



Mortality, morbidity and healthcare expenditures after local tumour ablation or partial nephrectomy for T1A kidney cancer[☆]

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Abstract

Background: Local tumour ablation (LTA) may yield better perioperative outcomes than partial nephrectomy (PN), however the impact of each treatment on perioperative mortality and health care expenditures is unknown. The aim of the study was to compare mortality, morbidity and health care expenditures between LTA and PN.

Patients and methods: A population-based assessment of 2471 patients with cT1a kidney cancer treated with either LTA or PN, between 2000 and 2009, in the SEER-Medicare database was performed. After propensity score matching, 30-day mortality, overall and specific complication rates, length of stay, readmission rates and health care expenditures according to LTA or PN were estimated. Multivariable logistic and linear models addressed the effect of each specific LTA approach on overall complication rates, length of stay, readmission rates and health care expenditures.

Results: The 30-day mortality was <2% after either LTA or PN (OR 2.27, $p = 0.2$). The overall complication rate was 21% after LTA and 40% after PN (OR 0.38, $p < 0.001$). Blood transfusions, infection/sepsis, wound infections, respiratory complications, gastrointestinal complications, acute kidney injury, and accidental puncture or laceration/foreign body left during procedure rates resulted lower after LTA relative to PN (all $p < 0.05$). Similarly, length of stay and health care expenditures resulted lower after LTA relative to PN (all $p < 0.05$). Conversely, readmission rate was not significantly different in LTA relative to PN ($p = 0.1$).

Conclusions: Despite similar perioperative mortality, LTA is associated with lower complications rate, shorter length of stay and lower health care expenditure relative to PN.

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Keywords: Kidney cancer; Local tumour ablation; Partial nephrectomy; Nephron sparing surgery; Perioperative mortality; Complications; Health care expenditure

Introduction

Partial nephrectomy (PN) represents the standard of care for small renal masses.^{1,2} Local tumour ablation (LTA) is an alternative option which may be associated with a more favourable complication profile than PN.^{1,2} Historically, LTA was considered a treatment associated with

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inferior oncologic outcomes than PN. However, permissive inclusion criteria of early reports raised the issue of biased results³ and the most recent assessments of long-term oncologic outcomes suggested comparable cancer control in either treatment modality.^{4–8} Under this light, the assessment of perioperative outcomes such as mortality, morbidity, and health care expenditure after LTA or PN requires special consideration for appropriate treatment selection and resource allocation.

For this reason, we examined the most contemporary version of the Surveillance, Epidemiology and End Results (SEER)-Medicare database (2000–2009) with the intent of performing a comprehensive comparison of perioperative outcomes and health care expenditure associated with either LTA or PN. Our hypothesis stated that LTA might be associated with lower perioperative mortality, lower perioperative morbidity and lower health care expenditure.

Methods

Study source

The current study relied on the 2000–2009 SEER-Medicare linked database with follow-up updated until December 31, 2011. The SEER registries identify 28% of all cancer cases in the United States. Medicare insures approximately 97% of all Americans aged ≥ 65 years. Linkage to the SEER database is complete for approximately 93% of cases.⁹

Study population

Patients with a primary diagnosis of T1a, organ confined, unilateral, renal cell carcinoma (RCC) between 2000 and 2009 were abstracted. For the purpose of the study, we focused on patients treated with PN or LTA as primary treatment using a claims-based algorithm^{10–12} for treatment identification ([Supplemental Table 1](#)).

Study design

The study design was a retrospective population-based matched-cohort study comparing patients treated with LTA and patients treated with PN.

Covariates

Demographic covariates consisted of age at diagnosis, gender, race, marital status, socioeconomic status (composite variable of income, education, and poverty levels¹³) and residency status (urban, rural). Baseline medical condition-related covariates consisted of comorbidities derived from the Klabunde's Charlson comorbidity index (CCI) modification,¹⁴ renal medical history and general medical

history.¹⁵ Cancer-related covariates consisted of tumour size, side and histology (clear cell, papillary, chromophobe, RCC of unspecified subtype and others).¹⁶

Outcomes

The first endpoint was to compare 30-day mortality between LTA and PN. The second endpoint was to compare the overall complication rates as well as the specific complication rates between LTA and PN. Perioperative complications were defined relying on the most comprehensive adverse events classification, using previously established methodology^{17,18} and were assessed at 30 days after either treatment modality. Specific complications categories included blood transfusion, infection/sepsis, wound infection, cardiac, respiratory, gastrointestinal and genitourinary complications, deep vein thrombosis and/or pulmonary embolism, acute kidney injury and other complications ([Supplemental Table 1b](#)). Specific patient safety indicators (e.g. accidental organ puncture or laceration or foreign body left during procedure) were also evaluated.¹⁹ Additional outcomes were length of stay and 30-day readmission rates.

The third endpoint of the study was to compare health care expenditure between LTA and PN. Procedure-related costs were computed in compliance with established definition,²⁰ as the sum of all Medicare health care expenditures within 12 months from surgery. Using each patient as his own control, we subtracted outpatient health expenditures accrued in the 12 months before diagnosis (baseline annual health care charges). Expenditures are reported in 2014 United States dollars after conversion according to annual inflation rate.²¹ The fourth endpoint of the study was to compare the length of stay and the 30-day readmission rate after LTA and PN. Length of stay, readmission rates and health care expenditures were evaluated in a sub-cohort of patients with complete in-patient claims information (215/510 42% LTA cases and 1961/1961 100% PN cases).

Statistical analyses

Statistical analyses and reporting and interpretation of the results were conducted according to established guidelines²² and consisted of four steps. First, Medians and interquartile ranges or frequencies and proportions were reported for continuous or categorical variables, respectively. Mann–Whitney and Chi-square tests were used to compare the statistical significance of differences in the distribution of continuous or categorical variables, respectively.

Second, due to inherent baseline differences among LTA and PN patients, adjustment was performed using a 1:1 nearest-neighbour propensity score matching ratio.²³

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