

Bicanalicular Silicone Intubation for the Management of Punctal Stenosis and Obstruction in Patients With Allergic Conjunctivitis

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Purpose: To evaluate the use of bicanalicular silicone intubation for the management of punctal stenosis and obstruction in patients with allergic conjunctivitis.

Methods: A retrospective interventional case series of patients with acquired epiphora due to stenotic or obstructed puncta as a result of allergic conjunctivitis was performed. Punctal dilation and bicanalicular silicone intubation were performed in all patients. Munk Scale for grading of epiphora along with grading of fluorescein dye disappearance test was used to evaluate the functional improvement. Grading of punctal stenosis using Kashkouli's grading system was applied to evaluate the anatomical improvement. Patients having canalicular or nasolacrimal duct obstruction, punctal stenosis, and obstruction due to other causes were excluded.

Results: Fifty-one patients met the inclusion criteria with male-female ratio of 1:1.55 and an average age of 46 years at presentation. High patient tolerances without complications with the use of tubes were reported. Significant improvement 6 months after tube removal in comparison to preoperative period was found with anatomical and functional success rate of 91.83% and 87.75%, respectively. Two patients had a recurrence of the punctal stenosis many months after stent removal because of the early tube prolapse and exacerbation of the allergic conjunctivitis.

Conclusions: Bicanalicular silicone intubation seems to be a well-tolerated and effective tool in the management of acquired punctal stenosis or obstruction secondary to allergic conjunctivitis. Bicanalicular silicone intubation appears to be a good option as patients with allergic conjunctivitis typically present with bilateral involvement of both puncti.

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Punctal stenosis is one of the common findings among patients coming to ophthalmology clinics. It is generally described as a narrowing of the external opening of the lacrimal canaliculus. Punctal stenosis is also defined as a punctum that is visible but it is smaller than 0.3 mm and requires a punctum finder followed by a standard punctal dilator to insert a #00 Bowman probe.^{1,2} The prevalence of this disorder can vary depending on many factors including the nature of ophthalmic practice and

demographics. In one study, the prevalence of punctal stenosis among patients passing by the routine eye check-up was found to be up to 54.3%.¹

Allergic conjunctivitis can affect up to 30% of the general population.³ This disorder can present in different forms depending on the triggers (allergens), and the time of the year at which symptoms occur. Many patients with chronic allergic conjunctivitis have epiphora with an evidence of punctal stenosis.³ With the passage of time, chronic uncontrolled inflammation as well as chronic use of topical medications can lead to membrane formation over the punctum and can contribute to the development of punctal stenosis.⁴

Epiphora is one of the main complaints among patients with acquired punctal stenosis (APS), which negatively affects their daily activities and quality of life.⁵ There are many risk factors that can lead to the development of punctum stenosis; two of the most studied risk factors are old age and chronic inflammation.^{1,2,6} Some authors considered female gender as a risk factor for the development of punctal stenosis; they suggest that postmenopausal hormonal changes might play a role for this sex predilection. However, it is still a controversial issue.^{1,2,7} Other factors such as longstanding use of topical antiglaucoma agents, trachoma, topical mitomycin C, and chemotherapeutic agents such as docetaxel, 5-fluorouracil, and paclitaxel are all thought to play a role in the development of lacrimal punctum stenosis.^{4,8–10}

Although there are many options mentioned in the literature regarding the treatment of APS, there is no gold standard intervention for this disorder.¹¹ Many procedures have been suggested with different anatomical and functional success rates. Chronic lid inflammation is one of the strongly associated risk factors for the development of punctal stenosis.² Therefore, medical treatment of such condition with lid hygiene and antibiotic ointments may prevent consequences associated with chronic blepharitis such as APS. The use of perforated punctal plugs is a good noninvasive option for the treatment of punctal stenosis with some studies reporting more than 90% success rate 6 months after plug removal.¹² However, the use of punctal plugs has some drawbacks as mechanical stress on the mucosa by punctal plugs was presumed to induce chronic inflammation, scarring, and stenosis in some patients.^{13,14} Moreover, there are some effective surgical interventions with excellent success rates. Snip procedures are currently recommended in the surgical treatment of APS with reported success rates ranging from 74.7% to 86%.^{15,16} Despite the high success rates of microsurgery (snip punctoplasty) in the treatment of APS, it involves sections of the fibrous ring of the punctum, with subsequent risk of fibrosis and scarring (restenosis) that may require stricturectomy if bicanalicular intubation is later required.¹⁷ Another noninvasive option for the treatment of APS is the use of monocanalicular intubation (Mini Monoka stents). The use of such

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technique is effective in treating patients with APS and it has showed excellent anatomical (96.2%) and functional (84.9%) success rates.¹⁸ Some of the main advantages of mono-canalicular stents are addressing the associated internal punctal and canalicular stenosis as well as preventing the reunion and scarring during the healing phase if snip punctoplasty is performed.¹⁸ Premature stent loss is one of the concerns with the use of Mini Monoka (MM) stents and it is reported in some studies to reach 9.4%.¹⁸ The use of bicanalicular silicon intubation showed excellent results in the treatment of APS.¹⁹

The aim of the current study is to assess the role of bicanalicular silicone intubation in treating epiphora in patients with allergic conjunctivitis and punctal stenosis/obstruction.

METHODS

The study was approved by the Institutional Review Board (IRB) of King Abdul Aziz University Hospital, King Saud University, and it adhered to the ethical principles outlined in the Declaration of Helsinki as amended in 2013. A retrospective interventional case series was conducted on 51 patients from January 2015 to May 2018. All patients who had symptoms of allergic conjunctivitis with punctal stenosis/obstruction documented on clinical examination and underwent bicanalicular silicon intubation because of failure of topical medications used to treat allergic conjunctivitis to resolve the punctal stenosis/obstruction were included. Patients with lid malposition, canalicular or nasolacrimal duct obstruction, previous eyelid surgery or trauma, or punctal obstruction/stenosis due to causes other than allergic conjunctivitis were excluded.

Detailed systemic and ocular history was taken from all patients including demographics, past medical/surgical history, duration of allergic conjunctivitis, laterality of involvement, topical or systemic medications, previous ocular surgery or trauma, previous chemo or radio therapy, and epiphora assessment using Munk grading system (Table 1).²⁰ The diagnosis of allergic conjunctivitis was based on patients' symptoms and clinical signs.

Slit lamp examination was performed to all patients including functional fluorescein dye disappearance test (FDDT) to assess tear drainage using 2% fluorescein drops and to reassess tear meniscus after 5 minutes; it was graded using Zappia and Milder grading system (Table 2).²¹ The diagnosis and severity of punctal stenosis were made using Kashkouli's grading system (Table 3).²² In addition, all patients underwent irrigation test to ensure patency of the nasolacrimal drainage system. Patients with signs of canalicular or nasolacrimal duct

TABLE 1. Munk grading system

Grade	Epiphora assessment
Grade 0	No epiphora
Grade 1	Epiphora requiring dabbing less than twice a day
Grade 2	Epiphora requiring dabbing 2–4 times a day
Grade 3	Epiphora requiring dabbing 5–10 times a day
Grade 4	Epiphora requiring dabbing more than 10 times a day
Grade 5	Constant epiphora

TABLE 2. Kashkouli grading system (punctum stenosis)

Grade	Clinical finding of the punctum
Grade 0	No papilla and punctum (punctal atresia)
Grade 1	Papilla is covered by a membrane (exudative or true membrane) or fibrosis and it is difficult to recognize
Grade 2	Punctum less than normal size but recognizable
Grade 3	Normal size punctum
Grade 4	Small slit (<2 mm)
Grade 5	Large slit (2 mm or more)

TABLE 3. Fluorescein dye disappearance test

Grade	Observation of dye and its color intensity
Grade 0	No residual dye
Grade 1	Minimal residual dye
Grade 2	Determined by repeated experience and observation
Grade 3	No decrease in color intensity

obstruction were excluded and managed accordingly. These assessment methods were performed in the pre and postoperative periods for comparison.

Anatomical success was achieved when grade 3 punctum was documented after tube removal using Kashkouli's grading system (Table 3).²² However, functional success was realized in patients who had grade 2 or better after tube removal using Munk grading system (Table 1).²⁰

Data were collected, stored, managed, and coded in a spreadsheet using Microsoft Excel 2010 software. Descriptive analysis was done in SPSS version 22.0 (IBM Inc., Chicago, Illinois, U.S.A.), where categorical variables were presented in forms of frequencies and percentages, while continuous variables in forms of mean ($\pm$ Standard Deviation) and range (minimum to maximum). Proportions were compared using *StatsDirect* statistical software, version 2.7.2 (*StatsDirect* Ltd., Cheshire, UK) while rest of the comparisons (χ^2 test) was done in SPSS. The statistical significance level was set as p value <0.05.

Surgical Procedure. An informed consent was obtained from all patients undergoing bicanalicular silicon intubation. Under conscious sedation, all puncti were dilated gently up to 1.25 mm for all patients. In 85 eyes, a pigtail probe with a diameter of 0.4 mm was used to pass a hollow silicon tube in place and to facilitate a proper canalicular intubation. A Crawford bicanalicular silicon tube (FCI ophthalmicus, Pembroke, MA, U.S.A.) was inserted through the upper and lower puncti of each eye into the nasolacrimal duct to be retrieved from the nose at the area below the inferior turbinate using Crawford hook in 13 eyes as it was not possible to pass the pigtail probe. The tube was tied, allowing a relaxed loop between the puncti.

Topical steroid and antibiotics were prescribed for 2 weeks in the postoperative period. Patients were asked to continue using antihistamine/mast cell stabilizer eye drops for 3 months as a minimum. During this period, the epiphora severity assessment, FDDT, and punctal stenosis severity assessment were applied to all patients using the same scoring systems to compare the results to those of the preoperative period.

RESULTS

This study included 98 eyes of 51 patients: 20 men and 31 women with a male to female ratio of 1:1.55. The average age was 46.3 ± 8.3 years with a range of 25–67. Four eyes were excluded because of the presence of canalicular obstruction. All patients in the current study had allergic conjunctivitis and they received topical eye drops for the management of its symptoms including artificial tears, antihistamine/mast cell stabilizer, and corticosteroids without remarkable clinical improvement regarding their epiphora few weeks after using them (15 ± 6.8 weeks). The silicon tube was left in place for an average of 18.7 ± 5.9 weeks ranging from 3 to 29, with a mean duration of follow-up (24 ± 8 weeks) after tube removal. The least follow-up period for defining success was 12 weeks.

In the preoperative period, all patients were found to have grade 4 or worse in Munk's scale for epiphora assessment. About 86/98 eyes showed significant improvement 6 months after tube removal in comparison to preoperative period and they were found to have grade 2 or better with a functional success rate of 87.75% ($p < 0.001$; Fig. 1).

All patients had either grade 2 or grade 1 punctal stenosis using Kashkouli's grading system in the preoperative period. About 180/196

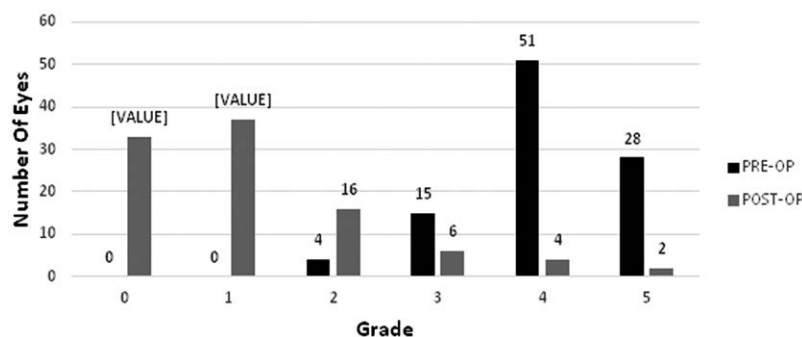


FIG. 1. This bar chart shows a comparison between patients in the preoperative period and six months after tube removal using Munk grading system for epiphora assessment.

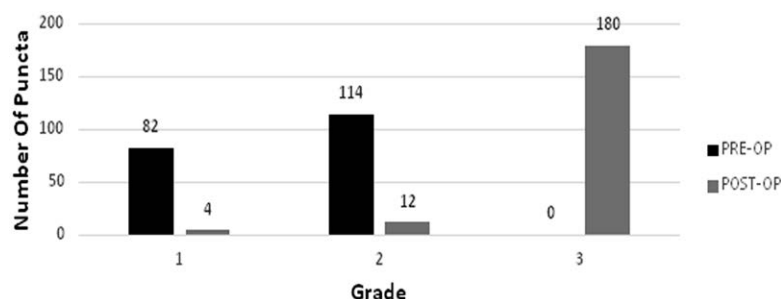


FIG. 2. This bar chart shows a comparison between patients in the preoperative period and six months after tube removal assessing the anatomical outcome using Kashkoul grading system.

puncta had grade 3 (normal size punctum), 6 months after tube removal with an anatomical success rate of 91.83%. ($p < 0.001$; Fig. 2).

The assessment of tear drainage using FDDT showed significant improvement among our patients after tube removal compared to the preoperative period. Almost all our patients had either grade 2 or 3 in the preoperative period; 92/98 (93.9%) showed improvement with grade 0 or 1, 6 months after tube removal ($p < 0.001$; Fig. 3).

Early tube prolapse was reported in 4 eyes (4 different patients). All cases occurred in the 1st month after intubation. Two of those eyes showed some improvement in their symptoms, while the other 2 believe no difference regarding the symptoms in the postoperative follow-up period because of the exacerbation of allergic conjunctivitis symptoms and restenosis of their puncti. No tube-related complications were reported during the study period.

DISCUSSION

Allergic conjunctivitis is considered a major cause of epiphora among patients seeking medical therapy in ophthalmology clinics. The main management usually consists of avoiding contact with any known allergens as well as using topical eye drops to control the inflammation. However, the use of these topical drops may not be beneficial for some patients even with the

prolonged use and good compliance. In fact, some studies revealed that prolonged use of some topical eye drops may be toxic and can induce an allergic reaction.^{4,23} Therefore, surgical intervention might be needed in some patients with allergic conjunctivitis and punctal stenosis who do not show improvement even with the appropriate use of topical eye drops.

The use of bicanalicular silicon intubation as a treatment option for APS is considered a short procedure with low complications and limited invasiveness. In contrast to snip punctoplasty, it has the advantage that no incisions are made during this procedure, which may lead to restenosis and scarring in the future especially in patients with uncontrolled allergic inflammation.¹⁷ Furthermore, unlike other surgical options, placing these tubes in the lacrimal excretory system through both puncti (bicanalicular) helps to maximize the enlargement of both upper and lower puncta and to drain the tears while they are in place.

Silicon tube is known for long time recorded to be inert and well tolerated by lacrimal excretory system.²⁴ This material has been used in the field of ophthalmology in various forms such as contact lenses (silicon hydrogel), punctal plugs, silicon tubes, and others. Many studies showed that silicon in the form of (silicon hydrogel) contact lenses or Mini-Monoka stents are well tolerated by patients.^{25,26,27} However, there are

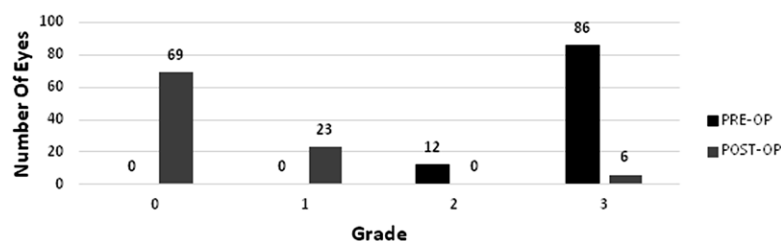


FIG. 3. This bar chart shows a comparison between patients in the preoperative period and six months after tube removal assessing the tears drainage with fluorescein using Zappia and Milder grading system.

some reported findings mentioned in the literature with the use of silicon tubes for the management of lacrimal excretory system disorders. Early tube prolapse is a known problem of such procedure. In the present study, early tube prolapse was reported in 4 patients. However, only 2 patients showed evidence of punctum restenosis because of the exacerbation of their allergic conjunctivitis symptoms few weeks after the prolapse of the tube.

Accumulation of debris and biofilms is another issue with the use of silastic tubes. Ali et al. addressed this issue nicely when they studied the presence and quantification of biofilms in silastic tubes following endoscopic dacryocystorhinostomy (DCR).²⁸ In their prospective study, they collected 9 silicone stents 4 weeks after endoscopic DCR. Although none of their patients showed signs of postoperative infection, all stents showed evidence of biofilms formation. Therefore, they concluded that further studies might be needed to show the impact on postoperative healing and ultimate outcome. Fortunately, in the current study, none of our patients showed signs of postoperative infection after 18.7 ± 5.9 weeks of tube retention.

Unfortunately, only few reports exist in the literature describing the effect of bicanalicular silicon intubation on the management of APS. However, such intervention showed to be effective in the treatment of punctal stenosis secondary to docetaxel (chemotherapeutic agent) as well as punctal stenosis in patients with trachoma.^{15,19}

Recently, a study was done to assess the use of MM stents in the treatment of patients with perennial allergic conjunctivitis and punctal stenosis.²⁷ It included 20 patients (40 eyes) with perennial allergic conjunctivitis who underwent MM stenting with an average of follow-up period of 18 months after the insertion of MM. Around 95% of patients showed significant improvement in their symptoms (38/40 eyes). Unfortunately, as mentioned by the authors, the study lacked a uniform system for categorizing symptoms severity, and the assessment was done only during the preoperative period while stent was on place and not after its removal. Although perennial allergic conjunctivitis is known to affect both eyes with the involvement of upper and lower puncti, the authors did not clarify whether MM stents were used only in the lower punctum or in both.

In the present study, 51 patients (98 eyes) were involved with a noticed female predisposition (F:M = 1.55:1), which is compatible with the literature.^{1,2,27} The mean age was 46.3 ± 8.3 years [ranging from 25 to 67]. All patients were assessed in the preoperative period, while tube was in place. After tube removal, the same 3 indices mentioned earlier were used. The current study showed that epiphora improved in 86 out of 98 eyes with a functional success rate of 87.75% around 6 months after tube removal (p value = <0.001). A study by Demerci et al. assessed the effect of bicanalicular silicon intubation on the treatment of partial lacrimal system obstruction not related to allergic conjunctivitis with resolution of epiphora symptoms in 79% of patients at 21 ± 9 months posttube removal.²⁹ Another study evaluating the use of bicanalicular silicon tubes for the treatment of patient with APS secondary to trachoma showed high patient satisfaction rates after 12 months of tube removal.¹⁹

The current study has some limitations, including the small sample size and the short follow-up period after tube removal. The treatment recommendations of punctal stenosis in the setting of allergic conjunctivitis are limited in the literature. Prospective randomized studies with longer follow-up period and larger sample size comparing different treatment options for APS especially in patients with allergic conjunctivitis are needed.

In conclusion, bicanalicular silicone intubation seems to be well tolerated and effective in the management of APS or

obstruction secondary to allergic conjunctivitis. It showed an excellent anatomical and functional success rates 6 months after tube removal. Silicon tubes seem to be well tolerated in patients with allergic conjunctivitis.

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