Original article

Assessment of Oxidant and Antioxidant Serum Levels in the Children with Chronic Tonsillitis Before and After Tonsillectomy

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Abstract

Background and Aims: Chronic Tonsillitis (CT) and adenoid hypertrophy (AH) are very frequently reported diseases in children; however, their pathogeneses are not exactly known. High amounts of free radicals produced during inflammation cause oxidative stress. Due to high activity, the oxidation products can make toxic, mutagenic, and carcinogenic injuries. Yet, antioxidants play an important defensive role against oxidative stress. This study aimed to investigate the potential role of oxidative stress in the pathogenesis of CT in children.

Subject and Methods: This case-control study was conducted on 20 children who suffered from CT and were prepared for adenotonsillectomy. The control group included 20 age- and sex-matched healthy children with normal ENT examination. The blood levels of antioxidants (glutathione) and peroxidation products (malondialdehyde) were determined before and 1 month after the operation in the patient group and only once in the control group.

Results: A significant difference was found between the patients and the controls regarding the pre and post-operative serum levels of malondialdehyde (MDA) and glutathione (GSH) (P<0.05). In the patient group, the blood GSH level increased and MDA level decreased significantly after the operation (P<0.05). However, they never reached the normal levels in the control group.

Conclusions: CT and AH can influence the oxidative productions and antioxidants due to the chronic condition in the children. Oxidative stress was obviously observed in these children. Adenotonsillectomy significantly reduced the oxidative stress but could not regulate this disorder completely.

Keywords: Chronic tonsillitis, Adenotonsillectomy, Oxidative stress, Antioxidant

Introduction

The infections and inflammatory diseases of the pharynx, tonsils, and adenoids comprise a considerable portion of childhood diseases (1). These infections lead to recurrent attacks of throat pain, fever, dysphagia, and malaise(2). Moreover, humoral and cellular immunity of tonsils change among the recurrent infections of the upper respiratory tract(3). Tonsillectomy is a common surgical approach generally applied for sleep-disordered breathing (SDB) and recurrent infections of tonsils, especially in the children(4). Chemically, oxidative stress is related to the increase in production of oxidizing elements or decrease in the efficiency of antioxidant defenses(5). Free radical molecules are highly reactive they can cause tissue damage especially in cell membranes by reacting with cellular lipids, proteins, nucleotides, and carbohydrates(2). In general, oxidants originate from numerous sources that can be exogenous, such as pollution, radiations, chemical substances,
and pathogenic micro-organisms, and endogenous, such as the mitochondrial electron transport chain, inflammatory cells, and enzymes(6). Chronic Tonsillitis (CT) and Adenoid Hypertrophy (AH) are chronic inflammatory diseases in the oropharynx. The oxidative elements are produced during inflammation and the antioxidants play a role in deactivating the damages by these oxidation products(2). Lipid peroxidation is an important indicator of the cell damages. Besides, malondialdehyde (MDA) is one of the final important products of membrane lipid peroxidation indicating extensive damage by free radicals(2). Furthermore, glutathione (GSH) plays important roles in antioxidant defense, nutrient metabolism, and regulation of cellular events, such as gene expression and DNA synthesis. Reduction of GSH as an antioxidant contributes to oxidative stress(8).

Thus, the present study aims to determine whether adenotonsillectomy may reduce oxidative stress and increase antioxidants in the patients suffering from CT and AH.

**Subjects and Methods**

The present study was conducted on 20 patients whose age ranged from 3 to 14 years old. In addition, the control group consisted of 20 healthy children with similar age and sex and normal ENT examination. The patients were admitted to the ENT ward from May 2012 to September 2012. The patients’ indication for adenotonsillectomy was suffering from recurrent chronic tonsillitis. All the procedures were performed under general anesthesia with endotracheal intubation which was maintained by inhalation anesthesia. In this study, 5 ml venous blood samples were taken from both the patients and the control group before and one month after the operation. The blood was stored at −70 °C after separating the serum from the cells (1500 rpm; 10-15 min).

Tonsillectomy and adenoidectomy were done by cold dissection and Curettage routine methods, respectively. It should be noted that none of the participants were involved with infectious diseases and malignancies, used drugs, or were exposed to X radiation one month before the sampling. In this study, High-Pressure Liquid Chromatography (Shimadzo 10VP/ Japan) was used to measure malondialdehyde-thiobarbituric acid as a peroxidation product in the plasma. Moreover, plasma reduced glutathione analyses were carried out spectrophotometrically (Shimadzo 1650PC/ Japan). Blood levels of malondialdehyde-thiobarbituric acid and reduced glutathione were expressed as ‘µmol/ml’.

**Statistical analysis**

The analyses were performed using the SPSS statistical software (version 16.0). The Independent t-test was used to compare the patients and the controls. In addition, Paired sample t-test was used to compare the patients before and after the operation.

**Results**

The patients and control groups consisted of 12 girls and 8 boys with the mean age of 8.1 and 7.75 years, respectively. The study results revealed a significant difference between the preoperative and postoperative blood levels of MDA and GSH (P<0.05). The mean serum levels of MDA and GSH in the patients and controls are presented in Tables 1 and 2, respectively (Figures 1 and 2). Before the operation, a significant difference was observed between the two study groups regarding the MDA and GSH serum levels (P<0.05). A significant difference was also observed between the two groups in this regard after the operation (P<0.05) (Tables 1 and 2).
Figure (1): Comparison between the controls’ pre- and post-operative mean MDA serum levels

Figure (2): Comparison between the controls’ pre and post-operative mean GSH serum levels

Table 1. The mean serum levels of MDA (µmol/ml) in the patients and controls

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<tr>
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<th>Min</th>
<th>Max</th>
<th>Mean ± SD</th>
<th>Patients vs. controls (P-Value)</th>
<th>Pre vs. post-operative (P-Value)</th>
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<tbody>
<tr>
<td>Controls</td>
<td>8.25</td>
<td>13.21</td>
<td>10.45 ± 1.53</td>
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<tr>
<td>Preoperative patients</td>
<td>10.67</td>
<td>14.75</td>
<td>12.7 ± 1.08</td>
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<tr>
<td>Postoperative patients</td>
<td>9.12</td>
<td>14.01</td>
<td>11.42 ± 1.23</td>
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Discussion  
Tonsils are important components of the immune system and tonsillectomy is a very common surgery in childhood(9). The major reason for tonsillectomy with or without adenoidectomy was chronic tonsillitis with the prevalence of 80% and 87% in the children (≤16 years old) and adults (>16 years old), respectively(10).

The levels of oxidative elements exceed during the chronic inflammatory processes and they can gradually result in a decrease in the antioxidant levels. Therefore, low antioxidant levels may result from chronic diseases(2). Kiroglu et al.(11) investigated the possible role of oxidants and antioxidants in the pathogenesis of chronic adenotonsillitis and adenotonsillar hypertrophy in children and they concluded that there were significant increases in tonsil MDA, adenoid MDA, tonsil catalase and adenoid catalase levels in the infection group (\(P<0.05\)). Shukla et al.(12) showed that the postoperative blood levels of MDA decreased and those of SOD and catalase increased in the adolescents suffering from CT. Also, the results of several studies indicated that the preoperative blood antioxidant levels increased, while that of the oxidant levels decreased significantly compared to the postoperative values(\(P<0.05\))(2,13-15). Yilmaz et al.(2) displayed that the blood antioxidant levels increased, while the blood oxidant levels decreased significantly after the operation in the children with otitis media with effusion undergoing adenoidectomy (\(P<0.05\)). Furthermore, Cvetkovic et al.(3) assessed the levels of lipid peroxidation evidenced by formation of thiobarbituric acid reactive substance (TBARS) and concluded that the postoperative serum TBARS levels in the patients with tonsillar hypertrophy were higher compared to before the operation. Our study results showed that the decreased preoperative blood levels of GSH significantly increased postoperatively, and that the increased preoperative blood levels of oxidation product MDA significantly decreased postoperatively.

According to the results of the present study and recent studies conducted on the issue, it can be stated that CT leads to oxidative stress with decreased levels of antioxidants in the patients suffering from CT. In one study, oxidative stress was still present in the patients with tonsillar hypertrophy and recurrent tonsillitis 1 month after the removal of the tonsillar tissue(3). In the same line, Yilmaz et al.(2) concluded that the antioxidant levels of the patients with CT increased but were not normalized 1 month after the operation. Abuhandan et al.(14) showed that both preoperative and postoperative serum total oxidant levels and

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<th>Min</th>
<th>Max</th>
<th>Mean ± SD</th>
<th>Patients vs. controls (P-Value)</th>
<th>Pre vs. postoperative (P-Value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controls</td>
<td>4.84</td>
<td>7.32</td>
<td>6.05 ± 0.59</td>
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<td>–</td>
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<tr>
<td>Preoperative patients</td>
<td>3.58</td>
<td>6.1</td>
<td>4.61 ± 0.78</td>
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<tr>
<td>Postoperative patients</td>
<td>4.36</td>
<td>5.93</td>
<td>5.27 ± 0.46</td>
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The children suffering from CT and AH are under significant oxidative stress. Tonsillectomy and adenoidectomy significantly decreased the oxidative stress in these patients, but the levels of oxidants and antioxidants did not normalize after the operation. Thus, using antioxidants in the patients can help to normalize their blood oxidant and antioxidant levels.

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Conflict of Interest: Nil

References


