

Effect of Hospital and Surgeon Case Volume on Perioperative Quality of Care and Short-term Outcomes After Radical Cystectomy for Muscle-invasive Bladder Cancer: Results From a European Tertiary Care Center Cohort

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Abstract

This prospective multicenter study analyzed the effect of hospital and surgeon case volume on perioperative quality of care and short-term complications and mortality in 479 patients undergoing radical cystectomy for bladder cancer. We found that hospital volume might represent an at least equally important factor regarding postoperative complications as the surgeon case volume itself at European tertiary care centers.

Background: Case volume has been suggested to affect surgical outcomes in different arrays of procedures. We aimed to delineate the relationship between case volume and surgical outcomes and quality of care criteria of radical cystectomy (RC) in a prospectively collected multicenter cohort. **Patients and Methods:** This was a retrospective analysis of a prospectively collected European cohort of patients with bladder cancer treated with RC in 2011. We relied on 479 and 459 eligible patients with available information on hospital case volume and surgeon case volume, respectively. Hospital case volume was divided into tertiles, and surgeon volume was dichotomized according to the median annual number of surgeries performed. Binomial generalized estimating equations controlling for potential known confounders and inter-hospital clustering assessed the independent association of case volume with short-term complications and mortality, as well as the fulfillment of quality of care criteria. **Results:** The high-volume threshold for hospitals was 45 RCs and, for high-volume surgeons, was > 15 cases annually. In adjusted analyses,

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high hospital volume remained an independent predictor of fewer 30-day (odds ratio, 0.34; $P = .002$) and 60- to 90-day (odds ratio, 0.41; $P = .03$) major complications but not of fulfilling quality of care criteria or mortality. No difference between surgeon volume groups was noted for complications, quality of care criteria, or mortality after adjustments.

Conclusion: The coordination of care at high-volume hospitals might confer a similar important factor in postoperative outcomes as surgeon case volume in RC. This points to organizational elements in high-volume hospitals that enable them to react more appropriately to adverse events after surgery.

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Introduction

Radical cystectomy (RC) is the standard of care for muscle-invasive urinary bladder cancer (BCa), but it entails significant morbidity and mortality.¹ Although much of this peri- and postoperative burden has been attributed to the invasive nature of the procedure itself, other underlying factors such as hospital case volume (HV) and surgeon case volume (SV) have been suggested to contribute significantly.²

In 2 seminal reports, Birkmeyer et al coined the term of surgical volume-outcome relationships. Relying on national claims data from the United States (US), the authors found significant associations between in-hospital mortality and both HV and SV.^{3,4} In case of RC, this concept has been expanded and cross-validated.⁵⁻⁸ However, most of the studies relied on administrative data with their inherent limitations.

Although less poignant, operative outcomes of RC have been suggested to be further influenced by quality-of-care criteria (QCC), such as the type of urinary diversion employed or the number of lymph nodes removed.⁹ However, a comprehensive assessment of this relationship between different QCC and perioperative outcomes after RC is lacking.

On the basis of these considerations, we sought to evaluate the volume-outcome relationship in a prospectively collected RC series from a contemporary European multi-institutional cohort. First, we evaluated the influence of HV and SV on perioperative complications and short-term mortality. Secondly, we aimed to assess the volume-outcome effect on the employment of different QCC. We hypothesized that both HV and SV will have profound effects on outcomes and QCC.

Patients and Methods

Data Source and Study Population

The Prospective Multicenter Radical Cystectomy Series (PROMETRICS) 2011 was an institutional review board-approved study of 18 European centers (15 German, 2 Austrian, and 1 Italian) that prospectively collected data of 679 consecutive patients undergoing RC for muscle-invasive or non-muscle-invasive high-risk BCa from January 1 to December 31, 2011. A computerized data collection sheet, including a comprehensive definition of all variables, was generated for data transfer. After combining the data sets, preliminary reports were generated to identify data inconsistencies and other data integrity problems. Regular communication among all participating centers ensured that all identified anomalies were resolved before

initiating the final analyses. We included men and women undergoing RC based on available information on HV and SV; patients with missing information on case volume as well as those with non-muscle-invasive disease at RC were excluded prior to further analyses.

Covariates

Preoperative clinical patient characteristics were evaluated and documented at admission for RC, comprising continuous variables such as age (stratified in 10-year increments), body mass index (grouped into < 18, 18-24.9, 25-29.9, and ≥ 30), and American Society of Anesthesiologists (ASA) score, as well as categorical variables such as gender, smoking status (never, former, and current), and the age-adjusted Charlson comorbidity index (≤ 2 , 3-5, and ≥ 6). Clinical preoperative staging was assessed by radiologic imaging (computed tomography or magnetic resonance imaging) and supported by pathologic review of the preceding transurethral resection of bladder tumor.

Histopathologic characteristics at RC were classified according to the 2009 TNM classification.¹⁰ The examination of the RC specimens was performed by experienced uropathologists at each center. We further assessed perioperative blood transfusion rates.

Endpoints

To assess volume-outcome associations, HV was divided into tertiles, and SV was stratified according to the median annual number of surgeries performed by each surgeon. Consequently, low, intermediate, and high HV were defined as ≤ 21 , 22-44, and ≥ 45 surgeries per center and year, and low and high SV as ≤ 15 and > 15 surgeries per surgeon and year, respectively. Primary endpoints were defined as short-term major complications, reported according to the Clavien-Dindo classification¹¹ at 30, 30 to 60, and 60 to 90 days as previously described,¹² as well as short-term mortality at the aforementioned time points. For the sake of the current analysis, complications were separated into no complications, minor (Clavien-Dindo 1-2) complications, and major (Clavien-Dindo 3-5) complications. Further endpoints were QCC, as introduced by Cooperberg et al,⁹ which were modified for the current study. QCC included continent (neobladder, ileocecal pouch) versus incontinent (ileal conduit, ureterocutaneostomy) diversion, the number of lymph nodes removed (< 10 vs. ≥ 10), receipt of neoadjuvant chemotherapy, the extent of lymph node dissection (extended dissection up to the aortic bifurcation vs. local dissection up to the iliac bifurcation), and the time interval between transurethral resection of bladder tumor and RC (≤ 3 vs. > 3 months).

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