



Risk reduction in kidney surgery

Martin Marszalek

Department of Urology and Andrology, Sozialmedizinisches Zentrum Ost - Donauspital, Vienna, Austria

Correspondence to: Martin Marszalek. Associate Professor of Urology, Vice Chair Department of Urology and Andrology, Sozialmedizinisches Zentrum Ost - Donauspital, Vienna, Austria. Email: ordination@marszalek.at.

Provenance: This is an invited article commissioned by the Section Editor Xiao Li, MD (Department of Urology, Jiangsu Cancer Hospital & Jiangsu Institute of Cancer Research & Nanjing Medical University Affiliated Cancer Hospital, Nanjing, China).

Comment on: 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.

Submitted Mar 31, 2019. Accepted for publication Apr 08, 2019.

doi: 10.21037/atm.2019.04.24

View this article at: <http://dx.doi.org/10.21037/atm.2019.04.24>

Partial nephrectomy: advantages, aims and indications

Partial nephrectomy has become a cornerstone of kidney cancer surgery. Several studies have shown at least equivalent oncologic results of partial and radical nephrectomy (1,2). The preservation of functioning kidney parenchyma is thought to reduce the risk of developing comorbidities such as chronic kidney failure, thereby potentially improving survival (3-6). The only randomized controlled trial comparing radical and partial nephrectomy showed equivalence of both procedures (7). Besides elective indications, several situations may require nephron sparing surgery in an imperative indication, where radical nephrectomy would subject the patient to hemodialysis, suffering from immunosuppressive side effects and experiencing reduced overall survival. The solitary kidney may be one of those situations, but also chronic kidney failure and bilateral kidney tumors. Looking further into the future, preserved kidney function will undoubtedly be an advantage in the miserable situation of disease recurrence. Metastatic renal cell carcinoma is currently treated with tyrosine kinase inhibitors, immune checkpoint inhibitors and the combination of both. The majority of these drugs will be given for a long period of time and exerts nephrotoxic side effects, rendering additional renal function an invaluable resource for future treatment lines (8).

Typical complications of partial nephrectomy: bleeding, urinoma and organ loss

The above advantages are traded off against a broadened spectrum of complications, first of all postoperative bleeding and arteriovenous fistula formation. The majority of bleeding complications can be treated conservatively, leaving secondary nephrectomy optional for only few cases. However, we have to bear in mind that some authors report negative effects of blood transfusions on cancer specific and overall survival (9), a risk that can be reduced if not avoided at all by a delicate surgical technique and appropriate preoperative risk assessment. Arteriovenous fistula typically becomes apparent with hematuria and requires reintervention with superselective arterial embolization. This may have detrimental impact on the residual functioning kidney parenchyma, and jeopardizes the benefit achieved with nephron sparing surgery, namely preserved kidney function. Organ sparing kidney surgery can be challenging due to a central or hilar location of the tumor or at least endophytic tumor growth patterns, reflected in high PADUA scores on preoperative computed tomography scans. This often leads to inadvertent lesion of the collecting system which may result in urinary fistula formation if not recognized and closed during primary surgery. Prestenting with antirefluxive stents can aid to avoid such complications in complex cases, however this

prolongs operating time and is probably underused. Finally, surgery is certainly a scenario of both, surgeons expertise and patients predispositions. Both factors may lead to successful procedures, or, if not addressed properly, to complications, which ultimately can necessitate unplanned secondary nephrectomy.

The intention of nomograms: risk assessment and improvement of counselling and treatment decisions

Nomograms initially arrived in the urological landscape some 20 years ago with the need for risk assessment in the treatment of prostate cancer. One more time, treatment related side effects and oncological efficacy were drivers in the development of those nomograms, with the ones published by Michael Kattan being the most prominent (10,11). These nomograms are tools. Their aim is to predict risks, for instance the risk of disease recurrence, the risk of metastatic disease or the probability of overall survival related to a certain treatment modality. As these endpoints are impacted by a variety of factors, the most important are identified and integrated in such a calculation tool to predict endpoints of interest to the treating physician, but most important, to the patient. The decision, how to treat a patient the best way, and even more the decision whether or not to treat a patient at all, is challenging. A variety of factors have to be taken into consideration, and how to integrate them into a single decision will be a difficult puzzle in complex cases. At this point, nomograms appear on stage as a tool helpful in keeping an objective eye on comorbidities as well as surgical and tumor related factors. In this context, nomograms can aid physicians and surgeons to optimize treatment decisions. However, these decisions in fact are suggestions, that may then be translated into decisions by the patient himself. As patients usually lack the medical background knowledge necessary to decide on a scientific base, they may benefit from a condensed simplification of information. And this exactly describes what nomograms are providing: condensed simplified information.

Factors relevant in this new nomogram

The nomogram proposed by Mari and coworkers aims to predict postoperative complications in patients undergoing nephron sparing surgery for kidney cancer. Multiple parameters are included in this nomogram, such as patient

age, ASA score, preoperative anemia, surgical indication and approach (open, conventional laparoscopic or robot assisted), clinical tumor stage and surgical complexity as estimated by PADUA score. Mari *et al.* identified these carefully selected components as independent risk factors for complications after nephron sparing surgery. Actually, they can be stratified into three groups: (I) patient related factors, which would include patient age, ASA score and surgical indication, (II) tumor related factors, such as clinical tumor stage and preoperative anemia, and finally (III) technical aspects, like surgical complexity and approach. In another fashion, these factors may also be grouped into (I) predefined and (II) changeable factors. Patient age, surgical indication and complexity as well as tumor stage may be given, cannot be influenced (although tumor stage may be downgraded by neoadjuvant treatment in select cases) and may form some sort of background risk of complication. However, comorbidities can be optimized. Preoperative medical intervention may improve ASA scores. Preoperative anemia, being a negative prognostic factor in metastatic disease, can be compensated. Finally, the surgical approach is chosen at the surgeons discretion and according to the institutions expertise. Robot systems, although increasingly available, are not the suitable device for every type of kidney surgery. Further, recent data suggests that robot assisted partial nephrectomy harbours an increased risk of positive surgical margins (12). Eventually, the most appropriate access has to be chosen by the surgeon in order to optimize the probability of successful tumor removal as well as to minimize the risk of surgically induced perioperative complications.

Clinical relevance of this nomogram: treatment decision, counselling and healthcare quality management

In this context, the nomogram developed by Mari and colleagues offers multiple opportunities. Based on clinical available and statistical significant markers, this nomogram enables the treating physician to improve his estimation of postoperative complication risk for patients planned for partial nephrectomy. This may in some cases be concordant with personal expertise and clinical view, but may in other cases override subjective misinterpretation of data and lead to a more precise and objective risk estimation. In a second step, this information then should translate into taking action to improve addressable patient related factors and chose the surgical approach most suitable to ensure complete tumor removal while reducing the risk of

complications to the most achievable extent. Besides this opportunity, this nomogram may enable the patient to obtain more objective information concerning the surgery related risk before undergoing partial nephrectomy. When obtaining informed consent from a patient scheduled for surgery, doctors may rely on data published and build their own opinion or adopt external expert opinion, both being subject to bias. The use of a nomogram may be a possible approach to avoid such bias, condense the information given in the literature and translate the often heterogeneous and complex data into an easy to understand risk calculator, which produces output understandable to patients. Last but not least, risk assessment is an integrative part of healthcare quality management. Several billion US\$ are spent annually due to complications after surgical procedures (13-15). In a landscape with continuously increasing health care expenses and limited resources, a nomogram improving risk assessment within a complex surgical procedure should be recognized as an auxiliary tool to reduce expenses and improve resource allocation.

Acknowledgments

None.

Footnote

Conflicts of Interest: The author has no conflicts of interest to declare.

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Cite this article as: Marszalek M. Risk reduction in kidney surgery. *Ann Transl Med* 2019;7(Suppl 3):S89. doi: 10.21037/atm.2019.04.24