Commentary: Slide tracheoplasty for congenital tracheal stenosis: Sliding by the missing pieces

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Central message: While a remarkably large study, additional details would have added greatly to our understanding of CTS patients. Instead, we wonder whether the authors have inadvertently slid by the missing pieces.

Central Picture Legend: Anusha Jegatheeswaran MD PhD FRCSC, Nagarajan Muthialu FRCSEd

Congenital tracheal stenosis (CTS) is a rare lesion which can have a spectrum of severity. Children with CTS often present early in life with symptoms including wheezing, stridor, cyanosis, apnea and recurrent pneumonia/upper respiratory tract infections. While multiple strategies have been employed to tackle CTS, slide tracheoplasty was first described by Victor Tsang and colleagues in 1989\(^1\). In their manuscript, Chen and colleagues describe their impressive 10 year experience with slide tracheoplasty in 120 infants with CTS, at a single center in Shanghai\(^2\). Of note, this only accounted for a mere 26% of slide tracheoplasties done at Shanghai Children’s Medical Center during the study period which spanned from April 2010-September 2020. Currently, slide tracheoplasty remains a challenging procedure for many, in part due to the infrequent treatment of this lesion at most centers and the common occurrence of complicating features. This is validated in this cohort, with 89% having a concomitant cardiovascular anomaly, 53% abnormal arborization, and 47% long-segment stenosis with an additional 18% having diffuse stenosis. While the subject matter is important and the manuscript has the potential to make an extremely strong contribution to the body of literature, there are some significant limitations.
The primary objectives of this retrospective study were to determine the predictors of both a longer duration of intubation and death. The investigators found that the predictors of a longer duration of intubation included lower body weight, concomitant cardiovascular anomalies, and normal tracheobronchial arborization using multivariable analysis. Due to the limited number of deaths in the series (n=6), only univariable analysis was performed, which demonstrated that the factors associated with death included low body weight, preoperative invasive ventilation, a longer cardiopulmonary bypass time and the presence of granulation tissue. It should be noted however that for all of the continuous variables, cut points were set based on maximizing the log-rank test statistic. It leads the reader to wonder why this exact method was chosen, whereby the authors made the variables binary using cut-offs, as opposed to using all the data available and maintaining the variables in their continuous form. One also wonders how the results may have changed if a standard data inclusive approach with continuous variables was performed, which is what we would have utilized if performing the analysis. Other findings of importance included reintubation in 17% of patients, with a median ICU stay of 8 days and hospital stay of 22 days. Reoperation occurred in 6 (5%) patients, however it is difficult to understand the significance of this, as follow-up was extremely limited with a left-skewed median of 4.4 months (range: 0.3-66.7 months). It was surprising, that although the study spanned approximately 10 years, that the longest duration of follow-up was shy of 6 years.

While the authors make convincing arguments regarding the use of the oblique technique in bronchial arborization anomalies, the role of additional pedicled pericardial patch coverage of the anterior wall to increase the blood supply to this area and use of anterior tracheopexy are
questionable. As the blood supply of the cartilage is provided by the vascular arcade from both the subserosal and submucosal levels, with improving surgical technique, at Great Ormond Street Hospital we now carefully dissect the tracheal wall, thereby avoiding skeletonization of tracheal flaps, which can lead to ischemic damage. Similarly, anterior wall collapse can be seen in smaller children, especially neonates, where the widening of entire lumen consequent to the sliding technique leads to a situation akin to a ‘collapsed tent’. Often the endotracheal tube has been used as an internal splint while the cartilage heals in these small babies. While the sliding technique is often simpler than alternatives, in terms of execution, even if bronchoscopic assessment is used to evaluate stability of anterior wall, in a paralyzed child with a tube already within the repaired trachea, this is difficult to quantify. As such, it remains unclear how areas are selected for direct anterior tracheopexy. An additional note made casually in this manuscript is related to the use of lung function testing for follow-up. These children need a clear long-term surveillance protocol to follow outcomes in an objective fashion; this can be achieved through regular follow up using a multi-disciplinary respiratory approach and assessment with various lung function tests and concomitant imaging.

In concluding, the authors state that a tailored individual management strategy can allow for favorable clinical outcomes, however it is unclear within the manuscript how surgical strategies are altered based on individual patient profiles, the exact surgical algorithm and timing, including its evolution over time, and the use of potentially extraneous surgical steps. The authors fail to provide those with limited experience, clear direction on how adjust practice in relation to these various aspects based on their vast knowledge. Ultimately, they remind us that
follow-up and continued functional evaluation are still needed, two features which indeed seem to be lacking in their study.

While this is a remarkably large study, additional detail in several key areas would have added greatly to the manuscript and our understanding of the complexities of managing these challenging patients. Instead, the reader is left wondering whether the authors have inadvertently slid by the missing pieces of the puzzle related to treating patients with CTS.

References
