

Outcomes of recurrent laryngeal nerve injury following congenital heart surgery: A contemporary experience



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Objective: Injury to the recurrent laryngeal nerve can lead to significant morbidity during congenital cardiac surgery. The objective is to expand on the limited understanding of the severity and recovery of this iatrogenic condition.

Design: A six-year retrospective review of all congenital heart operations at a single institution from January 1, 2008 to December 31, 2013 was performed. All patients with documented vocal cord paralysis on laryngoscopic examination comprised the study cohort. Evaluation of time to vocal cord recovery and need for further surgical intervention was the primary focus.

Results: The incidence of post-operative vocal cord paralysis was 1.1% (32 out of 3036 patients; 95% confidence interval: 0.7–1.5%). The majority were left-sided injuries (71%). Overall rate of recovery was 61% with a median time of 10 months in those who recovered, and a total follow up of 46 months. Due to feeding complications, 45% of patients required gastrostomy tube after the injury, and these patients were found to have longer duration of post-operative days of intubation (median 10 vs. 5 days, $p = 0.03$), ICU length of stay (50 vs. 8 days, $p = 0.002$), and hospital length of stay (92 vs. 41 days, $p = 0.01$). No pre-operative variables were identified as predictive of recovery or need for gastrostomy placement.

Conclusion: Recurrent laryngeal nerve injury is a serious complication of congenital heart surgery that impacts post-operative morbidity, in some cases leading to a need for further intervention, in particular, gastrostomy tube placement. A prospective, multi-center study is needed to fully evaluate factors that influence severity and time to recovery.

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Introduction

Congenital heart defects are the most common malformation found in newborns [1,2], of which nearly a third require surgical repair [1]. Post-operative vocal cord dysfunction is a known complication of congenital heart surgery (CHS), and is often associated with several respiratory and gastrointestinal complications that can be severe to the point of necessitating further surgical intervention [3]. Reported incidence of vocal cord paralysis (VCP) following cardiac surgery ranges widely from 1.7% to 67% [4]; however, most studies indicate the rate is less than 9%. This difference is largely attributed to whether routine clinical laryngoscopic exam is performed, which increases the rate of diagnosis compared with examination of only symptomatic patients. The two most common mechanisms implicated involve direct trauma either to the recurrent laryngeal nerve (RLN) during the operation or indirect injury to the nerve from intubation [5]. Following CHS, it has been a challenge to discern which mechanism is responsible. The left RLN is at higher risk for VCP than the right side, particularly during aortic arch procedures, due to its proximity to the surgical plane of dissection [4]. Many post-operative cases resolve over time with supportive care. In persistent cases of VCP, external laryngoplasty implants as well as injection laryngoplasty have both provided durable improvement of symptoms [6,7].

Patients with the injury typically present with stridor, hoarseness, and a breathy and weak cry, while severe cases result in aspiration and respiratory distress. Reports of recovery rates from VCP following cardiac surgery range widely from 0% to 82%. The lowest recovery rates have been found in patent ductus arteriosus (PDA) ligations; the highest after thyroid or purely cardiac operations [8]. Few studies have been published regarding the clinical outcomes of this population, and therefore there is limited knowledge of outcomes and predictors of injury resolution. The aim of this study is to review the injury characteristics, mode of presentation and outcomes of patients with vocal cord paralysis in a high volume CHS center.

Methods

From January 1, 2008 through to December 31, 2013, a total of 3036 cases of CHS were performed at the Children's National Medical Center (CNMC) in Washington, DC. The CNMC

Abbreviations

CHS	congenital heart surgery
GERD	gastro-esophageal reflux disease
ICU	intensive care unit
MBS	modified barium swallow
PDA	patent ductus arteriosus
RLN	recurrent laryngeal nerve
VCP	vocal cord paralysis

Institutional Review Board approved the retrospective review and informed consent was waived. All patients presenting with postoperative stridor or any other clinical signs of VCP underwent either flexible fiberoptic laryngoscopy or rigid laryngobronchoscopic examination by a pediatric otolaryngologist. Gastrostomy tube placement was performed in all patients with feeding difficulty resulting in poor weight gain as a direct or indirect consequence of VCP, patients with evidence of aspiration on barium swallow, and patients with severe gastroesophageal reflux.

A retrospective chart review was carried out, inclusive of all patients aged 18 years or below with confirmed new onset VCP documented on laryngoscopic exam following a cardiac or aortic operation. Pre-operative, intra-operative and post-operative variables were evaluated. Univariate analysis was done using the nonparametric Mann-Whitney U-test for continuous variables and Fisher's exact test for binary proportions. Wilson's method was used to derive 95% confidence intervals around the observed incidence of RLN injury and recovery [9]. Time to recovery was based on documentation of cord mobility on laryngoscopic examination or resolution of symptoms when repeat laryngoscopy was not performed. Kaplan-Meier time-to-event analysis was used for estimating recovery of VCP during the follow-up period with 95% confidence intervals around the curve constructed using Greenwood's formula [10]. Statistical analysis was performed using IBM SPSS Statistics (version 21.0, IBM, Armonk, NY). Two-tailed $p < 0.05$ were considered statistically significant.

Results

Thirty-two patients over the six-year period were identified as having post-operative VCP, representing 1.1% of those undergoing CHS. One patient was excluded from the analysis due to inadequate follow up and incomplete data set. Of the remaining 31 injuries, 16% had bilateral VCP, 13% had right-sided VCP, and 71% had

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