Are nephrometry scores enough to select patients really fit for nephron sparing surgery?

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Comment on: Dahlkamp L, Haeuser L, Winnekendonk G, *et al.* Interdisciplinary Comparison of PADUA and R.E.N.A.L. Scoring Systems for Prediction of Conversion to Nephrectomy in Patients with Renal Mass Scheduled for Nephron Sparing Surgery. J Urol 2019. [Epub ahead of print].

In this study, Dahlkamp and colleagues analyzed the role of PADUA and RENAL scores, as calculated by radiologists and urologists, in predicting the risk of conversion to radical nephrectomy (cNE) in a series of patients scheduled for partial nephrectomy.

The paper has the worth to be the first relating the nephrometry scores with an outcome different from the standard considered by the Literature of postoperative complications. Relating the anatomical complexity of a renal mass to the risk of radicalizing a surgery scheduled as nephron sparing has a strong rationale, being the conversion considerable as the first and the main indicator of a deviation from the planned treatment.

Moreover, another worth of the study is to underline that the nephrometry scores rates are similar, irrespectively from the physician evaluating them. Indeed, the PADUA and RENAL scores have been developed as tools to quantify numerically how a renal tumor is complex to be surgically removed from the kidney, sparing the surrounding parenchyma (1,2). The demonstration that both expert radiologists and urology residents score the renal masses similarly with these tools, underlines the rightness of such scores in assessing the renal tumors complexity.

Notwithstanding the strengths of this study, it is necessary to report also, to give the reader a real perspective of the work, the weak points of the paper.

At first, it is necessary to underline that, in the same cohort, were prospectively included patients undergone PN with both open and robotic approaches. The cNE for the two approaches is different: indeed, the published conversion rates, as reported in the paper, range from 7.3% to 33.5% in open partial nephrectomy series (3,4) and from 3.1% to 4.99% in robotic partial nephrectomy cohorts (5,6).

Secondarily, notwithstanding the perspective design of the study, the data have been evaluated retrospectively, analyzing the nephrometry scores of the cases undergone cNE, in order to evaluate if the anatomical complexity assessed preoperatively by looking at the standard imaging was related with the risk of radicalization of the surgery.

As third point, it is necessary to underline that an overall cNE of 13.5% is a quite high rate, in comparison with the recent case series published in *Literature* (6). Interestingly the highest rate of conversion was due to oncological reasons: indeed, the 77.4% of cNEs (24/31 patients) was due to intraoperative signs of tumor aggressiveness (12 hilar infiltrations, 7 multifocal tumors, 5 positive margins), with a low percentage of patients radicalized for surgical reasons (tumor size, bleeding, urinoma, tumor rupture).

At last, one other drawback of the study can be the abuse in indication to PN: considering the number of cNEs and at the meantime the reasons of radicalization (both oncological and surgical), the indications to perform a nephron sparing surgery were too much wide-ranging, including also patients with aggressive tumors (not properly fit for PN) or with surgically complex renal masses (not properly fit for not super-experienced surgeons).

More details should be given about the preoperative imaging used to assess the tumor features (maybe suboptimal considering the number of tumors resulting aggressive and unfit for PN intraoperatively), about the decision making process that led to indicate a nephron sparing surgery for the patients included in the study (maybe too much extensive considering the intraoperative oncological findings), and about the surgeon's experience (no information are reported about the expertise and learning curve of the surgeons performing PNs).

Considering all the strengths and limitations of the study a lot of "food for thought" concerning the role of nephrometry scores in driving the indication to nephron sparing surgery is available.

The reasoning develops trough three main topics.

The first topic is the way to assess the nephrometry scores. As surgeons, independently from the scoring system, our goal is to have a clear idea of the anatomical details of a renal mass preoperatively, perceiving how these characteristics can influence the surgical feasibility of a PN (7). In this setting seems clear that the imaging plays a key-role (8). For this reason, a four-phase (unenhanced, corticomedullary, nephrographic and urographic phases) contrast enhanced CT-scan can be a valid imaging tool to obtain the main information about the tumor and its neighboring structures (9). Notwithstanding the extensive Literature supporting the use of standard CT scan/MRI in assessing nephrometry scores, a complete comprehension of the morphologic and anatomic features of the renal tumors remains potentially suboptimal, being based on bi-dimensional images. Thus, a rather mental abstractive process, through which the surgeon re-build a three-dimensional figure from 2D standard scans is needed (10).

In recent years, new technological tools have been created to allow the production of 3D virtual reconstructions from the processing of standard 2D imaging. The rationale of this technological development was the optimization of the preoperative evaluation concerning the tumor features and its relationships with renal vasculature and upper urinary collecting system (11,12). A recently published paper by our group demonstrates that 3D virtual reconstructions are more accurate than standard 2D images in assessing the nephrometry scores, allowing a finer perception of the tumor location, depth, and contact with intrarenal structures, simplifying the preoperative planning. Moreover, the nephrometry scores assessed with this new imaging tool demonstrate a higher accuracy in predicting postoperative complications, in comparison with the old bi-dimensional imaging based ones. The strength of this evidences is to underline that the evaluation of the anatomical complexity of a renal tumor, strictly depends on the imaging tool used to assess it, irrespectively from the nephrometry score chosen (13).

Thus, a preoperative assessment of the surgical complexity of a renal tumor, maybe via nephrometry scores, is useful for the surgeon to choose his operative strategy, but should be based on the consultation of 3D virtual reconstructions of the standard (high quality) imaging, in order to give him the best possible perception of the real three-dimensional interactions among the tumor and the other neighboring intrarenal structures.

The second topic is the preoperative assessment of the oncological features of the tumors. Together with the evaluation of the anatomical characteristics of the renal masses, it is mandatory to consider all the information possible about the tumor aggressiveness, inferable from the preoperative imaging. Especially in case of large renal masses, the intratumoral behavior can become more heterogeneous and potentially aggressive, leading to a higher risk of pT3a at final pathology (14). One of the goals in the preoperative evaluation is to understand if the tumor has the potential to be invasive of the neighboring tissues. Among the clues assessable with CT/MRI imaging, we can identify as mains the presence of infiltrative growth pattern, the intratumoral necrosis and the policyclic pseudocapsular margins. All these evidences suggest a possible aggressive biological behavior of the tumoral cells, being possible signs of a high cellular turnover in some intralesional clusters (15).

Thus, in the preoperative evaluation of a renal mass, especially if the surgical plan is a pure enucleation (16), it is important to consider also the radiological clues of a possible aggressive biological behavior of the tumoral cells, in order to allow the selection of those patients really fit for PN, irrespectively from their surgical complexity features.

The third topic concerns the surgical indication to nephron sparing surgery. Especially with the development of minimally invasive surgery the indication to PN has expanded widely, from small and exophytic to larger and more complex renal masses (17). In this scenario, it is nowadays under scrutiny the role of PN for T2 tumors (18). Treating more cases conservatively has the rationale to maximize the functional recovery of the kidney after surgery, but can expose the patient to a higher risk of postoperative complications and positive surgical margins (19,20). Therefore, it is necessary to define where is the limit between partial and radical nephrectomy. At first,

this limit is surgeon-dependent. The surgeon experience plays the main role in the match, being the intraoperative and postoperative outcomes strictly dependent from his surgical skills (21). The experience of the surgeon influences strongly also his self-confidence when embarking in conservative surgeries for complex tumors, leading to a higher rate of PNs successfully concluded. Secondarily, the limit is influenced by a complete knowledge of the tumor and patient features (22). A precise idea of the tumor characteristics, both oncological and anatomical (also aided with 3D virtual model reconstructions), allows to plan a proper surgical indication. In addition, considering the preoperative functional status of the kidney allows to understand if the patient really needs to save every possible nephron or if he does not really benefit from a PN (23), especially when the choice is balanced with the risk of complications (24).

In conclusion, together with the standard nephrometry scores, many aspects must be considered before embarking in a partial nephrectomy. To optimize the outcomes of the surgery, choosing the best indication, it is necessary to have a fine knowledge of the anatomical, oncological and functional features of the kidney. With this purpose, a detailed evaluation of the standard imaging and its 3D virtual reconstructions could be useful, together with a preoperative assessment of the global renal status.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

References

1. Ficarra V, Novara G, Secco S, et al. Preoperative aspects and dimensions used for an anatomical (PADUA) classification of renal tumours in patients who are candidates for nephron-sparing surgery. Eur Urol 2009;56:786-93.

2. Kutikov A, Uzzo RG. The R.E.N.A.L. nephrometry score: a comprehensive standardized system for quantitating renal tumor size, location and depth. J Urol 2009;182:844-53.

3. Galvin DJ, Savage CJ, Adamy A, et al. Intraoperative conversion from partial to radical nephrectomy at a single institution from 2003 to 2008. J Urol 2011;185:1204-9.

4. Khandwala YS, Jeong IG, Kim JH, et al. The incidence of unsuccessful partial nephrectomy within the United States: A nationwide population-based analysis from 2003 to 2015. Urol Oncol 2017;35:672.e7-13.

5. Kara Ö, Maurice MJ, Mouracade P, et al. When Partial Nephrectomy is Unsuccessful: Understanding the Reasons for Conversion from Robotic Partial to Radical Nephrectomy at a Tertiary Referral Center. J Urol 2017;198:30-5.

6. Arora S, Chun B, Ahlawat RK, et al. Conversion of Robot-assisted Partial Nephrectomy to Radical Nephrectomy: A Prospective Multi-institutional Study. Urology 2018;113:85-90.

7. Sterzik A, Solyanik O, Eichelberg C, et al. Improved prediction of nephron-sparing surgery versus radical nephrectomy by the optimized R.E.N.A.L. Score in patients undergoing surgery for renal masses. Minerva Urol Nefrol 2019;71:249-57.

8. Wadle J, Hetjens S, Winter J, et al. Nephrometry Scores: The Effect of Imaging on Routine Read-out and Prediction of Outcome of Nephron-sparing Surgery. Anticancer Res 2018;38:3037-41.

9. Bertolo R, Fiori C, Piramide F, et al. Assessment of the relationship between renal volume and renal function after minimally-invasive partial nephrectomy: the role of computed tomography and nuclear renal scan. Minerva Urol Nefrol 2018;70:509-17.

10. Porpiglia F, Bertolo R, Checcucci E, et al. Development and validation of 3D printed virtual models for robot-assisted radical prostatectomy and partial nephrectomy: urologists' and patients' perception. World J Urol 2018;36:201-7.

11. Porpiglia F, Fiori C, Checcucci E, et al. Hyperaccuracy Three-dimensional Reconstruction Is Able to Maximize the Efficacy of Selective Clamping During Robot-assisted Partial Nephrectomy for Complex Renal Masses. Eur Urol 2018;74:651-60.

12. Porpiglia F, Amparore D, Checcucci E, et al. Current Use of Three-dimensional Model Technology in Urology: A Road Map for Personalised Surgical Planning. Eur Urol Focus 2018;4:652-6.

13. Porpiglia F, Amparore D, Checcucci E, et al. Three-dimensional virtual imaging of the renal tumors: a new tool to improve the accuracy of nephrometric scores. BJU Int 2019. [Epub ahead of print].

14. Beksac AT, Paulucci DJ, Gul Z, et al. Risk factors and prognostic implications for pathologic upstaging to T3a after partial nephrectomy. Minerva Urol Nefrol 2019;71:395-405.

15. Cho S, Lee JH, Jeon SH, et al. A prospective, multicenter analysis of pseudocapsule characteristics: Do all stages of renal cell carcinoma have complete pseudocapsules? Urol Oncol 2017;35:370-8.

16. Minervini A, Campi R, Sessa F, et al. Positive surgical margins and local recurrence after simple enucleation and standard partial nephrectomy for malignant renal tumors: systematic review of the literature and meta-analysis of prevalence. Minerva Urol Nefrol 2017;69:523-38.

17. Bertolo R, Autorino R, Fiori C, et al. Expanding the Indications of Robotic Partial Nephrectomy for Highly Complex Renal Tumors: Urologists' Perception of the Impact of Hyperaccuracy Three-Dimensional Reconstruction. J Laparoendosc Adv Surg Tech A 2019;29:233-9.

18. Bertolo R, Autorino R, Simone G, et al. Outcomes of Robot-assisted Partial Nephrectomy for Clinical T2 Renal Tumors: A Multicenter Analysis (ROSULA Collaborative Group). Eur Urol 2018;74:226-32.

19. Minervini A, Mari A, Borghesi M, et al. The occurrence of intraoperative complications during partial nephrectomy and their impact on postoperative outcome: results from the RECORd1 project. Minerva Urol Nefrol 2019;71:47-54.

20. Minervini A, Mari A, Ficarra V, et al. RECORd1 project: what have we learned?. Minerva Urol Nefrol 2018;70:1-3.

21. Dagenais J, Bertolo R, Garisto J, et al. Variability in Partial Nephrectomy Outcomes: Does Your Surgeon Matter? Eur Urol 2019;75:628-34.

22. Vartolomei MD, Matei DV, Renne G, et al. Long-term oncologic and functional outcomes after robot-assisted partial nephrectomy in elderly patients. Minerva Urol Nefrol 2019;71:31-7.

23. Bertolo RG, Zargar H, Autorino R, et al. Estimated glomerular filtration rate, renal scan and volumetric assessment of the kidney before and after partial nephrectomy: a review of the current literature. Minerva Urol Nefrol 2017;69:539-47.

24. Mari A, Campi R, Schiavina R, et al. Nomogram for predicting the likelihood of postoperative surgical complications in patients treated with partial nephrectomy: a prospective multicentre observational study (the RECORd 2 project). BJU Int 2019;124:93-102.