

Long-term outcomes of revision endoscopic dacryocystorhinostomy aided by 4-mm coronary balloon catheter dacryoplasty

Mohammad Javed Ali, Nandini Bothra

Our purpose was assess the long-term efficacy of 4-mm coronary balloon catheter dacryoplasty in revision endoscopic dacryocystorhinostomy (RevEnDCR). This retrospective interventional case-series was performed for patients who underwent RevEnDCR aided by a 4-mm coronary balloon catheter (CBC) dacryoplasty. The indications for the surgery were previously failed DCRs by external or endoscopic approach where the ostium showed near total cicatrization with or without the presence of organized granuloma threatening the internal common opening (ICO). The coronary balloon (4 × 10 mm, SPALNO, Cardiomac, Haryana, India) with the guidewire was used and a minimum of >12 months of follow-up was considered for analysis. Ten lacrimal systems of eight patients with mean age of 48.8 years underwent CBC-assisted revision endoscopic DCR. Of the 10 failed DCRs, 6 had a previous external approach DCR and 4 were endoscopic DCRs. Grossly stenosed ostium with near total cicatricial closure were noted in half of the patients (50%, 5/10) while the remaining half, in addition, showed organized granulomas threatening the ICO. The surgical technique using CBC was found to be minimally invasive, easy to perform with multiple advantages like uniform clearance of the area in front of ICO and more predictable lacrimal sac flaps. At a mean follow-up of 20 months, anatomical and functional success were achieved in 90% (9/10) of the eyes. We conclude that coronary balloon catheter-assisted revision endoscopic DCR is a minimally invasive and viable alternative in select group of patients of failed DCR with near total cicatrization or organized granulomas threatening ICO.

Key words: Balloon dacryoplasty, dacryocystorhinostomy, endoscopic DCR, failed DCR, lacrimal

Balloon dacryoplasty refers to a set of minimally invasive lacrimal drainage procedures that utilize variable balloon catheters for a variety of indications in pediatric and adult patients.^[1] Primary balloon-assisted dacryocystorhinostomy has been described utilizing the 9-mm balloon (no longer manufactured) or traditional 3 mm and 5 mm lacrimal balloon catheters.^[2-5] However, the same is not true for revision endoscopic DCRs (RevEnDCR), where only a single study has looked at the outcomes with a 3 mm lacrimal balloon catheter in patients with internal ostium stenosis following an endoscopic DCR.^[6] The use of balloon dacryoplasty in near total ostium cicatrization with or without internal common opening granulomas has not been studied before. Neither are the long-term outcomes known in such patients.

Anterograde transluminal coronary angioplasty balloon catheters (CBC) have shown excellent outcomes in congenital nasolacrimal duct obstructions.^[7] As compared to the traditional balloons, coronary ones offer several advantages that include wide spectrum of balloon lengths and diameters, compliant and semi-compliant varieties, very high rate burst pressure and enhanced safety, presence of guide-wire and are economically feasible option.^[7] However, no report exists on their usage in revision endoscopic DCR's. The present

work demonstrates a surgical technique of CBC-assisted RevEnDCR and further assessed their long-term surgical outcomes.

The manuscript adhered to the Tenets of the Declaration of Helsinki and was approved by the Institutional Ethics Committee. A retrospective chart review was performed on patients who underwent revision endoscopic dacryocystorhinostomy (RevEnDCR) aided by a 4-mm coronary balloon catheter (CBC) dacryoplasty. The indications for the surgery were previously failed DCRs by external or endoscopic approach, where the ostium showed near total cicatrization with or without the presence of organized granuloma threatening the internal common opening (ICO). All the patients were symptomatic for epiphora with a non-patency on irrigation and a soft stop at the ICO. The coronary balloon (4 × 10 mm, SPALNO, Cardiomac, Haryana, India) with the guidewire was used and a minimum of >12 months of follow-up was considered for analysis. Specific surgical parameters and technique were employed and the variables assessed include patient demographics, clinical presentation, indications, surgical technique, recurrences, and outcomes.

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Cite this article as: Ali MJ, Bothra N. Long-term outcomes of revision endoscopic dacryocystorhinostomy aided by 4-mm coronary balloon catheter dacryoplasty. Indian J Ophthalmol 2021;69:751-4.

Access this article online

Website:
www.ijo.in

DOI:
10.4103/ijo.IJO_1948_20

Quick Response Code:



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Received: 13-Jun-2020

Revision: 04-Aug-2020

Accepted: 09-Aug-2020

Published: 17-Feb-2021

Surgical Technique

All surgeries were performed under general anesthesia. Endoscopic surgery was performed with Image 1 HD system (Karl Storz, Tuttlingen, Germany) using the 4 mm, 0 and 30° telescopes. Nasal decongestion was achieved with infiltration of the lateral wall and the head of middle turbinate (MT) with 2% xylocaine with 1:80,000 adrenaline followed by nasal packing with tailored Merocel (Medtronic, Dublin, Ireland) sponges soaked in oxymetazoline (0.05%) for 5–10 min. The position and the initial surgical procedure were as described earlier for a revision endoscopic DCR^[8] with an additional step for coronary balloon catheter-assisted dacryoplasty.

In brief, a sharp no 15 knife was used to fashion a posterior-based nasal mucosal flap anterior to the MT [Fig. 1a]. It is important to raise this flap on the bone, so as to achieve a clear surgical plane before continuing to raise it over the scarred anastomosis of the lacrimal sac and nasal mucosa. Once the scarred tissue was encountered, the blade was used to carefully and precisely separate the scarred nasal mucosa from the underlying scarred lacrimal sac [Fig. 1a]. Where needed, the superior osteotomy of the thick frontal process of maxilla was performed using a 2.5 mm, 20° curved high-speed diamond DCR burr (Medtronic Xomed, Jacksonville, FL, U.S.A.) to achieve the complete exposure of the entire scarred lacrimal sac [Fig. 1b]. A thorough endoscopy assessment is performed of the remnant lacrimal sac. Under constant endoscopy visualization, a Sisler's trephine and subsequently a Bowman's probe is passed carefully up to the internal common opening and with a gentle manoeuvre, the focal scar tissue in front of the ICO was trephined and dislodged [Figs. 1a and 2c]. The protective sheath over coronary balloon catheter (4 × 10 mm, SPALNO, Cardiomac, Haryana, India) was removed and the long guidewire was pulled back to an extent that only 1–2 mms of it remained beyond the balloon segment. The uninflated catheter was now introduced easily through upper punctum into the grossly stenosed or cicatrized ostium and continued into the nasal cavity [Fig. 1c]. The end-point was the visibility of 2/3rd of the balloon segment within the nasal cavity [Figs. 1c and d]. The other end of the long catheter is secured by a Luer-lock to the inflation device and the balloon is slowly inflated to 8 ATM for 90 s, deflated and again re-inflated at 8 ATM for 60 s [Figs. 1d, e and 2d]. During this manoeuvre, the surgeon would be able to appreciate the circumferential separation of the scarred lacrimal sac flaps away from the ICO. The deflated balloon is gently withdrawn [Fig. 1e] and the full extent of the neo-ostium with a clearly visible ICO can be appreciated [Figs. 1f and 2e]. A fluorescent dye is irrigated to assess free-flow into the nasal cavity [Figs. 1g and 2f]. Occasionally the scarred and separated lacrimal sac flaps may need releasing cuts to achieve an open book configuration. The ostium was subjected to 0.02 mg% of mitomycin C which was applied topically as well as the circum-ostial injection (COS-MMC) as per earlier published protocols [Fig. 2g].^[9,10] The canaliculi were then stented with bicanalicular silicone stents [Figs. 1h, 2g, and h]. The sac flaps were reflected completely and 360° mucosa to mucosa anastomosis between the nasal and lacrimal sac flaps was achieved to promote healing by primary intention [Fig. 1h].

The patients who demonstrated ICO threatening granulomas or a bang-on granulomas were first managed as per earlier

published protocol.^[11] In brief, the granuloma underwent an endoscopic assessment to assess their mobility, extent and the base [Fig. 2a]. Subsequently, they were excised [Fig. 2b] and their base was subjected to silver nitrate cautery followed by 0.1–0.2 ml of Triamcinolone acetate (40 mg/ml) injection [Fig. 2c]. This was followed by the surgical technique of CBC-assisted RevEnDCR as described above [Fig. 2d-h].

Postoperative medications included Xylometazoline (0.05%) nasal drops, budesonide nasal spray (once daily), and antibiotic-steroid eyedrops for a period of 2 weeks post-surgery. Stent extubation was performed at 4 weeks. Primary outcome measures were anatomical success; defined as patent lacrimal ostium on irrigation; and functional success, defined as resolution of epiphora.

Ten lacrimal systems of eight patients with mean age of 48.8 years (range: 28–70 years) underwent CBC-assisted revision endoscopic DCR. All the patients presented with epiphora and 30% (3/10) were accompanied by discharge. Of the 10 failed DCRs, 6 had a previous uneventful external approach DCR and 4 were uneventful endoscopic DCRs. All these patients were diagnosed as primary acquired nasolacrimal duct obstruction (PANDO) prior to the primary DCR surgery and were symptomatic for a mean duration of 7.4 months (range: 1–12 months). Grossly stenosed ostium with near total cicatricial closure were noted in half of the patients (50%, 5/10) while the remaining half, in addition, showed organized granulomas threatening the ICO [Figs. 1 and 2]. The surgical technique using CBC was found to be minimally invasive, easy to perform with multiple advantages like uniform clearance of the area in front of ICO and more predictable fashioning of scarred lacrimal sac flaps. At a mean follow-up of 20 months (range: 16–24 months), anatomical and functional success were achieved in 90% (9/10) of the eyes. Anatomical and functional failure was noted in one patient who remained symptomatic post-operatively. Endoscopy evaluation showed reclosure of the ostium with complete cicatricial tissue. The patient declined the option for further intervention.

Discussion

The current study demonstrated that the use of coronary balloon catheter-assisted revision endoscopic DCRs are less invasive with better clearance of scar tissues in and around the internal common opening. The anatomical and functional outcomes were excellent and were maintained in long term. In addition, the coronary balloons were far economical than the traditional balloons with wider choices.

The use of balloon dacryoplasty for primary DCRs has demonstrated the techniques to be simple, less invasive, minimal manipulation, can be performed under local anesthesia with shorter operating time, less postoperative pain and better safety profile.^[4,5] However, such data on revision endoscopic DCRs is limited to a single study, where the authors used traditional 3 mm lacrimal balloon catheter for revising their internal ostium stenosis following a routine endoscopic DCR. They defined internal ostium stenosis as tiny DCR ostium on nasal endoscopy in symptomatic patients along with resistance to flow of fluid on irrigation and minimal dye passage through the ostium. They studied 19 lacrimal systems of 18 consecutive patients and found that at a mean follow up of 20 months (range: 3–54 months),

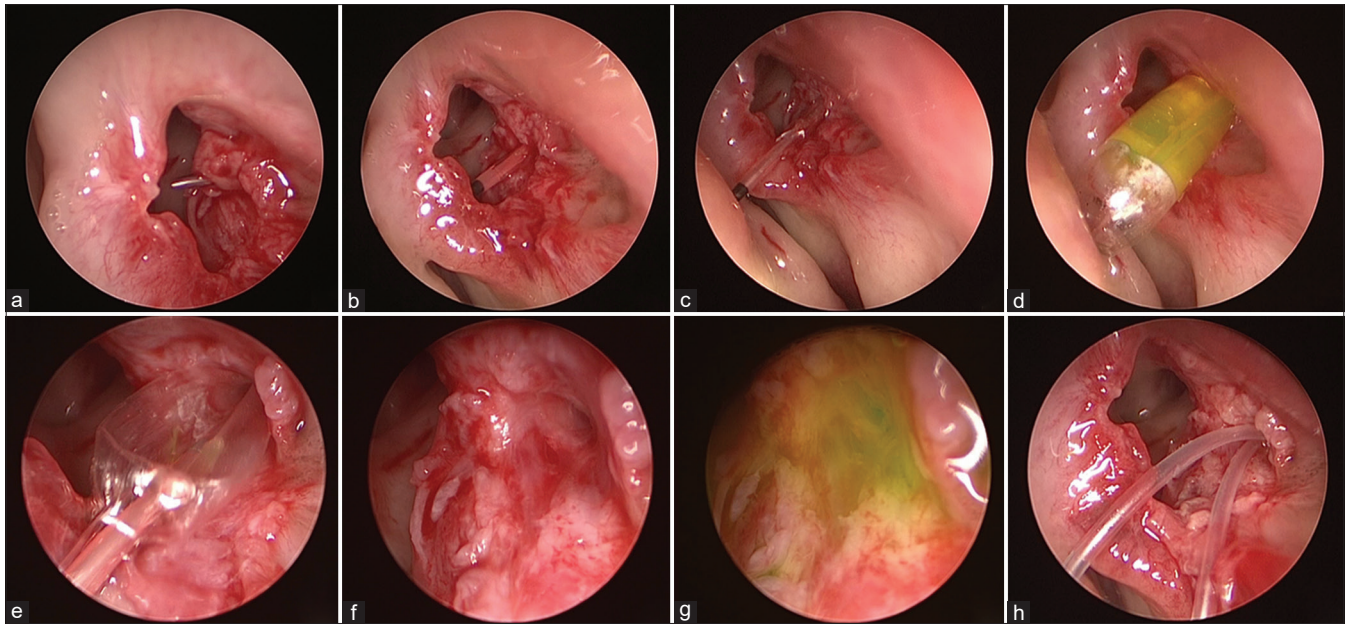


Figure 1: Coronary Balloon Assisted Revision Endoscopic DCR: Endoscopy image of the left nasal cavity demonstrating complete exposure of the ostium following removal of the cicatrix (a). Note the Bowman’s probe at the internal common opening (ICO) (a). Endoscopy image showing the initial placement of the uninflated coronary balloon catheters (b) and adjusting in a way that 2/3 of it is clearly visible in the nasal cavity (c). The inflated (d) and the deflated state (e) during the balloon dacryoplasty. Endoscopy image showing the well cleared neo-ostium and a regular and large ICO (f). Irrigation of the fluorescein dye showing patent ostium (g) followed by intubation and mucosa to mucosa approximation (h)

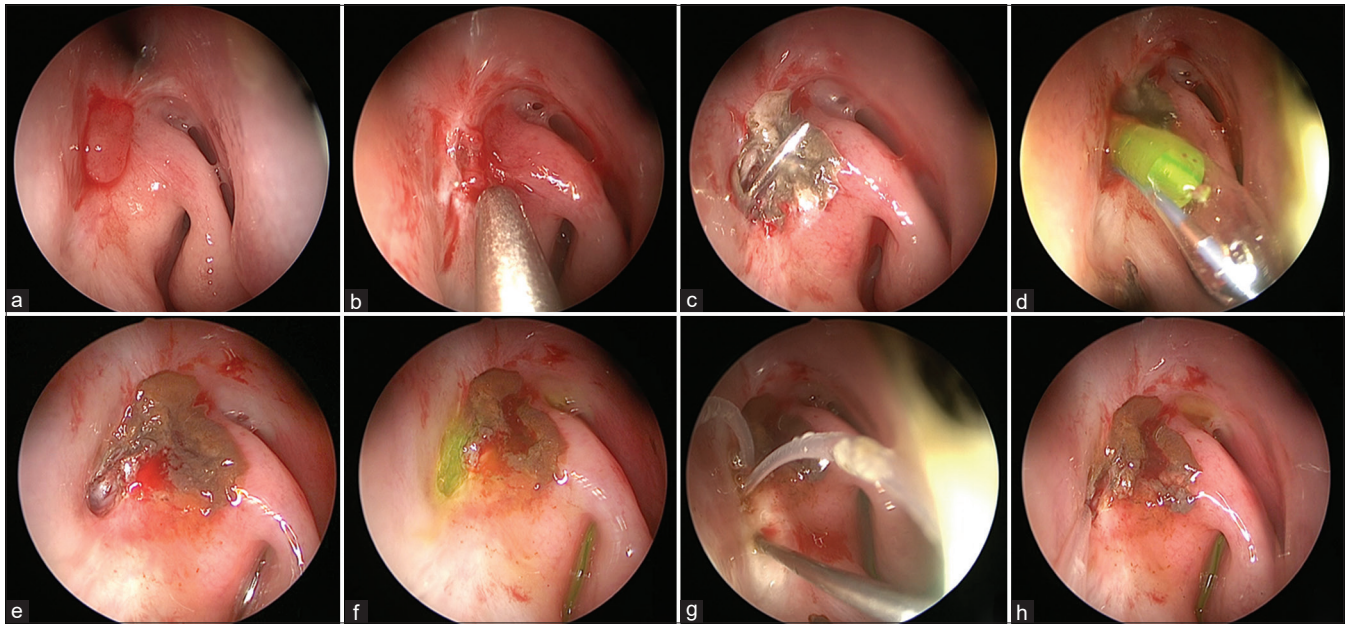


Figure 2: Coronary Balloon Assisted Revision Endoscopic DCR: Endoscopy image of the right nasal cavity demonstrating a large granuloma covering the whole of the previous ostium and threatening the ICO (a). Image following excision of the granuloma demonstrates a near total cicatricial closure of the ostium (b). Image following silver nitrate cautery to the base of the granuloma. Also note the Bowmans probe in the ICO (c). Active balloon dacryoplasty being performed (d) and the neo-ostium following it (e). Patency of the ostium upon fluorescein staining (f) followed by intubation and circumostial mitomycin C injection around the neo-ostium (g). Endoscopy image at the end of the surgery (h)

anatomical and functional success were achieved in 84% and 74%, respectively. In comparison, the current study included more complex causes of failures like near total cicatrization with or without ICO threatening granulomas. The choice of a 4 mm balloon was considered to keep a balance between the needed clearance of the scarred tissue in front of the ICO and

the safety of ICO. The earlier fixed use of either 3 mm or 5 mm traditional balloons is not sacrosanct in the absence of definitive evidence.^[7] The minimum follow-up in the present study was 16 months as compared to 3 months in the earlier one. The enhanced outcomes in the present study, in spite of inclusion of more complex cases, can be attributed to early recognition

and management of granulomas, the advantages of coronary balloons over traditional balloons and the use of topical and circumstrial injection of MMC, full-length sac marsupialization and 360° mucosa to mucosa approximation to promote primary intention healing. The stents were retained for a duration of 4-weeks since now there is evidence that ostium shrinkage does not happened beyond 4-weeks in well performed DCR's^[12] and also because stents tend to harbour significant biofilms beyond this time.^[13]

Cicatricial closure of the DCR ostium was one of the common causes of failed DCR^[14] and can present as classical circumferential or non-circumferential closure of the ostium due to progressive laying of fibrosis and scarring.^[15] They can occasionally present as mini-ostia or a pseudocicatricial process and needs to be differentiated from true cicatrization.^[16] Granulomas are not very uncommon and 8 variants of post-DCR granulomas are known. Although the "peri-ICO" and "bang-on" variants constitute around 10% of all granulomas, they nevertheless can get organized and block the ICO area leading to failure of the DCR. Based on their location and extent, various modalities and algorithms have been described to manage them effectively,^[11] as also has been shown in the present study.

The limitations of this study include smaller sample size, select patients of failed DCR and the learning curve of the technique. However, its strength lies in providing the proof of principle on the efficacy of coronary balloons in RevEnDCR. Its use for mixed spectrum of failed cases and during external revision DCR may help in further establishing this technique as a comprehensive and better armed alternative to the routine revision dacryocystorhinostomy.

Conclusion

Coronary balloon catheter-assisted revision endoscopic DCR is a minimally invasive and economically viable alternative in select group of patients of failed DCR with near total cicatrization or organized granulomas threatening ICO. Its use in revision endoscopic DCRs for indications other than those mentioned in the study would provide details for expanding the utility of this technique.

Financial support and sponsorship

Prof. Ali receives royalties from Springer for his treatise 'Principles and Practice of Lacrimal Surgery (2nd ed.)' and 'Atlas of Lacrimal Drainage Disorders'. Funding: Hyderabad Eye Research Foundation.

Conflicts of interest

There are no conflicts of interest.

References

1. Ali MJ, Naik MN, Honavar SG. Balloon dacryoplasty: Ushering the new and routine era in the minimally invasive lacrimal surgeries. *Int Ophthalmol* 2013;33:203-10.
2. Silbert DI, Matta NS. 5 mm and 9 mm balloon-assisted dacryocystorhinostomy. In: Ali MJ, editor. *Principles and Practice of Lacrimal Surgery*. 2nd ed. Singapore: Springer Nature; 2018. p. 253-70.
3. Winebrake JP, Mahrous A, Kacker A, Tabae A, Levinger JJ, Pearlman AN, *et al*. Postoperative bioresorbable chitosan-based dressing for endoscopic middle meatal dacryocystorhinostomy with balloon dilation. *Ear Nose Throat J* 2019. doi: 10.1177/0145561319866822.
4. Ragab SM, ek-Koddousy MS, Badr M. Endocanalicular, high-pressure balloon catheter, endoscopic dacryocystorhinostomy: A randomized controlled trial. *Otolaryngol Head Neck Surg* 2011;145:683-8.
5. Mishra AK, Nilakantan A, Mishra S, Mallick A. Comparison of balloon dacryocystorhinostomy with conventional endonasal endoscopic dacryocystorhinostomy for relief of acquired distal nasolacrimal drainage obstruction and its impact on quality of life: A prospective, randomized, controlled study. *Med J Armed Forces India* 2018;74:255-63.
6. Lee A, Ali MJ, Li EY, Wong AC, Yuen HK. Balloon dacryoplasty in internal ostium stenosis after endoscopic dacryocystorhinostomy. *Ophthalmic Plast Reconstr Surg* 2014;30:7-10.
7. Bothra N, Gupta N, Nowar R, Ali MJ. The use of anterograde percutaneous transluminal coronary angioplasty balloons in congenital nasolacrimal duct obstruction: A cost-effective alternative to the traditional dacryoplasty balloons. *Ophthalmic Plast Reconstr Surg* 2020;36:302-4.
8. Ali MJ, Psaltis AJ, Wormald PJ. Long-term outcomes in revision powered endoscopic dacryocystorhinostomy. *Int Forum Allergy Rhinol* 2014;4:1016-9.
9. Ali MJ, Mariappan I, Maddileti S, Ali MH, Naik MN. Mitomycin C in dacryocystorhinostomy: The search for the right concentration and duration – A fundamental study on human nasal mucosa fibroblasts. *Ophthalmic Plast Reconstr Surg* 2013;29:469-74.
10. Kamal S, Ali MJ, Naik MN. Circumstrial injection of mitomycin C (COS-MMC) in external and endoscopic dacryocystorhinostomy: Efficacy, safety profile and outcomes. *Ophthalmic Plast Reconstr Surg* 2014;30:187-90.
11. Ali MJ, Wormald PJ, Psaltis AJ. The dacryocystorhinostomy ostium granulomas: Classification, indications for treatment, management modalities and outcomes. *Orbit* 2015;34:146-51.
12. Ali MJ, Psaltis AJ, Ali MJ, Wormald PJ. Endoscopic assessment of the dacryocystorhinostomy ostium after powered endoscopic surgery: Behaviour beyond 4 weeks. *Clin Exp Ophthalmol* 2015;43:152-5.
13. Ali MJ, Baig F, Lakshman M, Naik MN. Scanning electron microscopic features of extubated monoka stents. *Ophthalmic Plast Reconstr Surg* 2017;33:90-2.
14. Dave TV, Mohammed FA, Ali MJ, Naik MN. Etiologic analysis of 100 anatomically failed dacryocystorhinostomies. *Clin Ophthalmol* 2016;10:1419-22.
15. Ali MJ, Mishra DK, Baig F, Naik MN. Histopathology, immunohistochemistry, and electron microscopic features of a dacryocystorhinostomy ostium cicatrix. *Ophthalmic Plast Reconstr Surg* 2016;32:333-6.
16. Ali MJ, Psaltis AJ, Wormald PJ. Dacryocystorhinostomy ostium: Parameters to evaluate and DCR ostium scoring. *Clin Ophthalmol* 2014;8:2491-9.