



Original article

Effect of median household income on surgical approach and survival in renal cell carcinoma

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Abstract

Purpose: We sought to determine whether median household income (MHI) independently predicts surgical approach (partial vs. radical nephrectomy) and survival in patients with renal cell carcinoma.

Methods: The U.S. Surveillance Epidemiology and End Results Database (1988–2011) was queried to examine kidney cancer cases and linked to the Area Health Resources File. We correlated surgical approach and survival, both overall and cancer-specific, with tumor stage, age, race, sex, and income data.

Results: Of 152,589 patients diagnosed with renal cell carcinoma, 24,221 (16%) patients underwent partial nephrectomy, 102,771 (67%) patients underwent radical nephrectomy, and 25,597 (17%) patients had no surgery. There was no significant difference in stage of presentation between the wealthiest and poorest MHI quartiles, with approximately 35% of patients in each quartile presenting with T1aN0M0 disease and 17% of patients presenting with metastatic disease. Despite this, 18% of patients in the wealthiest quartile underwent partial nephrectomy compared to 14% of patients in the poorest quartile. Although the percentage of patients undergoing partial nephrectomy rose over the timeframe studied in both the wealthiest and poorest quartiles, the rate of rise was highest in the wealthier group. Those in the poorest quartile were 0.10 times more likely to die of all causes (95% CI: 1.09–1.11, $P < 0.001$) and 0.09 times more likely to die of kidney cancer (95% CI: 1.05–1.10, $P < 0.001$) than those in the wealthiest quartile over the timeframe studied.

Conclusions: Despite presenting with similar stage, patients with lower MHI less commonly undergo partial nephrectomy and are more likely to die of kidney cancer than those in the highest MHIs. © 2017 Elsevier Inc. All rights reserved.

Keywords: Renal cell carcinoma; Socioeconomic status; Survival; Nephrectomy

1. Introduction

Renal cell carcinoma (RCC) is the most prevalent form of kidney and renal pelvis cancer, constituting 85% of all kidney cancer with an estimated incidence of 21.4/100,000 males and 10.7/100,000 females [1]. Most patients diagnosed have been on the rise in recent years with a larger number of small masses found on abdominal CT imaging [2]. An estimated 62,700 persons were diagnosed in 2016, and 14,240 died of the disease [1].

Complete surgical resection remains the mainstay of therapy, with partial robotic and laparoscopic nephrectomy

becoming increasingly adopted in recent years owing to superior preservation of renal function, improved convalescence, and overall survival advantage compared with traditional open radical nephrectomy [3–5]. Partial nephrectomy is the preferred modality in the treatment of stage I disease (pT1a) and has equivalent outcomes to radical nephrectomy in T1b tumors when technically feasible [6]. Registry studies of RCC have shown that patients from a lower socioeconomic status (SES), as defined by factors including median household income (MHI), education, and living in a county with higher percentage of the population below the poverty line have been associated with inferior outcomes, including shortened cancer-specific survival, presentation with a larger primary tumor and at later stage, and a lower rate of partial as opposed to radical nephrectomy [7–9].

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Although the precise reasons for this discrepancy in care are unclear given that overall incidence is similar across all SES groups [10] and in-hospital costs of partial vs. complete nephrectomy are comparable [5], a number of potential barriers to optimal treatment options may exist including reduced access to urologists specializing in laparoscopic or robotic techniques [11]. Additionally, several risk factors for RCC reported in the literature, including obesity, hypertension, and reduced physical activity, have been linked to the overall prognosis of RCC and are more prevalent among populations with low SES [12-17]. In this study, we set out to analyze a contemporary cohort of patients from the Surveillance, Epidemiology, and End Results (SEER) registry and determine whether MHI independently predicted surgical approach (partial vs. radical nephrectomy) and affected overall and cancer-specific survival. Based on previous studies, we hypothesized that patients diagnosed with RCC between 1990 and 2008 would present at a similar stage based on lack of uniform screening but would have significant differences in overall and cancer-specific survival based on MHI due to access to partial nephrectomy.

2. Materials and methods

2.1. Subjects and databases

This was a cross-sectional, observational study using the SEER database (1973–2011) as the source for the data regarding disease and demographics. This database is a publicly available cancer registry maintained by the National Cancer Institute that includes approximately 26% of the US population representing Connecticut, Iowa, rural Georgia, Alaska, New Mexico, Greater California, Utah, Hawaii, Kentucky, New Jersey, and Louisiana as well as the metropolitan areas of Detroit, San Francisco-Oakland, Seattle, Metropolitan Atlanta, Los Angeles, and San Jose-Monterey. Records before 1988 were excluded, as the SEER registry did not collect detailed lymph node data from 1973 to 1987. We linked the SEER data to the Area Health Resources File based upon patients' state and county codes to ascertain poverty level and MHI.

2.2. Inclusion and exclusion criteria

We included patients who were diagnosed with RCC (ICD-O-3 code 649.0) from 1988 to 2011. We excluded patients whose staging, nodal status, or MHI could not be determined. Patients lacking survival information were also excluded. For each patient, data on surgical approach, tumor stage, age, sex, race, and MHI were abstracted. Age was classified as <50 years, 50 to 59 years, 60 to 69 years, 70 to 79 years, and 80 years or older. Data on surgical approach were categorized as radical nephrectomy, partial nephrectomy, or no surgery. Tumor stage was

stratified into T1aN0M0, T1bN0M0, T2N0M0, T3N0M0, T4N0M0, TanyN+M0, and M+ based on the AJCC TNM staging system. We used state-county Federal Information Processing Standards (FIPS) codes to link SEER county data to the Area Health Resources File for the purpose of analyzing SES. We used MHI in 2011 as our socioeconomic metric. We divided this variable into quartiles for final analysis. The wealthiest quartile had a MHI of \$63,560 to \$110,200, the second quartile had \$52,250 to \$63,300, the third quartile had \$45,720 to \$52,240, and the poorest quartile had \$21,860 to \$45,600 per year.

2.3. Statistical analysis

Surgical approach or no surgery was correlated to stage, SES, and race and was the primary outcome measure. Logistic regression analysis was used to determine the likelihood of no surgery, partial nephrectomy, or nephrectomy based upon sex, age group, race, TNM stage, and MHI. Chi squared analysis was used to ascertain differences in presenting stage as related to operative approach for sex and percentage of patients' MHI. Kaplan-Meier analyses and Cox proportional hazard modeling were used to evaluate overall and cancer-specific survival by percentage of patients below the poverty level and by sex. The percentage of patients surviving 5 years as well as the rates

Table 1
Demographics of patients with kidney cancer

	No surgery	Partial nephrectomy	Nephrectomy	
Sex				
Male	15,815 (17)	15,561 (16)	64,456 (64)	95,832
Female	9,782 (17)	8,660 (15)	38,315 (68)	56,757
Age group				
<50	1,771 (7)	5,478 (21)	18,292 (72)	25,541
50–59	3,763 (11)	6,369 (19)	24,009 (70)	34,141
60–69	5,859 (14)	7,055 (17)	28,534 (69)	41,448
70–79	7,035 (20)	4,397 (13)	23,541 (67)	34,973
80+	7,169 (43)	922 (5)	8,395 (51)	16,486
Race				
White	20,991 (16)	19,987 (16)	86,526 (68)	127,504
Black	3,303 (19)	2,761 (16)	10,943 (64)	17,007
Other	1,303 (16)	1,473 (18)	5,302 (66)	8078
Stage				
T1aN0M0	4,138 (8)	18,276 (34)	31,184 (58)	53,598
T1bN0M0	2,093 (7)	3,379 (11)	23,937 (81)	29,409
T2N0M0	1,314 (8)	813 (5)	14,843 (87)	16970
T3N0M0	1,098 (5)	1,397 (7)	8,760 (88)	21255
T4N0M0	630 (35)	25 (1)	1,157 (64)	1812
N+M0	176 (6)	48 (2)	2,884 (93)	3108
M+	16,148 (61)	283 (1)	10,006 (38)	26,437
MHI quartile				
Poorest	7,131 (19)	5,372 (14)	25,444 (67)	37,947
2	6,629 (17)	6,078 (16)	26,176 (67)	38,883
3	5,999 (16)	6,016 (16)	25,602 (68)	37,617
Wealthiest	5,838 (15)	6,755 (18)	25,549 (67)	38,142
Total	25,597 (17)	24,221 (16)	102,771 (67)	152,589

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