Endoscopic Cricoid Split with Autologous Costal Cartilage Augmentation: A Single-Institutional Fifteen-Year Experience

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Introduction

Despite advances in open and endoscopic airway surgery subglottic stenosis (SGS), posterior glottic stenosis (PGS), and bilateral vocal fold immobility (BVFI) continue to present a significant challenge to airway surgeons. These pathologies often necessitate multiple surgical procedures to correct and despite these measures patients are often tracheotomy dependent for extended periods of time. The endoscopic cricoid split with rib grafting (EPCS/RG) procedure was developed by Dr. Andrew F. Inglis, Jr., at Seattle Children’s Hospital in the late 1990's as a less invasive, more directed surgical approach for the treatment of the above pathologies (Figure 1, 2). The initial ten patient series and description of the procedure were published in 2003 and the present study aims to examine our fifteen year experience with this procedure via a retrospective review.1

Since the initial publication of the EPCS/RG procedure a number of groups have reproduced the utility of this or similar approaches in the treatment of SGS, PGS, and BVFI. In 2002, Rutter and Cotton demonstrated a 97% decannulation rate in a population of 29 patients with PGS or BVFI using an open approach to place a costal cartilage graft.2 Despite an excellent overall decannulation rate this procedure requires at the minimum a partial laryngofissure and the majority of the patients in the series required a full laryngofissure. Provenzano et al. (2011) demonstrated a 67% decannulation rate in a series of 12 patients and was the largest population of such patients reported in the literature at that time.3 Gerber et al. (2013) subsequently published a series of 28 patients who underwent EPCS/RG procedures at tertiary care centers with 89% of patients either avoiding a tracheotomy or being successfully decannulated.4

In order to provide additional insight into the utility of EPCS/RG procedure in patients with SGS, PGS, and BVFI we performed a retrospective review of all patients who underwent this procedure at SCH from 1999 to 2014. The purpose of this study is to report our institutional experience with EPCS/RG and to expand upon the clinical outcomes data for children who underwent EPCS/RG procedure.

Methods

After obtaining Institutional Review Board Approval we performed a retrospective chart review of all patients undergoing airway reconstruction for LS, PGS, or BVFI using an autologous cartilage graft from January 1, 1999 to October 6, 2014. The subjects were then grouped based on the indication for the EPCS/RG procedure: SGS, PGS, or BVFI. Decannulation rates were the primary endpoint. Descriptive statistical analysis was used to evaluate the demographic characteristics of the patient population. ANOVA and Chi-square test for heterogeneity were utilized to determine if there were any differences in baseline characteristics among the groups as well as to determine if there were any differences in overall decannulation rates. Multivariate logistic regression analyses were then utilized to determine whether indication for surgery, prematurity, or age at the time of surgery impacted decannulation rates.

Results

A total of 33 patients who underwent EPCS/RG were identified, one was excluded as the patient never underwent tracheotomy, with an overall decannulation rate of 65.6%. For the BVFI group, 1 patient was not decannulated due to medical co-morbidities and a second patient was lost to follow-up. Four patients in the SGS group were not decannulated due to medical co-morbidities. If we exclude the patients with medical co-morbidities that prohibited their decannulation or were lost to follow-up, the overall decannulation rate was 80.8%. The demographic characteristics of the patient population are outlined in Table 1. There were no significant differences in age at the time of surgery among the SGS, PGS, and BVFI groups. ANOVA analysis found a significant difference between the BVFI group and the other two groups in terms of the proportion who were premature (p< 0.046). The overall decannulation rates for the groups are: 53.8% for the SGS group, 100% for the PGS group, and 28.6% for the BVFI group (Figure 3). Chi-square test for heterogeneity found a significant difference in decannulation rates between groups (p<0.004). In the SGS population 5 patients (38.5%) required a subsequent open airway surgery, 2 (15.4%) required a second EPCS/RG procedure, and 1 (7.7%) required both (Table 1). In the PGS Group, 1 patient (8.3%) required an open airway surgery and 1 (8.3%) patient required a second EPCS/RG procedure (Table 1). Only one patient (14.3%) in the BVFI group underwent a second airway reconstruction; an EPCS/RG procedure (Table 1). A multivariate logistic regression analysis that controlled for indication for surgery found that prematurity had a positive correlation with decannulation that approached significance (p=0.051, OR 6.1, 95% CI 0.99, 37.6). The median length of hospitalization after EPCS/RG was 3 days.

Conclusions

• Our experience represents the largest reported series of patients who have undergone EPCS/RG to date and demonstrates that the majority of patients can be decannulated after EPCS/RG.
• There was a statistically significant difference in decannulation rates among the SGS, PGS, and BVFI groups. The highest decannulation rate was in the PGS group followed by the SGS group. The BVFI group had the lowest decannulation rate.
• Prematurity had a positive correlation with decannulation however this did not reach statistical significance.
• Further studies are needed to fully evaluate the utility of the EPCS/RG procedure for SGS, PGS, and BVFI.

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References: