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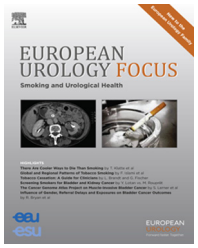

Review – Kidney Cancer

Renal Preservation and Partial Nephrectomy: Patient and Surgical Factors

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Abstract

Context: Optimization of the partial nephrectomy (PN) procedure in terms of preservation of functional outcomes is of special importance.
Objective: To review the most important patient and surgical factors that may influence the three elements that ultimately define the preservation of renal function (RF) after PN: preoperative RF, quantity of parenchyma preserved, and nephron recovery from ischemic insult.
Evidence acquisition: A nonsystematic review of the literature was conducted. Relevant databases were searched for studies providing data on surgical, patient, and tumour factors predictive of RF preservation after PN.
Evidence synthesis: Many renal cell carcinoma patients have low RF at baseline or are at risk of rapid progression of chronic kidney disease. A glomerular filtration rate (GFR) of $\leq$45 ml/min/1.73 m^2 after PN is associated with higher risk of a 50% drop in GFR or dialysis. Greater tumor size and complexity are nonmodifiable factors that predict worse postoperative RF, longer warm ischemia time (IT), and greater healthy parenchymal volume loss (HPVL). Global renal ischemic injury can be minimized using off-clamp or selective minimal renal ischemia techniques that vary from simple regional ischemia to more complex techniques such as tertiary or higher-order renal arterial branch clamping. However, the quality and quantity of parenchymal mass preserved are the main predictors of RF after PN, and IT seems to have a secondary role, as long as warm IT is limited or ischemia is hypothermic. HPVL is minimized using enucleation techniques (oncologically equivalent to traditional PN for low-grade tumors in retrospective studies) and reduction of the parenchyma incorporated in renorrhaphy. Evidence on the comparative effectiveness of the various PN surgical approaches (open, laparoscopic, robotic, and thermoablation) in terms of functional outcomes is characterized by low overall quality.
Conclusions: Efforts should be made to optimize the modifiable surgical factors identified for maximum RF preservation after PN. The low quality of evidence regarding the various surgical strategies for preserving RF prevents definitive conclusions.
Patient summary: We reviewed the literature to determine the most important modifiable and non-modifiable factors that ultimately influence renal function after partial nephrectomy. The most important factors are the preoperative renal function and the volume of healthy renal parenchyma that the surgeon can spare during tumor resection, as long as the time of renal ischemia is limited. We discuss the strategies that allow optimization of the modifiable factors, ultimately leading to maximization of renal function after partial nephrectomy.

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1. Introduction

With the intention of ensuring cancer control while preserving renal function (RF), partial nephrectomy (PN) is recommended as the preferred treatment for renal masses of up to 7 cm in diameter whenever technically feasible [1]. Recent evidence suggests that the new baseline glomerular filtration rate (GFR) after PN is an important prognosticator of RF stability and long-term survival; a new baseline GFR of <45 ml/min/1.73 m^2 was associated with worse long-term functional and survival outcomes [2]. In this context, optimization of the PN procedure in terms of functional outcomes is of special importance.

RF after PN seems to be the result of a complex and dynamic interplay among three elements: (1) preoperative parenchymal quality (ie, underlying renal disease); (2) parenchymal quantity (ie, volume of parenchyma preserved); and (3) recovery of preserved nephrons from the ischemic insult [3].

The aim of this study was to review the most important patient, tumor, and surgical factors that may influence the above-mentioned parameters and that ultimately define the preservation of RF after PN (Fig. 1).

2. Evidence acquisition

A nonsystematic review of the literature was conducted. In September 2016, a comprehensive search was performed of electronic databases (Medline, Embase, and the Cochrane Controlled Trials Register) and relevant websites to identify studies on surgical, patient, and tumour factors predictive of RF preservation after PN. The search was complemented by the reference lists of the studies included. The search was limited to English-language articles. No time period restrictions were imposed.

When analysing the evidence, the outcome of RF after PN was categorized as (1) global RF and (2) the function of the operated (ipsilateral) kidney. To minimize confounding due to contralateral hyperfiltration [4,5], we focused, whenever possible, on the second outcome, selecting (1) studies including patients with a single kidney and assessment of global RF after PN (eg, estimation of GFR [eGFR] using the Modification of Diet in Renal Disease formula) or (2) studies including patients with two kidneys and assessment of differential RF after PN (eg, via renal scintigraphy).

3. Evidence synthesis

3.1. *Patient and tumor factors*

3.1.1. *Preoperative RF*

RF after PN depends on the preoperative quality of the parenchyma [6–9]. This factor is especially important in the renal cell cancer (RCC) population, in which chronic kidney disease (CKD) from medical causes is present in

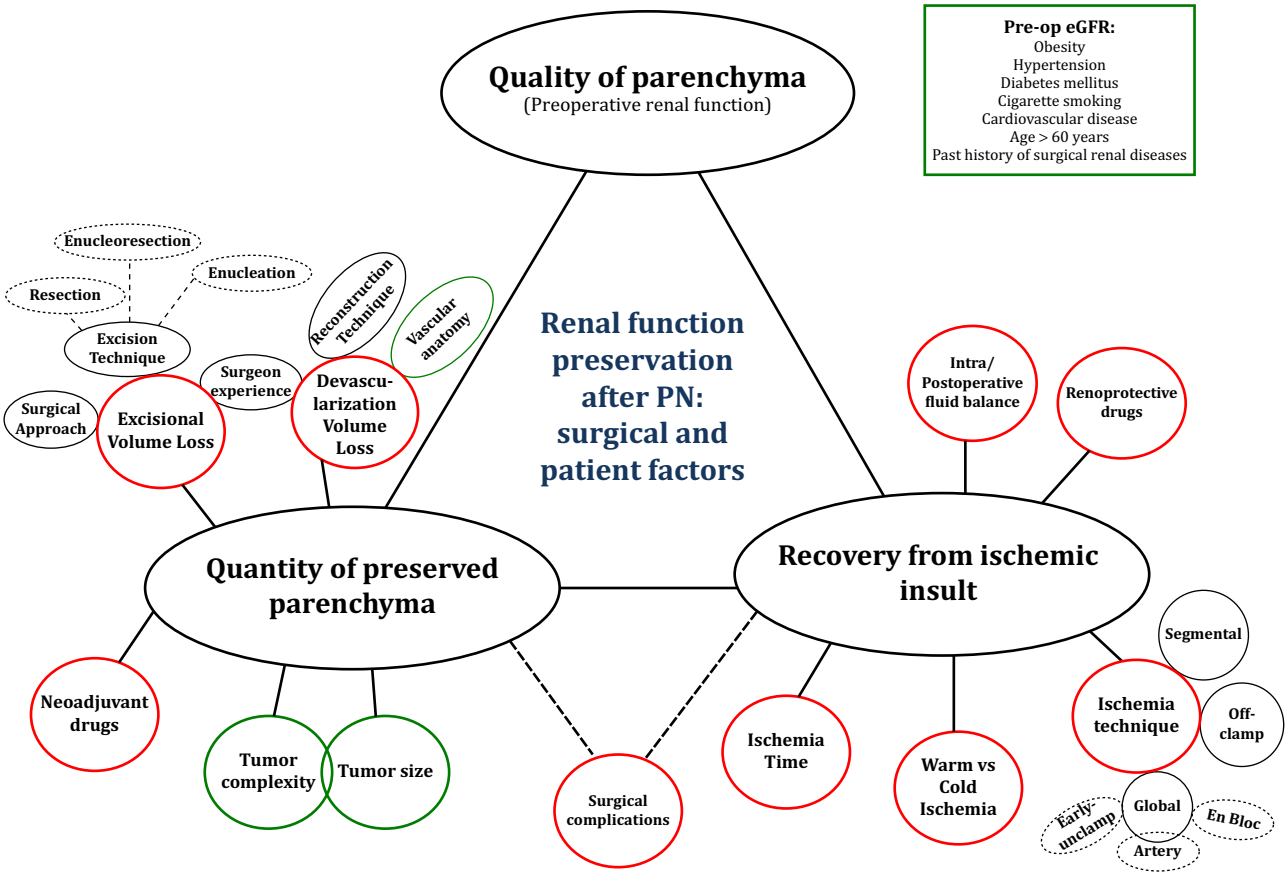

Fig. 1 – Patient, tumor, and surgical factors influencing renal function after partial nephrectomy (PN). Red = surgical factors; green = patient/tumor factors.

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