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CASE REPORT

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Enhancing pediatric robotic pyeloplasty with a no-touch urothelium approach: a case series

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Abstract

Background Robotic-assisted laparoscopic surgery has advanced minimally invasive urology. However, the absence of haptic feedback may increase the risk of tissue trauma. This case series evaluates a no-touch technique in robotic-assisted pyeloplasty to minimize urothelial handling and assess its feasibility and short-term outcomes.

Methods This retrospective case series reviewed 20 pediatric patients with ureteropelvic junction obstruction treated with robotic-assisted pyeloplasty between 2019 and 2022. In 10 cases, a no-touch urothelium approach was applied to minimize direct tissue handling. Patient selection, surgical details, perioperative outcomes, and follow-up at 6 and 12 months were documented.

Results The no-touch approach was successfully implemented in all cases without intraoperative complications. Median console time was 98 min (IQR: 81–131). Postoperative outcomes were favorable, with significant improvement or resolution of hydronephrosis in all cases. No major complications occurred, and no anastomotic strictures were observed during follow-up.

Conclusions The no-touch technique in robotic-assisted pyeloplasty is a feasible approach that maintains surgical efficiency while minimizing direct urothelial handling. Further studies with larger sample sizes and longer follow-up are needed to validate its potential benefits.

Trial registration This study was approved by the Institutional Review Board of New Children's Hospital, Helsinki University Hospital (permit nr 5485), Finland.

Keywords Robotic-surgery, Pyeloplasty, Haptic feedback, Minimally invasive approaches, Case series

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Background

The evolution of robotic-assisted surgery has redefined precision in minimally invasive urology, providing enhanced dexterity, three-dimensional visualization, and refined control in complex surgical settings [1]. While initially introduced for adult patients, the advantages of robotic systems are evident in pediatric urology, where confined anatomical spaces and the need for precision are paramount [2–5]. Robotic systems offer wristed instruments and tremor elimination, advancing surgeon ergonomics and control in intricate procedures [2, 6].

However, despite these benefits, robotic surgery is limited by a lack of haptic feedback, leaving surgeons to rely on visual cues [4, 7, 8]. This tactile absence is significant in pediatric patients, where inadvertent movement can extend beyond the small operative field, and excessive pressure on the urothelium can potentially lead to unintended scar formation. To this end, we evaluate a "no-touch" approach to mitigate the risk of urothelial damage during procedures such as robot-assisted pyeloplasty. This approach adds a dimension of mini-invasiveness by reducing tissue handling beyond robotics' inherent minimally invasive benefits.

This retrospective case series assesses the feasibility of the no-touch urothelium approach in robot-assisted pyeloplasty. The primary focus is to document the technique's implementation and its impact on surgical efficiency and postoperative outcomes.

Methods

Case descriptions

This retrospective case series included 20 pediatric patients diagnosed with ureteropelvic junction obstruction, indicated by progressive hydronephrosis, declining renal function, or pain. During 2019–2022, all patients over 12 kg or 2 years of age who met these indications were assigned to robotic-assisted pyeloplasty. In 10 cases, a no-touch urothelium approach was applied. Patients with intraoperative findings of unexpected anatomy, cases involving multiple console surgeons, or those requiring non-standard approaches or additional interventions were excluded from the study.

Data collection

Operative registry data from the Department of Pediatric Surgery at Helsinki University Hospital were reviewed for patient demographics and clinical variables, including sex, age, weight, preoperative urological assessments (AP-diameter, MAG3-renography), operative details (theater time, operative time, console time), and perioperative/postoperative complications. Complications were graded according to the Clavien-Madadi classification system [9]. Follow-up evaluations were conducted at 6 and 12 months postoperatively.

Surgical technique

All procedures were performed under general anesthesia with intravenous cefuroxime prophylaxis (50 mg/kg). An open infraumbilical technique was used to establish pneumoperitoneum, followed by port placement per manufacturer guidelines. The DaVinci Si or Xi robotic platform (Intuitive Surgical Inc., Sunnyvale, CA, USA) was used, with a 12 mm infraumbilical port, two 8 mm robotic working ports, and an assisting 5 mm port. All cases utilized a transabdominal approach. For right-sided pyeloplasty, the kidney was accessed by mobilizing the ascending colon, while for left-sided cases, a transmesenteric approach without colon mobilization was applied. Pelvic resection during reconstruction was minimal. The anastomosis was performed without directly touching the urothelium with the robotic instruments in the no-touch group to minimize tissue handling (see video). Instead of grasping the urothelium, contact was achieved either by lifting with the needle, grasping resected tissue, or using adjacent connective tissue for stabilization. In all cases, a double-J stent was placed and removed six weeks postoperatively. Drain and catheter management followed standard protocols. All procedures were completed robotically without the need for conversion to open surgery in either cohort.

Postoperative follow-up

Postoperative care included prophylactic antimicrobial treatment until stent removal. Follow-up assessments included ultrasonography and MAG-3 renography at 6 and 12 months.

Results

Twenty pediatric patients underwent robotic-assisted pyeloplasty, all presenting with hydronephrosis. The no-touch approach (video) was successfully implemented in 10 cases without intraoperative complications. Operative times were not prolonged by the no-touch approach with median console time was 98 min (IQR: 81–131, Fig. 1). Perioperative, short-term, and mid-term complications were graded by the Clavien-Madadi system with no major complications occurred, and no anastomotic strictures observed. One patient required early JJ-stent removal due to discomfort during voiding. Postoperative evaluations demonstrated significant improvement or resolution of hydronephrosis in all cases.

Discussion

Robotic-assisted laparoscopic surgery has revolutionized minimally invasive procedures in pediatric urology, offering enhanced precision, three-dimensional visualization, and increased dexterity essential for performing complex reconstructive tasks in limited anatomical spaces [2, 3]. These advancements are particularly beneficial

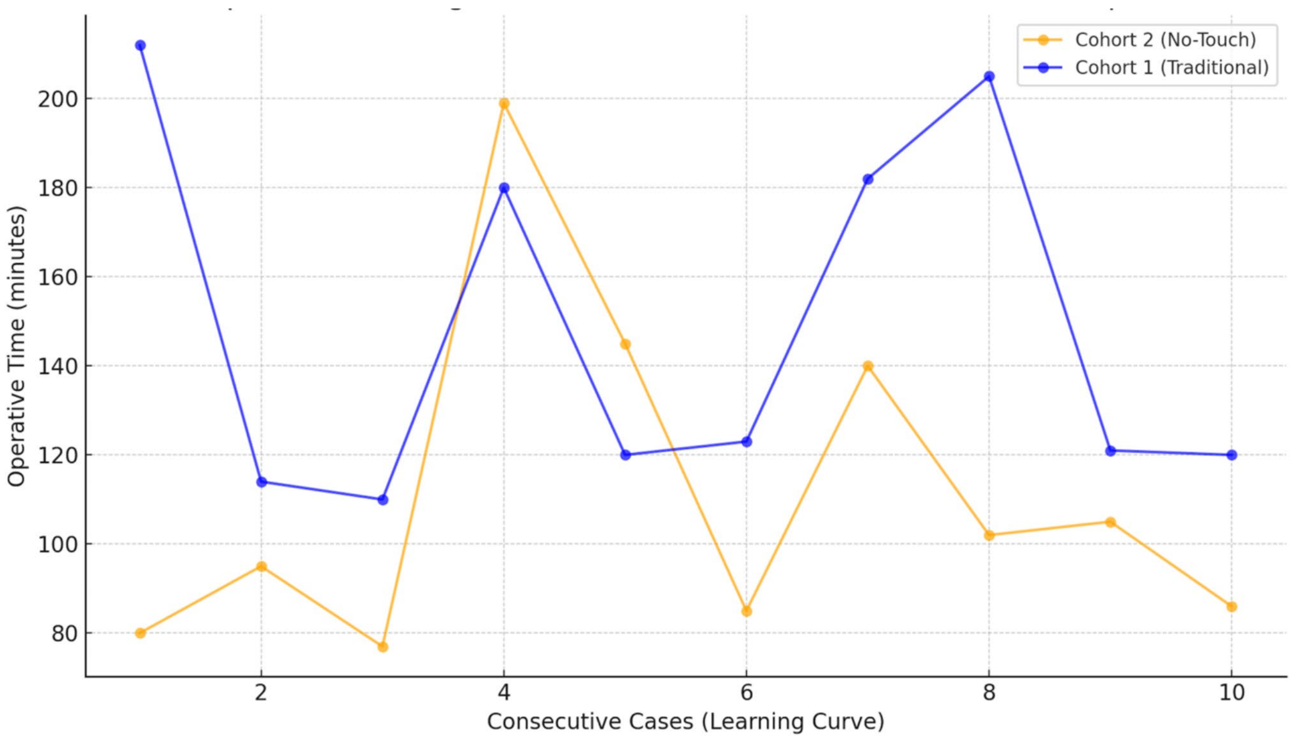

Fig. 1 Operative console times for traditional and no-touch robotic-assisted pyeloplasty

in pediatric patients, where robotic systems enable surgeons to minimize trauma to surrounding tissues, reduce postoperative pain, and often shorten hospital stays [3, 7]. Robot-assisted laparoscopic pyeloplasty has demonstrated high success rates comparable to traditional open or laparoscopic methods, with some studies reporting benefits such as reduced narcotic use and faster recovery [4]. Despite challenges such as high costs and a steep learning curve, studies indicate that robotic-assisted pyeloplasty remains a safe and effective approach, even in low-volume centers [2, 10]. The increasing adoption of robotic surgery in pediatric urology reflects its potential to improve outcomes in complex cases and its adaptability to the unique needs of pediatric anatomy [11–13].

This case series demonstrates that the no-touch technique in robotic-assisted pyeloplasty is a feasible approach in pediatric patients. By minimizing direct urothelial handling, this technique may reduce the risk of long-term scarring and anastomotic complications. Importantly, it does not appear to prolong operative time, supporting its viability as an alternative approach in pediatric urologic surgery.

A significant limitation of current robotic-assisted surgical systems is the absence of haptic feedback, which prevents surgeons from feeling tissue resistance and can lead to unintentional pressure or tissue trauma, especially in pediatric patients with delicate anatomies. This study suggests that a no-touch technique can mitigate these risks by refining instrument handling to minimize direct contact. While surgeons often adapt to the lack of tactile feedback by developing enhanced visual acuity and technique, advancements in haptic feedback technology could further improve tactile perception in robotic procedures, potentially enhancing outcomes in pediatric cases [2, 7].

As a case series, this study is inherently limited by its retrospective nature and small sample size. While our findings suggest that the no-touch technique is feasible and does not prolong operative times, further larger-scale studies with comparative designs are needed to validate long-term benefits.

Conclusion

This case series demonstrates the feasibility and potential benefits of the no-touch technique in robotic-assisted pyeloplasty for pediatric patients. By minimizing direct contact with the urothelium, the no-touch approach maintained surgical efficiency while achieving favorable outcomes. Further comparative studies with larger sample sizes and long-term follow-up are needed to validate its efficacy and assess its potential advantages over the standard approach.

Compliance with reporting guidelines

This case series follows the CARE guidelines for case reports and case series. A completed CARE checklist is included as a supplementary file.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12894-025-01782-y.

Supplementary Material 1

Supplementary Material 2

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Author contributions
NP conceived the study. NP, PJ, and LR collected and analyzed data. NP and ST edited the video. NP drafted the manuscript. All authors read and approved the final manuscript.

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Data availability
The datasets used during the study are not publicly available due to GDPR, but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
This study was approved by the Institutional Review Board of New Children's Hospital, Helsinki University Hospital (permit #5485), Finland, and adhered to the Declaration of Helsinki. The requirement for individual patient consent for retrospective data collection was waived by Review Board as per institutional guidelines.

Consent for publication
Informed consent was obtained from the patient and their legal guardians for the publication of the provided video demonstrating the no-touch robotic-assisted pyeloplasty technique. The consent includes permission to use anonymized visual material for educational and scientific purposes.

Competing interests
The authors declare no competing interests.

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