SURGICAL TECHNIQUE

Comparative study between laparoscopic extraperitoneal and open adenomectomy☆

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Received 1 July 2011; accepted 29 September 2011

KEYWORDS
Laparoscopic adenomectomy; Simple laparoscopic prostatectomy; Benign prostatic hyperplasia

Abstract
Objectives: In spite of the development of endoscopic techniques, open adenomectomy continues to be the treatment of choice for large adenomas. Laparoscopic and robotic adenomectomies provide good results in specialized centers.

The experience acquired with laparoscopic extraperitoneal adenomectomy (LEA) in a regional center is presented to evaluate its results and compare them prospectively with the results of open surgery.

Patients and methods: 46 patients with benign prostatic hyperplasia (BPH) (prostate >80 g) and an indication for surgery were evaluated. The first 11 patients underwent LEA and were not included in the comparison. Thereafter, the cases were compared; 17 patients underwent LEA and 18, open surgery. In the extraperitoneal technique with 4 trocars, enucleation was performed with an ultrasonic scalpel.

Results: There were no significant differences between groups in age, prostate volume, uroflow (Q\text{max}), International Prostate Symptom Score (IPSS), and Quality of Life scale (QoLs). The operation time was significantly greater in the LEA group (135.2 min vs. 101.2 min, \( p = 0.022 \)). Intraoperative bleeding (250 ml vs. 493.3 ml, \( p = 0.004 \)), irrigation time (22.2 h vs. 39.1 h, \( p = 0.038 \)), catheter indwelling time (5.5 days vs. 7.5 days, \( p = 0.030 \)), hospital stay (3.7 days vs. 6.6 days, \( p = 0.006 \)) and transfusion rate (0% vs. 22.2%) were significantly lower in the laparoscopy group. There was a greater incidence of hemorrhagic and surgical wound complications in the open surgery group.

Conclusions: LEA is a relatively complex technique that requires laparoscopic skills, but it is a feasible and safe alternative to open surgery and has several advantages.

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Introduction

Retropubic adenomectomy (RA), described by Terrence Millin in 1945, is indicated for the surgical management of benign prostate hyperplasia (BPH) in large adenomas. Despite the development of minimally invasive techniques, such as transurethral resection of the prostate (TURP) with bipolar resectoscope or Holmium laser enucleation, the RA remains the treatment of choice for adenomas greater than 80 g, and it is still performed routinely. The Holmium laser enucleation of the prostate obtains results equivalent to open surgery with lower morbidity. However, at the present time, the availability of laser equipment in public and regional hospitals is limited due to its costs, so its use is not widespread. In parallel, technological and operation advances in the TURP techniques have expanded its indication in large prostate; however, this has also led to an inevitable increase of incomplete resections and reinterceptions.

Mariano et al. performed the first laparoscopic adenomectomy (LA) in 2002. This procedure reproduced the surgical steps of RA, allowing for complete removal of the adenoma combined with the benefits of laparoscopic surgery. Several variants of the technique have reported satisfactory results, both laparoscopically, with robotic assistance, or through single-port access. However, the publications of large series and comparative studies between LA and open surgery are scarce.

We present the experience at our institutions with laparoscopic extraperitoneal adenomectomy (LEA) in order to evaluate its results prospectively comparing them with conventional open surgery.

Patients and methods

Following the acquisition of experience in laparoscopy in Urology, we decided to develop the LEA in our hospital. We designed a prospective comparative study between patients with BPH undergoing open surgery and others undergoing laparoscopic surgery.

Between October 2009 and April 2011, there was a total of 46 patients with prostate adenomas ≥80 cc and with indication for surgical treatment. The first 11 patients underwent LEA, and they were arbitrarily excluded from the comparative study, as they were considered as a period of learning and development of the technique. The following cases were included in the analysis, a total of 17 patients who underwent LEA, and 18 who underwent RA.

The indications for surgery in patients with BPH are well established: symptomatic patients refractory to medical treatment, and/or with presence of complications such as repeated urinary infections, refractory urinary retention, refractory gross hematuria, bladder lithiasis, and kidney failure caused by BPH. The study did not require ethics committee approval because they are already established and tested procedures. Informed consent was obtained in all the patients, and medical history and physical examination were performed. The clinical evaluation included: (a) the International Prostate Symptoms Score (IPSS); (b) the Quality of Life score (QoLs); and laboratory: total and free PSA, hemoglobin,
extraperitoneal

![Image](image.png)

**Figure 1** Placement of 4 trocars.

hematocrit, serum creatinine; (d) measurement of prostate volume by pelvic or transrectal ultrasound; (e) uroflowmetry ($Q_{\text{max}}$); (f) measurement of post-voiding residual volume by pelvic ultrasound; (g) urethrocytostomy, held only in selected cases for evaluation of comorbidities.

The demographic data and perioperative and follow-up parameters were recorded and analyzed. At the first postoperative month, IPPS, QoLs, and $Q_{\text{max}}$ were performed again. The data were analyzed by Student’s “t” test with the Stata v.10.1 program (Statcorp, Texas, U.S.A.). A value of $p < 0.05$ was considered statistically significant.

**Laparoscopic surgical technique**

Many steps of the surgical technique we use have been previously described. Extraperitoneal approach starts with a 1.5-cm subumbilical incision, and the space of Retzius is dissected with a distension balloon trocar (Autosuture PDB 1000°/Tyco Healthcare UK Ltd., Gosport, UK). 4 ports are placed. The first 10-mm trocar with gas sealing balloon (Blunt Tip Trocar°Autosuture/Tyco Healthcare UK Ltd., Gosport, UK) located at the subumbilical level for insertion of the laparoscope; two trocars for the main surgeon located bilaterally along the pararectal line and flow from the navel, the right of 5 mm, and the left of 10 mm. A fourth 5-mm trocar was located inside the right anterior superior iliac spine (Fig. 1).

A transverse incision is made at the vesico-prostatic junction up to exposure of the adenoma without need for placing hemostatic sutures, since with the ultrasonic scalpel (Ultracision° – Ethicon – Johnson & Johnson), satisfactory hemostasis is obtained. In some cases, where improvement of the exposure was required, the incision was extended in the form of inverted “T” on the prostatic capsule. Immediately afterwards, a transverse incision on the bladder neck is performed to begin the development of the plane of dissection. The surgeon holds the adenoma and with antisense traction on the gland and the edges of the capsule, the planes of dissection are exposed on the different sides of the prostate to release it. Bringing the laparoscope closer, we can accurately identify the cleavage plane between the adenoma and the cell. The adenoma enucleation is performed almost entirely with the ultrasonic scalpel. It is introduced transurethrally by a metal spark plug (Beniqué) to identify the urethra at the apex, and section it under vision (Fig. 2A and B). Once the extraction of the adenoma is completed, hemostasis of the prostate bed is verified using the ultrasonic scalpel on bleeding areas or subcapsular sutures are placed. The trigonization of the bladder mucosa is performed by two or three simple Monocryl° 2.0 UR-6 2.0 suture points in order to approximate the bladder neck into the posterior lip of the urethra or to the prostate.
cell (Fig. 3). A 3-way Foley bladder catheter 22 Fr is introduced transurethrally. The prostatic capsule and bladder are closed by a continuous suture line in the longitudinal direction. The tightness of the raffia is verified by instillation of 120 ml of solution in the bladder. Finally, the surgical piece is introduced into an endo-bag, morcellated, and removed through the subumbilical incision. A Jackson-Prat drainage is left.

**Results**

A total of 6 patients in each group had permanent catheter due to acute urinary retention at the time of the operation. Of the concomitant interventions during prostate surgery, inguinal hernioplasty was carried out jointly in two patients in the RA group, and three in the laparoscopic group; two patients in each group underwent cystolithotomy as well. The results are presented in Table 1.

In the comparison of the demographic data, clinical, perioperative, and follow-up parameters between the two groups of patients there was no difference in terms of age, prostate volume by ultrasound, pre- and postoperative IPSS score, pre- and postoperative QoLs score, and weight of the specimen. The improvement in postoperative Qmax values was evident in both groups, but it was higher in the open surgery (Qmax: 24.4 ml/s vs. 19.7 ml/s; p = 0.016).

The operative time was significantly longer in the laparoscopy group (135.29 min vs. 101.2 min; p = 0.022). The rest of the perioperative parameters are shorter in the laparoscopic group, obtaining significant differences between the following variables: (a) intraoperative bleeding (250 ml vs. 493.3 ml; p = 0.004); (b) irrigation time (22.2 h vs. 39.1 h; p = 0.038); (c) catheterization time (5.5 days vs. 7.5 days; p = 0.030); (d) hospital stay (3.7 days vs. 6.6 days; p = 0.006). One patient in the laparoscopy group required no irrigation.

There were differences in complications between the two groups; that of open surgery had a higher incidence of complications related to the abdominal wall (wall abscess in two patients, and operative wound seroma in other two), whereas the laparoscopy patients did not show this complication. Intraoperative bleeding was more frequent in the open surgery group, with 4 patients (22.2%) requiring transfusion, while in the laparoscopy group, there was no need for blood derivates. Serious medical complications were rare in both groups; in the RA, one patient had a myocardial infarction that required placement of coronary stents, and another one had gross hematuria after catheter removal, which resolved with new probing and irrigation. In the LA group, one patient had an acute pulmonary edema which improved with medical treatment, and another one developed a urinary fistula that resolved with the probe held for 9 days. The urinary tract infection occurred in one patient in each group. There was no conversion to open surgery.

**Discussion**

Despite the favorable results reported in the LA series, it has not achieved the impact that laparoscopic radical prostatectomy (LRP) achieved, because its technical difficulties have not been justified over its benefits. The RA is a simple and well-established procedure, with good results and acceptable morbidity, so it is difficult to compare it. However, in the scientific literature, LA and robot-assisted series have continued to appear mainly in centers specialized in laparoscopy and robotics.4,5,7,16-21 The American Urological

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**Table 1 Clinical, perioperative, and follow-up parameters.**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Laparoscopy group</th>
<th>Open group</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong> (Average: Range)</td>
<td>68.1: 54-82</td>
<td>72.6: 58-79</td>
<td>0.234</td>
</tr>
<tr>
<td><strong>Prostate size</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ultrasound volume (ml)</td>
<td>95.0: 60-135</td>
<td>114.7: 78-196</td>
<td>0.104</td>
</tr>
<tr>
<td>Weight of the specimen (g)</td>
<td>72.7: 50-101</td>
<td>82.2: 21-131</td>
<td>0.250</td>
</tr>
<tr>
<td><strong>IPSS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preoperative</td>
<td>25.8: 15-35</td>
<td>24.7: 10-35</td>
<td>0.753</td>
</tr>
<tr>
<td>Postoperative</td>
<td>6.3: 2-14</td>
<td>6.8: 2-13</td>
<td>0.774</td>
</tr>
<tr>
<td><strong>QoLs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preoperative</td>
<td>5.4: 3-6</td>
<td>5.3: 4-6</td>
<td>0.794</td>
</tr>
<tr>
<td>Postoperative</td>
<td>0.8: 0-2</td>
<td>1.0: 0-5</td>
<td>0.658</td>
</tr>
<tr>
<td><strong>Qmax</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preoperative</td>
<td>9.3: 5.1-12.9</td>
<td>5.9: 2.3-10.2</td>
<td>0.074</td>
</tr>
<tr>
<td>Postoperative</td>
<td>19.7: 14.6-28.5</td>
<td>24.4: 17.5-37</td>
<td>0.016</td>
</tr>
<tr>
<td><strong>Operative time (min)</strong></td>
<td>135.2: 90-210</td>
<td>101.2: 70-150</td>
<td>0.022</td>
</tr>
<tr>
<td><strong>Bleeding (ml)</strong></td>
<td>250: 100-700</td>
<td>493.3: 250-1,200</td>
<td>0.004</td>
</tr>
<tr>
<td><strong>Irrigation time (h)</strong></td>
<td>22.2: 0-36</td>
<td>39.1: 24-144</td>
<td>0.038</td>
</tr>
<tr>
<td><strong>Catheterization time (days)</strong></td>
<td>5.52: 4-9</td>
<td>7.5: 4-20</td>
<td>0.030</td>
</tr>
<tr>
<td><strong>Hospital stay (days)</strong></td>
<td>3.7: 2-5</td>
<td>6.6: 3-20</td>
<td>0.006</td>
</tr>
</tbody>
</table>

IPSS: International Prostatic Symptoms Score; QoLs: Quality of Life score; Qmax: maximum flow.
Table 2  Comparative series between open surgery and laparoscopic adenomectomy.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>OT (min)</th>
<th>Bleeding (ml)</th>
<th>Irrigation (h)</th>
<th>Probing (days)</th>
<th>Stay (days)</th>
<th>Weight of the piece (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Porpiglia et al.19</td>
<td>O = 20</td>
<td>O = 95.5</td>
<td>O = 687.5</td>
<td>UR</td>
<td>O = 5.1</td>
<td>O = 7</td>
<td>O = 88.1</td>
</tr>
<tr>
<td></td>
<td>L = 20</td>
<td>L = 107.2</td>
<td>L = 411.6</td>
<td>L = 6.3</td>
<td>L = 7.8</td>
<td>L = 69.5</td>
<td></td>
</tr>
<tr>
<td>Baumert et al.20</td>
<td>O = 30</td>
<td>O = 54</td>
<td>O = 643</td>
<td>O = 84</td>
<td>O = 6.8</td>
<td>O = 8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>L = 30</td>
<td>L = 115</td>
<td>L = 367</td>
<td>L = 4</td>
<td>L = 5.1</td>
<td>L = 6</td>
<td>UR</td>
</tr>
<tr>
<td>McCullough et al.21</td>
<td>O = 184</td>
<td>O = 54.7</td>
<td>O = 400</td>
<td>O = 6.4</td>
<td>O = 7.7</td>
<td>L = 6.3</td>
<td>UR</td>
</tr>
<tr>
<td></td>
<td>L = 96</td>
<td>L = 95.1</td>
<td>L = 350</td>
<td>L = 5.2</td>
<td>L = 6.3</td>
<td>L = 6.3</td>
<td></td>
</tr>
<tr>
<td>García-Segui and Gascón-Mir</td>
<td>O = 18</td>
<td>O = 101.2</td>
<td>O = 493</td>
<td>O = 7.5</td>
<td>O = 6.6</td>
<td>O = 82.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>L = 17</td>
<td>L = 135.2</td>
<td>L = 250</td>
<td>L = 5.5</td>
<td>L = 3.7</td>
<td>L = 72.7</td>
<td></td>
</tr>
</tbody>
</table>

O: open surgery; L: laparoscopic adenomectomy; UR: unreported; OT: operative time.

Association, in its latest review of the guidelines for the management of BPH in 2010, considers the LA as a surgical alternative.2 The Cleveland Clinic submitted a new LA proposal performed through single-port access through transvesical approach, and most recently presented the combination of this single-port technique combined with endoscopic bipolar enucleation.25 29 Comparative studies between LA and open surgery19-21 indicate that both procedures are equivalent with regard to functional results, and that laparoscopy provides benefits in perioperative terms. However, there are few relevant publications regarding that matter, and with a small number of patients; the largest series is McCullough’s,21 with 280 cases (Table 2). Most LA studies are non-comparative descriptive case series published in indexed journals or abstracts of presentations at scientific events,19-21 in which the advantages obtained with the laparoscopic approach are documented,24-26 many of which are characteristic of laparoscopy. Most articles indicate a low bleeding, occasional transfusions, short irrigation and catheter permanence times, short hospital stay, few analgesic requirements, short convalescence, and cosmetic effect that also makes it possible to perform concomitant procedures such as hernioplasty, cystolithotomhy, and diverticulectomy (Table 3). Intraoperative bleeding in the LA is low due to the effect of venous clogging that CO2 causes, due to direct coagulation of subcapsular blood vessels and meticulous enucleation. This hemostatic advantage also causes a lower incidence of postoperative bleeding, and it reduces bladder irrigation requirements; there are even cases that did not need it.9 29 Likewise, the incidence of transfusion is also very low.6-21 Our results are comparable with those published by other authors, with limited bleeding, short irrigation time, without transfusions, and one patient did not require irrigation.

Laparoscopic magnification allows for a vision significantly higher than that obtained in open surgery.6 7 10 12 13 18 20 This ensures a thorough enucleation with clear identification of the cleavage plane between the adenoma and the capsule, minimizing the risk of avulsion of the capsule, as it may occur in the ‘blind’ enucleation during open surgery. It also allows for selective coagulation of subcapsular bleeding vessels.7 18 20

The introduction of the laparoscope in the prostate cell allows for accurate identification of the anatomical structures that are never evident in conventional surgery. The visualization of the urethra is perhaps one of the biggest advantages of the laparoscopic technique, since its identification ensures a precise cut in the urethra that minimizes the risk of sphincter damage and urinary incontinence.8 Some authors have even reported cases with preservation

Figure 3  Trigonization is performed with the best quality, allowing for placement of the sutures on the posterior lip of the urethra to ensure a broad coverage of the inside of the prostate capsule, promoting reepithelialization and postoperative hemostasis.
of the prostatic urethra to remove the need for irrigation and maintain antegrade ejaculation.\(^9,^{15}\) The trigonization is also performed with the best quality, allowing for placement of the sutures on the posterior lip of the urethra. This ensures a broader coverage of the inside of the prostatic capsule, which promotes reepithelialization and postoperative hemostasis. Anecdotally, it is also known that some authors have performed complete urethrovessical anastomosis, thus isolating the passage of the urine from the prostate cell.

The complications inherent to the surgical wound that can appear in any open surgery (such as seroma, wall abscess, and eventrations), mainly in patients with probe or infected bladder calculi, do not occur in laparoscopic surgery.\(^7\)

The disadvantages of the LA are the same as those applied in the LRP: greater operative time, long learning curve, and costs. Surgical times are always longer in laparoscopic cases, and they are dependent on the surgeon’s experience. However, the series that have implemented the LA with a technique called ‘finger assisted’ have performed the fastest procedures.\(^{11,15,18,21}\) Castillo et al. conclude that the learning curve in LA is complicated and difficult to define,\(^6\) but, obviously, it requires training and skill acquisition. In our opinion, like Rey et al.,\(^7\) we consider that the LA can be part of the learning curve in LRP without the high risks of impotence and incontinence. There are no cost studies in LA, but we can apply the same considerations that have been expressed in the LRP, where perioperative costs are set against the short stay, reduced analgesia, minimized transfusions, early return to work, and less irrigation.

Porpiglia et al.\(^{17,19}\) conclude that the LA is reserved for centers specialized in laparoscopy. To our understanding, this is the first article on LA that is carried out from a regional hospital, and our results are approximate to the series published in this type of centers. In our opinion, the LA is not a difficult technique, and it is less complex than that of the LRP, and yet there are many non-specialized hospitals in laparoscopy that perform this oncological surgery with satisfactory results, and that can be qualified to perform the LA safely. The growing interest in laparoscopy makes the percentage of urologists trained in this technique be on the rise; unlike what happens with laser, the availability of laparoscopy equipment is widespread, so the elements to develop the LA are present if there is conviction and enthusiasm.

The limitations of our study lie in the small number of patients, making it impossible to draw firm conclusions. We need more prospective studies with more patients to be able to define the definitive role of the LA. Comparative studies between the LA with endoscopic enucleation techniques have not been performed, but it can be assumed that the advantages of laparoscopic techniques are less obvious. However, whereas the open adenomectomy remains valid and is still considered as the preferred treatment for BPH, the AL will be a reasonable alternative.

**Conclusions**

The LEA is a fairly complex procedure that requires training. It represents a feasible, safe, and effective alternative...
in the surgical treatment of BPH with functional outcomes equivalent to open surgery and with multiple benefits to the patient.

Conflict of interest

The authors declare that they have no conflict of interest.

Acknowledgments

To our nurse Rosa García Figueira, owing to her invaluable work and continued dedication, this study was made possible.

Due thanks to Dr. Eduardo Bercowsky for his valuable surgical assistance.

Appendix A. Supplementary data

Supplementary data associated with this article can be found in the online version, at doi:10.1016/j.acuroe.2012.04.008.

References