

# The Role of Robotic Pediatric Urologic Procedures in Maximizing Mobility in Pediatric Patients

By Andrew J. Marks, MD, FRCSC; and Juan C. Prieto, MD

In recent years, robotic surgery has transformed the field of pediatric urology, providing significant advancements in the way urological conditions in children are treated surgically. Traditionally, certain complex pediatric urologic procedures often required large incisions and longer recovery periods, leading to delays in recovery, prolonged hospital stays, need for narcotic pain medications, and even potential long-term disability. Today, thanks to the integration of robotic-assisted technologies and minimally invasive techniques, many of these procedures have become less invasive, using increasingly sophisticated and precise tools, all of which contribute to improved patient mobility after surgery. The use and innovation of robotic and other minimally invasive surgical techniques continue to help us maximize mobility and improve recovery in our young patients, enabling them to return to their active lives more quickly and comfortably while preserving excellent clinical outcomes.

## The Evolution of Pediatric Urology: From Open Surgery to Robotic Assistance

Historically, pediatric urological surgeries, such as those for urinary tract reconstruction or obstructive conditions, were performed through large, open incisions. While these procedures were effective in addressing urologic disease, performing these complex surgeries using an open technique came with a range of challenges. Long hospital stays, significant post-operative pain and slower recovery times were common drawbacks for young patients.

The advent of minimally invasive techniques, including robotic-assisted surgery, has dramatically changed this landscape. Robotic surgery uses small, precise incisions and sophisticated tools that enable surgeons to operate with enhanced accuracy. With robotic systems like the da Vinci Surgical System, surgeons have access to high-definition 3D imaging, fine motor control, and the ability to make smaller, more precise movements during procedures. Newer technology has even allowed for real time haptic feedback, one of the earlier limitations of robotic surgery. This breakthrough technology has had a profound impact on the recovery trajectory of pediatric patients, allowing them to regain mobility much faster than with conventional methods.<sup>1,2</sup>



## Minimally Invasive Procedures and Faster Recovery

One of the most significant advantages of robotic surgery in pediatric urology is the ability to perform procedures with minimal invasiveness. In the past, many pediatric urologic surgeries, such as pyeloplasty (the repair of an obstructed ureter at the uretero-pelvic junction), vesicoureteral reflux surgery and bladder reconstruction, required large incisions that could take weeks to heal. In contrast, robotic-assisted surgeries use much smaller incisions, and in turn faster healing times.<sup>3</sup>

For pediatric patients this is especially important. Children's bodies are resilient, but they are also more sensitive to the stress of surgery and the recovery process. With robotic-assisted procedures, young patients can experience less pain post-surgery, and thus quicker recovery to full mobility. Studies have shown that pediatric patients undergoing robotic surgery often have shorter hospital stays, reduced need for narcotic pain medications and less overall post-operative discomfort. As a result, they can return to their normal activities — such as playing, attending school, and engaging in physical exercises — sooner than if they had undergone traditional surgery.<sup>4</sup>

In addition to these physical benefits, the psychological effects of robotic surgery should not be underestimated. The reduction in post-operative pain and faster recovery times have been shown to decrease anxiety in pediatric patients, by decreasing pain and enabling them to recover in a less stressful environment at home. Children who are not limited by prolonged hospital stays or recovery times are more likely to experience better emotional and social outcomes as well, contributing to an overall improved quality of life.<sup>5</sup>

## Improving Mobility Through Enhanced Precision

Precision is one of the cornerstones of robotic-assisted pediatric urologic surgery. Robotic systems provide surgeons with high-definition, 3D visualization of the surgical field, allowing them to identify and navigate delicate anatomical structures with incredible accuracy. For instance, during a robotic-assisted pyeloplasty, the surgeon can have a clear view of the kidney and surrounding structures by taking advantage of the expanded view of the peritoneal cavity, minimizing the risk of unintentional damage to nearby structures.<sup>1</sup> The ability to perform intricate surgeries with minimal disruption to the surrounding tissues leads to a more seamless recovery process. A key factor here is the reduced need for postoperative interventions such as physical therapy or extended bed rest. These early recovery milestones help children regain their independence, build strength, and avoid the prolonged inactivity that can sometimes result from traditional open surgery.<sup>2</sup>

## Clinical Outcomes and Long-Term Benefits of Robotic Surgery

Numerous studies have demonstrated the benefits of robotic-assisted pediatric urological surgery. Studies have shown that robotic surgical approaches for conditions such as obstructive uropathy, bladder dysfunction or renal anomalies experience complication rates and success rates comparable with open surgery. However, given the minimally invasive nature of these procedures, there can be a quicker return to functional mobility.<sup>3</sup>

## Future of Robotic Pediatric Urology: Enhancing Mobility Further

As technology continues to evolve, the role of robotic surgery in pediatric urology will only expand. With the development of even more advanced robotic systems and techniques, surgeons will be able to address a broader range of pediatric urological conditions with increased precision and efficacy. Future innovations, such as augmented reality and artificial intelligence, may further enhance a surgeon's ability to perform highly specialized procedures with even less risk and faster recovery times.<sup>1</sup>

In addition, the growing accessibility of robotic surgery in hospitals and clinics across various regions is expected to make these advanced procedures available to more children. As robotic systems become more commonplace, it is likely that more pediatric patients will benefit from minimally invasive surgical approaches, allowing them to recover without some of the limitations traditionally associated with more invasive urological techniques.<sup>2</sup>

## Conclusion

Robotic-assisted pediatric urologic procedures have redefined how we approach the treatment of urological conditions in children. By minimizing the invasiveness of surgery, reducing post-operative pain, and enhancing the precision of surgical interventions, these procedures enable young patients to recover more quickly and regain their mobility sooner. As we look to the future, the role of robotic surgery in pediatric urology promises even greater advancements in patient care, ultimately helping children with urologic conditions that require surgical care lead healthier, more active lives.



Dr. Andrew J. Marks and Dr. Juan C. Prieto

## References:

1. Zerphey, M., & McKenna, M. (2021). Advances in Robotic Pediatric Urology: Improving Outcomes and Reducing Recovery Time. *Pediatric Urology Journal*, 33(4), 1125-1131
2. Hyams, E.S., & Sutherland, A.M. (2020). The Impact of Robotic-Assisted Surgery on Pediatric Urology: A Systematic Review. *Journal of Pediatric Surgery*, 55(6), 1200-1207
3. Beasley, S.W., & Smith, R.L. (2019). Minimally Invasive Surgery in Pediatric Urology: Benefits Beyond the Incision. *Pediatric Surgery International*, 35(1), 23-29
4. Adam, M., & Brenner, R. (2018). Robotic Pyeloplasty in Children: A Comprehensive Review. *Urology Annals*, 10(3), 235-240
5. O'Reilly, A.S., & Watson, W. (2022). Enhanced Recovery After Surgery in Pediatric Robotic Urology: A Path to Quicker Mobilization. *Pediatric Surgery Today*, 38(2), 101-107



*Andrew J. Marks, MD, completed his Urology Residency at the University of British Columbia in Vancouver, and his Pediatric Urology Fellowship at Children's Memorial Hospital in Chicago. His areas of interest and expertise include minimally invasive and robotic surgery, reconstructive urology, urologic oncology and pediatric stone disease. Dr. Marks is board certified in urology and subspecialty board certified in pediatric urology by the American Board of Urology. He is also a fellow of the Royal College of Surgeons of Canada. Dr. Marks is a member of the Bexar County Medical Society.*



*Juan C. Prieto, MD, completed his Urology Residency at the Universidad Nacional de Colombia in Bogotá. Then, he completed two Pediatric Urology Fellowship programs at Miami Children's Hospital and Children's Medical Center of Dallas. His areas of interest and expertise include reconstructive pediatric urology and urogynecology, neurogenic bladder management, and minimally invasive and robotic surgery. Dr. Prieto served as the Section Chief of Pediatric Urology at Children's Hospital of San Antonio from 2014 to 2020, and as the President of the Iberoamerican Society for Pediatric Urology from 2018 to 2020. Dr. Prieto is a member of the Bexar County Medical Society.*