Laparoscopic radical prostatectomy: a European virus with global potentials.

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Summary.- OBJECTIVES: To review the current status of the Laparoscopic Radical Prostatectomy in Europe (LRP).

METHODS: The published peer reviewed articles on the experience of the European groups performing Laparoscopic Radical Prostatectomy.

RESULTS: Three different approaches have been described for LRP, two of them transperitoneally (early dissection of seminal vesicles or of the prostatic apex) and one totally extra peritoneally. Results in terms of per operative performances and immediate outcomes seem to be comparable with the exception of the bleeding and the transfusion rate that seem higher in the transperitoneal approach with early dissection of the prostatic apex. Conversion rates have been described up to 5% but it is rare after the 20 first cases; after the learning curve has been overcome the complication rate varies between 10% and 17%.

CONCLUSIONS: LRP is feasible, teachable and reproducible. Although no comparative series with the open approach are available yet, functional and oncological results seem to be comparable to the ones reached after open Retropubic Radical Prostatectomy.

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Being a novel technique, all the series have a short median follow-up of around one year. The one-year continence rates are comparable to the ones described with the classical open approach, as it is the potency rate.
The rate of positive margins bounces between 2 and 49% depending mainly on case selection. A long and steady learning curve burdens the technique in terms of complications.

Resumen.- OBJETIVOS: Revisar el estado actual de la prostatectomía radical laparoscópica (PRL) en Europa.

MÉTODOS: Revisión de los artículos publicados sobre la experiencia de grupos europeos que realizan prostatectomía radical laparoscópica.

RESULTADOS: Se han descrito tres abordajes diferentes para la PRL, dos de ellos transperitoneales (discepción inicial de las vesículas seminales o apical) y uno totalmente extraperitoneal. Los resultados peroperatorios y de evolución inicial parecen ser comparables, con excepción del sangrado y los índices de transfusión, que son mayores en el abordaje transperitoneal con discepción apical inicial. Los índices de conversión referidos llegan hasta el 5%, aunque es rara después de los primeros 20 casos; los índices de complicaciones varían entre el 10% y el 17% una vez superada la curva de aprendizaje.
Tratándose de una técnica quirúrgica nueva, todas las series tienen una mediana seguimiento corta de alrededor de un año. Los índices de continencia al año son comparables con los del abordaje abierto clásico, al igual que los índices de potencia.

El porcentaje de márgenes positivos oscila entre el 2% y el 49%, dependiendo fundamentalmente de la selección de los pacientes. La curva de aprendizaje, que es larga y constante, es una carga para la técnica en lo que a complicaciones se refiere.

CONCLUSIONES: La PRL es factible, puede enseñarse y reproducirse. Aunque todavía no se dispone de series comparativas con el abordaje abierto, los resultados funcionales y oncológicos parecen ser comparables con los obtenidos después de la prostatectomía radical retropúbica abierta.


INTRODUCTION

Minimal invasive urological procedures as intraluminal stone surgery and urethral catheterisation were among the first interventional procedures performed by general surgeons. Obviously, already in the early days of (urological) interventions a trend towards minimal invasive therapies was set. However, it took decades before technologies were advanced enough to provide the (urological) community with the appropriate tools to really perform minimally invasive interventions. Benign prostatic hyperplasia and stone disease have mainly been treated in a minimal invasive fashion for many years and this has become an absolutely undisputed procedure in modern day urology. Laparoscopy can be seen as the next logical step in urological surgery. Amongst the first laparoscopic procedures performed in the field of urology were lymph node dissections and laparoscopic-assisted orchidopexia and varicocelectomies.

Currently, virtually every surgical operation can be performed laparoscopically. Since the first laparoscopic radical prostatectomy (LRP) reported by Schuessler et al (1) in 1993, more than 2500 procedures, bibliographically reported or not, have been performed in Europe. Nobody will dispute the efficacy and outcomes of a classical open retropubic radical prostatectomy (ORRP). All new surgical techniques for the treatment of localized prostate cancer, however, must be compared with this reference standard in terms of oncological and functional results. In the present manuscript we review the current status of LRP and compare this to the results of the ORRP. Obviously we now reached the crossroads where we have to make up our minds to either embrace LRP in the armamentarium of treatments of localized prostate cancer or to let it fall by the wayside.

TECHNICAL POINTS

The aim of LRP is, as in open surgery, the total excision of the gland and the surrounding tissue when indicated. The initial laparoscopic approach was transperitoneal (2). Later on a preperitoneal or extraperitoneal approach was developed (3).

Whether trans or extraperitoneal, there are at least three ways of approaching the prostatic gland. First of all a transperitoneal approach, with the initial dissection of the seminal vesicles through the Douglas performed before opening the Retzius’ space has been described by the French team of Guillonneau and Vallencien and rapidly reproduced in other Centres (2, 4-7).

Another transperitoneal technique is advocated by Rassweiler et al (8), freeing and dissecting first the Retzius’ space, approaching primarily the prostatic apex, dissecting the posterior aspect of the gland and finalized with the dissection of seminal vesicle after opening the posterior bladder neck.

Thirdly, a fully extraperitoneal technique was developed by Bollens et al (3). This approach is based on laparoscopic hernia repair, avoids potential intraperitoneal injuries, and is all in all-comparable to the standard ORRP.

Some key points have to be taken into account and surgical rules are common irrespective of the approach and type of initial dissection chosen.

Dissection of the apex

The techniques of apex dissection are similar from technique to technique reproducing the anatomic approaches described for the ORRP (9, 10). The pelvic fascia is opened on both sides and a haemostatic stitch
is placed on the dorsal vein complex before incising the urethra. The puboprostatic ligaments are cut after control of the deep venous complex and the urethra is freed from the prostate, using the same technique for all teams. Dissection proceeds then on the anterior aspect of the Denonvilliers fascia.

The bladder neck dissection is also similar among the different techniques and uses a bipolar forceps with or without monopolar coagulation. Recently, in order to avoid any type of thermal injury, some others have shifted towards the use of clips only (6).

The seminal vesicles and vas deferens can be dissected either by first opening the Douglas pouch (4-7) or after completing the bladder neck dissection (8). The vesicourethral anastomosis can be performed by single separate stitches of Vicryl 2 or 3 zeros (5, 7, 8) or by running suture (Polisorb 3 zeros) (3, 6). The running suture is probably faster, whereas some authors advocate single stitches as being easier and safer. Moreover one may use a urethral metallic bougie to point out the urethra and to guide the needle during the anastomosis (8). At completion of the anastomosis a bladder catheter is placed.

Nerve sparing dissection

As in open surgery a nerve sparing dissection requires higher experience and practice, being difficult to perform in the initial cases (11). In the techniques where initial dissection of the Seminal Vesicles is performed, the neurovascular bundles run close to their external surface, so a very careful dissection and the use of bipolar current or clips is required (4, 5, 7). The dissection of the neurovascular bundles begins at this point and proceeds distally to the bladder neck. After gaining control of the main prostatic pedicles and of the deep venous complex and dissection of the urethra the distal neurobundle is freed up from the prostate laterally.

Rassweiler et al. (8) dissect the neurovascular bundles from the apex to the prostatic base using also bipolar current and clips when necessary. This author finishes the excision of the gland with the dissection of the superior vascular pedicles and seminal vesicles. This approach facilitates the recognition of the neurovascular landmarks but seems to increase significantly the bleeding (6, 8).

RESULTS

Per operative results

Results in terms of operative performances are expressed in Table I.

The global conversion rate usually reflects the

| Table I: Operative outcomes of different series (3,6,7,8,11) regarding operative time (min), blood loss (ml), transfusion rate and conversion rate. |
|-----------------|----------------|--------|---------|--------|
|                  | Time           | Blood  | Transf  | Recon  |
| Guillonneau      | 203            | 380    | 4.9%    | 1.2%   |
| Turk             | 255            | 185    | 2%      | 0%     |
| Rassweiler       | 271            | 1.230  | 31%     | 4.4%   |
| Bollens          | 317            | 492    | 13%     | 0%     |
| Abbou            | 240            | -      | 3%      | 0%     |

| Table II: Postoperative outcomes in different series (3,6,7,8,11) regarding catheterisation (days), hospital stay (days), complication rate and reintervention rate. |
|-----------------|----------------|--------|---------|--------|
|                  | Catheter       | Stay   | Complic | Reinter|
| Guillonneau      | 6.8 *          | 6.2    | 17.1%   | 3.7%   |
| Turk             | 5.5 *          | 8      | 10.4%   | 0%     |
| Rassweiler       | 7              | 10     | 15%     | 4.4%   |
| Bollens          | 8 *            | 6 *    | 14%     | 2%     |
| Abbou            | 4.8 *          | 6.1 *  | 10.5%   | 0%     |

* After learning curve or with increasing experience.
learning curve and is an uncommon event after the first 20 patients. Moreover a 7 to 8 hour operation is common for the first operations, but, after about 50 cases, less than 200 minutes are required for an experienced team (5).

Main causes for conversion are: bleeding at the level of the dorsal venous complex and/or prostatic pedicles, extensive periprostatic adhesions, rectal or bowel injury, and difficult dissection of the bladder neck in the presence of a prominent median lobe (11).

The laparoscopic technique requires a 'non-bleeding' field and thus transfusions and major bleeding should be and are rare (Table I). The higher transfusion level reported by Rassweiler et al (8) is probably due to the retrograde dissection from the apex to the bladder neck.

Postoperative outcomes are reviewed in Table II. As in abdominal surgery, laparoscopic surgery in urology enables a quicker recovery for patients. In LRP, we observe the same evolution with reduced postoperative analgesia requirements (3, 6, 8). Optical magnification improves the quality of the anastomosis and allows for a reduced catheterisation time (5, 6).

COMPLICATIONS

Complications correlate with the surgeon's experience and occur more frequently during the learning curve. Recently Guillonneau et al. (11) published what is at the present the largest series in LRP. In their experience and after an initial higher rate of complications, those become stable and do not change with increasing experience.

In this series reoperation was necessary in 3.7% of cases, due to major complications in 13 patients (2.3%) and to minor ones in 8 patients (1.4%) (11). A major cause of reintervention during the postoperative period are bowel complications (11).

With the transperitoneal approach, bowel injuries, ureteric injuries, intra-abdominal leakage, and hemoperitoneum have been observed (5, 7, 8), but each one was rare. The extraperitoneal approach avoids all these intra-abdominal complications (3). Another major non-specific complication is rectal injury, which has been reported in all techniques (3, 5-8).

The more frequent complications are (11): anastomotic fistula (10%), bladder injury (1.6%), rectal injury (1.4%), hemoperitoneum (0.9%) and ureteral injury (7%). The postoperative complications and their frequency are listed in Table III.

Special mention deserves the event of an uroperitoneum. In the transperitoneal approach, leakage of the cervicourethral anastomosis results in a uroperitoneum, with consequent reabsorption of urine by the peritoneum and an increasing serum creatinine. Most of the time only support measures and a good drainage are enough to overcome this complication (11). In an attempt to secure the urine drainage some groups use to let also a suprapubic catheter during the first days (8).

FUNCTIONAL RESULTS

As a novel and still developing technique it is impossible to compare the functional results of LRP with the ones achieved after ORRP. The LRP series have only a limited mean follow-up of around one year.

So far no peer-reviewed article exists comparing the two techniques although we are aware that some groups are already working in this subject.

The lack of standard definitions makes functional
evaluation difficult for any technique of radical prostatectomy. In terms of continence it seems important to define "perfect continence" as no need at all of pads. In ORRP, perfect continence rates vary from 60% (12) to 93% (13) at 12 months in the best series. Table IV reflects the functional results in terms of continence after LRP. Delay until recovering perfect continence is certainly another important parameter in terms of quality of life.

The level of the potency rates depends on several factors. First of all the patient's age and his preoperative quality of potency is of importance. Secondly the possibility to perform a bilateral nerve sparing procedure is of crucial importance and the outcome will be better than following a unilateral nerve sparing procedure. Last but not least postoperative re-education program may help to restore potency. When the nerves are preserved bilaterally, in 'aggressive' post operative re-education programs, the patient is asked to achieve one adequate erection each week (with the help of e.g. prostaglandin) starting at 1 month postoperatively. When patients refuse to participate in this program, potency rates at 1 year are worse. The laparoscopic results seem in principle comparable to the ones after ORRP and probably will improve over time with technical increased experience and refinement (Table V).

### PATHOLOGIC RESULTS

As in ORRP the oncologic results depend on four main parameters: patient selection criteria, neurovascular bundle preservation, bladder neck preservation, and the surgical quality of the dissection. In patients with pT3 tumours, positive margins can relate to surgical technique and/or poor patient selection for nerve sparing. In fact, only the positive margin rate in pT2 tumours reflects the oncologic surgical assessment. In pT2 stage tumours, results with LRP are comparable with open surgery, in that 9% (15) to 26% (16) of positive margins have been reported (Table VI). Currently the oncological comparison between ORRP and LRP is a difficult task; first of all laparoscopic results include the learning curve and probably underestimate the laparoscopic expertise of the master surgeon. Secondly and in absence of specific description of the positive margins' pattern only time has the final answer over the clinical relevance of this positivity.

### DISCUSSION

Definitive conclusions for LRP are difficult to draw given the small cohort of patients (in comparison with the open technique), the learning curve inherent to a novel technique and the short follow-up.

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**Table IV: Evolution of continence rates according to different series (3,6,7,8,11).**

<table>
<thead>
<tr>
<th></th>
<th>3 m</th>
<th>6 m</th>
<th>12 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guillonneau</td>
<td>-</td>
<td>76%</td>
<td>85.5%</td>
</tr>
<tr>
<td>Turk</td>
<td>75%</td>
<td>86%</td>
<td>-</td>
</tr>
<tr>
<td>Rassweiler</td>
<td>54%</td>
<td>74%</td>
<td>97%</td>
</tr>
<tr>
<td>Bollens</td>
<td>39%</td>
<td>85%</td>
<td>-</td>
</tr>
<tr>
<td>Abbou</td>
<td>60%</td>
<td>64%</td>
<td>78.3%</td>
</tr>
</tbody>
</table>

**Table V: Potency rates according to different series (3, 6, 7, 8, 11). Once neurobundles have been preserved.**

- Guillonneau: 45%
- Turk: 59%
- Rassweiler: 33%
- Bollens: 66%
- Abbou: 56%
The peri and postoperative complications more frequently observed in each team during the learning curve reflect the difficulty of the procedure and become after this period is overcome more a potential than a real surgical risk. Similarly, transfusion rates decrease dramatically with surgeon's experience (5, 6). In fact, a realistic comparison with ORRP should include large cohorts and probably exclude the first 20 to 30 patients in each group. Oncological results remain the most important parameter and have been advocated as a major argument against LRP. However, because of the discovery of the technique and the learning curve, the first cases could burden an "unacceptable" high oncological risk. LRP is considered one of the most difficult procedures in laparoscopic surgery (17) and it is not yet recommended as a routine procedure by the EAU guidelines (18). For this reason, to minimize adverse oncological and functional results within the learning curve and the procedure, previous laparoscopic experience and practical teaching and proctoring by experienced surgeon are of most importance in LRP. Data from experienced teams demonstrate the feasibility, teachability, short-term oncological efficiency and comparable functional results of LRP. Future technical improvements are expected, and, therefore, results will probably be better than what would be by then considered as historical data.

The technical approach (Montsouris technique (2), Heilbronn technique (8), or the extraperitoneal approach (3)) is a matter of discussion. Each of them is feasible and has comparable results although bleeding has been reported to be higher with the Heilbronn technique (8). The surgeons' choice is based primary in preferences and habits than related to objective data. The peritoneal cancer spillage risk remains unclear. Only one case of cutaneous metastasis after lymphadenectomy for prostate cancer has been reported (19), and after a large number of LRPs no peritoneal metastasis has been described, till date. The delay between the operation and the potential metastasis, however, may be as long as several years.

The arguments against LRP are multiple, an enormous initial investment in terms of time is needed during at least the first year, larger skills than for other laparoscopic operations are required and so far the urologist committed to the technique face the reluctance of a part of the urological community. Until this moment and in spite of many advocated reasons only the superior cosmetic effect has been proven for the LRP.

Besides the arguments in pro of the ORRP it would be of interest not to forget that also ORRP was a seldom operation during decades and that the "open experts" had also a learning and troublesome period. As a final remark we should not forget that ten years ago, the firsts laparoscopic nefrectomies required also a very long operating time. By now this procedure has been accepted as the new standard surgical approach for (uncomplicated) nefrectomies.

**CONCLUSION**

Laparoscopic radical prostatectomy is feasible, can be taught, and is reproducible with oncologic and functional results comparable to ORP. The lengthiness of laparoscopic surgery could initially decrease its cost effectiveness, but this is less of a concern in Europe. Advantages to LRP include a reduced transfusion rate, increased immediate comfort, and quicker recovery. Current benefits from laparoscopic surgery might be underestimated because of a learning curve that is a major problem in a proper and definitive evaluation.

**Table VI: Oncological results for the different series (3, 6, 7, 8, 11).**

<table>
<thead>
<tr>
<th>Oncological Results</th>
<th>PT2</th>
<th>PT3</th>
<th>+ Margins</th>
</tr>
</thead>
<tbody>
<tr>
<td>GUILLONNEAU</td>
<td>86.6%</td>
<td>12.5%</td>
<td>13.7%</td>
</tr>
<tr>
<td>Turk</td>
<td>61.6%</td>
<td>38.4%</td>
<td>26.4%</td>
</tr>
<tr>
<td>Rassweiler</td>
<td>48%</td>
<td>47%</td>
<td>2% pT2</td>
</tr>
<tr>
<td>Bolles</td>
<td>52%</td>
<td>44.6%</td>
<td>22%</td>
</tr>
<tr>
<td>Abbou</td>
<td>75.4%</td>
<td>24.6%</td>
<td>16.8% pT2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>48.8% pT3</td>
</tr>
</tbody>
</table>

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REFERENCES AND RECOMMENDED READING (*of special interest, **of outstanding interest)