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EDITORIAL

Embracing the future: the necessity of implementing robotic surgery in South African training institutions

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In 1990, the first laparoscopic cholecystectomy in South Africa, and possibly in Africa, was performed by Professor Bornman at Groote Schuur Hospital.[1] In 2018 in this journal, the first series in the country of laparoscopic radical cystoprostatectomy for muscle-invasive bladder cancer was published.[2] In the latter case, we have witnessed the improved recovery of patients who had laparoscopic over those who had open surgery, particularly when combined with an enhanced recovery after surgery programme (ERAS). Surgical innovation has powered the expansion of surgical minimally invasive surgery (MIS). The central goals of the efficacy of MIS are patient outcomes based with the aim of enhancing recovery, minimising blood loss, reducing opioid use, improving cosmesis and critically improving functional and oncological outcomes. Robotic surgery holds promise to build on the above achievements in South Africa. It enables surgeons to perform complex procedures with exceptional precision, control, and accuracy. And it expands the complexity of cases that can be done with MIS.

Robotic surgery has been around for approximately 40 years, with the initial robotic "surgeons" being programable machines that were used in stereotactic brain biopsies in the late 1980s. Subsequent development led to the "master and slave" concept, with surgical robotic platforms that are fully controlled in real-time by a human operator. These machines currently utilised for robotic-assisted laparoscopy are at the forefront of modern MIS practice, as evidenced in the United States of America (USA) by an 8.4-fold increase from 2012 to 2018 in robotic surgery with a corresponding decrease in laparoscopic surgery.[3] They concluded that in general surgery, robotic surgery will ultimately become the gold standard for most procedures. In addition, they found worldwide diffusion of robotic surgery was uneven, which they related to economic strength, government healthcare policies, and surgeons' varying preference for MIS in different countries and regions, resulting in few robotic systems being deployed in low and middle-income countries (LMICs).[3] This is not surprising as a 2018 JAMA study estimated a cost per procedure of $3 568, with $1 866 for instruments and accessories, $1 038 for robot systems, and $663 for the service contract.[4]

In October 2021, we were amongst surgeons from several disciplines at Tygerberg and Groote Schuur Academic Health Complexes who lobbied robustly to acquire the *da Vinci* Xi system at a cost of R38 million per robot with the altruistic goal of providing the very best care possible to patients in the state sector.[5,6] In this editorial, we put forward the background and rationale to justify how robotic surgery's financial and environmental costs need not reduce our chance of providing "Health for All" in South Africa.

In 2014 the first South African radical prostatectomy was performed with *da Vinci* robot, of which there are now nine in the private sector. Their use in the country has expanded to general gynaecology and cardiothoracic surgical procedures. Since the acquisition in 2021, 240 and 260 surgeries have been performed at Groote Schuur and Tygerberg Hospitals, respectively. These include robot-assisted laparoscopic surgery (RALP), partial nephrectomy, pyeloplasty, complex reconstructive procedures and radical cystectomy total mesorectal excision, ventral mesh rectopexy, proctectomy and ileoanal pouch, and colectomies, hernia repairs, urogynaecology procedures, sacrocolpopexy, hepatobiliary bile duct exploration, hemi-hepatectomy and distal pancreatectomy and gynaecology procedures like advanced endometriosis and onco gynae radical resections.

These have been performed using rigorous training protocols. Prospective surgeons and their assistants, nurses and anaesthetic colleagues have all received formal training. The surgeons and their trainees underwent simulator, dry lab, and overseas wet lab training. The principal surgeon was then proctored by a local or international expert with an initial case series and ultimately signed off by the proctor as competent on a specific operation. This process aims to ensure surgeon competency and patient safety and, in our experience, has played a very positive role in inspiring surgeons, trainees, and medical students.

RALP has remained the mainstay of treatment for localised prostate cancer in the USA, with roughly 85% of operations now done robotically. It is the most studied and validated robotic procedure. It is, therefore, a useful candidate operation on which to base the efficacy of future robotic procedures. In a 2022 USA study comparing open

radical prostatectomy vs RALP, the authors reviewed 550 patients in each group. Overall, RALP patients had less pain, shorter hospital stays, and fewer post-surgical complications such as blood transfusions, infections, deep vein thrombosis (DVTs), and bladder neck contractures.[7] However, with regard to urinary and sexual health, there were no appreciable long-term differences between the two approaches.

One could ask of the above study, why not perform the surgery laparoscopically and save the cost of the robot? Laparoscopic radical prostatectomy never reached widespread acceptance because of the complexity of the procedure, the confined working space and the advanced skills required were only in the hands of a few experts. RALP brings the addition of magnification, 3D appreciation of anatomy and greater dexterity than the human hand into the confined space of the male pelvis.

Yet the road to becoming the gold standard may not be straight. Sheetz et al. caution that increasing the use of robotic surgery for common surgical procedures with limited evidence and unclear clinical benefit is raising concern.[8] They concluded that there is a need to continually monitor the adoption of robotic surgery to ensure that enthusiasm for new technology does not outpace the evidence needed to use it in the most effective clinical contexts. In South Africa, we must take cognisance of these comments and that the only way to prove benefit is to monitor the key metrics, including the cost for the efficacy of each robotic procedure performed. This has been done to some degree in the South African private sector, where de Jager et al. demonstrated that the learning curve for RALP on a range of metrics plateaued between 50 and 100 cases and provides a local benchmark to compare and monitor progress in the state sector.[9]

Despite the advanced technology, instrumentation and stable platform, the act of surgery will result in complications. The expansion of robotics into colorectal surgery, where morbidity is a constant threat, has seen the standard range and incidence of morbidity and mortality reported.[10] It must be borne in mind that robotic platforms are a tool in the surgeon's armamentarium and may not change the potential of life-threatening outcomes, which are key safety metrics.

We believe the philosophy of training institutions in South Africa is to have a responsibility to prepare future surgeons for the evolving landscape of surgery. Thus we consider the introduction of robotic surgery training in South African institutions can empower surgeons with the skills and knowledge necessary to navigate the advances in surgical technology. Modern surgical pedagogy demands we implement structured training using simulation trainers and virtual reality (VR) technologies. Realistic and immersive simulations provide surgeons with a safe environment to practice and refine their skills without posing any risk to patients and are well-validated competency-based assessment tools. The current *da Vinci* systems offer simulation training and the unique possibility for hands-on rather than remote telementoring.

To return to the question posed earlier, given the economic constraints on our national health system and the national goal of "Health for All", does robotic surgery have a place in our Academic State Hospitals? We have outlined why we have embarked on this course and feel it is in keeping with the 2015 Lancet Commission on Global Surgery assessment of the tremendous unmet burden of surgical disease and that surgery needs to take priority alongside non-communicable and infectious diseases in international medical efforts.[11] We have a duty to try and take robotic surgery forward in South Africa. We agree with Childers and Maggard-Gibbons that the continued use of the robotic platform in surgery requires demonstrating the superior clinical benefit of these devices while considering the full set of costs.[4] This statement echoes the distributive justice pillar of medical ethics as echoed in the UK's NICE guidelines: "to meet population needs by identifying care that is high quality, good value, and provides the best outcomes for people using health and social care services within the budget available."[12]

In our view, implementing robotic surgery in South African tertiary training institutions is not only a necessity but an opportunity to shape the future of surgical care in the country. As surgeons, our task is not small: we must balance the individual rights of each patient to exceptional care, we must be sure that what we claim as exceptional care is just that, and we cannot turn a blind eye to costs – both financial and environmental. A big ask – yes, but challenges we should try to address

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