Abstract

Objective: urolithiasis affects between five and 10% of the human population during their lifetime, only 2-3% of whom are children. Therapy of urolithiasis in the pediatric age group with minimally invasive methodology represents an attractive alternative. This study presents results of extracorporeal shockwave lithotripsy, a minimally invasive methodology, for the treatment of urolithiasis in children.

Methods: in the period between September 1991 and September 2000, 87 children were submitted to extracorporeal shockwave lithotripsy; as six of them presented with two calculi 93 urinary calculi were treated over that period. The Dornier-Philips lithotriptor was used in the procedures.

Results: Pelvic, superior and medium caliceal calculi were fragmented and eliminated in 87.7% and 77.8% of cases, respectively. Inferior caliceal stones were eliminated in 64.7% of cases. Only one of the three patients with staghorn calculi became stone-free after therapy (33.3%). All patients with ureteral calculi were stone-free after therapy. Bladder stones were fragmented and eliminated in 60% of cases.

Conclusions: Extracorporeal shockwave lithotripsy is a safe and effective treatment for pelvic, caliceal, ureteral and bladder urolithiasis in children. Staghorn calculi have not shown satisfactory results when treated by this method. Extracorporeal shockwave lithotripsy results were influenced in our experience by the position and size of the treated calculi.


Introduction

Urolithiasis represents the third most frequent cause of consultation with a urologist. Only 2 to 3% of the population could be affected by urolithiasis. You can find variation in this incidence of 1:1,714 to 1:9,500 cases in the different regions of the United States. Meanwhile, the potential morbidity and the recurrent character of the illness encourage special attention to pediatric patients with urolithiasis.

The clinical status of the child with urolithiasis is more variable than that of an adult. The most frequent signs and symptoms are: hematuria (34%), diffuse abdominal pain (28%), hematuria and pain (27%), and others such as infections (11%).
The diagnosis of urolithiasis in children can be made with noninvasive methods, such as urinary tract ultrasound and simple abdominal radiography; however, an excretory urography is useful to demonstrate anatomical and functional alterations.6

Starting in the 80s, treatment of urolithiasis has gone through significant changes. The use of methods such as extracorporeal lithotripsy, percutaneous nephrolithotripsy, and ureteroscopy, called minimally invasive, have become routine, reducing open surgery to only 1 to 4% of cases.7 Minimally invasive techniques in children, however, demonstrate variations as to their application and results.8

Extracorporeal lithotripsy was used clinically for the first time in 1980 by Chaussy, but it was Eisenberg who published the first case of urolithiasis treated by extracorporeal lithotripsy in a six-year-old child in 1983.9

Extracorporeal lithotripsy uses shock waves (high pressure), created and transmitted through liquids (water). The pressure waves are generated in variable forms, in agreement with the model of the lithotripsy machine (Litotritor), through electric sparks, vibration of ceramic pieces, vibration of magnetic membranes, or other ways. The shock waves transmitted by the water of the machine are equally transmitted through body water, without harming it. When directed and concentrated, the shock waves cause the fragmentation of the urinary stones, and they can therefore be eliminated. Lithotripsy is contraindicated in cases of urinary tract obstruction, stones larger than two centimeters, as well as in the cases of coagulation disorders and unitary tract infections.9

Studies have demonstrated that the use of extracorporeal shock wave lithotripsy (ESWL) in children presents higher indices of fragmentation than in adults.8 The theories to explain these results are based on the better condition of shock waves in children, due to a higher proportion of water and greater tissue elasticity, and greater fragility of the stones in children, as they are newer.8

The safety of ESWL use in children remains controversial. Studies have demonstrated that extracorporeal lithotripsy causes lesions to the renal parenchyma, as a result of the number of impulses and the intensity of the shock waves.10 Permanent lesions to the renal parenchyma, however, have not been demonstrated.10 We support the use of less intense shock waves in children, even if more sessions are deemed necessary.10

The object of the present study is to report the results of extracorporeal shock wave lithotripsy use in the treatment of urolithiasis in children.

Results

Table 1 shows the distribution of patients according to location, number and size of the stones subjected to lithotripsy. Table 2 describes the results obtained from extracorporeal lithotripsy. The forty-nine renal pelvic stones required on average 2.2 sessions. The nine upper and middle calyceal calculi required 1.2 sessions on average. The 17 cases of lower calyceal calculi necessitated, on average, 2.8 sessions. The three cases of staghorn stones needed 3.7 sessions on average/stone. The 10 ureteral stones were submitted to one treatment session on average and the five cases od bladder stones were submitted, on average, to 1.8 sessions.

Infectious, hemorrhagic, or obstructive complications were not observed in our patients. Emergency surgery was not necessary.

Discussion

The therapeutic results of urolithiasis with minimally invasive methods in children is not yet well established because urolithiasis in this age group is less frequently diagnosed and the patient population is consequently less robust. Some care is important when doing ESWL in children, with the use of lung protection, due to the potential lesions to the pulmonary parenchyma by the action of the shock waves.10 The gonads should also be protected from radiation when equipment that uses fluoroscopy is used to direct the shock waves to the stones.
The results of extracorporeal shock wave lithotripsy use depends on diverse factors, such as, for example, location of the stones, the size and dilation of the urinary tract. This study showed that ureteral and pelvic stones presented more favorable results, while the stones located in the lower calyx presented less favorable results. The study carried out by Sampaio and Aragão demonstrated that there exists influence of the angle between the lower calyx and the renal pelvis or the urethra on the results. The coralliform stones present much less favorable results and greater complications when treated with ESWL, in such a way that many researchers defend the use of percutaneous nephrolithotripsy for cases of urinary stones larger than twenty millimeters. The vesical stones present an extra difficulty for their treatment using ESWL, due to the constant movement of the stones inside the bladder when shock waves are applied.

In conclusion, the results of this method were influenced by the location of the stones. The pelvic and upper and middle calyceal calculi, as well as ureteral stones presented, in this study, more favorable results. This method was successful in 64.7% of the patients with lower calyceal stones. The vesical stones were eliminated in 60% of the cases and coralliforms in only 33.3%. Extracorporeal lithotripsy proved to be an efficient and safe method for the treatment of urolithiasis in pediatric patients.

Table 1 - Location, number, percentage and size of the stones submitted to lithotripsy

<table>
<thead>
<tr>
<th>Location</th>
<th>Number of stones</th>
<th>%</th>
<th>Mean size of stones (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pelvic</td>
<td>49</td>
<td>52.7</td>
<td>13.3</td>
</tr>
<tr>
<td>Upper and middle calyceal</td>
<td>9</td>
<td>9.9</td>
<td>6.7</td>
</tr>
<tr>
<td>Lower calyceal</td>
<td>17</td>
<td>18.3</td>
<td>8.7</td>
</tr>
<tr>
<td>Staghorn</td>
<td>3</td>
<td>3.2</td>
<td>30.0</td>
</tr>
<tr>
<td>Ureteral</td>
<td>10</td>
<td>10.7</td>
<td>10.0</td>
</tr>
<tr>
<td>Bladder</td>
<td>5</td>
<td>5.4</td>
<td>13.0</td>
</tr>
</tbody>
</table>

Table 2 - Result of extracorporeal lithotripsy according to location of the stones

<table>
<thead>
<tr>
<th>Location</th>
<th>Stone-free</th>
<th>Number of stones (%)</th>
<th>Mean size of stones (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pelvic</td>
<td>43 (87.7)</td>
<td>2 (4.1)</td>
<td>4 (8.2)</td>
</tr>
<tr>
<td>Upper and middle calyceal</td>
<td>7 (77.8)</td>
<td>1 (11.1)</td>
<td>0</td>
</tr>
<tr>
<td>Lower calyceal</td>
<td>11 (64.7)</td>
<td>1 (5.9)</td>
<td>1 (5.9)</td>
</tr>
<tr>
<td>Staghorn</td>
<td>1 (33.3)</td>
<td>–</td>
<td>2 (66.6)</td>
</tr>
<tr>
<td>Ureteral</td>
<td>10 (100)</td>
<td>–</td>
<td>0</td>
</tr>
<tr>
<td>Bladder</td>
<td>3 (60.0)</td>
<td>–</td>
<td>2 (40.0)</td>
</tr>
</tbody>
</table>

References


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