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Retroperitoneal Laparoscopic Radical Prostatectomy

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Abbreviations:
RLRP - Retroperitoneal Laparoscopic Radical Prostatectomy;
PSAi - prostate specific antigen;
LRP - Laparoscopic radical prostatectomy;
PCa - prostatic cancer;
HS - Harmonic scalpel;
BP - bipolar forceps;
MC - Maryland clamp;
FC - fenestrated clamps;
ES - Elephant suction;
LND - Laparoscopic needle drivers;
BN - bladder neck;
DF - Dennonvilliers fascia;
NVB - neurovascular bundles.

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Rezumat

Prostatectomia radicală laparoscopică retroperitoneală

Introducere: Prostatectomia radicală laparoscopică retroperitoneală (PRLR) a fost adoptată în departamentul nostru ca primă linie de tratament pentru pacienți diagnosticați cu cancer prostatic localizat şi speranța de viață de peste 10 ani. La data implementării instituționale a acestui program echipa operatorie avea experiență extinsă în chirurgia miniminvazivă urologică. Obiectivul prezentului articol este prezentarea technicii operatorii prin abord laparoscopic precum şi analiza rezultatelor oncologice şi funcționale ale PRLR.
Pacienți şi metodă: Toți pacienții operați pentru PRLR în perioada ianuarie 2015 - martie 2017 în cadrul Ponderas Academic Hospital au fost incluşi într-un studiu prospectiv. Protocolul de evaluare preoperatorie a inclus teste sangvine, biopsie prostatică, RMN pelvis şi scintigrafia osoasă şi, pentru fiecare caz, terapia oncologică a fost discutată şi aprobată în Comisia oncologică multidisciplinară instituțională. Operația de PRLR a fost efectuată în toate cazurile (45) pentru cancer de prostată localizat.
Rezultate: Vârsta medie a pacienților a fost 68 de ani (între 45-74 ani), nivelul mediu preoperator al antigenului specific prostatic (PSAi) a fost 8 ng/ml (între 3-15 ng/ml) şi volumul prostatic între 26 şi 52 cc. Toate intervențiile au fost finalizate laparoscopic în toate cele 45 de cazuri- fără conversie la chirurgie clasică. Bandeletele neuro-vasculare au fost conservate bilateral în 7 cazuri (16%) şi unilateral în 23 de cazuri (51%). Timpul mediu al intervențiilor a fost de 165 min (interval 120-240 min), în timp ce pierderea medie de sânge a fost de 255 ml (interval 20-800), iar 2 pacienți au necesitat transfuzie. Timpul mediu de cateterizare a fost de 10 zile (7-14 zile). Margini chirurgicale pozitive au fost observate în 8 cazuri (17,7%). În ansamblu, 86%, respectiv 93% dintre pacienți au

fost continenți la 3 şi 6 luni postoperator. La 51% dintre pacienți s-a identificat disfuncție erectilă la 6 luni după intervenție. Au fost prezente complicații la 4 pacienți: intraoperator – un caz de leziune rectală şi postoperator - sângerare postoperatorie (2 cazuri), şi stenoza anastomozei vezicouretrale (1 caz). Nu s-au înregistrat decese sau complicații tardive pentru lotul studiat.
Concluzie: Prostatectomia laparoscopică radicală este o procedură sigură şi eficientă pentru cancerul de prostată localizat, cu complicații minime şi timp scurt de spitalizare, dar necesită o echipă experimentată. Rezultatele oncologice şi funcționale alte RLRP cresc odată cu experiența.

Cuvinte cheie: cancer prostatic, prostatectomie laparoscopică, abord retroperitoneal, chirurgie urologică laparoscopică

Abstract
Introduction: Retroperitoneal Laparoscopic Radical Prostatectomy (RLRP) has been introduced in our department as the first line treatment for patients with localized prostatic cancer and life expectancy over 10 years. At the time, the surgical team had already extensive experience in minimally invasive urologic surgery. Our aim is to describe the laparoscopic technique we currently use and to analyze our oncologic and functional results.
Patients and Methods: All the patients who underwent RLRP in our institution (PONDERAS ACADEMIC HOSPITAL) from January 2015 to March 2017 were included into a prospective study. The standard preoperative protocol included blood tests, prostate biopsy, pelvis MRI and bone scintigraphy, while the particular therapy was discussed and approved by the Institutional Multidisciplinary Tumor Board. In all the 45 cases, RLRP was indicated for localized prostate cancer.
Results: The average patient's age was 68 years (range 45 – 74 years), mean preoperative prostate specific antigen (PSAi) level was 8 ng/mL (range 3–15 ng/mL) and prostatic volume between 26 and 52 cc. The laparoscopic approach was completed in all 45 cases – no conversions to open surgery. Bilateral nerve sparing was performed in 7 cases (16%) and unilateral in 23 cases (51%). The mean operative time was 165 minutes (range 120 - 240 min), while the average blood loss was 255 mL (range 20–800) and two patients received blood transfusions. The mean catheterization time was 10 days (range 7–14 days). Positive surgical margins were observed in 8 cases (17.7%). Overall, 86% and respectively, 93% of the patients were continent during the following 3 and 6 months. 51% of the patients had erectile disfunction 6 month after the intervention. Four complications were encountered: intraoperatively - rectal injury (1 case) and postoperatively - bleeding (2 cases) and stenosis at the vesicourethral anastomosis (1 case). No mortality or late morbidity encountered.
Conclusions: The radical laparoscopic prostatectomy is a safe and efficient procedure for localized prostate cancer with minimal complications and short hospitalization time, but it requires an experienced team of laparoscopic surgeons. The functional and oncological outcomes of LRP are expected to be improved as the medical team experience is extended.

Key words: prostatic cancer, laparoscopic prostatectomy, retroperitoneal approach, laparoscopic urologic surgery

Introduction

Radical prostatectomy is the gold standard treatment for patients with localized prostate cancer and life expectancy over 10 years. The radical prostatectomy was introduced in 1948 (by open retropubic approach) and during the last years it has been significantly improved. The nerve-sparing technique was described by Walsh and colleagues in 1980 (1) to reduce the postoperative incontinence and erectile disfunction. The laparoscopic approach was

firstly described in the 1990s and the robot-assisted technique was initially performed in 2000 (2).

Laparoscopic radical prostatectomy (LRP) is considered to be the standard treatment for localized prostatic cancer (PCa) in many hospitals. The laparoscopic procedure has demonstrated benefits over open retro-pubic radical prostatectomy: lower blood loss and transfusion rate, shorter hospital stay & convalescence, good cosmetics results, and better functional results regarding continence and potency (3,4).

Retroperitoneal Laparoscopic Radical Prostatectomy (RLRP) has been introduced in our department in 2015, as the first line treatment for patients with localized prostatic cancer and life expectancy over 10 years. By that time, the surgical team had already extensive experience in minimally invasive urologic surgery. The first author has previously performed over 300 laparoscopic radical prostatectomy and over 600 robotic interventions (robotic prostatectomy, robotic cystectomy with urinary diversion, partial nephrectomy).

Our objectives are to describe the laparoscopic surgical procedure we currently use, its technical difficulties, and to analyze our oncological and functional early results.

Methods

All the patients who underwent RLRP in our institution (Ponderas Academic Hospital) from January 2015 were included into a prospective study. The present study included 45 patients, operated between January 2015 and March, 2017.

The preoperative protocol included blood tests, prostate biopsy, pelvis MRI and bone scintigraphy, while the particular therapy was discussed and approved by the Institutional Multidisciplinary Tumor Board.

RLRP was indicated for localized prostate cancer in all studied cases.

The risk of pelvic lymph node invasion was estimated using preoperative nomograms (Memorial Sloan Kettering Cancer Center nomogram). A risk of nodal metastases over 15% was considered an indication to perform pelvic lymph node dissection during radical prostatectomy.

Each patient preoperatively signed the informed consent for the procedure, being extensively informed about all the therapeutic options, the intra and postoperative complications

The study's excluding criteria was considered: life expectancy less ten 10 years, metastatic or locally advanced prostate cancer.

The study was approved by the Institutional Review Board (IRB).

The statistical analysis was performed using Microsoft Excel 2016.

Surgical Technique

The Retroperitoneal Laparoscopic Radical Prostatectomy (RLRP) procedure was performed under general anesthesia with oro-tracheal intubation.

Specific laparoscopic instruments are currently use for the described surgical technique: Harmonic scalpel (HS), bipolar forceps (BP), Maryland clamp (MC), fenestrated clamps (FC), Elephant suction (ES), Laparoscopic needle drivers (LND), Blunt tip trocar with balloon (10 cm), one 10-12 mm disposable trocar, 3 x 5 mm trocars, 0 degrees camera. The surgical assistant will be responsible for their set-up and testing. The patient is placed in supine position, 10 degrees Trendelenburg (*Fig. 1*). A rectal cannula is introduced to guide the safe dissection and for final rectal testing.

The surgeon should be positioned on left side of the patient, the first assistant at the right side and the cameraman at the head (using a support for his arm). Once this set-up is done, the first assistant will introduce a sterile Ch18 urinary catheter.

A 3 cm transversal incision is performed at least 10-12 cm away from the symphysis, beneath the navel, right sided to the midline. The rectal muscle anterior aponeurosis is identified and transversally incised using the scissors. A blunt retro-rectal finger dissection will be performed toward the Retzius space. Care should be taken not to open the peritoneal layer. The working extraperitoneal

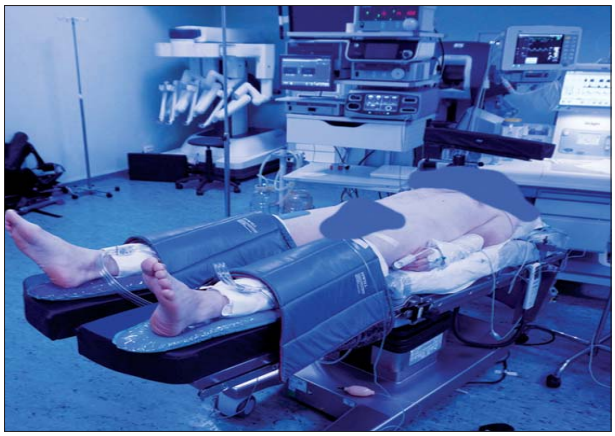

Figure 1. Patient position

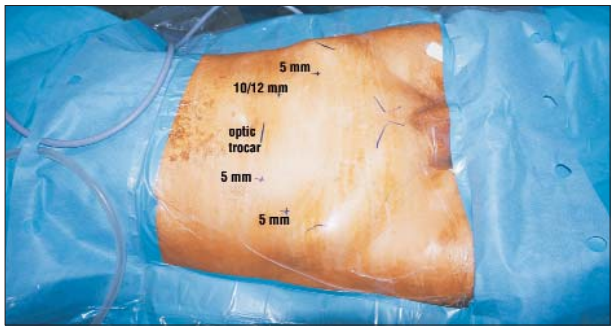

Figure 2. Trocars placement for RLRP

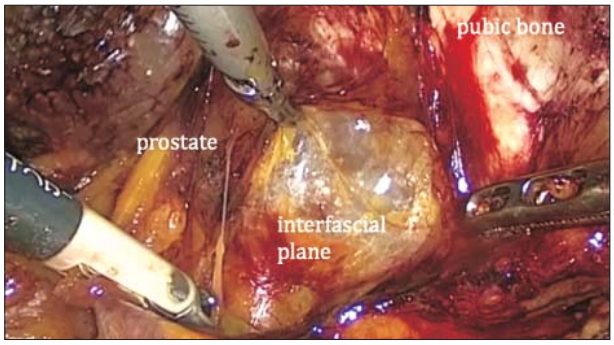

Figure 3. Incision of the endopelvic fascia on the right site

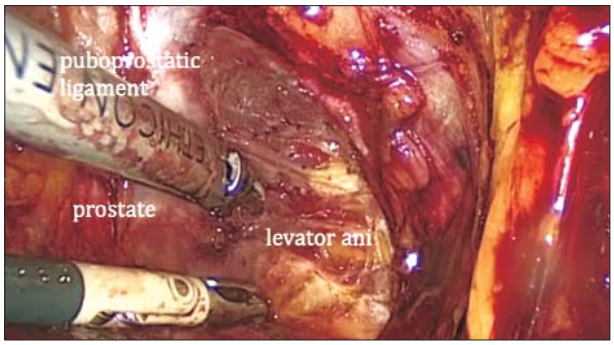

Figure 4. Dissection to prostatic apex

space should be further enlarged by using a hernia balloon dissector (space maker). Next, a balloon blunt tip optical trocar is placed (another option might be a Hasson trocar) and the CO2 insufflation is started up to the pressure of 15 mmHg. A 5 mm cannula will be then introduced on the left side, at a 1/3rd of the distance between the iliac crest and the navel. The second working trocar (10 mm) should be places also on left side, on the same line, at 1/3rd from the navel. Care to prevent the inferior epigastric vessels injury is necessary. Diaphanoscopy is very useful in this respect. By using bladeless trocars, the risk of bleeding from small muscle arteries is reduced. The extraperitoneal working space can be now extended to the right by using this to left sided access ports. Sometimes it will be necessary to transect linea arcuata (the outmost ridge of the dorsal rectus sheath). Finally, the last two 5 mm trocars should be introduced on the right side at 1/3rd and respectively 2/3rd of the same line, as performed on the left side (*Fig. 2*).

The surgeon handles the HS and the MC; the peri-prostatic fat will be therefore dissected while the superficial apical vein will be transected after using BF. The fat laterally siding the right distal trocar can be preserved intact. Then, the operator incises the endopelvic fascia at both sides, beginning with the middle of the prostate (*Fig. 3*). The incision will be extended dorsally and then ventrally (*Fig. 4*), while preventing to go too far toward the apex and harming the Santorini plexus. The puboprostatic ligaments should not be resected yet and the suturing of this complex should be avoided at this stage (this will fix the apex in an improper position and will give little benefits in terms of preventing bleeding).

The assistant must put some tension on the prostate towards the contralateral side, in order to improve the exposure. Once the lateral aspect of the prostate has been dissected, the procedure should continue with the bladder neck (BN).

The assistant uses the FC to put some traction on the urinary bladder, tenting of the bladder's neck. Then, the surgeon uses HD to begin the paramedian dissection, seeking for the fat layer between the prostate and the bladder. Alternatively, he should go right and left, helping the tenting to become obvious in the midline and transect the bladder neck in midline á niveau (*Fig. 5*). The procedure should be repeated until the urethra is opened. Once it is so, the catheter balloon should be deflated and the assistant should grab the catheter and fix the prostate ventrally (at 12 o'clock, as we will refer from now on). The catheter will be tensioned from outside and fixed with a Kocher clamp placed on it, against the glans penis (using a gauze to prevent injury of the glans is recommended).

The dissection of the BN is carried out with HS, firstly on the left side, dissecting from 9 to 7 o'clock, while staying outside the urethra. The manipulation of the BN at the midline should be avoided, as this is its most fragile segment. The same techniques should be applied for the right side. The mucosa of the BN should be kept intact at midline, while entering the dorsal plane behind the BN. If possible the tension on the prostate should be increased, by pulling it up with a FC or BP.

Gently grab the BN while the operator still uses the HS to create a plane parallel to the BN is recommended (*Fig. 6*). The vertical dorsal detrusor fibers should then be exposed (some people refer these as the first-ventral fibers of the Dennonvilliers fascia). After their division, the vas and vesicle are identified. The dissection of the vas is carried out for 2-3 cm while being very cautious with the small deferential vessels which have to be coagulated (*Fig. 7*). The vesicle is dissected; by putting some traction on it, a way to the apex can be created (once again, coagulate the seminal vesical arteries). The procedure contralateral repeated.

The assistant must grab the vas and vesicle at the right side, while the surgeon does the same for the left side. Consequently, the prostate should be pulled upwards, to reveal the dorsal fibers of Dennonvilliers fascia (DF).

A horizontal incision on DF will reveal the fat in the pre-rectal space. The dissection will be continued bluntly in the midline to the apex, moving away from the rectum, putting the instrument laterally and pushing the prostate away from it. More so, the compression on the rectum is to be prevented.

Back to the BN, we place a hem-o-lock clip on the left lateral bridge between the bladder and the prostate (referred as the bladder pedicles) and transect it with scissors. The procedure will

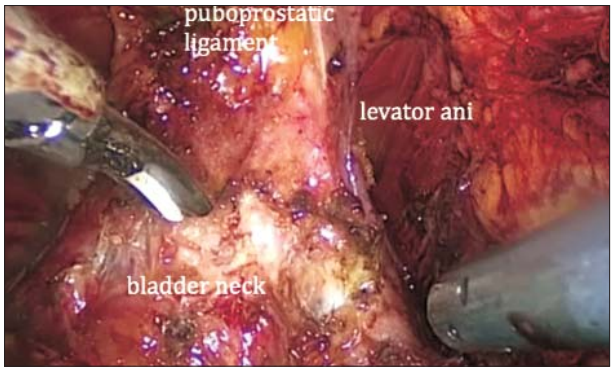

Figure 5. Incision the bladder neck on midline

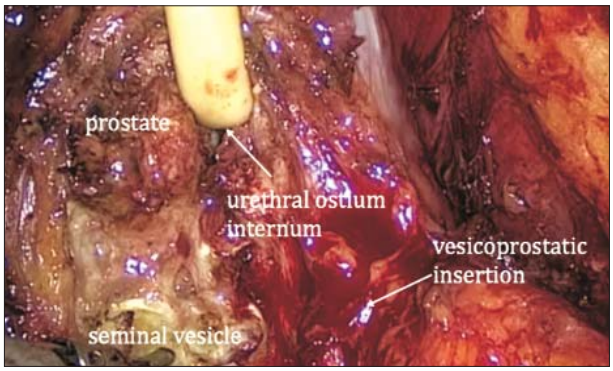

Figure 6. Identifying the deferent vas and seminal vesicle plane

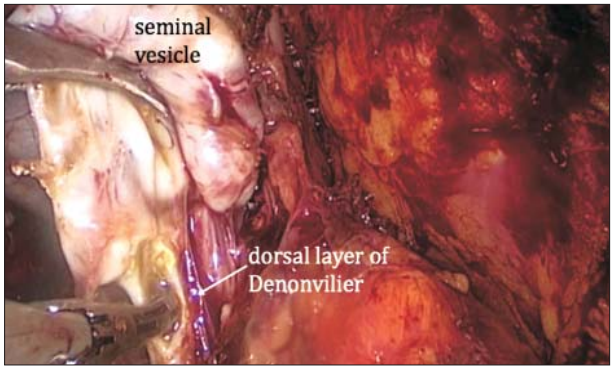

Figure 7. Dissection of the seminal vesicle

be repeated until the insertion level of the vas and vesicle is reached. The procedure is performed on the right side in a similar manner. Afterwards, the only left back structures will be the neurovascular bundles (NVB). Alternatively, the dissection can be performed only by HS, the hemostatic clips not being needed. However, while the possible bleeding caused by the dorsal sinusae can be self-limited, the arterial bleeders should be coagulated. The same procedure will be conducted on the right side.

When the nerve sparing procedure is planned, the reflection of the peri-prostatic fascia will be firstly identified on the posterior aspect of the prostate, over the NVB. Then, blunt dissection is continued to the NVB insertion on the prostate (marked by small vessels and nerves emerging from the NVB and entering the prostate). Next, the dissection is performed to the convexity of the prostate and the interfascial plane between the outer and inner layer of the periprostatic fascia is opened (*Fig. 8*); this might cause some bleeding from the lateral sinusae. The dissection is carried out over entire prostate length and then, continued dorsally, isolating the NVB (lateral aspect). By lifting the prostate, the NVB will be evident (inserted dorsally to the prostate). Hemostatic clips are horizontally placed, parallel to the prostate, and the insertions are transected with scissors. The dissection continues to the apex, while gently wiping away the NVB. The same approach is applied on the other side.

A Vicryl 1 CT1 suture is prepared. The puboprostatic ligaments will be incised, while the assistant pushes the prostate cranially. The needle is passed from left to right (*Fig. 9*) and then, after checking if the catheter is free, another suture is more superficially passed. Next, the suture is tightened and the needle removed. The plexus is transected with scissors until the urethra becomes visible (*Fig. 10*). Additional use of the BF is needed for bleeding control. The prostate is pulled to the left to allow the dorsal dissection of the apex. The ES will prevent rectum form being too close. If possible, the pubo-rectalis muscle will be divided just behind the urethra. The urethra is then transected in a controlled manner, being posteriorly completed after removing the urinary catheter.

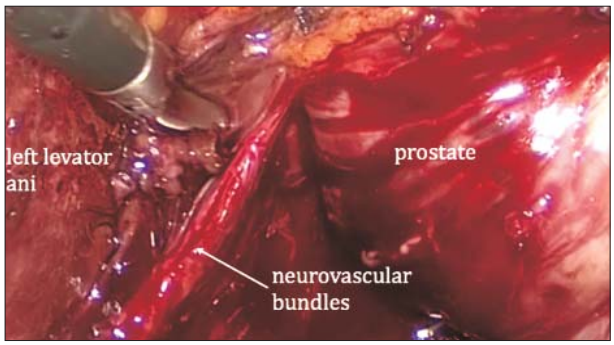

Figure 8. Left neurovascular bundles preservation

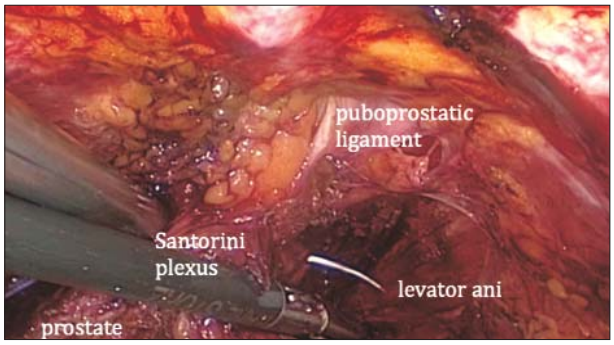

Figure 9. Santorini plexus suture

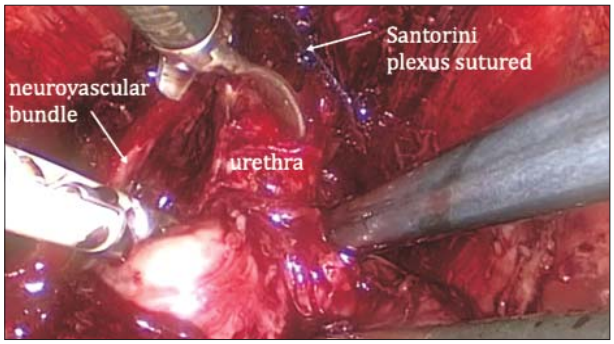

Figure 10. Incision of the urethra

Energy should not be used for this step as it can affect the continence.

Finally, the prostate is freed, placed into an endo bag and removed through-out the camera port.

The camera trocar is replaced and CO2 insufflation restarted. Careful hemostasis check, saline lavage and the rectal testing using the rectum cannula end the excision step of RLRP and prepare for the reconstructive part.

A double 5/8th needle 3.0 /2.0 25 cm length

resorbable multifilament thread is used for the anastomosis.

The assistant should grab the BN paramedian at the right side. The surgeon uses the needle-holder (LND) to grasp the needle on backhand, passing it firstly on the BN, from outside to inside, at 6 o'clock (*Fig. 11*). The same procedure should be applied for the urethra, from inside to outside. One can use some compression on the pelvic floor to lift up the urethra. The second pass goes at 7 o'clock on the BN and then though the urethra. A knot is then performed, leaving 3 cm free end thread. The suture continues at 5 o'clock, in the same manner, with the needle in backhand, behind the bladder and from the outside to the inside. A running suture is performed to the right, then ventrally and to the left. The assistant should keep the suture on tension (*Fig. 12*). Care should be taking when puncturing the urethra to keep the catheter intact. The last suture runs through 8 o'clock, being able to make a knot using the previous 3 cm free end thread. Catheter balloon should finally be inflated.

We routinely test the tightness of sutures by using 60-100cc saline and extra sutures are placed if necessary. A 21 Fr drain is placed for 24 hours and the laparoscopic trocars are removed under visual control. The aponeurosis and skin are carefully closed.

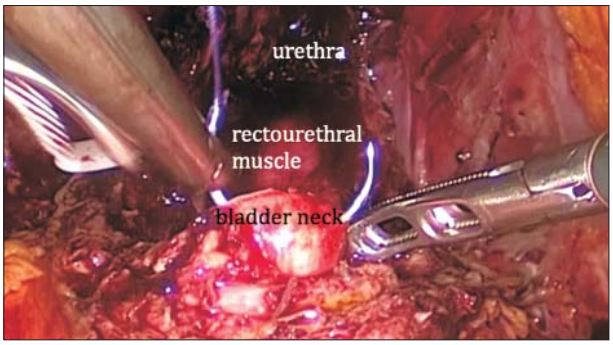

Figure 11. Start of anastomosis. First step - at 6 o'clock of the BN

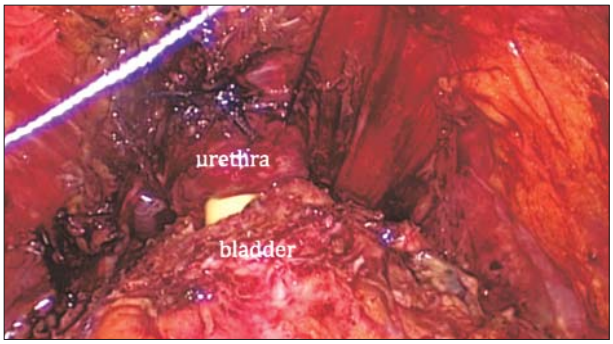

Figure 12. Aspect of anastomosis during ventral suture

Results

From January 2015 to March 2017 45 RLRPs were performed in our institution. In all cases, RLRP was performed for localized prostate cancer. The average patient's age was 68 years (range 45 – 74 years), mean preoperative prostate specific antigen (PSAi) level was 8ng/mL (range 3–15 ng/mL) and prostatic volume between 26 and 52 cc. The preoperative Gleason score was 6 (3+3) in 12 cases (26.6%), 7 (3+4) in 15 cases (33.3%), 7 (4+3) in 10 cases (22.2%) and over 7 in 8 cases (17.8%).

The patients were stratified considering initial PSA, clinical stage, positive biopsy core and initial Gleason score as follows: low risk (10 cases - 22.2%), intermediate risk (28 cases - 62.2%) and high risk (7 cases - 15.6%).

The laparoscopic approach was followed through in all cases – no conversions to open surgery. Bilateral nerve sparing was performed in 7 cases (16%) and unilateral in 23 cases (51%) (*Fig. 13*). Pelvic lymph node dissection during radical prostatectomy was performed in 7 cases (15.6%) as the calculated risk of nodal metas-

Figure 13. The specimen after laparoscopic prostatectomy with right (unilateral) nerve sparing

tases was over 15% in these cases.

The mean operative time was 165 minutes (range 120 - 240 min), while the average blood loss was 255 mL (range 20–800) and two patients received blood transfusions. The mean catheterization time was 10 days (range 7–14 days). Positive surgical margins were observed in 8 cases (17.7%). Overall, 86% respectively 93% of the patients were continent during the following 3 and 6 months. 51% of the patients had erectile disfunction 6 month after the intervention. The mortality rate was nil.

Complications were described in four cases, one intraoperative and three postoperative. A rectal injury occurred during the dissection of the intense adherences surrounding the apex. The colorectal surgeon performed the laparoscopic rectal dissection and the closing of the rectal would. The postoperative evolution was uneventful. Two cases of postoperative bleeding were encountered, one of them required laparoscopic reintervention for the bleeding control of an inferior epigastric muscle branch bleeder. Blood transfusions were necessary in both cases.

A stenosis at vesicourethral anastomosis was recorded and it was associated with the urinary catheter replacement. No local recurrences or late complications were encountered in the studied patients.

The mean follow-up period was 14 months (range 12-24).

The first postoperative PSA test was performed 6 weeks after the intervention. The average level was 0.06 ng/ml (range 0.003 - 0.09 ng/ml). The PSA test was repeated on every 3 months during the first postoperative year and on every 6 months, thereafter. The increase of PSA over 0.4 ng/ml was observed in 4 cases after an average period of 8 months of follow up (range 6-12). All these cases belonged to the high-risk group, and three of them had positive surgical margins. The adjuvant treatment was recommended (radiotherapy and hormonotherapy).

Discussions

Prostate cancer is the second most common cancer in men world-wide, and it is rapidly increasing in Europe (5).

The advantage of laparoscopic technique compared to the open surgical technique is already well known in terms of blood loss, hospitalization, postoperative complications and recovery time (6, 7).

The laparoscopic technique is available in two approaches: transperitoneal (TLRP) and retroperitoneal (RLRP). Although both are safe and effective, our results are correlated with recent studies and meta-analyzes, revealing some advantages of RLRP: lower transfusion rate, faster bowel function recovery, shorter catheterization and fewer days of hospitalization (8-10).

In RLRP, the limited dissection, the effect of pneumoperitoneum on micro vascularization (compression) and the shorter operating time resulted in a reduced blood loss and a lower rate of transfusions (11-13).

Eden et al. showed in their study that, for the extraperitoneal approach, the continence rate was higher than TLRP, probably because limited bladder dissections are needed (14).

The RLRP approach allows maintaining peritoneal integrity, which avoids leakage of blood or urine and possible bowel injuries. In addition, it decreases the duration of the postoperative ileus, which allows a rapid resumption of oral nutrition (15, 16).

A faster recovery of intestinal function was reported by Porpiglia et al., in a comparative study involving 160 patients operated using the two approaches (17). Our results show an average recovery time of intestinal function of 48 hours, comparable with the findings of a previous study by Liu et al (18).

Urinary fistulae have a less morbid progression in RLRP than in the transperitoneal approach, where the persistence of peritoneal irritation may require reintervention. However, the creation of a new anastomosis under unfavorable technical conditions would lead to a longer hospitalization period (15).

As a disadvantage of RLRP approach, some studies mentioned the higher risk of rectal lesions, especially in obese patients, during the initial seminal vesicle dissection (19). In our

experience only one rectal injury was observed during de posterior dissection of prostate. The incident was immediately identified during the surgery and the adequate repair was laparoscopically performed by the colorectal surgeon. The postoperative evolution was uneventful.

In terms of complications such as urinary leakage, stricture at vesicourethral anastomosis, lymphocele and pneumonia, the two approaches have shown a similar rate, with an average complication rate of approximately 10% (20, 21).

The main advantages of TLRP are the faster placement of trocars, a more generous working space allowing for better viewing and easier performing the anastomosis. However, it has many drawbacks, such as the need for a Trendelenburg position steeper need to move the intestines from the pelvic cavity (22).

We are aware about the world wide spread and the advantages and of the robotic radical prostatectomy and we are also currently offering the robotic technique to our patients since December, 2017. However, we consider that being familiar with the laparoscopic radical prostatectomy is very important for the minimally invasive surgery urologist. Therefor, a detailed description of the RLRP technique is presented in this article.

The present study is small sampled sized one but it is prospectively designed and all the patients were operated by a surgeon already experienced in minimal invasive urological procedures. However, the functional and oncological outcomes of LRP are increasing with experience and we are looking forward for better results that we could demonstrate.

Conclusions

The radical laparoscopic prostatectomy is a safe and efficient procedure for localized prostate cancer with minimal complications and short hospitalization time, but it requires an experienced team of laparoscopic surgeons. The functional and oncological outcomes of LRP are expected to be improved as the medical team experience is extended.

Conflicts of Interest

No conflict of interest.

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