



Article

Treatment of Chronic Stenosis of the Larynx and Trachea in Children

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Abstract: Chronic stenosis of the larynx and trachea in children is complex and challenging in otolaryngology. This article provides an overview of treatment approaches, with a focus on neonatal and pediatric populations. We examine the etiology of laryngeal stenosis, including congenital and acquired cases. Treatment options, including balloon dilation, are discussed. We also analyze the efficacy of radiofrequency surgery and balloon dilation interventions in pediatric patients. Demographics, severity, and outcomes are examined based on a study conducted at TashPMI Clinic. Minimally invasive techniques are recommended for limited scar stenosis. This analysis sheds light on managing chronic stenosis in pediatric patients.

Keywords: Chronic stenosis, Larynx, Trachea, Children, Treatment approaches, Comparative analysis, Radiofrequency surgery, Balloon dilation, Pediatric otolaryngology, Minimally invasive techniques.

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1. Introduction

Narrowing of the larynx and windpipe continues to be a significant issue in the field of otolaryngology, requiring careful consideration in surgical approaches due to their complex nature and impact on patient recovery. In particular, in newborns and children, laryngeal stenosis (LS) poses life-threatening dangers and greatly affects the well-being of children and their families. While LS can be present at birth, cases that develop after prolonged use of an endotracheal tube in neonatal intensive care are more common. The subglottis and posterior glottis are the main areas affected by LS, where injuries from intubation are most likely to occur. Treatment options for established cicatricial LS typically involve expanding the airway using costal cartilage, removing the narrowed portion of the airway, or using rigid dilators or inflatable balloons for dilation. Balloon dilation (BD), first introduced in 1984 for narrowing of the trachea and bronchi, is suitable when the airway's cartilaginous structure remains intact. This method applies pressure to the narrowed airway under direct endoscopic vision, theoretically reducing the risk of mucosal shearing and subsequent narrowing of the airway.

Several surgical procedures, including invasive techniques and open reconstructions such as laryngeal reconstruction and cricotracheotomy, have been suggested for treatment. The advancement of pediatric intensive care and neonatology has led to an increase in cases of scar-related laryngeal stenosis. Although open laryngotracheal plastic surgery has traditionally been the primary treatment for scar-related LS, balloon dilation has emerged as an option for managing mild post-intubation airway stenosis in immature cases. Post-

resuscitation stenosis accounts for a significant portion of laryngeal and tracheal stenosis cases, reported to range from 50 to 90% in various studies.

Managing non-neoplastic stenosis of the larynx and trachea poses difficulties because of the complex surgical procedures, challenges in accessing the affected areas, potential risks associated with anesthesia, and the tendency for the condition to reoccur despite appearing benign. The majority of cases arise from injuries related to scarring in the larynx and trachea, often caused by medical intervention such as prolonged intubation or surgical procedures.

Children who have been impacted by airway stenosis have posed significant difficulties within the fields of otolaryngology and head and neck surgery. Advancements in medical treatment have allowed more children with congenital defects to survive complex surgeries and extended ventilator use, resulting in a rise in cases of upper airway stenosis. Consequently, there is an increasing need for procedures to re-establish normal airflow in children.

Objective of the study: To evaluate the efficiency of endoscopic surgical methods using radiofrequency and balloon dilation for the treatment of non-cancerous stenosis in the larynx and trachea in children, and to compare their results.

2. Materials and Methods

A study that lasted from 2020 to December 2022 was carried out at the TashPMI Clinic, specifically in the Department of Otolaryngology, Pediatric Otolaryngology, and Pediatric Dentistry. The objective was to examine balloon dilation and the potential for radiofrequency surgery as treatment for laryngeal (and later) and tracheal stenosis in children. Four hundred and forty-five pediatric patients with chronic non-neoplastic laryngeal and tracheal stenosis were treated using these methods during the study.

Evaluating the performance of patients. Encompassed all-encompassing assessments, which encompassed endoscopic examinations. Measurements of external structures, including the larynx and trachea, were obtained using radiographic tomography. Numerical parameters for the respiratory function, besides computed tomography and magnetic resonance analysis. The art of resonance imaging is present. According to the study, patients were divided into two categories based on their symptoms. Their initial intubation, mechanical ventilation time (if possible), or both. Tracheotomy, or tracheectomy.

First. The 18 patients who underwent radiofrequency surgery in the group were part of it. Intensive medical care units located in TashPMI. 22 patients who were part of the second group. Has undergone intubation, mechanical ventilation, or tracheotomy for an infection. For individuals who had a period of one month or longer and were in need of balloon dilation, it was preferred to use balloons. Method of treatment.

3. Results

Patients were classified into three age groups, namely infants under one year (6.6%), children from 1 to 3, 14 kids (31%) aged 3 or more between 7 and 10, and 3 kids (6.6%) between 10 and 14. It is worth noting that the largest portion of patients fell within the 3 to 7-year-old age range (refer to Figure 1).

Children were classified according to the Cotton-Myer classification system based on the degree of stenosis. The majority of the 28 patients had stenosis, with 28 cases of 2nd-degree stenosis and 17 cases of 3rd-degree stenosis, in addition to the larynx and upper third of the trachea. In 62.2% of cases, 2nd-degree stenosis occurred, while in 37.7% of cases, 3rd-degree stenosis occurred according to this distribution. The surgery was

performed at a time when the average age was seven years and four months, with patients ranging in age from eight months to 14 years old.

The patients were further categorized by their stenosis location, with 14 of them demonstrating supraglottic stenosis and 23 exhibiting subglottic stenosis. Six children showed stenosis caused by the proliferation of granulation tissue in the cervical trachea, while two had it in the thoracic region. Endoscopic examinations revealed pathological changes marked by dense granulation and scar tissue. Stenosis severity was evaluated using rigid or flexible endoscopes as well as computed tomography scans.

The peak expiratory flow rates during preoperative assessments of external respiratory function varied between 0.5 and 2.2 liters per second, with an average of 2 ± 1.8 liters per second. Approximately 75% of the children had received prior surgical treatment for laryngotracheal stenosis, with two-thirds of them undergoing multiple procedures. Half of the patients in the primary subgroup underwent radiofrequency knife surgery.

After surgery, the initial group achieved a 60% success rate, albeit with some instances of relapse, whereas the second group exhibited favorable recoveries in all but one patient. The surgical intervention proved to be 94.5% effective in the primary patient group. Following endoscopic treatment for laryngotracheal stenosis, the proportion of patients able to have their breathing tubes removed was 33%, compared to 65% after balloon dilation.

The use of flexible endoscopic techniques and local anesthesia is recommended for the treatment of small, simple scar stenosis in the larynx and trachea, which can have a length of less than 5 mm and a preserved lumen of more than 5 mm. Compared to remote destruction, the preferred approach is to cut scar tissue through contact laser incision, which results in less thermal damage to surrounding tissues and promotes wound healing, thereby reducing significant scarring.

4. Conclusion

Endoscopic techniques, small-scale surgeries to remove scar tissue, and balloon dilation procedures speed up patient recuperation, decreasing the need for tracheostomy in people with systemic conditions, and notably enhancing the effectiveness of treatment for this patient group. For cases of restricted, isolated scar narrowing of the larynx and trachea, not exceeding 1 cm and with intact cartilage, irrespective of airway diameter, minimally invasive treatment methods are advised. The incorporation of surgical treatment stages allows patients to undergo rehabilitation in a solitary reconstructive therapy session.

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