

## External Oblique Muscle Wrap Technique for Renal Defect Closure Following Open Partial Nephrectomy and Anatomic Nephrolithotomy - A Novel Technique

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### Abstract

**Introduction and Objectives:** Open partial nephrectomy for appropriately selected renal tumours results in equivalent oncologic outcomes with less morbidity than radical nephrectomy. While bolsterless partial nephrectomy techniques exist for small tumors, as urologists attempt to excise larger lesions, securing hemostasis and closure of the parenchymal defect remain utmost importance to prevent complications. We describe a new technique of External Oblique Muscle Wrap, a tension free practical alternative in closing the renal defects after open partial nephrectomy and anatomic nephrolithotomy.

**Methods:** A new technique “external oblique muscle wrap” where external oblique muscle was placed in the tumour crater to close the renal defects that occur following partial nephrectomy for Renal Cell Carcinoma in 11 consecutive patients and 3 cases of anatomic nephrolithotomy between June 2017 - June 2018. Post-operative follow-up included physical examination, laboratory tests and radiological screening at 3 monthly intervals for the first year, at 6 monthly intervals for the second year, and annually thereafter

**Results:** There is no evidence of post-operative urinoma, urine leak, infection or graft necrosis in all 14 patients in post-operative period and were followed up.

**Conclusion:** Our new technique external oblique muscle wrap provides benefit in securing local hemostasis, simplifies parenchymal suturing and helps in tension free coaptation of the edges of tumor bed defect, and minimises nephron loss due to kinking and tearing of renal parenchyma in closure of renal defects following renal tumour excision and anatomic nephrolithotomy.

**Keywords:** Anatomic nephrolithotomy; External oblique muscle; Partial nephrectomy; Renal tumour

### Introduction

The surgical treatment of Renal Cell Carcinoma (RCC) has developed towards nephron sparing surgery and the use of minimally invasive techniques in the recent years. The emerging conservative technique is Partial Nephrectomy (PN), which is no longer an option reserved for patients with a single kidney or bilateral renal tumours, it has become a viable alternative to radical nephrectomy, partial nephrectomy is considered as the treatment of choice for selected patients with a normal contralateral kidney [1]. Recent studies have demonstrated the merits of Partial Nephrectomy (PN) as the preferred alternative to radical nephrectomy for small renal

masses [2]. Patients have been found to be at lower risk of developing chronic kidney disease [3], lower risk of overall mortality [3-5] and oncologic outcomes are reported to be equivalent in those with tumours < 7 cm [3]. While PN has become increasingly utilized, especially at academic centres [6] but the disadvantage of partial nephrectomy might be the risk of complications, both early and late, including urine leak, fistula formation, ureteral obstruction, delayed bleeding and pseudoaneurysm [7,8] that are effectively absent with radical nephrectomy. These complications are mainly attributed to inadequate closure [9].

### Standard Techniques of Crater Closure

The standard PN closure involves repair of the collecting system and vasculature followed by approximation of the renal

capsule with simple interrupted 3-0 absorbable sutures. Ozkan described the “lipocorticoplasty”, in which perirenal fat is wrapped in Surgicel and sutured into the defect without capsule closure [10]. Hayn and colleagues repaired PN using single layer closure using a slightly straightened CPX needle [11]. Perirenal fat or a hemostatic agent, such as Surgicel (Ethicon, Somerville, NJ, USA) may also be inserted into the defect. A number of additional closure techniques have been described. Gorin and associates discussed a closure with sliding clips, similar to those used in laparoscopic and robotic approaches, while Sammons used barbed sutures in patients undergoing robotic PN [12]. Here we introduce a novel closure technique in which “external oblique muscle wrap” is used to reduce tension on the site of closure following PN.

### Brief Anatomy of External Oblique Muscle

The External Oblique Muscle (EOM) is one of the muscles that forms the anterior abdominal wall. Its free inferior border forms the inguinal ligament, and its aponeurotic part contributes to the anterior wall of the inguinal canal. It originates from outer surface of the shaft of the lower 8 ribs and gets inserted in to upper aponeurotic fibres to the whole length of the linea alba and extends to the pubic crest and the pectineal line, lower fleshy fibres to the outer lip of the anterior end of the iliac crest. Innervation of EOM by segmental supply by lower 6 thoracic nerves (T<sub>7</sub>-T<sub>12</sub>). The upper part of the muscle is supplied by the lower intercostal arteries, and the lower part is by the deep circumflex iliac artery branches. Venous drainage follows the arterial supply.

### Material and Methods

A new technique “external oblique muscle wrap” where external oblique muscle was placed in the tumour crater to close the renal defects that occur following partial nephrectomy in 11 consecutive patients and 3 cases of anatomic nephrolithotomy between June 2017 - June 2018. Post operative follow up included physical examination, laboratory tests and radiological screening at 3 monthly intervals for the first year, at 6 monthly intervals for the second year, and annually thereafter (Figures 1-6).

#### Patients Characteristics:(Partial nephrectomy)

	Renal cell carcinoma(RCC)(n=11)
Age(mean)	60 years
Affected side	Right-6, left-5
Size of tumor (mean)	4.8cm
Associated comorbidities	Nil
Gender	Male-8, Female-3
Mean operative time	210min to220 min

Tumor site	Lower pole-9,Upper pole-2
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#### post-operative pathological details

Histology	Number of patients
Clear cell rcc	6
Chromophobe rcc	3
Papillary rcc	2

#### Patient characteristics:(anatomic nephrolithotomy)

	Renal Calculi(n=3)
Age(mean)	55 years
Affected side	Left(all patients)
Size of stone(mean)	3.5cms
Associated conditions	nil
Gender	Male(all patients)
Mean operative time	190 min

#### Novel closure technique (Procedure with images):



**Figure 1:** Exophytic renal cell carcinoma.



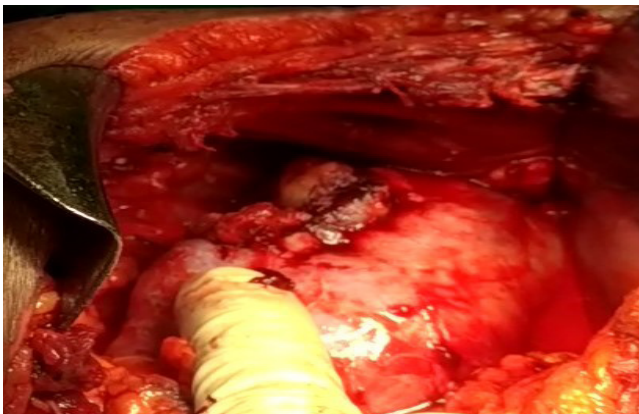
**Figure 2:** Renal crater - post partial nephrectomy.



**Figure 3:** External oblique muscle 8\*3 cm harvested.



**Figure 4:** Placing of External oblique muscle over renal crater.



**Figure 5:** External oblique strip of muscle anchored to renal parenchyma with absorbable sutures.



**Figure 6:** Muscle wrapped over renal parenchymal defect.

### Procedure:

The key to any PN closure is a delicate combination of hemostasis from tissue compression while maintaining a suture line with as little tension on the renal capsule as possible to prevent tearing through renal parenchyma. Our experience using external oblique muscle wrap to bolster the edges of the tumor defect has resulted in both effective closure and limited major postoperative complications.

In all our cases, Under general anaesthesia first in dorsal lithotomy position, using 6fr ureteroscope we placed a 4fr ureteric catheter in pelvicalyceal system of affected side, then patient changed to flank position(lateral position - for right side it is left lateral position and for left side it is right lateral position), 11 th rib cutting incision made and retro peritoneum entered by extra pleural and extra peritoneal approach, Then the renal hilum is dissected out, the renal artery and vein isolated, and vessel loops placed around them for control and bull dog clamp applied. The site of incision in the renal capsule is then marked circumferentially, approximately 1 cm from the tumor to allow a tumor free negative margin. After complete resection of tumor, closure of visible bleeding vessels of cut edge of kidney and after confirmation of no leak from calyceal system by injecting methylene blue dye from ureteric catheter placed before. External oblique muscle of 8\* 3 cm from the superior portion of fleshy muscle divided as a free flap and wrapped over the renal crater and anchored to renal



capsule. The Renal Capsule surrounding the defect is sutured to external oblique muscle with 3-0 absorbable suture in a tension free interrupted closure, sparing the adjacent renal parenchyma for more sparing of nephrons. Abdominal drain placed in retroperitoneum and wound closed by layers. The amount of drainage fluid (DT) fluid is significantly lower in the immediate postoperative period compared to standard techniques.

There is no evidence of postoperative urine leak, urinoma, infections or abscess in the postoperative follow-up. Our experience using external oblique muscle wrap to bolster the edges of the tumor defect has resulted in both effective closure and limited major postoperative complications.

## Discussion

Bleeding following partial nephrectomy can be a devastating complication and can occur early or in a delayed fashion. Patients may present with increasing flank pain, gross hematuria, flank mass [13] or constitutional signs representative of hypotension including malaise, dizziness, light-headedness, or in rare cases, hypovolemic shock. Large series have shown the rates of postoperative bleeding following open PN to be less than 5% [14-16]. Swift action including fluid resuscitation, hemodynamic monitoring, judicious administration of blood products when needed, and, in cases of hemodynamic instability, embolization of the bleeding area is all necessary to ensure patient safety. Urinary extravasation following PN is another troublesome complication. It necessitates prolonged drain utilization, may lead to development of an abscess or the need for ureteral stent placement. Results from a review by Van Poppel showed rates of urine leak varied widely (0.7%-17.4%), but pooling results demonstrated an overall rate less than 4% [16].

Previous reports have discussed the use of Gore-Tex mesh to bolster partial nephrectomy closures [17] while others have reported the use of Polyglycolic Acid Mesh (PGA) [18] Both reports cite positive results with small cohorts. Wainstein et al argue that PGA is superior due to it being absorbed over time and thus causing less scarring. In our experience, the use of external oblique muscle wrap results in low amounts of scarring in the operative region, very little artifact on follow up CT, and is easier to manipulate during preparation and while operating.

## Conclusion

Results of our use of external oblique muscle wrap to bolster the renal capsule during defect closure following PN were good. We believe the inclusion of this material works to reduce the shearing force of the sutures on the renal capsule and parenchyma, allowing a significantly tighter closure that provides excellent hemostasis and prevents urinary extravasation. Studies from our experience has not demonstrated an increased rate of complications, compared to standard techniques.

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