Endopyelotomy still has an important role in the management of ureteropelvic junction obstruction

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Advances in endourology have lead to a change in the management of primary ureteropelvic junction obstruction (UPJO) over the past 25 years. Minimally invasive procedures (endopyelotomy and laparoscopic pyeloplasty) have replaced open pyeloplasty as the standard of care. The benefits of these procedures include less postoperative pain, shorter hospital stay, faster return to normal activities and less morbidity.[1-3]

Laparoscopic pyeloplasty produces success rates (90% to 100%) equivalent to open pyeloplasty and has a 10% to 15% higher success rate when compared to endopyelotomy (antegrade or retrograde).[4-6] For these reasons, many urologists consider laparoscopic pyeloplasty the treatment of choice for primary UPJO; however, the technical challenges associated with laparoscopy and intracorporeal suturing have limited its widespread use. Therefore, although laparoscopic pyeloplasty has become the new standard of care, endopyelotomy remains an effective alternative first-line treatment for certain patients with primary UPJO, and can be easily performed by most urologists without the need for advanced laparoscopic training. Additionally, it is the treatment of choice for failed open or laparoscopic pyeloplasty and concomitant renal calculi. We present the case that endopyelotomy still has a role in the management of UPJO in select patients.

Background

Antegrade endopyelotomy was first described in 1984 by Ramsay and colleagues[7] and the retrograde technique was then reported in 1986 by Inglis and colleagues.[8] The choice of approach (antegrade or retrograde) has typically been influenced by the need to treat concomitant calculi, surgeon preference and anatomic factors. Endopyelotomy is based on the principle of the Davis intubated ureterotomy, where a full thickness incision through a strictured segment of ureter will heal over a stent to a larger caliber in a period of weeks.[9] A number of different cutting tools have been described including cold knife, electrocautery and laser. Acucise (Applied Medical, Rancho Santa Margarita, CA) was introduced in 1993 and consists of an electrocautery cutting wire over a dilation balloon.[10] Used primarily in a retrograde fashion, the device was designed so it could be used without proficiency in ureteroscopy. However, most studies comparing Acucise with other forms of endopyelotomy have shown lower success rates for Acucise.[11,12]

Success rates

Several factors influence success rates for endopyelotomy, including the presence of a crossing vessel (somewhat controversial), length of narrowing, preoperative split renal function, degree of hydronephrosis and the presence of contrast extravasation at the time of surgery. Improvements in fibre optic technology have lead to better visualization with ureteroscopy, which has contributed to higher success rates with the retrograde approach. Stilling and colleagues performed retrograde endopyelotomy with a 89% success rate in carefully selected patients (i.e., patients without a very large pelvis, high ureteral insertion, renal split function <20% or a long narrowed segment of UPJ (>2 cm).[13] For patients with these risk factors, Stilling and colleagues, as we do, recommend laparoscopic pyeloplasty. A study by Van Cangh and colleagues found that the presence of a crossing vessel lead to a lower success rate with endopyelotomy compared to the absence of a crossing vessel (42% vs. 86%).[14] Similarly, Parkin and colleagues found a lower success rate in 11 of 24 patients who had crossing vessels and were treated with retrograde laser endopyelotomy (55% vs. 85%).[15] However, Gupta and colleagues looked at 400 patients and found that only a small percentage of endopyelotomy failures had a crossing vessel (<5%).[16] Kapoor and colleagues found a lower success rate (62% vs. 90%) for patients with poor renal function (glomerular filtration rate [GFR] = 5-15 mL/min) who underwent antegrade endopyelotomy, as compared to patients with better renal function (GFR >15 mL/min).[17] Several other studies support this conclusion,[16,18] and preoperative differential renal function <30% is associated with a worse prognosis. Biyani and colleagues found a lower success rate with Acucise endopyelotomy when no contrast extravasation was seen (25% vs. 48%), highlighting the importance of a full thickness incision to periureteral fat.[18]

Finally, the degree of hydronephrosis has been shown to have an effect on success rates with endopyelotomy: patients with mild to moderate hydronephrosis have higher success rates compared to those with severe hydronephrosis.[19,20] Presumably, reduction of the renal pelvis during pyeloplasty assists in drainage of the kidney—something that cannot be performed during endopyelotomy.

The overall success rates for patients treated with endopyelotomy are lower than those treated with laparoscopic pyeloplasty. In a highly selective patient population, however, endopyelotomy can produce success rates that are equivalent to laparoscopic pyeloplasty. Patients without any adverse features (differential split renal function <30%, moderate-severe hydronephrosis, crossing vessel, UPJO >2 cm stenosed segment) enjoy success rates after endopyelotomy (80%-93%) that are comparable to laparoscopic pyeloplasty (90%-100%).[4,5,11]

A recent study revealed that endopyelotomy is more cost-effective, has shorter operating times and has lower equipment costs.[21] For these reasons, endopyelotomy can still be a useful first-line cost-effective treatment in carefully selected patients, and is not associated with a steep learning curve or a requirement for advanced laparoscopic training. As a result, endopyelotomy can be performed by a larger number of urologists which eliminates the need for many patients to travel to other centres to be treated by laparoscopy-trained urologists. This has the potential for significant cost savings, both to the patient and the health care system.

Patients who fail primary endopyelotomy can be managed laparoscopically with excellent outcomes. Prior endopyelotomy is not a contraindication to subsequent laparoscopic pyeloplasty, and salvage laparoscopic pyelopasty produces comparable success rates to laparoscopic pyeloplasty performed initially (94%).[22] Finally, it has been shown that endopyelotomy is the most effective treatment for salvaging failed laparoscopic or open pyeloplasty.[23] In this study, 10 of 227 patients had a failed laparoscopic pyeloplasty. Seven patients underwent salvage endopyelotomy using laser (n = 3), cold knife (n = 2) and cutting balloon endopyelotomy (n = 2). For 1 of these patients, the laser endopyelotomies failed; the remaining patients experienced improved imaging and symptom relief.

Conclusion

While pyeloplasty is the gold standard for surgical treatment of primary UPJO, endopyelotomy is still a useful alternative first-line treatment option for highly selective patients. The presence of a crossing vessel, preoperative differential split renal function <30%, UPJO >2 cm and moderate to severe hydronephrosis are associated with a poorer prognosis for patients treated with primary endopyelotomy, and these patients should be offered laparoscopic pyeloplasty as first-line treatment. However, for patients without any of these adverse features, endopyelotomy is a reasonable first-line treatment option with acceptable outcomes, and can be performed by a larger number of urologists without the need for subspecialty laparoscopic training. Endopyelotomy is also a less invasive procedure, associated with a shorter operative time and can be a reasonable treatment option for patients with significant medical comorbidities or contraindications to laparoscopic surgery. Finally, endopyelotomy is the treatment of choice for failed pyeloplasty and concomitant renal calculi.

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POINT/COUNTERPOINT

Laparoscopic pyeloplasty: the standard of care for ureteropelvic junction obstruction

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Open pyeloplasty has been the gold standard treatment for ureteropelvic junction obstruction (UPJO). Endopyelotomy, in spite of its inferior effectiveness, was sometimes preferred in select patients owing to its less invasive nature. Fortunately, over the past 2 decades a superior minimally invasive treatment has emerged with success rates equivalent to open pyeloplasty and complication rates equivalent to endopyelotomy. It is for good reason that laparoscopic pyeloplasty has become the new standard of care for the treatment of UPJO.

Ureteropelvic junction obstruction is marked by renal outflow obstruction and may be asymptomatic or result in pain and complications, such as renal failure, pyelonephritis and calculus formation. Surgical management of UPJO aims to provide symptomatic relief and preserve remaining renal function. Today, treatment usually consists of either laparoscopic pyeloplasty or endopyelotomy. Its effectiveness, versatility and safety make laparoscopic pyeloplasty the optimal treatment for UPJO in virtually all circumstances.

Short-term effectiveness

Most studies define treatment "success" as resolution of both symptoms and hydronephrosis. Laparoscopic pyeloplasty, performed via transperitoneal or retroperitoneal approaches, yields success rates of 93% to 100%,[1-7] equivalent to those of open pyeloplasty.[8,9] Endopyelotomy is significantly less effective, with success rates varying according to the particular approach employed; 67% to 86% for antegrade endopyelotomy,[10-14] 32% to 77% for Acucise endopyelotomy[15-17] and 73% to 85% for retrograde endopyelotomy.[18-21]

Three studies directly comparing the 2 treatments report success rates of 98%, 95.3% and 94.4% for laparoscopic pyeloplasty compared with 84%, 55.4%, and 72.6% for endopyelotomy, respectively.[22-24] By any approach, endopyelotomy is consistently less effective than pyeloplasty.

Long-term effectiveness

The superior effectiveness of laparoscopic pyeloplasty over endopyelotomy becomes even more pronounced in the long-term. Dimarco and colleagues followed patients after laparoscopic pyeloplasty or endopyelotomy for a mean 16 years.[25] Treatment failures occurred in both groups as late as 10 years after the procedure. The 3-, 5-, and 10-year recurrence-free survival rates were 85%, 80% and 75% for laparoscopic pyeloplasty and only 63%, 55% and 41% for endopyelotomy, respectively.

Versatility

Several factors decrease the effectiveness of endopyelotomy, including long strictures, severe hydronephrosis, poor renal function, presence of a crossing vessel and previous failed endopyelotomy.[11,13-15,18,24,26-29] Furthermore, anatomic variants, such as pelvic, horseshoe and solitary kidney, are contraindications to endopyelotomy. Conversely, laparoscopic pyeloplasty can be effectively employed in any of these variants.

The significance of crossing vessels, which occur in 38% to 44% of patients with UPJO,[25,29] is the subject of ongoing debate. The 5-year mean success rate of antegrade endopyelotomy is only 42% in the presence of a crossing vessel.[11] Laparoscopic pyeloplasty, unlike endopyelotomy, allows for the transposition of crossing vessels from anterior to posterior or vice versa. Furthermore, concurrent renal stones can be effectively treated by pyelolithotomy with a 90% success rate.[1]

Safety

Endopyelotomy previously filled a niche as a safer, less invasive treatment option than open pyeloplasty. Since it was first described in 1993,[30] laparoscopic pyeloplasty has developed into a procedure that is as safe as endopyelotomy and safer than open pyeloplasty, due to its lack of a substantial incision.[1,23] Complications of laparoscopic pyeloplasty include urine leak, urinary tract infection, stent migration and hemorrhage requiring transfusion. Reported complication rates are 0 to 18%, with most series citing about 10%.[1-7]

Complications of endopyelotomy include hemorrhage requiring transfusion, ureteral avulsion, stricture, ureteral intussusception and Page kidney. Complication rates range from 0 to 42%. Comparable to laparoscopic pyeloplasty, endopyelotomy has complication rates of about 10%.[12,13,18,31,32] Dimarco and colleagues found that complications occurred in 8.1% of patients undergoing laparoscopic pyeloplasty and 11.1% of patients undergoing endopyelotomy with 1.0% and 1.3% requiring transfusion respectively.[25]

Conclusion

The old argument for endopyelotomy as a potentially safer, albeit less effective, treatment for UPJO is now obsolete. Its superior effectiveness in the short-, and particularly the long-term, combined with its remarkable versatility and low complication rates make laparsocopic pyeloplasty the clear standard of care for the treatment of UPJO. Endopyelotomy should be relegated to a salvage procedure after failed pyeloplasty.[25] The steep learning curve for laparoscopic pyeloplasty may be smoothed by the adoption of robotic-assisted pyeloplasty, which appears to be as effective as open and laparoscopic approaches.[33-36] Other exciting developments, such as single-port pyeloplasty, are on the horizon.[37] In the meantime, laparoscopic pyeloplasty will remain the far superior treatment option for virtually all patients undergoing treatment of ureteropelvic junction obstruction.

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