UROLOGYPRACTICE

urologypracticejournal.com

Utilization of the Robotic Surgical Platform for Radical Nephrectomy: A National Comparison of Trends for Open, Laparoscopic and Robotic Approaches

Aaron C. Weinberg, Michael J. Whalen, David Paulucci, Solomon Woldu, Christopher M. Deibert, Ruslan Korets and Ketan K. Badani*

From the Departments of Urology, Columbia University College of Physicians and Surgeons (ACW, SW) and Department of Urology, Icahn School of Medicine at Mount Sinai Hospital (MJW, KKB), New York (DP), New York, Department of Urology, Medical College of Wisconsin (CMD), Milwaukee, Wisconsin, and Surgical Service, Veterans Affairs Boston Healthcare System, Harvard Medical School (RK), Boston, Massachusetts

Abstract

Introduction: The robotic platform in surgery has been widely adopted as it facilitates complex surgical reconstructions such as renorrhaphy during partial nephrectomy. Although the robotic approach to radical nephrectomy has higher costs and a lack of perioperative and oncologic evidence, the use of robotic platforms for radical nephrectomy is increasing. We evaluated a national database to explain the increased use of robotic radical nephrectomy despite a lack of perioperative and oncologic evidence.

Methods: The current retrospective cohort study used NIS (Nationwide Inpatient Sample) to identify patients who underwent radical nephrectomy from the last quarter of 2008 through 2010. We investigated hospital and patient specific factors associated with the robotic approach to radical nephrectomy, including hospital volume of robotic partial nephrectomy and robot-assisted radical prostatectomy.

Results: Of the 124,462 radical nephrectomies 4.7% were performed robotically. The median cost of robotic radical nephrectomy was $1,324 to $2,759 higher than that of open and laparoscopic radical nephrectomy. No differences in complications, length of stay, blood transfusion rates or mortality were found between laparoscopic and robotic radical nephrectomy. However the rate of open and laparoscopic radical nephrectomy decreased during the study period while the use of robotic radical nephrectomy increased almost fourfold. At hospitals in the middle or highest tertile of robotic radical nephrectomy the procedure was more likely to be performed. Patients younger than 60 years were less likely to undergo the surgery than those older than 80 years ($p < 0.001$). Robotic radical nephrectomy was less likely to be done at large and medium medical centers ($p < 0.05$). The hospital volume of robot-assisted radical prostatectomy did not predict that of robotic radical nephrectomy.

Abbreviations and Acronyms

LOS = length of stay

LRN = laparoscopic RN

MIS = minimally invasive surgery

ORN = open RN

PN = partial nephrectomy

RARP = robot-assisted radical prostatectomy

RN = radical nephrectomy

RPN = radical partial nephrectomy

RRN = robotic RN

Submitted for publication May 4, 2015.

No direct or indirect commercial incentive associated with publishing this article.

The corresponding author certifies that, when applicable, a statement(s) has been included in the manuscript documenting institutional review board, ethics committee or ethical review board study approval; principles of Helsinki Declaration were followed in lieu of formal ethics committee approval; institutional animal care and use committee approval; all human subjects provided written informed consent with guarantees of confidentiality; IRB approved protocol number; animal approved project number.

* Correspondence: Department of Urology, Mount Sinai Icahn School of Medicine, 1425 Madison Ave., New York, New York 10029 (telephone: 212-241-3919; *e-mail address:* ketan.badani@mountsinai.org).

2352-0779/16/33-1/0
http://dx.doi.org/10.1016/j.urpr.2015.07.007
UROLOGY PRACTICE
Vol. 3, 1-8, May 2016

Published by Elsevier

Conclusions: Although increased median costs and equivalent outcomes (perioperative and oncologic) question the benefit of robotic radical nephrectomy, its use is increasing. Robotic radical nephrectomy is more likely to be done at medium-high volume robotic centers for partial nephrectomy. This nationwide overtreatment and inefficiency may reflect the use of robotic radical nephrectomy as a training tool to facilitate the robotic learning curve and the proliferation of robotic radical nephrectomy.

Key Words: kidney neoplasms; nephrectomy; robotics; practice patterns, physicians'; medical overuse

It is estimated that in 2014 approximately 63,920 patients were diagnosed with kidney cancer.[1] While nephron sparing surgery is a feasible option for amenable small renal masses, RN represents the gold standard treatment of kidney cancer.[1] RN may be completed by an open, a laparoscopic or a robotic approach. For nephrectomy MIS offers decreased postoperative pain and more rapid convalescence compared to ORN.[2–5] Facilitating complex reconstruction and suturing in RN is the robotic surgical platform, which provides surgeons with many advantages over standard open or laparoscopic modalities, including enhanced 3-dimensional visualization and magnification, increased degrees of freedom of surgical instruments and elimination of hand tremor.[6] The da Vinci® robotic surgical platform in particular has facilitated the assimilation and advancement of MIS systems in the urological community as evidenced by the proliferation of RARP.[7]

However when compared to LRN, a robotic approach to RN provides no oncologic benefit and no improvement in estimated blood loss, convalescence, complications, morbidity, blood transfusion rates or analgesic requirements.[8–11] In addition RRN has higher direct costs and longer operative times than LRN.[8–11] Therefore robotic platforms for RN may represent technical overtreatment for kidney cancer and an inefficient use of expensive technology.[12] Nonetheless use of the robotic platform for RN has been reportedly increasing.[12]

While prior studies have compared oncologic and perioperative outcomes associated with open, laparoscopic and robotic approaches, to our knowledge no group has elucidated the characteristics of hospitals where the robot is gaining popularity for RN. Therefore we sought to identify epidemiological trends in the incidence of robotic RN with time along with the patient/hospital factors predictive of the approach to RN (ie ORN, LRN or RRN).

Methods

Data Source

Data were obtained using NIS from October 2008 through December 2010.[6] NIS includes individual level inpatient discharge data on approximately 8 million hospital stays in the United States, representing about 20% of community and public hospitals, and academic medical centers in the United States.

All patients provided informed consent before participation in NIS and therefore prior to study inclusion. This study was approved by the appropriate ethics committee. It was performed in accordance with the ethical standards established in the 1964 Declaration of Helsinki and its later amendments.

Sample Population and Surgical Procedures

We identified patients with a primary diagnosis of kidney cancer using the ICD-9-CM diagnostic code 189.0 as well as patients who underwent ORN (55.5x) or LRN (55.21 and 54.51). The robot-assisted modifier code (ICD-9-CM 17.4x), which has been recognized by NHCS (National Center of Health Statistics) and CMS (Centers for Medicare and Medicaid Services) since October 2008, has been shown to be a reliable indicator to identify robotic surgery.[3,7,13] Data were available to us through 2010.

In addition to the surgical procedure code we used the robotic modifier to identify the volume of RRN (55.21 and 54.51), RARP (60.5) and RPN (55.4x). We also combined the total surgical volume of each year for the 3 surgical procedures and created volume tertiles (low, medium and high) for ORN (fewer than 38, 39 to 93 and greater than 94 cases), LRN (fewer than 8, 9 to 20 and greater than 20) and RRN (fewer than 4, 4 to 12 and greater than 12) to enable comparison among hospital sites. We calculated procedural costs using direct hospital cost for the specific procedure, excluding surgeon fees, equipment maintenance costs and capital costs of acquiring the da Vinci robot and laparoscopic equipment.

Baseline Patient and Hospital Characteristics

Patient characteristics included age at surgery, gender, race, and baseline[14] and age adjusted[15] Charlson comorbidity index. To ensure uniformity in coding we combined detailed insurance categories into general groups (ie private insurance, Medicare, Medicaid and other, that is self-pay). Hospital characteristics provided by NIS included location