ENDOPYELOTOMY WITH THE ACUCISE™ CATHETER

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ABSTRACT

Objectives: Determine the efficiency of the Acucise™ catheter in the treatment of ureteropelvic junction (UPJ) obstruction.

Materials and Methods: Between May 1997 and April 1999, 30 patients with primary or secondary ureteropelvic junction obstruction were treated using Acucise™ endopyelotomy catheter. The diagnosis was based on intravenous urography and diuretic renography. None of the patients underwent imaging studies for identification of blood vessels at the UPJ region. Twenty-one patients presented mild pyelocalyceal dilation and 9 had severe pyelocalyceal dilation. As for etiology, primary stricture was found in 24 patients and secondary stricture in 6. Three patients had UPJ obstruction associated with homolateral renal lithiasis. Retrograde Acucise™ endopyelotomy was performed in 27 patients; the antegrade access was used in 3 patients that had associated renal calculi. Incision of the stricture was performed laterally in all patients under fluoroscopic guidance. A 7F double-J catheter was placed immediately following the procedure, and removed after 6 weeks. Antegrade pyelotomy required a hospital stay of 3 days and retrograde pyelotomy required 1 day.

Results: Postoperative intravenous urography and diuretic renography demonstrated good results in 26 patients (86.6%).

Conclusions: Acucise™ endopyelotomy represents a minimally invasive therapeutic option and can be used both in adults and in children 8 years old and above. Patients with UPJ obstruction and severe pyelocalyceal dilation had poorer results than those with mild pyelocalyceal dilation.

Key words: kidney; kidney pelvis; ureteral obstruction; ureteral stricture

INTRODUCTION

Pyeloplasty remains the gold standard technique for treating ureteropelvic junction obstruction (UPJ) (1). Success rate for this technique, in different series, ranged between 90 and 95% (2). Although long-term results are good, this procedure has some drawbacks: it is an invasive method, causes severe postoperative pain, convalescence takes a long time, and patient will have with a permanent cutaneous scar.

Endourologic techniques constitute an alternative for open surgery (3). The treatment of the UPJ obstruction by percutaneous access was performed for the first time in 1983. The procedure was then known as percutaneous pyelolysis (4). In 1986, it was acknowledged throughout the world as antegrade or percutaneous endopyelotomy (5). This technique requires a percutaneous access and one possible complication directly related to this method is bleeding (6). Investigators published, in 1983 in the urologic literature, their preliminary experience with endopyelotomy, performed by retrograde access using a newly developed catheter called Acucise™ (7). The treatment of UPJ strictures with the Acucise™ catheter by retrograde access is considered...
a minimally invasive new alternative therapy, with encouraging results (8,9). In the present study, we report our experience in managing ureteropelvic obstruction with the Acucise™ catheter.

PATIENTS AND METHODS

During the time period of May 1997 to April 1999, 30 patients with UPJ obstruction were treated by Acucise™ endopyelotomy. Ten patients were male, and 20 were female. Patients’ ages ranged from 8 to 75 years old (mean = 36.2), Figure-1. The study excluded patients with UPJ obstruction due to malignancies, previous radiotherapy, and retroperitoneal fibrosis.

Diagnostic suspicion was made in 26 patients based only on clinical symptoms. Four were asymptomatic, and the diagnostic suspicion was reached analyzing tests performed for other indications. Diagnosis was confirmed based on results of intravenous urography and diuretic renography. Clinical symptoms were back pain in 19 patients, renal colic in 6, and abdominal pain in 1 (Table-1).

All patients underwent intravenous urography, and in 27 patients, a diuretic renography was also performed. Twenty-four patients had primary UPJ stricture, and in 6 the obstruction was secondary. Of the 6 patients presenting secondary stricture, 5 had suffered previous surgeries for removal of renal calculi. One patient with secondary obstruction had undergone pyeloplasty 7 years before, due to primary UPJ obstruction. All patients had a complete blood test pre-operatively, with measurement of urea and creatinine, clotting factors, type I urinalysis and urine culture with sensibility tests. No patients with urinary tract infections were submitted to surgery.

Patients were informed that if failure occur, open surgery or laparoscopic pyeloplasty might be necessary. They were also told that in case of hemorrhage, its management could include blood transfusion, arteriography with selective embolization of the damaged blood vessel, surgical investigation, and even nephrectomy.

A broad-spectrum antibiotic was given to patients on the day prior to surgery. Endopyelotomy

Table 1 – Clinical symptoms.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>No. of Patients</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lumbar Pain</td>
<td>19</td>
<td>63.3</td>
</tr>
<tr>
<td>Renal Colic</td>
<td>6</td>
<td>20.0</td>
</tr>
<tr>
<td>Abdominal Pain</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td>Incidental</td>
<td>4</td>
<td>13.4</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>100</td>
</tr>
</tbody>
</table>

Figure 1 – Age of the patients.
was performed in all patients, using the Acucise™ catheter, with a diameter of 5F in its extremity. Twenty-seven patients, for whom the retrograde access was adopted for the procedure, were given epidural or spinal anesthesia, the remaining 3 were submitted to antegrade endopyelotomy and received general anesthesia. Lithotomy position was used for the 27 patients that were submitted to retrograde endopyelotomy, and prone position for 3 patients that underwent antegrade endopyelotomy.

For 3 patients with UPJ obstruction and renal calculus, the antegrade access was chosen for the procedure. First, a percutaneous nephrolithotripsy was performed, followed by endopyelotomy. The Acucise™ catheter balloon was positioned at the site of the obstruction, under direct and fluoroscopic vision, and the stenotic ring was visualized. The incision was made under direct vision, disappearance of the stenotic ring was visualized on the fluoroscopic image (Figure 2). Afterwards, a 7F double-J catheter was inserted.

In 27 patients, the access was retrograde or ascendental, which is the standard approach. The surgical technique performed was similar to one described in detail by other authors (9,10,12). The stricture is identified as a constriction ring or as a sandglass shape, once the balloon is inflated (Figure 3A). Simultaneously, the stenotic segment was incised using an electrocautery; the balloon was then inflated with 2.2 cc of distilled water and contrast medium.

After incision, it is observed the disappearance of the constriction ring (Figure 3B). The balloon was maintained inflated for 10 minutes to prevent bleeding. A 7F double-J catheter was placed. A Foley vesical stent was passed at the end of the procedure and left in place for 24 hours. The vesical stent avoids urine leakage at the site of the incision. The procedure was thoroughly monitored by fluoroscopy. Time of permanence of the double-J catheter was 6 weeks; removal was performed under local anesthesia as an outpatient procedure. Success was defined considering both radiographic patency and symptomatic relief of symptoms.

Clinical evaluation was carried out after 16 weeks. Patients were asked whether the symptoms were worse, had improved, disappeared or had remained unchanged.

Imaging studies were conducted 16 weeks following surgery, and comprised an intravenous urography and a diuretic renography.

The mean operative time for the antegrade approach ranged from 200 to 220 minutes (mean = 210). The time for the retrograde access procedure ranged between 30 and 80 minutes (mean = 52).

For procedures performed using the retrograde access, postoperative hospital stay was approximately 24 hours. For percutaneous antegrade endopyelotomies and nephrolithotripsies, hospital stay was about 3 days.
Postoperative follow-up ranged between 4 and 20 months. The mean follow-up time was 11.8 months.

RESULTS

Of 26 patients who reported lumbar pain during preoperative period, considering pain as a characteristic symptom, 23 became asymptomatic following the procedure.

Of 24 patients with primary UPJ obstruction, 20 had pain before the procedure and 19 became asymptomatic during postoperative follow-up. The 6 patients with secondary UPJ obstruction had pain before surgery, 4 of them became asymptomatic during follow-up.

During postoperative evaluation, intravenous urography was performed in all patients. In 26 the outcome was good, considering lower pyelocalicial dilation and patency of ureteropelvic junction. No changes could be detected in 4 patients, and this was considered failure (Table-2).

Twenty-seven patients were submitted to a diuretic renography. For 23 there was evidence of a curve in radioactive material excretion without obstruction, and in 4 an obstructive pattern was observed.

Twenty-one patients with mild pyelocalicial dilation had good results. Among 9 patients presenting severe pyelocalicial dilation, 5 experienced good results (55.5%), and 4 remained unchanged (44.5%) (Table-3). These percentages indicate a statistically significant difference (p=0.005).

In analyzing the 24 patients with primary UPJ obstruction, 22 had good outcome (91.6%). Of 6 patients with secondary UPJ obstruction, outcome was good in 4 (66.7%). These results showed no statistically significant difference (p=0.169) (Table-4).

During evaluation of 21 patients presenting with mild pyelocalicial dilation, it was observed that all patients had good results, regardless the primary or secondary etiology of the stricture. However, among 9 patients with severe pyelocalicial dilation, 6 had primary obstruction and in 3 the etiology of the obstruction was secondary. Among 6 patients with primary stricture, good results were achieved in 4 (66.6%). Of 3 patients with secondary obstruction,
only 1 showed good results (33.4%). This data express a statistically significant difference (Table-5).

Three patients had acute pyelonephritis during postoperative period. None of them had severe bleeding, and did not require any complementary procedure.

**DISCUSSION**

The Acucise™ catheter was designed to perform an precise incision of ureteropelvic junction under fluoroscopic guidance. Early studies on the use of the Acucise™ catheter in treating UPJ obstruction were reported in 1993. From that time on, UPJ and ureteral obstruction at any site could be managed by this method. This procedure is performed endoscopically, and is considered a minimally invasive surgery (7,9,10). Both primary and secondary strictures can be treated, and the success rate is similar in the 2 groups, showing long lasting results (11).

**Table 3 – Postoperative results considering preoperative pyelocalyceal dilation.**

<table>
<thead>
<tr>
<th>Result</th>
<th>Pyelocalyceal Dilation</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Accentuated</td>
<td>Mild</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>Total</td>
</tr>
<tr>
<td>Good</td>
<td>5</td>
<td>55.5</td>
<td>21</td>
<td>100</td>
<td>26</td>
</tr>
<tr>
<td>Failure</td>
<td>4</td>
<td>44.5</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>100</td>
<td>21</td>
<td>100</td>
<td>30</td>
</tr>
</tbody>
</table>

*p=0.005, exact test of Fisher*

Three patients in the present series had renal calculi and UPJ obstruction; we used the antegrade access for simultaneous management of calculi and obstruction. Kidney puncture was performed in an intermediate or upper calyceal group to obtain a better access to the UPJ. In 3 patients, it was possible to remove all the calculi and perform Acucise™ endopyelotomy. The antegrade approach method was carried out using a video camera, which allowed visualization of UPJ before and after incision. We were convincingly shown that the incision of the stricture was thorough and complete. The percutaneous access and subsequent insertion of a percutaneous tube imply some risks and discomfort.

Four patients were diagnosed during investigation of other pathologies. Two had mild pyelocalyceal dilation and 2 had severe pyelocalyceal dilation. In many patients an UPJ obstruction can be diagnosed incidentally, as symptoms may be absent. Even when present, symptoms are atypical and intermittent (12,13).

Regeneration of ureter occurs within a maximum period of 40 days. In a study involving 13 patients with UPJ obstruction, treated by Acucise™ endopyelotomy, and followed up for a mean time period of 17 months, it was observed that recurrence of obstruction takes place during the first three months (14).

Severe pyelocalyceal dilation, compression of UPJ by an anomalous vessel and obstruction exceeding 2cm in length are the unfavorable factors related to the outcome of endopyelotomy (13).

**Table 4 – Postoperative results considering etiology.**

<table>
<thead>
<tr>
<th>Result</th>
<th>Etiology</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Primary</td>
<td>Secondary</td>
<td></td>
<td></td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>22</td>
<td>91.6</td>
<td>4</td>
<td>66.6</td>
<td>26</td>
</tr>
<tr>
<td>Failure</td>
<td>2</td>
<td>8.4</td>
<td>2</td>
<td>33.4</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>100</td>
<td>6</td>
<td>100</td>
<td>30</td>
</tr>
</tbody>
</table>

*p=0.169, exact test of Fisher*
The success rate for endopyelotomy in patients with severe pyelocalyceal dilation is approximately 60% (13,15). The low pelvic pressure causing difficulty in pyelocalyceal voiding may be an explanation for this outcome. For a better drainage of urine, the UPJ must occupy the lowest position in the renal pelvis. In patients with severe pyelocalyceal dilation, the most caudal region of renal pelvis can exert a compression on UPJ causing a functional obstruction (13,16).

Some authors recognize endopyelotomy as the first-line therapeutic option, even for patients with severe pyelocalyceal dilation, since this is a minimally invasive procedure, with outcomes that cannot be neglected. If recurrence of the obstruction takes place, pyeloplasty is indicated; in this case, the previously performed endopyelotomy does not preclude the procedure (13,17).

There are studies showing better outcomes of retrograde Acucise™ endopyelotomy for secondary than for primary obstruction. The authors are convinced that there is a lower incidence of anomalous vessels compressing the UPJ in secondary obstruction than in primary strictures. Some authors also believe that urine extravasation into the retroperitoneum is lower in secondary obstruction due to the existence of local periureteral fibrosis which contributes to better outcome. A great deal of urine extravasation into retroperitoneum can lead to the development of further local fibrosis, increasing the possibility of obstruction recurrence (18).

Digital angiography, endoluminal ultrasonography, and spiral computed tomography have been employed with the purpose of detecting anomalous blood vessels that cross the UPJ. Digital angiography and transluminal ultrasonography are invasive and expensive procedures, whereas helical computed tomography is not considered an invasive investigation, but the cost is high for routine indication (19).

In 1993, was published a study with 146 autopsy kidneys investigated. Authors analyzed the anatomical correlation between blood vessels and UPJ. This study demonstrated that even in normal kidneys there are blood vessels crossing UPJ. They also found prominent vessels (artery or vein) crossing the anterior and posterior aspects of UPJ in 65% and 6.2% of cases, respectively. It was evidenced that the lateral region of the UPJ is the site with lesser possibility of presenting an anomalous vessel (20).

Bleeding following retrograde Acucise™ endopyelotomy is not very frequent. The requirement for blood transfusion ranged between 1 and 3%. When serious bleeding occurs, blood transfusion and emergency arteriography are recommended, with selective embolization of the injured vessel (21).

Results of antegrade endopyelotomy using a cold knife and retrograde Acucise™ endopyelotomy

<table>
<thead>
<tr>
<th>Table 5 – Postoperative results considering etiology and preoperative pyelocalyceal dilation.</th>
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<tbody>
<tr>
<td>Pyelocalyceal Dilation</td>
</tr>
<tr>
<td>-----------------------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Accentuated Primary</td>
</tr>
<tr>
<td>Accentuated Secondary</td>
</tr>
<tr>
<td>Accentuated Total</td>
</tr>
<tr>
<td>Mild Primary</td>
</tr>
<tr>
<td>Mild Secondary</td>
</tr>
<tr>
<td>Mild Total</td>
</tr>
</tbody>
</table>

*p<0.001, exact test of Fisher*
were compared in several studies. Findings indicated that retrograde endopyelotomy performed with the Acucise™ catheter is better tolerated, operative time is shorter, postoperative hospital stay, as well as convalescence, is reduced. Complications are uncommon and occur with a similar frequency in both groups (10).

In our series 2 children were treated by retrograde access. The procedure was successful at its first attempt for both. Postoperative outcome was good in these pediatric patients.

In a recent article it has been reported that 2 male patients, aged 4 and 6 years, were managed by retrograde pyelotomy using the Acucise™ catheter. The authors had no difficulties, and no complications occurred pre- or postoperatively. A short follow-up period revealed a good outcome in both children (9).

In a study involving 45 patients, the authors have compared pyeloplasty with 3 minimally invasive surgical modalities: antegrade endopyelotomy, retrograde Acucise™ endopyelotomy and laparoscopic endopyelotomy. Outcome was good in 100% of patients managed by laparoscopic pyeloplasty, 78% who underwent retrograde endopyelotomy using the Acucise™ catheter (22), and 77% submitted to antegrade cold knife endopyelotomy. A comparative study was carried out to investigate tolerance regarding minimally invasive techniques used in the treatment of UPJ obstruction. As parameters the authors considered operative time, doses of narcotics necessary during postoperative period, mean hospital stay, and time to recovery. According to their report, retrograde Acucise™ endopyelotomy was associated with the best tolerance (22).

CONCLUSIONS

Endopyelotomy with the Acucise™ catheter showed to be a simple and safe procedure, being a minimal invasive alternative to pyeloplasty. Patients with UPJ obstruction and mild pyelocalyceal dilation, independent of etiology, had success. Patients with UPJ obstruction and severe pyelocalicial dilation had the worse results.

REFERENCES

13. Danuser H, Ackermann DK, Dominique B:


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EDITORIAL COMMENT

The authors review their results using the Acucise™ balloon catheter for management of both primary and secondary UPJ obstruction, in both a retrograde and, in a few patients, antegrade fashion. A standard technique has been developed and well described previously, and a similar technique followed by the authors. With a mean follow-up of just under one year, the authors report an 86% “success” rate which is slightly higher than that reported in the literature, but consistent with previous reports.

The authors have done an excellent job evaluating the postoperative result both symptomatically (subjectively) and objectively with follow-up intravenous pyelography and, in the great majority of the patients, diuretic renography. However, the definition of success is still somewhat unclear, as it is with most similar papers in the literature. Success for managing ureteropelvic junction obstruction cannot be defined as either subjective or objective success alone. The goal of the procedure is complete symptomatic relief and freedom from functional obstruction. As such, success should only be defined as relief of symptoms combined with radiographic evidence of a non-obstructed system. It is unclear how
many of these patients in this study fit both categories, that is, those that are both free of pain and free of any residual functional obstruction.

Another potential explanation for the relatively high success rate is the relatively short follow-up duration. Follow-up was less than two years in all patients, and the mean overall follow-up was less than one year. In fact, while most failures of this approach will be apparent within one year, with time, success rates can only diminish as more patients suffer recurrent pain and obstruction. As such, as the mean follow-up in this study group increases in time, more failures will clearly become evident.

The authors have appropriately managed the majority of their patients with a retrograde approach and utilized a percutaneous antegrade approach only for those with concomitant upper tract stones, such that the stones and the UPJ obstruction could be managed simultaneously. However, one might question whether the use of the Acucise™ balloon was appropriate during a percutaneous procedure. Percutaneous endopyelotomy has been well described by others using either a cold knife or an electrosurgical incision with either a Bugbee electrode or Collins’ knife. The procedure is easily performed under direct vision and the need to use the Acucise™ balloon with its attendant increased expense does not seem clearly justified.

Finally, while the technique and results reported here are consistent with those on the literature, suggesting an ongoing role for the use of the Acucise™ balloon, at most centers, patients who otherwise might have been managed with the Acucise™ balloon are now being managed with a direct vision ureteroscopic approach. In most cases this is performed using a Holmium laser for the incision, though a small Bugbee electrosurgical incision provides comparable results. In this age of smaller semi-rigid and flexible ureteroscopes, the ability to reach the ureteropelvic junction without complications has become a routine part of urologic endoscopy. With it, the ability to make the endopyelotomy incision under direct visual control is quickly relegating the use of a fluoroscopically guided hot-wire balloon incision to more of a “historical” interest.

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