

## Pediatrics

## Zero ischaemia open partial nephrectomy using Thulium laser in pediatric renal tumor: A first experience

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## Introduction

The management of localized kidney tumors has changed, resulting in a shift from radical nephrectomy toward more frequent use of partial nephrectomy (PN). For many patients with small clinical T<sub>1</sub> renal tumors (< 7 cm) who are candidates for nephron-sparing surgery, PN is now the reference standard treatment<sup>1</sup>.

Laser technology, such as diode laser and holmium laser, has been reported in very selected series for PN since 1985.<sup>2</sup> Thulium laser utilization in pediatrics partial nephrectomy has not been significantly evaluated. Therefore, we reported this study to know its affectivity and efficacy in open PN especially in pediatric patient.

## Case presentation

A 10-year-old female patient with a symptom of dyspepsia was suspected having renal tumor from ultrasound. The tumor was confirmed by contrast abdominal CT scan investigation, located at lower pole of left kidney with size 4 × 3 × 3 cm (see Fig. 1A). No metastasis was found.

The patient underwent open PN with transverse upper abdominal (modified Chevron) incision. After approaching the renal hilum, renal artery and vein were identified. Vessel loop encircled both pedicle individually as a preparation to control unintended bleeding if necessary. We used the Thulium laser (RevoLix DUO<sup>®</sup>) with power 30–50 Watt to resect superficial aspect until close to central aspect of the tumor. Cavitron Ultrasonic Surgical Aspirator/CUSA (SONOCA 300<sup>®</sup>) in frequency 25 kHz then used to resect inner part of the renal since CUSA has the ability of destroying and suctioning the tissue without destroying the vessels. Larger vessels from the resection bed were then

ligated and opened pelvicaliceal system was repaired using Vicryl<sup>®</sup> 4–0. Renorrhaphy was performed using Vicryl 3–0 (See Fig. 1B–D).

The pedicle did not need cross-clamping at any time during tumor resection or renal reconstruction. The operative time was 180 minutes, tumor extirpation time was 33 minutes. There was no any urine leaks revealed through the intraabdominal drain postoperatively. Blood loss was not significant. Patient discharged four days after surgery. The serum creatinine and hemoglobin level were nearly unaltered before and after surgery.

The pathologic result of the patient's tumor was papillary renal cell carcinoma. All resections margins had negative results for tumor (See Fig. 2A, B).

The renal function and laboratory results before and soon after surgery; 2 months, 6 months, and 12 months after surgery are summarized in Table 1.

There is no recurrent tumor seems in follow up PET scan and no bone metastatic lesion in bone scan was found 6 months after surgery (See Fig. 2C, D).

## Discussion

This was the first case report that showed the use of zero ischaemia open PN technique for treating renal cell carcinoma in pediatric patient and had follow up result until 1 year after surgery. Duration of warm ischemia is the largest modifiable risk factor during PN in either solitary or two kidney settings. Studies investigated the role of nephron-sparing surgery in tumors within solitary kidneys have highlighted the risk of postoperative acute renal failure and new onset stage IV chronic kidney disease as a result of prolonged warm ischemia.<sup>3,4</sup>

The term “zero ischemia” in PN implies that tumor resection and

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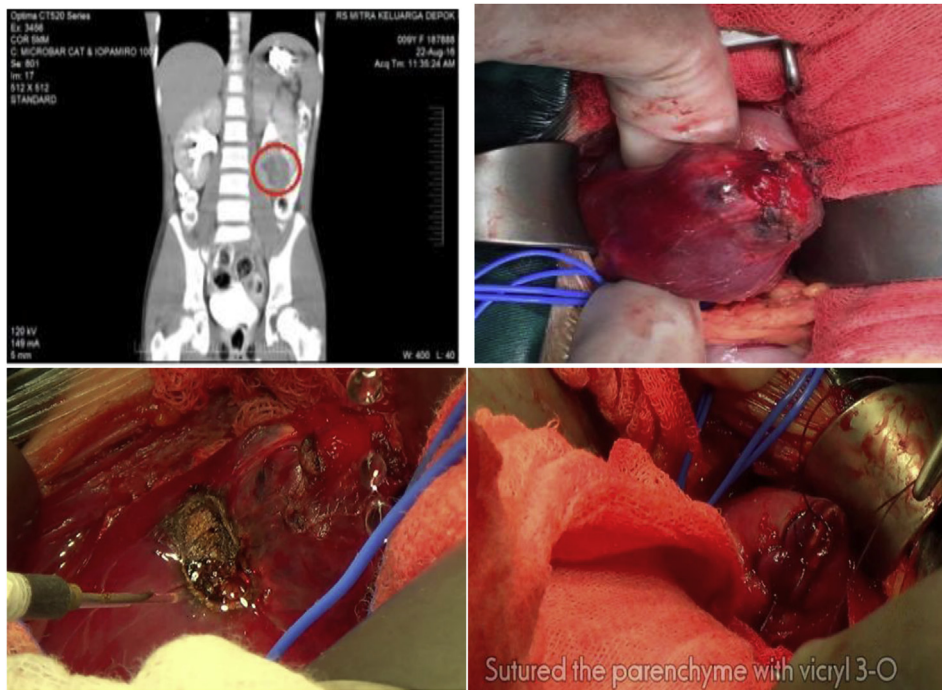


Fig. 1. A. CT scan findings (axial), B. Intraoperative clinical finding of the tumor. C. Tumor excision with Thulium laser (Revolix DUO). D. Renorrhaphy with Vicryl 3-0.

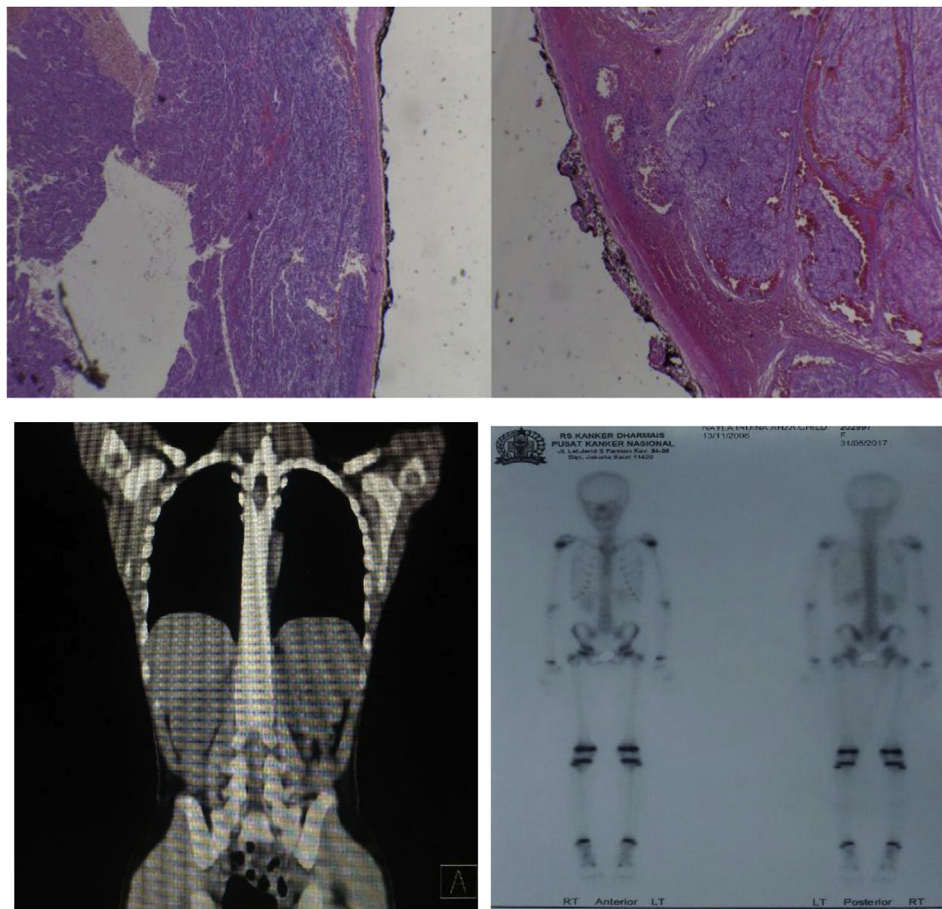


Fig. 2. A,B. Post operative histopathology findings, C. Follow up PET Scan, and D. Follow up bone scan 6 months after surgery.

**Table 1**  
Laboratory outcomes before and after surgery.

No	Laboratory Results	Pre-Op	Post-Op	2 months after surgery	6 months after surgery	12 months after surgery
1	Complete Blood Count (Hb/Ht/WBC/ Platelets)	12.5/37.9/10,290/ 273,000	10.0/37.2/24,200/ 223,000	12.7/36.9/12,500/ 316,000	13.6/39.3/8900/ 225,000	13.6/39.8/6570/ 199,000
2	Ureum/creatinine	25/0.4	19/0.36	30/0.45	28/0.6	24/0.5

renorrhaphy were completed without hilar clamping and not subjecting the resected kidney to ischemic stress. In our case, the main pedicles were just hanged by the vessel loop loosely so that if it is needed we can clamp the vessels easily.

Even though many different methods to minimize bleeding have developed for non clamping nephron-sparing surgery including hand pressure at proximal side of the tumor, the uses of advanced energy sources are potential alternatives.

The Thulium laser emits energy at a wavelength of 2013 nm in a continuous wave fashion. Although it has the same absorption characteristics as a holmium laser in water and tissue, it has superior properties in soft tissue surgery because of the continuous-wave output, resulting in smooth incision and vaporization of tissue with excellent hemostasis.<sup>5</sup> Most of tumor resection was safely done by Thulium laser and CUSA used to reveal the larger vessel at the center aspect.

Our case shows excellent perioperative functional and pathologic outcomes, including minimal blood loss, zero ischemia, negative results for tumor margins, and preservation of renal function. The laboratory, PET scan, and bone scan results until 6 months follow up showed good results with no sign of recurrence and metastasis. After surgical excision, 20–30% of patients with localized tumors experience relapse. Since the median time to relapse after surgery could occur within 3 years, it is still necessary to follow up this patient for longer period to ensure the good result.

## Conclusions

Thulium laser demonstrated acceptable hemostasis and precise

resection capability of the renal cortex during open partial nephrectomy without ischaemia. It showed promising perioperative and postoperative outcomes in pediatric patient including minimal blood loss, negative tumor margins, short length of hospitalization, preservation of renal function, and no recurrence after 6 months of follow up.

## Consent

This report has been consented by the patient's parents.

## Conflict of interest

The author declare they have no conflicts of interest.

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