Stentless pediatric robotic pyeloplasty

Alejandro R. Rodriguez, Mark A. Rich and Hubert S. Swana

Abstract:

Objectives: Open dismembered pyeloplasty remains the standard of care for the correction of ureteropelvic junction obstruction in children. We describe our experience with a tubeless, stentless pediatric robotic pyeloplasty technique.

Methods: Between October 2008 and September 2009, 12 consecutive children underwent robotic dismembered pyeloplasty. Ureteral stents or nephrostomy tubes were not used. Operative time, hospital stay, days of Jackson–Pratt drainage, and complications were analyzed. Postoperative renal ultrasonography was obtained at 4–6 weeks after surgery.

Results: The mean patient age was 9.1 years (3.5–16). The mean operative and console times were 178 (122–250) and 129 (96–193) minutes, respectively. The Jackson–Pratt drain was removed after a mean of 1.8 days (1–4). The mean hospital stay was 2.4 days (1–4.5). There were no complications. Mean follow up was 16 months (12–24 months). All patients had complete resolution of symptoms. Hydronephrosis either completely resolved or significantly decreased in all cases. In cases without complete resolution of hydronephrosis, 99m Tc-MAG-3 diuretic renography showed preservation of renal function without obstruction.

Conclusions: Robot-assisted laparoscopic pyeloplasty can be safely performed without internal indwelling stent drainage. In children, this avoids the need for additional anesthesia and stent-related morbidity.

Keywords: laparoscopy, pediatric, pyeloplasty, robotics

Introduction

The original description of the dismembered pyeloplasty by Anderson and Hynes was performed for a retrocaval ureter [Anderson and Hynes, 1949]. There have been various nuances and technical improvements over time, but the basic surgical procedure has remained the same. The issue of whether to stent across the ureteropelvic anastomosis has proven fertile ground for debate over the past 50 years. As technical aspects of the procedure evolved, there was a conservative push toward placement of nephrostomy tube and/or transanastomotic stenting to drain and decompress the kidney. Currently, many surgeons, when performing open pyeloplasty, will not routinely use a stent. Double J stents, nephrostomy tubes, or externalized nephroureteral catheters are usually reserved for select cases such as solitary kidneys, revision pyeloplasty, or pyeloplasties requiring extensive pelvic reduction [Hussain and Frank, 1994].

Minimally invasive techniques such as laparoscopy and robotics have presented the urologist with a new way of excising the defective ureteropelvic junction (UPJ), resecting renal pelvic redundancy, and reconstructing a freely draining renal pelvis. Robotic technology has helped facilitate the precise suturing necessary for reconstruction of the renal pelvis. Most reports of laparoscopic and robotic pyeloplasty describe the use of a transanastomotic stent for several weeks. To the best of the authors' knowledge, this is the first series to report on the initial outcomes of pediatric patients with UPJ obstruction treated with nonstented robotic pyeloplasty.

Patients and methods

Between October 2008 and September 2009, 12 consecutive patients underwent robotic dismembered pyeloplasty at one hospital using a daVinci robot (Intuitive Surgical, Sunnyvale,

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Figure 1. Stentless robotic dismembered pyeloplasty using interrupted sutures.

CA). All were found to have symptomatic UPJ obstruction. Preoperative workup included renal ultrasonography. All patients had diuretic nuclear renography which demonstrated delayed drainage ($T_{1/2}$ greater than 20 minutes). Several patients also underwent computed tomography or intravenous pyelography performed by emergency room physicians.

Surgical technique

Patients were placed in the lateral flank position. Pneumoperitoneum was achieved by standard transperitoneal, Veress needle access. A total of four ports were used in all cases. An 8 mm umbilical camera port was placed and the remaining two 8 mm robotic ports were placed under direct laparoscopic vision. One was placed subxyphoid in the midline and the other in the ipsilateral lower quadrant. The assistant surgeon's trocar (12 mm VersaStep Bladeless trocar) was placed in the contralateral upper quadrant between the two midline ports. The abdomen was insufflated with CO₂ to a maximum pressure of 12 cm H₂O. After docking the robot, a robotic laparoscopic dismembered pyeloplasty was performed. After dismemberment, interrupted 6-0 and 5-0 vicryl sutures were used to reconstruct the renal pelvis (Figure 1). No stent was used. A Jackson-Pratt drain was placed near the anastomosis and externalized through the lower quadrant port. The Jackson-Pratt drain was removed when drainage was less than 5 ml in an 8-hour period. If drainage exceeded 50 ml in an 8-hour period, the fluid was checked for creatinine. This Jackson-Pratt drainage management is our standard in any case scenario requiring urinary tract reconstruction.

Follow up

Patients were discharged and seen at 1–2 weeks postoperatively. Postoperative renal ultrasound was obtained at 4–6 weeks after surgery. A MAG-3 renal scan was performed if any residual hydronephrosis was identified.

Results

The mean patient age was 9.1 years (3.5–16 years). Mean operative and console times were 183 (135–250) and 133 (96–193) minutes, respectively. The Jackson-Pratt drain was removed after a mean and median of 1.9 days (1–4 days) and 1 day, respectively. The mean and median hospital stays were 2.5 days (1.5–4.5 days) and 2 days, respectively. Patients were discharged either the same day the Jackson-Pratt drain was taken out or the next day, in the majority of cases. Our first patient was left in the hospital longer, even though he had no complications, only to see how the outcome was since it was our initial case. There were no intraoperative or postoperative complications and no patient required a secondary procedure. No patient experienced urine leak or wound infection. At a mean follow-up of 6 months (2–12 months), all patients had complete resolution of symptoms. Ten patients had complete resolution of hydronephrosis on postoperative ultrasound. Two patients had decreased hydronephrosis. In these two patients, 99m Tc-MAG-3 diuretic renography showed $T_{1/2}$ in the nonobstructed range (4 and 5 minutes, respectively).

Discussion

The initial description of dismembered pyeloplasty did not report on the use of a stent [Anderson and Hynes, 1949]. In the decades that have followed there have been advocates and opponents of routine stenting for open pyeloplasty. In a recent review of open pediatric pyeloplasties no significant difference was noted in stented *versus* nonstented surgeries [Smith *et al.* 2002].

During both laparoscopic and robotic pyeloplasties the common practice is to create a stented anastomosis. Stent insertion is performed before or during surgery. Retrograde cystoscopic and antegrade laparoscopic techniques are the most commonly performed options for stent insertion during robotic pyeloplasty.

The retrograde approach, when combined with ureteropyelography, can identify distal ureteral

pathologies and ensure proper positioning of the distal end of the ureteral stent [Smith *et al.* 2002; Moon *et al.* 2006]. It, unfortunately, is time-consuming and requires repositioning of the patient. Decompression of the renal pelvis can sometimes make identification and dissection of the renal pelvis more challenging. A retrograde approach with flexible cystoscopy and extended surgical field has been reported. Flexible cystoscopy with the patient in the lateral position can be difficult especially in male infants [Wayment *et al.* 2009].

Antegrade stent insertion through a laparoscopic port has been described as an alternative. Mandhani and colleagues reported laparoscopic pyeloplasty with antegrade stent insertion in 24 patients [Mandhani *et al.* 2004]. This approach avoids the need to reposition the patient and, once mastered, can be performed in less than 10 minutes.

Alternative techniques for stent insertion including percutaneous manipulation of the dismembered ureteric end and combined retrograde and antegrade techniques have also been described. They avoid the need for repositioning but may not be useful in all patients [Nadu *et al.* 2009; Gaitonde *et al.* 2008]. In children, removal of indwelling double J stents requires anesthesia. In an attempt to avoid this, percutaneously externalized stents and stents with transurethral dangle strings have been utilized [Taveres *et al.* 2008; Yucel *et al.* 2007].

Stent insertion, regardless of the approach, can be challenging. Indwelling stents also carry the potential for morbidity. Richter and colleagues reported a 94% complication rate in 110 patients with indwelling stents. They described infection, flank pain with voiding, stent migration, and even stent fragmentation [Richter *et al.* 2000]. With the help of a validated questionnaire, Joshi and colleagues reported that 78% of the 62 patients suffered bothersome urinary symptoms that included urinary frequency, urgency, incontinence, and hematuria. A total of 80% of patients experienced stent-related pain severe enough to interfere with daily activities [Joshi *et al.* 2003].

Stentless laparoscopic pyeloplasty has been reported in adults with promising near term success [Shalhav *et al.* 2007]. Our initial experience with this small group of pediatric patients undergoing pure robotic dismembered pyeloplasty has been encouraging. All patients have experienced

symptomatic and ultrasonographic improvement. Analysis of our operative times reveals a trend towards shorter operative times and hospital stays. Our confidence has grown with experience and now we are removing the Jackson–Pratt drain before hospital discharge within 1–3 days after surgery.

The magnification and tremor filtering features of the robotic platform allow for precise reconstruction with minimal trauma to the pelvis and ureter. As with open surgery, strict adherence to the surgical principle of gentle tissue handling is important. Grasping of the pelvis and ureter with robotic forceps should be minimized. Owing to the lack of haptic feedback with the robotic system, the surgeon risks crushing and devitalizing tissue and potentially compromising one's repair. We use a feeding tube segment to facilitate the anastomosis and to minimize tissue handling [Swords *et al.* 2011]. We have chosen to perform our anastomosis with interrupted sutures. The use of running sutures for the anastomosis seems reasonable and may further decrease operative times. Extensive reduction and tailoring of the renal pelvis was not necessary in our patients. In complicated cases with extensive pelvic reduction or in a patient with a solitary kidney, ureteral stenting seems prudent.

Our report is limited by small numbers and relatively short follow up. Our patients have done well with short-term follow up. Some may question the lack of postoperative diuretic renal scan data. We do not routinely obtain diuretic renal scans in patients that experience complete resolution of both hydronephrosis and symptoms after pyeloplasty, either open or laparoscopic. Well-designed prospective studies would be helpful. A prospective comparison with control groups, such as a group with stents or nonrobotic alternative approaches, will test the real benefit of this type of technique.

Stentless robotic pyeloplasty is feasible in children with good short-term success and minimal complications. The technique decreases operative time, avoids certain stent-related morbidities, and in children, it avoids the need for a second anesthesia. Additional studies are needed to determine long-term success rates.

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Conflict of interest statement

The authors declare no conflicts of interest in preparing this article.

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