

Intraoperative ultrasound for safer resection margins during robotic assisted partial nephrectomy: A single-center experience and review of the literature



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INTRODUCTION

At present, partial nephrectomy is the standard technique allowing having the same oncological results as total nephrectomy while limiting nephrons loss, eventually preserving renal function [1]. This improved renal function compared to total nephrectomy might explain better survival rates observed in several retrospective studies [2]. Thus, the committee of cancer of the French Association of urology recommends a partial nephrectomy for all localized renal tumors classified T1, as well as for tumors classified T2, if the surgery is technically feasible. It is therefore compulsory to remove the entire tumor with a healthy margin of renal parenchymal tissue, although tumor enucleation with negative margins is also allowed. In this study, we propose an intraoperative ultrasound identification to control the margins of resections.

PATIENTS AND METHODS

This is an observational prospective study in which all patients operated in our department with a partial nephrectomy for a T1 or T2 kidney tumor between September 2017 and February 2018 were included.

OPERATIVE TECHNIQUE

All patients were operated on by Da Vinci® robot laparoscopic partial nephrectomy. After dissection of the kidney and pedicle, an intraoperative ultrasound was performed by the assistant to guide the operator to delineate the resection margins with electrocoagulation (Figure 1). Under pedicular or selective clamping if possible, partial nephrectomy was performed in a standardized way, while taking care to limit warm ischemic time and to ensure good hemostatic control at the end of the procedure. The piece was extracted with an endo-bag by the 12 mm trocar of the aid. A Jackson Pratt drain was left in contact with the section slice and removed on the second postoperative day. The duration of the ischemia was recorded in the file.

ULTRASOUND

We used a 5-12 Mhz probe, available in our operating room. We evaluate the size of the mass to resect; its depth and visualize the pseudo capsule. (Figure 2). The duration of the ultrasound use was recorded in the file for each case.

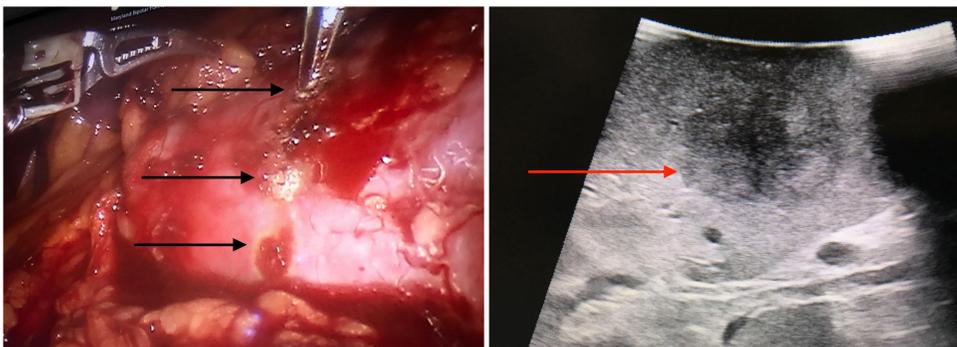


Figure 1:
Delineating surgical margins of resection guided by ultrasound (arrow)



Figure 2:
The tumor with its pseudo capsule (arrow) are visualized

RESULTS

The histopathological report was standardized according to the recommendations of the CCAFU notably concerning the histological type, the tumor size, the Fuhrman grade, the surgical margins and the TNM classification.

Four men and three women were included in the study. The characteristics of the patients have been summarized in a table.

The median age of patients is 67 years (58-78). All partial nephrectomies were performed by the different senior surgeons of our department. Four partial nephrectomies were performed on the right versus three on the left. The nephrometry score R.E.N.A.L. (NS) ranges from 4 to 8 with an average of 6.4. The mean duration of the spotting and electrosurgical marking of resection margins was 214s (160-290). Three patients underwent selective clamping. The average duration of clamping was 15.6 (10-25) minutes. The final histopathological findings confirmed the presence of negative margins in all cases.

Age	Sex	Side	R.E.N.A.L. nephrometry score	OR time in minutes	Selective renal artery	Warm ischemic time in minutes	Sampling size in cm	Tumor size (major axis)	TNM	Fuhrman grade
71	W	Right	6	120	No	12	3,5 x 1,7 x 1,2	2,1	pT1a	3
72	W	Left	4	175	Yes	19	2,5 x 2 x 1,2	2,2	pT1a	3
78	M	Right	7	165	No	10	4,5 x 3,5 x 3	3,6	pT1b	2
58	M	Right	6	195	No	12	2 x 1,5 x 1,2	1,6	pT1a	2
66	M	Right	7	90	Yes	17	2 x 1,5 x 1,2	1,7	pT1a	2
52	M	Left	8	110	Yes	25	7,2 x 6,5 x 6	5,8	pT2a	3
73	W	Left	7	135	No	14	9 x 7 x 4	8,1	pT2a	2

Table 1:
Characteristics of the patient population.

DISCUSSION

The Cancer Committee of the French Urology Association recommends partial nephrectomy for the treatment of localized kidney cancer whenever feasible. A complete resection with negative surgical margins becomes the challenge. Unlike surgeries for other cancers such as lumpectomy in breast cancer, there is a major challenge when performing a partial nephrectomy: the limited time of renal clamping. In fact, it was the reason behind abandoning extemporaneous histological analysis of surgical margins as the inevitable delay in getting the results unequivocally cause nephrons loss. To overcome this problem, another technique has been proposed: the macroscopic extemporaneous examination by the naked eye. According to Hagemann and Lewis (3) gross intraoperative consultation of tumor section have obtained a sensitivity of 75%. For Timsit et al. (4) these values are improved if the margins are evaluated macroscopically directly by the surgeon himself and thus will obtain a sensitivity of 100% and a specificity of 96%. Unfortunately, there is no randomized comparative study of the different techniques for assessing surgical margins.

The use of ultrasound intraoperatively can help identifying the depth of tumor extension in the renal parenchyma and allows complete excision of the tumor with safe margins with the help of delineating the renal capsule using electrocautery.

Despite the limited number of patients included in our study, it would seem from our results, that the practice of intraoperative ultrasound by an urologist is easy and efficient as satisfactory results were obtained. There was no actual need for a radiologist intra-operatively as the surgeon assistant requires only basic notions of ultrasound to be able to perform the task and to locate the tumor.

In addition, the average duration of localizing the mass and delineating resection margins with electrocautery was only 214s.

The intraoperative ultrasound technique has demonstrated advantages notably thanks to the presence of the pseudo tumor capsule, as well as the relatively short amount of time to localize and delineate the tumor thus allowing eventually rapid hemostasis and reduced clamping time.

Nevertheless, in literature, the role of positive margins in the is discussed in partial nephrectomy. The positive surgical margin increases the risk of local recurrence but appears to have a limited oncological impact in the medium term, while remaining subject to close supervision that allows for catch-up treatment in case of recurrence [5]. It therefore seemed logical and legitimate to propose a complete excision of the tumor and to avoid as far as possible any positive margins.

The control of resection margins during partial nephrectomies with intraoperative ultrasound seems of utmost importance.

CONCLUSIONS

The technique of controlling the resection margins of partial nephrectomies by intraoperative echography seemed efficient, effective and easy to perform by an urologist, without a significant increase in warm ischemia time. This technique, however, still needs to be evaluated by larger-scale prospective studies.

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