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Özgün Araştırma

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Comparison of Open Radical Cystectomy vs Robot-Assisted Radical Cystectomy Perioperative Outcomes and Complications at a Single Center: An Analysis of Matched Pairs

Tek Merkezde Açık Radikal Sistektomi ile Robot Yardımlı Radikal Sistektominin Perioperatif Sonuçları ve Komplikasyonlarının Karşılaştırılması: Eşleştirilmiş Çift Analizi

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ÖZET

Amaç: Metastatik olmayan yüksek riskli kasa invazif olmayan ya da kasa invazif mesane kanserinde standart küratif tedavi yöntemi bölgesel pelvik lenfadenektomi (PLND) ile birlikte radikal sistektomidir. Açık radikal sistektomi (ARS), birincil tedavi şeklidir, fakat bu cerrahi yöntem önemli riskler taşımaktadır. Minimal invazif cerrahi tekniklerinden robotik cerrahinin uygulanmasıyla cerrahi morbiditeyi en aza indirmek ve daha hızlı iyileşme gösterilmiştir. Bu çalışmada amacımız kendi kliniğimizde mesane kanseri nedeniyle robot yardımlı radikal sistektomi (RYRS) ve ARS uygulanan hastaların eşleştirilmiş çift analizi kullanarak komplikasyonlar ve perioperatif sonuçlarını karşılaştırmaktır.

Gereç ve Yöntemler: Kliniğimizde Ocak 2021 - Şubat 2023 tarihleri arasında radikal sistektomi hastaların verileri retrospektif olarak elde edildi. RYRS uygulanan 20 hasta, aynı dönemde yaş (± 2 yaş), cinsiyet, klinik TNM evresi ve üriner diversiyon (ileal konduit veya ortotopik yeni mesane) açısından 1:2 oranında ARS uygulanan 40 hasta ile eşleştirildi. Perioperatif, postoperatif sonuçlar ve komplikasyonlar karşılaştırıldı.

Bulgular: Her iki grupta preoperatif veriler açısından fark yoktu. Ameliyat süresi RYRS grubunda anlamlı olarak daha uzundu (307,5'e karşılık 391,7 dakika; P=0.0001). RYRS'de önemli ölçüde daha düşük kanama miktarı (P=0.001) ve daha az intraoperatif kan transfüzyonu (P=0.023) izlendi. Yoğun bakımda kalış süreci ARS'de anlamlı olarak daha yüksek izlendi (P=0.047). Gruplar arasında 90 günlük minör (clavien 1-2) komplikasyon oranları benzer izlendi. Majör (clavien 3-5) komplikasyonlar açık cerrahide anlamlı şekilde daha fazla görüldü (P=0.042). 90 günlük mortalite oranı, RYRS ve ARS için sırasıyla %0'a karşılık %7.5 idi. Her iki grup arasında önemli patolojik sonuçlar açısından fark görülmedi.

Sonuç: RYRS ile ilk deneyimlerimiz, daha yüksek ARS deneyimiyle karşılaştırıldığında bile benzer patolojik sonuçlar, perioperatif kan kaybını önleme ve 90 günlük mortalite iyileştirmeleri ile güvenli ve uygulanabilir olduğunu göstermiştir.

Anahtar Kelimeler: *komplikasyon, mesane kanseri, robot yardımlı radikal sistektomi*

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This study was approved by the University of Health Sciences, Başakşehir Çam ve Sakura Health Research and Practice Center, Ethical Committee (Approval Number: 173, Date: 2023-04-19). All research was performed in accordance with relevant guidelines/regulations, and informed consent was obtained from all participants.

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ABSTRACT

Objective: The standard curative treatment for non-metastatic high-risk non-muscle-invasive and muscle-invasive bladder cancer is regional pelvic lymphadenectomy (PLND) combined with radical cystectomy. The most prefered surgical procedure is an open radical cystectomy (ORC). However, there are significant risks related to this surgical procedure. Robot-assisted radical cystectomy (RARC), one of the minimally invasive surgical procedures, has been demonstrated to reduce surgical morbidity and boost recovery. In this study, we examined the postoperative complications and outcomes of patients who underwent RARC and ORC for bladder cancer in our clinic using matched pair analysis.

Material and Methods: Between January 2021 and February 2023, datas of radical cystectomy patients were collected retrospectivelly at our clinic. Twenty patients who underwent RARC and forty patients who underwent ORC were matched at a ratio of 1:2 for age (± 2 years), gender, clinical TNM stage, and urinary diversion (ileal conduit or orthotopic neobladder) during the same period. The outcomes and complications of perioperative and postoperative procedures have been compared.

Results: There was no difference in preoperative data between the two groups. The RARC group had found significantly longer operative times (307.5 versus 391.7 minutes; P=0.001). Patients with RARC group had significantly lower bood-loss (P=0.001) and required less intraoperative blood transfusions (P=0.023). ICU stays were significantly longer in ORC (p =.047). The rates of mild Clavien complications were found to be similar between groups in the postoperative first 90 days. Open surgery was found to be associated with a significantly higher incidence of major (clavien 3-5) complications (p =.042). The 90-day mortality rates for RARC and ORC were found to be 0% and 7.5%, respectively. There was no difference in pathological outcomes between the two groups.

Conclusion: Our initial experience with RARC has demonstrated its safety and practicability, with comparable pathology outcomes, reduction of perioperative blood loss, and advances in 90-day mortality, when compared to ORCs with more years of experience.

Keywords: *bladder cancer, complication, robot-assisted radical cystectomy*

INTRODUCTION

Globally, bladder cancer (BC) is an important issue for public health (1). It is four times more prevalent among men compared to women. While BC is the seventh most frequently diagnosed cancer in men, it is the tenth most commonly diagnosed cancer overall (2). Typically, the elderly and smokers are affected (3). About three-quarters of patients have non-invasive disease, while one-quarter have invasive disease. The disease prognosis and life expectancy are getting worse as the disease advances through its stages. Consequently, the treatment strategy varies by stage. Regional pelvic lymphadenectomy (PLND) combined with radical cystectomy is the standard curative treatment for non-metastatic, high-risk, non-muscle-invasive, or muscle-invasive bladder cancer. The conventional method is open radical cystectomy (ORC). As technology advances, however, robotic surgery is becoming increasingly prevalent worldwide. It is gaining popularity, especially in the field of urology. Robot-assisted radical cystectomy (RARC) is one of these procedures. From 2004 to 2010, the proportion of RARCs increased from 0.6% to 12.8%, demonstrating this growing interest (4,5).

The comorbid elderly population and smoking exposure are significantly associated with bladder cancer. In this population, major pelvic surgery, such as radical cystectomy and urinary diversion, has significant risks. The open surgical technique results in major perioperative morbidity and prolongs the recovery period. Following radical cystectomy, many patients experience at least one complication. 20% to 30% of patients are readmitted following discharge, and approximately 20% require intervention (6,7). Complications extend the duration of recovery and increase mortality rates (8). As one of the minimally invasive surgical techniques, robotic surgery aims to reduce surgical morbidity and accelerate recovery. Numerous

studies have demonstrated lower complication rates, faster recoveries, and comparable oncologic outcomes (9–12).

In this study, we used matched pair analysis to investigate the complications and postoperative outcomes of patients who underwent RARC and ORC for bladder cancer in our clinic.

MATERIAL AND METHODS

Data from 113 patients who underwent radical cystectomy in our clinic between January 2021 and February 2023 were retrospectively analyzed after receiving the institutional review board's approval. 20 patients underwent RARC, and 93 patients underwent ORC. Twenty patients with RARC were paired with forty patients with ORC based on age (± 1 year), gender, clinical TNM stage, and urinary diversion (ileal conduit or orthotopic neobladder) during the same time period. Two experienced urology surgeons conducted ORC, and one urology surgeon performed RARC. Surgeons performing RARC have conducted at least 15 ORC procedures every year. The surgeon doing the RARC procedure also has a lot of experience with robotic-assisted radical prostatectomy (478 cases were handled by one surgeon).

Surgery, Preoperative Assessment and Postoperative Care

Preoperative CT scans of the thorax and abdomen were performed on all patients, and MRIs using the Vesical Imaging Reporting and Data System (VI-RADS) protocol were used for local staging. The enhanced recovery after surgery (ERAS) regimen was used with all patients during the preoperative, perioperative, and postoperative phases (7). ORC and pelvic lymphadenectomy (PLA) were performed as usual (13,14). In accordance with earlier descriptions (15,16), robotic RC with pelvic lymph node dissection was performed. The specimen was extracted via a 6 cm periumbilical incision following RARC. Robotic urine diversions (ileal loop, orthotopic neobladder) were performed totally intracorporeally.

Collection of Data

Patient demographics (age, gender, BMI), American Society of Anesthesiologists (ASA) score, preoperative therapy (intravesical chemotherapy or BCG), history of abdominal surgery, previous pelvic radiotherapy, neoadjuvant chemotherapy, VIRADS score, perioperative variables (duration of surgery, Estimated blood loss (EBL), blood transfusion, intraoperative complications), and pathological results (pathological stage, surgical margin status, number of lymph nodes) were evaluated. In addition, within 90 days of cystectomy, complications were grade according to Clavien (17). Minor issues were classified as Clavien grades 1-2, and serious issues as Clavien grades 3-5. The utilization of adjuvant therapy, disease recurrence, and hospital readmission were also noted. Patients with concurrent upper urinary tract tumor, salvage radical cystectomy, or radical cystectomy for other purposes (intestinal and gynecological cancers) were excluded from the study.

Statistical Evaluation

In this study, data obtained from personal information forms and scales were transferred to a computer by the SPSS (Statistical Package for Social Sciences 22.0) program, and the data were analyzed by this program. The data obtained were presented as arithmetic mean ± standard deviation, while quantitative data were presented as numbers and percentages. Each group was tested with the Kolmogorov–Smirnov test to investigate the normal distribution of the obtained data. Mann–Whitney U test was used for data because of gender, American Society of Anesthesiologist (ASA) scores (1-2 vs. 3-4), VI-RADS scores, operative time, estimated blood loss, clavien scores (1-2 vs. 3-5), length of the hospitalization, and length of the intensive care unit (ICU) were found without normal distribution. Data of readmission, reoperation, and interventional procedures were analyzed with chi-Square and Fisher's exact tests. In all statistical analyses, the p-value was accepted <0.05 at a 95% confidence interval.

RESULTS

Comparison of sex, age, pathological TNM, and clinical (VIRADS score) stage between groups were shown in Table 1. The mean patient age was 62.3 ± 6.3 (RARC) and 63.5 ± 6.3 (ORC), and 15% and 10% of patients in the RARC and ORC groups were found to be female, respectively. In each group, more than 50% of the patients had stage cT2 or advanced disease. Orthotopic neobladder was done in one patient per group. More than fifty percent of ORC patients had an ASA score between 3 and 4, and no clinically significant difference was observed.

The preoperative and postoperative outcomes are shown in Table 2. The RARC group had found significantly longer operative times (307.5 versus 391.7 minutes; P=0.001). Patients with RARC group had significantly lower bood-loss (P=0.001) and required less intraoperative blood transfusions (P=0.023). There was no significant difference in hospital stays between the two groups (RARC, 6.7 days; ORC, 7.2 days). The ORC group had significantly longer ICU stays (P=0.047). Within 90 days of surgery, clavien 1-2 complications were experienced by 70% and 77% of RARC and ORC patients, respectively (P=0.147). These were evaluated within the first 30 days and most of them were clavien 1 (antipretic, analgesic administration) complications. The incidence of major complications (clavien 3-5) was found significantly higher than open surgery (P=0.042). In ORC, seven patients had evisceration surgeries. The necessity for interventional procedures, going back to the operation room, and hospital readmission were comparable. While the ORC group experienced 90-day mortality at a rate of 7.5%, there was no mortality in the RARC group.

Table 3 shows that there was no difference in the two groups' serious pathological outcomes. Only the T0 stage was observed more frequently in the robotic group. In RARC and ORC, the average number of lymph nodes excised was similar (26 vs 20; P=0123). Positive surgical margins were 10% in both groups (P=0.99). There was no difference in adjuvant therapy (radiotherapy, chemotherapy) between the RARC and ORC groups.

Table 1. Demographics and preoperative variables comparing RARC with ORC

	RARC n:20	ORC n:40	P value
Age (y) (Mean ± SD)	62.3 ± 6.3	63.5 ± 6.2	0.485
Gender n(%)			
Male	17 (85)	36 (90)	0.573
Female	3 (15)	4 (10)	
BMI (kg/m2)(Mean ± SD)	27.9 ± 2.1	26.9 ± 4.1	0.281
ASA Score n(%)			
ASA 1-2	14 (70)	18 (45)	0.063
ASA 3-4	6 (30)	22 (55)	
VI-RADS Score(Mean ± SD)	3.6 ± 1.6	3.8 ± 1.1	0.902
Pathology of TUR-B n(%)			
Ta	2 (10)	5 (12.5)	N/A
Tis	5 (25)	15 (37.5)	
T1	5 (25)	14 (35)	
T2	13 (65)	21 (52.5)	
Concomitant Variant Pathology n(%)	4 (20)	14 (35)	N/A
Previous abdominal surgery n(%)	1 (5)	2 (5)	
Neoadjuvant chemotherapy n(%)	1 (5)	1 (2.5)	
Intravesical therapy n(%)	2 (10)	7 (17.5)	

***BMI:** Body mass index; **ASA:** American Society of Anesthesiologist; **VI-RADS:** Vesical Imaging-Reporting and Data System*
***TUR – B:** Transurethral Resection of the Bladder*

Table 2. Perioperative and Postoperative outcomes

	RARC n:20	ORC n:40	P value
Perioperative			
Operative time (min)(Mean ± SD)	391.7 ± 69.9	307.5 ± 49.5	0.001
Estimated Blood Loss (ml)(Mean ± SD)	187.5 ± 77.5	374.5 ± 229.9	0.001
Peroperative Transfusion n(%)	0 (0)	9 (22.5)	0.023
Type of the Urinary Diversion n(%)			
İleal Conduit	19 (95)	39 (97.5)	N/A
Orthotopic Neobladder	1 (5)	1 (2.5)	
Postoperative < 90 day Complicationsn(%)			
Clavien 1-2	14 (70)	31 (77)	0.147
Clavien 3-5	4 (20)	14 (35)	0.042
Re-admission	4 (20)	8 (20)	0.125
Re-operation	3 (15)	7 (17)	0.356
Interventional procedure	3 (15)	4 (10)	0.147
Lenght of day (Mean ± S.D.)			
ICU	0.3 ± 0.4	0.67 ± 0.5	0.047
Hospitalization	6.73 ± 1.6	7.5 ± 2.2	0.436
Mortalityn(%)			
<30- day	0 (0)	2 (5)	N/A
30-90 day	0 (0)	1 (2.5)	

ICU: *intensive care unit;* ***RC:*** *Radical Cystectomy*

Table 3: Pathologic and adjuvant treatment outcomes of RC

	RARC n:20	ORC n:40	P value
Pathologic Findings n(%)			
T0	3 (15)	1 (2.5)	0.041
Non-muscle invasive	7 (35)	15 (37.5)	0.254
Ta	1 (5)	2 (5)	
Tis	4 (20)	3 (7.5)	N/A
T1	2 (10)	10 (25)	
Muscle invasive	10 (50)	24 (60)	0.129
T2	3 (15)	11 (27.5)	
T3	3 (15)	7 (17.5)	N/A
T4	4 (20)	6 (15)	
Concomitant Variant Pathology	8 (40)	18 (45)	0.715
LVI	8 (40)	11 (27.5)	0.331
Lymph Node Status n(%)			
N0	18 (90)	30 (75)	0.175
N1-2	2 (10)	10 (25)	
Positive Surgical Margin n(%)	2 (10)	4 (10)	0.998
Adjuvant Chemotherapy n(%)	7 (35)	17 (42.5)	0.579
Adjuvant Radiotherapy n(%)	2 (10)	6 (15)	0.594
Recurrence n(%)			
Local	2 (10)	5 (12.5)	0.778
Metastatic	4 (20)	7 (17.5)	0.815

LVI: *Lymphovascular invasion* ***RC:*** *Radical Cystectomy*

DISCUSSION

Radical cystectomy and extended lymph node dissection are the gold standard treatment modalities for muscle invasive and non-muscle invasive bladder cancer with very-high risk. Bladder perforation should be avoided during the excision of the bladder, surrounding tissues, and neighboring organs for local curative therapy of bladder cancer with this approach. Surgical procedures have continually advanced over the years, but have made significant strides in the past decade. Despite all of this surgical advancement, there is still significant perioperative morbidity (18). In particular, minimally invasive surgical methods have been developed in the aim of improving complication management and recovery time. Smaller incisions can speed up recovery, lower morbidity, and decrease hospital stays. Radial cystectomy and urine diversion for bladder cancer are now frequently carried out around the world using robot-assisted minimally invasive surgical procedures.

It was noticed that RARC had a number of distinct benefits throughout the perioperative period. In 2015, Novara et al. demonstrated that RARC patients were less likely to require a transfusion and that blood loss was 521 mL less in RARC than in ORC (19). EBL was significantly lower in the RARC group, according to Bochner et al. (20). Less blood loss was seen in RARC in Riccardo Mastroiann's randomized controlled research, which was carried out in 2022. In fact, no patient was transfused perioperatively on the robot arm (21). In accordance with the literature, our study found that there was statistically significant less blood loss in robotic surgery than in open surgery. Additionally, while perioperative blood replacement was not conducted with the robotic arm, it was performed at a rate of 22.5% during open surgery and was observed significantly more frequently. In open surgery, cleaning the blood with the aid of suction gases and an aspirator may result in greater variability of blood loss and transfusion discrepancies. Additionally, because the abdomen is not opened during robotic surgery and because of the impact of gas pressure, the amount of bleeding may be reduced. Furthermore, dorsal vein ligation in robotic surgery is more easily observed and managed. This technical management may be why blood loss is low and less blood is needed to restore it.

There are a few perioperative concerns to consider along with the benefits of RARC. The lengthened operation time is one of these disadvantages. In the CORAL research, which evaluated open, laparoscopic, and robotic cystectomy, the mean difference in operating time between robotic and open surgery was found to be 96 minutes (22). A randomized prospective controlled research found that robotic surgery took significantly longer (23). However, Casey et al.'s study claimed that the robotic arm's time was only 18 minutes longer and that this difference was not clinically significant (24). In the results of our study, a robotic arm's operating time was shown to be 84 minutes longer on average. Due to surgical factors such as complex patient preparation and suturing ability, it is expected that robotic surgery will take a long time. However, we believe that this difference was the result of the learning process and that comparable operative times could be achieved over time. After the 15th case, the duration of robotic surgery reached open surgery.

Oncological results are one of the crucial findings in our comparison of RARC and ORC. Early oncological results were similar in the RARC and ORC groups despite minor variations in preoperative pathological and clinical stage (VIRADS score). More patients were tracked in the robotic arm at the T0 stage. In RARC, an average of 26 lymph node dissections were carried out as opposed to an average of 20 in open surgery. However, the positive surgical margin was comparable in both methods. Even though these are the first 20 robotic surgeries, it's crucial to be aware that the robotic surgeon specializes in urooncology and has extensive training in both open cystectomies and robotic pelvic surgery. All of these findings demonstrated that the RARC technique complies with the surgical principles.

At 90 days, the rates of complications were comparable between the two surgical series. Additional minor issues were found. When compared to the overall complication rates, postoperative ileus represents a significant percentage in other series (25,26). But ileus was rare in both of our study's groups. due to the regular use of the ERAS protocol in both arms. We believe that using this technique lowers the incidence of ileus.

CONCLUSION

In one randomized experiment, rates of mild problems were 73% in RARC and 67% in ORC. Additionally, patients who underwent open surgery experienced wound-related complications more frequently (5.6% vs. 17.3%) (27). In our study, ORC showed greater clavien 3-5.

Conflict of Interest: The authors declare to have no conflicts of interest.

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Ethical Approval: The study was approved by the Ethics Committee of University of Health Sciences, Başakşehir Çam ve Sakura Health Research and Practice Center, Ethical Committee (Approval Number: 173, Date: 2023-04-19). The study protocol conformed to the ethical guidelines of the Helsinki Declaration.

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