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Effects of adenotonsillectomy on humoral immunity

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ABSTRACT

Background: Adenotonsillectomy is one of the commonest surgical procedures performed by the otolaryngologists. The immunological effects of adenotonsillectomy have not been studied extensively. Some researchers have found decreased immunoglobulin levels after adenotonsillectomy while others have not reported any significant changes. The present study aimed to evaluate the changes in humoral immunity in patients undergoing adenotonsillectomy before and after surgery as measured by serum immunoglobulin levels.
Methods: The study designed was a prospective observational case-control study conducted at Yenepoya Medical College Hospital, a tertiary referral hospital, Mangalore, Karnataka. A total of 25 patients in the age range 5-15years who underwent adenotonsillectomy for chronic adenotonsillitis and 25 age and sex matched controls participated in the study. Serum immunoglobulin G, A and M (IgG, IgA and IgM) levels were estimated 24 hours prior and 4 weeks after adenotonsillectomy. The statistical analysis used was non-parametric tests.
Results: Serum levels of IgG, A and M were found to be significantly higher in patients with chronic adenotonsillitis. The levels of all the three immunoglobulins decreased to normal one month post-operatively.
Conclusions: Removal of infected tissue and chronic antigenic stimulation resulted in restoration of serum immunoglobulin levels to normal. While chronic adenotonsillitis contributed to changes in humoral immunity as reflected by higher serum immunoglobulin levels, adenotonsillectomy enabled restoration of the immunoglobulin levels to normal.

Keywords: Adenotonsillectomy, Immunoglobulins, Humoral immunity

INTRODUCTION

Adenotonsillitis is one of the commonest health problems encountered in the general population particularly in children. Tonsillectomy is one of the commonest surgical procedures performed by the otolaryngologists all over the world.[1] Good clinical evidence regarding the need for tonsillectomy/adenoidectomy or both is available, which provides guidance to surgeons. Indications for removal of tonsils or adenoids, or both can be absolute or relative, and depend upon the clinical signs and symptoms of the child. Absolute indications for adenotonsillectomy include adenotonsillar hyperplasia with obstructive sleep apnea, failure to thrive, or abnormal dentofacial growth, suspicion of malignant disease, and hemorrhagic tonsillitis (for tonsillectomy). Relative indications for both procedures are adenotonsillar hyperplasia with upper airway obstruction, dysphagia, or speech impairment, and halitosis. Otitis media and recurrent or chronic rhinosinusitis or adenoiditis are relative indications for adenoidectomy only. Recurrent or chronic pharyngo-tonsillitis, peritonsillar abscess, and streptococcal carriage are relative indications for tonsillectomy only.[2] Adenotonsillectomy can benefit by removing chronically inflamed tissues, but may cause possible harm by eliminating an important source of mucosal defense in the host. The increased understanding of the immunological functions of both tonsils and adenoids has led to a debate on whether to consider adenotonsillectomy or not.[1] The immunological effects of adenotonsillectomy have not

been studied extensively. Several researchers have found decreased immunoglobulin (Ig) levels after adenotonsillectomy while others have not reported any significant changes.[1-8] Hence, a prospective case control study was planned to evaluate whether chronic adenotonsillitis had any effect on humoral immunity and whether adenotonsillectomy resulted in changes in humoral immunity as measured by serum immunogloblin levels.

METHODS

This was a prospective case control study, planned in a total of 50 subjects (25 patients and 25 controls). Instituitional Ethics Committee clearance was obtained prior to commencing the study. Twenty five patients in the age range 5-15 years who had history of recurrent attacks of tonsillitis and mouth breathing/ snoring due to adenoid hypertrophy were included in the study group. Patients with immune system disorders or with family history of immunodeficiency diseases were excluded from the study, as were patients with hepatitis B, liver cirrhosis, chronic allergic disorders, or presence of allergy at the time of inclusion in the study, and any condition that may acutely or chronically influence the Ig levels. Those undergoing adenotonsillectomy for indications other than chronic adenotonsillitis and above 15 years of age were also excluded. Signed and dated informed consent was obtained from all the subjects/ guardians.

All patients selected for the study were subject to a detailed ear, nose and throat examination. Five milliliters of venous blood samples were drawn 24-48 hours prior to and 4 weeks after surgery from the antecubital veins with all aseptic precautions, for immunoglobulin estimation. The specimen was allowed to clot for 10 minutes and then centrifuged at 3000 rpm for 5 minutes to separate the serum. The serum was then transferred to another test tube and used for immunoglobulin estimation. Total serum IgG, A and M estimation was done by quantitative immunoturbidometry method using Quantia IgG, Quantia IgA and Quantia IgM kits (Tulip diagnostics Co. Ltd) and values expressed as mg/ml. Serum IgG, A and M was also estimated for 25 age and sex matched normal subjects (controls) using the same method.

The values obtained from the blood samples drawn from controls and study group (pre-operative and post-operative) were tabulated and analyzed statistically using IBM SPSS statistics software program version 22.0. Non-parametric tests (Wilcoxon signed-rank test and Mann-Whitney U test) were used to compare the serum immunoglobulin levels of control group with pre-operative and post-operative cases. Values obtained pre-operatively were also compared with values obtained post-operatively.

RESULTS

The immunoglobulin levels of the control group and the pre-operative and post-operative immunoglobulin levels of the study group are provided in Table 1. The pre-operative levels of serum IgG, IgA and IgM levels were found to be numerically higher in patients with chronic adenotonsillitis as compared to controls; the serum IgG and IgM values being significantly higher in the study group as compared to the control group. Post operatively, values of serum IgG, IgA and IgM decreased significantly as compared to the pre-operative values.

Table 1: Comparison of serum immunoglobulin levels across study group and control group.

Serum Immuno-globulin levels (median and interquantile range) (mg/ml)	Controls	Pre-operative	P value (controls vs preoperative)	Post-operative	P value (preoperative vs postoperative)
Immunoglobulin G (IgG)	1126 (1046-1235)	1880 (1440-2591.5)	0.000*	1490 (1180-1932)	0.001*
Immunoglobulin A (IgA)	178 (96-217.5)	220 (110-400)	0.159	110 (80-164)	0.000*
Immunoglobulin M (IgM)	110 (73-147)	180 (116-285)	0.000*	120 (93-165)	0.000*

DISCUSSION

The tonsils and adenoids are the largest components of the Waldeyer's ring. They are anatomically located at the entrance of the respiratory and digestive tracts and represent the body's first line of contact with pathogens present in food and air. They are involved in both local immunity and systemic immunity by production of anti-bodies and changes in T and B cells. Structurally they are similar to lymph nodes and contain four specialized lymphoid compartments participating in immune function of these organs, namely the reticular crypt epithelium, the extrafollicular area, the mantel zones of lymphoid follicles and the follicular germinal center.[9,10] The effects of adenotonsillectomy on immunological functions of the body have not been fully understood. There is a widely held urban myth that adenotonsillectomy compromises lifelong immunity.

Researchers differ in their opinion on the effects of this surgery on the immune system and there has been considerable debate on this subject. Previous studies have reported that changes that occur in the immune system following adenotonsillectomy are not significant enough to cause increase in the frequency of diseases.[11-13] A conservative approach towards removal of tonsils and adenoids has been advocated by some authors despite the immunological activity of chronically hypertrophied adenotonsillar tissue being low. They have taken into consideration their immunological role prior to the surgery especially in children.[1,10,14]

This study was conducted to evaluate the changes in humoral immunity in patients with chronic adenotonsillitis and the effects of adenotonsillectomy on humoral immunity as measured by serum immunoglobulin levels. Observations of this study showed significantly higher serum IgG, A and M levels in patients with chronic adenotonsillitis, pre-operatively, as compared to age- and sex-matched controls. Four weeks after surgery, their values lowered significantly as compared to the respective pre-operative values. Nasrin et al have reported in their study that the pre-operative IgG, IgA, and IgM levels did not differ significantly in children undergoing tonsillectomy as compared to controls, but the levels of IgG decreased and those of IgA and IgM increased non-significantly 1 month post-operatively, as compared to the pre-operative values. Three-months post-operative, however, the levels of IgG decrease significantly as compared to the pre-operative values.[15] Santos et al have also reported that following adenotonsillectomy for adenoid hypertrophy in children, the IgG and IgA levels reduce significantly over a period of 12-14 months, but remain within the normal range for that age-group.[16] Decrease in serum immunoglobulin levels has been noted following surgery in several other studies This decrease has been attributed to the removal of infected tissue and antigenic stimulation. Similarly, an increase in serum immunoglobulin levels has been observed in patients with chronic adenotonsillitis in previous studies.[7,9,14,17] On the contrary, no significant variation in serum IgG, IgA and IgM levels before and after tonsillectomy has been noted by some authors.[5] IgM antibodies are produced in acute phase of infectious diseases and their levels decrease in 1-3 months after acute infection. Their levels are therefore not observed to be significantly high in chronic infections. The high pre-operative IgG levels in this study reflect the chronicity of infection. Observations of this study concur with observations in previous studies.[1,3,7-9,16-18]

In most previous studies, levels of immunoglobulins were increased before adenotonsillectomy and decreased after surgery. This was due to removal of infected tissue and continuous antigenic stimulation. Observations of this study revealed that adenotonsillectomy restored the elevated immunoglobulin parameters to normal by removal of the chronic bacterial stimulus. This confirms that tonsillectomy does not disturb the humoral immune system. Although the study was conducted on a small sample, the results are of importance with respect to reassuring patients that adenotonsillectomy does not affect the humoral immune system. However, further studies are needed with long term follow up to confirm if the serum immunoglobulin levels continue to remain normal in the long term.

CONCLUSION

Adenotonsillectomy restored the elevated immunoglobulin parameters to normal by removal of the chronic bacterial stimulus. Chronic adenotonsillitis caused alteration in the serum immunoglobulin levels. Adenotonsillectomy does not compromise the immunoglobulin integrity or the immunoglobulin response. The normal levels of serum immunoglobulins following surgery indicate that adenotonsillectomy does not disturb the humoral immune response.

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