



Multiple surgeries in pediatric otolaryngology patients and associated anesthesia risks

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ABSTRACT

Objectives: To determine the risk of healthy children undergoing tympanostomy tubes of an additional surgery prior to age three and associated risk factors.

Methods: A retrospective chart review of pediatric patients at a tertiary metropolitan children's hospital who underwent tympanostomy tube insertion procedure before age of three from January 2010 through March 2015. We determined patient demographics, indication for tympanostomy tube insertion, as well as information about additional procedures requiring general anesthesia before the age of three years. A prospective telephone interview was also performed on a portion of the study population to assess if there were additional surgeries before the age of three that did not occur at our institution.

Results: In our institution there was a 13% risk of getting an additional surgery after tympanostomy tubes in children who are otherwise healthy. The most common second procedure was an otolaryngologic procedure in 77.8% of the cases. Children with a diagnosis of recurrent acute otitis media had a threefold greater chance of getting an additional surgery than those with a diagnosis of chronic otitis media with effusion. Patients that identified as Black or African American were 3.2 times more likely to have additional surgery. With every year increase at age of surgery, the odds of an additional surgery decreased by 77%.

Conclusions: In healthy children undergoing tympanostomy tube insertion at our institution, the incidence of additional procedures under general anesthesia (GA) is low at 13%. Although there is evidence of possible deleterious effects of anesthesia on the developing brain, it is generally accepted that one short (≤ 1 h) anesthetic exposure under the age of three has not been associated with adverse neurodevelopmental outcomes. As a specialty that regularly performs procedures on young children, we need to be aware of the possible effects of anesthetic agents on our patients. However, this study shows that the exposure risk is low and should help reassure patient's families.

1. Introduction

One of the greatest worries of parents whose children need surgery is anesthesia and its risks. Traditionally these risks have included laryngospasm, physical damage to the airway, and rare reactions such as malignant hyperthermia, pneumonia and cardiac complications [1]. Over the last decade, an increasing number of studies show a correlation between multiple anesthetics in young children under three years of age and cognitive deficits [2–4]. There are multiple studies in animals, including non-human primates, which show deleterious neurobehavioral effects resulting from neuronal damage, impaired synaptogenesis and increased apoptosis [4]. Some human retrospective

analyses suggest multiple anesthetics are associated with an increased incidence of learning disabilities [5–7]. However, these findings are not corroborated by all investigators, and how the animal data translate to human subjects is a topic of much controversy and discussion [8,9].

In the United States, tympanostomy tube insertion (TT) is the most common surgery performed in children. The American Academy of Otolaryngology- Head and Neck Surgery estimates more than 600,000 children undergo TT insertion annually [10]. As otolaryngologists, we need to be aware of the potential for multiple anesthetics in our patient population and adhere to strict operative guidelines to ensure we are not subjecting children to undue risk. The aim of this study is to assess the number of healthy children who undergo tympanostomy tube

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insertion prior to the age of three who then require an additional surgery prior to the age of three. We hypothesized that the risk for second surgery is low. Additional aims of the study include assessing traits that put a child at risk for undergoing a second surgery prior to the age of three.

2. Methods

2.1. Chart review

Following IRB approval, a retrospective chart review was performed for patients who had a tympanostomy and tube (TT) insertion procedure before the age of three years from January 2010 to March 2015. Approval for this study was obtained from the Colorado Multiple Institutional Review Board at the University of Colorado Denver as an expedited study and informed consent was waived. Recorded data from the EMR included patient demographics, indication for tympanostomy and tube insertion, diagnosis of conductive hearing loss, as well as dates and descriptions of additional procedures requiring general anesthesia before the age of three years. All recorded data was de-identified and transferred to a secure REDCap (Research Electronic Database Capture) database for statistical analysis.

2.2. Statistical analysis

Demographic and clinical characteristics of the study cohort were reported using summary statistics, such as mean, median, standard deviation, and range for continuous variables and rate or percentage for categorical variables. Logistic regression analysis was performed to assess association between categorical outcome variable such as additional surgery (yes or no) and demographic characteristics. In addition, we also carried out time to event analysis to estimate the hazard for the event of additional surgery using Cox Proportional hazard regression model. Analyses were performed in SAS 10.3 (SAS Institute, Cary NC). P-value < 0.05 was considered statistically significant.

3. Results

Over the five-year period, we identified 1440 patients who had a tympanostomy and tube insertion procedure before the age of three years at our institution who were otherwise healthy. Population demographics are characterized in Table 1. Of the 1440 patients, 215 patients underwent at least one additional procedure requiring general anesthesia before the age of three years. 184 (12.8%) patients underwent one additional procedure and 31 (1.9%) patients had more than

Table 1
Patient characteristics.

Total n = 1440	No additional surgery n = 1225	Additional surgery n = 215
Gender, n (%)		
Male	718 (58.6)	143 (66.5)
Female	507 (41.4)	72 (33.5)
Age at TT, years		
Mean (range)	1.43 (0.31–2.99)	1.09 (0.21–2.37)
Ethnicity, n (%)		
Caucasian	892 (72.8)	150 (69.8)
Hispanic/Latino	194 (15.8)	43 (20.0)
Black/African American	22 (1.8)	8 (3.7)
More than one race	35 (2.9)	7 (3.6)
Asian	15 (1.2)	0
American Indian/Alaska Native	1 (0.08)	0
Native Hawaiian/Pacific Islander	0	1 (0.5)
Other	20 (1.6)	4 (1.9)
Unknown/not reported	46 (37.6)	4 (1.9)

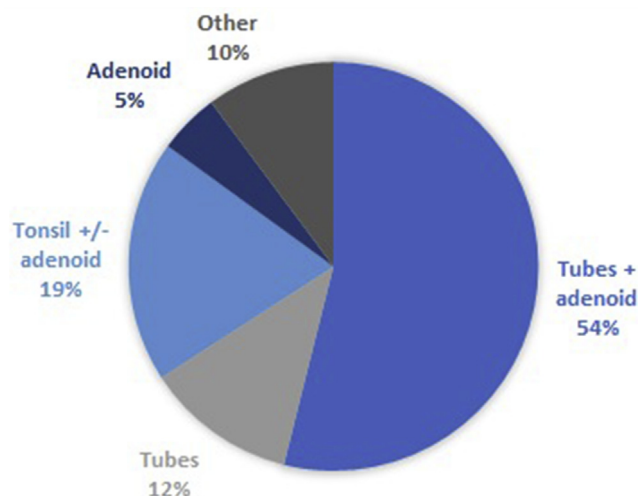


Fig. 1. Breakdown of secondary ENT surgeries.

one additional surgery.

Of the 215 subjects with 2 or more surgeries, the second surgery was an ENT surgery 77.7% (167 of 215) of the time. Of these second ENT surgeries, the most common was TT with adenoidectomy (54%) followed by adenotonsillectomy (19%) and TT (12%). Please see Fig. 1 for further details.

After ENT surgeries, dental surgery was the second most common additional surgery at 3.3%. 1.4% of the second anesthetic exposures were imaging procedures done under anesthesia. The rest of the second surgeries were a mixture of different specialties. Among the 215 subjects with 2 or more surgeries, 51 (24%) had the diagnosis of chronic otitis media at their first surgery and 164 (76%) had the diagnosis of recurrent acute otitis media.

In order to estimate how many subjects might have had subsequent operations outside of our institution, we attempted to contact all families of patients who did not have an additional surgery after their TT procedure in our hospital record for the year 2011 (n = 236). We were able to reach 80 families (33.9%). Of those 80 families, 2 reported their child having an additional surgery outside of our hospital. Those 2 patients have been included in the data analysis. We did obtain IRB approval for this portion of the study as well.

We performed a multivariate logistic regression to determine the variables that correlated with a patient having at least one additional surgery after their initial TT surgery. These variables included: sex, age, race/ethnicity, indication for TT, and diagnosis of conductive hearing loss. In multivariate analysis, Black and African American children were 3.2 times more likely to have additional surgery. With every additional year at age of surgery, the odds of additional surgery decreased by 77%. The results from the Cox model for time to the first additional surgery are similar to those from the logistic regression model, that race/ethnicity and age at TT are significantly associated with time to extra surgery. Compared to Black and African American children, the hazard for extra surgery for Hispanic or Latino, other ethnicity, and white are respectively 0.38, 0.33, and 0.16 of the hazard for Black and African American children. With every year increase for age at surgery, the hazard for additional surgery decrease 77%. In subjects with additional surgeries there were 8% more male subjects compared to subjects with no additional surgeries (P = 0.03). Subjects with more than one surgery had their first surgery on average at age 1.09 years of age compared to 1.42 years of age for subjects with no additional surgery. (P < 0.001).

4. Discussion

A recent epidemiologic study by Shi et al. showed that 3120 (14.9%) of 20, 922 children in a birth cohort underwent at least one

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