ORIGINAL ARTICLE

Effect of tonsillectomy on humoral immune system in children

Ali A. Abd-Elrahman [a], Ahmed H. Mohamed [a], Abd-Elsalam F. Abd-Elsalam [b], Essam R. K. Elmohr [a,*]

[a] Department of Otorhinolaryngology, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt
[b] Department of Clinical Pathology, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

Abstract

Background: ***Tonsillectomy is one of the surgical operations that is performed the most frequently all over the globe. For a long time, tonsil surgery has been restricted to only partial excision because of the concern that it might remove vital tissue.***

Aim: ***To study the impact of tonsillectomy on the humoral immune functions of kids regarding the concentrations of certain immunoglobulins (IgA, IgG, and IgM).***

Patients and methods: ***This was prospective comparative research performed on 60 cases from Al-Azhar University hospitals that indicated tonsillectomy.***

Results: ***The mean age of cases was 7.75 ± 2.36 years, with twenty-nine (48.3 percent) being male and thirty-one (51.7 percent) being female. Statistically insignificant variation has been seen among before and following surgery IgA levels in the examined group. A statistically insignificant variation has been seen between before and following surgery IgM levels in the examined group. Statistically insignificant variation has been seen among before and following surgery IgG levels in the examined group.***

Conclusion: ***The findings of this investigation indicated a statistically insignificant distinction had been observed in prior and following surgery levels of IgM, IgG, and IgA in the examined group.***

Keywords: Tonsillectomy; Immune System; IgM

1. Introduction

Tonsillectomy is one of the most prevalent surgical operations globally. Historically, tonsillectomy has been restricted to partial excision for concerns about maintaining healthy tissue. The credit for the first full tonsillectomy is attributed to Celsus in the first century. As treatment gained popularity, partial excision remained regarded as the safest and most effective way for excision. By the nineteenth century, enhanced illumination, improved hemostatic control, and advanced anesthetic procedures facilitated full excision. [1]

The adenoids, palatine tonsils, tubal tonsils, and lingual tonsils constitute the lymphoepithelial tissues forming Waldeyer's ring, named after the German anatomist Heinrich Wilhelm Gottfried von Waldeyer-Hartz. These organisms constitute the immune system of the mucosa. Their main role is to take part in the secondary immune system by local pathogens and immunological sampling antigens. They are deliberately positioned at the junction of the respiratory as well as digestive processes to function as a site for continued lymphoid stimulation. [2]

The palatine tonsils generate antibodies through their B cells. Tonsillar growth peaks between four and seven years of age, with involution commencing by fourteen years, leading to minimal lymphoid tissue by sixty years old. [3]

The purpose of this research was to study the impact of tonsillectomy on the humoral immune functions of children regarding the concentrations of certain immunoglobulins (IgM, IgG, and IgA).

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* Corresponding author at: Otorhinolaryngology, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt.
E-mail address: essamelmohr@gmail.com (E. R. K. Elmohr).

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2. Patients and methods

This was prospective comparative research performed on 60 cases from Al-Azhar University hospitals who were indicated for tonsillectomy.

Inclusion criteria: Age ranged from 3 to 16 years; sex: both females and males have been involved, and children who indicated tonsillectomy.

Exclusion criteria: Age: over 16 years old or fewer than 3 years old, cases with unilateral tonsillar mass (tumor), children who were immunocompromised (diabetes mellitus—steroid intake), and children who had bleeding disorders.

Methods

All patients in this research have been exposed to the following: Full history taking, general examination, nasal examination, ear examination, and oral cavity examination: ensure that there was no acute attack of tonsillitis or postnasal discharge and no signs of quinsy and Preoperative measurement of (IgG-IgM-IgA) levels, CBC, ESR, ASOT, PT, PTT, INR, and RBS was done within 1 month before the operation. Children underwent tonsillectomy operation, and postoperative measurement of (IgG-IgM-IgA) levels was done after 1 month, and the results of (IgG-IgM-IgA) levels preoperatively and postoperatively after 1 month were compared.

The risks to participants and measures used to minimize the risk: Any unexpected risks that occurred throughout the research were immediately notified to participants and the ethics committee. Informed permission has been acquired in writing from all research participants. The Ethics Committee of the Faculty of Medicine of Alazhar University permitted the research. Provisions are in place to ensure participant privacy and data confidentiality as follows: Each participant is assigned a code number, while their name and address are stored in a secure file. We concealed the case's identity during the research. We utilized the research's outcomes just for scientific analysis and didn't use them for any other objectives.

Statistical analysis

The data analysis has been conducted with SPSS (Statistical Package for the Social Sciences): characterization of quantitative variables through mean, SD, and range. Qualitative variables are described using counts and percentages. Analysis of variance (ANOVA) for the comparison of many groups exceeding two. The Spearman rank correlation test was applied to examine the potential association between two variables, with a positive correlation or an inverse association indicated by a value of more than 0.05 as insignificant, less than 0.05 as significant, and less than 0.01 as highly significant.

3. Results

Table 1 shows that the study group consists of 60 participants, with a fairly balanced gender distribution: 29 men (48.3%) and 31 femwomenales (51.7%). The mean age of the subjects is 7.75 years, with a standard deviation of 2.36, with a range of 3-13 years.

Table 1. Distribution of baseline characteristics in the examined group.

	STUDY GROUP (NUMBER= SIXTY)
AGE (YEAR)	
MEAN± SD	7.75± 2.36
MIN-MAX	(3 _13)
SEX	
MALE	29 (48.3%)
FEMALE	31 (51.7%)

Table 2 demonstrates that, pre-surgery, the participants exhibited normal coagulation parameters, with a mean prothrombin time (PT) of 12.85 ± 0.45 seconds, a mean partial thromboplastin time (PTT) of 28.8 ± 4.79 seconds, and a mean international normalized ratio (INR) of 1.08 ± 0.1, and the mean hemoglobin level before surgery was 11.58 ± 1.77 g/dL.

Table 2. Distribution of Laboratory Data in the Examined Group.

MEAN± SD	BEFORE SURGERY (NUMBER= SIXTY)
PROTHROMBIN TIME (PT) (SECONDS)	12.85 ± 0.45
PARTIAL THROMBOPLASTIN TIME (PTT) (SECONDS)	28.8 ± 4.79
INTERNATIONAL NORMALIZED RATIO (INR)	1.08 ± 0.1
HEMOGLOBIN (G/DL)	11.58 ± 1.77

Table 3 shows that the comparison between pre- and post-surgery IgA levels shows a statistically significant variance (P-value = 0.006). Before surgery, the mean IgA level was 192.8 ± 79.9 mg/dL, which decreased to 152.5 ± 90.5 mg/dL following surgery.

Table 3. Distribution of before and following surgery IgA in the studied group.

	BEFORE SURGERY (NUMBER= SIXTY)	FOLLOWING SURGERY (NUMBER= SIXTY)	P-VALUE
IGA (MG/DL)			
MEAN± SD	192.8 ±79.9	152.5 ±90.5	0.006

SD: standard deviation, P-value <0.05 is statistically significant, P-value >0.05: insignificant, p-value <0.001 is highly significant.

Table 4 shows that the comparison of pre- and post-surgery IgM levels shows a statistically significant decrease (P-value = 0.003). Before surgery, the mean IgM level was 149.9 ± 43.2 mg/dL, which decreased to 125.1 ± 48.1 mg/dL following surgery.

Table 4. Distribution of before and following surgery IgM in the studied group.

	BEFORE SURGERY (NUMBER= SIXTY)	FOLLOWING SURGERY (NUMBER= SIXTY)	P-VALUE
IGM (MG/DL)			
MEAN± SD	149.9 ±43.2	125.1 ±48.1	0.003

Table 5 shows that the comparison of pre- and post-surgery IgG levels shows a statistically significant decrease (P-value = 0.04). Before surgery, the mean IgG level was 1162.9 ± 156.26 mg/dL, which decreased to 1109.18 ± 140.06 mg/dL following surgery.

Table 5. Distribution of before and following surgery IgG in the studied group.

	BEFORE SURGERY (NUMBER= SIXTY)	FOLLOWING SURGERY (NUMBER= SIXTY)	P-VALUE
IGG (MG/DL)			
MEAN± SD	1162.9 ±156.26	1109.18 ±140.06	0.04

4. Discussion

It is generally agreed that tonsils are essential parts of the system that defend the body against pathogens that enter the upper respiratory tract from the outside. The human tonsils, which are components of Waldeyer's ring, are lymphoid organs that are immunologically active. They create specific antibodies and exhibit B- and T-cell action in response to a variety of antigens. As a result, they play roles in both humoral and cellular immunity.[4]

Human immune responses are categorized into 2 types: (a) humoral immune response, reliant on antibodies, plasma cells, and B cells, and (b) cellular immunological response, reliant on cytokines and T cells. Lymphocytes are the essential cells in the immune system. All lymphocytes originate from a similar lymphoid progenitor cell in the bone marrow, subsequently migrating to peripheral lymphatic tissues. [5]

Our investigation indicated that the study group consists of 60 participants, with a fairly balanced gender distribution: 29 men (48.3%) and 31 women (51.7%). The mean age of the participants was 7.75 ± 2.36 years, with a range of 3-13 years.

This investigation aligns with research conducted by Mohamdy et al.,[6] who aimed to examine the impact of tonsillectomy on humoral immune markers (IgM, IgA, and IgG) in children suffering from obstructive sleep apnea, both before and following surgery. Sixty cases scheduled for tonsillectomy, diagnosed with adenotonsillar hypertrophy by otorhinolaryngology surgeons based on clinical findings, have been involved. A total of sixty kids participated in the research; twenty-one of them were lost to follow-up three months following surgery, leaving just thirty-nine kids who completed the research. There were twenty-one females (53.8 percent) and eighteen males (46.2 percent), all aged up to three years of age.

Moreover, our outcomes align with those of Elmagd et al.,[7] who aimed to examine the alterations in humoral and cellular immunity in kids aged between eight and fifteen with chronic tonsillitis, both prior to and one month after tonsillectomy. The investigation involved thirty kids, comprising sixteen females and fourteen males, aged between eight and fifteen years, with a mean age of 11.5 ± 4.9 years.

Moreover, our results align with those of Radman et al.,[8] who aimed to examine the impact of long-term tonsillectomy on cases' immune systems. The case-control research assessed the immune system health in thirty-four kids post-tonsillectomy. The average age in the case group was 12.35 ± 1.57 years. Gender analysis of the two groups revealed fifteen males (44.11 percent) and nineteen females (55.89 percent) in the case group.

Additionally, Kaygusuz et al.[9] aimed to examine the long-term impacts of tonsillectomy in relation to their short-term findings. Among thirty-seven kids, there were twenty-one girls and sixteen boys, aged from five to nine years, with a mean age of 7.29 ± 2.6 years.

In our investigation, we indicated that a statistically insignificant variation has been observed in the distribution of IgA before and following surgery among the examined group (P-value more than 0.006). Before surgery, the mean IgA level was 192.8 ± 79.9 mg/dL, which decreased to 152.5 ± 90.5 mg/dL following surgery.

This outcome was consistent with the findings of Santos et al.,[10] who aimed to investigate both long- and short-term influences of tonsillectomy on the humoral and cellular immunity of kids. This continuous prospective research involved twenty-nine kids referred for adenotonsillectomy, revealing statistically insignificant variation prior to and following surgery IgA levels within the examined group.

Furthermore, our results align with those of Altwairqi et al.,[11] who demonstrated an insignificant variance in humeral immune indicators (IgA) before and after surgery.

Conversely, an investigation by Mohamdy et al.[6] indicated that the IgA level had been diminished in one- and three-month postoperative follow-up evaluations compared to the prior surgery level (P-value less than 0.001).

In contrast to the current findings, Dai et al.[12] aimed to examine the alterations in the cellular and humoral immunity of kids. It was observed that IgA levels one-month post-surgery were

considerably lower than preoperative levels; these levels reverted to baseline three months following the surgery. The alterations were statistically significant (P-value less than 0.01).

In our investigation, we revealed that the comparison of pre-and post-surgery IgM and IgG levels showed a statistically significant decrease within the examined group. Before surgery, the mean IgM level was 149.9 ± 43.2 mg/dL, which decreased to 125.1 ± 48.1 mg/dL following surgery. Before surgery, the mean IgG level was 1162.9 ± 156.26 mg/dL, which decreased to 1109.18 ± 140.06 mg/dL following surgery.

Our findings were in line with Kaygusuz et al.[9] which showed statistically significant variations among prior to and following surgery levels of IgG and IgM, which diminished one-month post-surgery (P-value less than 0.05).

Also, our results agreed with Mohamdy et al.[6] observed that the IgM level was significantly lower in the one- and three-month postoperative monitoring examinations compared to the prior surgery level (P-value less than 0.001).

Similarly, Dai et al.[12] observed that the concentrations of IgG and IgM at one-month post-surgery were significantly reduced compared to prior surgery levels; these levels reverted to baseline three months following the procedure. The alterations were statistically significant (P-value less than 0.01).

As well, Mohamdy et al.[6] found a reduction in IgG serum levels one-month post-surgery compared to prior surgery levels (P = 0.005). Three months after surgery, IgG levels did not alter significantly from before surgery levels (P-value equal to 0.16).

In contrast, our results disagreed with Altwairqi et al.[11] who demonstrated an insignificant variation in the levels of humeral immune marker antibodies (IgM and IgG) before and after surgery.

Also, our findings disagreed with Santos et al.,[10] who determined that a statistically insignificant variation has been observed in prior and following surgery IgG and IgM levels within the examined group.

4. Conclusion

The findings of this investigation indicated a statistically significant reduction had been observed in prior and following surgery levels of IgM, IgG, and IgA in the examined group.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

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All authors have a substantial contribution to the article

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