Robotic-Assisted Bladder Neck Repair
Feasibility and Outcomes

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KEYWORDS

• Robotic surgery • Urinary incontinence • Bladder neck reconstruction • Neurogenic bladder
• Appendicovesicostomy

KEY POINTS

- Complex robotic reconstruction follows the same steps and principles as those used during open surgery.
- Robotic bladder neck reconstruction is safe and feasible.
- Surgeons should expect longer operative times during robotic bladder neck reconstruction when compared with open.
- Patients with multiple ventriculo-peritoneal (VP) shunt revisions at the abdominal level have a statistically higher rate of intra-abdominal adhesions and higher conversion rates.

Minimally invasive techniques are rapidly being developed and integrated into urologic surgery. Over the past 5 years, the urologic literature is abound with novel techniques and adaptations to conventional laparoscopy, including but not limited to laparoendoscopic single-site surgery, natural orifice transluminal endoscopic surgery, and robot-assisted laparoscopic surgery (RALS). Pediatric urology is no exception to this trend, and the benefits of minimally invasive surgery may be accentuated in children given the relatively more confined working spaces and also a heightened awareness of cosmesis for the pediatric population. Increasingly, complex pediatric urologic procedures are being performed with robot assistance. The feasibility of nephrectomy, pyeloplasty, ureteral reimplantation, and bladder surgery has been clearly established. A few case reports and a small series have been published describing robot-assisted Mitrofanoff appendicovesicostomy (APV) with or without augmentation ileocystoplasty or creation of an anterograde continent enema colon tube.[1–3]

SURGICAL INTERVENTION FOR URINARY INCONTINENCE

Urinary incontinence secondary to an incompetent urethral sphincter mechanism is an entity commonly encountered in pediatric urology with multiple etiologies. Regardless of the primary cause (exstrophy/epispadias, cloacal anomalies, or neurogenic bladder secondary to spinal cord injury or dysraphisms) urine leakage in the absence of a detrusor contraction is the definition of an incompetent urinary sphincter mechanism.[4] It is in this patient population that a bladder outlet procedure, with possible concomitant procedures depending on the patient, is indicated to achieve urinary continence. Whether or not a concomitant bladder augmentation procedure should be performed is a highly contested topic and beyond the scope of this article, and thus will not be covered here.

The essential mechanism behind all surgical procedures for urinary incontinence secondary to an incompetent sphincter is to somehow tighten the bladder outlet. This can be accomplished

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through placement of a sling or artificial urinary sphincter or through a bladder neck reconstruction (BNR). In some cases, a bladder neck closure also can be performed. At our institution, management of neurogenic bladder with persistent urinary incontinence, despite clean intermittent catheterization (CIC) and anticholinergic therapy, includes creation of a Mitrofanoff APV (or Monti channel when the appendix is inadequate) and Leadbetter/Mitchell (LM) BNR along with a bladder neck sling (BNS).[5] Currently our center is one of a few performing these reconstructions using RALS. Because of this there is a paucity of data on robotic outcomes, we will thus first present some data from open series.

OUTCOMES FROM OPEN SERIES

Bladder Neck Repairs

There are various bladder neck reconstructive procedures that are available to increase the resistance at the bladder outlet. Perhaps the most common are the Young-Dees Leadbetter (YDL), the Pippi-Salle, the Kropp repair, and the modified LM repair.[6] Various studies have looked at outcomes with these different techniques, but unfortunately all of the published literature suffers from multiple limitations, including retrospective studies with significant confounders, nonstandardized protocols, and multiple definitions of what constitutes urinary continence. Most articles also combine patients with different primary diagnoses and some do not differentiate between BNR with and without augmentation cystoplasty. For example, in a retrospective study of 49 continence procedures in patients with multiple etiologies for their incontinence, Cole and colleagues[7] showed continence rates for YDL at 79%, and 75% for Kropp and Pippi-Salle repairs. Another retrospective review involved 18 children who underwent a Pippi-Salle reconstruction with neurogenic incontinence and showed a dry rate (4 hours or more between catheterizations) of 61%.[8] One of the few prospective studies by Snodgrass and Barber[9] compared initial and long-term continence in 37 consecutive patients with neurogenic bladder undergoing LM plus a BNS with 34 previous consecutive patients undergoing sling alone. The cohorts were equivalent with regard to gender, ambulatory status, and preoperative urodynamic parameters. Initial continence (dry, no pads) determined at 6 months after surgery was significantly different: 29 (78%) of 37 in the LM reconstruction with sling versus 18 (53%) of 34 with sling alone ($P = .04$). Kaplan-Meier curves showed initially dry sling patients to have recurrent incontinence during follow-up, leaving fewer than 25% dry long term, versus no loss of continence in LM plus sling patients after 18 months, with 60% still dry at maximum follow-up of 55 months. As can be seen, in spite of the multiple limitations, studies reviewing these BNR techniques report reasonable continence rates ranging from 50% to 85%.[10]

Bladder Neck Closure

Perhaps the most radical option for achieving continence is closure of the bladder neck. A retrospective review by Bergman and colleagues[5] included 52 patients with mixed etiology incontinence undergoing bladder neck closure as primary surgery after failed medical therapy and showed an 88% dry rate. Another study by Liard and colleagues[11] involving 21 patients with bladder neck closure as primary surgical therapy showed an 80% dry rate. Finally, another retrospective study by Hoebeke and colleagues[12] in 17 children undergoing bladder neck closure showed a dry rate of 100% but difficulty with catheterization in 47% of patients.

Laparoendoscopic Procedures for Urinary Continence

Bladder neck injection

A brief analysis of bladder neck injections for outlet incompetence and incontinence makes it clear that the success rates for this modality are extremely low. For example, Lotmann and colleagues[13] performed a prospective trial using Deflux (Salix Pharmaceuticals, Inc., Raleigh, NC, USA) at the bladder neck in 27 children with neurogenic bladder (4 after failed sling). With a mean follow-up of 26 months, they describe a 30% dry rate. Similarly, a retrospective evaluation in 27 patients with persistent outlet incompetency after fascial sling who then underwent injection with either Deflux (3) or Macroplastique (Uroplasty, Inc., Minnetonka, MN, USA) (24) showed a dry rate of 7%, and repeat injections did not improve outcomes.[14] Essentially no study using endoscopic injection at the bladder neck regardless of volume used or injection technique has shown a success rate higher than 33%.[15]

Robotic-Assisted Bladder Neck Reconstruction

Establishing urinary continence in pediatric patients with sphincteric incompetence usually involves a combination of medical therapy, CIC, and sometimes surgical intervention. This condition is most often encountered in children with spina bifida, and is diagnosed by persistent incontinence despite CIC and anticholinergics in patients with detrusor areflexia and detrusor leak point pressure less than 50 cm H2O on urodynamic testing. Cystography demonstrates a