Evaluation on the efficacy and safety of the flexible ureteroscopy and Holium laser in the treatment for calyceal calculi greater than 2 cm

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OBJECTIVE: To explore the efficacy of the flexible ureteroscopy and Holium laser in the treatment for calyceal calculi greater than 2 cm and its safety.

METHODS: A total of 48 patients with calyceal calculi who were admitted in our hospital were included in the study and randomized into the observation group (n=26) and the control group (n=22). Observation group were given the flexible ureteroscopy lithotripsy (FURL) treatment, while the control group were treated with percutaneous nephrolithotomy (PCNL). The time operation, the gravel energy, the effective rate three months after surgery, the hospitalization time after surgery, the change of blood NGAL and urine KIM-1 concentrations before operation, 4 h, 24 h, 48 h, and 72 h after operation, and the complications in the two groups were compared.

RESULTS: The comparison of the effective rate, the operation time, and the gravel energy between the two groups was not statistically significant. The hospitalization time after surgery in the observation group was significantly shorter than that in the control group. The comparison of blood NGAL and urine KIM-1 before operation between the two groups was not statistically significant. The blood NGAL and urine KIM-1 4 h and 24 h after surgery were significantly higher than those before operation (P<0.05), but the concentrations in the observation group were significantly lower than those in the control group. The comparison of blood NGAL and urine KIM-1 between 48 h and 72 h after operation and before operation was not statistically significant. The fever rate in the observation group was significantly higher than that in the control group. The comparison of the occurrence rates of complications, massive hemorrhage, infection, and stone street between the two groups was not statistically significant. CONCLUSIONS: The total efficacy of PCNL in the treatment for calyceal calculi greater than 2 cm is close to that by FURL, but FURL has a little kidney injury and shorter postoperative hospitalization time; therefore, it deserves to be rationally applied in the clinic.

1. Introduction

Urinary calculi is common in the clinic, among which renal calculi is the most common, approximately accounting for 86% of the pathogenesis of urinary calculi, and about 25% patients need gravel treatment[1]. The common gravel methods in the clinic consist of extracorporeal shock wave lithotripsy (ESWL), percutaneous nephrolithotomy (PCNL), and flexible ureteroscopy lithotripsy (FURL)[2]. ESWL is mostly used in the clinic in the treatment for renal calculi less than 2 cm, and PCNL is commonly utilized in the clinic in the treatment for renal calculi greater than 2 cm, whose calculi clearance rate can reach 77%-94%, but PCNL may cause a

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damage on renal parenchyma and its surrounding tissues to a certain extent[3]. With the development of FURL, it is gradually applied in the clinic, and has a better therapeutic effect in the treatment for renal calculi greater than 2 cm, but there is a less research on studying its safety. In order to observe the efficacy of the FURL in the treatment for calyceal calculi greater than 2 cm and its safety, PCNL and FURL are utilized to treat the patients with renal calculi greater than 2 cm, respectively.

2. Materials and methods

2.1. Clinical information

A total of 48 patients with calyceal calculi who were admitted in our hospital from January, 2012 to August, 2014 were included in the study, among which 29 were male and 19 were female, aged from 24 to 65 years old, with an average age of (46.3±10.5) years old and an average calculi diameter of (30.7±8.01) mm. The inclusion criteria were as the following[1,5]: (1) those who were diagnosed with single calyceal calculi confirmed by ultrasound, KUB, or CT before treatment; (2) those who had calculi greater than 2 cm; (3) those who had indications to PCNL or FURL; (4) those who were not merged with severe cardiopulmonary insufficiency or coagulation system disorders; (5) those who were not accompanied by severe hydronephrosis, hypertensive nephropathy, and other diseases which could affect the renal function; (6) those who had no history of multiple ESWL treatment.

2.2. Treatment method

The patients were randomized into the observation group (n=26) and the control group (n=22). The patients in the observation group were given FURL treatment, i.e. flexible ureteroscopy was placed and Holium laser was used for breaking the calculi. After intubation anesthesia, the lithotomy position was taken. Firstly, the ureteroscope was placed for seeking the ureteric orifice on the affected side. Then the guide wire was inserted into the renal pelvis collecting system. Along the guide wire, the channel sheath was used for the comparison of the enumeration data. The Chi-square test was used for the comparison between the groups, while the Chi-square test was used for the comparison of the enumeration data. P<0.05 was regarded as statistically significant.

3. Results

3.1. The efficacy comparison

The effective rate, time operation, and the gravel energy were 69.2% (18/26), (92.71±29.86), and (26.91±5.82) W in the observation group, respectively; 63.6% (14/22), (94.52±33.58), and (27.51±6.04) W in the control group, respectively. The comparison of the above indicators between the two groups was not statistically
different \((P>0.05)\). The postoperative hospitalization time in the observation group was \((5.82\pm1.63)\) d in the observation group, \((9.03\pm4.20)\) d in the control group. The postoperative hospitalization time in the observation group was significantly shorter than that in the control group \((t=5.624, P=0.001)\).

3.2. The renal function comparison

The comparison of blood NGAL and urine KIM-1 before operation between the two groups was not statistically significant \((P>0.05)\). The blood NGAL and urine KIM-1 4 h and 24 h after operation in the two groups were significantly increased when compared with those before operation \((P<0.05)\); the concentrations in the observation group were significantly lower than those in the control group \((t=5.373; P=0.022)\), but 48 h and 72 h after operation, their levels could basically return to the levels before operation \((P>0.05)\) (Table 2).

### Table 2

<table>
<thead>
<tr>
<th>Groups</th>
<th>Before operation</th>
<th>4 h after</th>
<th>24 h after</th>
<th>48 h after</th>
<th>72 h after</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Observation</strong></td>
<td>B 836.63(\pm)348.67</td>
<td>930.11(\pm)348.21</td>
<td>883.32(\pm)348.32</td>
<td>810.02(\pm)333.21</td>
<td>817.21(\pm)325.32</td>
</tr>
<tr>
<td></td>
<td>U 2.56(\pm)0.66</td>
<td>2.76(\pm)0.78</td>
<td>3.05(\pm)0.82</td>
<td>2.74(\pm)0.65</td>
<td>2.55(\pm)0.61</td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td>B 890.42(\pm)608.07</td>
<td>998.32(\pm)712.3</td>
<td>953.70(\pm)640.20</td>
<td>881.22(\pm)624.63</td>
<td>837.41(\pm)607.2</td>
</tr>
<tr>
<td></td>
<td>U 3.04(\pm)0.96</td>
<td>3.28(\pm)0.98</td>
<td>3.49(\pm)1.01</td>
<td>3.06(\pm)0.82</td>
<td>3.01(\pm)0.84</td>
</tr>
</tbody>
</table>

*P<0.05, when compared with that before operation; **P<0.05, when compared with the control group. B: blood NGAL; U: Urine KIM-1.

3.3. Complications

The fever rate in the observation group was significantly higher than that in the control group \((\chi^2=4.395, P=0.036)\). The comparison of the occurrence rates of massive hemorrhage, infection, and stone street between the two groups was not statistically significant \((P>0.05)\) (Table 2).

### Table 2

<table>
<thead>
<tr>
<th>Groups</th>
<th>Number</th>
<th>Fever</th>
<th>Massive hemorrhage</th>
<th>Infection</th>
<th>Stone street</th>
<th>Total occurrence rate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Observation</strong></td>
<td>26</td>
<td>90(35)</td>
<td>10(04)</td>
<td>10(04)</td>
<td>20(07)</td>
<td>12(06)</td>
</tr>
<tr>
<td><strong>Control</strong></td>
<td>22</td>
<td>20(09)</td>
<td>10(05)</td>
<td>10(05)</td>
<td>20(09)</td>
<td>12(06)</td>
</tr>
<tr>
<td>(\chi^2) or t value</td>
<td></td>
<td>4.395</td>
<td>1.207</td>
<td>0.015</td>
<td>0.031</td>
<td>3.385</td>
</tr>
<tr>
<td>(P) value</td>
<td></td>
<td>0.036</td>
<td>0.272</td>
<td>0.904</td>
<td>0.801</td>
<td>0.066</td>
</tr>
</tbody>
</table>

4. Discussion

With the altering of the diet in the modern individuals, there is an increasing trend for the occurrence rate of urinary calculi[12]. The renal calculi may cause a discomfort, such as pain, blood urine, etc. The obstruction of the calculus will pose an injury on the renal function. No instant treatment may be complicated with infection and a fever and other general symptoms will occur, which will further damage the renal function[12]. The traditional nephrolithotomy has the disadvantages of great trauma and massive postoperative complications. Along with the development of minimally invasive surgery, ESWL, PCNL, or FURL are more used in the treatment of renal calculi[13]. Due to the advantages of low cost, noninvasiveness on the surface, and no hospitalization, ESWL is widely applied in the treatment for renal calculi less than 2cm; however, in the treatment for renal calculi greater than 2cm, FURL or PCNL is mostly adopted in the clinic.

The results in the study showed that the comparison of effective rate, operation time, gravel energy between the two groups was not statistically significant \((P>0.05)\); the postoperative hospitalization time in the observation group was shorter than that in the control group \((P<0.05)\); the comparison of blood NGAL and urine KIM-1 before operation between the two groups was not statistically significant \((P>0.05)\); the blood NGAL and urine KIM-1 4 h and 24 h after operation in the two groups were significantly increased when compared with those before operation \((P<0.05)\); the concentrations in the observation group were significantly lower than those in the control group \((P<0.05)\), but 48 h and 72 h after operation, their levels could basically return to the levels before operation \((P>0.05)\); the fever rate in the observation group was significantly higher than that in the control group \((P<0.05)\); the comparison of the occurrence rates of massive hemorrhage, infection, and stone street between the two groups was not statistically significant \((P>0.05)\). It can be seen that the efficacy of PCNL or FURL is basically similar. Due to the premise for PCNL is to establish a channel through the skin, the instrument needs to pass the renal parenchyma and may cause a great damage on the kidney, especially for the calculi with a large diameter and little hydronephrosis, it may pose a greater injury on the kidney, a massive hemorrhage may occur sometimes[14]. FURL utilizes the natural physical channel in the body and the operation is relatively more simple; therefore, the postoperative hospitalization by PCNL is relatively longer than that by FURL. PCNL is directly destroying the renal parenchyma during the process of establishing percutaneous nephroscope, while FURL is not directly involved in the damage on the renal parenchyma. However, due to the narrow channel during the treatment course, a slow reflux of the perfusate during the operation causes a great pressure in the renal pelvis, so that the filtration of the glomerulus is affected[15]. The blood NGAL and urine KIM-1 after operation were increased by taking use of the two methods, but the concentrations in the observation group were lower than those in the control group, probably because during the FURL operation process, a persistent pouring needs to maintain the clearness of the surgery field, and such long-time perfusion will cause the bacteria, endotoxin, and other pyrotoxins to refl ow to the
blood through the renal blood and lymphatic vessels[15], resulting in a higher incidence of fever.

In conclusion, the total efficacy of PCNL in the treatment for calyceal calculi greater than 2 cm is close to that by FURL, but FURL has a little kidney injury and shorter postoperative hospitalization time; therefore, it deserves to be rationally applied in the clinic.

References


