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The Cost Burden of Complications after Major Surgery for Urological Cancer: Opportunities for Value Creation in Urology

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Abstract

Introduction: While improving patient outcomes and controlling costs have become primary pursuits in health care, priority areas for value creation remain unclear. In urology operative morbidity serves as a major barrier to high value care. To guide improvement efforts we assessed the prevalence and cost of inpatient complications among patients undergoing major surgery for urological cancer.

Methods: Using the Nationwide Inpatient Sample from 2009 to 2011 we identified hospital admissions for cancer related prostatectomy, nephrectomy and cystectomy among adults age 18 years or older. We then measured the occurrence of inpatient complications, medical and surgical, and used multivariable, mixed effect models to estimate the associated marginal cost.

Results: Among weighted samples of 229,743 prostatectomies, 111,683 nephrectomies and 31,213 cystectomies, inpatient complications occurred in 9.4% (95% CI 8.6−10.2), 32.0% (95% CI 30.7−33.4) and 57.7% (95% CI 54.7−60.6) of hospital admissions, respectively. For these respective samples an adverse event added $4,947 (95% CI 4,523−5,454), $6,782 (95% CI 6,336−7,293) and $10,756 (95% CI 9,999−11,759) to the cost of inpatient care. While surgical events occurred most frequently, medical complications generated $1,699 (95% CI 994−2,423), $2,052 (95% CI 1,545−2,662) and $4,852 (95% CI 3,519−6,531) more in expense per episode for prostate, kidney and bladder cancer cases, respectively.

Conclusions: Many patients undergoing major surgery for urological cancer experience a complication, adding substantially to health care costs. As urologists seek to generate value in urological cancer care, the prevention and management of complications, especially medically driven events, represent an immediate opportunity for quality improvement and cost savings.

Key Words: costs and cost analysis, urinary bladder neoplasms, kidney neoplasms, prostatic neoplasms, postoperative complications

Abbreviations and Acronyms

IVC = inferior vena cava

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By the end of the current decade the annual cost of cancer care will surpass $150 billion, representing a 27% to 39% increase in cancer related expenditures compared to 2010.[1] Prostate, kidney and bladder cancer currently represent 3 of the 10 most expensive cancers in the U.S. and are projected to outpace other malignancies in terms of cost by 2020. For patients with these cancers surgery remains a mainstay of treatment. Although episodic in nature, surgical management can be high intensity and high cost, with surgery in general accounting for 40% of hospital and physician spending in the U.S.[2]

The continued increase in health care expenditures, especially as it relates to urological malignancies, underscores the need for higher quality and more cost conscious care.[1] In the treatment of urological cancers the complications associated with surgery can be a major driver of low quality and high cost.[3–5] In response, urological providers and organizations have formed regional collaboratives and established urology specific data registries, largely in an effort to improve quality.[6,7] At the same time, several provisions featured in the Affordable Care Act aim to recalibrate our system's financial structure. Value based purchasing, episode based payments and accountable care organizations are each anticipated to influence provider practice in manners that potentially improve outcomes with respect to cost.[8] For both of these practice and policy trends, understanding major foci for suboptimal quality and cost serves as a critical first step for stakeholders aiming to create value in health care.

Therefore, we evaluated the prevalence of inpatient complications by type and their marginal contribution to hospital cost among adult patients undergoing major prostate, kidney and bladder cancer surgery in the U.S. By highlighting common and costly adverse events, we can better tailor efforts aimed at improving the value of urological cancer care.

Materials and Methods

Data Source

To evaluate the relationship between inpatient complications and cost we used Nationwide Inpatient Sample data from 2009 through 2011 as provided by the Agency for Healthcare Research and Quality Healthcare Cost and Utilization Project. This sample includes 20% of U.S. inpatient hospitalizations from nonfederal, community hospitals stratified by facility bed size, location, control/ownership, teaching status and region. Abstracted from discharge data, this data set draws from more than 40 states, representing nearly 97% of the U.S. population, and includes information on patient demographics, hospital characteristics, discharge diagnoses and procedures, and hospital charges.[9]

Case Selection, Procedure Assignment and Hospital Characteristics

For our analytic cohort we selected patient admissions with concurrent ICD-9 codes for prostate cancer (185) and prostatectomy (60.4, 60.5, 60.62), kidney cancer (189.0, 189.8−9) and nephrectomy (55.4, 55.5x) or bladder cancer (188.0−9) and cystectomy (57.6, 57.7x, 68.8). We then limited our sample to adults 18 years old or older, yielding an unweighted sample of 75,370 hospital admissions (prostate 46,474; kidney 22,588; bladder 6,308) for major urological cancer surgery.

Next we used established methodology to identify the application of minimally invasive surgery.[10] For kidney and bladder cancer cases we further distinguished partial from radical resection, and characterized the use of inferior vena thrombectomy during nephrectomy and continent diversion after cystectomy. Because tumor stage remains unknown, we used 2 proxies for disease severity, namely 1) elective vs nonelective surgery and 2) diagnosis of metastatic disease derived from the Elixhauser method.[11]

We further identified patient age, gender and race/ethnicity for each discharge. We assessed preexisting comorbidity by the Elixhauser method, characterized the expected payer and used median ZIP Code™ income as a measure of socioeconomic status.[11] We used hospital level measures related to bed size, location, control/ownership, teaching status and region. Finally, we determined the annual procedure specific volume for each hospital and stratified each measure into 4 equal size quartiles.

Identification of Complications

Based on prior validation studies[12,13] we measured inpatient complications using specific ICD-9 codes as previously described.[14] Our catalog of adverse events included accidental puncture or laceration (iatrogenic injury), acute renal failure excluding chronic dialysis, cardiac complications, gastrointestinal complications, genitourinary complications (eg urine leak, urinary obstruction, renovascular injury), neurologic events, postoperative hemorrhage, postoperative infection (eg pneumonia, Clostridium difficile), pulmonary failure, sepsis, venothromboembolism, wound complications and miscellaneous complications (eg foreign body, iatrogenic pneumothorax). Given population trends in the U.S.[15] we also identified complications related to delirium, frailty (eg failure to thrive, dehydration, malnutrition) and mobility (eg falls, fractures, pressure ulcers).[16] From these specific complications we created binary measures for any postoperative complications, medical complications (ie acute renal failure, cardiac