The effect and influence of lumen holmium laser lithotripsy on serum oxidative stress proteins and inflammatory factors of ureteral calculi patients

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ABSTRACT

Objective: To investigate the effect and influence of lumen holmium laser lithotripsy on treating serum oxidative stress proteins and inflammatory factors of patients with ureteral calculi. Methods: A total of 120 cases of patients with ureteral calculi treated in our hospital from May 2010 to Nov 2014 were enrolled in this research for an analysis study. The effect and influence on serum oxidative stress proteins and inflammatory factors of lumen holmium laser lithotripsy on ureteral calculi patients were assayed. Then 120 cases of healthy subjects in our hospital at the same period were taken as control. Results: Among the 120 cases of ureteral calculi patients, 113 cases of patients showed successful operation, with a success rate of 94.2%. The average calculi-discharged time was (28.4 ± 11.2) d and the average operation time was (58.9 ± 10.7) min, while the postoperative hospital stay is (3.8 ± 1.2) d. The results also showed that the levels of NOX1, NOX3, NOX4 and NOX5, and levels of interleukin-2 (IL-2), IL-6, IL-10 and TNF-α of patients with ureteral calculi were significantly higher, compared with the control group, and these parameters were normalized greatly after operation with that the levels of them were significantly different from those before operation. Conclusion: Lumen holmium laser lithotripsy exerts a significant effect on ureteral calculi patients and the oxidative stress parameters and inflammatory factor were normalized greatly.

1. Introduction

The ureteral calculi refers to a clinical common and frequently occurring disease which most occurred in the prime of life with a relatively high morbidity in male, seriously influencing the normal function of kidney[1,2]. Ureteral calculi, also called the upper urinary tract calculi, has an increased incidence year by year[3,4]. Currently, the patients with treating ureteral calculi is mainly treated via shock wave galet in vitro as well as holmium laser lithotripsy, with the latter having a better curative effect. For treating ureteral calculi patients, the pathogenesis of them should be pay attention and some appropriate measures are needed for preventing its relapse postoperation. The imbalance of redox state, commonly occurred in a variety of pathological processes, is also involved in the processes of occurrence, development as well as deterioration of many urogenital system diseases; and meanwhile, the inflammatory responses are closely correlate with the abnormity of urogenital system as well[5,6]. This study aims to analyze the effect of lumen holmium laser lithotripsy on treating ureteral calculi patients and study the influence of it on oxidative stress protein of patients, to provide the reference for the clinical therapy.

2. Materials and methods

2.1. Clinical materials

A total of 120 cases of patients with ureteral calculi treated in our hospital from May 2010 to Nov 2014 were selected for the analysis study, with 88 cases of male patients and the remaining 32 cases of female patients, and age ranging from (1.74 ± 0.31) years. Among 120 cases of ureteral calculi patients, 89 cases were solitary renal calculi and 31 cases were solitary multiple renal calculi, with that 24
cases had calculi in upper-middle ureter, while 96 cases in the low ureter (calculus size: 0.5-1.8 cm), average: (1.2 ± 0.3) cm.

2.2. The lithotripsy

An epidural anesthesia was continuously conducted in patients with ureteral calculus and then they were placed in the lithotomy position. The lithotripsy was carried out according to that reported previously[7,8]. After smashing the calculus by using lithotripsy, the smashed calculus was taken out through a basket manipulation, and routinely palced in double J ureteral catheter for 1-4 weeks.

2.3. The observation indexes and test methods

In this paper, the levels of serum oxidative stress proteins SOD, CAT, GSHpx and MDA, and levels of IL-2, IL-6, IL-2, IL-10, as well as TNF-, of patients with ureteral calculi before and after treatment were detected and analyzed. In the present study, the SOD and CAT detection kits (Tiangen Biotech Co., Ltd., Beijing), GSHpx and MDA detection kits (Nanjing Jiancheng Biotechnology Institute), IL-2 and IL-6 detection kits (R&D Systems China Co., Ltd.), IL-10 detection kit (Wuhan Boster Biological Engineering Co., Ltd.) and the TNF- detection kit (Omega Bio-teck) were prepared and properly applied in accordance with the specifications.

2.4. Statistical analysis

The statistical analysis was performed by using SPSS19.0 software. The enumeration data were showed by Mean ± SD and One-way ANOVA was used for the multi-sample comparison. P<0.05 was considered statistically significant.

3. Results

3.1. The effect analysis of lumen holmium laser lithotripsy on treating ureteral calculi patients

Among the 120 cases of patients with ureteral calculi after lumen holmium laser lithotripsy treatment, 113 cases showed successful operation, with a success rate of 94.2%, while the remaining 7 cases were failed in operation. All the patients had no postoperative infection. The average calculi-discharged time was (28.4 ± 11.2) d and the average operation time was (58.9 ± 10.7) min, while the postoperative hospital stay is (3.8 ± 1.2) d. Among the failed 7 cases, 3 cases failed in operation were due to the ureteral calculi shifted to other places; 2 cases were due to ureteral perforation resulting from the improper operation and the other 2 cases were due to that the patients were treated with open surgery because of the serious vision problems resulting from hemorrhage.

3.2. The changes of serum oxidative stress enzymes levels of patients with ureteral calculi after lumen holmium laser lithotripsy

The serum levels of SOD, CAT and GSHpx of ureteral calculus patients in treatment group were significantly lower than those in control group, while the MDA level was higher than that in control group (P<0.05), and these indexes were normalized greatly after operation (P<0.05) with that the levels of them were significantly different from those of patients before operation (P<0.05) (Table 1).

<table>
<thead>
<tr>
<th>Group</th>
<th>CAT (U/mL)</th>
<th>SOD (U/L)</th>
<th>MDA (U/L)</th>
<th>GSHpx (U/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>26.6 ± 2.84</td>
<td>16.1 ± 2.33</td>
<td>15.6 ± 3.10</td>
<td>68.9 ± 7.88</td>
</tr>
<tr>
<td>Treatment BT</td>
<td>13.1 ± 2.51</td>
<td>8.21 ± 1.04</td>
<td>22.9 ± 2.27</td>
<td>47.6 ± 7.65</td>
</tr>
<tr>
<td>AT</td>
<td>17.7 ± 3.04</td>
<td>11.8 ± 1.88</td>
<td>17.8 ± 1.98</td>
<td>55.3 ± 4.87</td>
</tr>
</tbody>
</table>

P-value: Control BT P < 0.05, AT P < 0.05

BT: Before treatment; AT: After treatment.

3.3. The changes in the levels of serum oxidative stress enzymes proteins of patients with ureteral calculi after lumen holmium laser lithotripsy

In the treatment group, the serum levels of oxidative stress enzymes NOX1, NOX3, NOX4 and NOX5 were significantly higher than those of control group, and these parameters were normalized greatly after operation (P < 0.05), with that the levels of them had a significant difference compared to those before operation (P < 0.05) (Table 2).

<table>
<thead>
<tr>
<th>Group</th>
<th>NOX1/β-actin</th>
<th>NOX3/β-actin</th>
<th>NOX4/β-actin</th>
<th>NOX5/β-actin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0.31 ± 0.05</td>
<td>0.22 ± 0.06</td>
<td>0.27 ± 0.08</td>
<td>0.26 ± 0.06</td>
</tr>
<tr>
<td>Treatment BT</td>
<td>0.68 ± 0.11</td>
<td>0.50 ± 0.12</td>
<td>0.57 ± 0.13</td>
<td>0.77 ± 0.05</td>
</tr>
<tr>
<td>AT</td>
<td>0.45 ± 0.10</td>
<td>0.42 ± 0.13</td>
<td>0.48 ± 0.11</td>
<td>0.51 ± 0.12</td>
</tr>
</tbody>
</table>

P-value: Control BT P < 0.05, AT P < 0.05

BT: Before treatment; AT: After treatment.

3.4. The changes in levels of serum inflammatory factor of patients with ureteral calculi after lumen holmium laser lithotripsy

The results also showed that the serum levels of IL-2, IL-6, IL-10 and TNF- of patients with ureteral calculi were significantly higher compared to the control group (P<0.05), and these parameters were normalized greatly after operation (P<0.05) with that the levels of them were significantly different from those before operation (P<0.05) (Table 3).

4. Discussion

The holmium laser is a high-energy pulse solid laser possessing the functions of precise cutting organization and hemostasis, and can be used to vaporizate the calculi to tiny grains then were discharged in vitro. The holmium laser lithotripsy, with its ability of efficiently crushing various kinds of urinary calculi, has been the preferred method for the intracavitary treatment of ureteral calculi. However, there is no related study reported on the redox and inflammatory...
status of patients after holmium laser lithotripsy treatment. In the present study, the effect and influence of lumen holmium laser lithotripsy on treating ureteral calculi patients and oxidative stress proteins of patients were investigated, and the results revealed that among 120 cases of ureteral calculi patients, 113 cases of patients showed successful operation, with a success rate of 94.2%, while the remaining 7 cases were failed in operation. The average calculated-discharged time was (28.4 ± 11.2) days and the average operation time was (58.9 ± 10.7) min, while the postoperative hospital stay is (3.8 ± 1.2) days. The results also showed that the levels of NOX1, NOX3, NOX4 and NOX5, as well as the levels of IL-2, IL-6, IL-10 and TNF- α of patients with ureteral calculi were significantly higher than those of the control group (P<0.05), and these parameters were normalized greatly after operation (P<0.05), with that the levels of them were significantly different from those before operation (P<0.05).

The redox imbalance refers to the most common pathological process in cell, involved in the occurrence and development of many diseases of the cardiovascular, nervous and urogenital systems. In the study on investigating the regulatory mechanism of oxidative stress in kidney tissues on diabetic nephropathy and the intervention effect of Chinese medicine, it was reported that the superoxidan state is a key inhibitor of causing renal injury in the drug therapy[9]. In a study on analyzing the effect of dry powder of Rosa roxburghii Tratt on related oxidative stress indicators of patients with qi deficiency of spleen and kidney with turbid damp in CKD stage 3-4, the results showed that the Rosa roxburghii dry powder could ease the renal interstitial fibrosis, delay the pathological process of kidney failure by eliminating the intracellular oxygen free radicals[10]. According to the study by Yang et al.[11], DM120 was reported possessing the ability to ease the kidney tissue damage mainly through inhibiting the excessive oxidative stress levels in kidney tissues of diabetic rats. The previously researches have also proved that the lithoexpulsium could improve the oxidative stress state, thereby increasing the postoperative therapeutic effect of treating urinary calculi through extracorporeal shock wave lithotripsy (ESWL)[12]. In this study, the results showed the levels of NOX1, NOX3, NOX4 and NOX5 of patients with ureteral calculi were significantly higher than those of control group, and theses indexes were normalized greatly after the treatment, with that the levels of them were significantly different from those before treatment, which showed that the improvement of the oxidative stress state was involved in the process of lumen holmium laser lithotripsy treatment. The inflammatory reaction is also closely associated with the occurrence and development of the genitourinary system disease. Many previous researches reported that there was an inflammatory reaction or an abnormal expression of inflammatory factor found in the process of treating urinary calculi by laparoscope or ESWL[13,14]; and in the present study, a results obtained was in accord with that from previous studies, with that the serum levels of IL-2, IL-6, IL-10 and TNF- α in of patients with ureteral calculi were significantly higher than those of the control group; these parameters were normalized greatly after operation, and there was a significantly difference compared to those before operation.

Therefore, the lumen holmium laser lithotripsy exerts a significant effect on ureteral calculi patients and the oxidative stress parameters and inflammatory factor were normalized greatly.

### Table 3

<table>
<thead>
<tr>
<th>Group</th>
<th>IL-2/β-actin</th>
<th>IL-6/β-actin</th>
<th>IL-10/β-actin</th>
<th>TNF-α/β-actin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0.17 ± 0.06</td>
<td>0.42 ± 0.08</td>
<td>0.37 ± 0.09</td>
<td>0.24 ± 0.08</td>
</tr>
<tr>
<td>Treatment</td>
<td>0.36 ± 0.08</td>
<td>0.66 ± 0.09</td>
<td>0.56 ± 0.09</td>
<td>0.50 ± 0.13</td>
</tr>
<tr>
<td></td>
<td>P &lt; 0.05</td>
<td>P &lt; 0.05</td>
<td>P &lt; 0.05</td>
<td>P &lt; 0.05</td>
</tr>
</tbody>
</table>

BT: Before treatment; AT: After treatment.

### Reference