Partial nephrectomy versus radical nephrectomy for T1bN0M0 clear cell renal cell carcinomas: A population-based propensity score-matched analysis

Chengwen Li (lichengwenszx@163.com)
Tianjin Fourth Central Hospital
Chang Liu
Tianjin Fourth Central Hospital
Chunlei Ma
Tianjin Fourth Central Hospital
Ding Tian
Tianjin Fourth Central Hospital

Research Article

Keywords: Clear cell renal cell carcinoma, partial nephrectomy, radical nephrectomy, propensity score matched analysis, Surveillance, Epidemiology, and End Results

Posted Date: June 6th, 2022

DOI: https://doi.org/10.21203/rs.3.rs-1415218/v1

Abstract

Purpose: Clear cell renal cell carcinoma (cc-RCC) comprises 70% of RCC and the majority of cancer-related deaths. The oncological comparison between partial nephrectomy (PN) and radical nephrectomy (RN) is undefined and previous studies have not indicated any significant benefit from PN compared with RN, for T1b renal tumors in terms of overall survival (OS). We retrieved T1bN0M0 cc-RCC patients and performed propensity score matching (PSM) to compare the oncological OS between PN and RN.

Method: All cc-RCC cases were divided into two groups according to different surgical approaches, namely, PN and RN. Log-rank tests were used to assess the differences in OS, and subgroup analysis was performed in terms of age and tumor size. PSM was performed between the PN and RN groups.

*Results:*11,966 T1bN0M0 cc-RCC patients were collected. After PSM, the log-rank test indicated that PN patients had better prognoses than those with RN. Age subgroup analysis indicated that PN was better than RN in all age subgroups. Cox analysis revealed that younger, larger tumor size, Black, and RN were associated with worse survival.

Conclusion: PN had significantly better oncological prognoses than RN for T1bN0M0 cc-RCC patients, and age, race, tumor size, and surgical approach were effective prognostic factors.

Introduction

Each year, more than 400,000 patients worldwide are diagnosed with renal cell carcinoma (RCC), and among them, approximately 70% are clear cell RCCs, representing the majority of cancer-related deaths.[1,2] Because of the ubiquitous use of abdominal imaging in medical practice, discoveries of renal masses have been increasing in recent decades[3]. Hendrik et al. reported the only randomized controlled trial comparing PN with RN for small (≤5 cm), solitary, T1–T2 N0 M0 RCCs, which demonstrated that there was no significant difference between the two types of surgeries[4]. Because of related research progress, PN has become the gold standard for T1aN0M0 renal carcinomas and for T1b RCCs the latest EAU guideline also recommend PN based on its functional advantage, However, the survival comparison between PN and RN for T1b (tumor sizes >40 mm, ≤70 mm) renal carcinomas is still complicated because of previous controversial and contradictory evidence.[5-8]. Although PN can preserve more kidney function because of a decreased risk of chronic kidney dysfunction, related studies have not reported any significant benefit from PN, when compared with RN for T1b (4−7 cm) renal tumors in terms of OS[5-8]. Because the most common and individual pathological renal cell carcinoma is clear cell (cc)-RCC, research could determine whether PN or RN is the best surgical treatment. In this study, we collected clinical information of cc-RCC patients from SEER registry, and PSM analyses to compare the oncological OS between PN and RN for T1bN0M0 cc-RCC.

Results

Clinical characteristics of patients. We retrieved 11,966 T1bN0M0 cc-RCC patients who underwent PN or RN between 2004 and 2018 using SEER*Stat 8.3.9 and the extraction process was showed in Figure 1 according to the inclusion and exclusion criteria. Among them, there were greater percentages of <65-year-old patients, males, Caucasians, and tumors measuring 40 mm<T≤50 mm. Regarding all T1bN0M0 cc-RCC patients, their 3-, 5-, and 10-year survival percentages were 91.09%, 84.15%, and 66.54%, respectively, and their median survival was 175 months. Among them, 2,681(22.41%) and 9,285(77.59%) patients underwent PN and RN, respectively. Compared with the RN group, there was a greater percentage of <65-year-old patients, females, and small size tumor cc-RCC patients in the PN group with a significant difference (all P<0.05). The percentages of different racial groups and lateralities were not significantly different for the PN and RN groups. However, there were more patients treated with lymphadenectomy in the RN group than in the PN group (9.13% vs. 4.36%; Table 1).

Survival analysis . Among all patients, the log-rank test indicated that PN patients showed significantly better prognoses than those in the RN group (P<0.0001), with a median survival of 171 months for RN patients and > 179 months for PN patients.

After PSM analyses, there were 2681 patients in the PN group and 2,681 in the RN group. After removing the inherent bias of retrospective studies by PSM, survival analysis still showed that the PN group had better prognoses than the RN group (P = 0.0064) (Figure 2).

To further determine the reasons for survival differences, we performed subgroup analyses according to tumor size and age. In terms of tumor size, there were 5768, 3888, and 2310 patients in the 40 mm<T≤50 mm, 50 mm<T≤60 mm, and 60 mm<T≤70 mm groups, respectively. In the 40 mm<T≤50 mm group, there were 1665 and 4103 patients who underwent PN and RN, respectively, and the log-rank tests revealed that PN patients had significantly better prognoses than RN patients (P < 0.0001). However, in the 50 mm<T≤60 mm, and 60 mm<T≤70 mm groups, there was no significant statistical difference between the PN and RN groups. After PSM analysis, 5362 patients remained and there were 3330, 1497, and 535 patients in the 40 mm<T≤50 mm, 50 mm<T≤60 mm, and 60 mm<T≤70 mm groups, respectively. Their clinical information is shown in S Table 2.The log-rank test indicated that in the 40 mm<T≤50 mm group, PN patients had a longer OS (P = 0.0092), but showed comparable results in the 50 mm<T≤60 mm, and 60 mm<T≤70 mm groups (Figure 3).

A subgroup analysis according to age was performed to compare the outcomes of PN and RN at different ages. The patients were divided into <65-year-old group and ≥65-year-old group. The patient characteristics are listed in S Table 3. The log-rank test indicated that in cc-RCC patients <65 years of age, the PN group had a better OS than the RN group (P = 0.0025) and in the patients ≥65 years group patients who underwent PN had a better OS than those who underwent RN (P= 0.0068). After PSM analysis, 3324 patients remained in the < 65 years of age group, while 2038 patients remained in the ≥ 65-year-old group (S Table 4). The log-rank test confirmed that in the two patient age subgroups, PN patients had a longer OS with a significant difference. (Figure 4)

Cox regression analysis. Univariate Cox regression analysis showed that younger age, female sex, other racial groups (including Indian/AK Native, Asian/Pacific Islanders), smaller tumor size, and PN were associated better prognoses, while tumor laterality and lymphadenectomy were not associated with the OS. The factors of age, sex, race, tumor size, and surgery were included into a multivariate Cox proportional hazards model. The results indicated that ≥ 65 years of age , 60 mm<T≤ 70 mm, and RN were associated with a worse survival, and other races (including Indian/AK Native, Asian/Pacific Islanders) had better prognoses (Table 2).

Discussion

Because of the increasing use of and advances in abdominal crossing imaging, a greater number of RCCs are being discovered at early stages. At present, RCC is one of the top 10 most commonly diagnosed cancers and affects more than 400,000 persons worldwide each year[1,10-12]. Cc-RCC comprises 75% of all RCC cases and the majority of cancer-related deaths[2].

As a nephron sparing surgery, PN is the first recommended clinical treatment for T1a and for T1b renal carcinomas. However, there is still controversy regarding the choice between PN and RN treatments in term of oncological survival.[13]. Previous studies reported that PN significantly preserved kidney function as much as possible, avoided chronic kidney dysfunction and cardiovascular events, and improved the quality of life of RCC patients who underwent kidney surgery. In a prospective study, Scosyre et al. reported that when compared with the PN cohort, there was a 21.0% (95 % CI: 13.8–28.3; P = 0.001) increase in the incidence of newly onset moderate renal dysfunction in the RN group[5]. The greater postoperative risks of RN have had negative effects on the choice of surgical treatments for RCC patients. However, the exact oncological prognostic implication of PN for T1b RCC is still undefined, when compared with RN. A survey of the Society of Urologic Oncology members indicated that the majority (56%) of respondents stated that PN provided equal oncological outcomes as RN, while 38% selected the response “based on the available studies, we cannot conclude whether a PN or RN is a better treatment with regards to cancer outcomes” for 4–10 cm renal masses, which suggested that many urology professionals could not clearly make a choice of surgical approaches for T1b and T2 RCCs[14].The only prospective randomized trial reported that PN and RN had no significant difference in terms of OS for <5 cm RCCs[4]. Directed toward the unique pathological and majority of renal carcinomas, 11,966 cc-RCC patients were retrieved from 2004–2018 in this study. We found that patients with PN had better prognoses than those who underwent RN with a significant difference. Previous studies also reported similar results concerning comparisons between PN and RN for RCC patients; however, these results differed because of differences of some key clinical patient characteristics, such as tumor size, age, and histology[6,7,15-29]. In 2010, Crepel et al. retrieved 5141 T1bN0M0 RCC patients—275 PN patients (5.3%) and 4866 RN patients (94.7%) from the SEER database, to compare the OS between two surgical approaches. They found that the two groups had no statistical difference for both before and after the matching groups, respectively[24]. However, Crepel et al. reported a relatively shorter follow-up time, and the early cc-RCCs had longer postoperative survival times resulting from its molecular characteristics[24]. Our study showed that the 3-year survival percentages of the PN and RN groups were 92.50% and 92.04%, respectively, the 5-year survival percentages of the PN and RN groups were 86.30% and 84.81%, respectively, and the 10-year survival percentages of the PN and RN groups were 73.06% and 67.06%, respectively. Based on these results, with extensions of follow-up times, the survival differences between the two groups became more obvious. Our study thus highlights the need for long-term follow-up to determine the oncological outcomes of early cc-RCC.

In further tumor size subgroup analyses, our study found that 5 cm was a cut off, with 4 cm<T≤5 cm cc-RCC patients obtaining a better OS from PN than RN, while 5 cm<T≤7 cm patients had no survival difference between the two surgical approaches. With regard to 4 cm<T≤5 cm cc-RCC patients, PN had both kidney function and oncological survival benefits, showing that PN was more preferable than RN for 4 cm<T≤5 cm cc-RCC patients. However, for 5 cm<T≤7 cm cc-RCC patients, PN was still an optional treatment resulting from its functional results, although the two surgical approaches had no statistical difference. In 2016, Professor Takagi used age subgroup analyses and found that older group patients could benefit more from PN[30]. However, we found that both younger and older patients could benefit from PN. We believe that this difference is due to the shorter follow-up time in Takagi's study. The survival difference of PN and RN was not obvious in the early postoperative periods, and became clearer during extensions of the follow-up times.

Our study also had some limitations. First, inherent bias was inevitable in this retrospective study. Second, the clinical characteristics of the SEER database were incomplete, such as resection type (R0, R1, or R2), kidney function, and operative pathway, which are also important factors in survival analyses.

Conclusion

Our study showed that PN had a significantly better oncological prognosis than RN for T1bN0M0 cc-RCC patients, while age, race, tumor size, and surgical approach were effective prognostic factors. Further randomized controlled studies should be performed to confirm these findings and to determine the optimal surgical approach for T1bN0M0 cc-RCC patients.

Methods

Patient data were collected from SEER*stat 8.3.9. All T1bN0M0 cc-RCC cases were retrieved. The inclusion criteria included the following: 1) the tumor site was the kidney; 2) the pathological result was cc-RCC; 3) the tumor size was 4-7 cm; 4) the N and M stages were N0 and M0, respectively; and 5) patients were treated with PN or RN therapy. The exclusion criteria were the following: 1) the pathological results were confirmed at autopsy or death; and 2) the patients were diagnosed with other primary cancers. Univariate and multivariate analyses were performed with Cox regression analysis using SPSS version 24.0, and variables were excluded sequentially if $P > 0.05$. All patients were divided into two groups according to the PN and RN surgical approaches. The distribution of variables across comparison groups was analyzed using the chi-square or Fisher's exact tests for categorical variables, and the t-test for continuous variables. The Kaplan–Meier method and log-rank tests were used to evaluate the differences in OS using Prism version 7.00. To reduce the inherent bias of retrospective studies, a PSM was performed at a 1:1 fixed ratio nearest-neighbor matching between the PN and RN groups using the "MatchIt" package in R version 3.6.2[9]. To further determine the effects of surgical approaches on the survival of patients with different characteristics, subgroup analyses according to tumor size and age were conducted for all cc-RCC patients. All tests were two sided, and the significance value of P was 0.05.

Declarations

Ethics statement of human data: We have submitted a request for the SEER data and complied with the sample data use agreement. The data released by the SEER database are publicly available and do not require informed patient consent. All methods were performed in accordance with relevant guidelines and regulations.

Author contributions

CW.L and C.L retrieved and analyzed all of the data in the study. CW.L, C.l, CL.M, and D.T revised the manuscript for important intellectual contents. CW.L and C.L designed, checked and supervise the all study process. All authors contributed to the article and approved the submitted version.

Author contributions

CWL and CL retrieved and analyzed all of the data in the study. CWL, Cl, CLM, and DT revised the manuscript for important intellectual contents. CWL and CL designed, checked and supervise the all study process. All authors contributed to the article and approved the submitted version.

Data availability statement: The population-based research was retrospectively operated with data from the SEER database, which incorporates national information on tumor samples from 18 large-scale cancer registries and is open to public for cancer studies (https://seer.cancer.gov/).

Funding: None

Conflict of interests: The author(s) declare no competing interests.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

References

1. Bray, F., Ferlay, J., Soerjomataram, I., Siegel, R.L., Torre, L.A., and Jemal, A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA: a cancer journal for clinicians 68, 394-424 (2018).
2. Hsieh, J.J., Purdue, M.P., Signoretti, S., Swanton, C., Albiges, L., Schmidinger, M., Heng, D.Y., Larkin, J., and Ficarra, V. Renal cell carcinoma. Nature reviews. Disease primers 3, 17009 (2017).
3. Caputo, P.A., Zargar, H., Ramirez, D., Andrade, H.S., Akca, O., Gao, T., and Kaouk, J.H. Cryoablation versus Partial Nephrectomy for Clinical T1b Renal Tumors: A Matched Group Comparative Analysis. European urology 71, 111-117 (2017).
4. Van Poppel, H., Da Pozzo, L., Albrecht, W., Matveev, V., Bono, A., Borkowski, A., Colombel, M., Klotz, L., Skinner, E., Keane, T., Marreaud, S., Collette, S., and Sylvester, R. A prospective, randomised EORTC intergroup phase 3 study comparing the oncologic outcome of elective nephron-sparing surgery and radical nephrectomy for low-stage renal cell carcinoma. European urology 59, 543-552 (2011).
5. Scosyrev, E., Messing, E.M., Sylvester, R., Campbell, S., and Van Poppel, H. Renal function after nephron-sparing surgery versus radical nephrectomy: results from EORTC randomized trial 30904. European urology 65, 372-377 (2014).

6. Antonelli, A., Ficarra, V., Bertini, R., Carini, M., Carmignani, G., Corti, S., Longo, N., Martorana, G., Minervini, A., Mirone, V., Novara, G., Serni, S., Simeone, C., Simonato, A., Siracusano, S., Volpe, A., Zattoni, F., and Cunico, S.C. Elective partial nephrectomy is equivalent to radical nephrectomy in patients with clinical T1 renal cell carcinoma: results of a retrospective, comparative, multi-institutional study. BJU international 109, 1013-1018 (2012).
7. Antonelli, A., Cozzoli, A., Nicolai, M., Zani, D., Zanotelli, T., Perucchini, L., Cunico, S.C., and Simeone, C. Nephron-sparing surgery versus radical nephrectomy in the treatment of intracapsular renal cell carcinoma up to 7cm. European urology 53, 803-809 (2008).
8. Levey, A.S., Bosch, J.P., Lewis, J.B., Greene, T., Rogers, N., and Roth, D. A more accurate method to estimate glomerular filtration rate from serum creatinine: a new prediction equation. Modification of Diet in Renal Disease Study Group. Annals of internal medicine 130, 461-470 (1999).
9. Austin, P.C. Balance diagnostics for comparing the distribution of baseline covariates between treatment groups in propensity-score matched samples. Statistics in medicine 28, 3083-3107 (2009).
10. Siegel, R.L., Miller, K.D., and Jemal, A. Cancer statistics, 2018. CA: a cancer journal for clinicians 68, 7-30 (2018).
11. Smaldone, M.C., Egleston, B., Hollingsworth, J.M., Hollenbeck, B.K., Miller, D.C., Morgan, T.M., Kim, S.P., Malhotra, A., Handorf, E., Wong, Y.N., Uzzo, R.G., and Kutikov, A. Understanding Treatment Disconnect and Mortality Trends in Renal Cell Carcinoma Using Tumor Registry Data. Medical care 55, 398-404 (2017).
12. Cho, E., Adami, H.O., and Lindblad, P. Epidemiology of renal cell cancer. Hematology/oncology clinics of North America 25, 651-665 (2011).
13. Ljungberg, B., Bensalah, K., Canfield, S., Dabestani, S., Hofmann, F., Hora, M., Kuczyk, M.A., Lam, T., Marconi, L., Merseburger, A.S., Mulders, P., Powles, T., Staehler, M., Volpe, A., and Bex, A. EAU guidelines on renal cell carcinoma: 2014 update. European urology 67, 913-924 (2015).
14. Best, S.L., Blute, M., Jr., Lane, B., and Abel, E.J. Surgical Treatment of 4-10 cm Renal-Cell Carcinoma: A Survey of the Lions and Gazelles. Journal of endourology 31, S43-s47 (2017).
15. Jang, H.A., Kim, J.W., Byun, S.S., Hong, S.H., Kim, Y.J., Park, Y.H., Yang, K.S., Cho, S., Cheon, J., and Kang, S.H. Oncologic and Functional Outcomes after Partial Nephrectomy Versus Radical Nephrectomy in T1b Renal Cell Carcinoma: A Multicenter, Matched Case-Control Study in Korean Patients. Cancer research and treatment 48, 612-620 (2016).
16. Pignot, G., Bigot, P., Bernhard, J.C., Bouliere, F., Bessede, T., Bensalah, K., Salomon, L., Mottet, N., Bellec, L., Soulié, M., Ferrière, J.M., Pfister, C., Drai, J., Colombel, M., Villers, A., Rigaud, J., Bouchot, O., Montorsi, F., Bertini, R., Belldegrun, A.S., Pantuck, A.J., and Patard, J.J. Nephron-sparing surgery is superior to radical nephrectomy in preserving renal function benefit even when expanding indications beyond the traditional 4-cm cutoff. Urologic oncology 32, 1024-1030 (2014).
17. Milonas, D., Skulčius, G., Baltrimavičius, R., Auškalnis, S., Kinčius, M., Matjošaitis, A., Gudinavičienė, I., Smailytė, G., and Jievaltas, M. Comparison of long-term results after nephron-sparing surgery and radical nephrectomy in treating 4- to 7-cm renal cell carcinoma. Medicina (Kaunas, Lithuania) 49, 223-228 (2013).
18. Iizuka, J., Kondo, T., Hashimoto, Y., Kobayashi, H., Ikezawa, E., Takagi, T., Omae, K., and Tanabe, K. Similar functional outcomes after partial nephrectomy for clinical T1b and T1a renal cell carcinoma. International journal of urology : official journal of the Japanese Urological Association 19, 980-986 (2012).
19. Brewer, K., O'Malley, R.L., Hayn, M., Safwat, M.W., Kim, H., Underwood, W., 3rd, and Schwaab, T. Perioperative and renal function outcomes of minimally invasive partial nephrectomy for T1b and T2a kidney tumors. Journal of endourology 26, 244-248(2012).
20. Weight, C.J., Larson, B.T., Gao, T., Campbell, S.C., Lane, B.R., Kaouk, J.H., Gill, I.S., Klein, E.A., and Fergany, A.F. Elective partial nephrectomy in patients with clinical T1b renal tumors is associated with improved overall survival. Urology 76, 631-637 (2010).
21. Weight, C.J., Larson, B.T., Fergany, A.F., Gao, T., Lane, B.R., Campbell, S.C., Kaouk, J.H., Klein, E.A., and Novick, A.C. Nephrectomy induced chronic renal insufficiency is associated with increased risk of cardiovascular death and death from any cause in patients with localized cT1b renal masses. The Journal of urology 183, 1317-1323 (2010).

22. Kim, J.M., Song, P.H., Kim, H.T., and Park, T.C. Comparison of Partial and Radical Nephrectomy for pT1b Renal Cell Carcinoma. Korean journal of urology 51, 596-600 (2010).
23. Deklaj, T., Lifshitz, D.A., Shikanov, S.A., Katz, M.H., Zorn, K.C., and Shalhav, A.L. Laparoscopic radical versus laparoscopic partial nephrectomy for clinical T1bN0M0 renal tumors: comparison of perioperative, pathological, and functional outcomes. Journal of endourology 24, 1603-1607 (2010).
24. Crépel, M., Jeldres, C., Sun, M., Lughezzani, G., Isbarn, H., Alasker, A., Capitanio, U., Shariat, S.F., Arjane, P., Widmer, H., Graefen, M., Montorsi, F., Perrotte, P., and Karakiewicz, P.I. A population-based comparison of cancer-control rates between radical and partial nephrectomy for T1A renal cell carcinoma. Urology 76, 883-888 (2010).
25. Breau, R.H., Crispen, P.L., Jimenez, R.E., Lohse, C.M., Blute, M.L., and Leibovich, B.C. Outcome of stage T2 or greater renal cell cancer treated with partial nephrectomy. The Journal of urology 183, 903-908 (2010).
26. Thompson, R.H., Siddiqui, S., Lohse, C.M., Leibovich, B.C., Russo, P., and Blute, M.L. Partial versus radical nephrectomy for 4 to 7 cm renal cortical tumors. The Journal of urology 182, 2601-2606 (2009).
27. Simmons, M.N., Weight, C.J., and Gill, I.S. Laparoscopic radical versus partial nephrectomy for tumors >4 cm: intermediate-term oncologic and functional outcomes. Urology 73, 1077-1082 (2009).
28. Margulis, V., Tamboli, P., Jacobsohn, K.M., Swanson, D.A., and Wood, C.G. Oncological efficacy and safety of nephron-sparing surgery for selected patients with locally advanced renal cell carcinoma. BJU international 100, 1235-1239 (2007).
29. Mitchell, R.E., Gilbert, S.M., Murphy, A.M., Olsson, C.A., Benson, M.C., and McKiernan, J.M. Partial nephrectomy and radical nephrectomy offer similar cancer outcomes in renal cortical tumors 4 cm or larger. Urology 67, 260-264 (2006).
30. Takagi, T., Kondo, T., Iizuka, J., Omae, K., Kobayashi, H., Yoshida, K., Hashimoto, Y., and Tanabe, K. Comparison of survival rates in stage 1 renal cell carcinoma between partial nephrectomy and radical nephrectomy patients according to age distribution: a propensity score matching study. BJU international 117, E52-59 (2016).

Tables

Table 1. Clinicopathological characteristics of cc-RCC before and after PSM.

	Estimate	cc-RCC before PSM			cc-RCC after PSM		
		PN(N=2681)	RN(N=9285)	P	PN(N=2681)	RN(N=2681)	P
Age				<0.001			1
<65y	7016(58.63)	1662(61.99)	5354(57.66)		1662(61.99)	1662(61.99)	
≥65y	4950(41.37)	1019(38.01)	3931(42.34)		1019(38.01)	1019(38.01)	
Gender							
Female	4739(39.60)	988(36.85)	3751(40.40)	0.001	988(36.85)	961(35.84)	0.443
Male	7227(60.40)	1693(63.15)	5534(59.60)		1693(63.15)	1720(64.16)	
Race				0.288			0.742
White	10048(83.97)	2219(82.77)	7829(84.32)		2219(82.77)	2245(83.74)	
Black	979(8.18)	235(8.77)	744(8.01)		235(8.77)	216(8.06)	
Other†	859(7.18)	207(7.72)	652(7.02)		207(7.72)	198(7.39)	
Unknown	80(0.67)	20(0.75)	60(0.65)		20(0.75)	22(0.82)	
Laterality				0.394			0.843
Left	5951(49.73)	1315(49.05)	4636(49.93)		1315(49.05)	1304(48.64)	
Right	6015(50.57)	1366(50.95)	4639(50.07)		1366(50.95)	1377(51.36)	
Size				<0.001			0.397
40mm, ≤50mm	5768(48.20)	1665(62.10)	4103(44.19)		1665(62.10)	1665(62.10)	
50mm, ≤60mm	3888(32.49)	735(27.42)	3153(33.96)		735(27.42)	762(28.42)	
60mm, ≤70mm	2310(19.30)	281(10.48)	2029(21.85)		281(10.48)	254(9.47)	
Lymphadenectomy				<0.001			0.087
Yes	965(8.06)	117(4.36)	848(9.13)		117(4.36)	144(5.37)	
No	11001(91.94)	2564(95.64)	8437(90.87)		2564(95.64)	2537(94.63)	
Survival Rate				<0.0001			0.0064
3 years(%)	91.09	92.50	90.74		92.50	92.04	
5 years(%)	84.15	86.30	83.62		86.30	84.81	
10 years(%)	66.54	73.60	65.25		73.06	67.06	
Median survival(m)	175	NR	171		NR	NR	

†: Including Indian/AK Native, Asian/Pacific Islander.

Table 2 Univariate and multivariate Cox regression analysis of factors affecting overall survival.

		Univariate				Multivariate			
		HR	LL	UL	P	HR	LL	UL	P
Age	<65y	ref				ref			
	≥65y	2.986	2.769	3.22	<0.001	2.981	2.764	3.216	<0.001
Gender	Female	ref							
	Male	1.128	1.047	1.216	0.002				
Race	Black	ref				ref			
	White	0.964	0.846	1.1	0.589	0.904	0.792	1.031	0.131
	Other†	0.822	0.678	0.996	0.045	0.798	0.659	0.967	0.021
	Unknown	0	0	6.5E+25	0.777	0	0	5E+26	0.785
Laterality	Left	ref							
	Right	1.018	0.947	1.094	0.631				
Size	40mm, ≤50mm	ref				ref			
	50mm, ≤60mm	1.073	0.988	1.166	0.095	1.081	0.995	1.175	0.065
	60mm, ≤70mm	1.221	1.111	1.341	<0.001	1.267	1.152	1.394	<0.001
Surgery	PN	Ref							
	RN	1.271	1.148	1.407	<0.001	1.186	1.071	1.315	0.001
Lymphadenectomy	Yes	ref							
	No	1.047	0.917	1.196	0.494				

†: Including Indian/AK Native, Asian/Pacific Islander.

Figures

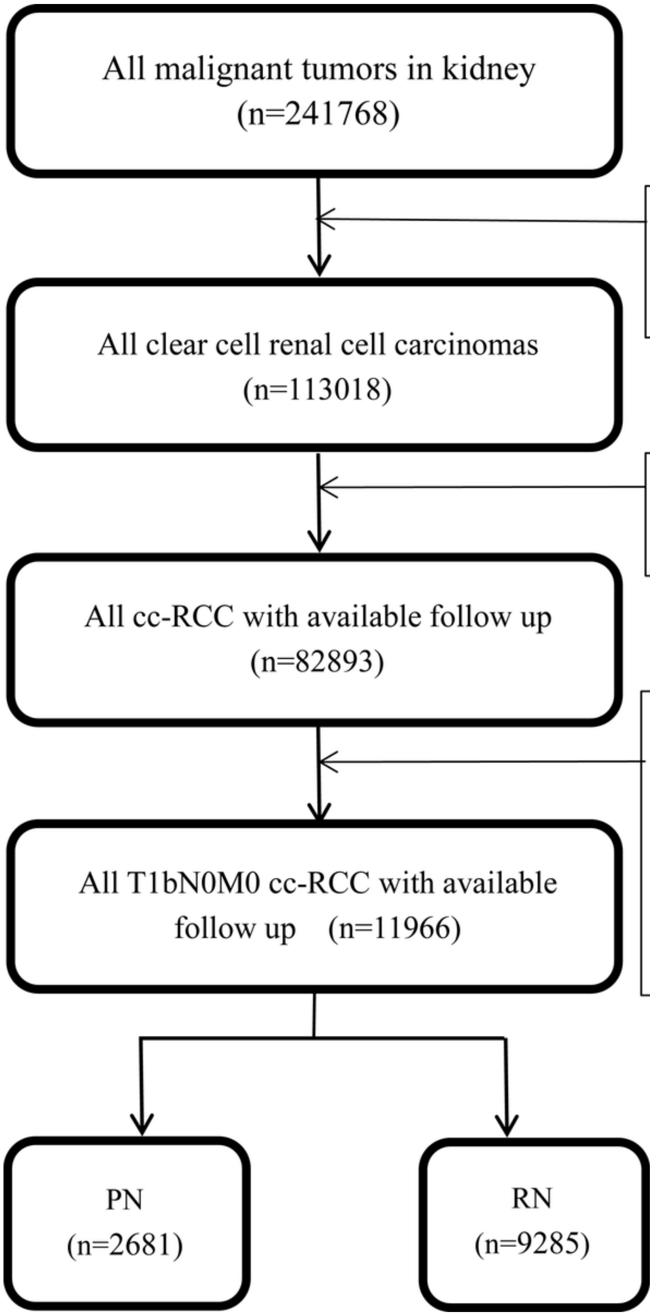

Figure 1

Flowchart for patients extraction from the SEER database according to the inclusion and exclusion criteria;

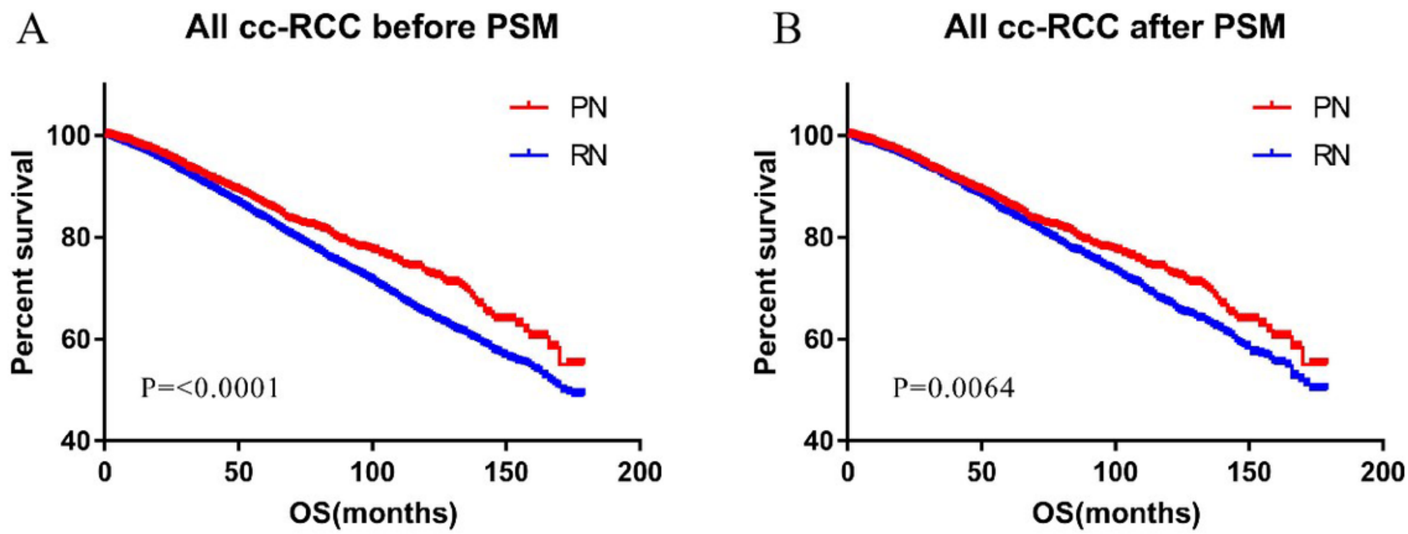

Figure 2

Kaplan-Meier survival curve of cc-RCC. A: PN *vs.* RN in all cc-RCC before PSM; B: PN *vs.* RN in all cc-RCC after PSM.

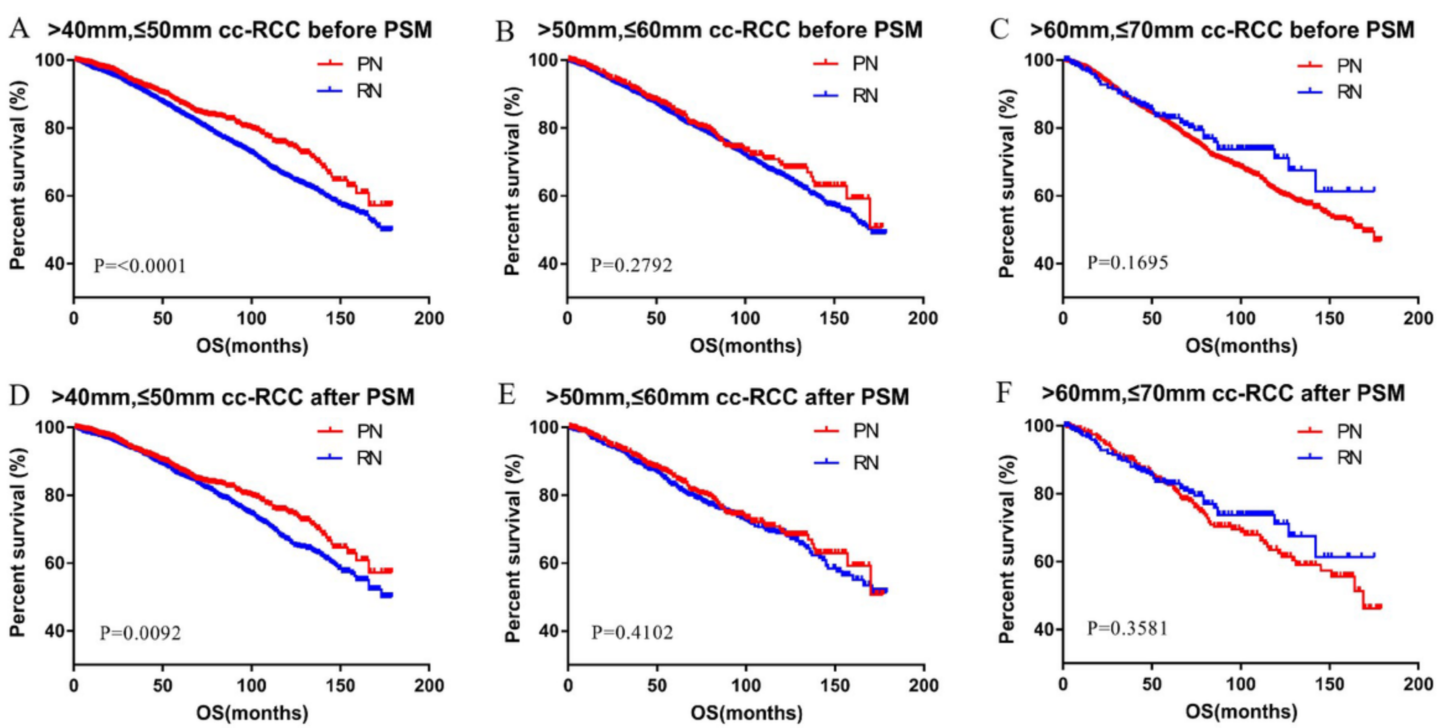

Figure 3

Kaplan-Meier survival curve of PN vs. RN in cc-RCC stratified by tumor size. A: PN vs. RN in 40mm < T ≤50mm cc-RCC group before PSM; B: PN vs. RN in 50mm < T ≤60mm cc-RCC group before PSM; C: PN vs. RN in 60mm < T ≤70mm cc-RCC group before PSM; D: PN vs. RN in 40mm < T ≤50mm cc-RCC group after PSM; B: PN vs. RN in 50mm < T ≤60mm cc-RCC group after PSM; C: PN vs. RN in 60mm < T ≤70mm cc-RCC group after PSM;

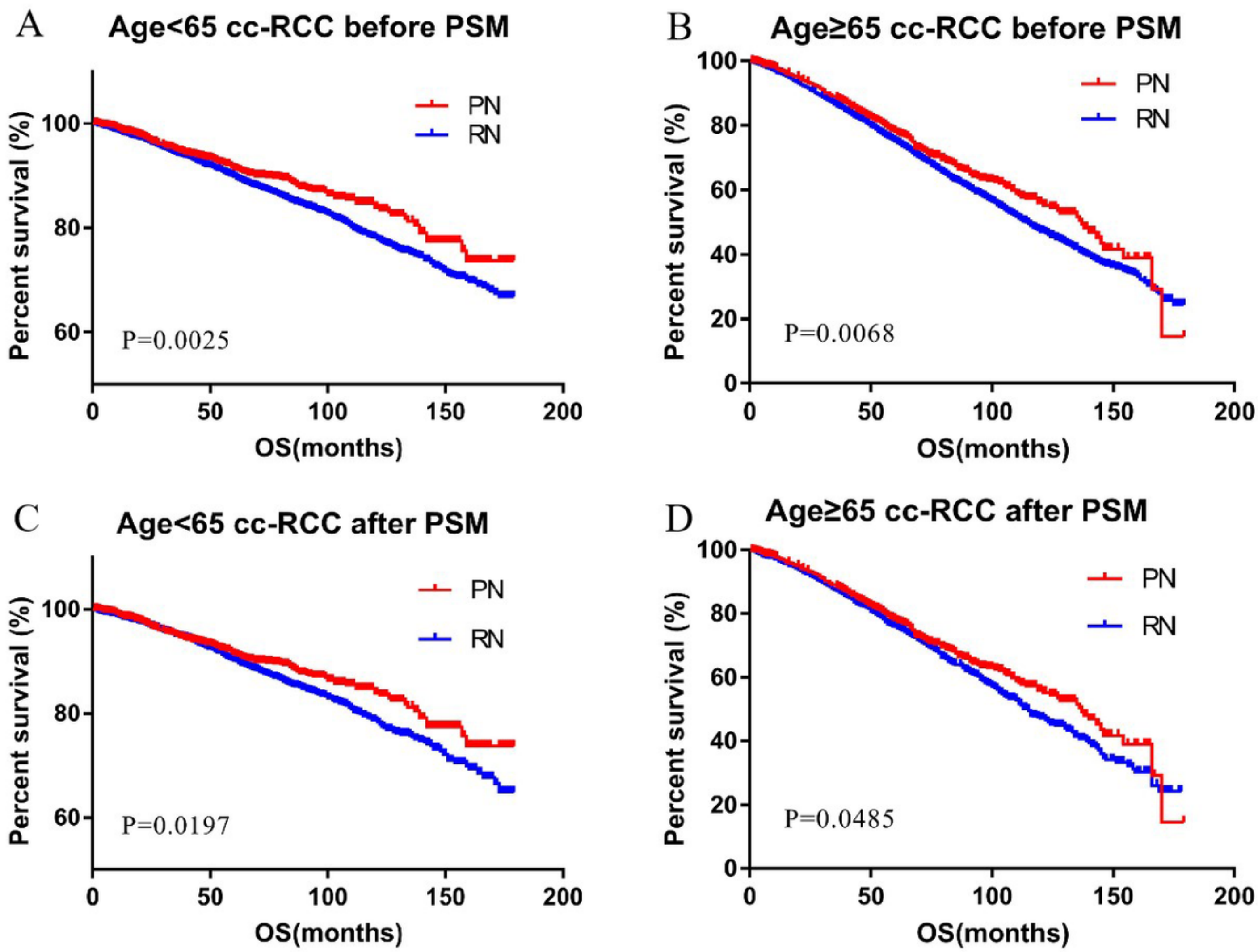

Figure 4

Kaplan-Meier survival curve of PN vs. RN in cc-RCC stratified by age. A: PN vs. RN in age <65y cc-RCC group before PSM; B: PN vs. RN in age ≥65y cc-RCC group before PSM; C: PN vs. RN in age <65y cc-RCC group after PSM; D: PN vs. RN in age ≥65y cc-RCC group after PSM;

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- STable1.docx
- STable2.docx
- STable3.docx
- STable4.docx