

Surgical treatment of kidney tumors – contemporary trends in clinical practice

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Introduction The aim of this article is to generally describe the roles of main surgical modalities in treatment of renal tumors, especially in the cT1a category in clinical practice. Surgical modalities include the following: laparoscopic or open resection (LR, OR) and laparoscopic or open nephrectomy (LN, ON). Representation of these methods has been changing over years due to improved operative skills and equipment and due to a shift of tumors to the lower T categories.

Material and methods The sources of data were surgeries performed for renal tumors at the institution of the main author during the period 2002 to III/2016, reaching a total of 2204 cases (546 ONs, 647 LNs, 668 ORs and 343 LRs). Patients indicated for percutaneous ablative therapy or active surveillance were not included.

Results During the whole period, the proportions of methods were: ONs 24.8%, LNs 29.4%, ORs 30.3%, LRs 15.6%. But during the years 2014 – III/2016, these changed to 12.6%:26.3%:31.6%:29.4% (in cT1a 1.7%:8.3%:37.8%:52.2%). Category cT1a constitutes in the years 2007 – III/2016 41.3%, in 2014 – III/2016 50.9%.

Conclusions Resections and minimally invasive approaches are being performed more frequently and are the preferred methods in surgical treatment of kidney tumors. Resection is now indicated in about 60% of cases (open vs. laparoscopic resection are used nearly equally with a slight tendency for laparoscopic predomination). In the cT1a category (amounting to approximately 50% of all surgically treated tumors), resection is possible in about 85–90% of cases.

Key Words: renal tumor ↔ nephrectomy ↔ laparoscopy ↔ incidence ↔ histology

INTRODUCTION

The diagnosis and management of renal cell carcinoma (RCC) have changed remarkably rapidly. Although the incidence of RCC has been increasing, survival has improved substantially. As incidental diagnosis of small indolent cancers has become more frequent, active surveillance, laparoscopic or robot-assisted nephron-sparing surgical techniques, and minimally invasive procedures, such as thermal ablation, have gained popularity. Despite progression in cancer control and survival, locally advanced disease and distant

metastases are still diagnosed in a notable proportion of patients. An integrated management strategy that includes surgical debulking and systemic treatment with well-established targeted biological drugs has improved the care of patients [1–8]. The early diagnosis and a subsequent surgical treatment (or use of ablative modalities) of localised RCC remains the only method with a real chance at curing RCC. The modalities of surgery are the following: laparoscopic or open resection (LR, OR) and laparoscopic or open nephrectomy (LN, ON). Indications for surgery strictly follow the European Association of Urology

(EAU) guidelines for treatment of renal tumors [2]. Resection is preferred before nephrectomy in all T1 category (≤ 7 cm) cases [9, 10, 11]. In resection, as well as in nephrectomy, preference is given to the less invasive approach (laparoscopic, even robotically assisted) before open surgery [12]. In metastatic disease, available targeted therapy has only a palliative and temporary effect even in less than 50% of treated cases [2]. Moreover, cytoreductive nephrectomy (or even cytoreductive resection) is part of the treatment of metastatic RCC (mRCC) as well. Surgery is not indicated only in: (a) smaller tumors ($<$ about 3.5 cm) in elderly patients, unfit or refusing surgery – here are available active surveillance or percutaneous ablation (radiofrequency ablation or cryoablation) options; (b) in locally advanced disease and (c) mRCC not indicated for cytoreductive surgery [2, 4]. The aim of this article is to present the stratification of four basic methods of surgery performed at our department. Representation of these methods has been changing over the past years due to improved operative skills (in nephron sparing surgery and laparoscopy), enhance-

ment of equipment (mainly for laparoscopy) and due to a shift of tumors to the lower T categories. Our department performs nearly all types of surgeries for kidney tumors in the Pilsen region which has 575 123 inhabitants. Thus, we have a representative spectrum of kidney tumors to assess the real needs of different surgical modalities. Additionally, it is worth noting that the Czech Republic has the highest incidence of renal tumors worldwide and within the Czech Republic the ‘leader’ is the Pilsen region (Figures 1, 2).

MATERIAL AND METHODS

All surgeries performed for treatment of kidney tumors at the Faculty Hospital Plzeň, CZ during the period from 2002 to March 2016 were included in the study. In 2003, laparoscopy was introduced as an option; 2003 LN and 2004 LR. The robotic system is not available at Pilsen. Patients with indications for percutaneous ablative therapy (mainly radiofrequency ablation – RFA) or active surveillance were not included.

RESULTS

During the period of 14.25 years (2002 – III/2016), 2204 men were surgically treated for kidney tumors by 4 basic surgical techniques. The total numbers are shown in Table 1. In the whole period, the proportion of methods was: ONs 24.8%, LNs 29.4%, ORs 30.3%, LRs 15.6%. But in years 2014 – III/2016, it changed to 12.6%:26.3%:31.6%:29.4% (in cT1a 1.7%:8.3%:37.8%:52.2%). During the years 2007 – III/2016, category cT1a constituted 41.3% of cases and in 2014 – III/2016 50.9%. Final histologies are shown in Table 2. Mostly renal cell carcinoma (RCC) – clear RCC 75.9%, papillary RCC 9.7% and chromophobe RCC 2.6%, but of course, some benign tumors (oncocytoma 4.2% and angiomyolipoma) and other unusual tumors were found. The stratification of four basic surgical techniques is shown in Table 1, and is graphically expressed in tab 3 as well. Figure 4 (source of data is in Table 1) demonstrates the growing representation of clinical category T1a up to about 50%. Figure 5 (sources of data are again found in Table 1) shows that nephron sparing surgery is feasible now in about 60% of all cases and in about 85% of cT1a category. Generally (resections and nephrectomies), over 60% of all tumors are treated with a laparoscopic approach (Figure 3).

DISCUSSION

The surgical management of renal masses has undergone rapid evolution in clinical practice during the past two decades [14] and this is visible on our

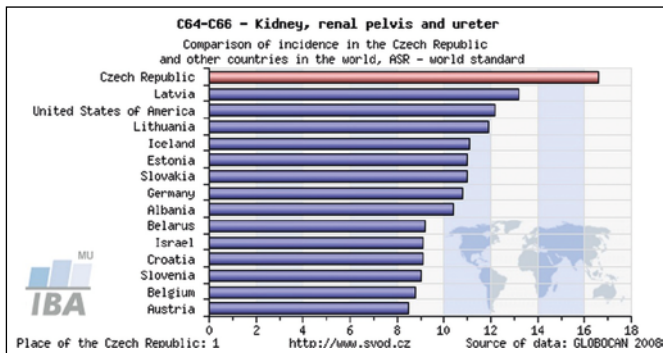


Figure 1. Incidence of kidney tumor worldwide showing leading position of the Czech Republic. Source of data is www.svod.cz

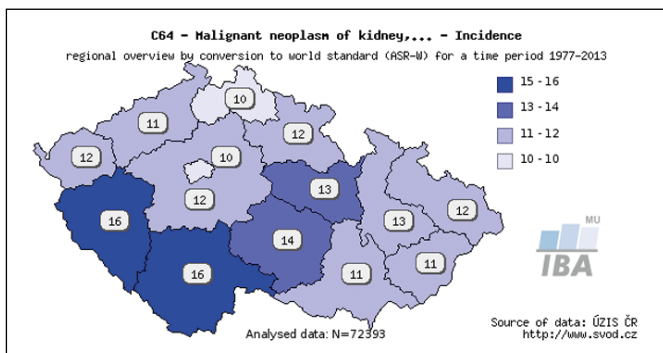


Figure 2. Incidence in different areas of the Czech Republic. The darkest region with overall incidence of 26 new cases per year per 100.000 inhabitants is the Pilsen region. Source of data is www.svod.cz

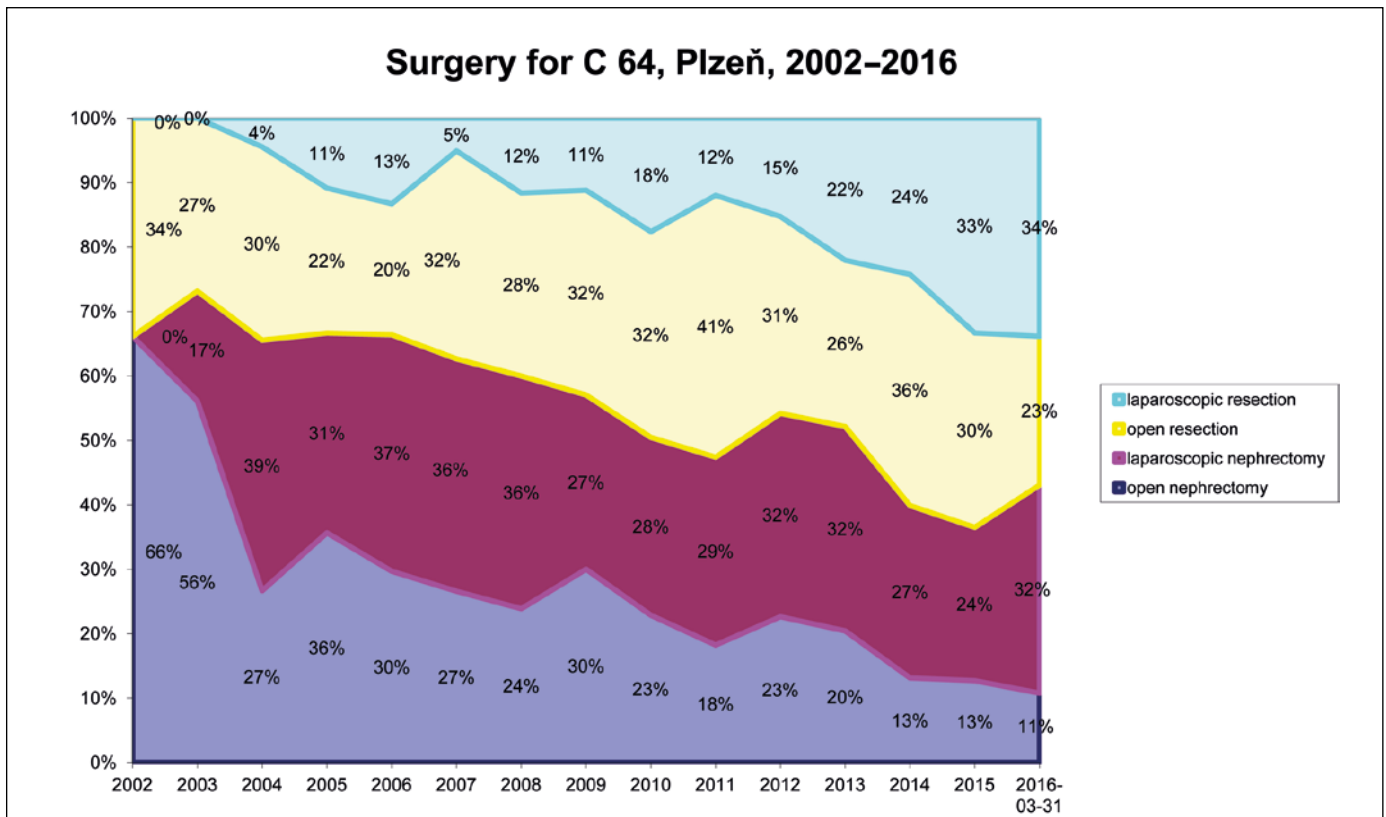


Figure 3. Stratification of surgeries (in percentages) by basic surgical procedures in years 2002-III/2016. The sources of data are found in Table 1.

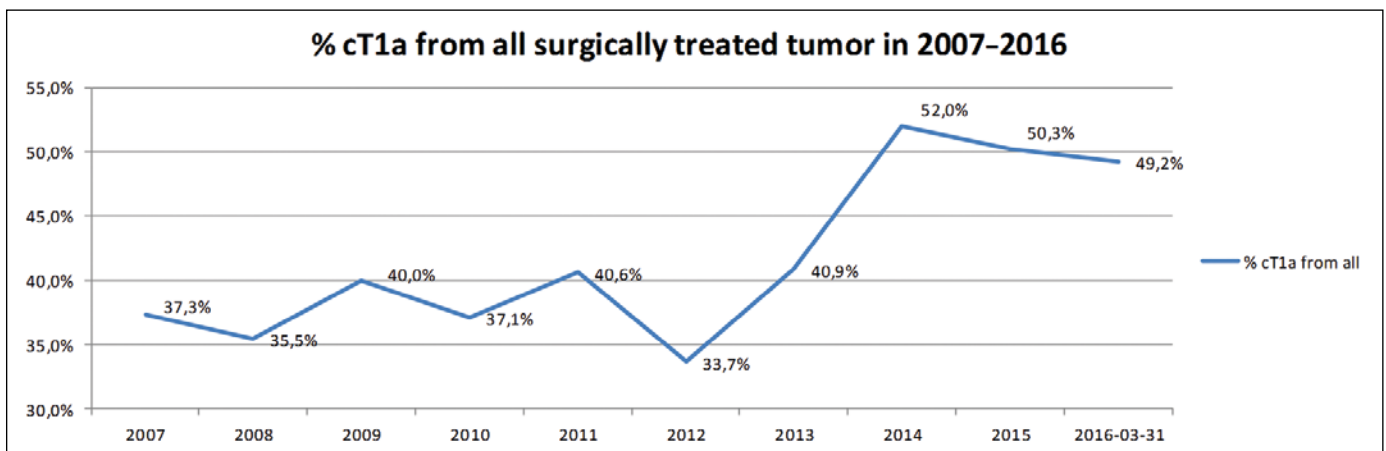


Figure 4. Percentage of clinical T1a category (tumor ≤ 4 cm) in surgically treated tumors. The sources of data are found in Table 1.

series as well. In 2002, 2/3 of all cases were treated with open radical nephrectomy and 1/3 with open resection. However, in 2015-2016, the ratio of resections increased from 1/3 to up to 60% of cases (Figure 3). This is due to (I) the expansion of general EAU guideline indications from category T1a only (tumor ≤ 4 cm) to T1b (>4 cm and ≤ 7 cm) and even T2a (>7 cm and ≤ 10 cm) as well [2]; (II) improved

technique of laparoscopic resection [15] and technical equipment; and (III) a shift of diagnosis to less advanced cases (increasing of clinical T1a category between years 2007–2016 from 37% to about 50%) (Figure 4). For comparison, in the Netherlands in 2014, 62% of cT1a underwent nephron sparing surgery (NSS) and a further 5% underwent thermal ablation therapy. Partial nephrectomy (PN) was more

Table 1. Total numbers of surgeries performed in years 2002-III/2016 and stratified by different treatment modalities

		Total No or % of methods in topical year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016-03-31		
All T categories	ONE	Total	41	46	24	46	38	42	37	51	48	35	43	38	26	24	7	546	
		%	66.1%	56.1%	26.7%	35.7%	29.7%	26.6%	23.9%	30.0%	22.9%	18.2%	22.6%	20.4%	13.1%	12.7%	10.8%	24.8%	
	LNE	Total	0	14	35	40	47	57	56	46	58	56	60	59	53	45	21	647	
		%	0.0%	17.1%	38.9%	31.0%	36.7%	36.1%	36.1%	27.1%	27.6%	29.2%	31.6%	31.7%	26.8%	23.8%	32.3%	29.4%	
	OR	Total	21	22	27	29	26	51	44	54	67	78	58	48	71	57	15	668	
		%	33.9%	26.8%	30.0%	22.5%	20.3%	32.3%	28.4%	31.8%	31.9%	40.6%	30.5%	25.8%	35.9%	30.2%	23.1%	30.3%	
	LR	Total	0	0	4	14	17	8	18	19	37	23	29	41	48	63	22	343	
		%	0.0%	0.0%	4.4%	10.9%	13.3%	5.1%	11.6%	11.2%	17.6%	12.0%	15.3%	22.0%	24.2%	33.3%	33.8%	15.6%	
		% of NSS in all		33.9%	26.8%	34.4%	33.3%	33.6%	37.3%	40.0%	42.9%	49.5%	52.6%	45.8%	47.8%	60.1%	63.5%	56.9%	45.9%
		Total 2002-2016		62	82	90	129	128	158	155	170	210	192	190	186	198	189	65	2204
	Total 2007-2016							158	155	170	210	192	190	186	198	189	65	1713	
cT1a		Total						59	55	68	78	78	64	76	103	95	32	708	
		% cT1a from all						37.3%	35.5%	40.0%	37.1%	40.6%	33.7%	40.9%	52.0%	50.3%	49.2%	41.3%	
	ONE in cT1a	Total						5	0	7	1	4	3	3	1	1	2	27	
		%						8.5%	0.0%	10.3%	1.3%	5.1%	4.7%	3.9%	1.0%	1.1%	6.3%	3.8%	
	LNE in cT1a	Total						10	10	10	9	8	6	8	11	5	3	80	
		%						16.9%	18.2%	14.7%	11.5%	10.3%	9.4%	10.5%	10.7%	5.3%	9.4%	11.3%	
	OR in cT1a	Total						38	28	36	38	44	34	26	46	34	7	331	
		%						64.4%	50.9%	52.9%	48.7%	56.4%	53.1%	34.2%	44.7%	35.8%	21.9%	46.8%	
	LR in cT1a	Total						6	17	15	30	22	21	39	45	55	20	270	
		%						10.2%	30.9%	22.1%	38.5%	28.2%	32.8%	51.3%	43.7%	57.9%	62.5%	38.1%	
	% of NSS in cT1a							74.6%	81.8%	75.0%	87.2%	84.6%	85.9%	85.5%	88.3%	93.7%	84.4%	84.9%	

Note: exact data for cT1a category from years 2002-2006 are not available
 ONE – open nephrectomy, LNE – laparoscopic nephrectomy, OR – open resection, LR – laparoscopic resection

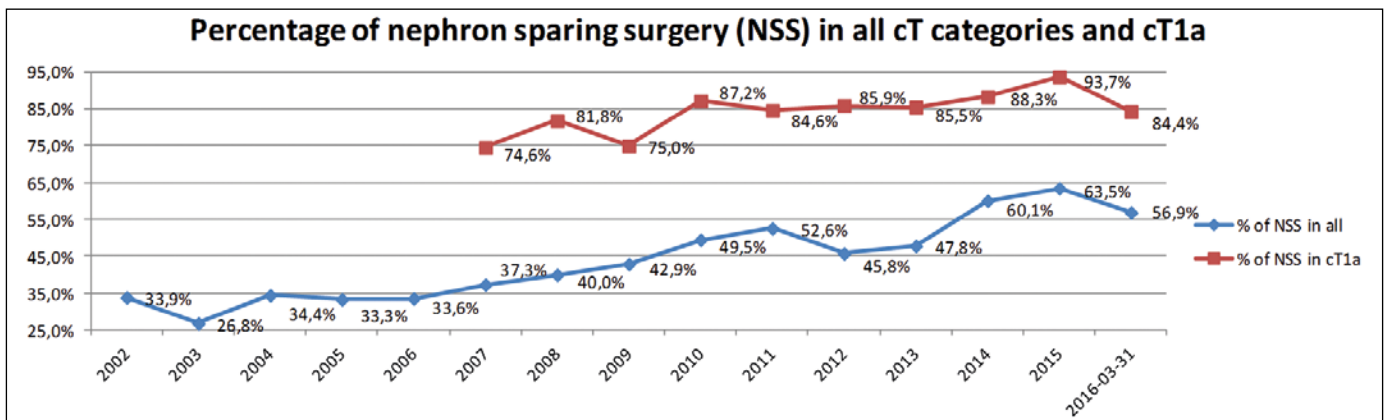


Figure 5. Percentage of nephron sparing surgery (NSS) in all cT categories and in category cT1a. The sources of data are found in Table 1.

common in the under 70 age group, in patients with non-centrally located tumors and in patients treated in high-volume hospitals. In the same study, 70% of cT1b patients underwent radical nephrectomy (RN), which were mainly performed laparoscopi-

cally. The rate of open RN vs. laparoscopic NE has increased in patients with larger tumor sizes and tumors located in the right kidney [16]. Elderly patients with T1a are treated with RN more frequently than with PN [16]. A higher rate of indication of PN

Table 2. Result of histology in surgically treated tumors mentioned in Table 1:

Histology in 2002-III/2016		
Histology	Total number	Percentage
CRCC	1673	75.9%
PRCC	213	9.7%
ChRCC	58	2.6%
oncocytoma	92	4.2%
angiomyolipoma	48	2.2%
others	120	5.4%
Together	2204	100.0%

RCC – renal cell carcinoma, CRCC – clear, PRCC – papillary, ChRCC – chromophobe. The 2016 WHO classification is used [13]

by urologists at academic hospitals and a lower rate of PN in elderly patients are confirmed by several studies [10, 16, 17, 18]. Data from the USA (from the Healthcare Cost and Utilization Project Nationwide Inpatient Sample from 2009 to 2012) supports a higher rate of PN in teaching hospitals (cumulative rates of PN were 48% vs. 33% in teaching vs. nonteaching hospitals respectively ($p < 0.0001$) [10]. In the UK, the British Association of Urological Surgeons (BAUS) performed a survey in 2012 and found that the indications for NSS were: elective with a tumor of ≤ 4.5 cm in 59%, elective with a tumor of > 4.5 cm in 10% (relative in 7%, imperative in 12%). The median (range) tumor size was 3.4 (0.8–30) cm. The technique used was minimally invasive surgery in 42%, open in 58%, with conversions in 4% [9]. The situation in the whole Czech Republic is documented in a survey performed by the Czech Urological Society and by the National Health Information System (NHIS). Selected urological surgical procedures were quantified in the a six-year period (2009–2014). A total of 20 634 (4 809 – 23.3% resections; 6 772 – 32.8% laparoscopies) urological procedures for kidney tumors (without any stratification by cT category) were performed in the mentioned period [19]. Nephron sparing surgery is generally underutilised [10, 20, 21, 22], but our presented study shows it can be performed in over 85% of cT1a cases (Figure 5). When technically feasible, RN is no

longer an acceptable option when a PN is indicated, and might even be considered as malpractice [14]. The indications for nephrectomy in cT1a remain mainly centrally located tumors and tumor combined with other pathologies (e.g. end-stage kidney disease). What is a role of laparoscopy? In at least half of all cases (not only nephrectomies but also resections), laparoscopy can be applied. Laparoscopic surgery is technically more difficult and more expensive than open surgery, but is a more comfortable option for patients [15, 23]. Laparoscopic/robotic surgery is more commonly recommended by academic urologists and for patients under 65 year of age [24]. Robotic technology is associated with increased use of PN [25]. However, the open approach remains an important part of kidney tumor surgery. Open resections are indicated mainly in more complex tumors with higher nephrometry scores [26]. Open nephrectomy remains the standard for treating patients with the following findings: large advanced-stage tumors and/or perinephric extension, lymphadenopathy, thrombus in the renal vein and vena cava inferior – frequently with need of cooperation of urologist with cardiovascular surgeons [12, 27–30].

CONCLUSIONS

Resections and minimally invasive approaches are being performed more frequently and are the preferred methods in surgical treatment of kidney tumors. Clinical sequences are the following: resection (laparoscopic > open) > nephrectomy (laparoscopic > open). Resection is now (2016) indicated in about 60% (open vs. laparoscopic resection are used nearly equally with a slight tendency for laparoscopic predomination). In the cT1a category (tumors up to 4 cm, making up approximately 50% of all surgically treated tumors), resection is possible in about 85–90% of cases. Over 60% of all tumors are treated with a laparoscopic approach. The open approach is indicated mainly in resections of more complex tumors and in nephrectomy for locally advanced tumors.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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