

Increased risk of end-stage renal disease in patients with renal cell carcinoma: a 12-year nationwide follow-up study

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OBJECTIVES

The effect of renal cell carcinoma (RCC) on the risk for end-stage renal disease (ESRD) has not been confirmed. The present population-based study used the claims data from the Taiwan National Health Institutes from 1998 to 2010 to compare the risk for ESRD in patients with and without RCC.

METHODS

The study cohort consisted of 2940 patients who had newly diagnosed with RCC but no history of ESRD; the control cohort consisted of 23,520 matched patients without RCC. Cox proportional hazard regressions were performed to compute ESRD risk after adjusting for possible confounding factors. Kaplan–Meier analysis and the log-rank test were also used to compare patients and controls.

RESULTS

A total of 119 patients in the RCC group (incidence rate: 119/2940; 4.05%) and 160 patients in the control group (incidence rate: 160/23,520; 0.68%) were diagnosed with ESRD during the follow-up period. After adjusting for potential confounders, the RCC group had an ESRD hazard ratio (HR) of 5.63 [95% confidence interval (CI): 4.37–7.24] relative to the control group. In addition, among patients with RCC, females (adjusted HR: 6.95, 95% CI: 4.82–10.1) had a higher risk for ESRD than males (adjusted HR: 4.79, 95% CI: 3.37–6.82). Finally, there were significant joint effects of chronic kidney disease and diabetes on increasing the risk of ESRD in patients with and without RCC ($P < 0.01$). The limitations of this study include the retrospective design and the inability to assess methods of treatment and measure the aggressiveness of RCC.

Table 1 Distribution of Sociodemographic Factors and Comorbidity Between Cohorts With and Without RCC

Variable	RCC N=2940		Non-RCC N=23,450		P value
	N	%	N	%	
Age					0.99
25–44	2552	10.9	319	10.9	
45–64	10352	44.0	1294	44.0	
≥65	10616	45.1	1327	45.1	
Sex					0.99
Male	14,480	61.6	1810	61.6	
Female	9040	38.4	1130	38.4	
Geographic region					<0.0001
Northern	9965	27.3	802	42.4	
Central	4855	12.8	375	20.6	
Southern	6496	46.6	1371	27.6	
Eastern	2203	13.3	392	9.37	
Occupation					0.24
White collar	11,251	49.2	1447	47.9	
Blue collar	9624	40.4	1188	40.9	
Others	2631	10.3	304	11.2	
Monthly income, NTD					<0.0001
≤15840	11,570	50.8	1494	49.2	
15841–20100	1136	7.18	211	4.83	
>20100	10,814	42.0	1235	46.0	
Comorbidity					
Diabetes	576	19.6	1811	7.70	<0.0001
Hypertension	1164	39.6	3270	13.9	<0.0001
Coronary heart disease	294	10.0	1586	6.74	<0.0001
Atrial fibrillation	57	1.94	293	1.25	0.002
Heart failure	96	3.27	454	1.93	<0.0001
Chronic kidney disease	53	1.80	108	0.46	<0.0001
Hyperlipidemia	182	6.19	854	3.63	<0.0001

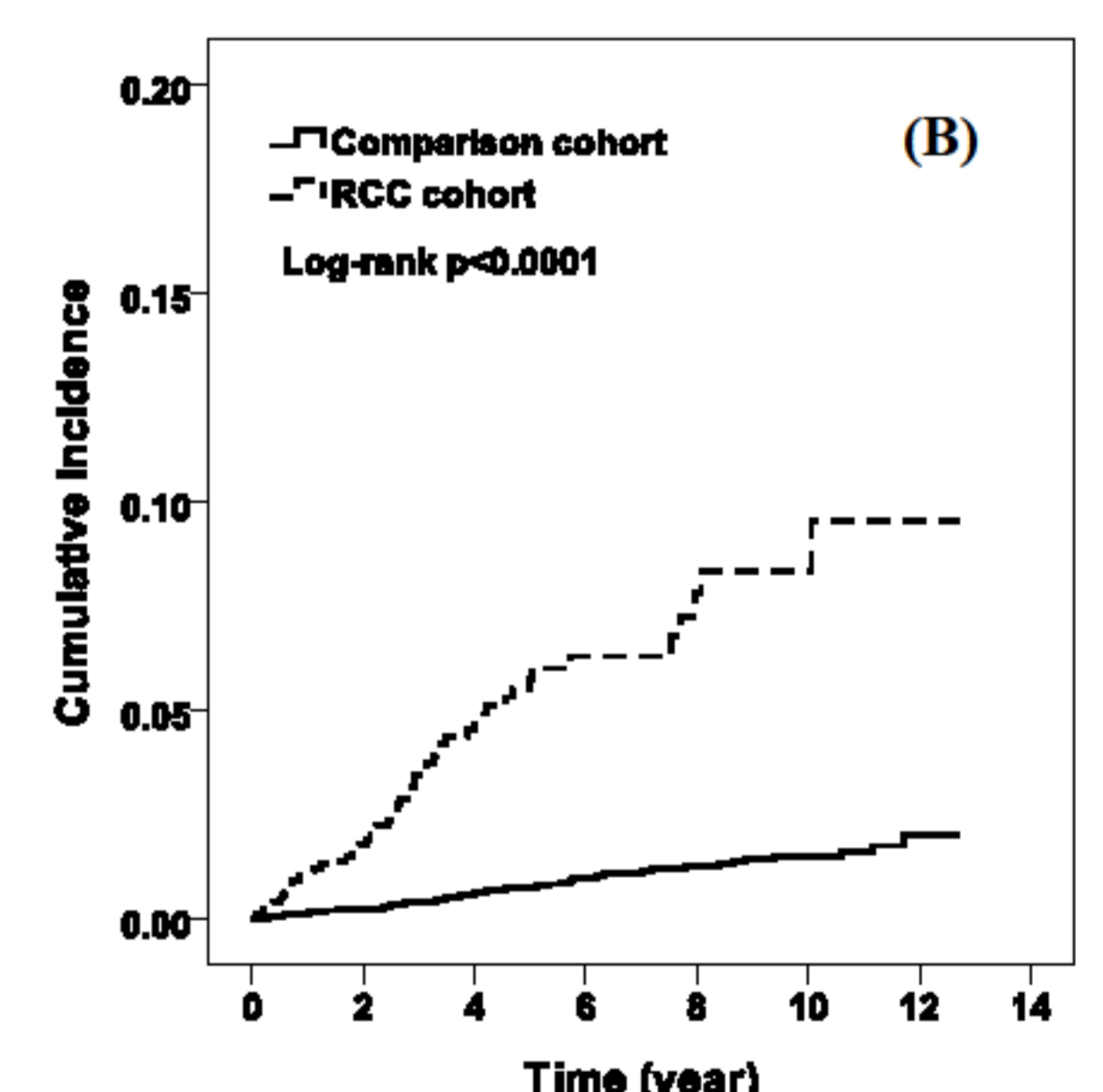
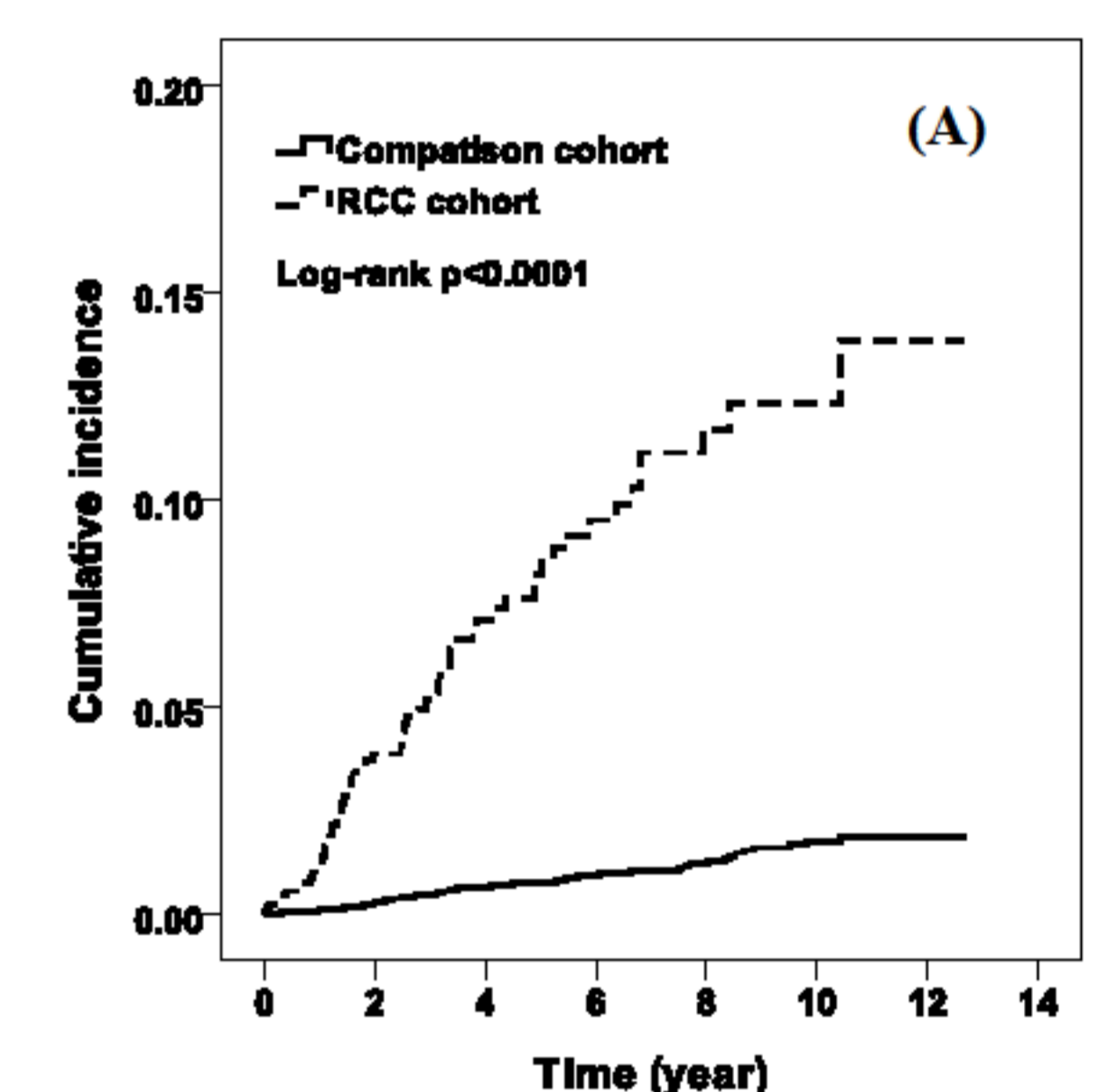


Figure 1 ESRD cumulative incidence rates for RCC. (A) Females (B) Males

Table 2 Comparisons of the Incidence Rate Ratios and Hazard Ratios of ESRD in Cohorts With and Without RCC

Variables	Non-RCC			RCC			Crude HRs (95% CI)	Multivariate-HRs (95% CI)
	Cases	PY	Rate	Cases	PY	Rate		
All	160	101,611	1.57	119	9464	12.57	8.24 (6.50–10.5)***	5.63 (4.37–7.24)***
Age								
25–44	1	1187	0.09	6	1192	5.03	54.8 (6.59–456)***	41.8 (4.57–383)**
45–64	53	46,063	1.15	42	4321	9.72	8.52 (5.68–12.8)***	4.05 (2.54–6.45)***
≥65	106	44,360	2.39	71	3951	17.97	7.53 (5.57–10.2)***	5.57 (4.07–7.64)***
Sex								
Male	91	59,598	1.53	57	5545	10.28	6.74 (4.84–9.40)***	4.76 (3.34–6.78)***
Female	69	42,013	1.64	62	3919	15.82	9.58 (6.79–13.5)***	7.06 (4.90–10.2)***
Diabetes								
No	112	95,792	1.17	82	8033	10.21	8.80 (6.62–11.7)***	7.15 (5.27–9.70)***
Yes	48	5819	8.25	37	1431	25.85	3.14 (2.04–4.82)***	2.98 (1.90–4.68)***
Hypertension								
No	104	90,875	1.14	65	6251	10.40	9.15 (6.71–12.5)***	6.77 (4.83–9.50)***
Yes	56	10,735	5.22	54	3213	16.81	3.26 (2.24–4.74)***	3.61 (2.45–5.32)***
Coronary heart disease								
No	135	96,217	1.40	107	8691	12.31	8.83 (6.85–11.4)***	6.28 (4.79–8.23)***
Yes	25	5394	4.64	12	772	15.54	3.34 (1.67–6.65)***	2.49 (1.22–5.07)*
Atrial fibrillation								
No	157	100,742	1.56	118	9348	12.62	8.09 (6.37–10.3)***	5.65 (4.38–7.29)***
Yes	3	869	3.45	1	116	8.62	2.49 (0.29–24.0)	3.40 (0.17–67.3)
Heart failure								
No	1153	100,336	1.52	113	9244	12.22	8.04 (6.30–10.3)***	5.53 (4.26–7.17)***
Yes	7	1274	5.49	6	220	27.29	4.83 (1.62–14.4)**	3.79 (1.17–12.3)*
Chronic kidney disease								
No	146	101,401	1.44	100	9343	10.70	7.53 (5.83–9.71)***	5.74 (4.39–7.51)***
Yes	14	210	66.81	19	121	157.36	2.60 (1.30–5.22)**	2.13 (0.94–4.81)
Hyperlipidemia								
No	143	98,908	1.45	109	8994	12.12	8.42 (6.56–10.8)***	5.87 (4.48–7.68)***
Yes	17	2703	6.29	10	470	21.30	3.33 (1.52–7.29)**	3.46 (1.53–7.79)**

CI=confidence interval, ESRD=end-stage renal disease, HR=hazard ratio, IRR=incidence rate ratio, PY=person-years, RCC=renal cell carcinoma.

Table 3 Interaction of RCC with Age, CKD, and Diabetes in ESRD

Variables	Crude HRs (95% CI)	Multivariate HRs (95% CI)	Interaction p value
RCC CKD*			
No No	146/23,412	1.00	1.00
Yes No	100/2887	7.47 (5.79–9.64)***	5.94 (4.54–7.76)***
No Yes	14/108	47.6 (27.4–82.7)***	20.9 (11.6–37.8)***
Yes Yes	19/53	112 (69.1–180)***	80.2 (48.7–132)***
p for trend	<0.0001	<0.0001	
RCC Diabetes†			
No No	112/21,709	1.00	1.00
Yes No	82/2364	8.78 (6.60–11.7)***	7.31 (5.42–9.85)***
No Yes	48/1811	7.12 (5.07–10.0)***	4.30 (2.96–6.24)***
Yes Yes	37/576	22.5 (15.5–32.7)***	14.0 (9.33–20.9)***
p for trend	<0.0001	<0.0001	
RCC Age≥65‡			
No No	54/12,904	1.00	1.00
Yes No	48/1613	9.25 (6.26–13.6)***	5.83 (3.90–8.72)***
No Yes	106/10,616	2.52 (1.82–3.50)***	1.93 (1.37–2.70)***
Yes Yes	71/1327	19.0 (13.3–27.1)***	10.1 (6.84–14.8)***
p for trend	<0.0001	<0.0001	0.42

*Multivariate model, adjusted for sex, monthly income, and comorbidities (including diabetes, chronic kidney disease, hypertension, coronary heart disease, heart failure, and hyperlipidemia).

†Multivariate model, adjusted for age, sex, monthly income, and comorbidities (including diabetes, hypertension, coronary heart disease, heart failure, and hyperlipidemia).

CONCLUSIONS

Our data indicates that RCC is an independent risk factor for ESRD, especially in females.