Robotic surgery in urology: the way forward

Riccardo Autorino¹ · Francesco Porpiglia²

Published online: 19 March 2020

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Keywords Adrenalectomy · Fluorescence · Lymph node dissection · Prostatectomy · Radical cystectomy · Single port · Robotic surgery · Technology · 3D imaging

The idea of robotic intervention in medicine is not recent. In 1960, a preliminary report on robotic angiography was published [1]. In the late 1980s, applications of robotic stereotactic neurosurgery were explored [2]. In the early 1990s, there were early experiences with robotic-assisted laparoscopy [3], and during the same period, the first “urologic” robotic system—the Probot—was described by investigators from the Imperial College in London with the purpose of performing transurethral prostate resections [4, 5]. A decade later, at the dawn on the new century, French and German groups reported the first cases of robotic assisted laparoscopic radical prostatectomy using the first generation DaVinci system [6, 7], and soon after the world’s first robotic prostate cancer surgery program was established by Dr. Menon and his team in Detroit [8].

Since then, while radical prostatectomy has remained the bulk of robotic procedures in Urology [9], other oncology and non-oncology indications have been explored [10]. As robotic technology is being rapidly implemented in different surgical specialties, with Urology in the forefront of this phenomenon [11], evidence supporting its use continues to build up (Fig. 1), while ongoing debate related to increases costs [12] and need for structured training [13] remain.

In this special issue of the *World Journal of Urology*, we collected a series of reports from leading institutions in the field on hot topics in robotic urologic surgery. The idea was to fuel the debate on key clinical questions by providing

the readers with interesting (and in some cases provocative) readings on the latest developments in the field.

In the area of prostate surgery, risk of positive margins remains an issue [14], and Cumarasamy et al. present a model based on preoperative variables to predict this risk [15]. Moreover, robotic surgery has “revived” the perineal approach for radical prostatectomy [16], and Kaouk and collaborators present an overview on the recent advances based on their experience with robotic perineal prostatectomy [17]. As robotic surgery is being implemented for the surgical treatment of benign prostatic hyperplasia [18], Hemal et al. describe a novel radical prostatectomy for patients with low risk cancer and enlarged prostate gland [19].

In the area of bladder surgery, robotic assisted techniques are gaining momentum, but they are still under scrutiny [20]. Brassetti et al. report one of the largest series with long-term data about robot-assisted radical cystectomy with totally intracorporeal urinary diversion [21].

As the role of robotic nephroureterectomy for upper urothelial cancer remains under scrutiny, Veccia et al. report a systematic review and meta-analysis of comparative outcomes versus more established nephroureterectomy techniques [22]. Robotic surgery is also being explored for adrenal surgery [23], and Ye et al. describe a novel adrenal enucleation technique [24]. Moreover, the robotic platform has allowed to replicate in quality and extent lymph node dissections for several genitourinary cancers [25], and a leader group in the field report one of the largest series of primary robotic retroperitoneal lymph node dissection for non-seminomatous germ cell testicular cancer [26].

As we enter the era of precision surgery [27], the role of robotic-assisted procedures is here to stay, and surgery applications of robotic technology are expanding and consolidating. Integration of novel technologies will further boost this process, and image guidance will represent a key tool in the hands of the console surgeon. In this respect,

✉ Riccardo Autorino
ricautor@gmail.com

¹ Division of Urology, Department of Surgery, VCU Health, 980118, Richmond, VA 23298-0118, USA

² Division of Urology, Department of Oncology, School of Medicine, San Luigi Hospital, University of Turin, Orbassano, Italy

Fig. 1 Scopus-based literature trend analysis on index robotic surgical procedures in Urology (years 2001–2019). *RARP* robotic assisted radical prostatectomy, *RAPN* robotic assisted partial nephrectomy, *RARC* robotic assisted radical cystectomy, *RPYELO* robotic assisted pyeloplasty, *RAA* robotic assisted adrenalectomy, *RASP* robotic assisted simple prostatectomy

Checucci et al. provide a comprehensive overview of 3D imaging technology [28], whereas Cacciamani et al. report current best practices in near-infrared fluorescence imaging-guided robotic surgery [29].

Last, the advent of new systems is awaited to enrich the current robotic armamentarium [30]. The DaVinci SP™ port platform just entered the market in the US, will soon be available in Europe, and it is likely to foster renewed interest for single port surgery [31]. Dobbs et al. describe their initial clinical experience with this platform [32]. We eagerly await new developments in the field, and it is our responsibility to stay tuned.

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