1. Complications in robotic prostatic surgery

The recognition, report, and analysis of complications remain an essential element of surgical development. As robotic prostatectomy has expanded tremendously in the last few years, there is an important interest in the urologic community in improving the outcomes of this procedure, with avoiding complications and diminishing morbidity as its main objectives. The reporting and description of complications vary greatly among authors. A range of overall complication rates from 4% to 34% and from 1% to 8.8% has been reported for laparoscopic radical prostatectomy (RP). Safety, efficacy, and potential complications of RALP should be clearly known and emphasized in order to improve outcomes. To prevent complications, RALP should be considered in its entirety from patient evaluation to postoperative care, not just the surgery itself. The surgeon remains the first actor, and no place is left for improvisation. Thus, every step of the procedure must be perfectly understood and mastered. One must remember that years of training stand behind these high levels of control and technique.

Conclusions: Prevention and management of complications in RALP require a high level of team expertise. Perfect standardisation of the procedure and the communication of the procedure’s results are mandatory to lowering the incidence of complications and to facilitating its diffusion to the urologic community.
prostatectomy (LRP) and robot-assisted laparoscopic radical prostatectomy (RALP), respectively. Ficarra et al have recently reported that the overall complication rates recorded in the comparative studies evaluating retropubic prostatectomy and RALP were similar in most of the available publications, with a nonstatistically significant trend in favour of RALP being identified after cumulative analysis [1].

Using the Clavien system, several groups have reported their complications in laparoscopic or robot-assisted radical prostatectomy (RP). In our early experience in LRP, Guillonneau et al [2] reported complication rates for grades 1, 2a, 2b, and 3 of 1.95%, 10.52%, 5.67%, and 0.17%, respectively; Gonzalgo et al [3]. reported complication rates of 8.1%, 1.2%, 3.7%, and 0.8% for grades 2, 3a, 3b, and 4a, respectively. Stolzenburg et al [4] reported on 900 patients who underwent LRP, showing complication rates of 4.6%, 2%, 6.2%, and 0.3% for grades 1, 2, 3, and 4a, respectively. Regarding RALP, Kaul et al [5], in 154 patients, reported complication rates of 2.5%, 5%, 0.6%, and 2% for grades 1d, 1, 2b, and 3a, respectively. Bhandari et al [6], in a study with 300 patients, recorded 3.7% and 2% for grade 1 and grade 2 complications, respectively.

John et al reported on 210 cases of RALP performed (second half of their series) and compared their results with a retrospective Medline-based meta-analysis of 4928 patients from 8 centers. Overall, 55 of 210 patients (26%) had complications, of which 48 of 55 (87%) were minor (Clavien grade 1–3a). Major complications (grades 3b and 4a) with open reoperations occurred in 7 of 210 patients (3%). John and colleagues state that the robotic complication rate is low and seemed to be even lower than in open series [7]. Novara et al [8], applying standardised criteria (Memorial Sloan–Kettering Cancer Center), identified early complications in about 22% of patients undergoing RALP. In their series, 3% of patients did experience grade 3 or 4 complications.

As we all know, to accomplish a categorical 0 in surgery-related complications, we would probably have to stop doing surgery. For that reason, the aim is to reduce complications to their lowest possible levels. The experience gathered up to now should allow us to provide a list of precautions that would benefit the outcomes of RALP in the future.

2. Definition of complications

First, we need to speak the same language; similarly, defining the events we are going to measure is of great importance. We must have a clear idea that complications can be reduced even before the surgery is performed, comprehensively analysing all interacting variables in RP. Furthermore, we have to keep in mind that the outcomes of RP could be assumed as clear complications in terms of functionality.

The report of complications in surgical literature seems to be a pending issue. Martin et al performed an analysis of articles reporting short-term outcomes after pancreactectomy, oesophagectomy, and hepatectomy, including randomised clinical trials published from 1975 to 2001 and retrospective series of >100 patients published from 1990 to 2001. They deploy 10 criteria to evaluate publications: (1) the method of accruing data (prospective or retrospective); (2) the duration of outpatient information (ie, the time period of the postoperative accrual of complications); (3) definitions of complications; (4) mortality rate and causes of death; (5) morbidity rate; (6) total complications (ie, the number of patients with any complication and the total number of complications); (7) procedure-specific complications; (8) the severity grade utilised; (9) length-of-stay data; and (10) risk factors.

A total of 119 articles reporting outcomes in 22 530 patients were analysed. Surprisingly, no articles met all criteria. Only 2% of the information verified met nine criteria [9]. In the urologic oncology literature, Donat also verified the disparity in the quality of surgical complication reporting, with 87% of studies accruing data retrospectively, and only 66% reporting on a minimum of 5 of 10 critical surgical reporting criteria established in the surgical literature. The criteria least commonly met were the failure to include complication definitions (78%), complication severity or grade (67%), outpatient data (63%), patient risk factor stratification (59%), and the duration of the complication period (56%) [10].

More recently, Rabbani et al [11] have applied the Martin et al [8] criteria to evaluate the incidence, severity, and timing of onset of medical and surgical complications of 4592 patients operated on using open RP and LPR between 1999 and 2007 in a tertiary referral center. They verified 612 medical complications in 467 patients (10.2%) and 1426 surgical complications in 925 patients (20.1%). The laparoscopic approach was associated with a higher incidence of any grade of medical and surgical complications but a lower incidence of major surgical complications than RP. This timely publication emphasises the idea of objective standardised reporting as a way to verify the real picture of complications and their impact on cancer treatment.

The complications for any form of RP include intraoperative events such as haemorrhage; obturator nerve, rectal, and ureteral injuries; and postoperative complications such as the risk of delayed bleeding, incontinence, and erectile dysfunction (ED). As cancer control remains the first objective of the trifecta, we should think that adjuvant oncologic treatment after RP is to be regarded as a complication.

If we look at the classification of complications proposed by Stephenson et al [12], we can see that the interventions we perform to treat problems of potency or continence after RP can be perfectly included in the different grades presented: phosphodiesterase 5 inhibitors for ED equals grade 1 (oral medication or bedside care); intracavernous therapy for ED equals grade 2 (intravenous therapy); and penile prosthesis and sphincter placement equal grade 3 (intubation, interventional radiology, endoscopy, or reoperation).

Then, we need to look at complications as a network of events having a defined impact on outcomes. Robotic prostatectomy has been received in our community with
great enthusiasm, and the work of Constantinides et al [13] shows that in a comparison of complications in laparoscopic, open, and robotic prostatectomy, complications seem to be fewer and with lower grades for RALP. Comparison remains a controversial issue in RP, and whether we use one classification or another (Clavien [14] or Stephenson et al [12]), the idea is to keep objectively evaluating our procedures.

2.1. Are we comparing apples with apples?

An interesting publication by Hu et al [15] states that complications are lower for what they called minimally invasive radical prostatectomy (MIRP) but with the expensive price of exposing patients treated with MIRP to a higher probability of salvage therapy. Two comments should be emphasised in the setting of this study.

First, laparoscopic and robotic prostatectomies are not the same. We would agree that the objectives of trifecta remain the same, but perhaps the augmented range of movement and tridimensional vision have an impact on outcomes for these patients. We pioneered a laparoscopic approach in Montsouris in 1998, and then RALP in 2001. Waiting for objective comparative results between LRP and RALP, we have been very cautious towards robotic prostatectomy at our institution, even if we were convinced of the real potential of the technology. Our early comparison of perioperative outcomes between LRP and RALP showed that in an experienced team, the techniques were equivalent [16]. Today, we can see that our results are shifting towards the robotic interface in terms of both cancer control (a decrease in the rate of positive surgical margins [PSM]) and functionality (self-questionnaire evaluation). Again, we are more experienced today, which certainly has an influence on outcomes, but the robot definitively contributes. We are in the process of reporting our latest result with RALP.

Second, the manuscript by Hu et al [15] was developed over the analysis of a limited population of patients (2702 men who underwent RP from 2003 to 2005 from a national sample representing 5% of Medicare beneficiaries). These prostatectomies were not necessarily performed by the referent surgeons of this technique.

More recently, Hu et al reported on a population-based observational cohort study using the US National Cancer Institute Surveillance Epidemiology and End Results Program data from 2003 through 2007 [17]. They compared MIRP and radical retropubic prostatectomy in terms of postoperative 30-d complications, anastomotic stricture, long-term incontinence, ED, and the postoperative need for adjuvant cancer therapies, concentrating on high-volume surgeons. The report showed no difference in additional cancer therapy between robotic MIRP and open RP, but this time, their results in terms of additional cancer therapies were comparable for both techniques. There were fewer complications for minimally invasive surgery, with a significantly increased risk of incontinence and ED with MIRP. Again, a restricted view of the real situation of RP in the United States is a limitation of this study.

3. Robot-assisted laparoscopic prostatectomy: a multivariable event

The evaluation and planning of any form of RP should be performed in a minutely precise manner in which all elements should be incorporated into the analysis (the patient, the surgeon, and the technique). The robotic interface brings a great deal of new detail into an already crowded arena.

3.1. The patient

Patient and approach selection are essential. There are no specific indications for RALP compared to open or laparoscopic RP. The patient should be carefully evaluated to define potential risk associated with comorbidities, body mass index, specific features of the disease, previous treatments (eg, transurethral resection of the prostate, androgen deprivation, radiation therapy). In RALP, special attention should be paid to the possible effects of pneumoperitoneum and severe cardiopulmonary disease, which remain contraindications for both LRP and RALP. The particularisation of every case would benefit outcomes, and as we have previously stated, complications can be reduced when evaluating the indications for RALP. Elements such as being overweight and previous surgical history have recently been evaluated as factors that could affect outcomes, and they should be emphasised especially at the beginning of an experience with RALP. Obesity affects operative and postoperative outcomes (complications and trifecta) and is associated with higher-grade tumours and a higher rate of PSM [18]. Previous abdominal or inguinal surgery does not increase the risk of complications in RALP.

3.2. The surgeon

It does not matter how advance and effective the technology might be, there is always a person “behind the wheel,” and the final results depend on his or her performance. The surgeon needs to know the disease and understand its variations; at the same time, in terms of technique, training is mandatory and surgical volume essential to accomplishing a learning curve in any operation. The example speaks by itself: The magnificent Ferrari automobile is just a machine without a champion driver behind the wheel. The German Formula 1 driver and seven-time Formula 1 world drivers’ champion Michael Schumacher accomplished his successful career not only with Ferrari but also with other Formula 1 teams. The message: The technique of surgery depends on the surgeon. As sufficient training and competence are mandatory, proctoring is an essential mechanism for assuring safe and effective outcomes with RALP [19].

3.3. The surgical team’s training

Sufficient technical preparation and training are mandatory not only for the surgeon but for the whole surgical team. Standardisation of the whole procedure adds security for
the patient. Clear and loud communication must be maintained between the console surgeon and his or her assistant.

3.3.1. Checklist and maintenance
Complications can be only avoided by minutely precise prevention. In RALP, as in any surgery, the formal application of a checklist plays an important role in the procedure [20]. The robot works like an airplane, which must be adequately maintained and verified before every flight. Adequate installation of every component is essential.

3.3.2. Trocar positioning
RALP inherited from classic laparoscopy the minimal access philosophy. Formal knowledge of anatomic landmarks and potential complications at this point of the procedure are of the utmost importance. Trocar positioning should be customised for every patient in order to facilitate the procedure.

3.3.3. Robot docking
Verification of the ideal positioning of the chart and convenient docking of the arms is essential, keeping in mind the internal position of the trocars and the minimum mandatory space between instruments. Maintain bipolar and monopolar installation in the corresponding instruments. The robot can be safely undocked when the trocars are totally unscrewed before pulling the interface.

3.3.4. Instrument insertion
The first insertion of the instruments is not intuitive and must be visually controlled in order to avoid visceral or vascular lesions. With each touch of the button in the robotic arms, the position changes; therefore, the chance of complications should be emphasised to the surgical team. Trocar mobilisation or extraction should be performed under direct vision at all times.

3.3.5. Learning curve
Solid training is the cornerstone of success for the surgeon; today, several options are available for becoming trained in robotic prostatectomy. Urologists who are proficient in laparoscopic RP will still have a learning curve when first performing RALP. In our initial experience, a total of 293 consecutive men underwent RALP between May 2000 and November 2006. Operative time showed a statistically significant decrease at two different breakpoints: after the first 12 cases and after 189 cases, dividing the patients into 3 groups. Operative times were 242 ± 64 min, 165 ± 43 min, and 134 ± 45 min, respectively, for each group. We also evaluated margin status in the three groups. The PSM rate in each group was 7 of 12 (58%), 41 of 180 (23%), and 10 of 89 (9%), which was statistically significant [21].

Improvement continues in operative and pathologic parameters with regard to operative duration and PSM rate as experience grows. The deployment of the robot has reduced the learning curve as a result of the endowrist technology, three-dimensional vision, and magnification, but there is still a need for solid evidence to back up the analysis on the learning curve. Completing the procedure or being able to perform it does not necessarily mean that the procedure is done well.

Vickers et al in their timely publication assessing surgical learning curve for prostate cancer (PCa) control [22] found statistical significance related to surgeon experience and cancer control after RP. This study brings back to earth the concept of learning curves and reflects a real link between surgical technique and cancer control. This analysis verified a dramatic improvement in cancer control with increasing surgeon experience. Prior to the 250 previously treated cases reported by Tooher et al [23], the laparoscopic learning curve had only been addressed in a limited number of studies. The need for surgical expertise also applies to RALP in order to reach the same level of performance. This learning curve for robotic MIRP has been estimated at 100–250 patients [24,25].

4. Robot-assisted laparoscopic prostatectomy
features that reduce potential functional complication of radical prostatectomy

To optimise nerve-sparing techniques, the surgeon confronts the dilemma: margins versus potency. On which side of the fascia should one stand? Even with all the improvements made since Walsh’s first operation >25 yr ago, RP remains a challenging procedure with a steep learning curve and two objectives that are contradictory [26]. The idea is to obtain reliable cancer control, which means avoidance of PSM while preserving functionality as much as possible in terms of continence and potency. To accomplish these objectives, we believe that the interfascial plane would be the elected plane for comprehensive nerve sparing in order to be oncologically safe while preserving functionality. One should avoid intensive manipulation or haemostasis over the sphincter or the bundles. The robotic features are rather strong, but only precise and delicate manoeuvres should be performed [27].

The big picture is that tension and energy-free surgical manoeuvres are perhaps the keys to every procedure. Suturing should take advantage of the endowrist technology to improve anastomosis reconstruction. Different means to improve continence can be deployed, including the concept of urethral suspension, which has recently been proposed by Patel et al and that we consider useful for continence [28].

5. Future endeavours
Obviously, today we are at the threshold of robotic surgery. This technology would be incorporated into the different aspects of surgical treatment to improve our performance and, subsequently, our results. The same technology allows for training and clinical application, which surely improves the path to follow.

Robotic surgery inherits years of work and effort. We should be able to recognise that this is not a novel
procedure but rather the same operation with the same objectives, highly refined because of strict evaluation of results and comprehensive analysis of its possible impact on the lifestyle of patients. The incorporation of new devices such as robots into surgical practice requires that surgeons acquire and master new skills. Like any new technology, robotic surgery demands dedication to achieve expertise.

We still need to be cautious regarding patient expectations, because when surrounded by rather impressive robotic paraphernalia, the hopes you set are high and patients are likely to feel less satisfied. Schroek et al in a study with 400 patients demonstrated that open prostatectomy patients were 4.4 times more likely to be satisfied with the operation. In contrast, RALP patients were shown to be three times more likely to hold regrets about their treatment [29]. With higher expectations related to marketing effect and promotion of innovation, there is a greater risk of dissatisfaction. So, even with a high level of technology, we need an expert team behind the wheel and an objective evaluation of outcomes.

6. Conclusions

Prevention and management of complications in RALP requires a high level of team expertise. Perfect standardisation of procedure and communication of the procedure's results are mandatory to lowering the incidence of complications and facilitate the procedure's diffusion to the urologic community. Evidence of robotic contribution to surgery is undeniable, and future improvements combining imaging is the gift all surgeons are expecting to further contribute to the lives of our patients.

Conflicts of interest

The authors have nothing to disclose.

Funding support

None.

References

