

# Outcome of laparoscopic nephron sparing surgery using a Satinsky clamp for hilar control: A trusted tool (SKIMS experience)

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## Abstract

**Background:** Nephron sparing surgery is a well-established surgical procedure for patients with small/bilateral renal masses. During the procedure, hilar control can be achieved by using bulldog clamps individually on the renal vessels, the renal artery alone without clamping the vein, or a laparoscopic Satinsky clamp for en bloc hilar clamping. In our series, we described the outcome of laparoscopic nephron sparing surgery using a Satinsky clamp for hilar control.

**Materials and methods:** All eligible cases with confirmed diagnosis of a renal mass were advised of nephron sparing surgery. The short-term outcomes were evaluated by warm ischemia time (using a Satinsky clamp especially when CT renal angiography was not available), average blood loss, and length of postoperative hospital stay. The oncological outcome was evaluated by noting the surgical margins of histopathological specimen, local recurrence, and distant metastasis.

**Results:** Of 30 cases 20 were male. The mean age was 54.25 years. On preoperative evaluation, 24 cases were T1a stage and the rest were 6 T1b stage. Four tumors were located in the upper pole, 4 in the posterior midpole, and 22 in the lower pole. Twenty-six patients had a low complexity score on RENAL scoring (ie, 4–6) and 4 patients a medium complexity score (ie, 7–9). Three patients were converted to open partial nephrectomy because of technical difficulty in intracorporeal suturing and difficulty in achieving hemostasis. Among these 3 patients, 2 patients had posterior base tumors and 1 had a lower polar tumor. Average blood loss was 350ml, warm ischemia time was 28.46 minutes, and postoperative stay was 4.55 days. Of 30 specimens for histopathology, 23 (76%) were clear cell renal cell carcinoma (RCC), 4 (13%) were papillary RCC, 1 (3.3%) was chromophobe RCC, whereas 2 (6.6%) were benign (oncocytoma). Margins were free of tumors in all the patients with no recurrence in 2 years of follow-up.

**Conclusion:** Laparoscopic partial nephrectomy by using a Satinsky clamp as a tool for en bloc hilar clamping in the proper axis at the hilum takes care of multiple vessels irrespective of size and number, particularly when renal angiography is not available. This technique of en bloc hilar clamping is quite useful especially in developing countries where robotic facilities are not available. The Satinsky clamp decreases blood loss and intraoperative time.

**Keywords:** Hilar control; Nephron sparing surgery; Renal cell carcinoma; Small renal masses

## 1. Introduction

There is an increasing incidence of incidentally detected asymptomatic small renal masses (SRM). Renal masses can be classified based on radiographic appearance as simple cystic, complex cystic, or solid.<sup>[1]</sup> Etiologically, these can be malignant, benign, or inflammatory.<sup>[2]</sup> Nephron sparing surgery (NSS) is a well-established surgical procedure for patients with small or bilateral renal masses that entails complete local resection of the tumor while leaving the largest possible amount of functioning

parenchyma in the involved kidney. A recent trend has been to perform NSS by minimally invasive approaches with several series showing encouraging results. For minimally invasive approaches either pure laparoscopic or robotics, the aim is to replicate the surgical steps of open partial nephrectomy, with control of renal vasculature, excision of the tumor with negative surgical margins, followed by repair of the pelvicalyceal system and renorrhaphy of the surgical defect. In our series, we described the outcome of laparoscopic NSS using a Satinsky clamp for complete occlusion of renal vasculature for tumor excision and the oncological outcome of retrieved specimens.

## 2. Materials and methods

In this case series all eligible cases in whom the diagnosis of renal mass was confirmed were advised of NSS. All patients in our study had SRMs confirmed by abdominal ultrasound and a CT urogram. No CT renal vasculature details were available. Work-up of patients included a detailed history and a general physical examination with base line investigations. No repeat contrast study was done to assess renal vasculature details preoperatively in order to avoid any additional contrast nephrotoxicity. Thirty

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**Table 1**

**Characteristics of the renal lesions and operative outcomes (n=30).**

Items	Value
Sex, <i>n</i>	
Male	20
Female	10
Stage, <i>n</i>	
T1a	24
T1b	6
Location, <i>n</i>	
Upper pole	4
Midpole	4
Lower pole	22
RENAL score, <i>n</i>	
4–6	26
7–9	4
≥ 10	0
Average blood loss, mL	350
Average warm ischemia time, min	28.46
Renal arteries, <i>n</i> (%)	
Solitary	25 (83%)
Multiple	5 (16.66%)
Laparoscopic NSS done successfully, <i>n</i> (%)	27 (90%)
Laparoscopic converted to open NSS, <i>n</i> (%)	3 (10%)
Histopathological examination, <i>n</i>	
Clear cell	23
Papillary	4
Chromophobe	1
Oncocytoma	2

NSS = nephron sparing surgery.

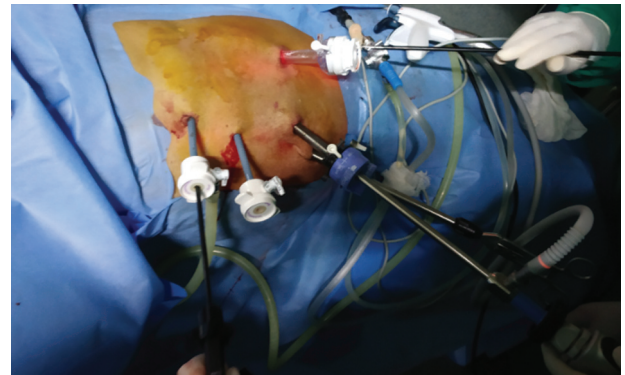
cases were included in our study (Table 1). The short-term outcomes were evaluated by warm ischemia time (using a Satinsky clamp especially when CT renal angiography was not available), average blood loss, and length of postoperative hospital stay. The oncological outcome was evaluated by noting the surgical margins of histopathological specimen, local recurrence, and distant metastasis.

**2.1. Surgical technique**

Port placement is the standard technique for laparoscopic nephrectomy with one extra 10mm port placed in line of the umbilicus for placement of the Satinsky clamp (Figs. 1 and 2).



**Figure 1.** Port placement in laparoscopic partial nephrectomy.



**Figure 2.** Port placement and Satinsky clamp placement in laparoscopic partial nephrectomy.

Complete hilar dissection with separation of either single/multiple renal artery and vein was done to achieve complete occlusion and for Hem-o-lok clips to be separately applied, if the need arose for radical nephrectomy. The same Satinsky port was used for specimen retrieval with a little extension of the incision through the midline (no muscle splitting).

**2.2. Postoperative care**

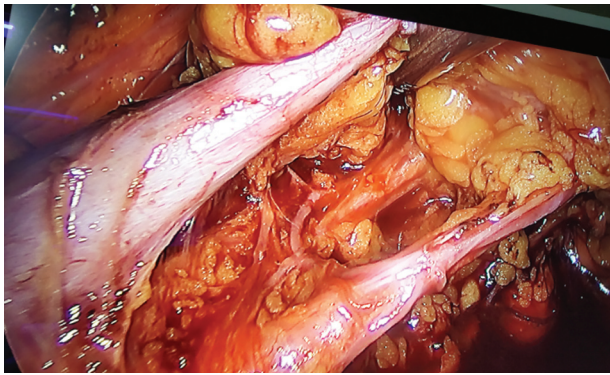
All the patients were mobilized on the second postoperative day and the catheter was removed once patients were pain free. The postoperative stay of patients ranged from 2 to 8 days with a median of 4 days.

**3. Results**

Of the 30 cases, 20 were male (Table 1). The mean age was 54.25 years and 24 cases were T1a stage on preoperative evaluation and the rest were 6 T1b stage. Four tumors were located in the upper pole, 4 in the posterior midpole, and 22 in the lower pole. Twenty-six patients had a low complexity score on RENAL scoring (ie, 4–6) and 4 patients a medium complexity score (ie, 7–9). Three patients were converted to open partial nephrectomy because of technical difficulty in intracorporeal suturing and difficulty in achieving hemostasis. Of these 3 patients, 2 had posterior base tumors and 1 had a lower polar tumor. Average blood loss was 350 mL, warm ischemia time was 28.46 minutes, and the postoperative stay was 4.55 days. Histopathology showed 23 (76%) had clear cell renal cell carcinoma (RCC), 4 (13%) had papillary RCC, 1 (3.3%) had chromophobe RCC, and 2 (6.6%) were benign (oncocytoma). Margins were free of tumors in all the patients with no recurrence in 2 years of follow-up.

**4. Discussion**

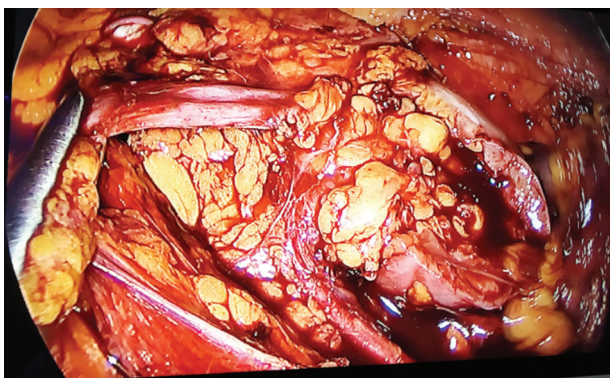
The incidence of incidental SRM has increased because of increased use of abdominal imaging (ultrasound, CT, MRI) for abdominal complaints. NSS has emerged as the standard treatment for SRM. The classical radical nephrectomy is deemed excessive in the surgical excision of SRM. Multiple retrospective studies have shown no difference between partial and radical nephrectomy in patient with SRM in cancer-specific survival and rate to distant metastasis in long-term follow-ups. Preservation of renal function with NSS partial nephrectomy was initially proposed for the surgical management of patients in such a subset



**Figure 3.** Multiple renal vessels.

in which radical nephrectomy would render them functionally anephric,<sup>[3]</sup> for example, patients with bilateral renal tumors, tumors in a solitary kidney, or with pre-existing renal insufficiency.<sup>[4]</sup> Due to the excellent results seen in these patients, the indications for NSS have been expanded to include all patients with small renal tumors (<4 cm). In T1b (4–7 cm) an increasing trend exists towards the NSS when possible.<sup>[5,6]</sup>

Laparoscopic partial nephrectomy has equivalent oncologic outcomes to open partial nephrectomy and replicates the same surgical steps of open partial nephrectomy, as control of renal vasculature, excision of the tumor with negative surgical margins followed by repair of the pelvicalyceal system and renorrhaphy of the surgical defect. Transient vascular occlusion at the hilum is an important step in laparoscopic NSS to facilitate complete excision of the tumor, with a relatively bloodless surgical field to achieve goals of partial nephrectomy. Multiple tools are widely used for such occlusion as laparoscopic Satinsky vascular clamps, bulldog clamps, and the vessel loop Hem-o-lok clip system. Each tool has its advantages and in our series we used a laparoscopic Satinsky vascular clamp for *en bloc* hilar control. Reasons for choosing the laparoscopic exteriorized handheld vascular Satinsky clamp (Figs. 3 and 4) for renal ischemia are: (1) ease of introduction, (2) angled jaw, (3) reusability, (4) cheapness, (5) complete occlusion and more effective if there is any arteriosclerosis, (6) does not interfere during dissection, if properly aligned, (7) single or multiple renal arteries can be occluded all at once, and (8) will not get lost in the peritoneal cavity because of exteriorized handheld vascular clamp. Disadvantages are: (1) separate trocar for hilar



**Figure 4.** Application of Satinsky clamp with completion of partial nephrectomy.

control and (2) difficult to apply in the retroperitoneal approach (restricted work space). In our study (Table 1) patients undergoing NSS had an average age of 54.25 years and there were more males than female. Similar results were observed by Hew et al.<sup>[7]</sup> and Roos et al.<sup>[8]</sup>

In our study (Table 1), 70% of patients were incidentally diagnosed, whereas the rest of the patients had nonspecific abdominal discomfort. None of the patients in our study presented with the classical triad of flank pain, hematuria, and fever, although 2 patients had flank discomfort and microscopic hematuria. We found that 80% of patients undergoing NSS at our institute had clinical stage T1a (<4 cm) and 20% had T1b (4–7 cm). Most of the earlier literature recommended partial nephrectomy in T1a stage, whereas newer studies extended the stage to T1b and some up to T2a. In the study by Brewer et al.,<sup>[9]</sup> they compared NSS in T1b and T2a and concluded that in the hands of an expert surgeon the result of complication was the same.

Histopathological examination showed 23 (76%) had clear cell RCC, 4 (13%) had papillary RCC, 1 (3.3%) had chromophobe RCC, whereas 2 (6.6%) were benign (oncocytoma). Similar findings were also reported by Crispin et al.,<sup>[10]</sup> Datta et al.,<sup>[11]</sup> and Mubarak et al.<sup>[12]</sup>

None of our patients (Table 1) had a positive surgical margin because of the sensible and selected patient population with the majority of renal tumors being exophytic and nonhilar in nature and probably the small number of patients. Permpongkosol et al.<sup>[13]</sup> found a positive surgical margin of 1.8% (9 out of 511) and Breda et al.<sup>[14]</sup> found 2.4% (21 out of 855) in minimally invasive partial nephrectomies.

Of 30 surgeries (Table 1) 27 (90%) procedures were successfully completed, whereas 3 (10%) cases were converted to open partial nephrectomy because of technical difficulty in intracorporeal suturing and difficulty in achieving satisfactory hemostasis (only V-loc 2-0 sutures were used for repair with Hem-o-lok clips). Of these 3 patients, 2 had posteriorly base tumors and 1 had a lower polar tumor. In a study by Rais-Bahrami et al.,<sup>[15]</sup> they found conversion to radical nephrectomy in 35 (13.6%) cases out of total of 257 of minimally invasive NSS. Average blood loss in our study was 350 mL and warm ischemia time was 16–35 minutes with an average of 28.46 minutes. Similarly, in study by Dar et al.<sup>[16]</sup> warm ischemia time was 30.1 minutes in 17 patients.

We introduce a simple descriptive term for the trusted tool Satinsky clamp in laparoscopic NSS as: S = Safe, AT = Atraumatic, I = In, N = Nephron, S = Sparing, K = Kidney tumors, Y = Yields good results. In our study for transient occlusion of renal vasculature for renal space occupying lesion excision laparoscopically, we utilized laparoscopic vascular Satinsky clamps (Figs. 3 and 4) for the reasons stated above and we advocate laparoscopic Satinsky clamps can be safely used in patients without renal angiography. We are not advocating superiority over other tools for vascular control as it depends upon the surgeon and institute’s preference. Prolonged ischemia (occluding both artery and vein) can result in postoperative acute tubular necrosis and acute renal failure, and this becomes an issue particularly when the other kidney has a compromised function or is a solitary kidney.

## 5. Conclusion

Laparoscopic partial nephrectomy by using a Satinsky clamp as a tool for *en bloc* hilar clamping in the proper axis at the hilum takes care of multiple vessels irrespective of size and number

particularly when renal angiography is not available. This technique of *en bloc* hilar clamping is quite useful especially in developing countries where robotic facilities are not available. The Satinsky clamp decreases blood loss and intraoperative time.

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None.

### Statement of ethics

The Ethics committee of the hospital approved the study with the Ethical number IEC 27U, and all patients provided written informed consent for the participation in the study. All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

### Conflict of interest statement

No conflict of interest has been declared by the author.

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None.

### Author contributions

Manuscript writing: Abdul Rouf Khawaja, Shaysta Ali, Yasir Dar;

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