Original Study

Risk of Subsequent Primary Kidney Cancer After Another Malignancy: A Population-based Study

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Abstract

The Surveillance, Epidemiology, and End Results (SEER)-9 database (1973-2013) was queried using the SEER*Stat program. A total of 10,145 kidney cancers were observed. Many common cancers are associated with an increased risk of kidney cancer development.

Background: Population-based data on the development of kidney cancer as a second malignant neoplasm following the diagnosis of other common malignancies are rare. This clinical scenario has been evaluated within the Surveillance, Epidemiology, and End Results (SEER) database. **Materials and Methods:** The SEER-9 database (1973-2013) was queried using the SEER*Stat program to determine the standardized incidence ratios (SIRs) of kidney cancer development following each one of 10 common invasive malignancies (colorectal, breast, prostate, lung, thyroid, corpus uteri, urinary bladder, kidney/renal pelvis, cutaneous melanoma, and non-Hodgkin lymphoma). The following data were collected for patients with a second renal cancer: age at diagnosis of the second renal cancer; gender, race, and histology of the second primary renal cancer; SEER historic stage of the second primary renal cancer; and method of diagnostic confirmation of the second primary cancer. **Results:** A total of 10,145 kidney cancers were observed. Elevated SIRs for kidney cancer were noted for all 10 evaluated malignancies in the initial 12 months after diagnosis. The SIRs remained elevated 12 to 59 months after diagnosis for all cancers except breast and prostate cancers. Increased risks persisted 60 to 119 months beyond diagnosis for renal cancer (SIR, 4.13), thyroid cancer (SIR, 2.30), and non-Hodgkin lymphoma (SIR, 1.40); and 120+ months for renal cancer (SIR, 3.60), thyroid cancer (SIR, 1.90), and non-Hodgkin lymphoma (SIR, 1.27). Increased kidney cancer risk after non-Hodgkin lymphoma was not related to radiation therapy. Papillary renal cell carcinoma has the highest SIRs for subsequent kidney cancers. **Conclusion:** Many common cancers are associated with an increased risk of kidney cancer development within the first 5 years after their diagnosis. Although this can be partly interpreted by increased rates of surveillance tests, radiotherapy effects, or genetic associations for some cancers, additional research is required to explain the persistently increased risk beyond 5 years associated with some cancers.

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Introduction

Kidney cancer ranks as the 13th most prevalent malignancy worldwide, according to the Globocan 2012 report.[1] The most common form of renal parenchymal cancer is renal cell carcinoma (RCC), comprising 95% of cases, which may be broadly classified into clear- and non—clear-cell histologies.[2]

Multiple etiologic factors have been reported to contribute to the development of RCC. These include genetic factors and syndromes (eg, von Hippel-Lindau [vHL] disease and hereditary papillary RCC), as well as environmental factors.[3,4] Examples of environmental factors include cigarette smoking and obesity, as well as some chemicals.[5-7]

RCC has been frequently described as a second cancer event following the diagnosis of other primary cancers.[8,9] Possible reasons include common etiological factors (eg, smoking, obesity), effects of the primary treatment of the first cancer, or rare genetic syndromes predisposing to both events. However, a systematic, latency-based assessment of the risk of a second primary renal parenchymal cancer following common primary invasive neoplasms is lacking. Given the practical difficulties associated with evaluating this research question in prospective settings, a high-quality population-based database was explored to answer this question.

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Subsequent Kidney Cancer

The objective of this analysis is to review the patterns of diagnosis of renal parenchymal cancer as a subsequent malignant neoplasm following the diagnosis of 10 of the most common invasive cancers (colorectal, breast, prostate, lung, thyroid, corpus uteri, urinary bladder, kidney/renal pelvis, cutaneous melanoma, and non-Hodgkin lymphoma) in the Surveillance, Epidemiology, and End Results (SEER) database.

Materials and Methods

Data for the current analysis were extracted from the SEER-9 registry of the United States National Cancer Institute; November 2015 submission.[10] These data were further elaborated using the SEER*Stat software (Version 8.3.2).

Selection of the Study Cohort

The MP-SIR session of the SEER*stat program was utilized to extract baseline characteristics of the included patients as well as the standardized incidence ratios (SIRs). The following parameters were chosen in the selection tab of the SEER*Stat: Site recode International Classification of Diseases for Oncology, 3rd edition (ICD-O-3)/World Health Organization (WHO) 2008 = (colorectal, breast, prostate, lung, thyroid, corpus uteri, urinary bladder, kidney/renal pelvis, cutaneous melanoma, non-Hodgkin lymphoma): in order to restrict the cohort to patients with 1 of these first primaries. The cohort was further restricted to cases with malignant behavior and to cases with first primary only (sequence number 0 or 1) with exclusion of cases diagnosed only from autopsy or death certificate. "Kidney" was then selected in the events tab. It has to be noted here that renal pelvis is considered a different event in this session; thus, the event selection here is restricted for renal parenchymal tumors only.

From the statistics tab, both SIR tables and case listing options were chosen. The following data were collected for patients with a second renal cancer developing after each 1 of the 10 primary invasive cancers: age at diagnosis of the second renal cancer; gender, race, and histology of the second primary renal cancer; vital status at the time of data cutoff; SEER historic stage of the second primary renal cancer; and method of diagnostic confirmation of the second primary cancer (histology or radiology). Additionally, data about local treatment modalities of the second renal cancer were collected.

Statistical Analysis

SIRs and 95% confidence intervals (CIs) were calculated according to the exact method.[11] The SIR is defined as the ratio of the observed number of second primary renal cancer among survivors of each of the 10 first primaries to the expected number among the general population. Expected numbers were automatically calculated through the SEER*Stat program.[12] All of the above statistical analyses were conducted through the SEER*Stat program.

Results

Patient Characteristics

A total of 10,145 subsequent primary renal cancers were identified in 9861 patients, and these were included in the current analysis. Among the 10,145 events, 9590 patients experienced only 1 subsequent renal cancer event, 259 patients experienced 2 subsequent renal cancer events, 11 patients experienced 3 subsequent renal cancer events, and 1 patient has experienced 4 subsequent renal cancer events. The percentage of patients who developed subsequent kidney cancer out of the total number of patients with 1 of the 10 primary tumors evaluated is 0.4%, whereas the percentage of patients who developed subsequent kidney cancer out of the total

Table 1 Criteria of Second Primary Kidney Cancer Diagnosed After the 10 Most Common Cancers

First Primary Cancer	Diagnostic Confirmation of Second Primary Renal Cancer	Histology of Second Primary Renal Cancer
Colorectal	Histology: 85% Radiology only: 14% Unknown: 1%	Clear-cell: 27% Papillary: 6.5% Chromophobe: 2% Collecting duct: 0.1% RCC, NOS: 49.4% Unknown: 15%
Lung	Histology: 82.5% Radiology only: 16% Unknown: 1.5%	Clear-cell: 26% Papillary: 8% Chromophobe: 2% RCC, NOS: 46.5% Unknown: 17.5%
Breast	Histology: 87% Radiology/clinical only: 11.5% Unknown: 2.5%	Clear-cell: 39% Papillary: 5% Chromophobe: 2% Collecting duct: 0.2% RCC, NOS: 42.3% Unknown: 11.5%
Prostate	Histology: 87% Radiology/clinical only: 12% Unknown: 1%	Clear-cell: 33% Papillary: 11% Chromophobe: 3% RCC, NOS: 40% Unknown: 13%
Kidney and renal pelvis	Histology: 91% Radiology only: 7% Unknown: 2%	Clear-cell: 37.5% Papillary: 14% Chromophobe: 3% RCC, NOS: 36.5% Unknown: 9%
Cutaneous melanoma	Histology: 91.5% Radiology/clinical only: 8% Unknown: 0.5%	Clear-cell: 37% Papillary: 12% Chromophobe: 3.5% Collecting duct: 0.2% RCC, NOS: 37% Unknown: 10.3%
Corpus uterus	Histology: 88% Radiology only: 10% Unknown: 2%	Clear-cell: 38% Papillary: 5% Chromophobe: 3% RCC, NOS: 42% Unknown: 12%
Urinary bladder	Histology: 85% Radiology/clinical only: 13.5% Unknown: 1.5%	Clear-cell: 26% Papillary: 6.5% Chromophobe: 2% RCC, NOS: 42% Unknown/others: 23.5%
Thyroid	Histology: 93% Radiology only: 6.5% Unknown: 0.5%	Clear-cell: 41% Papillary: 10% Chromophobe: 4% RCC, NOS: 38% Unknown: 7%
Non-Hodgkin lymphoma	Histology: 91% Radiology only: 7% Unknown: 1.3%	Clear-cell: 39% Papillary: 10% Chromophobe: 2.5% Collecting duct: 0.2% RCC, NOS: 40% Unknown: 8.3%

Abbreviations: NOS = not otherwise specified; RCC = renal cell carcinoma.