

## EDITORIAL



## Editorial: new horizons in robotic platforms

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At the beginning of the 21st century, the first Intuitive Surgical Da Vinci system was introduced. Historically, the AESOP and ZEUS systems were the first robots adopted in general surgery before Intuitive and American Computer Motion merged into a single company. By 2023, over 7500 robotic platforms have been installed, with over 11 million surgeries performed worldwide. The success of the robotic platform relies on the magnification, 3D imaging, motion scaling, tremor filtration, dexterity and quick learning curve of the machine. After many years of monopoly by Intuitive, several companies have proposed new robotic platforms that may challenge the Da Vinci system [1].

In this issue, Lin et al. report a retrospective revision of the results of radical prostatectomy performed via the novel Senhance digital laparoscopic model (SRP) or the standard Da Vinci Xi robot (DRP) [2]. The Senhance® Surgical System removes the economic limitations of current robotic systems with standard reusable instruments and an open-platform architecture strategy that enables hospitals to leverage existing technology investments. It is composed of three robotic arms (one camera and two working arms) and an open console. Senhance allows a comfortable and easy shift from standard laparoscopy to robotic-assisted surgery. The authors matched 60 cases and performed a comparative analysis. There was no difference in blood loss (180 versus 180 mL,  $p = 0.86$ ) and postoperative surgical complication rate (Clavien–Dindo grade I–IV, 25.3% versus 22.2%,  $p = 0.21$ ) between the SRP cases and the DRP. Oncologic and functional outcomes were similar: in particular, the rate of undetectable PSA (68.3% versus 66.7%,  $p = 0.85$ ), positive surgical margins (36.5% versus 41.3%,  $p = 0.58$ ) and incontinence rates (14.3% versus 15.9%,  $p = 1.0$ ) were comparable. Finally, the authors performed a cost analysis with a median procedure cost for SRP of \$4170 versus \$7675 for the DRP patients. The authors have to be complimented for the interesting study, which highlights the need for novel comparison studies across robotic platforms. However, when interpreting the results, readers should keep in mind the important biases of different surgeons included in the analysis and the limited sample size.

Yet, the authors clearly open new insights into the robotic panorama in urological surgery and confirm the safety of this novel platform for radical prostatectomy. The new robotic platforms obviously have to fill the gap of the 20 years of experience in the field by Intuitive, although it seems that this initial disadvantage will soon be leveraged. Currently, several companies are running this race, with many machines being introduced in different markets worldwide. These include Versius (CMR Surgical), Raven (by Applied Dexterity), AVRA Medical Robotics, Titan Medical's SPORT Surgical System, Hugo RAS (Medtronic) and REVO-I (MEERE Company) (Fig. 1). Overall, the systems are focusing on ergonomics, portability, single-port (SP)

surgery, tactile sense (Haptic) and costs to improve the actual limitations of the Da Vinci system.

Although, through the years, Intuitive has improved the Da Vinci system, ergonomics and space are still suboptimal, specially to fit small operating theaters. The Versius system concentrated particularly on ergonomics, introducing a multi-arm robot. The hand controllers and console have been crafted to fit a variety of hand sizes, enabling surgeons to position their hands comfortably, irrespective of the operating angle. In addition, the system offers a versatile workspace, permitting surgeons the choice of either sitting or standing. Equally important attention was dedicated to the surgeon's cognitive and sensory needs. For instance, the adjustable height of the console screen not only promotes a more upright posture but also enhances the visualization of 3D features [3].

SP surgery raised interest among urological surgeries since the introduction of Gel ports in laparoscopy [4–7]. In 2018, the SP Da Vinci system was introduced to accommodate small working spaces, port triangulation, and reduce instrument clashing. Titan Medical has also focused on SP surgery, and Hugo Ras is developing a SP system, which is still not on the market. There are not many high-quality studies focused on the SP system. However, several case series highlight distinct indications and surgical techniques using the SP robot, showcasing its safety and viability when operated by seasoned robotic surgeons. In addition, there is a growing body of prospective studies with larger cohorts that compare outcomes of SP with multiport (MP) techniques. These studies suggest advantages of the SP system, including enhanced cosmetic results, better postoperative pain management, and shorter hospital stays. However, the true clinical impact of hard surgical outcomes is not evident.

Laparoscopic surgeons, when introduced to robotic surgery, clearly suffered from the lack of tactical feedback of robotic platforms. Since then, companies have focused on improving the haptic abilities of the robotic systems. Senhance has concentrated on this aspect and is the only available platform nowadays having haptic feedback. The authors have not given feedback on the importance of such technology in performing radical prostatectomy.

Finally, costs play an important role in robotic surgery. Currently, Da Vinci system is the most expensive robot in terms of initial costs and instrument costs. Most of the competitors are focusing on reducing costs to challenge the monopoly created by intuition. The introduction of the latest robots may open third world countries to robotic surgery and modular robots may as well reduce the costs of robotic surgery. Some studies have addressed the cost-effectiveness of robotic surgery and overall robotic surgery has been demonstrated cost-effective particularly when compared to open surgery [8].

As David Sarnoff said in the early 1900 “Competition brings out the best in products and the worst in people.” The introduction of new robotic platforms has forced every company to improve the technological capacities of their machines. As highlighted earlier, ergonomics, haptic feedback and costs are the main aspects to



**Fig. 1** New robotic platforms. Operating room setting for different robotic platforms.

consider when looking at robotic platforms. Soon, companies will introduce artificial intelligence to improve the quality of surgical procedures and outcomes, anticipating possible complications [9].

The current landscape of robotic surgery seems just the dawn of an exciting journey. Lin et al. certainly add important evidence on the safety and efficacy of the Senhance system for radical prostatectomy.

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## AUTHOR CONTRIBUTIONS

RL: conceptualization, writing, and reviewing the final version. MR: data collection, writing, reviewing and approval of the final version. CDN: conceptualization, writing, reviewing and approval of the final version. SA: conceptualization, data collection, reviewing and approval of the final version.

## COMPETING INTERESTS

The authors declare no competing interests.