



Long-Term Effects of Tonsillectomy on Immunity

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Abstract

Tonsillectomy is one of the most common surgical procedures performed on children under the age of 15 [1]. The long-term consequence of tonsillectomy has received considerable attention in the medical field. In this study we looked at the effect of tonsillectomy on the subsequent diagnosis of select immunodeficiency. In a retrospective study comparing post-tonsillectomy patients with a primary immunodeficiency, diagnosed through IgG subclass testing, out of a total of 46 patients, 16 were post-tonsillectomy patients. Overall, IgG subclass 3 was significantly lower in the post-tonsillectomy group than in the comparison group without tonsillectomy ($p = 0.009$). Other subgroup factors such as gender and age were also analyzed and did not show a significant effect on IgG levels. Due to the small number of the study population, results could be validated by further studies on a larger group of tonsillectomy and non-tonsillectomy patients presenting with IgG subclass deficiency with speculation on the long-term consequences of tonsillectomy and the immune system.

Introduction

Despite numerous studies the effect of tonsillectomy surgery on the immune system is poorly understood. This study seeks to examine one aspect of what effect tonsillectomies may have in the long term, beyond 20 years. We examine 46 patients who were diagnosed immunodeficient and formulated two groups: non-tonsillectomy and post tonsillectomy. Immunoglobulin G subclass levels were measured and compared to determine how and if the two groups might differ.

Methods

All patients in this study were diagnosed through specific IgG class and total IgG level testing with a primary humoral immunodeficiency. Under patient consent, interviews were conducted to determine which individuals had tonsillectomy during childhood (before age 18). Two groups emerged which included post-tonsillectomy and non-tonsillectomy. The two groups serum IgG subclass levels were measured and statistically analyzed for comparison.

Patients

The study was performed on a total of 46 patients (32 females and 14 males, aged 24-89, mean age 57.5 ± 15.5 years) at the Washington ENT Center in Rockville, Maryland. The control group consisted of 30 patients, 21 women and 8 men (median: 56 years; age interval 24-89) who reported not having tonsillectomy surgery. The experimental group consisted of 16 patients, 11 women and 5 men (median: 59 years; age interval 27-85) who reported having their tonsil removed during childhood. The average age of when tonsils were removed was 11.

Statistical Analysis

Exact Wilcoxon rank sum test was used to test difference between the two group's serum IgG levels. IgG measurement was log transformed for analysis. In addition, linear regression model was used for subgroup analysis, which specifically looked at differences in age and gender groups to determine if the surgery effect differs between the subgroups.

Discussion

The data suggests tonsils may contribute to long-term immune function. Specifically, having tonsils removed may be a risk factor for significantly lower IgG3 serum levels. Various studies analyzing the effect tonsillectomy surgery on immunity suggest a transient impact on immunity post-surgery that returns to normal within one month [2,3,4,5]. However our analysis suggests that compensatory immunologic mechanisms that may have allowed a return to normal immune function may not persist lifelong. Additionally, gender and age appears to have no effect on the immune system health based on IgG levels.

IgG3 fixes complement better than any other IgG subclass and contributes a major role in antibody-dependent cellular cytotoxicity (ADCC) [6]. To this date though, little is known about the distinctive functions of each IgG subclass. However, recently the "Temporal Model of human IgE and IgG function" suggested a major role for IgG3 in the early immune response [7]. As such, a deficiency in this subclass may result in a weaker and delayed initial immune response.

Overall, primary immunodeficiencies are due to multifactorial factors from diet, environment, and genetics. We believe that tonsillectomy may be one piece of the larger puzzle and removal of tonsils may be a contributing factor to lower IgG3 levels in adults with primary immunodeficiency.

Results

Table 1 Humoral immune parameters

Parameter	Patients without Tonsillectomy (n = 30)	Patients with Tonsillectomy (n = 16)	P-value
IgG1	418 (250-991)	476 (200-730)	0.716
IgG2	223.5 (138-604)	254 (17-531)	0.596
IgG3	44 (14-160)	28.5 (2-97)	0.009
IgG4	13.45 (0.2-49.4)	20.05 (0.2-38.5)	0.440
IgG Total	815 (506-1445)	773 (453-1298)	0.916

Values are given as median (range)

Table 1 shows the summary statistics for the serum IgG levels by tonsillectomy surgery or no tonsillectomy surgery based on Wilcoxon rank sum tests. The data suggests that the patients who once had a tonsillectomy surgery have lower level of IgG3 than the patients who did not have such a surgery ($p = 0.009$).

Table 2 Subgroup analysis

Parameter	P-value for Age	P-value for Gender
IgG1	0.253	0.801
IgG2	0.506	0.649
IgG3	0.220	0.151
IgG4	0.790	0.436
IgG total	0.179	0.711

Table 2 shows the P-values of the interaction term from subgroup analysis. The data did not provide strong evidence to support that the surgery effect on any outcome measure differs between genders and age groups because all P-values for the interaction terms are larger than 0.05.

Conclusions

The paradigm of whether or not to remove tonsils is still up for debate; however this evidence suggests that in the long term, tonsils may be more strongly associated with immune system deficiency than previously thought, especially in IgG3.

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