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Research Article

Laparoscopic surgical treatment for renal tumors. A comparison between simple enucleation and partial nephrectomy

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Abstract. Abstract. Aim: The aim of the study was to assess the selection differences between patients who underwent 3D laparoscopic simple enucleation (SE) and patients who underwent partial nephrectomy (PN) for renal masses. We also assessed the postoperative distinctions between the two methods. Material and methods: The study included 101 patients diagnosed with renal tumors who underwent 3D laparoscopic SE or PN. Demographic, clinical, laboratory and surgery related data were noted for every patient. Results: SE was performed in 36 (35.6%) patients and 65 (64.4%) patients underwent PN. There were no statistically significant differences between the two groups regarding age, gender distribution, cT and pT stage, positive surgical margins, pre and postoperative levels of hemoglobin or creatinine, intratumoral necrosis, histology of the renal tumors or hospitalization time. Patients with PN had slightly larger tumors, compared with the patients that underwent SE (p=0.09), statistically significant lower PADUA scores (p=0.05) and statistically significant increased frequency of intratumoral hemorrhage (p=0.005). Conclusion: The PADUA score was a selection criterion for the type of laparoscopic partial nephrectomy for patients with renal masses.

Key Words: laparoscopy, renal tumors, simple enucleation, partial nephrectomy

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Introduction

Renal cell carcinoma (RCC) represents 5% of newly discovered cancers in men and 3% in women in the United States (American Cancer Society. Surveillance Research 2019), whereas in Europe the incidence is 4.1% of newly discovered cancers in men and 2.8% in women (Bray et al 2018).

In the present days when general ultrasonography is used as a screening method, kidney tumors are not an uncommon finding. The instances of later stages when the patient presents with abdominal pain, palpable mass, hematuria or paraneoplastic signs/symptoms are less frequent in our times. The incidental discovery of renal masses leads to the opportunity of nephron-sparing surgery (NSS), as the tumors are diagnosed in early stages. Nephron-sparing surgery is a surgical technique which aims to ensure the treatment of kidney tumors, respecting the oncological principles, together with maximum preservation of the kidney function (Herr 2005). The current European guidelines recommend that patients with stage T1 RCC should undergo NSS as the first option. NSS should also be preferred when there are systemic diseases with a high chance of affecting the renal function in the future (severe atherosclerosis, diabetes, autoimmune diseases), as well as in the case of an already established chronic kidney disease or a single functioning kidney (Van Poppel et al 2016). Studies have shown that patients with tumors up to 7 cm who undergo NSS have a better overall survival rate and a lower cancer-specific mortality rate when compared to patients in whom radical nephrectomy was performed (Luo et al 2017; Lerner et al. 1996; Patard et al 2004; Leibovich et al 2004).

Although partial nephrectomy (PN) was established almost 15 years ago as the gold standard for the surgical treatment of T1 renal tumors, another type of NSS is starting to be used more and more in recent years: simple enucleation (SE) (Becker et al 2006; Minervini et al 2011; Huang et al 2016; Schiavina et al 2015). SE is based on a surgical technique that preserves as much healthy kidney tissue as possible by performing the dissection of the renal mass along an avascular plane between the tumor capsule and the normal renal parenchyma (Carini et al 2006). A metanalysis by Minervini et al (2017) showed that SE is not inferior to PN regarding oncological outcomes. Xu et al (2019) found that SE is less-traumatizing than PN, with a better recovery time and is also less damaging to the renal function due to the fact that it can be performed without the ischemia of the kidney.

The aim of the study was to assess the selection differences between patients who underwent 3D laparoscopic SE and patients who underwent PN for renal masses in our department. We also assessed postoperative differences between the two methods.

Material and methods

The study was observational, transversal, analytical, prospective and case-control type. The study included 101 patients previously diagnosed with renal cell tumors who underwent either SE (n=36) or PN (n=65) surgery. The patients underwent surgery in the Department of Urology of the Municipal Hospital of Cluj-Napoca, between January 2015 and December 2017. All patients signed the informed consent. The study protocol was in accordance with the Helsinki Declaration of 1975, as revised in 2000 and was approved by the Ethics Committee.

The study inclusion criteria were as follows: diagnosis of a renal tumor with the clinical stage T1 that could be removed through either SE or PN (surgeon choice), age over 18 years and signed informed consent. We did not include patients with the indication of radical nephrectomy.

Demographic, clinical, laboratory and surgery related data were recorded: age, gender, environment, tumor diameter, clinical stage of the tumor, ASA score, PADUA score, pre- and postoperative levels of hemoglobin and creatinine, type of approach (transperitoneal or retroperitoneal), blood loss volume, total duration of surgery, warm ischemia time (for PN group), histology

Table 1. Interpretation of the difference between the inhibition zones diameters

Variables		Characteristic
Age (years), median (25-75 percentiles)		55 (43; 65)
Gender	Male	55 (54.5%)
	Female	46 (45.5%)
Environment	Rural	26 (28.9%)
	Urban	75 (74.3%)
Tumor diameter (longest measurement) cm		3.4 (2.5; 4)
cT stage	1a	76 (75.2%)
	1b	24 (23.8%)
ASA score	1	10 (9.9%)
	2	33 (32.7%)
	3	55 (54.5%)
	4	3 (3%)
PADUA score, median (25-75 percentiles)		8 (7; 9)
Preoperative hemoglobin, median (25-75 percentiles)		13.3 (12.2; 14.7)
Preoperative creatinine, median (25-75 percentiles)		0.97 (0.83; 1.1)
Type of intervention	SE	36 (35.6%)
	PN	65 (64.4%)
Type of approach	Transperitoneal	36 (35.6%)
	Retroperitoneal	65 (64.4%)
Duration of surgery, median (25-75 percentiles)		120 (120; 140)
Warm ischemia time (for PN), median (25-75 percentiles)		18 (16; 20.5)
Blood loss (ml), median (25-75 percentiles)		100 (70; 135)
Postoperative hemoglobin (at 24 h), median (25-75 percentiles)		12 (10.9; 12.9)
Postoperative creatinine (at discharge), median (25-75 percentiles)		0.89 (0.73; 1.03)
pT stage	1a	80 (79.2%)
	1b	21 (20.7%)
Intratumoral necrosis		8 (7.9%)
Intratumoral hemorrhage		30 (29.7%)
Histology	Angiomyolipoma	8 (7.9%)
	Oncocytoma	4 (4%)
	Chromophobe renal cell carcinoma	6 (5.9%)
	Papillary renal cell carcinoma	4 (4%)
	Clear cell renal cell carcinoma	79 (78.2%)
Hospital stay (days)		7 (5; 9)

Table 2. Comparison between SE and PN groups

Variables		SE (n=36)	PN (n=65)	p
Age (years), median (25-75 percentiles)		55 (46; 64)	56 (43; 65)	0.9
Gender	Male	16 (44.4%)	39 (60%)	0.1
	Female	20 (55.6%)	26 (40%)	
Environment	Rural	14 (38.9%)	12 (18.5%)	0.04
	Urban	22 (61.1%)	53 (81.5%)	
Tumor diameter (longest measurement) cm median (25-75 percentiles)		3.3 (2; 3.9)	3.5 (2.8; 4)	0.09
cT stage	1a	29 (82.9%)	47 (72.3%)	0.3
	1b	6 (17.1%)	18 (27.7%)	
ASA score	1	2 (5.6%)	8 (12.3%)	0.7
	2	12 (33.3%)	21 (32.3%)	
	3	21 (58.3%)	34 (52.3%)	
	4	1 (2.8%)	2 (3.1%)	
PADUA score, median (25-75 percentiles)		8 (7; 9)	8 (6; 8)	0.05
Preoperative hemoglobin, median (25-75 percentiles)		13 (12.2; 14.4)	13.7 (12.3; 14.9)	0.4
Preoperative creatinine, median (25-75 percentiles)		0.94 (0.81; 1.1)	0.97 (0.85; 1.12)	0.3
Type of approach	Transperitoneal	10 (27.8%)	26 (40%)	0.3
	Retroperitoneal	26 (72.2%)	39 (60%)	
Duration of surgery, median (25-75 percentiles)		120 (115; 140)	120 (120; 137.5)	0.6
Blood loss (ml), median (25-75 percentiles)		100 (70; 135)	100 (70; 135)	0.9
Postoperative hemoglobin (at 24 h), median (25-75 percentiles)		11.5 (10.7; 13)	12 (10.9; 12.9)	0.7
Postoperative creatinine (at discharge)		0.8 (0.74; 0.99)	0.91 (0.73; 1.03)	0.7
pT stage	1a	31 (88.6%)	49 (76.6%)	0.2
	1b	4 (11.4%)	15 (23.4%)	
Intratumoral necrosis		2 (5.6%)	6 (9.2%)	0.7
Intratumoral hemorrhage		4 (11.1%)	26 (40%)	0.005
Histology	Angiomyolipoma	3 (8.3%)	5 (7.7%)	0.6
	Oncocytoma	-	4 (6.2%)	
	Chromophobe renal cell carcinoma	2 (5.6%)	4 (6.2%)	
	Papillary renal cell carcinoma	2 (5.6%)	2 (3.1%)	
	Clear cell renal cell carcinoma	29 (80.6%)	50 (76.9%)	
Hospital stay (days), median (25-75 percentiles)		7 (4; 10)	7 (5; 9)	0.5

of the tumor, presence of intratumoral necrosis or hemorrhage and hospital stay.

All surgeries were performed using a 3D laparoscopic transperitoneal or retroperitoneal approach. Choice of operative technique and use of warm ischemia vs. no ischemia was dictated by the location of the tumor and the surgeon's preference.

Statistical analysis was performed using MedCalc Statistical Software version 19.4.1 (MedCalc Software bvba, Ostend, Belgium; https://www.medcalc.org; 2020). Continuous variables were tested for normality using the Shapiro-Wilk test. Qualitative data were characterized by frequency and percentage, and continuous variables were described by median and 25-75 percentile. Comparisons between groups were performed using the Mann-Whitney test and the chi-squared test, when appropriate. A p value <0.05 was considered statistically significant.

Results

Study data are detailed in Table 1. Median age of patients was 55 years. There were slightly more men in the study (54.5%) than women. Median tumor diameter was 3.4 cm. The majority of the patients had normal preoperative levels of hemoglobin and creatinine. A third of the patients underwent SE (35.6%) and for the remaining cases partial nephrectomy was performed. Blood loss was minimum (100 (70; 135) ml). The majority of the tumors were clear cell renal cell carcinoma (78.2%). The mean hospitalization time was 7 days.

The comparison between SE and PN groups can be observed in Table 2. Age, gender, cT and pT stage, ASA score, pre and postoperative hemoglobin and creatinine levels, type of surgical approach, duration of surgery, blood loss during surgery, frequency of intratumoral necrosis, type of tumors and hospitalization

length did not differ significantly between groups. As for the demographic element, the PN group included more patients from the urban area, while the SE group had more patients from a rural region (p=0.04). Tumor size was slightly bigger in the PN group, but the statistical significance threshold was slightly passed (p=0.09). PADUA score was somewhat higher in the SE group (p=0.05). Intratumoral hemorrhage was more frequent in the PN group (p=0.005).

Discussions

The current study revealed little differences between patients treated with SE and those treated with PN. Blood loss during the intervention was similar between the two groups. Postoperative renal function and hemoglobin levels were not affected by the type of surgery. Hospital stay was the same for both groups. Tumors resected by PN were slightly larger than those operated by SE. Intratumoral hemorrhage was more frequent in the PN group. PAUDA score seemed to be the main selection criteria between PN and SE.

NSS is a surgical technique with a complication rate between 9% and 33%, even though it showed an improvement on long-term follow-up (Gill et al 2007; Campbell et al 2009; Schiff et al 2005). This is the case for open NSS, as laparoscopic PN or SE are minimally invasive procedures and may be associated with a lower rate of complications and a shorter period of post-surgery recovery. In a study by Lucas et al (2012) blood loss during laparoscopic/robotic PN was twice as low than during open PN (100 ml vs 250 ml). In our study median blood loss was similar, with 100 ml reported in both groups. Median hospitalization time was the same for both the SE and PN group from our study. A metanalysis by Xu et al (2019) showed that patients with PE had shorter hospital stay, but this may be due to the heterogeneity of the studies that were included. Postoperative creatinine was higher in the PN group, but the difference was not statistically significant. Other studies showed more significant differences, with a better renal function preservation in patients who underwent SE (Dong et al 2017; Zhu et al 2017; Lu et al 2017). The functional advantage after SE is most likely related to the smaller amount of resected renal parenchyma accompanying the tumor excision (Kaouk et al 2012). Another factor can be that during SE the tumor can be more easily dissected from the vessels, which in turn can reduce the risk of hemorrhage and blood loss (Gupta et al 2015).

The PADUA score was introduced in 2009 in order to predict the risk of medical/surgical perioperative complications in patients undergoing open NSS. The use of PADUA should help surgeons differentiate patients who are suitable for NSS into subgroups with different complication risks. (Ficarra et al 2009). Several researches of recent years studied the use of SE, laparoscopically or robotically, for patients with a high PADUA score (Minervini et al 2015; Serni et al 2015). One study showed that SE was a better option than PN for more complex renal tumors, due to the fact that complex renal tumors are often associated with unfavorable nephrometry profiles (Serni et al 2015). Minervini et al (2017) recorded a higher prevalence of positive surgical margins, loco-regional recurrence and renal recurrence in patients who underwent SE as compared with those with PN. A metaanalysis revealed that SE had acceptable early oncology outcomes compared with PN (Cao et al 2017). In our study, PADUA score was slightly higher in SE patients, as compared with PN patients. It is possible that the surgeon used the PADUA score in order to choose the type of intervention, but the number of patients with SE was lower than that of PN patients, so this fact should be regarded with caution.

The difference in tumor size was minimal and the statistical threshold was slightly passed. As almost all tumors were under 4 cm, the physicians chose PN for slightly larger masses, although both procedures can be performed in tumors up to 7 cm. The limitations of our study included the relatively small number of patients and the lack of data regarding long-term survival.

Conclusions

The PADUA score was a selection criterion for the type of laparoscopic partial nephrectomy for patients with renal masses.

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