available at www.sciencedirect.com
journal homepage: www.europeanurology.com

European Association of Urology

Platinum Priority – Review – Prostate Cancer

*Editorial by Peter C. Albertsen on pp. 365–367 of this issue*

# Systematic Review and Meta-analysis of Perioperative Outcomes and Complications After Robot-assisted Radical Prostatectomy

*Giacomo Novara [a,*], Vincenzo Ficarra [a,b], Raymond C. Rosen [c], Walter Artibani [d], Anthony Costello [e], James A. Eastham [f], Markus Graefen [g], Giorgio Guazzoni [h], Shahrokh F. Shariat [i], Jens-Uwe Stolzenburg [j], Hendrik Van Poppel [k], Filiberto Zattoni [a], Francesco Montorsi [l], Alexandre Mottrie [b], Timothy G. Wilson [m]*

[a] *University of Padua, Padua, Italy;* [b] *O.L.V. Robotic Surgery Institute, Aalst, Belgium;* [c] *Department of Epidemiology, New England Research Institutes, Inc., Watertown, MA, USA;* [d] *University of Verona, Verona, Italy;* [e] *Royal Melbourne Hospital, Grattan Street, Melbourne, Australia;* [f] *Memorial Sloan-Kettering Cancer Center, New York, NY, USA;* [g] *Martini-Clinic, Prostate Cancer Centre, University Hamburg-Eppendorf, Hamburg, Germany;* [h] *University Vita-Salute San Raffaele, H. San Raffaele-Turro, Milan, Italy;* [i] *Weill Medical College of Cornell University, New York, NY, USA;* [j] *University of Leipzig, Leipzig, Germany;* [k] *University Hospital, Katholieke Universiteit Leuven, Leuven, Belgium;* [l] *University Vita-Salute San Raffaele, H. San Raffaele, Milan, Italy;* [m] *City of Hope National Cancer Center, Duarte, CA, USA*

## Article info

***Article history:***
Accepted May 22, 2012
**Published online ahead of print on June 2, 2012**

***Keywords:***
Prostatic neoplasms
Prostatectomy
Laparoscopy
Robotics

## Abstract

***Context:*** Perioperative complications are a major surgical outcome for radical prostatectomy (RP).
***Objective:*** Evaluate complication rates following robot-assisted RP (RARP), risk factors for complications after RARP, and surgical techniques to improve complication rates after RARP. We also performed a cumulative analysis of all studies comparing RARP with retropubic RP (RRP) or laparoscopic RP (LRP) in terms of perioperative complications.
***Evidence acquisition:*** A systematic review of the literature was performed in August 2011, searching Medline, Embase, and Web of Science databases. A free-text protocol using the term *radical prostatectomy* was applied. The following limits were used: humans; gender (male); and publications dating from January 1, 2008. A cumulative analysis was conducted using Review Manager software v.4.2 (Cochrane Collaboration, Oxford, UK).
***Evidence synthesis:*** We retrieved 110 papers evaluating oncologic outcomes following RARP. Overall mean operative time is 152 min; mean blood loss is 166 ml; mean transfusion rate is 2%; mean catheterization time is 6.3 d; and mean in-hospital stay is 1.9 d. The mean complication rate was 9%, with most of the complications being of low grade. Lymphocele/lymphorrea (3.1%), urine leak (1.8%), and reoperation (1.6%) are the most prevalent surgical complications. Blood loss (weighted mean difference: 582.77; $p < 0.00001$) and transfusion rate (odds ratio [OR]: 7.55; $p < 0.00001$) were lower in RARP than in RRP, whereas only transfusion rate (OR: 2.56; $p = 0.005$) was lower in RARP than in LRP. All the other analyzed parameters were similar, regardless of the surgical approach.
***Conclusions:*** RARP can be performed routinely with a relatively small risk of complications. Surgical experience, clinical patient characteristics, and cancer characteristics may affect the risk of complications. Cumulative analyses demonstrated that blood loss and transfusion rates were significantly lower with RARP than with RRP, and transfusion rates were lower with RARP than with LRP, although all other features were similar regardless of the surgical approach.



* Corresponding author. Department of Surgical and Oncological Sciences, Urologic Unit, Via Giustiniani 2, 35100 Padua, Italy. Tel. +39 049 8212720; Fax: +39 049 8218757.
E-mail address: giacomonovara@gmail.com, giacomo.novara@unipd.it (G. Novara).

0302-2838/$ – see back matter © 2012 Published by Elsevier B.V. on behalf of European Association of Urology.
http://dx.doi.org/10.1016/j.eururo.2012.05.044

## 1. Introduction

Radical prostatectomy (RP) is a standard surgical treatment for clinically localized prostate cancer [1]. Robot-assisted RP (RARP) has become a very popular procedure in both the United States and Europe, and it has been estimated that >75% of RPs are performed using the da Vinci platform (Intuitive Surgical Inc., Sunnyvale, CA, USA) [2,3]. As for every surgical procedure, perioperative complications are a major surgical outcome for RP. Some recent population-based studies evaluated prevalence of complications in large cohort of patients who received retropubic RP (RRP) or minimally invasive RP (MIRP; mainly RARP in the United States) and demonstrated lower risk of complications in patients having robotic surgery [4,5]. However, data from population-based studies might be limited by inaccuracies in data collection that may lead to underreporting of complications and heterogeneity in surgical techniques. We previously reported a systematic review of the literature on RARP demonstrating complication rates ranging from 1.5% to 20% in surgical series published up to 2007 and including the very first cases performed with the da Vinci platform [6]. Moreover, in another systematic review of the literature limited to papers published up to 2008, we demonstrated that prevalence of perioperative complications following RRP, laparoscopic RP (LRP), and RARP was similar [7].

In 2002, Martin et al. proposed a standardized method for reporting complications from surgical procedures. The method was based on 10 criteria, including methods of data accrual, duration of follow-up, presence of outpatient information, definitions of complications, mortality and morbidity rates, procedure-specific complications, severity grading, length of in-hospital stay, and analysis of risk factors [8]. Although such criteria are not routinely applied, some studies evaluated complications following RRP [9], LRP [10], or RARP [11–14] using such standardized criteria.

Because of the increasing use of RARP as well as the mounting literature in the field on perioperative complications of RARP, we elected to update our previous systematic reviews. Specifically, we aimed to evaluate complication rates following RARP, risk factors for complications after RARP, and surgical techniques to improve complication rates after RARP. We also performed a cumulative analysis of all studies comparing RARP with RRP or LRP in terms of perioperative complications.

## 2. Evidence acquisition

To update our previous systematic review [6,7], we performed a literature search in August 2011 using the Medline, Embase, and Web of Science databases. The Medline search included only a free-text protocol using the term *radical prostatectomy* in the title and the abstract fields of the records. The following limits were used: humans; gender (male); and publications dating from January 1, 2008. The searches of the Embase and Web of Science databases used the same free-text protocol, keyword, and publication dates.

Two authors (G.N. and V.F.) separately reviewed the records to select RARP case series as well as studies that compared RRP with LRP, RRP with RARP, and LRP with RARP, and discrepancies were resolved by open discussion. Other significant studies cited in the reference lists of the selected papers were evaluated as well as studies published after the systematic search.

All noncomparative studies reporting the outcome of RARP for >100 cases were collected. The present review included only studies reporting perioperative complications (excluding functional sequelae such as urinary incontinence or erectile dysfunction). Studies published only as abstracts and reports from meetings were not included in the review. All of the data retrieved from the selected studies were recorded in an electronic database. Quality control of the electronic data recording was performed on a random sample of papers (accounting for about 15% of the articles).

All of the papers were categorized according to the 2011 level of evidence for therapy studies: systematic review of randomized trials or n-of-1 trials (level 1); randomized trial or observational study with dramatic effect (level 2); nonrandomized controlled cohort/follow-up study (level 3); case series, case–control study, or historically controlled study (level 4); or mechanism-based reasoning (level 5) [15]. Methodological reporting of complications was evaluated according to the Martin criteria [8].

### 2.1. Statistical analysis

Cumulative analysis was conducted using Review Manager v.4.2 software designed for composing Cochrane Reviews (Cochrane Collaboration, Oxford, UK). Statistical heterogeneity was tested using the chi-square test. A $p$ value <0.10 was used to indicate heterogeneity. Where there was a lack of heterogeneity, fixed effects models were used for the cumulative analysis. Random effects models were used in case of heterogeneity. For continuous outcomes, the results were expressed as weighted mean differences (WMDs) and standard deviations (SDs); for dichotomous variables, results were given as odds ratios (ORs) and 95% confidence intervals (CIs). Due to limitations in the Review Manager v.4.2 software, meta-analysis of continuous variables was possible only when rough data were presented as mean SD. For all statistical analyses, a two-sided $p < 0.05$ was considered statistically significant.

## 3. Evidence synthesis

### 3.1. Quality of the studies and level of evidence

Figure 1 shows the flowchart of this systematic review of the literature. We selected 110 records reporting oncologic outcomes after RARP. One further study (level 2) published during the realization of the systematic review was also added [16].

Thirty-six abstracts or meeting reports and three duplicate publications were excluded. The remaining studies were 21 case series (level 4), 32 studies comparing different techniques in the context of RARP (5 studies, level 2;