Ureteral duplications and ureteroceles - surgical treatment

Lisieux Eyer de Jesus,1 Mariana Mesquita Júdice,2 Eduardo G. Mello3

Abstract

Objective: To study clinical and radiological data and surgical treatment for symptomatic ureteral duplications in childhood, especially the results for superior polar heminephrectomies.

Methods: Prospective observational study concerning 15 pediatric patients surgically treated following a protocol with a minimum follow-up of 6 months.

Results: 93% of the patients presented urinary infection and/or fetal hydronephrosis during their first year of life. These were the usual reasons for evaluation. Superior polar heminephrectomy was indicated for 80% of the patients, all of whom presented clinical and radiological improvement after the surgery. There were no significant complications. All children with severe vesicoureteral reflux to the duplicated superior pole presented symptomatic reflux to the stump after the surgery and were submitted to stumpectomy. None of the patients without preoperative reflux needed any other surgical procedure.

Conclusions: Superior polar heminephrectomy is safe and efficient in order to treat ureteral duplications in childhood. If the patient does not present vesicoureteral reflux this will probably be the only surgery needed. Most patients with reflux to the resected superior pole will need stumpectomy subsequently.


Introduction

The treatment of symptomatic duplications of the urinary tract in children is highly complex and continues to be very controversial. A number of treatment proposals are recent, in particular those which employ a systematic endoscopic incision of the ureterocele as initial treatment,1,2 the evaluation of whose long term results is still incomplete. This methodology, which is very attractive because of its initial simplicity, in certain cases causes severe vesicoureteral reflux which is very difficult to treat.

The absolute majority of studies available in literature is retrospective. We do not find studies based on Brazilian sample populations, and many works concentrate on very long periods of time, during which time clinical conduct algorithms have altered, which make uniformity of results difficult to achieve. We present a sample of pediatric patients (< 12 years) studied prospectively, highlighting clinical and diagnostic aspects in our environment and results, particularly those of upper pole partial nephrectomies. Our principle objective was to record the

1. Pediatric surgeon, Hospital Municipal Jesus, RJ and Hospital Universitário Antônio Pedro, Universidade Federal Fluminense.
2. Resident physician, Pediatric Surgery Service, Hospital Municipal Jesus.
3. Resident physician, Pediatric Surgery Service, Hospital Municipal Jesus.

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clinical expression and diagnostic aspects of symptomatic ureteral duplications in our locale and verify the capacity of upper pole partial nephrectomies as a treatment for ureteropelvic duplications to achieve resolution and also possible eventual complications. The protocol chosen defines the treatment of the urinary tract as a single entity, without isolating the treatment of ureteroceles, which we consider to be an integral part of a complex of anatomical deformities, whose entirety, in its detrimental effect on each individual component determines its clinical consequences and its treatment.

Patients and methods

We present a controlled prospective case study performed over a five year period (1996-2001) into 15 children operated on by the same surgeon at the Pediatric Surgery Service of the Hospital Municipal Jesus, Rio de Janeiro, Brazil, with a minimum post-operative observation period of 6 months. This is a tertiary pediatric hospital which is a center of excellence for complex pediatric surgery within the Municipal Health Secretariat of Rio de Janeiro.

A diagnosis of complete symptomatic ureteral duplication was adopted as the inclusion criterion for this sample. The children were initially assessed using ultrasound (US), voiding cystourethrography (VCUG), renal scintigraphy (RSG) and intravenous pyelography (IVP). Surgical indications were repeated or intractable urinary infection (IUT) and/or sub-occlusion of the vesical orifice or the ureters.

Duplications with significant lack of function in the upper pole segment underwent upper pole partial nephrectomies by lumbotomy, with excision of the corresponding ureter to the maximum extent possible without further incisions and also cauterization of the proximal extremity of the residual segment of the ureter (12 cases). Sufferers with good upper pole function and no vesicoureteral reflux observable (one case) had ureteropelvic bypass terminal to lateral superior to inferior, with maximum resection of the distal ureteral stump at the upper pole and anastomosis of the ureteral stump proximal to the lower renal pelvis. Patients with good upper pole function and symptomatic vesicoureteral reflux unresolved with antibiotic prophylaxis and prolonged observation (≥2 years) or with associated problems which demanded surgery received double ureter reimplantation, after resection of the ureterocele (one case). Cases with negligible ipsilateral renal function were nephrectomized (one case). All procedures were open surgeries and none of the children received pre-operative endoscopic treatment.

All of the patients were scheduled for observation according to a protocol aimed at the use of antibiotic chemoprophylaxis, preferably using sulfamethoxazole in conjunction with trimethoprim (40 mg/kg sulfamethoxazole + 8 mg/kg trimethoprin in a single nocturnal dose) for children older than 4 months and a single nocturnal dose of cephalexin 25 mg/kg for lactates still in their first trimester, continued for three months after the operation and extending if clinical criteria prove this to be necessary (a diagnosis of intercurrent vesicoureteral reflux, the occurrence of IUT in the absence of the chemical treatment). All of them were scheduled for outpatient clinical follow-up and systematic ultrasound scanning irrespective of the presence of symptoms of abnormality at 1, 3 and 6 months and 1 year after surgery and outpatient clinical vigilance for a minimum of 5 years. Parents and guardians were instructed to contact the service in the event of febrile infections and/or intercurrent urological symptoms. RSG and VCUG were taken a minimum of 4 months after the procedure.

All of the parents and guardians were informed of the eventual necessity of a second phase of surgery for the treatment of sequelae to the disease (in general vesico-ureteral reflux - VUR) at the time that their children underwent the initial surgery to the upper renal segments.

Results

Fifteen children between 3 and 50 months old (median 7 and mean 13.5 m) were studied, 11 girls and 4 boys (ratio 2.8:1), for a minimum post-operative observation period of 6 months (variance of 6 to 77 months, mean 24.7 months, median 16 months). Presented with the condition on the right hand side and 10 the left, two had bilateral ureteral duplications with pathological manifestations in only one of the duplicated kidneys.

Four patients (27%) had a prenatal diagnosis of urological anomaly, but did not receive antibiotic chemoprophylaxis or radiological investigation on birth, being referred to our service after episodes of acute pyelonephritis, with the exception of one, initially asymptomatic patient, referred for fetal hydronephrosis investigation, who later presented (IUT) symptoms despite chemoprophylaxis. Eight sufferers (53%) presented symptoms until 3 months old, 3 until 6 months and one for the first year of life, from a total of 73% symptomatic cases during the first semester and 93% within the first year of life. Only one child first presented symptoms at pre-school age. The mean average of the age at which symptoms were expressed was 8.3 months and the median was 3 months. Despite the precarious clinical status there was significant latency between the appearance of symptoms and the first specialist consultation, varying between less than three months from the initial symptoms (7/13) and more than 1 year from the first infectious episode (2/13). Four of the thirteen children were seen only after between 6 months and 1 year after the first clinical manifestations. The period between the first satisfactory medical assessment and surgery was more than 6 months for 9/13 patients, with a mean average of 13.8 months and a median of 21.
For 14/15 children the motive for referral was one or more episodes of IUT with fever or persistent/intractable IUT. The only exception was the asymptomatic newborn referred for investigation of fetal hydronephrosis. The first episode of IUT was identified during the first month of life in two cases, during the first three in six and by the sixth month in nine. The remainder presented their first episode during the first year of life (three cases) and just two girls (13%) presented their first infectious symptoms after 1 year. For one patient it was not possible to identify the point at which the first infectious episode had occurred. The means and medians of the age at which the first episode of IUT was observed were, respectively, 10.4 and 6 months overall, 13.7 and 5 months for females and 4.8 and 6 months for males. The referral for investigation was later for the girls than for the boys (an average of 15.2 and a median of 11 months for girls and 7 months for boys). 11 of the 15 patients observed had presented more than two episodes of febrile IUT when referred (a variance of three to eight recognized episodes) and one presented after two months of treatment using a variety of therapies with persistent intractable IUT. In only three cases were there two episodes of severe IUT before diagnosis.

Two patients presented urine retention, both males suffering from ureterocele, one of them a newborn with a ureterocele prolapsed into the posterior ureter referred as an intractable IUT case. Two girls had vaginal discharge. There were no cases of prolapsed ureterocele among the girls, urinary incontinence, orchiepididymitis or perineal ureteral ectopia.

All of the children were examined using US, VCUG and IVP. RSG was performed for 87% (n = 13). It was difficult to achieve uniform test data since there was no standardization of methodology for the performance and description of the tests. In the case of patients who underwent more than one test of the same type before surgery the results were integrated.

The US scan explicitly determined duplication in just 5/15 sufferers, although the existence of this can be deduced indirectly or presupposed in a further eight (a description of two ureters on the same side, ectopic ureterocele, upper megaureter), and the diagnosis of duplication can be confirmed or assumed with only the US results in 87% of cases. In four patients more than one scan was necessary to detect the condition and US was unable to diagnose the problem for two more, making a total 6/15 in which the initial US was not satisfactory for the detection of duplication. The US detected lesions to the renal parenchyma in six children, 12 hydronephroses of the upper pole (one pyonephrosis) and six hydronephroses of the lower pole of duplication, and no cases of contralateral hydronephrosis. This test showed itself highly sensitive to associated megaureter, detecting it in all of the patients, but related to an anomaly of the upper pole of the duplication in only seven. In 11/15 cases, US detected ureteroceles, including three which were not detected by the VCUG, and described 3/15 ureteral ectopias (compared with the four detected by VCUG).

RSG with DMSA was performed on 13 patients, demonstrating decrease in ipsilateral renal mass or of the upper pole of the ipsilateral kidney in 77% (n = 10). In 3 (23%) patients the ipsilateral upper pole possessed function, although uniformly diminished and in only one significant dysfunction of the lower pole. One child (8%) had renal scarring at the ipsilateral lower pole. The contralateral kidney was normal in 12/13 and enlarged in 1/13 (bilateral duplication). The RSG with DTPA (n=13) showed exclusion of the upper pole and hydronephrosis of the lower pole of the duplication in nine cases, with contralateral hydronephrosis in two. The function of the affected kidney was significantly less than that of the homologue in 56% of those examined (the difference in function between the two sides > 10%).

The VCUG testing demonstrated lower sensitivity than the US for the detection of ureteroceles (Table 1). Four out of fifteen patients, 2 of whom were found to have ureterocele by US, had a normal VCUG. In 11 children known to have ureteroceles, US identified 10 (sensitivity of 91%), and VCUG 7 (sensitivity of 64%). Only one baby had straining bladder (male sex, urinary obstruction due to ureterocele prolapse), but there was an increase in post voiding residue in 3/15 (20%) sufferers, all with ureteroceles. None were detected by US, however systematic vesical post voiding examinations were not performed. VCUG is indispensable to the detection of vesico-ureteral reflux (VUR), ipsilateral in 5 (33%) patients (4 for the upper pole and three for the lower pole, 3/4 5th degree to the upper pole) and contralateral in two (13%) (3rd degree), revealing an abnormally high incidence VUR ratio in this specific population (average incidence in lactates of 1 to 2 % 3). VCUG was capable of demonstrating the existence of ureteral ectopia (in ureters with reflux corresponding to the upper pole of duplication) in four patients. All of these patients presented highly dilated ectopic ureters inserted close to the vesical neck.

The IVP tests revealed an excluded upper pole in 11/15 patients (in seven indirectly, by means of the ‘drooping lily sign’). Two patients with an excluded upper pole showing by IVP had function which was demonstrating with scintigraphy. One patient presented total ipsilateral renal exclusion (nephrectomized). An ipsilateral lower pole functional obstruction was discovered in only 4/15 patients as against 9/15 with scintigraphy with DTPA. IVP managed to detect five cases of ureteroceles, all of them previously seen with VCUG and US.

In 12 sufferers upper pole partial nephrectomy, maximum ureterectomy and ligation of the residual extremity of the ureter was the approach of choice. There was one top-to-bottom ureteropelvic bypass, one Poliato method double ureteral reimplant and one total nephrectomy. There were post-operative problems with three children: one pneumonia, one IUT (pyonephrosis of the upper pole of the duplication by Pseudomonas aeruginosa detected during surgery), one
auto-limiting aseptic cystitis (ureteral reimplant, ureterocele resection and reconstruction of the vesical floor). The internment period varied between 3 and 9 days (mean: 6.1; median: 6).

In twelve cases anatomical parts required histological review. Eleven presented chronic pyelonephritis and obstructive and inflammatory alterations. Only three upper poles were described as dysplastic, one as carrying glomerulosclerosis and three as atrophied (25%).

Observation varied between 6 and 77 months (mean average 24.7 and median 16 months). In a number of patients for whom we have staged measurement there is a renal growth process proportionally greater on the operated side than on the contralateral. In 14/15 children no anomalies were detected in the remaining renal segment with post-operative ultrasound (9/15 presented an obstructive complex in the lower pole of the duplication at the preoperative examination, which we presume was due to secondary compression of the ureteral outlet(s) by the ureterocele). The remaining patient demonstrated a progressive improvement of the hydronephrosis found during preoperative tests.

Two of the thirteen sufferers who underwent partial nephrectomy presented asymptomatic low volume cysts (maximum diameter < 20 mm) on the remaining renal segment. None of those with ureterocele showed post-operative lesions, although localized vesical thickening was visible in four and one developed (72 m after total nephrectomy) a vesical diverticulum at the site of the ureterocele described earlier, with reflux at the ureteral stump.

Post-operative VCUG is available for 10/15 patients. In three cases it is normal (asymptomatic), shows stump reflux in three (they had presented post-operative IUT), reflux to the lower ipsilateral pole in three (two with post-operative IUT and one asymptomatic) and contralateral reflux in one (asymptomatic).

Six patients are clinically asymptomatic at between 6 and 60 months after surgery. Nine others presented IUT (at between 2 and 72 months, median of 10 months). There were anatomical explanations for all seven cases: Three of the nine presented VUR revealing residual ureteral stumps (IUT at 8, 12 and 72 months after surgery), one of them hydrocolpos (follow-up not completed), 3/9 had VUR to the ipsilateral and/or contralateral lower pole (one follow-up not completed). Two of the nine are awaiting further investigation.

Three severe cases of reflux upper pole de duplication presented residual ureteral stump syndrome, with IUT and episodes of post-operative dysuria and were re-operated (distal extravescical ureterectomy), and since then remain asymptomatic. Among those who had presented preoperative VUR there are three ‘new’ cases of VUR” (one asymptomatic and two cases of post-operative IUT). Four children have not yet had post-operative VCUG and three continue VUR free.

Five of the fifteen patients (33%) continue to be asymptomatic since surgery, none of whom exhibit at any point evidence of VUR. Another two cases presented ‘new’ reflux after surgery, also resolved spontaneously after a period of observation and chemoprophylaxis, making a total of 7/15 (47%) cured after a single intervention. Two of the patients remain under observation, one of them who had no pre-operative VUR diagnosis, and a single episode of post-operative IUT, awaiting VCUG. Four sufferers (27%) were re-operated, three for resection of the residual ureteral stump (a 24 hour hospital stay) and one to cure VUR (surgery solicited by the patient’s family who did not accept

### Table 1 - Comparison between the possibility of detecting specific problems through complementary exams

<table>
<thead>
<tr>
<th>Parameter</th>
<th>US (%)</th>
<th>VCUG (%)</th>
<th>IVP (%)</th>
<th>Scintigraphy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distal ureter anomaly</td>
<td>13/15 (87)</td>
<td>8/15 (53)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Ureterocele</td>
<td>11/15 (73)</td>
<td>8/15 (53)</td>
<td>5/15 (33)</td>
<td>–</td>
</tr>
<tr>
<td>Ureteral ectopia</td>
<td>3/15 (20)</td>
<td>4/15 (27)</td>
<td>0</td>
<td>–</td>
</tr>
<tr>
<td>Megaureter</td>
<td>15/15 (100)</td>
<td>5/15 (33)</td>
<td>0</td>
<td>–</td>
</tr>
<tr>
<td>Pyeloureteral duplication</td>
<td>13/15 (87)</td>
<td>Indirect</td>
<td>11/15 (73)</td>
<td>0</td>
</tr>
<tr>
<td>Ipsilateral upper pole hydronefrosis</td>
<td>11/15 (73)</td>
<td>–</td>
<td>1/15 (7)</td>
<td>4/13 (31)</td>
</tr>
<tr>
<td>Ipsilateral lower pole hydronefrosis</td>
<td>6/15 (40)</td>
<td>–</td>
<td>5/15 (33)</td>
<td>9/13 (69)</td>
</tr>
<tr>
<td>Ipsilateral exclusion of the upper pole</td>
<td>–</td>
<td>–</td>
<td>10/15 (67)</td>
<td>9/13 (69)</td>
</tr>
<tr>
<td>Ipsilateral function of the upper pole</td>
<td>–</td>
<td>–</td>
<td>5/15 (33)</td>
<td>4/13 (31)</td>
</tr>
<tr>
<td>Contralateral hydronefrosis</td>
<td>0</td>
<td>–</td>
<td>0</td>
<td>2/13 (15)</td>
</tr>
</tbody>
</table>

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long term chemoprophylaxis). Only two sufferers (13%) were not followed up, both symptomatic girls: one a ‘new’ case of post-operative VUR and one case with neither pre nor post-operative VUR, with US diagnosing hydrocolpos. A summary of the monitoring data can be found in Table 2.

**Discussion**

We consider that the sample presented is representative despite the small number of cases, and taking into account the low number of prospective studies available and the absence of national studies into the treatment of complicated duplications of the urinary tract in children, after extensive research using the BIREME database. The subject is controversial and a number of treatments have been made available very recently: there has not yet been long term monitoring for certain methods, notably therapeutic endoscopy. The main controversies involve the dilemma of therapeutic endoscopy versus the capacity to achieve a definitive cure and of higher risk operating methods (extensive vesical reconstruction surgery) versus lower morbidity surgical methods (partial nephrectomy), but less efficacy in terms of a definitive one-off cure. It is pertinent here to reiterate that diagnostic endoscopy already has classical indications, and that the controversy relating to therapeutic endoscopy does not apply in cases of obstruction of the vesical opening or perinatal infections which don’t respond to optimum antibiotic therapy, where initial endoscopic treatment, wherever available, is not disputed.

In our area there remain difficulties with the early diagnosis and referral of patients. When there was interuterine diagnosis of urinary anomaly this was not, in the majority of cases, accompanied by referral for investigation and treatment: of four patients (27%) diagnosed by means of fetal US, one was referred while still asymptomatic. A further problem is related to the lateness of specific diagnosis after the onset of symptoms, with an average of 13.5 months (median 7 months) between the onset of symptoms and referral for urological investigation and the occurrence of more than 1 IUT episode before specialist examination and the introduction of chemoprophylaxis. This problem was more serious among the female sex (median of age at first examination for girls 11 months and 7 months for boys). It is possible that this difference may be attributable to older practices, now reformed, which employed investigation after the first IUT episode for males, but only after two for girls. It is also possible that there is a bias towards earlier diagnosis among boys in response to the greater seriousness of their clinical status or the greater control difficulties. Late referral and investigation demonstrated an onus related to repetitive IUT and sepsis sequelae. It is necessary draw the attention of professionals active in the areas of obstetrics, pediatrics and primary health care to the necessity of early investigation of children suspected of urological malformations or who present IUT, immediately after the first episode. It is also necessary to improve prenatal care, in the light of the small number of patients with interuterine diagnoses (27%), despite data in international literature frequently being similar.

**Table 2 - Summary of the clinic follow up after surgery**

<table>
<thead>
<tr>
<th>Patient</th>
<th>FU* (m)</th>
<th>Postoperative IUT</th>
<th>Associated clinic status</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>No</td>
<td>Asymptomatic</td>
<td>Not necessary, asymptomatic patient</td>
</tr>
<tr>
<td>2</td>
<td>16</td>
<td>3m</td>
<td>Sinéquia vulvar/ VUR, LPD and CL</td>
<td>Bilateral ureteral reimplant</td>
</tr>
<tr>
<td>3</td>
<td>14</td>
<td>3m</td>
<td>Stump reflux</td>
<td>Surgery 11m after 1st surgery</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
<td>12m</td>
<td>Waiting for VCUG</td>
<td>Chemoprophylaxis</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>8m</td>
<td>Hydrocolpos</td>
<td>Lost follow up</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>2m</td>
<td>VUR (4) LPD</td>
<td>Lost follow up</td>
</tr>
<tr>
<td>7</td>
<td>28</td>
<td>No</td>
<td>Asymptomatic, VUR (2), IL 3(CL)</td>
<td>Chemoprophylaxis, cure 15m</td>
</tr>
<tr>
<td>8</td>
<td>18</td>
<td>No</td>
<td>Asymptomatic</td>
<td>Not necessary, asymptomatic patient</td>
</tr>
<tr>
<td>9</td>
<td>40</td>
<td>8m</td>
<td>Stump reflux</td>
<td>Surgery 12m</td>
</tr>
<tr>
<td>10</td>
<td>37</td>
<td>8m</td>
<td>Asymptomatic, VUR (2), IL</td>
<td>Clinic observation</td>
</tr>
<tr>
<td>11</td>
<td>6</td>
<td>No</td>
<td>Asymptomatic</td>
<td>Not necessary, asymptomatic patient</td>
</tr>
<tr>
<td>12</td>
<td>35</td>
<td>No</td>
<td>Asymptomatic</td>
<td>Not necessary, asymptomatic patient</td>
</tr>
<tr>
<td>13</td>
<td>4</td>
<td>2m</td>
<td>Asymptomatic</td>
<td>Chemoprophylaxis</td>
</tr>
<tr>
<td>14</td>
<td>60</td>
<td>No</td>
<td>Asymptomatic</td>
<td>Not necessary, asymptomatic patient</td>
</tr>
<tr>
<td>15</td>
<td>77</td>
<td>72m</td>
<td>Stump reflux</td>
<td>Surgery 74m after 1st surgery</td>
</tr>
</tbody>
</table>

(*) FU: Follow up, duration. LPD: lower pole of duplication, IL: ipsilateral, CL: contralateral.
(28%, 8 17%, 9 31%, 10 25%, 5 52%, 4 58%, 11), when it is considered that prenatal diagnoses permits a significant decrease in the incidence of IUT.

The inadequate uniformity of complementary test data caused us great difficulty, and it would have been ideal to prepare a protocol for the execution and documentation of these tests. Even so it is possible to conclude that US is extremely efficient, in terms of its low cost, minimal morbidity and high sensitivity. In this series, US was the most effective imaging method for the diagnosis of ureteroceles, including with respect to VCUG, although they are indispensable for the detection of VUR (present in up to 50% of patients12). It is probable that the higher level of positivity found with US compared with VCUG is explained by the highly compressible nature of the majority of ureteroceles, which may not be apparent in the bladder when replete. Although within this sample there have been problems with correct diagnosis of duplication, this is assumed to be due to the lack of standardization in the execution and description of tests. The pre and post voiding studies, which we do not have available, would have been interesting for the detection of subocclusive phenomena of the secondary vesical exits and ectopic ureteroceles. A new angle on US use is for the indirect verification of the functional potential of the upper duplicated poles neonates, for whom currently available functional tests are of low effectiveness: the evaluation of thickness and sonographic characteristics of the renal parenchyma by US may be the best resource available.

IVP did not add any data to the information already acquired by means of the other tests (US/VCUG/scintigraphy), and obliges the drawing of certain conclusions in an indirect manner. In the case of duplication with excluded upper pole, common in pediatrics, IVP corroborates diagnosis by means of radiological signals dependent upon mechanical phenomena of renal dislocation (drooping lily sign, lateral dislocation of the lower pole), by way of the visualization of an incomplete ureteropelvic system at the lower pole of the duplication or demonstrating the upper pole of the duplication by means of spontaneous vesicoureteral reflux (which may cause a false impression of functionality of the upper pole, a fact which we suspect may explain certain disagreements between results obtained from DMSA, DTPA and IVP). In our opinion the functional evaluation obtained with IVP can be surpassed by renal scintigraphy and anatomical information derived from ultrasound examination of a high level of technical quality, relegating this test to a lower level. We recognize, nevertheless, that in the absence of standardization of the US examination and/or a qualified operator or even in cases of diagnostic doubts, IVP remains a valuable resource.

We observed a relatively low incidence of renal dysplasia of the upper pole segment de (25%), although the majority of authors report levels of around half their patients8,13-15). This datum suffers from the absence of standardization by pathologists of the definition of renal dysplasia16. This can be problematic, especially because there are those who argue - in defense of a resection of the upper pole approach - that the extirpation of these segments is necessary given the possible complications potentially present in dysplastic segments. If, in renal dysplasia sufferers, the frequency of dysplasia is low, and this is associated with information proving neoplasm or hypertension incidence similar to that found in the general population,17 then this argument should not be considered.

We observed a clinical improvement in all of the patients who were operated upon. Surgical morbidity was low: we had only one case of a problem exclusively linked to surgery (cystitis repeated vesical spasms of the ureteral reimplant). In patients subjected to partial nephrectomy, complications were linked with orotracheal intubation (early post-operative pneumonia) and chronic infection of the urinary system.

There was no evidence of functional compromise or renal growth deficit in any remaining lower pole, despite such a possibility being a theoretical argument employed by many authors. Although we have found small remaining kidneys on the operated side with relation to the contralateral the renal remnant in all patients presents a size which is compatible with the norm for their age group by nomogram, wherever measurement is available (nine patients). This data is in agreement with the literature which describes significant upper pole function in only about 1/4 of cases and with Vates,15 who, in a functional analysis of patients with renal duplication did not find global function levels to be significantly different between cases of upper pole resection and preservation (global renal function differences post-operatively from +2.3 to ±2.3% in partial nephrectomies and -1.3 to ±2.7% in patients whose upper pole was preserved, with respect to pre-operative levels). Functional abnormalities in the form of functional subocclusion of the lower renal segment or of the contralateral kidney normalized (14/15 cases) or presented significant improvement (1/15 cases). It is possible that perinatal endoscopic treatment offers better results in terms of restoration/preservation of renal function of the upper polar segments, with good results in from 1/51,8 to 2/3 cases,2-20,21 although this data is still dependant upon the passage of time to prove itself effective, and it will be necessary to prove the relative importance of the preserved upper pole function within the total renal function available to the patient, inclusive of possible problems secondary to the use of endoscopy (particularly induction of severe VUR).

We found small cysts on the remaining renal segment in a region corresponding to the renal suture line in two patients, a fact which we did not find described in the literature. Such lesions remain asymptomatic and it is possible that they will resolve spontaneously, possibly constituting retention cysts. All of the ureteroceles resolved spontaneously without sequelae, except in the case of one patient, who came to present periureteral vesical diverticulum, after a long period of observation (6 years).
Approximately half of the patients are asymptomatic post-operatively, two have low level VUR. None of them had demonstrated pre-operative VUR. This data is in line with Hussman,22 who describes partial nephrectomy as one-off surgery in 85% of patients with no pre-operative VUR, with 30% new VUR post-operatively and 15% of reimplants, as against 84% of persistent VUR in pre-operative VUR carriers and 57% of VUR and secondary reimplants after perinatal therapeutic endoscopy. In 6/7 patients who presented post-operative problems it was possible to detect the cause: two cases of VUR to the lower pole of duplication or contralateral kidney, three cases of reflux to the residual ureteral stump (one of them associated with periureteral diverticulum), one case of associated genital malformation (one patient awaiting VCUG). In all patients symptomatic post-operatively, with a single exception, residual symptoms presented during the first year of observation soon after the suspension of antibiotic chemoprophylaxis. Our incidence of reflux to the residual ureteral stump was similar to that of the literature and all cases were re-operated with a Pfannenstiel incision and extravesical resection of the do residual ureteral stump with a post-operative hospital stay and minimal aesthetic sequelae. It is also to be supposed that if laparoscopic surgery was available then such an approach would become even more simple.

In our opinion the possibility of complications oblige long observation periods and at least one post-operative VCUG is necessary, although certain authors recommend this test only in cases of clinical symptoms.

There were post-operative problems in all of the cases where there was pre-operative VUR. The necessity for re-operation has been held to be a strong argument against the minimal approach by means of partial nephrectomy proposed by Cendron26 and in modern times endoscopy has been offered as a new minimum intervention treatment. However, endoscopic treatment is a recognized inductor of VUR (35% of cases) which will necessitate complementary surgical treatment, diverting the axis of surgical care from partial nephrectomy to reimplantation surgery and requiring redoubled care in terms of antibiotic prophylaxis while awaiting surgery, which may prove difficult under adverse social conditions.

We conclude that treatment by partial nephrectomy of complicated duplications with functional upper pole exclusion is a good therapeutic resource and the only intervention necessary in patients who do not present with VUR. In the case of patients with reflux to the upper duplicated pole it is possible that the resection of the residual ureteral segment will prove necessary, although this second half consists of small scale surgery and in the interval between the two interventions there is great clinical and anatomical improvement of the remaining renal segments. For patients with contralateral pre-operative reflux or to the lower duplicated segment the chances of re-operation are intermediate and depend upon anatomical problems at the level of the vesical implantation of the remaining ureters and/or functional bladder disorders and the capacity to keep the patient on chemoprophylaxis over the long term.

References

Corresponding author:
Lisieux Eyer de Jesus
Rua Presidente Domiciano, 52/801 – Boa Viagem
CEP 21210-270 – Niterói, RJ, Brazil
Tel.: +55 (21) 2622.3843
E-mail lisieux@uol.com.br