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Open Nephron-Sparing Surgery for Renal Cell Carcinoma

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KEYWORDS

- Kidney cancer
- Renal cell carcinoma
- Tumor
- Nephron-sparing surgery
- Partial nephrectomy
- Open surgery

ABSTRACT

Partial nephrectomy or nephron-sparing surgery (NSS) provides effective curative therapy for patients with localized renal cell carcinoma. In patients with imperative indications, it represents an alternative to renal replacement therapy. For selected patients with systemic comorbidities that threaten global renal function, NSS preserves unaffected nephrons with excellent cancer-specific survival. Elective partial nephrectomy for patients with a small (≤4cm), unifocal tumor, and a normal contralateral kidney is associated with a low risk (0% to 3%) of local recurrence and cancer-specific survival rates of 90% to 100%. Comparisons between radical and partial nephrectomy demonstrate equivalent cancer control over 5 years.

Surgical resection remains the standard treatment for renal cell carcinoma (RCC). The concept of wide excision of the affected kidney outside its investing (Gerota’s) fascia to include the perirenal fat and ipsilateral adrenal gland has dictated surgical thinking and management of this tumor for over a half a century. Compared to simple nephrectomy, this approach was favored due to the recognition that extrarenal involvement of the adjacent perirenal fat and adrenal gland may contribute to surgical failure, thus necessitating the maintenance of anatomic planes of resection in order to obtain the widest surgical margin possible. Today, a better understanding of the biology of RCC, standardized staging, and changing patterns of presentation for patients with this tumor permit a refined surgical approach, limiting potential long-term morbidity by maximizing preservation of functional renal parenchyma.
Nephron-sparing treatment of renal tumors dates to the 1800s, when Wells described the technique for removal of a perirenal fibrolipoma. In 1887, Czerny was the first to use partial nephrectomy for therapy of a renal malignancy. The initial enthusiasm for this approach abated after significant problems were encountered with renal bleeding, urinary fistulas, and postoperative death. Such postoperative morbidity limited utilization of nephron-sparing techniques until 1950, when Vermooten suggested that peripheral encapsulated renal neoplasms could be locally excised, leaving a margin of normal parenchyma around the tumor. Following the observations by Robson et al. of better survival rates after extrarenal nephrectomy, the use of partial nephrectomy in patients with RCC fell into disfavor. Since that time, radical nephrectomy has remained the standard against which all other forms of surgical treatment for RCC must be measured.

Interest in nephron-sparing surgery (NSS) has been stimulated by several developments, including advances in renal imaging, improved surgical techniques and methods to prevent ischemic renal injury, better postoperative management including renal replacement therapy, and long-term prospective cancer-free survival data. Extended experience has now established that NSS can be performed safely, with low morbidity and low local recurrence rates, high patient satisfaction, and equal cost-effectiveness to radical nephrectomy.

**INDICATIONS FOR NEPHRON-SPARING SURGERY**

Standard indications for NSS fall into three categories: absolute, relative, and elective. Absolute indications for NSS include circumstances where radical nephrectomy would render the patient anephric, with the subsequent immediate need for dialysis. This encompasses patients with bilateral RCC or RCC involving a solitary functioning kidney, whether resulting from unilateral renal agenesis, prior removal of the contralateral kidney, or irreversible impairment of contralateral renal function. Patients with bilateral synchronous renal tumors also have an absolute indication for NSS, and an attempt should be made to preserve as much functioning parenchyma as possible. Preservation involves performing bilateral partial nephrectomy when feasible, usually as a staged procedure with the less involved side done first. When partial nephrectomy is not indicated on one side due to tumor size or anatomy, initial partial nephrectomy is performed as a separate procedure on the less involved side, followed by contralateral radical nephrectomy. Such an ordering precludes the need for temporary dialysis in the immediate postoperative period should acute tubular necrosis arise following partial nephrectomy, and it also affords flexibility when preparing the contralateral operation.

Relative indications for NSS include patients with unilateral RCC and a functioning opposite kidney, and when the opposite kidney is affected by a condition that might threaten its future function, such as calculus disease, chronic pyelonephritis, renal artery stenosis, and ureteral reflux, or systemic diseases such as diabetes and nephrosclerosis. In such patients, the risks and benefits of NSS must be considered in the context of the general clinical status including age, comorbidities, risk of disease progression, and the possibility that these conditions will negatively affect remaining renal function.

Relative indications for NSS also include patients with hereditary forms of RCC such as von Hippel–Lindau (VHL) disease, where there is a high likelihood of subsequent lesions developing in the remaining renal parenchyma. The natural history of RCC in patients with VHL differs from sporadic RCC in that the diagnosis is made at a younger age, and there usually are multiple bilateral renal tumors. In patients with VHL or other