

TECHNIQUE OF ENDOPYELOTOMY WITH THE ACUCISE CUTTING BALLOON

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ABSTRACT

Historically, upper urinary tract strictures have been managed by open surgery. It was after the research studies by Davis in the early 1940's that clinical foundations for current endourological management were set. When describing his "intubated ureterotomy" Davis stated that a stented incision of the ureteropelvic junction (UPJ) took one week for complete epithelization and six for muscular regeneration.

Endopyelotomy has withstood the test of time and is currently considered first line therapy for primary and secondary UPJ obstruction in adults and secondary UPJ obstruction in children. Acucise endopyelotomy has the major advantage of being performed under fluoroscopic imaging without the need for ureteroscopy, thereby reducing the need for general anesthesia and prolonged hospitalization.

Herein we discuss the procedural aspects of Acucise endopyelotomy.

Key words: ureteropelvic junction, stenosis, endopyelotomy, Acucise balloon
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INTRODUCTION

Acucise endopyelotomy is based on the principle of the simultaneous dilation and incision of a ureteral stricture under fluoroscopic guidance. The Acucise cutting balloon catheter (Applied Medical Technologies, Laguna Hills, CA) incorporates both a monopolar electrocautery cutting wire and a low-pressure balloon. The balloon is used to define the area of stenosis and to carry the cutting wire into the area to be incised. The electrically active surface on the cutting wire is 2.8 cm in length and 150 mm in diameter. The device has radiopaque markers located on the catheter body, which assist in locating the position of the balloon and the cutting wire during positioning (Figure-1). The position of the cutting wire, in relation to the inside guide wire, facilitates alignment of the device prior to the incision of the stenotic area. The balloon is designed to accept a



Figure 1 – Placement of the Acucise cutting balloon catheter across the UPJ in a lateral orientation.

maximum of 2.5 cc of fluid. It is intended for use with fluoroscopy and designed to interface with presently marketed electrosurgical units.

SURGICAL TECHNIQUE

Need for preoperative stenting

Originally, due to the large size of the original Acucise catheter and the standard post-operative placement of a 7/14F endopyelotomy stent, preoperative stenting for passive ureteral dilation was highly recommended. Yet, the advent of the smaller Acucise RP (reduced profile) catheter and the achievement of equally successful long-term outcomes with the post-operative use of smaller stents, have obviated the need for pre-treatment stent placement. The Table-1 compares the characteristics of the first and second-generation Acucise catheters.

passage of the Acucise catheter and stent, directly through the cystoscope.

Technique

1)- An open-ended ureteral catheter is placed into the distal ureter, and a retrograde pyelogram is performed to define the area of stenosis at the UPJ. A guidewire is then advanced into the renal collecting system. If a regular ureteral guidewire cannot be passed beyond the UPJ, we have found that a “glidewire” is very helpful in negotiating the stenotic segment. Progression of the open ended stent into the renal collecting system allows for the exchange of the original wire for a super stiff guidewire since we have found that this more sturdy

Table 1 – Comparison between the characteristics of the first and second-generation (RP) Acucise catheters.

	ACUCISE	ACUCISE RP
Deflated balloon profile	13F	10F
Inflated balloon profile	24F	24F
Catheter size	7F	5F
Length of active cutting wire	3 cm	3 cm
Width of active cutting wire	150 micron	150 micron
Working length of catheter	40 cm	40 cm
Maximum inflation volume	2 cc	2.2 cc
Guidewire used	.035”	.028”
Generator setting	75 watts	75 watts
Preoperative stenting	Recommended	Not required

Equipment

Only basic cystoscopic equipment and real-time fluoroscopy are needed for this procedure. It is essential to have real-time fluoroscopy to visualize the markers and the cutting wire of the balloon to ensure that they straddle across the area of stenosis. C-arm fluoroscopy is useful in allowing rotational views of the cutting balloon within the ureteropelvic junction (UPJ) ureter, where the wire should be positioned in a lateral plane.

The Acucise balloon catheter will pass through a standard 25F cystoscope sheath. However, one must use a cystoscopic bridge which will accommodate the catheter, and if desired a 7/14F endopyelotomy stent. This bridge should not have any severe angles, allowing for straight, direct

guidewire provides better purchase for the passage of the Acucise catheter. A “safety” wire should never be used during the Acucise procedure, given the possibility of conducting electrical current from the cutting wire of the Acucise device, thereby potentially damaging a large portion of the ureter.

2)- The Acucise catheter is placed over the guidewire and passed through the cystoscope. Prior to insertion at the ureteral orifice, the Acucise catheter should be rotated under direct cystoscopic vision enabling the cutting wire to be positioned in the correct lateral orientation. This maneuver minimizes the need for rotation of the device once it has been placed across the ureteropelvic junction.

3)- The cutting balloon catheter is advanced over the super stiff guidewire until the UPJ stenosis lies between the two radiopaque markers. At the UPJ and in the proximal and mid ureter, the cutting wire is positioned **laterally** (Figure-1). Only in the distal ureter is the cutting wire activated in a medial position. Real time fluoroscopy is essential in the proper positioning of the catheter across the UPJ, in a lateral orientation.

4)- Once the wire is seen in the lateral position, the balloon is gently inflated with dilute contrast media to ensure correct positioning across the UPJ, demonstrated by a characteristic “waist” of the balloon (Figure-2). If the balloon waist is not seen, the Acucise device may have migrated cephalad into the dilated renal pelvis, or may have been positioned



Figure 2 – Gentle inflation of the Acucise balloon demonstrates a waist, which documents correct position of the device across the UPJ obstruction.

too distally. If waisting of the balloon is not seen, the balloon should be deflated, advanced or withdrawn, and re-inflated until a waist is identified. When confirmed, the balloon is deflated prior to activation of the cutting wire.

5)- After insuring proper grounding of the patient, the cutting wire is activated at 75-100 watts (pure cut) and simultaneously, dilute contrast is again instilled into the dilating balloon under continuous, fluoroscopic guidance. As the balloon inflates, the

stricture is incised. The waist of the stricture should disappear as the balloon progressed to full inflation (Figure-3). The cutting wire is typically activated for a total of 5 seconds during the initial cut. If a waist persists after instillation of 2.5 cc of contrast, the



Figure 3 – With activation of the cutting wire, the UPJ is incised, allowing full inflation of the balloon.

cutting wire may be reactivated for an additional 3-5 seconds. After completion of the incision, a retrograde pyelogram is performed through the Acucise catheter to confirm extravasation at the incision site (Figure-4). If extravasation is not confirmed, the Acucise catheter can be withdrawn distal to the UPJ, and a retrograde ureterogram performed. Once the adequacy



Figure 4 – Following deflation of the balloon, a retrograde pyelogram performed through the Acucise catheter demonstrates contrast extravasation, documenting a through-and-through incision of the UPJ.

of the incision is confirmed the balloon is repositioned across the UPJ and maximally inflated for 10 minutes to provide tamponade of the incised area. If extravasation is not confirmed, delivery of the electrical current to the cutting wire should be checked. Alternatively, ureteroscopy can be performed to visually inspect the UPJ and the incised area. Identification of fat through the incised UPJ confirms a through-and-through incision. The cutting balloon catheter is deflated and removed and a 7/14F endopyelotomy stent or a 7-8F internal stent is placed over the guidewire (Figure-5). Once the stent is in proper position, the bladder is evacuated and a Foley catheter is placed for 48 hours to prevent extravasation of urine into the retroperitoneum. We do not routinely perform a cystogram prior to removal of the catheter.



Figure 5 – An internal ureteral stent is placed into the renal collecting system. Extravasation is still documented at the site of the UPJ incision.

6)- The internal stent is removed at 6 weeks postoperatively with a flexible cystoscope in males or a rigid cystoscope in females.

7)- Patients return 12 weeks following stent removal for post-operative intravenous pyelography and/or differential renal scan with Lasix washout to confirm efficacy of the endopyelotomy. These studies allow the detection of early failures, thereby allowing salvage of an obstructed kidney. The majority of failures from the Acucise catheter have been discovered within 3 months of the procedure and late

failures (after 1 year) are generally uncommon. In the largest series of endopyelotomy patients reported thus far, 85% of failures occurred within 6 months, and 92% within the first year (1). However, a 10-13% late failure rate (i.e. > 1 year) has been reported independently by other investigators (2). We recommend, therefore, that the patient, who is asymptomatic, with improvement on postoperative IVP, should be followed yearly with an IVP for a period of 5 years.

Postoperative stenting

Recent reports have suggested that after endopyelotomy management of primary UPJ obstruction, stenting for less than 6 weeks with a 7F or 8F internal stent produce comparable results to those achieved by the placement of a “standard” 7/14F endopyelotomy stent for 6 weeks (3-5). However, it would seem that ischemic strictures (e.g. secondary UPJ obstruction) might benefit from a larger-sized stent (8F or larger) placed for the full 6-week course.

The different response to stent size and duration may be due to the fact that the underlying etiology in primary UPJ strictures is muscle derangement and in secondary strictures, is mostly a result of ischemia. Further randomized prospective studies are warranted to better define the optimal stent size and duration following endopyelotomy.

Complications

Since a “safety wire” should not be used during Acucise endopyelotomy, one must avoid “losing access” to the collecting system with the working guidewire after incising the UPJ. Regaining access may be quite difficult. Therefore, loss of the working wire with subsequent inability to place a stent would necessitate insertion of a percutaneous nephrostomy tube, or possibly conversion to an open surgical repair if a ureteral stent cannot be placed.

Prolonged hematuria of early onset (i.e. after removal of the Acucise catheter) is generally due to a vascular injury that may need to be managed with arterial embolization. Therefore, Acucise endopyelotomy is not recommended if access to a vascular radiology suite is unavailable.

A recent report has demonstrated the absence of crossing vessels lateral to the UPJ, and for this reason the **Acucise incision should allow be performed laterally** (6). Although a straight lateral incision should significantly decrease the incidence of post-operative bleeding after endopyelotomy for primary UPJ obstruction, the possibility of bleeding still exists and patients should be closely observed.

CONCLUSIONS

Although Acucise endopyelotomy does not provide the identical success rates as open pyeloplasty, this endourologic procedure is currently the preferred approach given its decreased morbidity, reduced operative time, shorter hospitalization, and overall decreased costs. Moreover, failure of this minimally invasive approach does not preclude performance of a successful open operative repair. Acucise endopyelotomy is currently our first choice for managing the majority of patients with ureteropelvic junction obstruction.

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