Published in final edited form as:

Int J Pediatr Otorhinolaryngol. 2020 January ; 128: 109725. doi:10.1016/j.ijporl.2019.109725.

Current trends and 30-day surgical outcomes for thyroglossal duct cyst excision in children

Jeffrey Cheng, MD¹, Reginald Lerebours, MA², Hui-Jie Lee, PhD²

¹Pediatric Otolaryngology, Division of Head and Neck Surgery and Communication Sciences, Department of Surgery, Duke University Medical Center, Durham, NC

²Department of Biostatistics & Bioinformatics, Duke University, Durham, NC

Abstract

Objective: Identify current trends, adverse events, and clinical predictors in children treated with thyroglossal duct cyst surgery.

Methods: Cross-sectional analysis using American College of Surgeons (ACS) National Surgical Quality Improvement Program® (ACS NSQIP® - pediatric), years 2012 – 2016. Patients were identified using CPT codes: 60280 - excision of thyroglossal duct cyst or sinus and 60281 - excision of thyroglossal duct cyst or sinus, recurrent.

Results: 1532 (333 inpatient and 1199 outpatient) total cases were identified. Median age was 5.16 years interquartile range [IQR] (2.87, 8.35 years). No mortalities, cases of sepsis or nerve injury were identified. Adverse event rate was 4.4% (68/1532). Inpatient cases were associated with higher rates of adverse events ($p = 0.006$). Adverse events mostly consistent of wound infections, unplanned reoperations and readmissions, 2.6%, 2.2% and 2.0%, respectively. The most common unplanned reoperation was hematoma, seroma, or fluid drainage (0.59%). Median length of stay was 1 day, IQR (0, 1). An adjusted, multivariable logistic regression model revealed that the odds of adverse event rates for inpatient status were 101% higher than outpatients (odds ratio [OR] = 2.01; 95% CI = 1.20, 3.37; $p = 0.008$).

Conclusions: The most common adverse events were unplanned reoperations and readmissions. Outpatient surgery was most common and surgery for recurrent thyroglossal duct cysts was rare. Children selected for outpatient thyroglossal duct cyst surgery tended to be healthier and less medically complicated and may contribute to our observation of lower rates of adverse events compared to inpatients.

Corresponding author: Jeffrey Cheng, MD, Duke University Medical Center, Box 3805, Durham, NC 27710, Fax:(919) 613-4581, jeffrey.cheng@duke.edu.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Disclosures: The American College of Surgeons National Surgical Quality Improvement Program and the hospitals participating in the ACS NSQIP Pediatric are the source of the data used herein; they have not verified and are not responsible for the statistical validity of the data analysis or the conclusions derived by the authors.

Conflicts of interest: none.

Keywords

NSQIP; complications; thyroglossal duct cyst; Sistrunk

Introduction

In children, anterior midline or near midline neck masses may often be attributed to thyroglossal duct cysts. The recommended surgical approach to this lesion is a Sistrunk procedure with removal of the central portion of the hyoid bone, along with the cyst and accompanying tract, and has a recurrence rate of 3-5%.¹ Risk factors that may increase the risk of recurrence include surgery during active exacerbation, multiple duct tracts, and technical errors in surgical technique.^{2,3} Currently, little debate exists regarding the appropriate surgical procedure that should be performed. However, beyond the generally accepted Sistrunk procedure surgical technique, there are variations in clinical practice regarding preoperative evaluation and postoperative management.

We sought to investigate some of the questions regarding risk factors for adverse events associated with surgical management of thyroglossal duct cyst in children. Factors such as age, medical comorbidities, postoperative disposition, or operative setting have not been established or other clinical risk factors that may contribute to adverse events. There are several authors who report that same-day and/or ambulatory surgery for thyroglossal duct cyst surgery is safe and cost effective.⁴ Using a national, surgical database, we sought to investigate the answers to some of these questions.

Methods

The American College of Surgeons (ACS) has developed a hospital based reporting system called the ACS National Surgical Quality Improvement Program® (ACS NSQIP®). Data were collected from the patient's medical chart, not insurance claims, and reports 30-day patient outcomes. Starting in 2012, children's hospitals began using this database and reporting results in the ACS NSQIP-pediatric® database. This database presents a unique opportunity to examine clinical factors that may be associated with 30-day adverse events related to surgical procedures in children. Duke University Institutional Review Board (IRB) approval exemption was obtained prior to initiating this investigation.

Patients were identified using 2016 current procedural terminology (CPT) codes: 60280 - excision of thyroglossal duct cyst or sinus and 60281 - excision of thyroglossal duct cyst or sinus, recurrent.

The primary outcomes were adverse events, defined as: superficial incisional surgical site infection (SSI), deep incisional SSI, superficial wound disruption, wound disruption, pneumonia, unplanned intubation, unplanned reoperation, readmission, nerve injury, prolonged hospitalization (> 30 days), sepsis, septic shock, bleeding with transfusion, bloodstream infection, and mortality. Superficial, deep incisional, and any wound disruption were grouped together as wound infection adverse event.

Summary data regarding demographic information were collected. Categorical variables are summarized with frequency counts and percentages. Continuous variables are summarized with means, standard deviations, median, interquartile ranges (IQR) and ranges. Patients were divided into two groups, based on the presence of an adverse event. Differences between the two groups were assessed using Wilcoxon-Mann-Whitney tests for continuous variables, and Chi-square or Fisher's exact tests for categorical variables. Multivariable, logistic regression analysis was performed to model the probability of experiencing an adverse event using clinical risk factors as covariates. The frequencies of candidate covariates were assessed, and covariates with low cell counts were excluded from the regression model. Adjusted odds ratios and 95% confidence intervals (CIs) were reported. Throughout this work, the threshold for determining statistical significance was set at α level = 0.05. All analyses were performed using SAS 9.4 statistical software (SAS Institute Inc., Cary, NC).

Results

1532 (333 inpatient and 1199 outpatient) total cases were identified. There were only 4 (0.26%) cases that were coded as excisions for recurrent thyroglossal duct cysts. All these 4 cases were done in outpatient settings. The median age was 5.16 years [IQR (2.87, 8.35 years)]. Relatively equal number of males and females were included (52.5% male) and the majority of the patients were white (51.3%). Demographic information stratified by inpatient/outpatient status can be found in Table 1. Compared to outpatient patients, inpatient patients in general had a higher percentage of history of asthma (6.3% vs. 5.1%), structural pulmonary/airway abnormality (5.4% vs. 1.7%), developmental delay/impaired cognitive status (3.9% vs. 2.6%), congenital malformation (3.9% vs. 2.6%), emergent or urgent admission (2.4% vs. 0.6%), not clean wound (43.2% vs. 39.7%), and ASA class 2 or above (46.5% vs. 41.5%). 161 (10.5%) cases had other concurrent procedures performed.

No mortalities, cases of sepsis or nerve injury were identified. Adverse event rate was 4.4% (68/1532). The breakdown of adverse event data can be found in Table 2; these are also broken down by inpatient and outpatient classification. The most common adverse event was wound infection (39/1532, 2.6%). Adverse events also mostly consisted of unplanned reoperations and readmissions, 2.2% and 2.0%, respectively. The most common unplanned reoperation was for hematoma, seroma, or fluid drainage (0.59%). Median length of stay was 1 day, IQR (0, 1).

Bivariate analysis using a Chi-square test revealed that the adverse event rate in the inpatient group was significantly higher than the outpatient group (7.2% vs 3.7%; $p = 0.006$). History of asthma and premature birth variables were not included in the multivariable regression model due to small cell counts and high percentages of missing values. As these were suspected to be an important risk factors for adverse events, Fisher's exact tests were conducted for these variables. Elevated adverse event rates were associated with asthma, as opposed to those with no asthma (9.8% vs 4.1%; $p = 0.03$). Premature birth was also noted to have a higher adverse event rate, as opposed to those without prematurity (8.8% vs 3.9%; $p = 0.07$), but this was not statistically significant.

Table 3 reports the multivariable logistic regression results for adverse event. After accounting for age, sex, race, wound classification and ASA classification status, the odds of having an adverse event were about two-fold higher for inpatient compared to outpatient status (odds ratio [OR] = 2.01; 95% CI = 1.20, 3.37; $p = 0.008$). Females were also found to have reduced odds of adverse events and was 68% lower (OR = 0.32; 95% CI = 0.18, 0.57; $p = <0.0001$) than males. The C-index yielded a value of 0.688, and the Hosmer-Lemeshow goodness of fit test yielded a non-significant result at the $\alpha = 0.05$ level (chi-square = 8.56, $df = 8$, $p = 0.38$), indicating no evidence of lack of fit of the model. Age, race, wound class, and ASA classification status were not significantly associated with increased odds of adverse events.

Discussion

A number of previous studies have looked at a decade or more of institutional experience with surgery for thyroglossal duct cysts in children have been performed in the past, including around 100 children. National databases allow for us to examine across multiple institutions with a much larger cohort and look at potential clinical factors affecting adverse events. A prior study by Farquhar et al presented some initial findings investigating thyroglossal duct cyst surgery in children using the NSQIP-pediatric database from 2012 to 2014. Our findings expand on the prior work by Farquhar et al in several ways.⁵ First, our cohort is four times the size of the previous investigation, allowing us to report results based on a more sizeable base. Also, we tried to include surgery for recurrent thyroglossal duct cysts.

Adverse events were limited (4.4%) and mostly were related to wound infection, unplanned reoperations and readmissions. Unfortunately, there was incomplete documentation and a relatively high number of reoperation codes and primary readmission diagnoses that were not listed within the database to fully characterize the types of reoperations and primary diagnoses for hospital readmission. Wound infection rates were low (2.6%) and length of hospital stays were relatively short. Outpatient surgery appears to be safe and associated with decreased adverse events.

Interestingly, logistic regression analysis revealed that inpatient status and male sex were significantly associated with higher rates of adverse events. Age, race, wound class, and ASA classification were not associated with adverse events. Further investigation to explain our findings between adverse events in outpatients and inpatients may be helpful to determine if there is an identifiable relationship. The outpatient group in our investigation was notably healthier than the inpatient group. We were not able to adjust for history of asthma and premature birth in the regression model. In bivariate analyses, we did find that these two factors were associated with adverse events. Moreover, inpatient patients had a higher percentage of asthma and other comorbidities, as noted in our results, which may contribute to the differences in adverse event rates between inpatient and outpatient thyroglossal duct cyst surgery. This may help determine what factors are most important to optimizing resources, minimizing adverse events, and achieving the best clinical outcomes.

One of the primary shortcomings of our work is that recurrence after thyroglossal duct cyst excision in children is one of the primary complications. We likely would not have been able to capture those children in the 30-day time window after the initial surgery. Instead, we attempted to examine the CPT code for recurrent thyroglossal duct cyst excision, but we were only able to identify 4 (0.3%) such entries. There appears to be relatively little surgical treatment for recurrent or residual thyroglossal duct cysts and represents a significantly lower rate than previously reported. It is possible that the trend is towards lower recurrences. However, this may also be explained by coding within the national database, and it is possible that surgery for recurrent thyroglossal duct cysts still were coded with 60280 code. Descriptions of surgical management of thyroglossal duct cysts in children seem to suggest that recurrence rates are affected by lack of preoperative imaging, preoperative infection, cyst removal alone without Sistrunk procedure, and surgical specialty performing the procedure (lower rates for surgeons with fellowship training in pediatric otolaryngology versus pediatric surgery). These recurrence rates ranged from around 4.0% - 9.1% for pediatric otolaryngologists and 27.3% - 30.1% for pediatric surgeons.^{2,3}

Our investigation had some significant limitations in looking at two important clinical questions: safety of outpatient surgery for thyroglossal duct cyst surgery in children and value of postoperative drain use. It appears that most are performed in an outpatient setting. However, while we report that outpatient surgery for thyroglossal duct cyst in children appears to be associated with less adverse events in comparison to inpatient surgery, this conclusion may need to be taken with caution, especially as the outpatient group tended to be notably healthier. The data entry for the inpatient/outpatient setting of the surgery in the NSQIP-pediatric is defined by the participating hospital's definition of inpatient and outpatient surgery. Outpatient surgery may still include overnight stays with 23 hours or less of hospitalization, and we were not able to ascertain if outpatient surgeries were discharged from the facility as day surgery. Even after controlling for confounding factors, we found that the inpatient group had significantly higher rates of adverse events, $p = 0.008$. Regardless, it appears that if there is a concern regarding distance for the family to travel or other medical considerations, overnight stay may be advised. There is also some clinical controversy regarding the utility of drains for prevention of postoperative complications, such as hematoma or seroma, with authors reporting no significant improvement in complication rates with the use of drains.^{6,7} We also were not able to draw any conclusions about the use of postoperative drains, as there was no data entered to specify the use of postoperative drain placement. We also were not able to draw any conclusions regarding preoperative evaluation of thyroglossal duct cysts.

Conclusions

Current approaches to thyroglossal duct cyst in children appear to be associated with an acceptable rate of adverse events. The most common complications were unplanned reoperations and readmissions. It appears that surgery for recurrent thyroglossal duct cysts is not very common, and outpatient surgery was more common. Children selected for outpatient thyroglossal duct cyst surgery tended to be healthier.

Acknowledgments

Funding sources: This work was made possible by Grant Number UL1TR002553 from the National Center for Advancing Translational Sciences (NCATS), a component of the National Institutes of Health (NIH), and NIH Roadmap for Medical Research. Its contents are solely the responsibility of the authors and do not necessarily represent the official view of NCATS or NIH.

References:

1. Hussain K, Henney S, Tzifa K. A ten-year experience of thyroglossal duct cyst surgery in children. *Eur Arch Otorhinolaryngol* 2013;270:2959–61. [PubMed: 23539413]
2. Geller KA, Cohen D, Koempel JA. Thyroglossal duct cyst and sinuses: a 20-year Los Angeles experience and lessons learned. *Int J Pediatr Otorhinolaryngol* 2014;78:264–7. [PubMed: 24332664]
3. Ross J, Manteghi A, Rethy K, Ding J, Chennupati SK. Thyroglossal duct cyst surgery: A ten-year single institution experience. *Int J Pediatr Otorhinolaryngol* 2017;101:132–6. [PubMed: 28964283]
4. Coelho A, Sousa C, Marinho AS, et al. Five-years' experience with outpatient thyroglossal duct cyst surgery. *Int J Pediatr Otorhinolaryngol* 2017;96:65–7. [PubMed: 28390616]
5. Farquhar DR, Rawal RB, Masood MM, et al. Outpatient management and surgeon specialty for thyroglossal duct cyst excision: A retrospective analysis of 377 patients and 30-day outcomes in the American College of Surgeons NSQIP-P Database. *Clin Otolaryngol* 2018;43:1402–6. [PubMed: 29900688]
6. Hong P Is drain placement necessary in pediatric patients who undergo the Sistrunk procedure? *Am J Otolaryngol* 2014;35:628–30. [PubMed: 24888796]
7. Qureshi TA, Suhail A, Zaidi SS, Siddiq W. Is There Any Benefit of Drain Placement on Postoperative Complications in Patients Undergoing the Sistrunk Procedure? *Int Arch Otorhinolaryngol* 2015;19:331–5. [PubMed: 26491480]

Table 1.

Demographic table, stratified by inpatient/outpatient status.

	Inpatient (N=333)	Outpatient (N=1199)	Total (N=1532)
Age of patient in years at time of surgery, Mean (SD)	6.3 (4.3)	6.1 (4.1)	6.1 (4.2)
Median (IQR)	5.3 (2.9, 8.8)	5.1 (2.9, 8.2)	5.2 (2.9, 8.3)
Range	(0.0-17.9)	(0.0-17.9)	(0.0-17.9)
Sex			
Female	152 (45.6%)	576 (48.0%)	728 (47.5%)
Male	181 (54.4%)	623 (52.0%)	804 (52.5%)
Race			
Non-White or Unknown	164 (49.2%)	582 (48.5%)	746 (48.7%)
White	169 (50.8%)	617 (51.5%)	786 (51.3%)
Premature Birth	17 (6.1%)	63 (6.1%)	80 (6.1%)
Missing	54 (.%)	173 (.%)	227
History Asthma	21 (6.3%)	61 (5.1%)	82 (5.4%)
Bronchopulmonary Dysplasia/Chronic Lung disease	3 (0.9%)	0 (0.0%)	3 (0.2%)
Tracheostomy	3 (0.9%)	1 (0.1%)	4 (0.3%)
Structural pulmonary/airway abnormality	18 (5.4%)	20 (1.7%)	38 (2.5%)
Cardiac Risk Factors	10 (3.0%)	25 (2.1%)	35 (2.3%)
Developmental delay/impaired cognitive status	13 (3.9%)	31 (2.6%)	44 (2.9%)
Seizure Disorder	3 (0.9%)	4 (0.3%)	7 (0.5%)
Hematologic Disorder	4 (1.2%)	10 (0.8%)	14 (0.9%)
Congenital Malformation	13 (3.9%)	31 (2.6%)	44 (2.9%)
Nutritional support	3 (0.9%)	3 (0.3%)	6 (0.4%)
Case Status			
Elective	325 (97.6%)	1193 (99.5%)	1518 (99.1%)
Emergent	5 (1.5%)	3 (0.3%)	8 (0.5%)
Urgent	3 (0.9%)	3 (0.3%)	6 (0.4%)
Wound classification			
Clean	189 (56.8%)	723 (60.3%)	912 (59.5%)
Clean/Contaminated	111 (33.3%)	376 (31.4%)	487 (31.8%)
Contaminated	14 (4.2%)	52 (4.3%)	66 (4.3%)
Dirty/Infected	19 (5.7%)	48 (4.0%)	67 (4.4%)
ASA classification			
ASA 1 - No Disturb	178 (53.5%)	702 (58.5%)	880 (57.4%)
ASA 2 - Mild Disturb	136 (40.8%)	473 (39.4%)	609 (39.8%)
ASA 3 - Severe Disturb	18 (5.4%)	22 (1.8%)	40 (2.6%)
ASA 4 - Life Threat	1 (0.3%)	2 (0.2%)	3 (0.2%)

Table 2.

Clinical outcomes by inpatient/outpatient status.

	Inpatient (N=333)	Out patient (N=1199)	Total (N=1532)	p-value
Adverse Event	24 (7.2%)	44 (3.7%)	68 (4.4%)	0.006 ^I
Death in 30 days	0 (0%)	0 (0%)	0 (0%)	
Deep Incisional SSI	3 (0.9%)	3 (0.3%)	6 (0.4%)	
Bleeding/Transfusion	0 (0%)	0 (0%)	0 (0%)	
Unplanned Reoperation	13 (3.9%)	20 (1.7%)	33 (2.2%)	
Unplanned Readmission	14 (4.2%)	17 (1.4%)	31 (2.0%)	
Unplanned Intubation	1 (0.3%)	0 (0.0%)	1 (0.1%)	
Pneumonia	0 (0%)	0 (0%)	0 (0%)	
Nerve Injury	0 (0%)	0 (0%)	0 (0%)	
Sepsis	0 (0%)	0 (0%)	0 (0%)	
Wound Infection	12 (3.6%)	27 (2.3%)	39 (2.6%)	0.28
Total hospital length of stay in days, mean (SD)	1.4 (2.0)	0.7 (3.0)	0.8 (2.8)	
Median (IQR)	1.0 (1.0, 1.0)	1.0 (0.0, 1.0)	1.0 (0.0, 1.0)	
Range	(0.0-25.0)	(0.0-92.0)	(0.0-92.0)	

^I Chi-square.

Table 3.

Multivariable logistic regression analysis.

Covariates	Adjusted OR (95% CI)	P-value
<u>Inpatient/Outpatient Status</u>		
Inpatient	2.01 (1.20, 3.37)	0.008
<u>Age of patient (years)</u>	1.03 (0.98, 1.09)	0.27
<u>Sex (male/female)</u>		
Female	0.32 (0.18, 0.57)	<0.0001
<u>Race (white/other)</u>		
Non-White or Unknown	0.83 (0.51, 1.36)	0.46
<u>Wound Classification Status (clean/not clean)</u>		
Not Clean	0.80 (0.48, 1.33)	0.40
<u>ASA Classification Status (ASA 1/ASA2-4)</u>		
ASA 2-4	0.95 (0.58, 1.56)	0.84