

Balloon Dilatation of Recurrent Post-treatment Short Segment Subglottic Stenosis by Airway Balloon in an Adult

Anuja Santosh Kulkarni, Prabodh Karnik, Uma Nataraj

ABSTRACT

Subglottic stenosis poses a challenging situation for otolaryngologist. In many cases tracheostomy is required to safeguard the airway. Recently, encouraging results in use of balloon dilatation for subglottic stenosis has led us to successfully treat a recurrent post-treatment short segment subglottic stenosis in a 37-year-old male patient who presented to us with complaints of breathlessness and noisy breathing.

Keywords: Subglottic stenosis, Balloon dilatation, Airway balloon.

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CASE REPORT

A 37-year-old male patient presented to us with history of breathlessness and noisy breathing since 1.5 months duration. There was history of shortness of breath with difficulty while walking upstairs and also trouble 'catching breath' especially with exertion since 1.5 months which had progressively worsened over the period of time. The patient had developed subglottic stenosis due to prolonged intubation and ventilation post-organophosphorus poisoning 15 years back. Later, the stenosis was first laser excised and then definitively and successfully treated with laryngotracheal resection and anastomosis. Details of these procedures were not available. There was no history suggestive of any other comorbid illness.

On examination of neck, there was external scar of previous surgery over the skin.

Seventy-degree scope revealed infantile larynx. Apart from this there was no abnormality detected. Bilateral vocal cords were mobile (Fig. 1).

Apart from routine hematological and biochemical investigations following specific investigations were done:

- Radiograph of neck lateral view
- Virtual bronchoscopy
- Examination under anesthesia with 0 degree scope.

Neck radiograph lateral view revealed bottle neck narrowing of airway in subglottic region. Computed tomographic (CT) scan neck virtual bronchoscopy on 64 slice scanner revealed slit-like narrowing of airway just

below the glottis with maximum diameter at the stenotic level being 4×7 mm (transverse and anteroposterior respectively; Figs 2A to D).

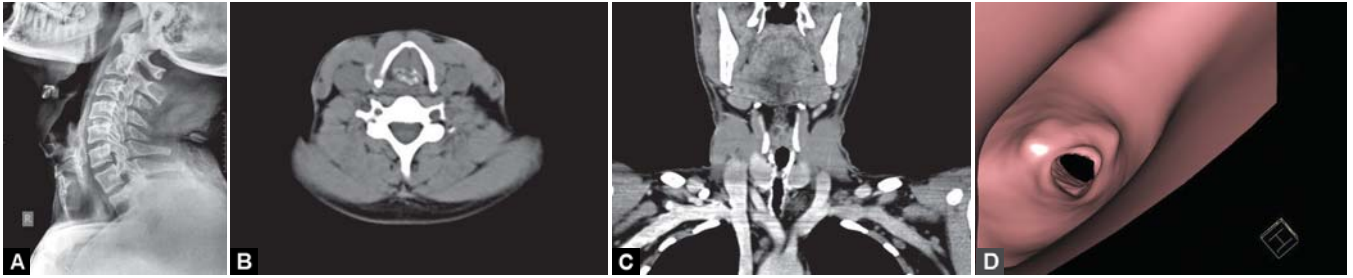
Subsequently the patient was worked up for endoscopic examination of stenosis followed by balloon dilatation of stenosis. Examination under anesthesia with 0 degree endoscopy through laryngoscope revealed stenotic segment just below the vocal cords (Figs 3A to C). A 5 mm endotracheal tube could not be negotiated across the stenosis. Under aseptic precautions airway balloon catheter of polyethylene terephthalate (PET) balloon of size 10×40 mm was inserted; with the help of guide wire up to stenotic segment, stylet was removed, balloon was inflated with saline under direct vision, pressure serially raised initially up to 6 atmospheric pressure for 10 seconds to 1 minute using inline pressure gauge. Then the balloon is deflated and removed. Intermittent ventilation technique was used by anesthetist. Endoscopy was repeated following dilatation which revealed marked improvement in diameter of previously stenotic segment, leading to complete disappearance of stenosis. The patient tolerated the procedure well. Following the procedure, patient had immediate relief of symptoms and had an uneventful recovery. A postoperative scan after 2 months was done which showed that the segment was 1×1.7 cm in diameter (Figs 4A and B).

DISCUSSION

Narrowing of airway below glottis leads to subglottic stenosis.¹ Chronic stenosis may be said to be established if



Fig. 1: Clinical photograph showing external scar of previous surgery over the skin



Figs 2A to D: (A) Neck radiograph lateral view revealed narrowing of airway in subglottic region, (B) CT neck transverse section showing narrowing of airway just below the glottis (plain, slice thickness: 0.6 mm), (C) CT neck coronal section showing narrowing of airway just below the glottis (post-contrast, slice thickness: 0.6 mm), (D) CT neck virtual bronchoscopy reveals narrowing of airway just below the glottis

the airway is unsatisfactory 4 weeks after the injury. It is an important condition which interferes with speech, breathing and ability to clear secretions from lower respiratory tract. Various etiological factors contribute for this condition, such as nonrecognition of acute trauma or failed treatment, complication of prolonged intubation, tracheostomy or partial laryngectomy, scleroma, Wegener’s granuloma,

polychondritis, autoimmune thyroiditis.¹ The main cause is, therefore, disruption of the supporting cricoid and tracheal skeleton. The associated soft tissue narrowing usually reflects the lack of integrity of supporting structures. The important factor in the correction of chronic subglottic stenosis is that of tissue memory. Disrupted cartilaginous framework heals with fibrous tissue compromising fibrocytes with a directional memory. Thus, merely incising and separating scar tissue will lead to replacing scar tissue in its original scarred state.¹ Mayer and Cotton proposed classification originally for pediatric subglottic stenosis^{2,3} (Table 1), which may be applied in broader sense to all adult and pediatric laryngotracheal stenosis. As per literature review except for congenital cartilaginous laryngotracheal stenoses, grade I stenoses are amenable to endoscopic management with potentially high success rate ($\geq 90\%$ of cases with a nearly normal airway).³ Use of closed surgical approaches was the earliest documentation for interventional methods for laryngotracheal stenosis. Various endoscopic treatment modalities available are dilatation by boogies, CO₂ laser excision and balloon dilatation.^{3,4} Traditionally, dilatation was performed by passing rigid boogies along the tracheal long axis, thereby creating unnecessary injury

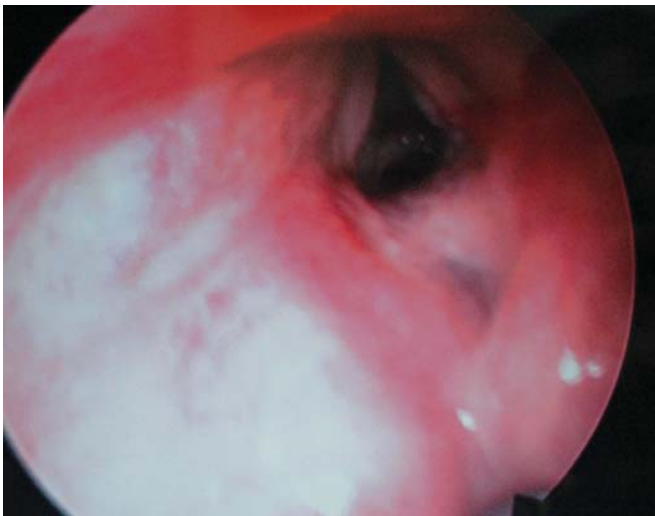


Fig. 3A: Clinical photograph of 0 degree scopy through laryngoscope depicting stenotic segment just below the vocal cords



Fig. 3B: Clinical photograph of 0 degree scopy through laryngoscope showing stenotic segment just below the vocal cords



Fig. 3C: Intraoperative photograph showing dilatation of stenotic segment being done by airway balloon



Fig. 4A: CT neck AP view 2 months after surgery showing significant dilatation of glottic and subglottic airway (postcontrast, slice thickness: 1 mm)

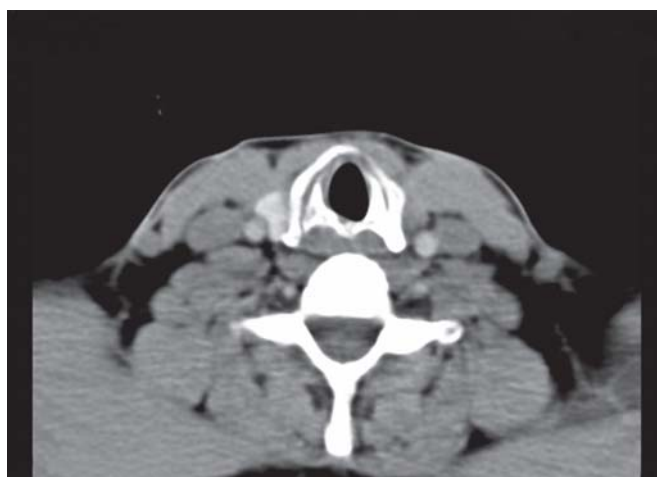


Fig. 4B: CT neck transverse view 2 months after surgery showing significant dilatation of glottic and subglottic airway (plain, slice thickness: 1 mm)

Table 1: Mayers and Cotton classification originally proposed for pediatric subglottic stenosis^{2,3}

Classification	From	To
Grade I	No obstruction	50% obstruction
Grade II	51% obstruction	70% obstruction
Grade III	71% obstruction	99% obstruction
Grade IV	No detectable lumen	

to surrounding healthy mucosa, even compounding initial problem. Due to its tissue interactions, CO₂ laser is the laser of choice for mature cicatricial laryngotracheal stenosis.³ However, it is preferred for first try endoscopic laser treatment and not when there is recurrence to initial grade of stenosis as extensive use might worsen the initial condition and induce restenosis.³ Endoscopic balloon dilatation is currently gaining acceptance as a primary or complementary treatment in the management of upper airway obstruction especially in children.^{3,4} Most authors agree that the radial pressure exerted by balloon in opening

the airway is far less damaging to subglottic and tracheal wall mucosa.³⁻⁵ Any balloon larger than 1.6 mm of subglottis is found to be capable of causing cricoid fracture at pressures of 6 atmospheric pressure as per animal model.⁴

In the present case, the patient had already been operated twice for subglottic stenosis in past, 15 years back initially by laser and then by open resection of stenotic segment and end-to-end anastomoses of trachea. In this case, the stenosis had recurred at the anastomotic site. Dilatation of this short segment stenosis by airway balloon catheter resulted in immediate relief of symptoms.

CONCLUSION

Subglottic stenosis, although not very uncommon, presents a challenging problem to otolaryngologists. Since, various treatment modalities are available the management requires expertise in selection of the appropriate candidate for the right type of treatment. Balloon dilatation is the recently introduced treatment modality for subglottic stenosis. Although literature review suggests that this is being used in the western part of the world,⁴⁻⁶ apparently, this was the first case of its kind of management of subglottic stenosis by balloon dilatation in the entire Asia-Pacific region. Since, this was not associated with mortality or morbidity it has proven to be safe and effective suitable treatment option for the patient of short segment subglottic stenosis.

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