Surgical Techniques in the Management of Small Renal Masses

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KEYWORDS

• Small renal mass • Tumor enucleation • Enucleoresection • Selective arterial clamping
• Partial nephrectomy • Technique • Ischemia • Nephrometry

KEY POINTS

- Management of small renal masses (SRMs) is increasingly common for urologists, and surgical treatment of theses masses requires multiple technical skill sets.
- There does not seem to be an oncologic outcome difference in surgical approach as long as the surgery performed is in the skill set of the urologist.
- There are multiple options for renal hilar control and tumor extirpation that need to be tailored to the patient and renal mass during dissection.

INTRODUCTION

There has been an increased incidence of renal cell carcinoma (RCC) and it is estimated that there will be 63,990 new cases of RCC diagnosed in the United States in 2017.[1] This incidence trend is largely due to increased use of cross-sectional imaging for unrelated reasons that lead to an incidental finding of an SRM, defined as an enhancing solid renal mass, usually less than 4 cm. There has also been a stage migration to lower-stage RCC, because a majority of these incidental renal masses are found as localized, low-stage tumors.[2,3]

Partial nephrectomy (PN) was initially reserved for obligate reasons, such as a renal mass in a solitary kidney, or in cases of bilateral renal masses. The notion of renal preservation, however, has led to the increased adoption of PN. Gradual acceptance and adoption of PN occurred after studies demonstrated association of chronic kidney disease with increase in cardiovascular mortality[4] and preservation of renal parenchyma with a decreased rate of development of chronic kidney disease postoperatively.[5–11] Multiple retrospective studies have shown a survival advantage of patients undergoing PN compared with radical nephrectomy (RN) while providing equivalent oncologic outcomes.[12–20] Many of these studies, however, are limited by their retrospective nature and selection bias. On the contrary, the only prospective randomized study comparing survival outcomes of PN versus RN that showed survival advantage for patients treated with RN and not PN.[21] Although that study was not without limitations, it had an imprint on practice patterns, where PN is not advocated as aggressively for some renal masses. Nevertheless, because of equivalent oncologic outcomes, improved renal function postoperatively, and decreased risk of future development of cardiovascular disease, PN remains a preferred treatment of SRM in most centers.

The treatment of SRMs has evolved over the past several decades and current management options include active surveillance, cryoablation, radiofrequency ablation, PN, and RN. When selecting the method of treatment, patient factors, such as medical comorbidities and tumor location

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and size, must be taken into account along with surgeon factors, including experience, technical ability, and availability of instrumentation/technology. Nevertheless, the standard of care remains surgical extirpation of an SRM with the treatment of choice PN, as agreed on by both American Urological Association and European Association of Urology guidelines.[22,23]

Over the past 15 years there has been increased use of minimally invasive surgery (MIS) in urology.[24] MIS has been increasingly adopted in management of renal masses and surgery of retroperitoneum because it greatly reduced the morbidity associated with an open flank or abdominal incisions. In the United States, with the increased availability of the da Vinci robotic platform (Intuitive Surgical, Sunnyvale, CA, USA), robotic-assisted laparoscopic PN has become the preferred MIS strategy for PN because it is less technically demanding, with a shorter learning curve.[25,26] Regardless of surgery type for renal mass, the goal of the treatment is often referred to as a trifecta, defined as (1) negative margins, (2) minimal renal function decrease, and (3) no surgical complications.[27–29]

SURGICAL APPROACH

The progression of nephron-sparing surgical management of an SRM has traversed from an open approach, to hand-assisted laparoscopic surgery, to pure laparoscopic surgery, and now to robotic-assisted laparoscopic surgery. Although there have been no prospective trials comparing the various techniques, there have been many retrospective comparisons that show that all types have similar oncologic efficacy.[28,30–32] A meta-analysis by Zheng and colleagues[33] combined 6 studies comparing oncologic outcomes of patients with T1a and T1b RCC treated with open PN versus laparoscopic PN, with a minimum follow-up of 5 years, and found no difference in overall survival, cancer-specific survival, or recurrence-free survival between groups (odds ratios 1.83 [95% CI, 0.8–4.19], 1.09 [95% CI, 0.62–1.92], and 0.68 [95% CI, 0.37–1.26], respectively). Open PN has been shown to have shorter operative times but increased estimated blood loss along with increased hospital length of stay (**Table 1**). Regardless of the approach, there have been similar rates of major complications between all groups, with rates between 1% and 10%.[28,30–32,34–44] A meta-analysis by Shen and colleagues[37] combined 16 comparative studies between robotic PN and open PN and found that robotic-assisted PN had a lower rate of perioperative complications compared with open PN. Many of these comparative studies, however, reflect surgeon biases and lack details about intricacies of tumor complexities that likely influenced patient selection and outcomes. Finally, an open approach allows for the ability to implement cold ischemia compared with minimally invasive approaches that normally use warm ischemia, although several investigators described application of cold ischemia in MISs.[45–51]

Over the course of the past decade, it has been shown that laparoscopic PN is technically demanding and often is performed only by higher-volume surgeons, whereas robotic PN has been more widely adopted because the robotic platform allows for increased dexterity, improved visualization, and limitation of tremor.[26] Leow and colleagues[35] recently performed a meta-analysis combining 4919 patients undergoing laparoscopic PN or robotic PN and found a benefit in favor of RPN for any complications, major complications, WIT, and positive margin rates. It is possible that the technical improvements with the robotic platform and 3-D vision may offer improved perioperative and possibly oncologic outcomes compared with laparoscopic PN. Nevertheless, the decision to choose one approach versus another depends on surgeon experience and skills, technologic availability, tumor location, and size of the renal mass that may necessitate increased ischemia times. All surgical options seem to provide adequate oncologic and perioperative outcomes when performed properly.

NEPHROMETRY SCORING

To quantify the complexity and difficulty of performing a PN there have been different scoring systems developed, including radius, exophytic/endophytic properties of the tumor, nearness of the deepest portion of the tumor to the collecting system, anterior/posterior descriptor and location relative to the polar line (RENAL); preoperative aspects and dimensions used for anatomic classification system (PADUA); and centrality index.[52–56] The RENAL nephrometry scoring has been more universally adopted to describe the complexity of a renal mass prior to PN. Although there is not a clear correlation with RENAL score and type of PN performed, often high-complexity, endophytic tumors are performed open, given the extensive dissection required and expected longer ischemia times.[57] Nevertheless, a few series of high-complexity tumors undergoing minimally invasive PN, whether robotically or purely laparoscopically, report increased WIT and higher complication rates.[58–60] In select hands, high-nephrometry tumors can still undergo robotic PN with similar outcomes.[61]