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Original article

The impact of hospital volume, residency, and fellowship training on perioperative outcomes after radical prostatectomy

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Abstract

Objectives: Although high-volume hospitals have been associated with improved outcomes for radical prostatectomy (RP), the association of residency or fellowship teaching institutions or both and this volume-outcome relationship remains poorly described. We examine the effect of teaching status and hospital volume on perioperative RP outcomes.

Methods and materials: Within the Nationwide Inpatient Sample, we focused on RPs performed between 2003 and 2007. We tested the rates of prolonged length of stay beyond the median of 3 days, in-hospital mortality, and intraoperative and postoperative complications, stratified according to teaching status. Multivariable logistic regression analyses further adjusted for confounding factors.

Results: Overall, 47,100 eligible RPs were identified. Of these, 19,193 cases were performed at non-teaching institutions, 24,006 at residency teaching institutions, and 3,901 at fellowship teaching institutions. Relative to patients treated at non-teaching institutions, patients treated at fellowship teaching institutions were healthier and more likely to hold private insurance. In multivariable analyses, patients treated at residency (OR = 0.92, $P = 0.015$) and fellowship (OR = 0.82, $P = 0.011$) teaching institutions were less likely to experience a postoperative complication than patients treated at non-teaching institutions. Patients treated at residency (OR = 0.73, $P < 0.001$) and fellowship (OR = 0.91, $P = 0.045$) teaching institutions were less likely to experience a prolonged length of stay.

Conclusions: More favorable postoperative complication profile and shorter length of stay should be expected at residency and fellowship teaching institutions following RP. Moreover, postoperative complication rates were lower at fellowship teaching than at residency teaching institutions, despite adjustment for potential confounders.

Keywords: Prostatic neoplasms; Prostatectomy; Complication; Teaching; Residency; Fellowship

1. Introduction

Radical prostatectomy (RP) represents one of the principal management options for patients with clinically localized prostate cancer [1]. Several patient and system attributes associated with favorable outcomes after RP have been identified, namely, patient age, baseline comorbidity profile, and geographical region [2], as well as surgeon and hospital volume (HV) [3]. Moreover, institutional teaching status might also represent an important predictor of perioperative outcomes [4–7]. Investigators have postulated that the sub-specialty practice profile at tertiary teaching institutions may be associated with improved outcomes. Conversely, the increased complexity of cases performed at tertiary teaching centers may also undermine outcomes.

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Currently, many urologists are pursuing advanced training in urology. Professional organizations such as the Society of Urologic Oncology (SUO) and the Endourological Society have developed accreditation guidelines to define adequate fellowship training. However, there are limited data supporting the competence of these initiatives. Given the lack of available data, we sought to explore the effect of HV, residency, and fellowship accreditation status on 4 immediate and short-term RP outcomes. Specifically, we focused on intraoperative and postoperative complications, prolonged length of stay beyond the median of 3 days, and in-hospital mortality.

2. Methods

2.1. Data source

Data from 5 contemporary years (2003–2007) of the Nationwide Inpatient Sample (NIS) were abstracted. The NIS includes inpatient discharge data collected via federal-state partnerships, as part of the Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project.

2.2. Sample population and surgical procedures

Relying on discharge records, all patients with a primary diagnosis of prostate cancer (ICD-9-CM code 185) were considered for the study. The prostatectomy procedure code (ICD-9-CM 60.5) resulted in identification of 63,827 patients.

2.3. Baseline patient and hospital characteristics

For all patients, the following variables were available: age, year of surgery, ethnicity (white vs. black vs. other vs. unknown), Charlson Comorbidity Index (CCI), HV, accreditation status, hospital region, and insurance status. Information about hospital region was obtained from the American Hospital Association Annual Survey of Hospitals, and defined by the United States Census Bureau [8]. CCI, based on the comorbidity scale developed by Charlson et al. [9] and adapted by Deyo et al. [10], was derived from ICD-9 codes according to previously established criteria [11] and was stratified according to 4 levels: 0, 1, 2, and ≥ 3. HV was defined according to the number of procedures performed at each participating institution, and was calculated for each study calendar year.

Institutional teaching status was obtained from the AHA Annual Survey of Hospitals. A hospital is considered to be a teaching hospital if it has an American Medical Association-approved residency program, is a member of the Council of Teaching Hospitals, or has a ratio of full-time-equivalent interns and residents to beds of 0.25 or higher. Detailed information on accredited urologic oncology fellowship training was obtained from the website of the SUO [12]. The NIS hospital universe was then searched for all hospitals related to the institutions listed on the aforementioned website. NIS hospital identification numbers were determined for all hospitals included in both groups, and appropriate notation was added to the discharge level entry in the NIS dataset. Of the 32 accredited fellowship programs, 12 were excluded from subsequent analyses: 2 fellowship programs were not located in the USA, 8 were based in states in which hospital identification was not provided, and 2 were not found within the NIS hospital universe. Because all accredited fellowship institutions were also teaching institutions, we were able to stratify teaching status into 3 categories: non-teaching, teaching without accredited fellowship program (residency teaching), and teaching with accredited fellowship program (fellowship teaching). To minimize confounding, patients from states in which hospital identification was not provided were excluded, resulting in 47,100 eligible cases for subsequent analyses. While sampling weights are typically incorporated into NIS population-based studies, we elected not to perform weighted analyses in the current study due to the large number of excluded patients.

2.4. Intraoperative and postoperative complications during hospitalization

The presence of any complication was defined using ICD-9 diagnoses 2 through 15, as previously described [13,14]. Intraoperative complications consisted of surgical laceration of the bowel, ureter, and nerves or vessels or both. For statistical analysis purposes, we stratified patients by 0 vs. 1 or greater complications during hospitalization.

2.5. Length of stay and in-hospital mortality

Length of stay, provided by the NIS, is calculated by subtracting the admission date from the discharge date. In-hospital mortality information is coded from the disposition of the patient.

2.6. Statistical analysis

Descriptive statistics focused on frequencies and proportions for categorical variables. Means, medians, and ranges were reported for continuously coded variables. The chi-square and analysis of variance tests were used to compare the statistical significance of differences in proportions and means, respectively.

Subsequently, we focused on the rates of intraoperative complications, postoperative complications, pLOS, and in-hospital mortality. We then relied on multivariable logistic regression models to quantify the effect of institutional teaching status on these outcomes. Regression analysis did not take into account clustering of patients within hospitals, because choice of hospital was the independent variable