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Incidence and Predictors of 30-Day Readmission After Robot-Assisted Radical Prostatectomy

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Abstract

Readmission after major surgery is a common but understudied event. In this context, the attention on readmission after discharge is growing, as this parameter has recently been scrutinized as a driver of health care expenditure. We analyzed the incidence of 30-day readmission after robot-assisted radical prostatectomy. Patients in intermediate- to high-risk D'Amico groups and patients who incurred postoperative complications are at a higher risk of readmission.

Objective: To evaluate the incidence and predictors of 30-day readmission in prostate cancer (PCa) patients treated with robot-assisted radical prostatectomy (RARP). **Patients and Methods:** Overall, 1402 consecutive PCa patients treated with RARP at a single center between 2006 and 2013 were identified. Uni- and multivariate logistic regression analyses assessed predictors of 30-day readmission after surgery. **Results:** Overall, 38 patients (2.7%) experienced hospital readmission within 30 days after discharge. The most common causes of rehospitalization were fever in 12 patients (31.6%), lymphoceles in 11 (28.9%), and urine leak in 6 (15.8%). By multivariable analyses, D'Amico risk group and occurrence of postoperative complications (odds ratio [OR], 2.89) represented independent predictors of 30-day readmission (all $P \leq .02$). When analyzing the type of complication associated with the risk of readmission, fever (OR, 6.19; $P = .01$), urine leak (OR, 10.83; $P < .01$) and cardiocirculatory complications (OR, 18.57; $P < .001$) were significantly associated with 30-day readmission. **Conclusion:** Patients undergoing RARP have a relatively low risk of 30-day readmission (2.7%). The occurrence of an early postoperative complication and a higher D'Amico risk group were independent predictors of 30-day readmission. In addition, fever, urine leak, and cardiocirculatory complications are significantly associated with a higher risk of readmission.

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Introduction

Prostate cancer (PCa) represents one of the most frequently diagnosed malignancies in the United States and Europe, with an estimated incidence of 220,800 new cases in the United States alone in the year 2015.[1] Robot-assisted radical prostatectomy (RARP) represents one of the most common treatment modalities for patients with clinically localized PCa.[2]

Beyond the traditional surgical trifecta, which includes cancer control as well as recovery of continence and potency,[3] a new combination of surgical outcomes has been recently proposed, including short length of stay, absence of perioperative complications, and absence of readmission after discharge.[4] In this context, the attention on readmission after discharge is growing because this parameter has recently been scrutinized as driver of health care expenditure. Indeed, recent studies highlighted that a considerable proportion of early hospital readmission after discharge could be avoided.[5-7] Additionally, the national health care system in the

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United States has approved the Readmission Reduction Program, with the objective of penalizing hospitals with a high rate of early readmission after surgery.[8]

Several studies have thus assessed the incidence and predictors of readmission after discharge after radical prostatectomy.[9-19] However, few data are available when evaluating patients treated with robot-assisted surgery. To address this issue, we evaluated the incidence and predictors of 30-day readmission after discharge in a large cohort of patients treated at a single center.

Materials and Methods

Study Population

After institutional review board approval, we retrospectively evaluated a prospectively maintained database of 1402 consecutive patients treated with RARP and pelvic lymph node dissection for PCa between 2006 and 2013 at a single tertiary referral center. The institutional review board approved the study. Preoperative staging included pelvic and/or abdominal computed tomography or ultrasound, bone scan, and chest x-ray. All patients with a preoperative

Table 1 Clinical and Pathologic Characteristics of Population Stratified According Readmission at 30 Days After Robot-Assisted Radical Prostatectomy

Characteristic	Overall Population (n = 1402; 100%)	30-Day Readmission (n = 38; 2.7%)	No 30-Day Readmission (n = 1364; 97.3%)	*P*
Age, Years				.002
Mean	62.7	63.8	62.7	
Median (IQR)	63 (58-68)	65 (59-70)	63 (58-68)	
Charlson Comorbidity Index				.6
0	1145 (81.7%)	31 (81.6%)	1114 (81.7%)	
1	204 (14.6%)	7 (18.4%)	197 (14.4%)	
2-3	53 (4.0%)	0 (0%)	53 (4.0%)	
D'Amico Risk Group				.02
Low	661 (43.7%)	8 (21.1%)	653 (47.9%)	
Intermediate	600 (42.8%)	21 (55.3%)	579 (42.4%)	
High	189 (13.5%)	9 (23.7%)	180 (13.2%)	
Length of Stay, Days				.6
Mean	6	6.2	6	
Median (IQR)	6 (6-6)	6 (3-7)	6 (6-6)	
PLND				.2
Yes	961 (68.5%)	29 (76.3%)	932 (68.3%)	
No	441 (31.5%)	9 (23.7%)	432 (31.7%)	
Pathologic N Stage				.002
pNx	441 (31.5%)	9 (23.7%)	432 (31.7%)	
pN0	908 (64.8%)	24 (63.2%)	884 (64.8%)	
pN1	53 (3.8%)	5 (13.2%)	48 (3.5%)	
Pathologic T Stage				.3
pT0-T2	1176 (83.9%)	30 (78.1%)	1147 (84.1%)	
pT3-T4	226 (16.1%)	8 (21.9%)	217 (15.9%)	
Pathologic Gleason score				.2
2-6	545 (38.9%)	14 (37.8%)	531 (38.9%)	
7	773 (55.1%)	18 (48.6%)	753 (55.2%)	
8-10	84 (6.0%)	5 (13.5%)	79 (5.8%)	
Postoperative Complications				.04
Yes	161 (11.5%)	10 (26.3%)	151 (11.1%)	
No	1241 (88.5%)	28 (73.7%)	1213 (88.9%)	
Clavien-Dindo				<.001
0	1241 (88.5%)	28 (73.7%)	1213 (88.9%)	
1	53 (3.8%)	2 (5.3%)	51 (3.7%)	
2	69 (4.9%)	1 (2.6%)	68 (5.0%)	
3	39 (2.8%)	7 (18.4%)	32 (2.3%)	

Abbreviations: ECE = extracapsular extension; IQR = interquartile range; LNI = lymph node invasion; PLND = pelvic lymph node dissection; SVI = seminal vesicle invasion.

risk of lymph node invasion of ≥ 5% received an anatomically defined extended pelvic lymph node dissection.[20] The decision to perform an extended pelvic lymph node dissection in patients with a low risk of nodal invasion was left to the clinical judgment of the treating physician.

Prognostic Factors and Outcomes

Before surgery, patient's clinical, pathologic, and perioperative characteristics were recorded. These included age at surgery, Charlson comorbidity index, D'Amico risk group (low vs. intermediate vs. high), length of stay (days), pelvic lymph node dissection (yes vs. no), extracapsular extension (yes vs. no), lymph node invasion (yes vs. no), seminal vesicle invasion (yes vs. no), pathologic T stage (pT0-pT2 vs. pT3 vs. pT4), pathologic Gleason score (2-6 vs. 7 vs. 8-10), postoperative complications (yes vs. no), and Clavien-Dindo classification (0 vs. 1 vs. 2 vs. 3). Dedicated genitourinary pathologists examined all surgical specimens. The primary outcome was 30-day readmission. This is defined as readmission within 30 days after discharge. Every cause of 30-day readmission was recorded in our database.

Statistical Analyses

Descriptive statistics of categorical variables focused on frequencies and proportions. Means, medians, and interquartile ranges (IQR) were reported for continuously coded variables. The Mann-Whitney and chi-square tests were used to compare the statistical significance of differences in medians and proportions, respectively. Univariate and multivariate logistic regression analyses tested the relationship between preoperative, intraoperative, and postoperative characteristics and the possibility of experiencing a readmission within 30 days after discharge. Statistical significance was considered to be $P < .05$. Statistical analyses were performed by SPSS 22.0 software (IBM SPSS, Chicago, IL).

Results

Baseline Characteristics

Between February 2006 and August 2012, 38 patients (2.7%) were readmitted within 30 days after discharge. Clinical, operative, pathologic, and postoperative characteristics of patients included in the study are shown in Table 1. The mean age was 62.7 years (median, 63 years; IQR, 58-68 years). Mean length of stay was 6 days (median, 6 days; IQR, 6-6 years). Patients who experienced a readmission within 30 days of discharge were older ($P = .002$) and had a higher D'Amico risk ($P = .02$), higher pathologic N stage (0.002), higher rate of postoperative complications ($P = .04$), and worse Clavien-Dindo rate ($P < .001$). No differences were observed in Charlson comorbidity index, length of stay, pelvic lymph node dissection, pathologic stage, or pathologic Gleason (all $P > .08$). Readmission characteristics after RARP are shown in Table 2. The most frequent causes of readmission at 30 days were fever (n = 12, 31.6%), lymphoceles (n = 11, 28.9%), and anastomosis leak (n = 6, 15.8%).

Prediction of 30-Day Readmission

Table 3 provides the univariable and multivariate logistic regression analyses predicting 30-day readmission. By univariable analysis, lymph node invasion (odds ratio [OR], 4.15, 95% confidence interval [CI], 1.55-11.11; $P = .01$), postoperative complications (OR, 2.87; 95% CI, 1.37-6.02; $P = .005$), and high-risk disease (OR, 5.35; 95% CI, 1.90-15.07; $P = .002$) were associated with a risk of readmission within 30 days after discharge. By multivariable logistic regression analyses, postoperative complications (OR, 2.89; 95% CI, 1.35-6.18; $P = .006$), intermediate D'Amico risk group (OR, 2.64; 95% CI, 1.15-6.03, $P \leq .02$), and high D'Amico risk group (OR, 3.64; 95% CI, 1.17-11.32; $P \leq .02$) were associated with readmission within 30 days after discharge.

Table 4 shows the univariable logistic regression analysis predicting 30-day readmission after discharge according to type of postoperative complications. Fever (OR, 6.19; 95% CI, 1.34-28.53), urine leak (OR, 10.83; 95% CI, 2.20-53.33), and cardiocirculatory complications (OR, 18.57; 95% CI, 4.56-75.55) were all positively associated with 30-day readmission (all $P < .02$).

Table 2 Readmission Characteristics of 38 Patients at 30 Days After Robot-Assisted Radical Prostatectomy Due to Prostate Cancer Performed Between February 2006 and August 2012

Characteristic	n (%)
Cardiac/vascular	1 (2.6)
Anastomosis leak	6 (15.8)
Edema	1 (2.6)
Hematoma	1 (2.6)
Hernioplasty	1 (2.6)
Gastrointestinal	2 (5.3)
Fever	12 (31.6)
Lymphoceles	11 (28.9)
Urinary retention	1 (2.6)
Anastomosis sclerosis	1 (2.6)
Ureteral leak	1 (2.6)

Discussion

Readmission within 30 days after surgery is a predictor of surgical quality.[21] In addition, readmissions represent a consistent cost for the health care system. In 2012, the Centers for Medicare and Medicaid Services introduced a deduction from reimbursement for 30-day readmission patients with the Hospital Readmission Reduction Program.[8] On this basis, 2217 American hospitals in 2013 experienced a reduction in their Medicare reimbursements.[8,22] In this setting, we sought to analyze 30-day readmission causes and predictors after discharge in patients who underwent RARP at a single tertiary referral European center.

Our findings are several. Overall, 38 patients (2.7%) experienced 30-day readmission. Of these, fever (31.6%), lymphoceles (28.9%), and anastomosis leak (15.8%) were the most frequent causes of readmission. The predictors of readmission in our cohort are represented by occurrence of postoperative complications and intermediate to high D'Amico risk group. Additionally, considering the type of postoperative complications, patients who experienced fever, urine leak, or cardiocirculatory complications during their first recovery are the major candidates to experience a 30-day readmission after discharge.

Previous investigators have assessed the incidence and predictors of 30-day readmission after radical prostatectomy. Jacobs et al,[16] using

Table 3 Univariate and Multivariable Logistic Regression Analyzing Factors Associated With 30-Day Readmission Status

Characteristic	Prediction of 30-Day Readmission by:			
	Univariate Analysis		Multivariate Analysis	
	OR (95% CI)	*P*	OR (95% CI)	*P*
LNI	4.15 (1.55-11.11)	.01	2.62 (0.87-7.85)	.08
Postoperative complications	2.87 (1.37-6.02)	.005	2.89 (1.35-6.18)	.006
Age, years	1.02 (0.98-1.07)	.3		
D'Amico Risk Group				
Low	Ref	Ref	Ref	Ref
Intermediate	2.74 (1.20-6.24)	.02	2.64 (1.15-6.03)	.02
High	5.35 (1.90-15.07)	.002	3.64 (1.17-11.32)	.02
PLND	1.49 (0.70-3.18)	.3		
LOS	1.03 (0.91-1.17)	.6		
pT (pT0-pT2 vs. pT3-pT4)	1.48 (0.63-3.46)	.4		
pGS				
2-6	2.6 (Ref)	Ref		
7	0.91 (0.45-1.84)	.8		
8-10	2.39 (0.84-6.81)	.1		

Abbreviations: CI = confidence interval; LNI = lymph node invasion; LOS = length of stay; OR = odds ratio; pGS = pathologic Gleason Score; PLND = pelvic lymph node dissection; pT = pathologic stage.

the Surveillance, Epidemiology, and End Results database, reported a series composed by 44,698 patients treated with radical prostatectomy with a 30-day readmission rate of 4.7%. However, this report was limited by the lack of stratification according to the surgical technique (open vs. robotic), where it has been hypothesized that minimally invasive surgery might be associated with a reduced risk of complications and in turn readmission.[16] Moreover, Chung et al[9] reported a 30-day readmission rate of 3.6% in patients who underwent RARP. However, they evaluated a relatively small number of patients (n = 274). As a consequence, they were not able to comprehensively address predictors of 30-day readmission after surgery. Pilecki et al[10] evaluated the National Surgical Quality Improvement Program database and observed a rate of 3.5% for readmission after RARP. Of note, the majority of these reports were based on data coming from the United States, and scarce evidence is available for patients treated in high-volume European centers. In our series, we recorded a relatively low readmission rate compared to the previous literature. This could represent the effect of different health care systems. In particular, the longer length of stay observed in our series might be one of the reasons for the relatively low rate of 30-day readmission.

Table 4 Univariate Analysis Predicting 30-Day Readmission Stratifying for Type of Postoperative Complication

Complication	Univariate Analysis Predicting 30-Day Readmission	
	OR (95% CI)	*P*
No complications	Ref	Ref
Anemia	0.51 (0.70-3.79)	.5
Lymphoceles	2.41 (0.31-18.66)	.4
Fever	6.19 (1.34-28.53)	.02
Urine leak	10.83 (2.20-53.33)	.003
Cardiocirculatory complications	18.57 (4.56-75.55)	<.001
Other	2.28 (0.29-17.63)	.4

Abbreviations: CI = confidence interval; OR = odds ratio.

The importance of our study in relation to previous reports lies in several aspects. First, our investigation represents the largest available single-center cohort assessing incidence and predictors of readmission in RARP patients within 30 days after discharge. Moreover, all individuals included in our study were treated at a single European tertiary referral center. Therefore, the nature of our investigation takes advantage of experienced surgeons and a high-volume setting. Second, we assessed incidence and predictors of 30-day readmission with the benefit of a single-center experience. As previously discussed, considering differences existing among hospitals and countries, our series benefits from a unique management strategy in RARP patients, with a median length of stay of 6 days in patients treated between 2006 and 2013. In addition, we found that intermediate- to high-risk D'Amico patients and those who experienced postoperative complications (fever, urine leak, or cardiocirculatory complications) were those who were more likely to experience a 30-day readmission. These findings should be taken in account by physicians as they decide on patient management, which will help individualize treatment of patients who need a longer hospitalization period and a closer follow-up in order to prevent 30-day readmission.

Our study has several limitations. First is the retrospective nature of the study; our study is therefore susceptible to the limitations and biases inherent in this kind of study. Second, no socioeconomic characteristics were recorded; it is possible that some of these unmeasured characteristics could affect the 30-day readmission risk, as demonstrated by Chung et al.[9] Third, selection bias may exist for the surgical techniques offered to patients, considering that the study only included patients who underwent RARP.

Conclusion

Patients undergoing RARP have a relatively low risk of 30-day readmission. More advanced and/or aggressive disease as well as occurrence of perioperative complications are independent predictors of 30-day readmission. Specifically, postoperative fever, urinary fistula, and cardiocirculatory complications are significantly associated with a higher risk of 30-day readmission after surgery. Our findings highlight the need for better patient management when a complication occurs during hospitalization after RARP, especially in cases of more advanced and/or aggressive disease.

Clinical Practice Points

- Readmission after RARP has been recognized as a driver of health care expenditure.
- We recorded a rate of 2.7% for 30-day readmission after RARP.
- The occurrence of an early postoperative complication and higher risk groups are independent predictors of 30-day readmission after discharge.

Disclosure

The authors have stated that they have no conflict of interest.

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