Pelvi-ureteric junction obstruction treated with Acucise® retrograde endopyelotomy

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Objective To determine the efficacy of retrograde endopyelotomy for the treatment of pelvi-ureteric junction (PUJ) obstruction using the Acucise® ureteric balloon cutting catheter.

Patients and methods Between February 1995 and July 1997, 13 consecutive patients with primary PUJ obstruction underwent Acucise® endopyelotomy at our institution. The mean follow-up was 17.7 months (range 7–33). The success of the procedure was based on objective patency on follow-up diuretic isotopic renography and the subjective resolution of symptoms.

Results The treatment was successful by objective criteria in eight of 13 patients and by subjective criteria in nine. The mean operative duration was 33 min (range 25–45) and all 13 patients were discharged within 24 h of the procedure. There were no major complications, such as vascular injury requiring transfusion. There were no delayed failures, as all failures occurred within 3 months of the procedure. Of the four total failures, two patients have successfully undergone open pyeloplasty and one other was found to have a crossing vessel at the lower pole at the time of the operation.

Conclusion In this small series, Acucise® endopyelotomy was a safe procedure that offered effective, expeditious first-line treatment for PUJ obstruction. All failures occurred soon after treatment and did not hinder subsequent open pyeloplasty. Further studies with additional patients and a longer follow-up are warranted to determine the long-term efficacy of this promising new treatment.

Keywords Kidney, ureter, ureteric disease, ureteric obstruction

Introduction

Recent advances in the field of endourology have led to the development of several percutaneous techniques for the repair of PUJ obstruction. The endoscopic counterpart of Davis’ intubated ureterotomy [1,2] was first described by Wickham and Kellett in 1983 as ‘percutaneous pyelolysis’ [3] which was later modified and popularized by Badlani et al., who coined the term ‘endopyelotomy’ [4]. The first retrograde endopyelotomies were performed using ureteroscopy in which either a diathermy hook or cutting electrode was introduced through the ureteroscope [5,6]. Compared with open pyeloplasty, the endoscopic approaches offer the advantages of shorter operative duration, minimal blood loss and faster convalescence. The long-term success rate for antegrade percutaneous endopyelotomy is \( \approx 85\% \) [7,8]. The retrograde ureteroscopic approach, despite success rates comparable with those of the antegrade percutaneous approach, was associated with a significantly higher incidence of late ureteric stricture thought to be secondary to prolonged ureteroscopic manipulation [9].

More recently, Chandhoke et al. introduced the Acucise® (Applied Medical, Laguna Hills, CA, USA) endopyelotomy, which uses a balloon catheter with an electrocautery cutting wire to make a retrograde incision under fluoroscopic control. In patients with primary or secondary PUJ obstruction, radiographic success was documented in 78% and symptomatic relief in 72% at a minimum of 3 months of follow-up [10]. Similar results were reported by Faerber et al. in 32 patients [11]. We report our preliminary experience of Acucise® endopyelotomy at the Stanford University Medical Center.

Patients and methods

Between February 1995 and July 1997, 13 consecutive patients (seven men and six women, mean age 41 years, range 21–75) with PUJ obstruction underwent retrograde endopyelotomy at our institution, using the Acucise® ureteric balloon cutting catheter. All patients were symptomatic and presented with either episodic flank pain (\( n=11 \)) or recurrent UTI (\( n=2 \)). All patients were initially screened using IVU; a retrograde pyelogram was taken in two of the 13 patients. Preoperatively, all patients underwent diuretic isotopic renography with

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either DTPA or MAG3. All the patients had primary, unilateral PUJ obstruction, with five on the right side and eight on the left.

Over the same period, two patients with PUJ obstruction were excluded from the study because they had radiographic evidence of high ureteric insertion suggestive of crossing vessels. These patients underwent open pyeloplasty instead of Acucise® endopyelotomy and were both found to have lower-pole crossing vessels at the time of operation.

Acucise® endopyelotomy was performed as previously described [10], with modifications. In the first four patients in the series, a 7 F JJ stent was placed preoperatively for 7–14 days to permit ureteric dilatation. At the time of the procedure, cystoscopy was performed to identify the ureteric orifice and the stent removed if previously placed. The Acucise® catheter, with the cutting wire facing posterolaterally, was advanced over a 0.025 inch guidewire and positioned at the PUJ under fluoroscopic guidance. A 7 F Acucise® catheter was used in the first four patients and a 6 F catheter in the subsequent nine, precluding the need for a preoperative stent for ureteric dilatation. Incision was undertaken with 75 W of cutting current for 5 s, during which the catheter balloon was inflated with 2.5 mL of contrast medium for 3 min. The balloon was then deflated and extravasation of contrast media from the collecting system noted. The Acucise® catheter was withdrawn and a 7 F JJ ureteric stent left in place for 6–8 weeks. The 7 F/14 F indwelling endopyelotomy stent was not used in this study. At 3 months after endopyelotomy, isotopic renography was repeated and patients were asked about subjective improvements in their symptoms.

Results
The mean operative duration was 33 min (range 25–45). The first five patients were observed in hospital overnight and the remaining patients discharged home on the same day as the procedure. A minimum 3-month follow-up was available in all patients (mean 17.7 months, range 7–33). All the patients underwent follow-up diuretic isotopic renography at 3 months. Overall, eight of the 13 patients had normal findings on renography 3 months after treatment and subjectively, nine patients had complete resolution of their symptoms. All the patients tolerated the procedure well. Patients were typically discharged home on oral analgesics. There were no major complications such as haemorrhage requiring transfusion or stent-related problems requiring replacement or external drainage. Most of the patients reported a variable degree of irritative lower urinary tract symptoms after surgery which were treated with short-term anticholinergics. All the irritative symptoms resolved after stent removal and no patients required chronic anticholinergic therapy.

All failures occurred within 3 months of the procedure. Of the five patients who showed no improvement on follow-up renography, four continued to complain of flank discomfort after the removal of the stent, whereas one patient reported complete resolution of symptoms. Two of the four symptomatic patients successfully underwent open pyeloplasty at 6 and 9 months after the failed Acucise endopyelotomy, and are currently asymptomatic.

Discussion
PUJ obstruction has traditionally been classified as either primary or secondary [12]; primary PUJ obstruction may be have intrinsic or extrinsic causes. The former include congenital adynamic pelvi-ureteric segment and, less commonly, valvular mucosal folds, persistent fetal convolutions and upper ureteric polyps. Extrinsic causes are most commonly related to an aberrant, accessory or early branching vessel to the lower pole of the kidney. The many causes for secondary PUJ obstruction include lower tract obstruction, VUR, renal calculi and previous surgery. The gold standard for the treatment of both primary and secondary PUJ obstruction has been open pyeloplasty, with success rates of ≈90% [13,14].

The advent of endoscopic techniques in recent years has challenged open pyeloplasty as the treatment of choice for adults with symptomatic PUJ obstruction. Both antegrade and retrograde endopyelotomy are an extension of the intubated ureterotomy of Davis [1] and Davis et al. [2], in which a longitudinal incision is made at the obstructed PUJ and the lesion allowed to heal around an intubated stent. The mechanism responsible for a successful outcome after intubated ureterotomy was evaluated by Oppenheimer and Hinman in 1955. They showed in a dog model that smooth muscle regeneration, rather than fibrous wall contracture, appears to be the major factor in ureteric healing [15].

Compared with open pyeloplasty, endoscopic approaches offer the advantage of improved patient tolerance, reduced operative duration and a more expeditious recovery period, with success rates approaching those of open pyeloplasty. Furthermore, retrograde endopyelotomy obviates the need for a skin incision and nephrostomy tube placement. The reported long-term success rate for antegrade endopyelotomy in other centres is ≈85% [7,8]. In their preliminary study, Chandhoke et al. described 18 patients with primary (n = 15) or secondary (n = 3) PUJ obstruction who underwent Acucise® endopyelotomy. They reported that 14 patients were treated successfully by radiographic criteria and 13 reported complete resolution of symptoms, with
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A left mid-ureteric stricture [16], have also been reported. 6 Clayman RV, Basler JW, Kavoussi L, Picus DD. for a left uretero-enteric anastomotic stricture [10] and eric junction obstruction.

is not uncommon in patients with PUJ obstruction [17].

One patient reported the resolution of symptoms despite minimal improvement on follow-up renography. All the present patients had primary PUJ obstruction. The mean operative duration and length of hospital stay were comparable with or slightly better than those in previous reports [10,14,16]. At present, nine of the 13 patients who were successful have been followed for > 6 months, with the longest follow-up 33 months, with no delayed failures. All four failures occurred within 3 months of treatment: of these four total failures, two have undergone successful open pyeloplasty and are currently asymptomatic. At the time of the pyeloplasty, one of the patients was found to have a lower pole vessel.

The use of the Acucise® catheter not preclude subsequent open pyeloplasty, rather than repeating the Acucise® endopyelotomy, to offer the best chance of a successful outcome. It might be argued that in cases of secondary PUJ obstruction caused by stricture formation from previous surgical manipulation, it may be worthwhile to repeat Acucise endopyelotomy before proceeding to open pyeloplasty, although there are no such reports published. One of the present patients is currently awaiting a repeat endopyelotomy.

A potential drawback of Acucise® endopyelotomy is that the use of a blind, transmural incision at the PUJ may injure an unsuspected lower pole vessel, which is not uncommon in patients with PUJ obstruction [17]. Such haemorrhagic complications necessitating selective arterial embolization have been reported [16,18]. Left iliac vessel injuries, requiring open operative intervention, resulting from the use of the Acucise® catheter for a left uretero-enteric anastomotic stricture [10] and a left mid-ureteric stricture [16], have also been reported. In the present patients, there were no major bleeding complications requiring blood transfusion. Most patients reported blood-tinged urine postoperatively which resolved within a few days. The present favourable results may be related to the small series and patient selection. We excluded patients with evidence of high insertion of the ureter radiographically, or if there was clinical suspicion of crossing vessels. Such preoperative insight is not always possible, as exemplified by one patient who failed endopyelotomy and was found to have a lower pole vessel at subsequent open pyeloplasty.

In future, the combined use of endoluminal ultrasonography [19] with Acucise® endopyelotomy may be effective in identifying crossing vessels, to further minimize the risk. We encountered no other problems related to, but not exclusive to, Acucise® endopyelotomy, including stent obstruction requiring external drainage or replacement, prolonged irritative symptoms, or infection.

Technically, the use of the smaller 6 F Acucise® cutting balloon catheter allows the procedure to be performed without preoperative ureteric dilatation. This was so in nine of the 13 patients after the smaller calibre Acucise® catheter was introduced, and thus further simplified the procedure. In addition, we did not use the standard 7/14 F endopyelotomy stent after the incision of the PUJ, as described by others [10,14,16]. We feel that the 7 F JJ stent is adequate for postoperative stenting. The overall success rate using a regular 7 F stent is comparable with those reported by authors who used 7 F/14 F endopyelotomy stents [10,14,16].

In conclusion, Acucise® endopyelotomy is a safe procedure which offers effective, expeditious first-line treatment for primary PUJ obstruction. These results indicate that all failures occur early and do not hinder subsequent open pyeloplasty. It is important to select patients carefully to exclude those with radiographic evidence of a crossing vessel. Further studies with additional patients and a longer follow-up are warranted to determine the long-term efficacy of this promising new treatment.

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