

# Contemporary Trends in the Management of Renal Trauma in the United States: A National Community Hospital Population-based Analysis

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<b>OBJECTIVE</b>	To better define the shift in the management of renal trauma throughout the United States, with a population-based assessment of community hospital practice patterns. To investigate how hospital, patient, and injury-specific factors influence management strategy by both urologists and nonurologists.
<b>MATERIALS AND METHODS</b>	Using the Premier Hospital database, we performed a retrospective study of all patients with renal trauma between 2003 and 2013. We identified patients using International Classification of Diseases, Ninth Revision diagnosis codes (866.0x, 866.1x), determined management strategy by International Classification of Diseases, Ninth Revision procedure codes, and dichotomized grouping by surgeon specialty. We stratified hospitals by annual renal trauma volume categorized a priori into low, <10 cases per year; intermediate, 10-20 cases per year; and high, >20 cases per year. We performed descriptive statistics and univariate and multivariate regression analyses adjusting for survey weighting and for patient, hospital, and injury-specific characteristics.
<b>RESULTS</b>	Our study cohort included a weighted sample size of 21,531 patients. Higher renal trauma hospitals (12.6%) were significantly less likely than low (26.4%) and intermediate (31.3%) volume hospitals to undergo surgical intervention for renal trauma on adjusted models. There was a statistically significant increase in nonoperative management from 65.2% in 2003 to 81.8% in 2013.
<b>CONCLUSION</b>	National rates of surgical intervention for renal trauma are significantly higher than those frequently quoted by the literature, especially among low- and intermediate-volume renal trauma hospitals. Although operative rates are decreasing, further consideration may need to be given to centralization of care in higher-volume teaching hospitals to improve renal salvage. UROLOGY ■■: ■■-■■, 2016. © 2016 Elsevier Inc.

Renal trauma is commonly encountered in hospitals across the United States, with an estimated incidence of 4.9 per 100,000 persons, and a particularly high prevalence among males in their 20s.<sup>1</sup> Blunt injuries account for 82%-95% of renal trauma.<sup>2</sup> Penetrating injuries and those causing multiorgan injury or he-

modynamic instability are more likely to require operative intervention.<sup>2</sup> Because nephrectomy rates parallel rates of exploration,<sup>3</sup> identifying patients in whom the renal injury can be managed nonoperatively has become a central tenet in the current management of renal trauma.

The development of the American Association for the Surgery of Trauma (AAST) Organ Injury Scale was an instrumental step in providing classification and risk stratification to patients with renal trauma and has helped to standardize management protocols, thus allowing physicians to better determine which patients need intervention.<sup>4</sup> Since its validation in the early 1990s, an increasing number of contemporary studies have been published that suggest a shift in the management of renal trauma, with an increasing use of nonoperative strategies by urologists and nonurologists alike.<sup>5-7</sup>

Current data are derived primarily from high-volume referral centers including the few studies that examine trends at the national level.<sup>8,9</sup> Therefore, the practice patterns for

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renal trauma outside of high-trauma volume institutions are poorly characterized and, like many urological diseases, may be different in a more community-based setting.<sup>10</sup> Furthermore, there are limited data regarding the respective role of urologists and nonurologists in managing renal trauma. We hypothesized that by involving lower-trauma volume centers and focusing on community-based hospitals that are more representative of national practice patterns, we may see lower rates of nonoperative management than previously reported, with discrepancies in the patterns of urologists and non urologists on the basis of patient and injury characteristics. To better define these trends, we evaluated the Premier Hospital Database, a large hospital discharge database comprised primarily of community hospitals to determine contemporary practice patterns for the care of patients with renal trauma.

## MATERIALS AND METHODS

### Data Source

The Premier Hospital Database (Premier Inc, Charlotte, NC) is a nationally representative all-payer hospital clinical and economic database developed for quality and utilization benchmarking in the United States. It captures over 45 million inpatient discharges (about 20% of total discharges) from over 600 hospitals, including all hospital costs and charge data. It includes over 60% of the United States community hospital market and thus allows for ascertainment of community practices of care. All data are de-identified and we received institutional review board exemption from our institutions for this study.

### Study Cohort and Covariates

Using *International Classification of Diseases, Ninth Revision* (ICD-9) codes, we identified all patients with renal trauma (866.0x, 866.1x) between January 1, 2003 and December 31, 2013. We examined patient, hospital, and injury characteristics that may be associated with renal trauma. Patient characteristics included age (<35, 35-54, 55-75, >75 years), gender, race (Caucasian, African American, Hispanic, Other), and insurance status (Medicare, Medicaid, managed care, commercial, other or unknown). Hospital characteristics included teaching status (teaching or nonteaching), hospital size (<200, 200-399, or >400 beds), location (urban or rural), and region (East, West, Midwest, South). We stratified hospitals by annual renal trauma volume a priori on the basis of discussions regarding standard rates of consultations for renal trauma with collaborating coauthors nationwide: low, <10 cases per year; intermediate, 10-20 cases per year; and high, >20 cases per year.

We utilized ICD-9 codes to categorize the grade of renal injuries. Given that choice of management strategy is most divisive for high-grade injuries, and considering the inherent flaws with mapping ICD-9 codes to AAST grading schemes, we simplified categorization by dichotomizing into high-grade injuries with renal vascular injury (902.4x [grade IV]) or complete disruption of the renal parenchyma (866.03, 866.13 [grade V]), vs all other renal injuries. We also looked separately at penetrating (866.1x) vs blunt trauma (866.0x). Global injury characteristics were defined by applying each encounter's associated ICD-9 and calculating a corresponding severity score using the Trauma Mortality Prediction Model (TMPM), which has been shown to outperform the Injury Severity Score in this setting.<sup>11</sup> This vali-

dated metric estimates the likelihood of mortality on the basis of severity of presenting injuries, assigning a percentage score for each patient.

Among the patients in the study cohort, we identified the type of management based on the ICD-9 codes and the timing of therapy based on billing data. Management was based on intended strategy and was considered "surgical" if it involved partial nephrectomy, radical nephrectomy, or renorrhaphy on the first day of the hospital stay, and "conservative" for all other management, including minimally invasive techniques and delayed surgical intervention ([Supplementary Table S1](#)). The procedures were further dichotomized by specialty of the operative surgeon (urologist vs nonurologist) through review of the administrative data.

### Statistical Analyses

We summarized patient, hospital, and injury characteristics with descriptive statistics. Categorical variables were compared using chi-square tests, and continuous variables using the Mann-Whitney *U* test. Multivariable logistic regression models were also employed to compare the odds of surgery by urologists vs nonurologists, and to examine the odds of surgery as a function of hospital renal trauma volume. These models adjusted for sampling weights inherent to the Premier database to ensure nationally representative estimates for discharge data. These weights were derived from the 1998 American Hospital Association Annual Survey, validated by the 1998 National Hospital Discharge Survey.<sup>12</sup> Our models also incorporated clustering by hospitals to adjust for interhospital outcome variations.<sup>13</sup> All statistical analyses were performed using STATA 13 (StataCorp, College Station, TX). All tests were two sided and a *P* value of <.05 was considered statistically significant.

## RESULTS

Our study cohort included a weighted sample size of 21,531 patients, reflecting 3495 patients with renal trauma from the Premier Hospital Database. [Table 1](#) shows the baseline patient and hospital characteristics. The majority of renal traumas occurred in young white males presenting to large nonteaching urban hospitals with low annual renal trauma volume; 72.3% were blunt injuries, 13.7% were high grade, and many of them (37.3%) had high TMPM severity scores. The majority of patients (15,757, 73.2%) underwent nonoperative management, whereas 5774 (26.8%) underwent operative management by urologists and nonurologists.

There were several patient, hospital, and injury characteristics that independently predicted operative management ([Table 2](#)). Compared to patients <35 years old, there was a decreased odds for surgery among patients aged 55-74 (odds ratio [OR] 0.49, *P* < .001) and >74 (OR 0.17, *P* < .001) years old. Compared to Caucasians, there was an increased odds for surgery for African Americans (OR 1.63, *P* < .001) and Hispanics (OR 1.51 *P* < .001). There was also an increased odds for surgery among patients at nonteaching hospitals (OR 1.54, *P* = .04). Surgery was also associated with penetrating (OR 7.31, *P* < .001) and high-grade (OR 2.74, *P* < .001) traumas. The highest TMPM category was also much more likely (OR 2.37, *P* < .001) to undergo surgery compared to the lowest category.

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