Original Article

Contemporary Results of Endopyelotomy for Ureteropelvic Junction Obstruction

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Abstract

Introduction: Endopyelotomy is an accepted treatment option for ureteropelvic junction obstruction (UPJO). In this study, we reviewed our 7-year experience with antegrade endopyelotomy for UPJO. Materials and Methods: We reviewed the records of 35 consecutive antegrade endopyelotomy for UPJO between 1996 and 2002. Patients were included if they had shown radiographic evidence of UPJO on diuresis urography or intravenous urogram with signs and symptoms or deterioration of renal function. Results: A total of 34 consecutive patients underwent 35 antegrade endopyelotomy procedures in 35 renal units. One patient had bilateral endopyelotomy for bilateral UPJO. Eighteen renal units (51%) had concomitant renal calculi that required percutaneous nephrolithotomy, including 8 renal units with pelvi-ureteric junction stones. Twenty-four renal units (69%) had moderate degree of hydronephrosis whilst 11 renal units (31%) had severe hydronephrosis. The mean operating time for antegrade endopyelotomy was 94 ± 28 minutes and the mean hospital stay was 4.7 ± 2.8 days. No patients had conversion to open pyeloplasty and no patient required perioperative blood transfusion. The mean follow-up was 33 ± 23 months and the overall success rate following endopyelotomy was 83% (n = 29 renal units). The success rate for primary UPJO was 81%, whilst the success rate for secondary UPJO was 84%. Four renal units (11%) required ancillary procedures for failed endopyelotomy. Two patients required repeat endopyelotomy, and 2 patients needed open pyeloplasty. Two patients were lost to follow-up. Conclusion: Endopyelotomy remains a viable approach for UPJO compared to open reconstruction. Careful patient selection can optimise the surgical outcome and minimise endopyelotomy failures.

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Key words: Minimally invasive surgery, Outcome, Ureteral obstruction

Introduction

Ureteropelvic junction obstruction (UPJO) results in the gradual dilatation of the renal collecting system, and may lead to deterioration of renal function and pain. Although traditional open pyeloplasty remains the gold standard in the treatment of this condition, endoscopic management via endopyelotomy has provided a less invasive option in selected patients, with similar outcome, shorter hospital stay and earlier return to activity.

The rationale for endopyelotomy was based on Davis' experimental and clinical studies in 1943,[1] which advocated simple intubated ureterotomy for ureteropelvic obstruction and upper ureteric strictures. Since then, many novel techniques and instruments have been devised and deployed through either an antegrade renal access or the use of retrograde approach to incise the obstruction and splint the defect. In our centre, we adopted the antegrade endopyelotomy approach as an extension of our experience in percutaneous nephrolithotomy for renal calculi.[2] In this study, we reviewed our experience with this technique, with particular emphasis on the efficacy, complication rate and the need for ancillary procedures in an Asian population. To our knowledge, this series is the largest published series on antegrade endopyelotomy in Singapore and Southeast Asia.

Materials and Methods

We reviewed the records of 35 consecutive antegrade endopyelotomy for UPJO performed between 1996 and 2002. Patients were included if they had shown radiographic evidence of UPJO on diuresis urography (either a MAG-3

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or DTPA scan) or hydronephrosis with delayed function on intravenous urogram in conjunction with signs and symptoms or deterioration of renal function. Primary UPJO refers to congenital UPJO. Secondary UPJO refers to those acquired as a result of stone disease, inflammatory stricture, or postoperative stricture. Hydronephrosis was assessed via renal ultrasonography. Moderate hydronephrosis refers to moderate dilatation of the renal pelvis with mild calyceal blunting and good remnant cortical thickness. Severe hydronephrosis refers to gross dilatation of the renal pelvis with severe calyceal blunting and loss of papillary impressions.

Technique

Routine preoperative preparation of our patients includes a urine culture. Patients were given intravenous ceftriaxone on induction for antibiotic prophylaxis. Patients were placed in the prone position under general anaesthesia. Percutaneous renal access was obtained via an upper or middle pole puncture under fluoroscopic guidance after the placement of a retrograde catheter. The percutaneous tract was dilated with a balloon dilator and a 26 Fr Amplatz sheath was placed. Nephroscopy with an 18.5 Fr Wolf nephroscope was used after 2 guidewires were placed in antegrade fashion down to the bladder (Fig. 1). Endopyelotomy was subsequently performed using a 12 Fr ureteroresectoscope (hot-knife) until full thickness incision was achieved posterolaterally and periureteric fat was seen. Adequacy was judged by the absence of balloon waisting on straddling the UPJ and by the extravasation of the contrast. A 14/7 Fr endopyelotomy stent was then placed in antegrade fashion and nephrostomy drainage was maintained for 48 hours or until extravasation ceased. The endopyelotomy stent was placed for 6 weeks. Our patients were reviewed 1 month post-surgery and assessed by renal sonography. A retrograde pyelogram and flexible ureteroscopy was done at the time of stent removal at 6 weeks. Documentation of resolution of obstruction was done 3 months post-surgery via an intravenous urogram or diuresis renography (MAG-3 or DTPA scan). Subsequent serial renal sonography was done at 6 months, 12 months, and annually thereafter.

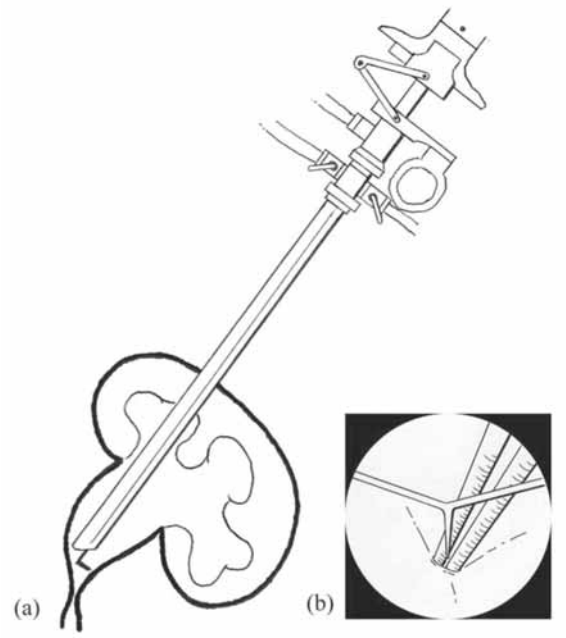

Fig. 1. Diagram illustrating principles of antegrade endopyelotomy. (a) Percutaneous placement of a nephroscope through an upper or middle pole puncture via an Amplatz sheath, and (b) full-thickness incision of the UPJO with the hot-knife between 2 guidewires until peri-ureteric fat is seen.

Success was defined as improvement in symptomatology, and radiological evidence of improvement of hydronephrosis and excretory function on intravenous urography (IVU) or diuresis urography. All patients underwent postoperative radiological imaging. Twenty-four patients had intravenous urogram or MAG-3 scans at 3 months. The remaining 10 patients had MAG-3 scans or IVU at 6 months. All patients had renal sonography at 3 months and 6 months.

Results

A total of 34 consecutive patients underwent 35 antegrade endopyelotomy procedures in 35 renal units. One patient had bilateral endopyelotomy for bilateral UPJO. The mean age of the patients was 42 years (range, 17 to 72) with a gender distribution of 19 male (56%) and 15 female (44%) patients. In terms of ethnic distribution, Chinese patients formed the majority (n = 22, 61%), followed by Indian patients (n = 8, 22%) and Malay patients (n = 3, 8%); other races made up 8% (n = 3) of the patients.

Twenty-two patients (63%) presented with loin pain, 9 patients (26%) had incidental abnormal radiological imaging, 3 patients (8%) had urinary tract infection and 1 patient had macroscopic haematuria (3%).

Eighteen renal units (51%) had concomitant renal calculi that required percutaneous nephrolithotomy, including 8 renal units with pelvi-ureteric junction stones. One patient had preoperative renal failure from bilateral UPJO and bilateral renal calculi with a serum creatinine level of 328 μmol/L. Twenty-four renal units (69%) had moderate degrees of hydronephrosis whilst 11 renal units (31%) had severe hydronephrosis.

The mean operating time for antegrade endopyelotomy was 94 ± 28 minutes and the mean hospital stay was 4.7 ± 2.8 days. No patients had conversion to open pyeloplasty and no patient required intraoperative blood transfusion. One patient with endopyelotomy for primary UPJO had continuous bleeding from the nephrostomy site that required

urgent angioembolisation and blood transfusion after the removal of the nephrostomy tube.

The mean follow-up was 33 ± 23 months in this series. The overall success rate following endopyelotomy was 83% (n = 29 renal units). The success rate for primary UPJO was 81%, whilst the success rate for secondary UPJO was 84%. When we analysed the subgroup of patients with gross hydronephrosis (n = 11 renal units), the success rate fell to 64%, compared to 92% in the moderate hydronephrosis group (n = 24 renal units). Since only 1 patient had impaired renal function, this could not be analysed as a risk factor for poorer outcome. Whilst we demonstrated differences in outcomes between primary and secondary UPJO and between grades of hydronephrosis, our series is too small to give any meaningful statistical significance to the differences.

Two patients were lost to follow-up. Four patients (11%) underwent ancillary procedures for failed endopyelotomy. Two patients required repeat endopyelotomy, and 2 patients needed open pyeloplasty. One of the patients who underwent a repeat endopyelotomy subsequently had an open pyeloplasty for failed endopyelotomy. All 3 patients with failed endopyelotomy underwent uncomplicated and uneventful open pyeloplasty (2 in our institution and 1 in the private sector) and thus reinforced the notion that endopyelotomy did not preclude subsequent successful pyeloplasty.

Table 2. Comparison of Primary and Secondary UPJO

Parameter	Primary UPJO	Secondary UPJO
Number of renal units	17	18
Mean age (y)	33 ± 15	48 ± 14
Symptomatic (%)		
Loin pain	14 (82%)	8 (44%)
Abnormal IVU or sonography	2 (12%)	7 (39%)
Others	1 (6%)	3 (17%)
Grade of hydronephrosis		
Moderate	12 (71%)	12 (67%)
Severe	5 (29%)	6 (33%)
Mean serum creatinine (μmol/L)	81 ± 20	116 ± 79
Mean operative time (min)	88 ± 24	99 ± 32
Mean hospital stay (days)	4.2 ± 2.5	5.1 ± 3.0
Success (%)	81	84
Ancillary procedures (%)	3 (18%)	1 (6%)

IVU: intravenous urography; UPJO: ureteropelvic junction obstruction

Discussion

When Davis popularised the concept of intubated ureterotomy, he emphasised several key points that were pivotal to the success of the procedure: (1) the incision must be of full thickness and extend from the stricture to include normal tissue, (2) adequate early urinary diversion is crucial, (3) an intact longitudinal strip of urothelium must remain to permit ureteral regeneration, and (4) the ureteral blood supply must remain intact.[1,3] These principles remain relevant today in endopyelotomy as failure to adhere to these points often leads to technical failure.

The outcome of our series compares favourably with the results from centres with larger series (Table 1). Our study also demonstrated slightly better results for secondary UPJO (Table 2) as this group had a slightly higher success rate and lower rate of ancillary procedures for failed endopyelotomy. This may be the result of adequate stone clearance in addition to endopyelotomy, which effectively removes the secondary cause of the UPJO. It is also clear that severity of hydronephrosis has a significant impact on the failure rate, as 36% of those with severe hydronephrosis failed after endopyelotomy, compared to 8% of cases with moderate hydronephrosis. This probably reflects the poor residual tone of the renal pelvis and therefore the persistent delayed function despite adequate endopyelotomy. In these cases, pyeloplasty would be a more suitable procedure to trim the redundant pelvis prior to anastomosis.

In addition to high-grade hydronephrosis, several other factors are known to predict poor outcome following the endoscopic management of UPJO. These include: (1) poor preoperative renal function, (2) long avascular strictures, (3) total obliteration of the UPJ, (4) several periureteral fibrosis, and (5) crossing vessel.[9] The role of crossing vessels in the aetiology and its influence on the outcome of endopyelotomy remain controversial. Van Cangh et al[9] found crossing vessels in close contact with the site of

Table 1. Comparison of Outcome Following Antegrade Endopyelotomy

Authors	Patients	Method of incision	Stent size (Fr)	Duration of stent (weeks)	Success rate			Follow-up (mo)
					Overall %	1º UPJ %	2º UPJ %	
Gupta et al[4]	401	Cold-knife	12 or 14/8.2	6	85	82	89	51
Kuenkel and Korth[5]	143	Cold-knife	10-14	3-6	78	83	75	12
Van Cangh et al[9]	123	Cold-knife	-	-	71	68	83	12
Kletscher et al[7]	50	Cold-knife	14/7	6	88	90	82	12
Combe et al[8]	49	Hot-knife	12/7	6	78	75	84	16
Our series	34	Hot-knife	14/7	6	83	81	84	33

UPJO: ureteropelvic junction obstruction

UPJO in up to 39% of patients in their series. This finding reduced the final success rate from 86% to 42%. However, opponents of this view feel that the mere presence of crossing vessels near the ureteropelvic junction does not imply that the vessel contributed to the obstruction.[10] In the series by Gupta et al,[4] crossing vessels accounted for only less than 4% of their endopyelotomy failures. In our centre, we do not routinely perform imaging to assess for crossing vessels.

In certain centres, retrograde endopyelotomy is the preferred approach. It can also be performed as an ambulatory procedure. The 2 main techniques that have emerged are ureteroscopic endopyelotomy and Acucise endopyelotomy (Applied Medical, Irvine, California). Ureteroscopic endopyelotomy requires the use of a cold-knife, Greenwald electrode or Holmium laser to make the incision and permits direct visualisation of the stricture and a properly sited full-thickness endopyelotomy but the procedure can be difficult in muscular male patients. Its success rate ranges from 80% to 88% and the initial problem of ureteral strictures are less common now with the introduction of finer ureteroscopes.[11-13] Acucise endopyelotomy uses a ureteral cautery wire balloon under fluoroscopy with a cutting current to incise strictures less than 2 cm in length. However, the success rates are lower, ranging from 64% to 80% and the technique is now less commonly used.[14,15] At our institution, we will consider a retrograde endopyelotomy only if there is a previous ureteral stent placement as passive dilatation will have occurred and retrograde access is simpler.

Recent experimental and clinical studies on percutaneous endopyeloplasty provide another possible form of endoscopic management. This technique entails a longitudinal percutaneous antegrade endopyelotomy incision with a full-thickness horizontal suturing of the incision in a Mikulicz fashion using a laparoscopic suturing device. In a series with 9 patients, Gill and Desai et al[16] demonstrated good results using this technique with a mean operating time of 100 minutes, including an endopyeloplasty suturing time of 27 minutes and a mean hospital stay of 2.2 days. All patients remained symptom-free and showed improved renal function on IVU and diuresis urography. However, the long-term results of this technique are not available.

In recent years, laparoscopic pyeloplasty has emerged as a viable alternative to open pyeloplasty in selected centres with well developed laparoscopic urology programmes. Jarrett et al[17] reported 100 cases of laparoscopic pyeloplasty with a 96% success rate at 2-year follow-up using a transperitoneal approach. Other authors reported similar results with both transperitoneal[18,19] and retroperitoneal approaches.[20,21] These early laparoscopic series suggest that the technique is feasible and the outcome comparable to open pyeloplasty. However, the technique has a steep learning curve as it is a laparoscopic reconstructive procedure and not just an ablative procedure. In contrast, endopyelotomy is easier to learn and master as many urologists are already familiar with percutaneous renal access from percutaneous nephrolithotripsy (PCNL) techniques. Results are comparable to open pyeloplasty when the patients are carefully selected.

Early results using the da Vinci robotic device (Intuitive Surgical, Sunnyvale, California) to assist laparoscopic Anderson-Hynes dismembered pyeloplasty suggest that the dissection and intracorporeal suturing are simplified by the three-dimensional visualisation, tremor filtration and additional 2 degrees of freedom at the instrument tip.[22,23] However, current studies are limited by small numbers and short follow-up. These laparoscopic techniques have transformed open pyeloplasty into a less invasive procedure with shorter hospital stay, lower pain scores and earlier return to activity.

Careful selection of patients with UPJO ensures that these patients will have the best chance of success following endopyelotomy. The data from our study suggest better outcome following endopyelotomy in patients with moderate hydronephrosis and concomitant renal pelvic calculi. In addition, other authors recommend endopyelotomy in patients with short ureteropelvic junction strictures with low ureteric insertion, good preoperative renal function and strong motivation for close follow-up. Pyeloplasty (open or robot-assisted laparoscopic approach) would be more appropriate in patients with severe hydronephrosis, high ureteric insertion, large redundant renal pelvis, long segment (more than 2 cm) avascular UPJ strictures, and poor preoperative renal function.

Conclusion

Endopyelotomy remains a viable approach that offers significantly less morbidity, reduced operating time, faster recovery and comparable results to open pyeloplasty. Our results showed that careful patient selection can optimise the surgical outcome and minimise endopyelotomy failures.

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