

## Balloon catheter dilatation in Otorhinolaryngology

Mahmoud Reda Essa El Malah MD<sup>1</sup>, Ahmed Mohammed Abdelghany MD<sup>1</sup>, Ahmed Shehata El said MD<sup>1</sup>, Galal Elsayed Hussein Eldeeb MSC<sup>2</sup>

<sup>1</sup> Department of Otolaryngology, Benha Faculty of Medicine, Benha, Egypt.

<sup>2</sup> Free medical postgraduate student.

[dreldeebonline@gmail.com](mailto:dreldeebonline@gmail.com)

**Abstract:** Over the years, various tubal surgical techniques have been introduced eg: laser tuboplasty and bypass surgeries but most of which characterized by invasiveness and possible damage to the lining tubal mucosa. These treatments show insufficient results. The introduction of microsurgical and endoscopic techniques as balloon catheter dilatation is a promising option for chronic tubal dysfunction. Transferring this technology in otorhinolaryngology for the dilatation of the obstructed tubes such as Eustachian tube, paranasal sinuses ostium, salivary gland ducts, nasolacrimal duct and others opens the way for more treatment options, especially for chronic tubal dysfunctions. The objective of this article is to review and highlight the effectiveness of using balloons for dilatation of tubal and ostial obstructions in otorhinolaryngology.

[Mahmoud Reda Essa El Malah, Ahmed Mohammed Abdelghany, Ahmed Shehata El said, Galal Elsayed Hussein Eldeeb. **Balloon catheter dilatation in Otorhinolaryngology.** *Nat Sci* 2019;17(10):112-115]. ISSN 1545-0740 (print); ISSN 2375-7167 (online). <http://www.sciencepub.net/nature>. 15. doi: [10.7537/marsnsj171019.15](https://doi.org/10.7537/marsnsj171019.15).

**Keywords:** balloon, catheter, dilatation, duct stenosis.

### 1. Introduction:

Disorders in tube function often include a chronic defect in function in which the regular ventilation, aeration and self-cleaning capability are affected. The results of these disorders lead to development of chronic inflammatory changes resulting in subsequent complications. Historically many different treatments have been used to manage tubal obstruction either medical or surgical eg: laser tuboplasty and bypass surgeries but most of which characterized by invasiveness and possible damage to tubal mucosal lining. These treatments show insufficient results. The introduction of microsurgical and endoscopic techniques as balloon catheter dilatation is a promising option for chronic tubal dysfunction. Balloon tuboplasty is a new technique in which insertion of small balloon to wide or expands the tubal orifice and drainage pathways to regain drainage and promote healing [1].

### 2. Material and methods:

The data in this review article were collected from different papers which published in different medical journal by those authors who approved this procedure. For the performance of the balloon catheter, traditional functional endoscopic surgery materials are required, as well as specific tools. Endoscopes sets of 0, 30, 45 or 70 degrees may be used. In addition, a set of guide-catheters, flexible guide-threads, flexible balloon-catheters, washing catheters and pump for the balloon insufflation with manometer are necessary. The BCD procedure was offered to patients after subjective, physical and

otorhinolaryngological examinations, all of the procedures followed were in accordance with institutional ethics committee approval.

### 3. Results:

There are a promising results regard to balloon catheter dilatation published over last years suggested the success of this technique for examples:

The results of a prospective multicenter analysis published by [2], they found that initial evidence of the safety and effectiveness of balloon sinuplasty (for examples) has been encouraging. Results published by [3], found impressive symptoms improvement in patients' symptoms underwent balloon catheter sinuplasty in ESS with follow up for 2 years, also [4] reported using dilating balloon catheters for the surgical treatment of 31 immunocompromised and critically ill patients with acute rhinosinusitis. These immunocompromised patients had associated conditions such as thrombocytopenia, neutropenia, and anemia. They concluded that these patients may have been treated as successfully with standard through cutting instrumentation; the balloon catheter offered a safe, less invasive and effective surgical option with potentially less risk of bleeding related complications. Another result published by [5], suggest that endoscopic frontal sinusotomy assisted with dilation via a suitable sized Foley catheter is a safe, less invasive and cost effective option in management of chronic frontal sinusitis and may be a valuable treatment for otorhinologist working in the developing world.

#### 4. Discussion:

The treatment principle of balloon dilatation in otorhinolaryngology is similar to that of balloon dilatation in vascular stenosis [6]. It is assumed that this technique will decrease trauma to mucosal lining when compared with traditional surgical techniques, leading to decrease the formation of fibrosis and restenosis at obstructed ostia [1].

Transferring this technology in otorhinolaryngology for the dilatation of the obstructed tubes such as Eustachian tube, paranasal sinuses ostium, nasolacrimal duct, salivary gland ducts and others opens the way for more options of treatment, especially for chronic tube dysfunction [6].

Applications of balloon catheter dilatation in otorhinolaryngology:

Balloon catheter sinuplasty is a recent procedure for performing functional endoscopic sinus surgery that further decrease mucosal injury and advances us toward our optimal aim of improving function with maximal mucosal protection without cutting bone or removing tissue using balloon catheter system. BCS can be used alone as a sole intervention for chronic rhinosinusitis either one or more sinus affected, or in association with more conventional ESS as a hybrid intervention [7]. Indications for balloon sinuplasty are the same for performing endoscopic sinus surgery. Balloon sinuplasty is indicated to manage patients with chronic sinusitis after failure of other options [8]. Balloon sinuplasty appears to be less invasive, effective, a safe treatment to remove paranasal sinus ostial occlusions, low recurrence rates and doesn't limit future treatment options if a patient has progressive disease. A potential limitation of BCS is that the instruments used in this technique can't be used again, and the cost of the disposable materials may increase the total cost of the technique [9]. Multiple studies have proven the success of the technique in adults and proved that the procedure is safe and feasible in children who had CRS and failed medical therapy. While use of any surgical instrument involves some risk [10].

Balloon catheter dacryoplasty is less invasive lacrimal procedure in which especially designed balloons are used directed to different points in the lacrimal system for variety indications instead of dacryocystorhinostomy in treatment of nasolacrimal duct obstruction either complete occlusion or partial obstructions [11]. Advantages of balloon catheter dacryoplasty (over the external or endoscopic DCR) include: less invasive procedure, less time consuming and minimal or no bleeding, no need for powered endoscopic instruments, less morbidity postoperatively, early recovery and higher rates of success [12].

Many different treatments have been tried to treat ETD. Either medical or surgical these are systemic antihistamines and corticosteroids, intranasal corticosteroids and decongestants, noninvasive autoinflation manoeuvres, ET catheterisation, bougie dilatation, drilling of the bone, laser tuboplasty and other invasive treatments. These treatments have not shown enough evidence of success [13]. BET involves the using a specially designed balloons to widen the cartilaginous portion of the Eustachian tube [14]. This method has proven to be feasible, safe and rapid. Balloon tuboplasty gives better option for graft healing and retains the integrity of middle ear [15].

Balloon sialoplasty is a novel nonsurgical option management of obstruction due to narrowing of salivary duct [16]. Stenosis can be treated with balloon catheters through endoscopic vision. The indications for balloon catheter sialoplasty are all salivary gland swellings of unclear origin including, swelling as associated with stones, inflammation, stenosis, or cancers and other inflammations that may cause obstruction of the ductal system with failure of conservative measures such as gland massage or as alternative to traditional surgical methods which are associated with significant morbidity, such as wound infection and hematoma [27]. With balloon sialoplasty no need for general anesthesia and has no complications had been reported. Balloon catheter sialoplasty preserves the gland also it is a simplest, less invasive, and clinically effective method of relieving symptoms of salivary glands duct narrowing [18].

Bronchoscopic balloon dilatation is a safe and rapid method to retain airway diameter in cases of laryngotracheal stenosis. BBD can be used as a sole intervention or in association with other options such as laser resection, electrocautery and cryotherapy [19]. BBD can be used in the treatment of stenosis of subglottic area in all age groups, and decrease the need for open laryngeal surgery by 70–80% [20]. The major benefits of BBD are low morbidity and mortality rates than other traditional methods [21].

Endoscopic balloon dilatation for esophageal stenosis, a new non-surgical treatment modality gives a new hope in the children where the traditional methods may be very traumatic. Dilatation using a balloon is better than other traditional options as a bougie as the force of expansion is applied radially and equally at the stenosis site, whereas a bougie exerts a shearing axial force that lead to a greater degree of injury and so increases the rates of perforation [22]. Recent researches have reported that this technique is especially effective for relieving congenital rather than acquired esophageal stenosis in children [23].

A balloon catheter dilatation for the dilation of choanal atresia or stenosis is a new method alternative to traditional surgical approaches which are invasive and associated with large wounds and tissue defects, necessitating intensive postoperative care [24]. The advantage of this method is minimal trauma to surrounding tissues as dilatation occurs without any traditional interventions, such as tissue removal, incisions and suturing [25].

Other uses of balloon catheter in ORL:

**Balloon catheter in the management of epistaxis:** Posterior nasal packing with balloon using double balloon approach or Foley catheter approach is an effective method in treatment of epistaxis when anterior packing fails, high suspicion of posterior epistaxis and patient with bleeding diathesis [26].

**Balloon catheter in frontal bone fracture:** Using of endoscopic balloon for reduction of fractures of anterior frontal sinus is less invasive surgical technique. The goal of this procedure is mucosal preservation with normal anatomy instead of the traditional procedures of cranialization or obliteration of frontal sinus [27].

**Balloon catheter in zygomatic arch fracture:** Using Foley's catheter balloon in fixation of isolated zygomatic arch fracture after reduction is simple and relatively easy with minimal or no side effects. Also, the settings needed for this procedure (Foley's catheter and radiopaque dye) are available already. The site of the inflated balloon that is considered to provide stabilization temporary to the reduced isolated zygomatic arch can be assessed easier [28].

**Balloon catheter for trigeminal neuralgia:** Pharmacotherapy is generally the mainstay of treatment of TN. If medical treatment fails, surgical options are available. Recently, minimally invasive percutaneous techniques include percutaneous micro balloon compression (PMC) is indicated in old ages patients or patients who unable to undergoes to invasive techniques because it has a very low associated morbidity and does not injure the gasserian ganglion. Because of micro invasion, the technique is more physiological without leading to a loss of facial sensory. Shorter time of the operation with PMC when compared with MVD, this is expected as percutaneous approach is less invasive and need much lesser time when compared with other techniques as retrosigmoid lateral skull base approach needed for MVD [29].

### Conclusion:

BCD is an endoscopic tool and may be used with other medical therapies and/or surgical techniques. It does not limit future treatment options if a patient has progressive disease. BCD has been proved to be safe, effective and less invasive in terms of distortion of the original anatomy and mucosal disruption, thereby

minimizing potential for synechiae formation and ostial stenosis and decreasing the need for postoperative debridements, when compared to traditional techniques which characterized by the invasiveness of these methods and possible damage to the nasotubal lining mucosa. Last but not least, balloon catheter can be used in the management of epistaxis, patients with frontal bone fracture, stabilization of the isolated zygomatic arch fracture and in patients with trigeminal neuralgia. The initial evidence of the safety and effectiveness of BCD has been encouraging. Further researches are needed establish the place of this type of surgery in management of tubal obstruction and to compare balloon dilation and other surgical techniques.

### References:

1. Johnson J, Broniatowski M and Eisele D (2002): Maintenance manual for life long learning, 2nd edn.
2. Bolger WE, Brown CL, Church CA, Goldberg AN, Karanfilov B, Kuhn FA and et al., (2007): Safety and outcomes of balloon catheter sinusotomy: a multicenter 24-week analysis in 115 patients. *Otolaryngol Head Neck Surg* 137:10–20.
3. Weiss RL, Church CA and Kuhn FA (2008): Long-term outcome analysis of balloon catheter sinusotomy: two-year follow-up. *Otolaryngol Head Neck Surg.* 2008; 139: S38-S46.
4. Wittkopf ML, Becker SS and Duncavage JA (2009): Balloon sinuplasty for the surgical management of immunocompromised and critically ill patients with acute rhinosinuitis. *Otolaryngol head neck surg* 2009,140:596–598.
5. Askar MH, Hossam S. El-Sherif, Mohamed O. Tomoum, and Brent A. (2015): Use of a Foley catheter balloon as a tool during endoscopic frontal sinus surgery in a resource-poor environment. *Annals of Otolology, Rhinology & Laryngology* 2015, Vol. 124(3) 194–197.
6. Aroon Kamath (2012): Use of balloon and balloon like devices in Medicine. *Doctors Lounge Website.* Available at: [http://www.doctorslounge.com /index. php/blogs/ page/ 13962](http://www.doctorslounge.com/index.php/blogs/page/13962). Accessed January 12 2012.
7. Peter F. Svider, Spencer Darlin, Michael Bobian, Vibhav Sekhsaria, Richard J. Harvey, Stacey T. Gray and et al. (2018): Evolving trends in sinus surgery: What is the impactof balloon sinus dilation? *Laryngoscope*, 128:1299–1303, 2018.
8. Levine HL, Sertich AP II and Hoisington DR (2008): Multicenter registry of balloon catheter sinusotomy outcomes for 1,036 patients. *Ann Otol Rhinol Laryngol*; 117(4): 263-270.

9. Melroy CT (2008): The balloon dilating catheter as an instrument in sinus surgery. *Otolaryngol Head Neck Surg* 2008;139:S 23–S 26.
10. Ramadan HH, McLaughlin K and Josephson G (2010): Balloon catheter sinuplasty in young children. *Am J Rhinol Allergy*; 24(1): e54-e56.
11. Javed M Ali (2013 ): Balloon dacryoplasty: ushering the new and routine era in minimally invasive lacrimal surgeries. *Int Ophthalmol*. 2013.
12. Silbert DI and Matta NS (2010): Outcomes of 9 mm balloon assisted endoscopic dacryocystorhinostomy: Retrospective review of 97 cases. *Orbit*; 29:25 28.
13. Gluth MB, Mc Donald DR, Weaver AL, Bauch CD, Beatty CW and Orvidas LJ (2011): Management of Eustachian tube dysfunction with nasal steroid spray: a prospective, randomized, placebo Controlled trial. *Arch Otolaryngol Head Neck Surg*.2011; 137: 449-455.
14. Svider PF, Darlin S, Bobian M, Sekhsaria V, Harvey RJ, Gray ST and et al. (2018): Evolving trends in sinus surgery: What is the impact of balloon sinus dilation? *Laryngoscope*. 2018 Jun; 128 (6):1299-1303.
15. Micucci S, Keschner DB and Liang J. (2018): Eustachian tube balloon dilation: Emerging: Practice patterns for a novel procedure. *Ann Otol Rhinol Laryngol*. 2018 Nov.
16. Makdissi J, Feinberg L and Roy A. (2017): Is there a role for ultrasound-guided balloon sialoplasty technique in salivary gland structures. *Dentomaxillofac Radiol*. 2017 Dec; 46 (8):20170088. Epub 2017 Oct 6.
17. Marchal F (2005): Salivary gland endoscopy: new limits *Rev Stomatol Chir Maxillofac* 106(4):244–249.
18. Brown A, Shepherd D and Buckenham T (1997): Per oral balloon sialoplasty: Results in the treatment of salivary duct stenosis. *Cardiovasc Intervent Radiol* 20:337–342.
19. Zongming Li, Hongwu Wang and Gauri Mukhiya (2018): Benign tracheal/bronchial stenosis. *Airway stenting in interventional radiology* pp 81-117.
20. Kim JH, Shin JH, Song HY, Shim TS, Ko GY, Yoon HK and et al., (2007): Tracheobronchial laceration after balloon dilation for benign strictures: incidence and clinical significance. *Chest*, Vol.131, No.4, pp. 1114-1117.
21. Masayuki Tanahashi, Hiroshi Niwa, Haruhiro Yukiue, Eriko Suzuki, Hiroshi Haneda, Naoko Yoshii and et al., (2012): Bronchoscopic balloon dilation for benign tracheobronchial stenosis, *Global Perspectives on Bronchoscopy*, Dr. Sai P. Haranath (Ed.), ISBN: 978-953-51-0642-5.
22. Swagata Khanna and Subhash Khanna (2008): Management of benign oesophageal strictures in children. *Indian J. Otolaryngol. Head Neck Surg* (July–September 2008) 60:218–222.
23. Hogan W (2013): Dilation (UES, Esophagus, LES) Balloon Dilations, *Bougies*. Frombook *Nascent oral phase* (pp.859-875)
24. Cedin AC, Atallah AN, Andriolo RB, Cruz OL and Pignatari SN (2012): Surgery for congenital choanal atresia. *Cochrane Database of Systematic Reviews* 2012.
25. Folz B. J and Konnerth C. G (2011): Endoscopically guided balloon dilatation of recurrent choanal stenosis. *Advances in endoscopic surgery*, Prof. Cornel Iancu (Ed.), ISBN: 978-953-307-717-8, In Tech, Available from: <http://www.intechopen.com/books/advances-in-endoscopic-surgery/endoscopically-guided-balloon-dilatation-of-recurrent-choanal-stenosis>.
26. Quoc A Nguyen, Francisco Talavera, Ted L Tewfik and Arlen D Meyers (2019): How is posterior nasal packing performed in the treatment of epistaxis (nosebleed)? from <https://www.medscape.com>. Johannes Buller, Volker Maus, Andrea Grandoch, Matthias Kreppel and Joachim E. Zöller (2018): Frontal sinus morphology: A Reliable factor for classification of frontal bone fractures? *Journal of Oral and Maxillofacial Surgery*. Volume 76, Issue 10, October 2018, Pages 2168.e1-2168.e7.
27. D. G. Lee (2012): Stabilization of the unstable fractured zygomatic arch with a ballooned Foley Catheter, Received: 30 July 2010/Accepted: 26 December 2011/Published online: 5 January 2012 association of Otolaryngologists of India 2012.
28. Nurmikko TJ and Eldridge PR (2001): Trigeminal neuralgia, pathophysiology, diagnosis, and current treatment. *British Journal of Anesthesia* 2001, 87:117-32.