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Evaluation of positive surgical margins in patients undergoing robot-assisted and open radical prostatectomy according to preoperative risk groups

Nazareno Suardi, M.D.[a,*], Paolo Dell'Oglio, M.D.[a,b], Andrea Gallina, M.D.[a],
Giorgio Gandaglia, M.D.[a], Nicolò Buffi, M.D.[c], Marco Moschini, M.D.[a], Nicola Fossati, M.D.[a],
Giovanni Lughezzani, M.D.[c], Pierre I. Karakiewicz, M.D.[b,d], Massimo Freschi, M.D.[e],
Roberta Lucianò, M.D.[e], Shahrokh F. Shariat, M.D.[f], Giorgio Guazzoni, M.D.[c],
Franco Gaboardi, M.D.[a], Francesco Montorsi, M.D.[a], Alberto Briganti, M.D.[a]

[a] Division of Oncology/Unit of Urology, Urological Research Institute, IRCCS Ospedale San Raffaele, Milan, Italy
[b] Cancer Prognostics and Health Outcomes Unit, University of Montreal Health Center, Montreal, Canada
[c] Department of Urology, Humanitas Clinical and Research Center, Rozzano, Milan, Italy
[d] Department of Urology, University of Montreal Health Center, Montreal, Canada
[e] Division of Oncology/Unit of Pathology, IRCCS Ospedale San Raffaele, Milan, Italy
[f] Department of Urology, Medical University of Vienna and General Hospital, Vienna, Austria

Abstract

Objectives: Recent studies showed that robot-assisted radical prostatectomy (RARP) represents an oncologically safe procedure in patients with prostate cancer (PCa), where the rate of positive surgical margins (PSMs) might be lower in patients treated with RARP as compared with that of those undergoing the open approach (open RP [ORP]). The aim of this study is to analyze the rate of PSMs according to preoperative risk groups in a large cohort of patients treated with RARP and ORP in a single institution with standardized surgical technique and pathological examination.

Materials and methods: We evaluated 6,194 consecutive patients with PCa undergoing either ORP (71.1%) or RARP (28.9%) between 1992 and 2014. Logistic regression analyses were used to test the association between type of surgery and PSMs in each preoperative risk group (low vs. intermediate vs. high) after adjusting for confounders.

Results: Overall, 21.6% patients had PSMs. RARP was associated with a lower rate of PSMs in low-risk (11.5 vs. 15.4%, $P = 0.01$), intermediate-risk (18.9 vs. 23.5%, $P = 0.008$), and high-risk patients (19.7 vs. 30.1%, $P < 0.001$). In multivariable analyses, after stratification according to risk group categories, no difference in PSMs between RARP and ORP was observed for low-risk (odds ratio [OR] $= 0.87$, $P = 0.46$) and intermediate-risk patients (OR $= 0.84$, $P = 0.19$). Conversely, RARP was associated with lower odds of PSMs in high-risk patients (OR $= 0.69$, $P = 0.04$). Similar results were observed when our analyses were repeated after accounting for pathological characteristics, in patients treated between 2006 and 2014 and in a cohort of men treated by high-volume surgeons (all $P \leq 0.03$).

Conclusions: The introduction of RARP at our institution led to a significant reduction in the risk of PSMs in patients with PCa with high-risk disease. © 2016 Elsevier Inc. All rights reserved.

Keywords: Prostate cancer; Positive surgical margins; Robot-assisted radical prostatectomy

1. Introduction

The avoidance of positive surgical margins (PSMs) after radical prostatectomy (RP) represents the most important surgery-related oncological outcome of RP for prostate

* Corresponding author. Tel.: +39-02-2643-7292; fax: +39-02-2643-7298.
 E-mail address: suardi.nazareno@hsr.it (N. Suardi).

cancer (PCa). Despite the open debate of the influence of PSMs on long-term outcome [1–4], patients with PSMs are at a higher risk of biochemical recurrence [1,2,4,5] as compared with patients with negative SMs. Moreover, the presence of PSMs may represent an indication for adjuvant therapies, such as radiation therapy, which might have a nonnegligible effect on patients' quality of life [6].

Robot-assisted radical prostatectomy (RARP) has been gaining popularity worldwide in the last 10 years [7], and several studies have demonstrated significant benefits of RARP as compared with open RP (ORP) regarding blood loss, hospital stays [8], complication rates, timing of urinary continence (UC), and erectile function recovery [9,10]. However, only few studies—multi-institutional or based on a small number of patients [11–17]— have demonstrated a benefit of RARP vs. ORP in reducing the rate of PSMs. Moreover, as newly diagnosed high-risk patients with PCa remain significant despite the introduction of prostate-specific antigen (PSA), and as RARP has been recently demonstrated effective for high-risk patients with PCa [8,17], the achievement of negative SMs is of utmost importance in these patients with PCa. The safety of RARP vs. ORP in high-risk patients with PCa was tested by only population-based studies [8,17], with great variability in surgeons and pathological examination.

In this study, we aimed at comparing the rate of PSMs in a large population of patients treated with RARP and with ORP in a single institution, with standardized surgical technique and pathological examination. Our hypothesis is that the introduction of robotic technology in our center improved the rate of PSMs in patients undergoing RP, especially in high-risk patients.

2. Materials and methods

2.1. Study population

Data of 8,580 consecutive patients with PCa treated with ORP between 1992 and 2014 or with RARP between 2006 and 2014 at a single institution were collected in our institutional database. Patients with unknown biopsy Gleason score (GS; $n = 115$), clinical tumor stage ($n = 456$), PSM status ($n = 376$), and tumor volume ($n = 2,128$) were excluded from the analyses. This resulted in 6,194 assessable patients with PCa for this study.

2.2. Covariates

We assessed the following patient characteristics: age at surgery, preoperative PSA values, clinical category (T1, T2, and T3), biopsy GS (≤ 6, 7, and 8–10), prostate volume, pathological stage (extra-capsular extension [ECE] and seminal vesicle invasion [SVI]), pathological GS (≤ 6, 7, and 8–10), lymph node involvement (positive (pN1), and SM status. Moreover, patients were divided according to

their PCa risk group: low-risk (biopsy GS ≤ 6 and c-category T1 and PSA levels < 10 ng/ml), high-risk (biopsy GS ≥ 8 or c-category T3 or PSA levels > 20 ng/ml), and intermediate-risk (all the remaining patients) PCa, as previously described [18]. Finally, detailed intraoperative information regarding the surgical technique (none, monolateral nerve sparing, and bilateral nerve sparing) was reported.

2.3. Outcome and pathological assessment

The outcome measure was rate of PSMs according to the surgical approach. All RP specimens were fixed, totally embedded, processed, and analyzed by dedicated genito-urinary pathologists with standardized procedures despite significant changes in histopathological assessment during the study period by evaluating the inked apex, base, and posterolateral margins of the prostate. A PSM was defined as the presence of at least one malignant gland at the inked surface of the prostate specimen [19]. A PSM in an area where no prostatic capsule was present was recorded as pT2 with PSM.

2.4. Statistical analyses

Frequencies and proportions were reported for categorical variables. Means, medians, and interquartile ranges were reported for continuously coded variables. The Mann-Whitney U test and the chi square test were used to compare the statistical significance of differences in medians and proportions, respectively.

In the first part our analyses, we addressed the rate of PSMs according to the surgical approach (RARP vs. ORP) in the overall population, as well as after stratification according to preoperative risk group (low, intermediate, and high risk). A multivariable logistic regression model was used to test the effect of surgical approach on PSMs, after accounting for prostate volume, nerve-sparing status, tumor volume, year of surgery, and risk group in the overall population. Data were then stratified according to the risk group categories. The same analyses were performed according to both clinical and pathological characteristics.

In the second part of our analyses, the same methodology was used to compare the rate of PSMs according to the surgical approach in patients treated between 2006 and 2014 ($n = 4,092$).

In the third part of our analyses, the same analysis was repeated to compare the rate of PSMs according to the surgical approach in a subgroup of patients ($n = 4,832$) operated on by surgeons who have performed a minimum number of 300 procedures per each technique—RARP ($n = 3$) and ORP ($n = 6$). Two surgeons were considered expert in both the techniques. All statistical analyses were performed using R statistical package (version 0.98.1091). All tests were 2 sided, with a significance level set at $P < 0.05$.