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Laparoscopic radical prostatectomy with bladder neck and neurovascular bundle sparing: technique and surgical outcomes

Radykalna prostatektomia laparoskopowa z oszczędzeniem szyi pęcherza moczowego i zachowaniem pęczków nerwowo-naczyniowych: technika zabiegu i ocena wyników

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Summary

Introduction and Objectives. The technique alternative to open radical prostatectomy is to perform radical prostatectomy from transperitoneal and extraperitoneal approach.

The aim of the study is to present the technique of laparoscopic radical prostatectomy (LRP) with the intention of preserving the bladder neck (LRP/BNS) and neurovascular bundles, this being crucial achieving continence and the fast recovery of erectile function.

Material and methods. From January 2004 to December 2010, LRPs were performed in 469 (95.7%) cases of clinically organ-confined prostate cancer. Extraperitoneal laparoscopic technique was performed in 449 cases. LRP with the intention of bladder neck preservation (LRP/BNS) was performed in 194 (41.3%) patients. The procedure was performed with bilateral neurovascular bundle (NVBs) preservation in 40 (8.5%) patients and unilateral NVB preservation in 78 (16.6%) patients.

Results. In all of 194 cases LRP/BNS was performed laparoscopically in the extraperitoneal space. The mean hospital stay was 5 (4-7) days. The median catheter time was 7 (5-9) days. The continence rates (no pads at all) at 3, 6 and 12 months after LRP/BNS were 74.5%, 84.6%, 92.3%, respectively in pts remaining in follow-up. After LRP/BNS and nerve sparing procedures, total potency rates (measured by IIEF5) at 3, 6 and 12 months were 17.6%, 42.8%, 55.2%, respectively in pts remaining in follow-up.

Conclusions. The bladder neck preservation during laparoscopic radical prostatectomy (LRP/BNS) is an effective, safe procedure, which offers good functional results based on fast recovery of continence. Bladder neck preservation offers full tight anastomosis, especially in cases with no large median lobe of prostatic adenoma. The "learning curve" of the LRP in a team with experience in laparoscopic surgery is significantly shorter, than we expected before the routine implementation of this technique. LRP/BNS with intention of NVB preservation offers the chance of erection recovery in about 50% pts previously potent.

Key words: prostate cancer, laparoscopic radical prostatectomy, functional outcomes

Streszczenie

Wstęp. Alternatywę otwartej prostatektomii radykalnej stanowi laparoskopowa prostatektomia radykalna (LRP) wykonywana z dostępu przezotrzewnowego lub przedotrzewnowego.

Cel pracy. Celem opracowania jest przedstawienie techniki LRP wykonywanej z intencją oszczędzenia szyi pęcherza moczowego (LRP/BNS) oraz pęczków nerwowo-naczyniowych, jako kluczowych elementów odpowiedzialnych za powrót trzymania moczu (kontynencji) oraz erekcji po operacji.

Materiał i metody. LRP w latach 2004-2010 wykonano u 469 chorych na raka klinicznie ograniczonego do stercza. Operację z dostępu wyłącznie przedotrzewnowego przeprowadzono u 449 (95,7%) z nich, przy czym u 194 (41,3%) z intencją zachowania szyi pęcherza i u 40 (8,5%) z intencją obustronnego, a u 78 (16,6%) jednostronnego zachowania pęczków nerwowo-naczyniowych.

Wyniki. LRP z oszczędzeniem szyi pęcherza (LRP/BNS) przeprowadzono wyłącznie przedotrzewnowo u wszystkich 194 chorych. Średni czas hospitalizacji u tych chorych wynosił 5 (4-7) dni. Średni czas utrzymywania cewnika w pęcherzu wynosił 7 (5-9) dni. Pełną kontynencję w 3, 6 i 12 miesiącu po LRP/BNS osiągnęło odpowiednio 74,5, 84,6 i 92,3% poddanych kontroli w tym okresie. Odsetki chorych po LRP/BNS i operowanych z intencją oszczędzenia pęczków nerwowo-naczyniowych, którzy po 3, 6 i 12 miesiącach od operacji zgłosili występowanie wzdodów prącia wyniosły odpowiednio 17,6, 42,8 i 55,2% spośród poddanych kontroli w tym okresie.

Wnioski. LRP/BNS jest zabiegiem skutecznym i bezpiecznym, umożliwiającym wytworzenie szczelnego zespolenia pęcherzowo-cewkowego i stwarzającym szansę szybkiego powrotu pełnej kontynencji. „Krzywa nauki” LRP/BNS jest dla zespołu mającego doświadczenie w wykonywaniu urologicznych operacji laparoskopowych krótsza niż sądziliśmy, przed wprowadzeniem tej techniki do stosowania rutynowego. Operowanie z intencją oszczędzenia pęczków nerwowo-naczyniowych stwarza możliwość zachowania erekcji u około 50% mężczyzn, u których wzdody prącia występowały przed operacją.

Słowa kluczowe: rak stercza, laparoskopowa prostatektomia radykalna, wyniki czynnościowe

INTRODUCTION

Treatment methods offered to patients with prostate cancer (PCa) are selected depending on cancer stage, the age and general health of the patient as well as his expectations expressed after he becomes fully informed of the outcomes and risks of available treatment modalities. Radical treatment is warranted in patients with an organ-confined tumour (cT1-2 N0 M0), whose natural life expectancy is at least 10 years. **The most widely used radical treatment is radical prostatectomy performed by the classic, open method (ORP – open radical prostatectomy) or through laparoscopy (LRP – laparoscopic radical prostatectomy).** Recently, a growing number of centres effectively perform radical surgical treatment of patients with locally advanced PCa (cT3 N0 M0). Limiting factors for the applicability of radical surgical treatment do not include patient age; on the other hand, they comprise the patient's general health and age-related concomitant diseases, which may adversely impact overall survival (1).

Radical prostatectomy performed through the retropubic, perineal or laparoscopic approach is based on total removal of the gland with the seminal vesicles and lymph nodes located inferiorly to the common iliac vessel bifurcation. It involves bilateral removal of lymph nodes below the bifurcation of the common iliac artery and the obturator lymph nodes, while the tissue that surrounds the external iliac artery is spared. In high-risk cancers, an extended pelvic lymphadenectomy is performed, which additionally includes nodes located along the external iliac vessels as well as nodes lying medially to the internal iliac vessels, and occasionally nodes located along the common iliac vessels up to the point, where they are crossed by the ureters. **The efficacy of RP is reflected by the fall of the serum level of prostate-specific antigen (PSA) below the lower limit of detection (< 0.2 ng/ml).** If prostatectomy is radical at the oncological way, the PSA level becomes undetectable 3 weeks following the operation. A higher PSA level in the early post-operative period may point to incomplete local resection of the tumour, remnant

normal gland in the surgical site, and/or the presence of metastases undetected prior to the operation. Prostatectomy offers a 65-75% 10-year recurrence-free survival. Five-and ten-year biochemical recurrence-free survival (elevation of PSA level \geq 0.2 ng/ml following a period of “undetectability”) following prostatectomy is 69-84% and 47-75%, respectively (1).

The first report on laparoscopic radical prostatectomy (LRP) was presented by Schuessler et al. during the Annual Meeting of the American Urological Association in 1992. In 1997, the same authors published a series of 9 patients treated by LRP, providing a negative assessment of the method, stating that, compared to the classical approach, laparoscopy fails to add significant benefit for the patient mainly because it poses exceptional technical difficulties, takes much longer to perform and is therefore burdened with excess risk of general complications (2). In the same year, Raboy et al. reported the first instance of LRP performed through a preperitoneal (extraperitoneal) approach (3). The initially abandoned transperitoneal LRP technique was further developed by Gaston in Bordeaux as well as Guilloneau and Valancien in Paris. Initially, these authors conducted a radical prostate excision exclusively by a transperitoneal approach (the Montsouris technique) (4, 5). Five months later, Claude Abbou in Paris-Creteil developed his own technique of removing the prostate and creating a vesico-urethral anastomosis (6). Further years brought a dynamic propagation of the method to many European and American centres with various modifications. The latter especially referred to the direction of dissecting and separating of the prostate gland; the technique of developing working space during the extraperitoneal prostate gland excision; and the technique of anastomosing the urethra and the bladder neck (2-12).

Older techniques of radical prostatectomy, classical, suprapubic or laparoscopic, involved dividing the base of prostate from the bladder, starting from the anterior bladder wall, which required adapting of the bladder

neck diameter to that of the urethra stump at the stage of vesico-urethral anastomosis (13).

This paper presents a surgical technique of LRP performed for organ-limited prostate cancer, using exclusively the extraperitoneal approach, with the intention of sparing the bladder neck (LRP/BNS) and unilateral or bilateral preservation of neuro-vascular bundles.

MATERIAL AND METHODS

Between January 2004 and December 2010, we performed LRP in 469 patients with cancer clinically limited to the prostate gland (cT ≤ 2 N0 M0) aged from 41 to 75 (mean age = 62). The operation was performed through an exclusively extraperitoneal approach in 449 (95.7%) of them. The surgery was performed with the intention of preserving the bladder neck (LRP/BNS) in 194 (41.3%) patients (tab. 1).

We performed operations with intended bilateral sparing of neurovascular bundles in 40 (8.5%), and unilateral sparing in 78 (16.6%) patients, which in the group of purely preperitoneal LRP/BNS comprises 20.6% and 40.2%, respectively.

Surgical space was initially created by delaminating the tissues with a finger, and later by visually controlled insufflation without the use of Gaur's balloon. We performed LRP using five trocars (two of a 10 mm diameter and three of a 5 mm diameter) and a 0° and 30° videolaparoscope. Haemostasis was secured with bipolar coagulation (Ligasure®). Initially, we performed an appropriate pelvic lymphadenectomy. Next, we liberated the anterior prostate surface and incised the pelvic fascia on either of its sides. Then, we identified the bladder neck and the prostate base and went on to divide the muscular fibres of the bladder wall, in direct vicinity of the gland and we liberated the perivesical segment of the urethra. After incising the urethra in direct vicinity of the prostate, we reached the spermatic duct and the seminal vesicles. At this stage, we gained an excellent view of both neurovascular bundles, which made it possible to safely preserve at least one of them. Fol-

lowing further liberation of the prostate in a caudal direction, we divided the pubo-prostatic ligaments, control haemostasis, and divided the dorsal vein complex (Santorini plexus). Next, using meticulous dissection, we exposed the prostate apex and divided the urethra in its direct vicinity, avoiding damage to the muscle fibres of the external urethral sphincter. Having shifted a completely liberated prostate, we anastomosed the fully preserved bladder neck with the urethral stump on an 18-20F Foley catheter using a 3/0 continuous suture. With this surgical method, the opening in the bladder neck was relatively narrow and there was no need to adapt its diameter to that of the urethral stump, while the vesico-urethral anastomosis could be created without any tension. We seated a 14F drainage tube in the region of the anastomosis, following which we removed the excised prostate, withdrew the trocars and sutured the incisions through which they had been inserted.

RESULTS

The surgery was performed by exclusively preperitoneal laparoscopy in all 194 patients subjected to LRP with intention of bladder neck sparing (LRP/BNS). In one patient, we inadvertently perforated the rectal wall while liberating the posterior surface of the prostate. The wound was immediately closed by laparoscopic approach with double-layer knot sutures. In 22 patients (11.3%) with a large middle lobe of the gland, the diameter of the bladder neck opening was inadvertently enlarged during LRP/BNS. The enlarged opening was adapted to the urethral stump by partial suturing with knot sutures. No further intraoperative complications were noted during LRP/BNS in our patient group.

The mean duration on the LRP/BNS surgery was 150 min (110-210 min). The mean blood loss during surgery was 150 ml (110-350 ml). None of the patients undergoing LRP/BNS needed a blood transfusion.

The post-operative course in all 194 patients treated by LRP/BNS was un-

Table 1. Numbers of patients who underwent laparoscopic radical prostatectomy.

LRP	Number (percentage) of patients				
			NVBS [-]	NVBS [+]	
				Unilateral	Bilateral
Trans-peritoneal	20 (4.3%)	BNS [-] 20 (4.3%) BNS [+] -	20 (4.3%)	-	-
Preperitoneal	449 (95.7%)	BNS [-] 255 (54.4%)	255 (54.4%)	-	-
		BNS [+] 194 (41.3%)	76 (16.2%)	78 (16.6%)	40 (8.5%)
Total	469		351 (74.9%)	78	40
				118 (25.1%)	

Legend:
 BNS [+] = with bladder neck sparing;
 BNS [-] = without bladder neck sparing;
 NVBS [+] = with intention of neurovascular bundle sparing;
 NVBS [-] = without intention of neurovascular bundle sparing.

eventful. The full mobilisation of patients and the reinstating of a normal diet was on average achieved in the second post-op day. The mean hospital stay was 5 days (4-7 days). The indwelling bladder catheter was maintained for a mean time of 7 days (5-9 days).

The pathological stage of the tumour in the surgical specimen is presented in table 2. Positive surgical margins (PSM) were found in 14 (7.2%) of patients undergoing LRP/BNS, however, in none of the cases was the PSM found on the basal side of the gland.

After LRP/BNS, full continence in post-op months 3, 6 and 12, in the subset reporting for follow-up visits, was achieved by 74.5%, 84.6% and 92.3%, respectively (tab. 3). Following operations performed with the intention of sparing neurovascular bundles, the total percentage of regained erectile function (assessed by the IIEF-5 questionnaire) in post-op months 3, 6 and 12 was reported by 17.6%, 42.8% and 55.2%, respectively among those remaining in follow-up who had erections prior to surgery (tab. 4).

Table 2. Pathological stage of prostate cancer assessed by histology examination of surgical specimens collected following LRP performed extraperitoneally with bladder neck preservation (PSM – positive surgical margin).

Pathological stage pT/PSM	No. of patients/percentage
pT2a	58 (29.8%)
pT2b	117 (60.3%)
pT3a	12 (6.3%)
pT3b	7 (3.6%)
Total	194
PSM	14 (7.2%)

Table 3. Assessment of full continence (without need for pad wear) in patients treated by preperitoneal LRP with bladder neck sparing (LRP/BNS).

Follow-up month	Percentage (No. of patients/Total number of patients assessed)
3	74.5% (114/153)
6	84.6% (99/117)
12	92.3% (48/52)

Table 4. Assessment of regained erectile function (based on the IIEF5 questionnaire) in patients subjected to LRP/BNS with the intention of sparing neurovascular bundles.

Follow-up month	Percentage (No. of patients/Total number of patients assessed)
3	17.6% (9/51)
6	42.8% (18/42)
12	55.2% (21/28)

DISCUSSION

Ever since laparoscopic radical prostatectomy was introduced to routine clinical practice, there has been an on-going search for techniques that would further reduce the degree of its invasiveness and prevent significant complications such as urinary incontinence

and erectile dysfunction. Admittedly, no correlation has been found between bladder neck sparing in classic open retropubic prostatectomy and the return of continence in long-term follow-up (14). However, some authors propose the sparing of both the bladder neck and an appropriately long membranous segment of the urethra during laparoscopic surgery (15, 16). Others propose that dissection of the prostate, which preserves the periprostatic fascia (PF) and separates the prostatic apex below the pubo-prostatic ligaments, provides the fastest return of continence although it must be applied only in selected patients, who have a low risk of surgical margin positivity (17). However, further studies of large patient groups are needed to determine whether dissecting the apex of the prostate with PF sparing improves the return of continence following radical prostatectomy. Bladder neck sparing is also advocated for radical prostatectomy performed by robotic surgery. The analysis of a large group of 619 patients suggests that the oncological risk related to robotic surgery with or without bladder neck sparing is similar, while the former option provides higher probability of earlier regaining of continence (18). Similar results are achieved with manual laparoscopic prostatectomy in European centres with the highest level of experience in LRP (19). In our opinion, benefits of bladder neck sparing during radical prostatectomy also relate to the post-operative course. The restoration of nearly normal urinary tract continuity prevents the catheter balloon from contacting the vesico-urethral anastomosis and impinging on vesical ostia of the ureters. Moreover, the preservation of the bladder neck and dividing the urethra distal to it allows for creation of a fully tight urethro-urethral anastomosis with no need for adapting the diameter of the bladder neck opening to that of the urethral stump. Additionally, the anastomosis is created without tissue tension, not least because the membranous segment of the urethra is relatively long. The presented surgical technique offers a very good view of the course of the neurovascular bundles both across the lateral aspects and across the base of the prostate, enabling the safe preservation of at least one of them.

CONCLUSIONS

Laparoscopic radical prostatectomy performed through extraperitoneal approach with bladder neck and neurovascular bundle preservation is a safe and effective procedure offering good chances of rapid return of full continence and meeting all criteria of a minimally invasive operation.

The preservation of the bladder neck allows for the creation of a tight urethro-vesical anastomosis, especially in patients whose middle lobe of the prostate is not large.

For a team with experience in urological laparoscopic surgery, the learning curve of LRP with bladder neck sparing is shorter than we expected before we implemented it in routine care.

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