Possibilities of retrograde intrarenal surgery in the treatment of renal lower pole stones in children

Mogućnosti retrogradne intrarenalne hirurgije u lečenju kalkulusa u donjem polu bubrega kod dece

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Abstract

Background/Aim. Renal stones located in the lower pole of kidney represent a serious challenge for surgical treatment in children. The options are: open surgery, extracorporeal shock-wave lithotripsy, percutaneous nephrolithotomy and retrograde intrarenal surgery. Reports about the endoscopic treatment in children are limited. The aim of the study was to evaluate the effectiveness of retrograde intrarenal surgery in pediatric patients with renal stones in lower pole of the kidney. Methods. We retrospectively analyzed the results of the retrograde intrarenal surgery in 24 patients with renal stones in lower pole, between April 2012 and April 2016. Flexible ureterorenoscopy in combination with holmium laser lithotripsy were performed. We considered stone fragment size 3 mm or less as a measure of sufficient fragmentation of the stone. Results. Mean duration of general anesthesia was 68 (range, 40–90) minutes. Duration of hospitalization was 1–3 (mean, 1.6) days. Complications were found after two (8.4%) surgical procedures: perirenal haematoma in one (4.2%) and urinoma in one (4.2%) patient. The stone was completely fragmented in 18 (75%) patients. In 3 (12.5%) patients the stone was incompletely fragmented and in 3 (12.5%) patients the stone was not fragmented. Double J stent was placed in 5 (21%) patients. Mean follow-up was 9 (range, 6–18) months. Conclusion. Retrograde intrarenal surgery in children is the least invasive, effective and safe surgical procedure for stones in lower pole of the kidney, with minimal complication rate. Unsuccessful treatment in some patients was due to loss of ureterorenoscope deflection with laser probe in working channel.

Key words: child; kidney calculi; lithotripsy, laser; postoperative complications; treatment outcome.

Apstrakt

niskom stopom pojave komplikacija. Razlog neuspešnog
ishoda kod pojedinih bolesnika jeste gubitak savitljivosti
ureterorenoskopa sa laserskom sondom u radnom kanalu.

Introduction

The surgical treatment of urolithiasis in children is ba-
sically similar to treatment in adult patients, but anatomic
and physiologic specificities makes it more difficult in pedi-
atric patients. It is very clear that the narrow urinary tract
in children is one of the biggest problems. Renal stones lo-
cated in the lower pole of the kidney represent the biggest
challenge for surgical treatment in all patients, especially in
children. The options are: open surgery, extracorporeal
shock-wave lithotripsy, percutaneous nephrolithotomy and
retrograde intrarenal surgery. Open surgery is, in general, an
out-of-date technique. Shock-wave lithotripsy is very limited for
lower pole stones. Percutaneous nephrolithotomy is effective,
but more invasive technique than the endoscopic treatment.
Retrograde intrarenal surgery is the least invasive technique, but
reports on the treatments in children are limited.

The aim of the study was to evaluate the effectiveness
of a retrograde intrarenal surgery in pediatric patients with
renal stones, located in lower pole calices of the kidney. We
also evaluated the limitations of the endoscopic treatment in
lower pole of the kidney.

Methods

We retrospectively analyzed the results of the retro-
grade intrarenal surgery in 24 patients with renal stones lo-
cated in the lower pole calices of the kidney (Figures 1 and
2). The patients were treated between April 2012 and April
2016 (10 girls and 14 boys, mean age 9.2 years (range 4–18
years).

Patients with renal stones in other segments of the kid-
ney (upper pole calices, renal pelvis) were excluded from the
study. Flexible 7.5-F ureterorenoscopy with possibility of de-
flexion of 270, in combination with holmium laser lith-
otripsy were performed in all patients, under the general an-
esthesia. Routine and bacteriological analysis of urine and
kidney function tests were also evaluated. In all patients
metabolic screening of urine was performed to find the cause

Fig. 1 – Stones in the lower pole of the left kidney, ureter
and bladder (KUB) radiography.

Fig. 2 – Endoscopic view of the retrograde intrarenal
surgery in the lower pole of the kidney.
of stone formation. Ultrasound and kidney, ureter and bladder (KUB) radiography were performed to identify the location of the stone. Stones were measured by ultrasound. Patients received preoperative antimicrobial prophylaxis. After introduction through the ureteral orifice, flexible ureterorenoscope was placed through ureter to the renal pelvis. Then, the deflection of the flexible ureterorenoscope was performed in order to achieve an adequate stone visualization. We used a 365 μm and 230 μm probes with a 3 mV green helium light guide for transferring energy from the lithotripter to the stone. Micro laser fibers were used, generating 0.2 to 2 J at a frequency of 5 to 10 Hz. We considered stone size 3 mm or less as a measure for sufficient fragmentation of the stone. Some bigger particles were removed from the urinary tract by a stone-basket and smaller ones were left for spontaneous ejection. If ureteral wall damage was present, 4-F or 4.7-F double J stent was placed depending of the constitution and the age of the patient. We used to remove it after two to five days after the surgery. Ultrasound examination was performed in all patients during the first postoperative day. Depending on the severity of surgery, the patients were discharged between the first and the third postoperative day. After one, three and six months, patients were evaluated by urinalyses, kidney function tests, ultrasound and, in some cases, by KUB radiography. The size of the residual stone bigger than 3 mm was the indication for retreatment.

Results

Flexible ureterorenoscopy and holmium-laser nephrolithotripsy were performed in the total number of 35 procedures in 24 patients. There were 10 (41.7%) girls and 14 (58.3%) boys. Mean age was 9.2 years (range 3–18). In 20 (83.3%) patients a single stone was found and in 4 (16.7%) patients the multiple ones. Stones were located in left kidney in 9 (37.5%), in right kidney in 11 (45.8%) and in both kidneys in 4 (16.7%) patients. Mean stone size was 13 mm (range, 8–26 mm). Bacteriological findings of urine were normal in all patients (sterile urine culture) and also, kidney function tests (urea, creatinine) were within reference values (Table 1).

<table>
<thead>
<tr>
<th>Patients' characteristics</th>
<th>Values</th>
</tr>
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<tbody>
<tr>
<td>Number of patients</td>
<td>24</td>
</tr>
<tr>
<td>female, n (%)</td>
<td>10 (41.7)</td>
</tr>
<tr>
<td>male, n (%)</td>
<td>14 (58.3)</td>
</tr>
<tr>
<td>Mean age (years), mean (range)</td>
<td>9.2 (3–18)</td>
</tr>
<tr>
<td>Single stone, n (%)</td>
<td>20 (83.3)</td>
</tr>
<tr>
<td>Multiple stones, n (%)</td>
<td>4 (16.7)</td>
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<tr>
<td>Stone side, n (%)</td>
<td></td>
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<tr>
<td>left</td>
<td>9 (37.5)</td>
</tr>
<tr>
<td>right</td>
<td>11 (45.8)</td>
</tr>
<tr>
<td>bilateral</td>
<td>4 (16.7)</td>
</tr>
<tr>
<td>Mean stone size, mm (range)</td>
<td>13 (8–26)</td>
</tr>
<tr>
<td>Urine culture, n (%)</td>
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<tr>
<td>sterile</td>
<td>24 (100)</td>
</tr>
<tr>
<td>UTI</td>
<td></td>
</tr>
</tbody>
</table>

n (%) – number (percentage) of patients; UTI – urinary tract infection.

Discussion

Stones located in the lower pole calices of the kidney always represent one of the biggest problem in the surgical treatment of urolithiasis, especially in children. It is difficult to decide what kind of treatment is optimal in every particular case. Extracorporeal shock-wave lithotripsy (ESWL) is not sufficiently effective for stones located in that part of the kidney. On the other hand, there are many reports about very serious side effects of that kind of treatment in children after long term follow-up such as diabetes and hypertension. That is why many authors nowadays do not suggest ESWL as good choice of the treatment of renal stones in children. Also, some authors suggest combination of ESWL and retrograde intrarenal surgery for the most complicated cases. When we talk about lower pole stones in children, the data in current literature are very limited. It is difficult to find guidelines or relevant suggestions on how to treat those patients. Some authors suggest only observation/medical treatment option for asymptomatic patients. Retrograde intrarenal surgery is mentioned like the best and less invasive surgical approach. However, that kind of treatment is associated with serious technical problems during flexible ureterorenoscopy in narrow urinary tract in children. When the stone is visualized and available for laser probe, the treatment is highly effective. In some patients, even if we visualize the stone, when the laser probe is inside the working channel, sufficient deflection of the flexible ureterorenoscope is lost. In that case the stone is not available for laser beam and the lithotripsy is impossible.
Thus, the last observation represents limited success rate in the treatment of lower pole renal stones in children in our study. All other problems during flexible ureterorenoscopy were overcome, but problem of loss of ureterorenoscope deflection when the laser probe was inside the working channel could not be solved. We can state that was the only reason for unsuccessful treatment in one quarter of our patients. Those patients were selected for percutaneous nephrolithotomy. The other option is open surgery, but that kind of treatment is no longer in the protocol for surgical treatment of nephrolithiasis in our institution.[13–15].

The results of retrograde intrarenal surgery for the treatment of lower pole stones are different in various publications. Bozkurt et al. report stone-free rate of 94%, while Kim et al. report stone-free rate of 47%. In our series stone-free rate was 75%. Considering small invasiveness of that procedure in comparison with alternative surgical techniques, it represents a good result.

The occurrence of complications in retrograde intrarenal surgery is associated with stone composition, morphological and physiological conditions, constitutional characteristics of the patient, use of adequate equipment and surgeons' experience in endoscopic surgery. Ureteral perforation, urinoma, bleeding, renal puncture with instruments or accessories, postoperative hydronephrosis, urinary tract infection, urosepsis, etc. are possible complications[16–18]. None of them was found in our series. There were only two complications: perirenal haematoma in one patient and urinoma, also, in one patient. Those are, the so-called, "minor" complications, which do not affect the final outcome of the treatment (Grade II, Clavien-Dindo classification of surgical complications).[19]. Two days of prolonged hospitalization with bed rest and antibiotic intravenous therapy, were measures for the treatment of those patients. After three days ultrasound findings were correct.

Ureteral stenting after endoscopic lithotripsy was always controversial. In the past, that was a mandatory procedure, but recently it has been applied in fewer cases, required only in case of mucosal damage and in case there was a risk of ureteral stone particles obstruction.[20]. In our series, five patients required double J stenting when the surgeon estimated that the degree of mucosal damage was significant. Double J stent was removed 2–5 days after the surgery and did not affect the final outcome of the treatment.

Conclusion

Retrograde intrarenal surgery in children is the least invasive surgical procedure for the treatment of stones, located in lower pole calices of the kidney. It is effective and safe kind of treatment, with minimal complication rate. In some patients retrograde intrarenal surgery is not effective because of specific anatomic conditions in lower pole, when the stone is not available for laser beam, even the deflection of flexible ureterorenoscope is maximal. In these patients the use of alternative surgical procedures should be considered, primarily percutaneous nephrolithotomy.

R E F E R E N C E S


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