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Robotic Urological Surgery in Children

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Abstract

While robotic surgery has shown clear utility and advantages within the adult population, its role in medical specialty remains controversial. Pediatric-sized robotic instruments and instrumentation aren't without delay offered nevertheless, thus bound modifications are often created so as to create robotic surgery victorious in kids. Whereas the value of robotic surgery remains high compared to open procedures, patients expertise bigger satisfaction and quality of life with robotic surgery [1]. Robotic pyeloplasty may be a normal of care in older kids, and has even been performed in infants and re-do surgery. Different robotic procedures performed in kids embody heminephroureterectomy, ureteroureterostomy, ureteral reimplantation, urachal cyst excision, bladder diverticulectomy, and bladder constructive procedures like augmentation, appendicovesicostomy, antegrade continence clyster, bladder neck reconstruction and sling, further as different procedures. Robotic surgery has conjointly been employed in medical specialty cases like partial excision and retroperitoneal lymphoid tissue dissection. Future enhancements in technology with production of pediatric-sized robotic instruments, in conjunction with will increase in robotic-trained medical specialty urologists and operating surgeon expertise on each's learning curve can facilitate to any advance the sphere of robotic surgery in medical specialty medical specialty [2].

Keywords: Robotic; Robotic-assisted; Pediatric; Children; Urology

Introduction

Minimally invasive surgery has become more widely accepted in pediatric urology. Laparoscopy was first employed in 1976 to identify an intraabdominal testes in an 18-year-old male. The first infant laparoscopic nephrectomy was performed in 1992 by Koyle et al. for a right multicystic dysplastic kidney identified in utero; the operative time was under 1 h and the patient recovered well. Robotic-assisted laparoscopic surgery was widely accepted in adult urology due to improved visualization (10–15 times magnification power and three-dimensional images), improved range of motion with 90° articulation of the robotic arms with seven degrees of freedom (compared to four in conventional laparoscopy) and motion scaling, along with elimination of hand tremor. This led to shorter hospital stays, decreased narcotic usage, decreased blood loss, with smaller scars and improved cosmesis. In children, the advent of better robotic instrumentation has led to its greater use for many common surgeries and its expansion in more complex procedures [3].

Patients have expressed improved satisfaction with robotic surgery. Parents of children who underwent robotic pyeloplasty reported significantly higher satisfaction with overall life, confidence, self-esteem, postoperative care, and scar size compared to open pyeloplasty in a validated survey. As the size of the incision grows with the patient, the improved cosmesis that accompanies minimally-invasive surgery becomes arguably one of the most important factors in the pediatric population [4].

Material and Methods

Bladder diverticulectomy

Bladder diverticula can develop as consequences of bladder outlet obstruction (e.g., posterior urethral valves), neuropathic bladder dysfunction, and with congenital defects at the ureterovesical junction (i.e., Hutch diverticulum). Diverticulae that retain urine, cause incontinence and urinary tract infections should be removed. A robotic approach can be performed safely along with ureteroneocystostomy, if indicated. Port placement is similar to robotic extravesical reimplantation. Illumination of the diverticulum by placement of a cystoscope facilitates its dissection. A diverticulum positioned along the posterior bladder wall precludes the need to drop the bladder. The ease of intracorporeal suturing with the robot improves detrusorrhaphy outcomes, in which the bladder should be closed in two layers. Christman reported on 14 patients (mean age 7.9 years) in which the mean operative time was 132.7 min and length of stay 24.4 h. There were no complications, and all patients had normal voiding cystourethrograms at follow-up. In the six patients who had diurnal enuresis preoperative, this resolved after surgery [5].

Posterior urethral diverticula

Alsowayan et al. reported on robotic repair of symptomatic posterior urethral diverticula proximal and lateral to the verumontanum in 2- and 4-year-old boys. They placed a catheter into the diverticula and distended it with saline to aid in identification and a hitch stich placed in the diverticula to help with complete dissection. The ureteral edges were closed with 5-0 suture and catheters left in place. Postoperatively, the patients had good stream with no urinary retention or strictures seen on voiding cystourethrography.

Prostatic utricles

Robotic removal of large prostatic utricles have also been described. One report discussed a patient with perineal hypospadias and a 10 cm utricle which persisted after failed conventional laparoscopic removal year prior. After robotic dissection with the aid of a catheter within the utricle, a stapler was passed through the assistant port and the utricle

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removed, leaving a small stump on the urethra. Foley catheter was removed 1 week after surgery and voiding cystourethrography 1 year later showed no strictures or cystic remnants [6].

Seminal vesicle cyst

Robotic excision of a symptomatic, cystic seminal vesicle in a 16-year-old male with ipsilateral renal agenesis and absence of the vas deferens. There were no complications and he was discharged home on postoperative day one, with resolution of symptoms at follow-up.

Varicocelectomy

Robotic-assisted varicocelectomy has been described, either transperitoneal laparoscopic or subinguinal without ports (for the use of the robot's magnification advantages). For the transperitoneal approach, the robotic-assistance to laparoscopy shows to be technically feasible with avoidance of complications, but costs remains higher than conventional laparoscopic varicocelectomy [7].

Pediatric gynecologic surgeries

Robotic sacrouteropexy for adolescent patients with a history of bladder exstrophy and pelvic organ prolapse has been performed successfully, without recurrence at 1 year follow-up. Robotic surgery for adnexal pathology (ovarian cystectomy, oopherectomy, salpingo-oopherectomy) was shown to be safe and effective, with mean operative times of 117.5 min, and without any complications or conversions, in six children aged 2.4–15 years and weighing 12–55 kg. There is one reported case of a robotic-assisted vaginoplasty with bowel interposition in a 9-year-old girl with vaginal atresia. Robotic operative time was 135 min, and there was no complications and with minimal blood loss. Follow-up at one year showed a good cosmetic result with healthy tissue and maintenance of continence [8,13].

Conclusion

The transition of robotic-assisted laparoscopic surgery to the pediatric population comes with its own specific set of challenges. Proper patient selection and alterations to the surgical procedure can be employed to yield successful outcomes. While pyeloplasty is the most common and best described robotic procedure in pediatric urology, many other operations have been reported and are currently utilized at some centers. Future improvements in technology with production of pediatric-sized robotic instruments, along with increases in robotic-trained pediatric urologists and surgeon experience along each's learning curve, will help to further advance the field of robotic surgery in pediatric urology [9,11]. This evolution will offer alternative management in treating pediatric patients, with improvement of care and patient quality of life. Further research and time are required before we will truly see the full potential of robotic surgery as a therapeutic option in our pediatric patients [10,12].

Conflict of Interest

The authors declare no conflict of interest.

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