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Endolaryngeal dilatation versus laryngotracheal reconstruction in the primary management of subglottic stenosis

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ABSTRACT

Objectives: The scope of the study is to compare endolaryngeal dilatations (ED) with laryngotracheal reconstruction with cartilage grafting (LTRCG) in terms of restenosis.**Methods:** Pediatric subglottic stenosis patients treated in Hacettepe University, between 2002 and 2012 were retrospectively evaluated. Patients who had ED or LTRCG as primary management were included in the study. EDs were grouped into bronchoscopic dilatation (BD), laser incision and balloon dilatation (LBD) and cold knife incision and balloon dilatation (CKBD). The groups were evaluated in terms of restenosis and decannulation rates.**Results:** There were 35 patients (9 females, 26 males; mean age 4.42). LTRCG was performed in 16 patients (9 anterior and 7 anterior and posterior grafts). EDs were performed in 19 patients with 6 CKBDs, 7 LBDs and 6 BDs. There were 3 grade II, 13 grade III cases in the LTRCG group while 4 grade I, 6 grade II, 8 grade 3 and 1 grade 4 in the ED group. Overall decannulation rate was 97% (34/35) in all patients. Restenosis was higher in the ED group (63.2%) than the LTRCG group (31.3%) with rates of CKBD 16.7% (1/6), LBD 71.4% (5/7) and BD 100% (6/6). Restenosis rates were found to be increasing with higher grades (grade I–25%, grade II–66%, grade III–85%).**Conclusion:** ED may need more repetitive interventions than LTRCG due to restenosis. Less restenosis might be observed when balloon is used for dilatation and cold knife for mucosal incisions.

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Introduction

Pediatric laryngotracheal stenosis (LTS) incidence has increased and etiology has changed over time, corresponding with the developments in medicine [1]. The incidence increased in the late 1970s and early 1980s because of the introduction of prolonged endotracheal intubation in neonates in the 1960s, and has since seen a decline because of improvements in airway management, with recent rates ranging from 0.63 to 2% [2,3]. Etiological factors have also changed from diphtheria in the early half of the 20th

century to trauma in the 1930s and to prolonged intubation in the 1970s [4].

Laryngotracheal reconstruction with cartilage grafting (LTRCG) and partial cricotracheal resection (PCTR) are the two major open surgical procedures used successfully in pediatric LTS treatment for nearly 30 years [5,6]. Endolaryngeal dilatation (ED) was popular in management of pediatric airway before 1960s which shifted to open airway reconstruction with expansion grafting or resection in time. Today both techniques are used subsidiary as endoscopic techniques have gained popularity again with new instruments introduced such as balloon dilators, debriders and laser [7].

Decision for the technique to be used is not precisely reached at a consensus for all cases. As the goal of the treatment is to achieve serviceable airway without a tracheotomy, the procedure that provides successful result with least number of interventions as possible will be the choice of the surgeon. Herein we present our ten years' experience on EDs and open LTRCG and evaluate these techniques in terms of restenosis which necessitates repeated interventions for decannulation.

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Materials and methods

In this study, a retrospective review of medical records (available at the time of the study) of pediatric patients who were treated for subglottic stenosis between January 2002 and September 2012 in the Hacettepe University Department of Otorhinolaryngology – Head and Neck Surgery was undertaken. Ethical committee approval was given from the university. The patients who had their initial treatment as ED or LTRCG, either in our university or in another center, were included in the study. Patients were graded according to the Cotton–Myer grading system [8]. LTRCG procedures were performed as double-stage surgeries. ED group was evaluated in three groups including bronchoscopic dilatation (BD), laser incision and balloon dilatation (LBD) and cold knife incision and balloon dilatation (CKBD). BDs were performed with rigid bronchoscopes, starting with the narrowest than can pass through the stenosis and widening till optimum bronchoscope size for the patient is achieved. Three of the 6 patients treated with BDs were managed in other centers from our university and referred due to restenosis while the other three were treated in our department. BD has not been performed in our clinic for about eight years, but these cases were included in order to compare dilatations with either with balloon or rigid instruments. Cold knife incisions to the mucosa were performed either with endolaryngeal micro scissors or sickle-knife. For balloon dilatations 5–14 mm airway dilatation balloon catheters (Inspira Air™ Balloon Dilatation System) were used that were inflated up to 12 atmospheric pressure pressure for 60 s or until the patient's oxygen saturation level dropped below 92%. The procedures were performed 2 or 3 times per session. All the patients in the study had postoperative antireflux medications, steroids, and antibiotics and were followed-up in post anesthesia care unit for one day. Data including patient demographics, comorbidities, etiology, severity and level of the stenosis, management details, complications and outcomes were gathered. The success of the treatment is determined as decannulation if the patient was tracheotomized before the intervention or relief of dyspnea if the patient did not have a tracheotomy. Chi square test was used for statistical analysis.

Results

There were 35 patients included in this study. There were 9 female and 26 male patients with a mean age of 4.42 years (4 months–15 years). Of the patients 7 were younger than 1 year of age, 7 were between 1 and 2 years, 5 were between 2 and 3 years,

5 were between 3 and 4 years and the other 11 were between 7 and 15 years of age at the time of the procedures. The median follow-up time was 4 years (1–7 years).

As an initial treatment LTRCG was performed in 16 patients while ED was performed in 19 patients. Distribution of the patients' genders, etiological data and stenosis grades are given in Table 1. Patients in the LTRCG group had 9 anterior and 7 anterior and posterior grafts. In the ED group BD was performed in 6 patients, LBD in 7 and CKBD in 6 patients. Two patients in the LBD group and 3 patients in the CKBD group had also topical mitomycin C (1 mg/mL) application with cottonoid pledgets. Ten patients (28%) had substantial co-morbidities such as: cystic fibrosis, isovaleric acidemia, ventricular septal defect (VSD), Fallot's tetralogy, Guillain–Barré syndrome, Down syndrome, congenital hypothyroidism, atrial septal defect, paraplegia, tricuspid valve insufficiency, hyperimmunoglobulinemia E syndrome. There were five premature born patients ranging from 24 to 30 weeks at birth.

Restenosis was higher in patients who had ED (12/19) than patients who had LTRCG (5/16) ($p=0.006$) (Table 2). Rates of restenosis were significantly different within ED techniques with CKBD 16.7% (1/6), LBD 71.4% (5/7) and BD 100% (6/6) ($p=0.001$). LTRCG was found to be leading lower rates of restenosis than balloon dilatation procedures (LBD and CKBD) with 5/16 and 6/13 respectively, but the difference was not significant ($p=0.466$). Distribution of stenosis grades within ED techniques was found to be heterogeneous with CKBD being preferred for grade I patients while LBD and BD for grade II–IV patients. LTRCG was performed for grade II and III patients. Restenosis was also found to be higher in ED group (11/15) than LTRCG group (5/16) when higher grade patients (grades II–IV) were compared with each other ($p=0.019$). Age and grade was not significantly related to restenosis either in the ED or in LTRCG groups although increasing restenosis rates were observed for ED group with more severe disease [(25% for grade I (1/4), 66% for grade II (4/6) and 85% for grade III (6/7)].

Of the five restenosis patients in the LTRCG group two had LBD, two had revision LTRCG using anterior grafts and one had PCTR as a 2nd intervention. Of the 12 restenosis following ED, 7 required LTRCG (5 anterior and 2 anterior and posterior) while 3 required LBD, 1 BD and 1PCTR.

There were 2 grade II patients in LTRCG and 4 grade I, 4 grade II and 1 grade III patients in ED group without tracheotomy before treatment. Successful decannulation was performed in 23 of 24 patients with preoperative tracheotomy and optimum airway passage was able to be achieved in all patients (11/11) without

Table 1
Distribution of genders, etiological factors and grades of the groups.

	LTRCG		ED	
Gender	6 Females 10 Males		3 Females 16 Males	
Etiology	6 Congenital 10 Acquired	1 Cystic fibrosis 1 Encephalitis 3 Premature birth 1 CHD ^a operation 1 Falling down from height 1 Pneumonia 2 Traffic accident	3 Congenital 16 acquired	2 Pneumonia 5 Traffic accident 3 CHD ^a operation 3 Falling down from height 2 Premature birth 1 Electric shock
Grade	I II III IV	0 3 13 0	I II III IV	4 6 8 1
Subgroup	Ant graft Ant + post graft	9 7	BD LBD CKBD	6 7 6

^a CHD: Congenital heart disease.

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