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Will Robotic Surgery Become the Gold Standard for Radical Prostatectomy?

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1. The worldwide spread of robotic surgery

The robotic assistance by the da Vinci surgical system (Intuitive Surgical, Sunnyvale, CA) offers to surgeons a sophisticated tool to perform complex laparoscopic surgery. With a global cost of approximatively 1 million euros, the da Vinci robot was developed for the military and sold to private industry. Approximatively 36,600 robotic procedures will be performed this year. In the field of urology, radical prostatectomy (RP) is probably the intervention that offers the most favourable conditions for the development of the robotic approach. The increasing number of patients diagnosed with clinically localised prostate cancer allows the standardisation of this surgical procedure.

In May 2004, it was estimated that 90 da Vinci systems in the United States were regularly used by urologists, with one system added every week. From 2000 to 2004, 5200 robotic RPs had been performed worldwide, making RP the most frequent single surgical procedure performed with robotic assistance. More than 8000 prostate glands were removed robotically in 2005. This procedure accounted for >10% of the 75,000 RPs performed in 2005, according to Intuitive Surgical on its Web site [1].

2. Optimising surgical quality

To justify the introduction of this complex and expensive technology into our medical care system, we must have some good reasons. The first rationale, which is universally admitted, is the enhancement of the ergonomics and the optimisation of vision. The robotic interface provides a three-dimensional visualisation, a 10- to 15-fold magnification, a wrested instrumentation, intuitive finger-controlled movements, and a comfortable seated position for the surgeon. It allows optimal visualisation and precision that facilitate tissue incisions and sutures. The only technical disadvantage when compared to the retropubic radical prostatectomy (RRP) is, for some practitioners, the loss of tactile palpation. A new generation of robots should emerge in coming years. According to Cathelineau et al. [2], future developments should include 5-mm instruments with enhanced articulation, a fourth robotic arm allowing solo surgery or arms installed directly in the roof of the operating room, and new three-channel optical systems allowing a panoramic view.

3. The increasing place of mini-invasive surgery

Robotic-assisted RP (RARP) involves performing a laparoscopic radical prostatectomy (LRP) using a robotic interface. LRP is now widely accepted as feasible procedure [3]. According to most authors, the rates of positive margins for pT2 tumours are similar to those of open surgery. Even though this

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issue remains controversial, it seems that the functional results of LRP are equivalent to those of RRP in terms of urinary continence and sexual function. Regarding perioperative parameters, LRP may be associated with lower blood loss, less postoperative pain, and shorter hospital stays [3]. Nevertheless, even if LRP has several advantages over RRP in the hands of experienced surgeons, it is a technically demanding procedure that requires unique surgical skills [4].

4. Is the learning curve the main problem?

The learning curve of laparoscopy is long, which still discourages some surgeons. The robotic instruments may facilitate suturing and other aspects of laparoscopic surgery and could help to reduce the learning curve of the laparoscopic approach. Reports indicate that proficiency to perform an LRP in 4 h requires 40–60 cases [5,6]. It was also reported that, with no prior laparoscopic experience, just >10 cases were needed to achieve 4-h proficiency to perform LRP with a robotic interface [4]. Then, the initial benefits might be similar to LRP, except that it is more easily learned by surgeons trained in open techniques. For new surgical procedures, the experience of the learning curve is very important. Indeed, the major concern is that a patient could have an adverse outcome due the inexperience of the surgeon. Although the shortened learning curve might be a significant advantage of RARP over LRP, it cannot be easily proven. Hence, there is no accepted standard for either a definition or measurement of the learning curve. Typically, it is a self-declared point at which a surgeon states he or she has become comfortable performing the procedure.

5. What can be learned from literature about RARP?

The review paper by Ficarra et al. [7] contributes greatly to the evaluation of the results of RARP. What we discussed previously was highlighted in their article. The authors observe that RAPR has been widely used in the last 5 yr. They state that the leaning curve is shortened compared to LRP, but some authors hypothesised that up to 250 RARPs were necessary to complete the learning curve. Oncologic results should be considered first, and the technique should be validated based on these criteria. It seems reasonable to assume that RARP will allow better potency and continence recovery. According to most recent comparative analyses, blood loss may be diminished in RALP compared to RRP, but no significant advantage is found in terms of postoperative pain. Concerning the operating time, which includes the installation of the patient and of the robotic system, the standard open procedure provides obviously a major advantage. Although many papers (>70) were included in the review by Ficarra et al., most of the studies were considered as level 4 of evidence, and only three nonrandomised comparative studies were considered as level 3b of evidence. Furthermore, RARP appears to be a feasible procedure, but a hypothetical superiority over RRP remains to be proven by randomised clinical trials with long-term follow-up and using validated methods of assessment.

6. The concern of financial cost

In the field of robotics, the issue of costs is decisive. For RARP to become the standard care for the treatment of clinically localised prostate cancer, the cost will have to be overcome. American and Asian surgeons are rapidly embracing this new technology, and demand from patients is increasing in the United States. According to American surgeons who use the robot, robotic technology might add $1000 to the surgical cost of an RP, for a total cost of about $24,000 for RRP [1]. One can argue that the cost may be reduced due to shorter hospital stay and less pain medication. For European hospitals, the initial investment of 1 million euros is hampering a more rapid spread of this technology. There is some concern that once a hospital invests in such an expensive system, surgeons might feel pressured to use it and steer patients toward surgery over other treatment options such as radiation therapy or brachytherapy. It is also questionable whether RARP will become a technique only for rich people because of the high cost of the procedure.

7. What is the future?

It is likely that the place of robotic surgery will increase in the near future. When most institutions are be able to purchase the da Vinci system, a universal spread will be almost unavoidable. We can assume that the population of patients with localised prostate cancer might shift to RARP as the future standard technique. There are two main reasons to explain that. First, as discussed previously, RARP offers an advantage over LRP because of a shortened learning curve. In the opinion of most urologists, the major inconvenience

of LRP is its long learning curve. Second, because LRP may be superior to RRP in terms of precision, we can assume that RARP will become the preferred surgical option. This raises an interesting question: Will the residents still learn to perform open RP? RRP has its own learning curve also. Being able to perform LARP does not provide the experience necessary to perform RRP. If all the interventions performed in academic institutions are robotically assisted, will the new generation of urologists be able to perform RP without the robot? In the future, will the surgical interventions depend more on the technology than on the surgeons themselves?

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