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Original article

ROBOT-ASSISTED RADICAL PROSTATECTOMY WITH DA VINCI XI: OUR INITIAL EXPERIENCE

Deyan Anakievski, Rostislav Marinov, Inna Gocheva, Viktor Nikolov, Pavel Abushev

Clinic of Urology, University Hospital "St. Marina", Medical University - Varna, Bulgaria.

ABSTRACT

During the recent years, prostate cancer becomes a major socio-medical challenge worldwide, as well as in Bulgaria, because of its rising importance and unfavorable impact on human health. Recently we are facing significant theoretical and practical advances in the field of minimally invasive prostate cancer surgery.

The last two decades witness a dramatic change in the surgical treatment of most urological diseases with the adventage of a robotic surgical platform. In fact, surgical treatment of prostate cancer has undergone most significant change, thus almost every case nowadays is performed with a robot. The present abstract indicates our initial experience with the use of da Vinci Xi-system in prostate cancer surgery.

Materials and methods: 137 robot-assisted radical prostatectomies have been performed in patients with prostate cancer for the period 1 February 2020 / 1 May 2021 in our clinic.

Results: The average operative time for the performed operations with minimal blood loss was 160 minutes. Blood transfusion was performed to two patients, whereas no conversion of operations was required in other patients. About half of the patients underwent extended pelvic lymph node dissection due to the high risk for them.

Conclusion: Robot assisted radical prostatectomy (RARP) is shown to be an easily performed laparoscopic technique and best practice, compared to the standard open procedure. When analyzing the open approach, certain preliminary studies indicate that robotic prostatectomy has similar outcomes in short-term oncologic control, continence and potency. Initial long-term quality-of-life outcomes have demonstrated priority results for robotic radical prostatectomy, compared to open radical prostatectomy.

Keywords: robotic, prostate cancer, lymph node dissection, prostatectomy

INTRODUCTION:

Prostate cancer is the most common cancer in men and second leading cause of cancer-related deaths. It represents the most frequent cancer diagnosed in men mainly in Germany and other countries in Europe as well.

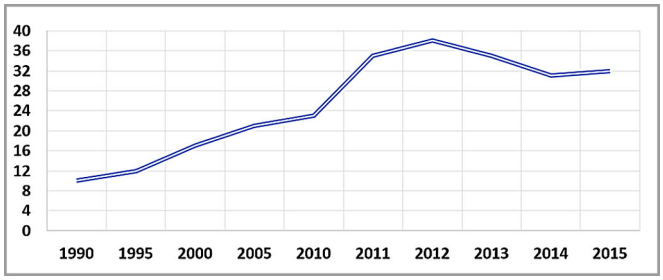
According to the International Agency for Research on Cancer GLOBOCAN cancer statistics for the year 2020 in 185 countries or territories worldwide, based on the best available data on cancer incidence from population-based cancer registries, prostate cancer incidence rate one of 1,41 comes second after lung cancer one of 2,21 [1].

According to an update of the global cancer burden, using the GLOBOCAN 2020, the statistic estimates cancer incidence, prognosed by the International Agency for Research on Cancer, with 1,414,259 newly-diagnosed prostate cancer cases, or 7,3% of all estimated 19,292,789 new cancer cases in 185 countries worldwide [1]. Efforts to build a sustainable infrastructure for the dissemination of cancer prevention measures and provision of cancer care in transitioning countries is critical for global cancer control.

The most recent annual dynamics of age-adjusted (world standard) incidence rates 100,000 per year of prostate cancer diagnosis in Bulgaria is illustrated in Fig. 1 (Cancer Incidence in Bulgaria, 2017) [2].

After a stable increase until 2012, there is a decrease in the subsequent years of registration available.

Fig. 1. Annual dynamics of age-adjusted (world standard) incidence rates 100,000 per year of prostate cancer diagnosis in Bulgaria

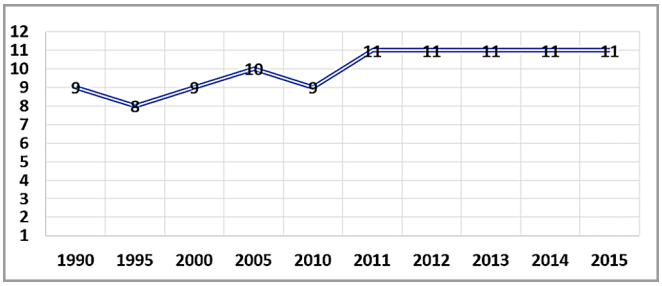


According to an update of the global cancer burden, using the GLOBOCAN 2020, the statistic estimates cancer mortality rates, prognosed by the World Health Organization mortality database, in 185 countries or territories worldwide, with a total of 375,304 deaths of prostate cancer and 3,8% of all estimated 9,958,133 cancer deaths in 185 countries worldwide [1].

The most recent annual dynamics of age-adjusted (world standard) mortality rates 100,000 per year of prostate cancer diagnosis in Bulgaria is illustrated in Figure 2 (Cancer Incidence in Bulgaria, 2017) [2].

It remains relatively high during the last five years of registration available.

Fig. 2. Annual dynamics of age-adjusted (world standard) mortality rates 100,000 per year of prostate cancer diagnosis in Bulgaria



The European and American societies have not recommended prostate cancer screening with prostate specific antigen in the past, allowing physicians to take such decision [3]. The United States American Preventive Task Force in 2012 recommends to abandon the use and analysis of the prostate-specific antigen. This results in an increased incidence rate of the metastatic prostate cancer and its mortality rate as well. For the first time in 2018, the European Association of Urology releases new recommendations in favour of screening based on the prostate-specific antigen, followed in 2019, when guidelines are updated with no alterations in their recommendations.

Results of the largest screening trials reveal that prostate-specific antigen testing reduces the incidence rate of locally advanced and metastatic prostate cancer and shows an effect on cancer-specific mortality as well. Early diagnosis results in overdiagnosis and overtreatment of insignificant cancer cases with comorbidity, thus more individualized and risk-tailored modern strategy is needed. The German Federal Joint Committee declines the financial coverage of such testing by health insurance funds. Available validated instruments should accompany the baseline prostate-specific antigen to optimize detection of clinically significant prostate cancer [4].

Changes in screening guidelines, adoption of active surveillance and implementation of high-cost technologies have changed treatment costs of prostate cancer.

The real world-wide costs of first-line prostate cancer management are assessed from 24 to 60 months, following diagnosis using clinical electronic health records for 2008-2018, linked with the California Cancer Registry and the Medicare Fee Schedule [5]. In 3,433 patients, surgery (54,6%) is more common than radiation (22,3%), or active surveillance (23,0%) of the cases. When following and analyzing the diagnosis for the initial two years, active surveillance ($2,97 per day) is cheaper than surgery ($5,67 per day), or radiation ($,34per day) in favourable cases, whereas surgery ($7,17 per day) is less expensive than radiation ($16,34peerday) for unfavourable prostate cancer.

The health care costs and use one year after open radical prostatectomy (in 9,853 patients) and robotic-assisted radical prostatectomy (in 1,604 patients) are comparatively assessed within a retrospective cohort study of a US commercial claims database from January 1, 2013, to December 31, 2018 [6]. The patients with robotic-assisted radical prostatectomy (RARP) have a statistically significant higher cost at the index hospitalization (p<0,001), but similar total cumulative costs observed within 180 days and one year after discharge. In these patients, a one-year post-discharge health care regime is statistically and significantly lower for mean numbers of emergency department visits (p<0,001) and hospital outpatient visits as well (p<0,001). The reduced use of health care services among these patients translates into additional savings of $2,929 (p<0,001) and approximately 1,69 fewer days (p<0,001) absent from work for health care visits.

Robot-assisted radical prostatectomy (RARP) is indicated for men with prostate cancer with an acceptable lifetime expectancy. Historically, the primary indication for RARP has been accepted as a localized disease, but there has been recent evidence that men with non-localized disease will likely experience significant improvement in survival. Therefore, an indication as long as a complete discussion of risks, benefits, and complications have been accomplished. Contraindications that may impact the decision for RARP include a history of extensive abdominal or pelvic surgery, morbid obesity, or extremely large prostates.

MATERIALS AND METHODS:

137 robot-assisted radical prostatectomies were performed in our clinic for the period from 1 January 2020 to 1 May 2021 in patients with prostate cancer.

Clinicodemographic information of our patient cohort is presented in Tab 1.

Table 1.

n = 137	
Median age, yrs(range)	62(50-78)
PSA ng/ml, n%	
< 5	17(12,4)
5-10	97(71)
>10	23(16,5)
Median BMI kg/m^2 (range)	22,65 (18,14- 30,08)
ASA score, n (%)	
1	37 (27%)
2	70 (51%)
3	15 (11%)
4	15 (11%)
Previous abdominal or pelvic surgery, n.	
Repair of bowel perforation	12
Herniorrhaphy	14
Laparoscopic cholecystectomy	9
IIEF-5, n (%)	
22-25	92 (67%)
15-21	24 (17,5%)

pGScore, n (%)	
3+3	48(35%)
3+4	31(23%)
4+3	30 (22%)
4+4	18 (13%)
3+5	2 (0,8%)
>4+5	8 (21,2%)
P- stage, n (%)	
pT2	98 (71,5%)
pT3/T4	49 (28,5%)

Patient preparation:

We use laxative for colon cleaning and fasting for 8 hours is the preoperative preparations, as well as typing and blood reserve are routinely performed. Antibiotic prophylaxis is done to all patient prior to surgery, and low dose heparin is started the day before surgery. We recommend to every patient, who is sexually active (due to the IIEF which is given to all patients before surgery), that a few days before the surgery date, he shall be given low-dose phosphodiesterase (PDE-5) inhibitors.

Patient Positioning (for RARP)

All patients were operated under general anesthesia. Elastic bandage of both legs was done for thromboembolic events. After the patient is prepared and we draped the robot hands, a Foley catheter is gently placed. After that the pneumoperitoneum was created with a Veress needle, applying pressure at 15 mm Hg. The first optical 8 mm trocar was inserted above the umbilicus and a 0-degree optic was used for reviewing of the abdominal cavity. The other four trocars were inserted under optical control and were placed on the same line with optical troacar, and only one 5 mm port is placed above that line. When all ports are positioned, AirSeal is installed and activated, and the pneumoperitoneum is reduced to 10 mm Hg, in some cases to 8 mm Hg for the procedure. After that the patients are positioned in the Trendelenburg position 25 degree, allowing gravity to gently pull the abdominal contents out of the pelvis, facilitating access to the bladder and prostate, and reducing the risk of injury to abdominal organs. The legs are separated to facilitate docking of the daVinci robot. Once the patient is positioned, the robot is docked.

Figure 3. Patient positioning.

Surgical Steps

The main Surgical Steps are:

1. Releasing the bladder
2. Endopelvic fascia
3. Anterior and posterior bladder neck
4. Seminal vesicles and rectum
5. 'Clipless' transection of the prostatic pedicles and the NVBs
6. DVC and urethral transection
7. Rocco and Van Velthoven anastomosis

The bladder is released by incising the peritoneum from the right obliterated umbilical artery to the left obliterated umbilical artery and then down to the *vas deferens* and then deep into the perirectal space. This facilitates retraction of the bladder and rectum out of the pelvis to improve more space. The anterior prostatic fat is dissected to skeletonize the puboprostatic ligaments for optimal visualization of the apex. In patient with high risk of the disease we incised endopelvic fascia laterally closer to muscle than the nerve, whereas in low-risk patients we don't incise the endopelvic fascia, we simply start directly from bladder neck incision. In the same moment we change the optics from 0 to 30 degree. After the incision of the bladder neck, we continue with resection of the prostate urethra and separate the bladder from the prostate. Once the bladder is entered, we prefer to retract the prostate with fourth arm rather than use the catheter. From now on, in patients in whom we retain sexual function, we do not use calter, but only hemolok clips. Continuous retraction of the prostate is the key to safe and speedy progress. This facilitates a quick method to change angles and improve visualization and dissection planes. The intent is to enter the muscular/vascular space behind the detrusor (or the posterior bladder neck). Immediately behind the posterior bladder, the longitudinal muscle and multiple vessels, that need cauterization, are ready for our approach. This muscular/vascular layer is later incorporated into the Rocco stitch.

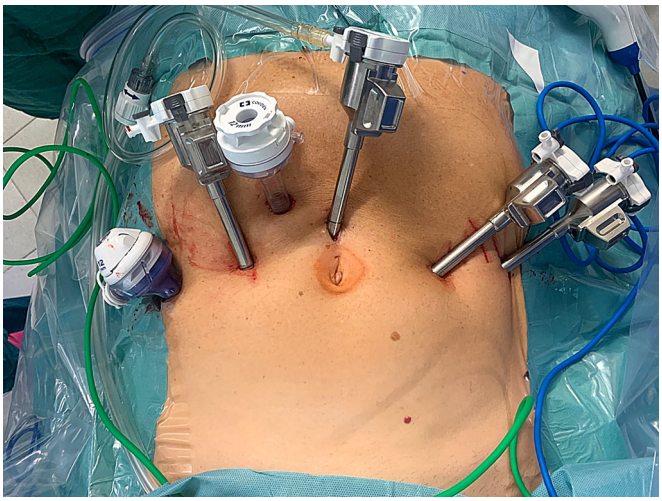
We incise the muscle fibers between the bladder and the prostate in order to find the *ductus defense* and the seminal vesicles. An important key to the mobilization of the SVs is to focus on lifting the SVs with minimal traction to the surrounding hypogastric nerves, which are important for the sensation of orgasm. The SVs are then used to lift the prostate for separation from the rectum. Denonvilliers is grasped and lifted and incised sharply until the perirectal fat is seen. Dissection of the plane between the prostate and rectum is facilitated by the surgeon's left hand elevating the prostate as the assistant retracts gently but firmly on the rectum with the sucker, if needed. The dissection is carried distally to the apex. We can fleep up the 30 degree optic, which is facilitated very easy to release the nerves from the prostate without traction. Cauterization is optimized by using one blade of the open scissors. Thermal injury results from desiccating bipolar cauterization. Touch cautery (meaning cut and cauterize) has no measurable thermal injury. Our aim is to maximizing urethral length without tracking on the nerves. We suture the DVC with a 3-0 V-lock suture in all cases to prevent late or delayed venous bleeding. Arterial bleeding along the nerves is sutured with 4-0 PDS.

The Rocco stitch is performed to all patients, which significantly reduces postoperative hematuria and reduces bladder neck contractures. A 3-0 Quill begins at the bladder incorporating the cut edge of Denonvilliers and then the posterior bladder detrusor. The anastomosis is the standard Van Velthoven anastomosis with Quill 2-0 two needles. We apply anterior support as well, which we believe is helping for early continence. In high risk patients we perform extended lymph nodes dissection which include obturator, external, internal and common iliac, presacral, paraaortic and paracaval lymph nodes.

The lymphadenectomy boundaries include the bladder medially, the genitofemoral nerve laterally, Cloquet's node distally, the obturator nerve and its vessels posteriorly, and the mid-common iliac vessels proximally. In the end we install drainage for 24 hours.

The patients are discharged from the hospital in the morning of postoperative day 5 after the surgery, with a urinary catheter in place. The catheter is removed after 6 to 7 days. Cystograms are rarely indicated and only in the event of persistent gross hematuria. Regarding sexual function recovery, patients are advised to take a daily dose of a PDE-5 inhibitor (preferably at nighttime). Patients are advised that sexual function recovery may occur over 1 to 2 years post-RARP.

Fig. 3. Patient position and port placement



RESULTS:

The average operative time for the performed operations is 160 minutes, with minimal blood loss. In two patients we performed transfusion, no conversion of operations was required in other patients. About half of the patients underwent extended pelvic lymph node dissection due to the high risk for the patients.

DISCUSSION:

A. Nathan et al. [7] state that robot-assisted radical prostatectomy, RARP, is associated with fewer intraoperative adverse events, reduced blood loss and lower complication rates in localized prostate cancer patients than open and laparoscopic surgery, but could be a risk for comparable oncological and functional outcomes. The use of enhanced recovery after surgery pathways improves patient's recovery and experience, reduces costs and maintains patient's safety. New recommendations to reduce unnecessary postoperative blood tests are suggested.

According to E. F. Faria *et al*. [8] RARP for localized/locally advanced prostate cancer is comparable to open radical prostatectomy in terms of cancer control and complication rates, while certain new evidence suggests that the robot-assisted radical prostatectomy may have better functional outcomes, especially with respect to patient's urinary incontinence and erectile dysfunction.

The differences in perioperative characteristics, surgical complications, as well as in oncological and functional control between the extraperitoneal and transperitoneal RARP, are established and analyzed using contemporary systematic review and meta-analysis of a total of 16 studies including 3,897 prostate cancer patients [9]. The extraperitoneal RARP offers faster operative time (mean difference of 14,4 min.); shorter postoperative hospital stay length (mean difference of 0,9 days), as well as decreased postoperative ileus rates (relative risk of 0,2; between 0,1 and 0,7 at reliability interval of 95%) and inguinal hernia formation (relative risk of 0,2; between 0,1 and 0,5 at reliability interval of 95%).

In a multicentre, randomized, patient-blinded controlled trial in Germany, the functional and oncological outcomes between robot-assisted and laparoscopic radical prostatectomy in a follow-up of 3 months of 718 prostate cancer patients are compared [10]. The difference in continence rates is 8,7% in favour of the robot-assisted radical prostatectomy (54% versus 46%; p=0,027). The RARP remains superior and preferable to the laparoscopic radical prostatectomy, even after adjustment for the randomization stratum nerve sparing and age >65 years (hazard ratio of 1,40; between 1,09 and 1,81; p=0,008). A significant benefit in early potency recovery is identified as well.

Within a prospective, single-center, single-surgeon cohort of 70 consecutive prostate cancer patients undergoing RARP between January and December 2019, 35 patients operated with the urethral fixation technique, in which the urethral stump is fixed to the dorsal median raphe posteriorly and to the medial portion of the *m. levator ani* posterolaterally, are compared with a control group of 35 patients receiving standard vesicourethral anastomosis only [11]. There is urinary continence recovery at three months after catheter removal in 34 patients (in 97,14%) in group one, and in 28 patients (in 80% of the cases) in the control group (p=0,02). The patients in group one report statistically significant higher urinary continence rates even at one week and one month after catheter removal, than those in the control group (68,6% versus 45,7%; p=0,04 and 80% versus 54,3%; p=0,04, respectively). Ninety-day postoperative complications are observed in one patient in group one (in 2,86%) and in four patients (in 11,43% of the cases) in the control group.

The anatomy and concepts of the nerve-sparing radical prostatectomy are first conceptualized by P. C. Walsh & P. J. Donker in 1982. These authors conclude that impotence after radical prostatectomy results from injury to the pelvic nerve plexus that provides autonomic innervation to the corpora cavernosa [12]. The various mechanisms of injury to neurovascular bundle lying in proximity to the prostate have further compounded the concept of nerve-sparing in radical prostatectomy.

The nerve-sparing techniques can be intrafascial or interfascial, based on fascial dissections, as well as antegrade or retrograde based on the surgical approach [13].

A. Kumar et al. [13]., list the following nerve-sparing preservation techniques: veil of Aphrodite technique (high anterior release), super veil technique, early retrograde re-

lease, hypothermic nerve-sparing robot-assisted laparoscopic prostatectomy, modified clipless antegrade nerve-sparing robot-assisted laparoscopic prostatectomy, flexible carbon dioxide laser fibre guided nerve-sparing robot-assisted laparoscopic prostatectomy, potassium titanyl phosphate laser nerve-sparing radical prostatectomy, laparoscopic Doppler ultrasound probe in nerve-sparing robot-assisted laparoscopic prostatectomy and transrectal ultrasound-guided energy-free nerve-sparing laparoscopic radical prostatectomy.

According to A. Kumar et al. [13] the introduction of nerve-sparing to standard RARP has positive results in terms of functional outcomes in addition to the oncological outcomes. The current perspectives of the nerve-sparing RARP in terms of applied anatomy of the prostatic fascial planes, the neurovascular bundle, various nerve-sparing techniques and postoperative functional outcomes are reviewed. Variables such as preoperative risk assessments, baseline potency, surgical anatomy of individual patients and surgeons' expertise play a major role in the outcomes. A tailored approach for each patient is required for applying the nerve-sparing approach during the RARP.

The efficacy and safety of unilateral or bilateral nerve-saving technique of radical prostatectomy is compared between 117 prostate cancer patients aged e"65 years and 333 control patients from January 2012 to December 2019 [14]. There are minimal differences between both groups in erectile function 24 months after radical prostatectomy with bilateral nerve-saving technique (84,2% towards 87,9%), and more relevant differences with unilateral nerve-saving technique (53,8% towards 66,7%) (p=0,033). The performance of radical prostatectomy with nerve-saving technique in elderly patients is not associated with additional oncological risks. The bilateral nerve-saving technique provides high potency recovery results regardless of age.

CONCLUSION:

RARP has shown to be an easily acquired laparoscopic technique, requiring shorter practical experience, thus competing and opposing the open procedure as best practice. We have witnessed a paradigm shift from open to robotic radical prostatectomy as the procedure of choice worldwide. When compared with the open approach, early studies indicate that robotic prostatectomy has simular outcomes in short-term oncologic control, continence, and potency with potentially favorable perioperative outcomes, such as in blood loss and transfusion rates, minor complications, narcotic use, convalescence, and length of hospital stay. Initial long-term quality-of-life outcomes have demonstrated superior outcomes for robotic radical prostatectomy to open radical prostatectomy.

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Address for correspondence:
Assoc. Prof. Dr. Deyan Anakievski M.D
University Hospital St. Marina, Head of Clinic of Urology,
1, Hristo Smirnenski Blvd., 9010 Varna, Bulgaria
E-mail: dejan_anakievski@yahoo.com