

# LAPAROSCOPIC RADICAL PROSTATECTOMY

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## ABSTRACT

**Purpose:** After the pioneering period when only few teams were performing the procedure, the laparoscopic approach to radical prostatectomy has become widespread with several technical variations. A comprehensive review of the published literature on laparoscopic radical prostatectomy was performed to determine the current state of the art of this surgical innovation in terms of perioperative parameters, functional results and cancer control.

**Materials and Methods:** English language, peer reviewed articles published before June 2004 concerning laparoscopic radical prostatectomy were found by MEDLINE query. All articles were analyzed and none were a priori excluded. Conclusions were drawn from series of 50 or more patients.

**Results:** Laparoscopic radical prostatectomy is being performed at multiple centers worldwide using various surgical approaches and technologies. Analysis of perioperative parameters, including surgical blood loss, operative time, complications and convalescence, demonstrated low morbidity and showed a clear trend toward improvement with increased experience. The reported positive surgical margin rates were lower in more recent series. As measured by prostate specific antigen recurrence and disease-free intervals, oncological results and cancer control rates are difficult to ascertain in the immature series published to date. Functional results in terms of postoperative urinary and sexual function appear encouraging.

**Conclusions:** Overall the current operative, oncological and functional results of laparoscopic radical prostatectomy appear to approximate those of open radical retropubic prostatectomy. These results justify the considerable interest of the urological community in laparoscopy, as evidenced by its widespread application. Nevertheless, longer followup and more mature data are needed definitively to establish laparoscopic radical prostatectomy as an alternative to the retropubic approach.

**KEY WORDS:** prostate, prostatectomy, prostatic neoplasms, laparoscopy, robotics

## HISTORY

The first laparoscopic radical prostatectomy (LRP) was performed in 1997 by Schuessler et al.<sup>1</sup> Since then, LRP has been reported widely and it has become increasingly important as a prostate cancer treatment. Two large early series originated in France<sup>2–4</sup> and LRP has since been described in large series (greater than 50 cases) from Germany,<sup>5,6</sup> Belgium,<sup>7</sup> Japan,<sup>8</sup> the United Kingdom,<sup>9</sup> the United States<sup>10,11</sup> and Italy.<sup>12</sup> Cumulatively well over 3000 procedures have been published worldwide using various techniques, surgical approaches, and surgical and robotic instruments. The evolution of LRP, surgical nuances and functional results are reviewed.

## THEORETICAL ADVANTAGES

The major impetus driving the development of minimally invasive techniques for prostate cancer has been patient satisfaction and quality of life (QOL). Shorter convalescence with a more rapid return to normal activity and shorter Foley catheter duration are attractive goals to be achieved by LRP. Cosmetic results, which are a common benefit of minimally invasive procedures in general, may be less of a concern in the generally older male population with prostate cancer.

Additional potential benefits of LRP are decreased blood loss and magnification of the operative field. Most operative bleeding during radical prostatectomy is venous, which CO<sub>2</sub>

insufflation theoretically tamponades by increased intra-abdominal pressure. The 10× to 15× magnification afforded by laparoscopy also allows more precise visualization of intraoperative details, which is particularly valuable for creating the vesicourethral anastomosis. The anastomosis, which is fashioned with a running suture or 8 to 12 interrupted sutures, is generally watertight immediately, allowing rapid removal of the Foley catheter.

An area of concern with LRP is the lack of tactile sensation normally available during open prostatectomy. Tactile sensation has been advocated as a useful aid for the assessment of induration and palpable nodules, and delineation of the proximity or involvement of the neurovascular bundles by cancer. These concerns are balanced by the improved vision under magnification afforded by laparoscopy.

## TECHNIQUE

*Evolution of techniques.* The initial report of LRP by Schuessler et al was of 9 cases performed through an intraperitoneal approach in antegrade fashion.<sup>1</sup> Average operative time was 9.4 hours and there were 3 complications, namely cholecystitis, thrombophlebitis associated with pulmonary embolism and small bowel hernia into a trocar site. Therefore, the experience was not conclusive and the group stated that, although laparoscopic radical prostatectomy was feasible, this approach offered no advantage over open surgery with regard to tumor removal, continence, potency, length of stay, convalescence and cosmetic result. Shortly thereafter a single case of laparoscopic radical prostatectomy through an extraperitoneal approach was reported.<sup>13</sup> However, the largest initial series originated in

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France at Montsouris Institute in Paris and then at Henri Mondor Hospital in Créteil<sup>2-4, 14-18</sup> with different conclusions. Retrospectively it appears that the French experiences were more successful because they involved a technique that mimicked more closely the retroperitoneal approach commonly used in open radical retroperitoneal prostatectomy (RRP). Particularly control of the prostatic pedicles was performed in the space of Retzius, not through the posterior approach through the pouch of Douglas. Additionally, the intracorporeal suturing technique was mastered and used efficiently to allow more accurate control of the dorsal venous complex (DVC) and creation of the vesicourethral anastomosis. More recently LRP using robotic assistance was described.<sup>19, 20</sup>

**Intraperitoneal:** According to the Montsouris technique, which was described after the report of Schuessler et al,<sup>1</sup> the seminal vesicles are dissected first through the pouch of Douglas and the bladder is then dissected off of the anterior abdominal wall, allowing access to the space of Retzius.<sup>14</sup> The endopelvic fascia is incised, exposing the lateral margins of the DVC distal and allowing placement of a suture ligature around the DVC for hemostasis. The bladder neck is incised and the previously dissected seminal vesicles are exposed. In select patients neurovascular bundle preservation is then performed from the base toward the apex, starting at the lateral pedicle of the prostate. Finally, the urethra is transected and urethrovesical anastomosis is performed.

**Extraperitoneal:** The intraperitoneal approach to LRP has been criticized as creating the potential for several different complications. A risk of the intraperitoneal technique is unrecognized bowel injury away from the visual field. Intraperitoneal urine leakage or hematoma formation perioperatively with subsequent bowel dysfunction or ileus and delayed intra-abdominal adhesion formation have also been cited as potential negatives. These concerns led investigators to develop extraperitoneal (EP) approaches to LRP.<sup>7</sup> Subsequent reports from Belgium<sup>7</sup> and then from Germany<sup>21-23</sup> demonstrated the feasibility of extraperitoneal approaches. At these 2 centers groups use an antegrade approach, starting at the bladder neck, dissecting the seminal vesicles and vasa deferentia through the bladder, and proceeding distal toward the prostate apex and dorsal venous complex. Besides the theoretical advantages noted the groups suggested that operating in the space of Retzius is more familiar to urologists experienced with open retroperitoneal prostatectomy, which may improve the learning curve. The potential disadvantages of this approach are a more limited working space and less bladder mobilization, which can make the urethrovesical anastomosis more difficult and may place the anastomosis under increased tension. Finally, dissection of the seminal vesicles could be more difficult, theoretically leading to unrecognized trauma to the inferior hypogastric plexus and neurovascular bundles with functional consequences.

**Transperitoneal (TP) and extraperitoneal LRP** were first analyzed by Hoznek et al.<sup>24</sup> In this retrospective study the last 20 patients operated on through a transperitoneal LRP were compared with the first 20 undergoing extraperitoneal LRP. Operative time for extraperitoneal LRP was significantly shorter and resumption of a regular diet was significantly more rapid. The duration of catheterization and positive margin rates were similar in the 2 groups. However, more recently a retrospective study analyzing 100 consecutive extraperitoneal LRPs and 100 consecutive transperitoneal LRPs at Montsouris Institute showed no significant differences in operative, postoperative or pathological parameters between the 2 approaches, but rather highlighted the importance of individual surgeon training and experience for determining the optimal technique to use.<sup>25</sup> Another retrospective study from Créteil examined the outcomes in 165 first patients operated on transperitoneally and then 165 operated on extraperitoneally.<sup>26</sup> There were no differences in complication, convalescence or positive margin rates but there was a slightly shorter mean operative time in the extraperito-

neal cohort, which could be explained by the learning curve and greater experience. There was also significantly higher blood loss and catheter duration in the extraperitoneal LRP cohort, of which the explanation is not easily attributable except for experience. Therefore, it would be reasonable to consider a history of abdominal surgery, prostate size and the intent to spare the neurovascular bundles to select the appropriate approach in a given patient.

**Robotic:** The use of robotics in laparoscopy has been spurred by the commercial availability of master-slave robotic devices such as the daVinci surgical robot (Intuitive Surgical, Mountain View, California). The operating surgeon sits at a computer console separate from the operative field.<sup>27</sup> The computer software damps the degree of movement by the operator, resulting in motion of the laparoscopic instruments that are further articulated, which afford extra planes of motion.<sup>20, 28-31</sup> Despite the lack of haptic feedback provided, it has been suggested that this combination of factors could lessen learning time and allow novice laparoscopists to complete these procedures.<sup>32</sup> Use of the da Vinci robotic system has been reported with the transperitoneal and extraperitoneal approaches.<sup>33, 34</sup> Analysis of the results of robotic LRP are often difficult to interpret since they are often dominated by the enthusiasm of the investigators rather than supported by data. Regarding radical prostatectomy, to our knowledge there are no data supporting a potential benefit in terms of cancer control or functional results of the laparoscopic approach with or without robotic assistance. The decrease in the learning curve with robotic assistance is equivocal and not convincing from an oncological point of view. Finally, most advantages (pain, blood loss and recovery time) are related to laparoscopy per se rather than to the assistance of a computer. The instruments are not yet comparable in term of quality with those used in laparoscopic surgery. Most groups authors described an important use of the hook with monopolar electric current, which has significant thermal and electrical spread, and can cause injury to adjacent structures, such as the neurovascular bundles.

Finally, the cost of the use of robotic devices in prostate surgery is critical.<sup>35</sup> Besides extra time for the preparation and set-up necessary to use the master-slave robot, the system requires a tremendous capital investment (purchase and maintenance) and functional cost since the laparoscopic instruments used by the master-slave robot have pre-programmed senescence, requiring new instruments after a defined number of procedures.

**Learning Curve:** LRP is generally thought of as a technically demanding laparoscopic procedure with an extended learning curve. LRP can be learned during residency or fellowship training and other formats have been explored for the practicing urologist. Training laboratories with laparoscopic skills trainers and ex vivo models of the urethrovesical anastomosis have enabled urologists to improve their skills in a short period.<sup>36</sup> On site mentoring by experienced laparoscopists has created successful LRP programs in the United States of America.<sup>34, 37</sup>

The question of the learning curve is relatively recent in the surgical field and it has certainly been scrutinized widely for the laparoscopic techniques. The minimum number of cases required for proficiency in LRP has been debated and there is no more accurate answer for laparoscopy than there is for the open retroperitoneal approach. There is clear evidence that there is continued improvement in operative parameters, such as operative time, blood loss and the need for open conversion, even after the initial 50 operations.<sup>15</sup> Subsequent reports from Montsouris demonstrated continued improvement in operative time even after 300 cases.<sup>38</sup> There is not yet a consensus of what proficiency should be required before performing LRP independently and how safely this level can be achieved by a junior surgeon. Therefore, there is a clear lack of information regarding this topic but certainly de-

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