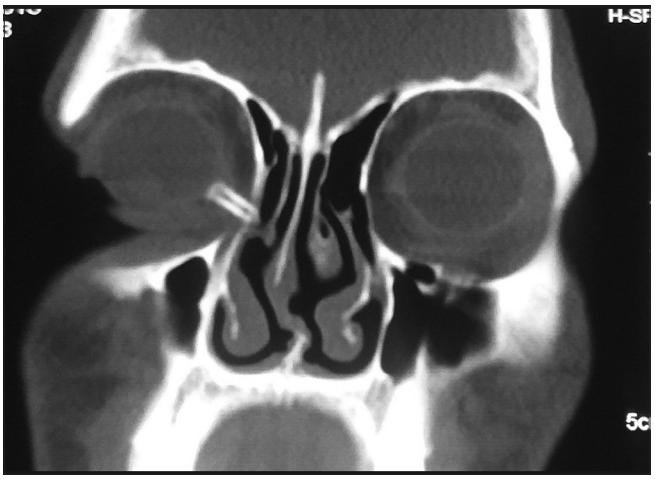

Figure 12: Coronal view of computed tomography scan showing displacement of tube on the right side

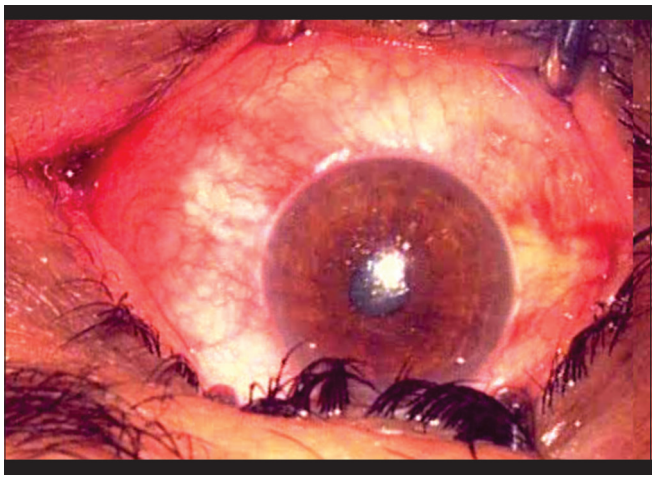

Figure 13: Clinical picture showing conjunctival overgrowth on the tube in the right eye

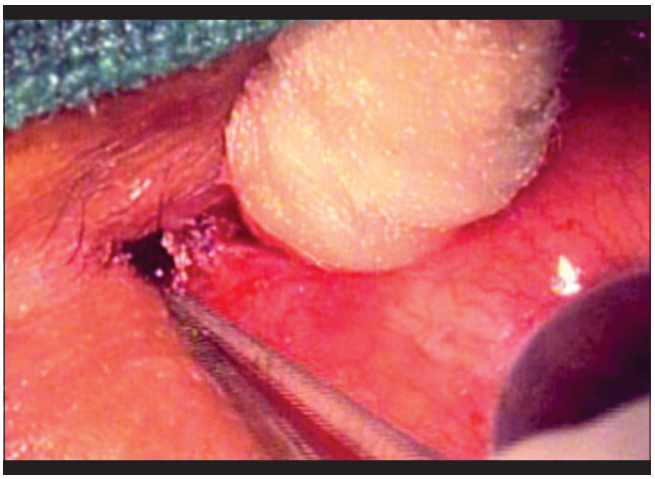

Figure 14: Patent tract with tube in position after excision of conjunctiva and 0.02% mitomycin C application

healthy canaliculus. Canalicular blocks pose a challenge to ophthalmologists as unlike external dacryocystorhinostomy which has replicable high success rates in the treatment of nasolacrimal duct obstruction, there is no surgical technique

Table 1: Comparison of different sutures used for tube fixation

Study	Suture used	Method employed	Remarks
Lamping[22]	6-0 nylon	Tied around the collar, exit at the skin in the medial canthal region	
Putterman[23]	6-0 black silk	Knot near the collar, secured at medial canthal angle	Suture passed through the lumen
Ma'luf[24]	6-0 vicryl	Knot near the collar, secured at medial canthal angle	Suture passed through the lumen
Schwarcz[20]	6-0 prolene	Purse-string manner	
Chang[25]	6-0 prolene	Encircling fixation method	
Goel	6-0 prolene	Mirror tuck technique	

with assured results in CDCR. Various methods have different success rates depending on surgeon factors and the method used.[1]

Our study had a patient population with a mean age of 34 years. This was in accordance with the study done by Zilelioglu and Gündüz[11] with a mean age of patients being 30.1 years and Enany and Al-Aswad[12] who had a mean age of 37 years. The tube length was slightly longer, 21–24 mm in our study in comparison to Pushker *et al*. where the length used was 14–20 mm.[13] This could be explained by a longer tract length created by laser probe in our study in comparison to the external approach. In laser CDCR, the vertical positioning of tube is all the more important as the lacrimal sac remnants can otherwise result in sump syndrome.[14]

The principal demerit of bypass tubes is extrusion. This is related to tube itself that acts as a foreign body. Several attempts have been made to minimize tube extrusion by altering the shape and material of the bypass tube or the way it is fixed. Some of these modifications include the Putterman-Gladstone tube that has an extra intranasal dilatation of the glass tube, frosted tubes with extra lightly textured outer surface, extended angled tubes, Medpor-coated tubes that promote fibrovascular ingrowth, and the StopLoss tube with an intranasal silicone flange.[15] However, there have been reports of mechanical strabismus and diplopia with Medpor-coated tube and promotion of growth of harmful biofilm on intranasal silicone flange of the StopLoss tube.[16,17]

The bypass tube can be fixed to the medial canthus, caruncle, conjunctiva, or lid margin.[18-21]

Various sutures have been used to fix the tube in CDCR [Table 1]. Lamping and Levine used a 6-0 nylon double-armed suture that was tied around the collar of the Pyrex tube, the arms then traversed the orbicularis to exit at the skin in the medial canthal region.[22] Putterman secured the Jones tube to the medial canthal angle by 6-0 black silk. He passed the suture through the lumen of the Jones tube, and the ends of this suture were tied in triplicate on the outside of the tube and then the taut suture was slid to make the knot near the collar.[23] Ma'luf *et al*. employed double-armed 6-0 vicryl suture. They passed one arm through the lumen of the tube, and the ends were then tied in triplicate on the outside of the tube, placing the knot near the collar. The two arms were then tied around the collar, placing the second knot on the opposite side of the tube, following which the two arms were externalized to the skin at the medial canthal area and tied.[24] All these methods required an external approach.

Schwarcz *et al*. used 6-0 prolene suture placed in the purse-string manner.[20] Chang *et al*. proposed encircling fixation method similar to the purse-string technique using 6-0 prolene. They buried the suture material under the conjunctiva and caruncle and did not externalize it to the skin. In their follow-up of 15.4 ± 2.4 months, they had no extrusions in the 52 cases. However, there were four tube malpositions, four conjunctival granulomas, and three tube obstructions.[25]

To achieve a better stabilization of the tube in its position, we used continuous interlocking pattern of 6-0 prolene suture instead of purse-string suturing. Over the time, the suture material got buried under the conjunctiva, and there was no irritation due to the suture material [Fig. 2]. The tube got displaced only in one patient within a week because of vigorous rubbing. This patient was suffering from allergic conjunctivitis, and the tube had to be removed.

Conjunctival overgrowth occurred in one of our patients that was effectively treated by the application of mitomycin C. There were no cases of suture abscess as the suture was not externalized to the skin. There were no cases of nasal irritation as appropriately sized tubes had been placed under direct endoscopic visualization. The success rates did not vary with the etiology of obstruction, especially so in posttraumatic cases. This could be explained by the fact that the primary repair of any associated lid defect or telecanthus was performed a month before inclusion in the study. This was to minimize the confounding factors. This along with stable positioning of tube could have contributed to similar anatomical and functional success rates.

Therefore, "mirror tuck technique" using 6-0 prolene suture is an effective method for tube fixation (for tube without holes) in CDCR. It helps to hold the tube firmly preventing its displacement; however, it may be avoided in patients with allergic conjunctivitis.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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