The impact of surgical strategy in robot-assisted partial nephrectomy: is it beneficial to treat anterior tumours with transperitoneal access and posterior tumours with retroperitoneal access?

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Brief Correspondence

The Impact of Surgical Strategy in Robot-assisted Partial Nephrectomy: Is It Beneficial to Treat Anterior Tumours with Transperitoneal Access and Posterior Tumours with Retroperitoneal Access?

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Article info

Abstract

Available comparison of transperitoneal robot-assisted partial nephrectomy (tRAPN) and retroperitoneal robot-assisted partial nephrectomy (rRAPN) does not consider tumour's location. The aim of this study was to compare perioperative morbidity, and functional and pathological outcomes after tRAPN and rRAPN, with the specific hypothesis that tRAPN for anterior tumours and rRAPN for posterior tumours might be a beneficial strategy. A large global collaborative dataset of 1169 cT1-2N0M0 patients was used. Propensity score matching, and logistic and linear regression analyses tested the effect of tRAPN versus rRAPN on perioperative outcomes. No differences were observed between rRAPN and tRAPN with respect to complications, operative time, length of stay, ischaemia time, median 1-yr estimated glomerular filtration rate (eGFR), and positive surgical margins (all $p > 0.05$). Median estimated blood loss and postoperative eGFR were 50 versus100 ml ($p < 0.0001$) and 82 versus 78 ml/min/1.73 m^2 ($p = 0.04$) after rRAPN and tRAPN, respectively. At interaction tests, no advantage was observed after tRAPN for anterior tumours and rRAPN for posterior tumours with respect to complications, warm ischaemia time, postoperative eGFR, and positive surgical margins (all $p > 0.05$). The techniques of rRAPN and tRAPN offer equivalent perioperative morbidity, and functional and pathological outcomes, regardless of tumour's location.

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Patient summary: Robot-assisted partial nephrectomy can be performed with a transperitoneal or a retroperitoneal approach regardless of the specific position of the tumour, with equivalent outcomes for the patient.
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For robot-assisted surgical exploration of the kidney and tumour excision, either a transperitoneal or a retroperitoneal approach can be used. However, current urological guidelines [1,2] do not provide recommendations regarding specific surgical approach for partial nephrectomy candidates. Indeed, available evidence comparing transperitoneal robot-assisted partial nephrectomy (tRAPN) versus retroperitoneal robot-assisted partial nephrectomy (rRAPN) is discordant and based on studies that relied on a small sample size [3,4]. Moreover, the clinical dilemma whether patients with an anterior tumour should preferably receive tRAPN and, conversely, patients with a posterior tumour should preferably receive rRAPN has never been investigated.

To address this void, the current study relied on a very large global multi-institutional database of tRAPN and rRAPN, to perform a comprehensive comparison of perioperative morbidity, and functional and pathological outcomes between the two approaches, with specific focus on tumour's location. Specifically, our hypothesis postulated better outcomes in case of tRAPN for anterior tumours and rRAPN for posterior tumours.

A prospectively maintained multi-institutional database of 1169 patients with a cT1-T2 cN0 cM0 first episode of single renal mass treated with tRAPN or rRAPN between 2006 and 2017 was assessed. The outcomes of the study were perioperative morbidity (postoperative complications ≥ 2 according to the Clavien-Dindo [CD $\geq$ 2] classification [5], estimated blood loss [EBL], operative time [OT], and length of stay [LOS]), functional outcomes (warm ischaemia time [IT], and postoperative and 12-mo estimated glomer-

ular filtration rate [eGFR] measured at the last determination before discharge and 1 yr after surgery, respectively), and positive surgical margins (PSMs).

Mann-Whitney and chi-square tests were used to compare the differences in the distribution of continuous or categorical variables between cases treated with tRAPN and rRAPN. In order to account for any potential baseline differences among the two groups, adjustment was performed using 1:1 nearest-neighbour propensity score matching [6]. Propensity scores were computed using a logistic regression model to account for all measurable potential confounders [7,8]. The effect of surgical approach on the study outcomes was estimated using linear or logistic regression for continuous or categorical outcome variables, respectively. An interaction term between surgical approach and location of the tumour was fitted in the multivariable regression model to test the hypothesis of better outcomes in case of tRAPN for anterior tumours and rRAPN for posterior tumours, and model-derived coefficients were used to graphically represent the risk profile of each perioperative outcome relying on an established methodology [7,8]. All statistical tests were performed using R software v.3.0.2, and all tests were two sided with a significance level set at $p < 0.05$.

Overall, 1169 patients were included in the study. After propensity score matching, 384 tRAPN and 384 rRAPN patients remained and no differences were recorded between the two groups with respect to all covariates assessed (Supplementary Table 1). In the post-propensity score matching cohort (Table 1), there were no differences between rRAPN and tRAPN with respect to CD $\geq$ 2, OT, and

Table 1 – Clinical outcomes of 768 patients treated with tRAPN (*n* = 384) or rRAPN (*n* = 384) for a cT1-cT2 renal mass after propensity score matching for clinical characteristics in a global, multi-institutional dataset (2006–2017).

Morbidity and complications	tRAPN (*n* = 384)	rRAPN (*n* = 384)	rRAPN vs tRAPN OR-estimate (95% CI)	*p* value
Complication Clavien-Dindo $\geq$2	22 (5.7)	33 (8.6)	1.55 (0.88–2.7)	0.1
Estimated blood loss (ml)	100	50	−92 (−115; −69)	<0.0001
Operative time (min)	120	124	9 (−2; 19)	0.1
Length of stay (d)	7	8	−0.4 (−1.2; 0.3)	0.3
Functional outcomes	**tRAPN (*n* = 384)**	**rRAPN (*n* = 384)**	**rRAPN vs tRAPN Estimate (95% CI)**	***p* value**
Ischaemia time (min)	19	20	0.8 (−0.7; 2.35)	0.3
Postoperative eGFR	81.59	78.36	−4 (−8; −0.2)	0.04
1-yr eGFR	88.57	86.91	1 (−5; 7)	0.8
Pathological outcomes	**tRAPN (*n* = 384)**	**rRAPN (*n* = 384)**	**rRAPN vs tRAPN OR (95% CI)**	***p* value**
Positive surgical margins	14 (3.6)	7 (1.8)	0.49 (0.19–1.22)	0.1

CI = confidence interval; eGFR = estimated glomerular filtration rate; rRAPN = retroperitoneal robot-assisted partial nephrectomy; OR = odds ratio; tRAPN = transperitoneal robot-assisted partial nephrectomy.
Data are presented as frequencies, percentages, and odds ratio for categorical variables, and as median and estimate for continuous variables.
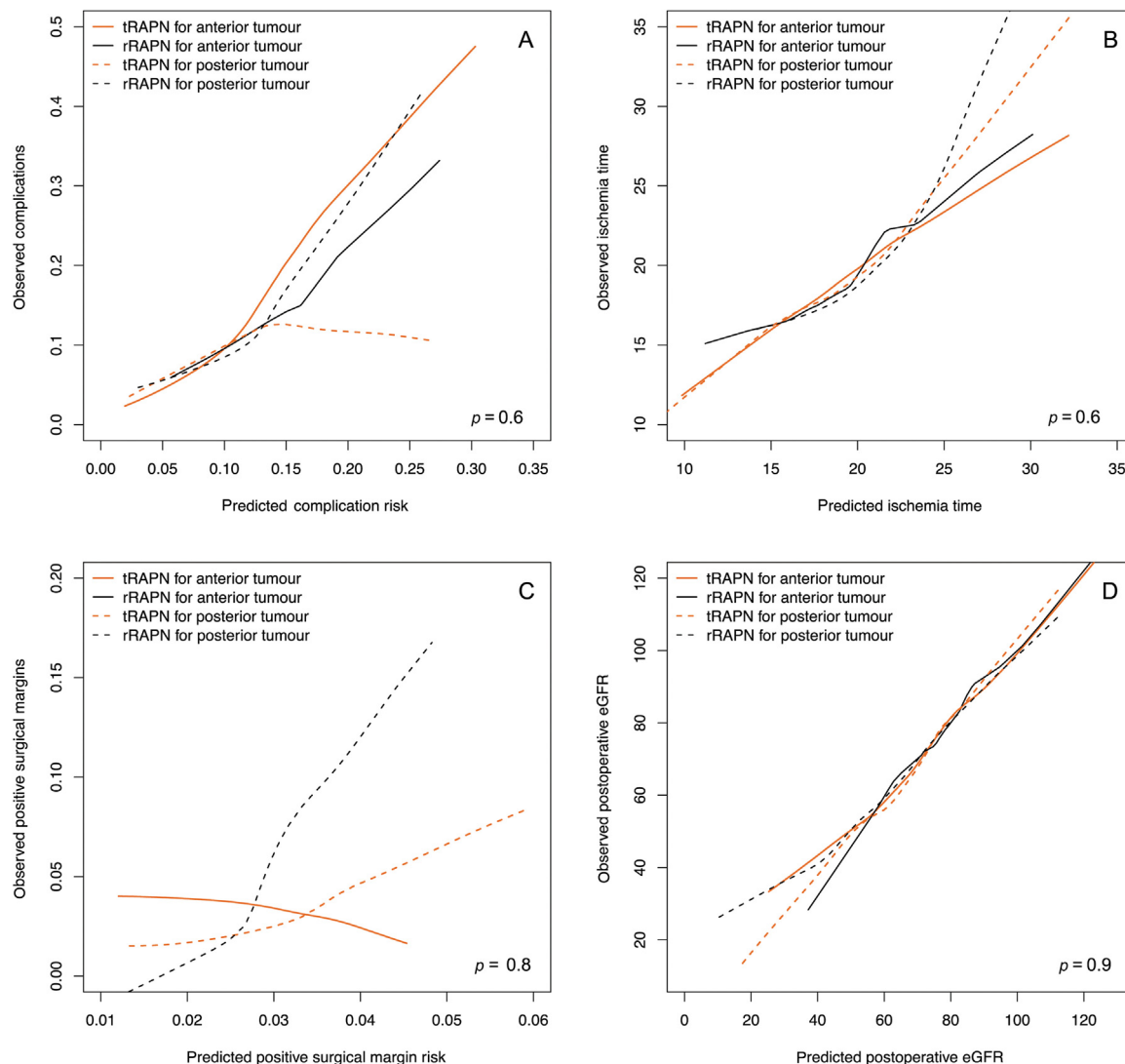
Fig. 1 – Impact of surgical strategy according to the specific tumour position on (A) postoperative complications, (B) ischaemia time, (C) positive surgical margins, and (D) postoperative estimated glomerular filtration rate in 854 patients treated with robot-assisted partial nephrectomy. Red lines represent transperitoneal access and black lines represent retroperitoneal access. Solid lines represent anterior tumours and dotted lines represent posterior tumours. All *p* values are computed using an interaction term between surgical strategy and tumour position. eGFR = estimated glomerular filtration rate; rRAPN = retroperitoneal robot-assisted partial nephrectomy; tRAPN = transperitoneal robot-assisted partial nephrectomy.

LOS (all $p > 0.05$). Conversely, a statistically significant difference in terms of EBL was observed in favour of rRAPN (median 50 vs 100 ml; estimate-92; $p < 0.0001$). Although no differences were observed between rRAPN and tRAPN with respect to IT ($p = 0.3$), a statistically significant difference in terms of postoperative eGFR was observed in favour of rRAPN (median 82 vs 78 ml/min/1.73 m^2; estimate-4; $p = 0.04$). However, 1 yr after surgery, no difference was recorded between tRAPN and rRAPN ($p = 0.8$). Finally, no difference was recorded with respect to PSMs ($p = 0.1$). At interaction tests, no advantage was recorded in case of tRAPN for anterior tumours or rRAPN for posterior tumours in terms of postoperative complications, IT, PSMs, and postoperative eGFR (all $p > 0.05$; Fig. 1).

Taken together, these findings demonstrate that both trans- and retroperitoneal approach are equally safe and effective for RAPN candidates, and that perioperative morbidity, and functional and pathological outcomes are virtually the same after either treatment modality. Of note, EBL and postoperative eGFR were statistically better after rRAPN; however, the clinical relevance of 92 ml and 4 ml/min/1.73 m^2 of differences is negligible. More importantly, the findings of the current study reject the hypothesis of superior outcomes when a specific surgical approach is chosen based on tumour's location.

Two recent meta-analyses [3,4] compared rRAPN and tRAPN, and observed that EBL, OT, and LOS were significantly lower after rRAPN relative to those after tRAPN. Conversely, no significant differences were detected between the two robotic approaches in terms of complications, transfusion, conversion to open and/or radical nephrectomy, IT, and PSMs. Unfortunately, the study design did not allow for a precise consideration of potential confounders that significantly affect treatment selection

and patient outcomes, such as complexity and location of the tumour. Moreover, the cumulative evaluation included many heterogeneous studies with a small sample size. For instance, meta-analyses were not applicable to postoperative renal function owing to the paucity of studies reporting this specific outcome and to the different methodologies applied to measure renal function. Conversely, the multi-institutional data collection used in the current study allowed for the homogenous construction of a granular dataset that allowed for a detailed clinical analysis. Recently, another original investigation observed similar rates of a composite definition of optimal perioperative outcomes after either approach modality [9], suggesting that the ultimate choice of the operative approach may be based on surgeon comfort. However, the impact of tumour's location on surgical indication was not considered.

The current study is the first to undertake the mission of assessing perioperative, pathological, and functional outcomes according to the location of the tumour (anterior vs posterior) and the robotic approach (rRAPN vs tRAPN). Two other reports [10,11] evaluated perioperative outcomes between tRAPN and rRAPN exclusively in patients who harbour posterior renal lesions. However, these studies are limited by the sample size that does not allow for a clear interpretation of the negative findings observed. Furthermore, their results are not generalisable to patients with an anterior lesion.

It is also important to remember that RAPN is a complex surgical procedure with a learning phase in which suboptimal surgical outcomes are achieved [12]. These observations, taken together with the findings of the current study, suggest that the choice of the approach should be driven by the surgeon's expertise rather than the tumour location. Furthermore, it is possible to speculate that the commitment to one specific approach might result into faster improvement during the learning phase, eventually improving patients' outcomes.

Despite several strengths, the current study is not devoid of limitations related to its retrospective nature, such as the inability of accounting for surgical technique and surgeon's expertise. Moreover, our findings derive from tertiary care centres, and might not be generalisable to lower-volume hospitals and less experienced surgeons. Finally, no cost analysis was provided. Of note, it is unlikely to find a difference in favour of one approach, since the main drivers of health-care expenditures, namely, OT and LOS [13], were similar after either treatment modality. Notwithstanding these limitations, our study represents the largest available comparative investigation assessing perioperative morbidity, and pathological and functional outcomes between rRAPN and tRAPN on a global scale, and this feature deserves special consideration in the interpretation of the lack of difference observed. Moreover, this study is the first to evaluate surgical outcomes according to surgical approach and tumour's location.

In conclusion, the current study provides evidence that both rRAPN and tRAPN offer equivalent perioperative morbidity, and functional and pathological outcomes, regardless of tumour location.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.euo.2018.12.010.

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