International Journal of Pediatric Otorhinolaryngology 91 (2016) 15–18

Contents lists available at ScienceDirect

International Journal of Pediatric Otorhinolaryngology

journal homepage: http://www.ijporlonline.com/

Comparison of treatment outcomes between intracapsular and total tonsillectomy for pediatric obstructive sleep apnea

David T. Chang, Allison Zemek, Peter J. Koltai*

Stanford Department of Otolaryngology – Head and Neck Surgery, 801 Welch Road, Stanford, CA 94305, United States

ARTICLE INFO

Article history:
Received 22 June 2016
Accepted 22 September 2016
Available online 24 September 2016

Keywords:
Intracapsular tonsillectomy
Tonsillectomy
Pediatric
Obstructive sleep apnea
Complications
Polysomnogram

ABSTRACT

Background: Intracapsular tonsillectomy (IT) has been advocated as a treatment for pediatric obstructive sleep apnea (OSA). However, evidence in the literature utilizing polysomnography (PSG) is limited.
Objective: To examine the experience at a tertiary children's hospital to evaluate the effectiveness and risks of intracapsular tonsillectomy compared to total tonsillectomy (TT) for treating pediatric OSA.
Methods: A retrospective study was undertaken of pediatric tonsillectomy cases performed for OSA at a tertiary children's hospital from 2005 to 2010. Patients with recurrent tonsillitis, craniofacial abnormalities, chromosomal abnormalities, neuromuscular disease, and congenital malformations were excluded. Main outcome measures were apnea-hypopnea index (AHI), minimum oxygen saturation ($minO_2$), and surgical complications.
Results: Of the 1583 patients reviewed in this study, there were 75 IT and 93 TT patients with pre- and post-operative PSG results. The IT patients were younger, had lower BMI, larger tonsil size, lower pre-operative (AHI) and lower post-operative AHI ($p < 0.05$). There was a similar percentage of patients that showed improvement in AHI and minimum oxygen saturation between the IT and TT groups. There were statistically similar average change in AHI and minimum oxygen saturation between the IT and TT groups at 5.6 ± 8.6 and 8.6 ± 12.9, respectively ($p = 0.8$) as well as similar improvement in minimum oxygen saturation between the two groups at $3.3\% \pm 4.3\%$ and $3.0\% \pm 5.2\%$, respectively ($p = 0.66$). Of TT patients, 2.9% experienced post-operative bleeding with 1.6% requiring OR for control of hemorrhage. Of IT patients, 2.2% were found to have tonsillar regrowth with 2.0% returning to the OR for secondary tonsillectomy.
Conclusions: Intracapsular tonsillectomy, like total tonsillectomy, is effective in improving polysomnogram results in appropriately selected children. Intracapsular tonsillectomy is a suitable option for the surgical treatment of pediatric OSA consequent to its demonstrated efficacy in relieving OSA and its favorable safety profile.

1. Introduction

Tonsillectomy is one of the most common procedures performed in the United States in the pediatric population, and obstructive sleep apnea (OSA) is the primary indication for this surgery [1,2]. Total tonsillectomy (TT) has been traditionally the procedure of choice and shown to be effective in treating pediatric obstructive sleep apnea [3]. Complications are uncommon but can lead to significant morbidity. Known risks of TT include post-operative oropharyngeal hemorrhage and dehydration, requiring admission for observation, pain control, and rehydration, or a return to the operating room for control of bleeding. The rates of post-tonsillectomy hemorrhage varies but has generally been reported to range from 1% to 3% [1,4].

In light of the risks of total tonsillectomy, we developed the concept of intracapsular tonsillectomy [5–7]. Rather than an extracapsular dissection in traditional TT, this technique removes tonsillar tissue but spares the capsule overlying the pharyngeal muscles and preserves them as a biologic dressing. This approach results in less post-operative pain and a quicker recovery with a more favorable safety profile consequent to reduced rates of post-operative bleeding [7–14]. The risk of post-operative hemorrhage has been reported from 1 to 3% with total tonsillectomy while bleeding after intracapsular tonsillectomy is usually reported to be

* Corresponding author.
E-mail address: pkoltai@ohns.stanford.edu (P.J. Koltai).

http://dx.doi.org/10.1016/j.ijporl.2016.09.029
0165-5876/

much less than 1% [1,4].

Nevertheless, the question remains whether intracapsular tonsillectomy is as effective as TT in treating sleep apnea. Previous studies have shown improvements in sleep apnea symptoms after intracapsular tonsillectomy to be on par with total tonsillectomy [15–17]. However, there are relatively few studies comparing pre-operative and post-operative polysomnograms (PSG), which is the current standard for the diagnosis of obstructive sleep apnea. These studies have shown improvements in sleep study results for intracapsular tonsillectomy to be comparable to total tonsillectomy with potential for cure [17–20].

Our objective was to examine the experience at a tertiary children's hospital in terms of surgical outcomes after intracapsular tonsillectomy (IT) and compare them to total tonsillectomy (TT) as our control group. We hypothesize that intracapsular tonsillectomy produces similar improvements in sleep apnea measured by polysomnography while minimizing significant post-operative complications when the children are appropriately selected.

2. Methods

A retrospective study was conducted of pediatric tonsillectomy cases performed for OSA at a tertiary children's hospital from 2005 to 2010. The study protocol was approved by the Institutional Review Board at Stanford University. The Stanford Translational Research Integrated Database Environment (STRIDE) was utilized for selection of the cohorts and data acquisition. The STRIDE database is a clinical data warehouse integrating clinical data from pediatric patients cared for at our institution since 1995 and provides clinical and demographic data, clinical encounters and documents, ICD9-coded diagnosis, clinical procedures, radiology reports, surgical pathology reports, and laboratory results. The patient electronic charts were reviewed to clarify or supplement the STRIDE data. Patients under the age of 18 years, diagnosed with OSA either clinically or by polysomnography, and undergoing total or intracapsular tonsillectomy were included. All available post-operative events captured in the medical records up until the time of this report were included. Diagnosis of obstructive sleep apnea was made when AHI was greater than 1. Total tonsillectomies were performed using coblation, electrocautery, or cold technique by multiple surgeons operating at the children's hospital. Intracapsular tonsillectomies were performed either with coblation or microdebrider. Children with recurrent tonsillitis, craniofacial abnormalities, chromosomal abnormalities, neuromuscular disease, or congenital malformations were excluded.

All patient charts were reviewed for procedure performed, tonsillectomy indication, age, gender, and body mass index (BMI), tonsil size on exam, pre-operative and post-operative polysomnography results, and complications. The primary outcome measures were the change in polysomnogram results in terms of apnea-hypopnea index (AHI) and minimum oxygen saturation ($minO_2$). The change in AHI and minimum oxygen saturation after surgery was calculated by subtracting the pre-operative value from the post-operative value. The percentage of patients who showed improvement in AHI and minimum oxygen saturation were calculated by taking the number who improved divided by total patients. Secondary outcome measures were post-operative complications, namely oropharyngeal bleeding, dehydration, tonsillar regrowth, velopharyngeal insufficiency (VPI), and subsequent need for admission and surgery.

SPSS IBM software (Armonk, NY) was utilized for statistical analysis. Linear regression was performed for comparison of patient characteristics and PSG results between intracapsular tonsillectomy and total tonsillectomy. Adjustments were made for age, gender, BMI, and tonsil size, and pre-operative PSG results. Chi square and logistic regressions were utilized for statistical comparisons of complications between intracapsular tonsillectomy and total tonsillectomy. The Fisher exact test was used in instances where counts were less than 5. P-value < 0.05 was used for statistical significance.

3. Results

There were 1583 patients who underwent total or intracapsular tonsillectomy for obstructive sleep apnea from 2005 to 2010 at our institution who met inclusion criteria. Of these patients, 168 patients had both pre-operative and post-operative polysomnograms and were included in the primary PSG outcomes comparison. Ninety-three patients underwent total tonsillectomy while seventy-five patients underwent intracapsular tonsillectomy. Comparisons of the patient groups in Table 1 show that the children obtaining intracapsular tonsillectomies were younger (5 vs 9, $p < 0.001$), had lower BMI (16.6 vs 20.9, $p < 0.001$), but larger tonsil size (3.3 vs 2.7, $p < 0.001$). Post-operative AHI was lower in the partial intracapsular tonsillectomy group (4.5 vs 6.7, $p = 0.047$) but also started with lower pre-operative AHI (10.1 vs 15.3, $p = 0.008$).

Table 2 shows a comparison of the improvements in sleep study results after tonsillectomy. The relative number and percentage of patients showing improvement in AHI and minimum oxygen saturation after surgery was similar between the two groups. In the intracapsular tonsillectomy group, 76% of the children showed improvement in AHI and 79% showed improvement in their minimum oxygen saturation. For the total tonsillectomy group, 77% showed improvement in AHI and 70% showed improvement in minimum oxygen saturation. Despite the average change in AHI at 5.6 for intracapsular tonsillectomy cases being less than the change in AHI at 8.6 for total tonsillectomy, this was not statistically significant. Likewise, the actual changes in minimum oxygen saturation (3.3% and 3.0%, for IT and TT, respectively) after tonsillectomy were not statistically different between the two groups.

A total of 1583 patients were reviewed for complications. The percentage of complications between the IT and TT groups were statistically similar, but the complication profile for the two groups was significantly different (Table 3). In all, 2.6% of the patients who underwent IT (12 out of 455 patients) and 3.8% of the TT group (43 out of 1128 patients) experienced complications. Of these 12 IT patients with complications, 9 patients (2% of total) required return to the operating room for total tonsillectomy due to recurrent sleep apnea symptoms with regrowth of tonsils. Of the 43 patients in the TT complications group, 34 patient (3% of total) required re-admission and 18 patients (1.6% of total) required return to the operating room for control of oropharyngeal bleeding. The most

Table 1
Comparison of patient groups.

	Intracapsular tonsillectomy	Total tonsillectomy	p-value
Total patients	75	93	
Age	4.9 ± 2.8	8.5 ± 3.8	<0.001
Gender (M/F)	44/31	62/31	0.833
BMI	16.6 ± 2.7	20.9 ± 6.4	<0.001
Tonsil size	3.3 ± 0.7	2.7 ± 0.9	<0.001
PSG			
Pre-operative AHI	10.1 ± 9.9	15.3 ± 13.9	0.008
Pre-operative min O_2 (%)	88.8 ± 4.1	88.3 ± 5.9	0.789
Post-operative AHI	4.5 ± 5.3	6.7 ± 7.7	0.047
Post-operative min O_2 (%)	92.1 ± 3.0	91.3 ± 3.9	0.365

Abbreviations: m = male; f = female; PSG = polysomnogram; min = minimum; AHI = apnea hypopnea index; O_2 = oxygen saturation.
Values are provided as mean ± STD.