Editorial

Pediatric robotic surgery

The first publications focused on robot-assisted surgery (RAS) were reported in pediatric patients about 20 years ago. However, in particular in the last 10 years, RAS using the da Vinci surgical system (Intuitive Surgical, Inc., Sunnyvale, CA, USA) has had an impressive development in children and it has become a clinical reality also in pediatric patients.

The principal fields of application or RAS are urology, general surgery, gynecology, and pediatric surgery. More recently, novel fields of application of RAS have been described as thoracic surgery, cardiac surgery, otolaryngology.

As reported in adults, the robotic platform advantages in children include stable magnified view, tremor filtering, better ergonomics, and motion scaling allowing for more precise intracorporeal exposure and easier suturing also in narrow spaces.

RAS has been mainly adopted to perform reconstructive procedures in children, demonstrating the consistent advantage to overcome the technical challenges of such procedures compared with conventional laparoscopy as robotic arms have 7° of freedom and can articulate up to 90°. Other advantages related to the use of EndoWrist technology include three-dimensional (3D) high-definition view of the operative field, and improved ergonomics since the surgeon can operate seated on the robotic console, with alignment of eyes and hands position with the instruments and elimination of hands tremor.

Analyzing the international literature, the use of robot in complex reconstructive procedures has also been associated with a shorter learning curve compared with conventional laparoscopy.

However, despite all these technical advantages of robot, its large-scale application has still several limitations in children.

The main drawback is represented by the significant cost of acquiring and maintaining the da Vinci robot. Another important challenge is to adapt the big robotic platform, originally designed for adults, to the small dimensions of children. Modifications and arrangements of the equipment and positioning of the patient and trocars are required.

As for the size of robotic trocars, they are of 8-mm in diameter while the size of trocars currently adopted in pediatric patients is 3-mm.

Robot-assisted laparoscopic pyeloplasty (RALP) is, to date, the most frequent procedure performed in the pediatric population, and the only one where outcomes have been proved to be better to the open or laparoscopic techniques in patients over 10 kg of body weight. Many other applications of RAS, including ureteral reimplantation, appendico-vesicostomy creation, bladder neck reconstruction, kidney or bladder stone surgery and oncology have been described in children, but further evidence is needed to validate these indications. As already reported, the most important limitation for RAS is still represented by the costs, which remain higher than the open approach.

Analyzing the international literature, the main advantages of robotics over laparoscopy remain improved dexterity, easier suturing, and better surgeon ergonomics. However, robotics is a very dynamic field and with the development of new technologies such as virtual reality, artificial intelligence, and 5G technology, robotics will have further development and larger application also in pediatric surgery.

The aim of this focused series is to give an overview about the main indications of RAS in pediatric patients and the long-term outcomes of pediatric patients operated using this amazing technology and I would like to thanks all the authors of this focused series of *Translational Pediatrics* devoted to robotic pediatric surgery that are world leader experts in this field.

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