

A comparative study between open radical prostatectomy and minimally invasive radical prostatectomy

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Abstract. Objective: In our study we aimed to determine the clinical benefits and harms of the robotic and laparoscopic surgical system for radical prostatectomy compared with the open radical prostatectomy surgical methods. Material and Methods: The study cohort consists 443 patients of: 191 that had open radical prostatectomy (ORP), 44 patients that had robot-assisted (RARP) and 208 laparoscopic prostatectomy (LRP) in clinically localized prostate cancer. The patients were collected, in different periods, between January 2011 and March 2021 from the County Clinical Emergency Hospital Oradea, Urology Clinic of Pelican Hospital, Oradea and Clinical Hospital Th. Burgele, Bucharest. The results of the association were calculated between the clinical variables and some intraoperative observations: the surgical approach, the time of surgery, lymphadenectomy, the duration of hospitalization and the amount of blood loss during surgery / hospitalization. Results: We notice a clear decrease in blood loss for LRP/RARP (221,5 ml) compared to ORP (524.3 ml) ($p=0.21$). For hospitalization we observed a similar trend with 5.09 days for RARP/LRP compared with 7.28 days for ORP ($p=0.8$). A disadvantage compared to the classic prostatectomy technique, was longer operating time (133.64 min.) and LRP/RARP (229.9 min.) ($p=0.06$). Conclusion: This study demonstrates that RARP / LRP has suggests benefits in terms of blood loss, shortening the average length of hospital stay, but with longer operating times. To confirm these results, additional studies are needed, including larger cohorts.

Key Words: prostate cancer, open radical prostatectomy, robot-assisted radical prostatectomy, laparoscopic radical prostatectomy, prostatectomy.

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Introduction

Prostate cancer (PCa) is the second most frequently diagnosed cancer and the fifth leading cause of cancer death affecting men worldwide, in 2018, estimated new PCa cancer cases was 1,276,106 worldwide and 358,989 of total PCa cancer deaths in men (Bray et al 2018). Currently, men diagnosed with clinically localized prostate cancer have a variety of management options including radical prostatectomy (RP), RP is recommended for localized prostate cancer patients with a life expectancy >10 years as a first-line treatment (Sanda et al 2018). According to the data of the National Institute of Statistics, among the existing elderly, men totaled 1,433,412 people, representing approximately 15% of the total number of men residing in Romania out of 9,543,228 people (INS 2021). In this men, prostate cancer ranked first with 23% (335,514) of all cases diagnosed with cancer, followed by lung cancer (14%) and colorectal cancer (13%) (Sinescu et al 2008; INS 2021).

Taking into account this information, we aimed to bring an objective analysis regarding the current modalities of surgical treatment of prostate cancer in the localized phase. Radical prostatectomy, the only way of treatment with radical possibility, is a

widespread therapeutic option in our country. In recent years, the surgical variants of prostatectomy have diversified a lot in our country. Currently being used in the surgical treatment of localized prostate cancer: open radical prostatectomy (ORP), laparoscopic radical prostatectomy (LRP) and robotic assisted radical prostatectomy (RARP). The aim of this study being the comparative analysis of the three surgical variants of the radical prostatectomy performed at present in Romania. Comparatively presenting preoperative, operative and postoperative information.

Materials and methods

We conducted an observational, analytical, retrospective and prospective study and the type of case-control. The subjects included in this study were male patients hospitalized at different times between 01.2011 and 03.2021 in two clinics in Oradea and one in Bucharest, Romania who were diagnosed with prostate cancer. This study included 443 patients confirmed histopathologically by prostate needle biopsy (PNB) with prostate cancer and who subsequently benefited from surgery. Thus, out of the 443 patients included: $n=191$ patients (43%) had ORP in the Oradea County Emergency Clinical Hospital, $n=44$ (10%)

Table 1. Comparison between ORP and LRP/RARP group

Variables	Characteristic of control group (ORP) (n=191)	Characteristic of experimental group (LRP+RARP) (n=252)	P
Age (years)	64.3 (45;78)	66.4 (43;78)	0.88
Environment	rural	89 (46.6%)	0.04
	urban	102 (53.4%)	
cT stage	cT1c	162 (84.8%)	0.2
	cT2	26 (13.6%)	
	cT3	3 (1.6%)	
Type of approach	Transperitoneal	0 (0%)	0.0072
	Extraperitoneal	191 (100%)	
Duration of surgery	133.64 (96;193)	229.9 (90;420)	0.06
Blood loss (ml)	524.3 (400;850)	221.5 (200;400)	0.21
Hospital stay (days)	7.28 (5;9)	5.09 (4;7)	0.8
Lymphadenectomy	Yes	115 (60.2%)	0.007
	No	76 (39.8%)	
pT stage	pT1c	8 (4%)	0.35
	pT2a	59 (31%)	
	pT2b	11(6%)	
	pT2c	65 (34%)	
	pT3a	19 (10%)	
	pT3b	25 (13%)	
	pT4	4 (2%)	

patients underwent RARP in the Oradea Pelican Hospital and n=208 patients (47%) LRP in the Pelican Hospital Oradea and Th. Burghel Bucharest, Romania, all interventions being performed on patients with clinically localized prostate cancer. To perform a good comparative analysis of the results, we divided the cohort into two groups: the control group consisting of patients who benefited from ORP and the experimental group consisting of patients who had LRP and RARP.

The criteria for including patients in the study were:

- diagnosis of localized prostate cancer, with or without associated comorbidities;
- the patient's consent by signing the informed consent;
- performing radical prostatectomy (open, robotically assisted or laparoscopic);
- adherence to follow-up.

The exclusion criteria were:

- the patient's refusal to take part in the study;
- non-adherence to follow-up.

According to the European Society of Urology (EAU) localized prostate cancer is (Aus, 2011):

- T1a – when life expectancy exceeds 10-15 years or a high degree of anaplasia
- T1b – T2
- T3 – limited to unilateral extracapsular extension, Gleason score less than 8 and PSA below 20 ng / ml

All patients included in this statistical analysis voluntarily participated, expressing their agreement on all these things in writing in the observation sheets and in the special consents for each work performed. For all patients, the confidentiality of the data was respected, without publishing data related to the name, personal data thus respecting all the GDPR norms valid

at present. The ethics commissions of each hospital were also approved in order to study the patients treated in the respective clinics for prostate cancer.

Study of these patients data included general data on: age, c and pTNM staging, environment, gender, mean of origin and particular operative and postoperative data on: operative time, type of approach, intraoperative blood loss, lymphadenectomy mean length of hospital stay. Also, classifications used internationally regarding the possibility of postoperative complications Clavien-Dindo calcification (Dindo et al 2004) and Briganti's classification (Peillon et al 2020) regarding the suggestion of lymphadenectomy in radical prostatectomy were used.

Surgical Technique

Within the group of subject patients, we used the 3 main techniques of radical prostatectomy currently used internationally. The main technique used as a gold standard until recently, ORP (191 cases) which consists of removal of the prostate and seminal vesicles in block with periprostatoseminal cellular fatty tissue, followed or not by lymphadenectomy and bladder-urethral anastomosis (Finkelstein et al 2012). The extraperitoneal retro-pubic procedure allows simultaneous access to the prostate and lymph nodes, but is burdened with an increased risk of bleeding (García-Sánchez et al 2017). Minimally invasive surgical techniques for prostatectomy have appeared more recently in our country and have been practiced in our clinic since 2017 for LRP so far in both clinics we have a total of 208 cases. The laparoscopic approach uses standard laparoscopic instruments in the urology clinic at Pelican and Th. Bucharest drills using a 3D laparoscopy video system. Starting with 2019 in Pelican Hospital, the practice of RARP has been implemented, having

so far 44 cases that have benefited from this technology. The robotic procedure uses the same incisions and tools, but the surgeon uses controlled robotic arms accessed from a console to perform the operation remotely (Lanfranco et al 2004). The robot used in the urology department of Pelican Hospital is DaVinci X. Statistical analysis was performed using Microsoft Office Excel / Word 2013, R +, SPSS. Qualitative data were characterized by frequency and percentage, and continuous variables were described by median and 25-75 percentile. Comparisons between groups were performed using association tests (Fisher's exact test and chi-squared test, when appropriate). The association tests were performed between groups of qualitative variables divide as nominal variables for: environment, type of approach, cT stage, pT stage; ordinal variables for age, duration of surgery, blood loss, hospital stay and binary variables for lymphadenectomy. All tests had 2-sided P values, and all values <0.05 were considered statistically significant.

Results

The data analyzed in this study are presented in comparative detail in Table 1. Out of the total of 443 patients included in the study, at $n = 191$ (43.1%) ORP was performed and at the rest, minimally invasive surgery was performed $n = 252$ (56, 9%). The mean age of the patients was close in the two groups 64.3 years in the control group and 66.4 years for the experimental group ($p = 0.88$). Analyzing comparatively the two groups included in the study, as we observe in Table 1, we do not observe significant differences in terms of: age, environment of origin, cT stage and pT stage.

We observe in the control cohort most cases are performed by extraperitoneal approach, unlike the experimental group when both approaches are used ($p = 0.007$). When comparing the operating time, a much shorter operating time is observed in the control group compared to the minimally invasive procedures ($p = 0.06$). Blood loss during radical prostatectomy shows as seen in Table 1. a major difference between ORP versus LRP / RARP, with a much higher loss for ORP ($p = 0.21$). We also notice a superiority of the interventions from the experimental group in terms of the average duration of hospitalization ($p = 0.8$).

Discussions

Radical prostatectomy remains the only form of radical therapy in localized prostate cancer treatment. Regardless of the surgical technique used in prostatectomy, classical (ORP) or minimally invasive (RARP and LRP) it can be practiced safely in terms of surgery and postoperative and oncological results (Cao et al 2019). As we observe in the literature, doing a review, we do not notice major differences between the two groups studied from an oncological point of view (Cao et al 2019). We observe significant differences between the two groups studied when analyzing the surgical approach where we observe that in the control cohort $n = 191$ (100%) of the patients were operated by extraperitoneal approach, while in the experimental group only $n = 169$ (67%) had extraperitoneal approach, the rest $n = 83$ (33%) having transperitoneal approach ($p = 0.007$), these aspects are similar to those in the literature according to Atug et al (2007). Blood loss during radical prostatectomy, an important surgical element, suggests a significant benefit for the experimental group

with an average of 221.5 ml / intervention (200; 400) compared to an average of 524.3 ml / intervention (400; 850) in the control group ($p = 0.21$), although the statistical difference is not significant. As noted, RARP and LRP are minimally invasive procedures with significantly lower blood loss (-237%) compared to ORP (221.5ml vs. 524.3ml), which is consistent with all systematic reviews conducted previously. (Ilic et al 2017; Du et al 2018). Analyzing the duration of the surgery, we observe a much longer time in the experimental group 229.9 (90;420) minutes / intervention vs. 133.64 (96;193) minutes/intervention in control group ($p = 0.06$). The shorter operating time can be explained by the complexity of the instrumentation required for surgery in the experimental group (LRP / RARP), compared to the usual surgical instruments required for ORP. According to the data resulting from the analysis of the studied cohorts, ORP requires a shorter operating time, which is consistent with the meta-analysis conducted (De Carlo et al 2014). Regarding the analysis of the average duration of hospitalization we observe a shorter hospitalization period for RARP / LRP 5.09 (4;7) days compared to ORP 7.28 (5;9) days ($p=0.8$), and this difference even if not statistically significant is also supported by several other studies (De Carlo et al 2014; Ficarra et al 2009). When we analyzed the performance of lymphadenectomy, we saw a much higher frequency of its practice in the RARP / LRP group, which is also presented in specialized reviews (Cao, 2019). We performed an analysis of the included cohorts using the Briganti 2018 classification (Peillon et al 2020), which recommends extended lymphadenectomy (LND) for a risk value above 7% for positive lymph nodes, so according to this classification we see an indication for eLND in over 95% of radical prostatectomy cases, regardless of the technique used (Peillon et al 2020). To strengthen these observations resulting from this study, meta-analyzes on larger cohorts of patients and long-term follow-up of functional and oncological outcomes are needed (Cao et al 2019).

Conclusions

This study demonstrates that RARP / LRP has suggests benefits in terms of blood loss, shortening the average length of hospital stay, but with longer operating times. To confirm these results, additional studies are needed, including larger cohorts.

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