Simplified hemostatic technique during laparoscopic partial nephrectomy

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ABSTRACT

Introduction: Laparoscopic partial nephrectomy (LPN) has gained popularity in recent years, although it remains a challenging procedure. Herein we describe our technique of renal defect closure using sutures as the sole means of hemostasis during LPN.

Surgical technique: The kidney is approached transperitoneally in a standard fashion. After the renal artery is clamped and the tumor has been excised, the defect is closed in two separate knot-free suture layers. The deep layer suture is continuous and involves deep parenchyma including the collecting system, if opened. The superficial layer suture approximates the margins of the defect using absorbable clips on one parenchymal edge only. No bolsters, glues or other additional hemostatic agents are used.

Results: At present this technique was applied in 34 patients. Tumor size ranged from 17-85 mm. Median warm ischemia time was 23 min (range 12-45) and estimated blood loss 55 mL (30-1000). There were no intraoperative complications or conversions to open surgery. No urine leaks or postoperative bleedings were observed.

Conclusions: This simplified technique appears reliable and quick, and therefore may be attractive for many urologic surgeons. Furthermore, the avoidance of routine use of additional hemostatic maneuvers may provide an economical advantage to this approach with no compromise of the surgical outcome.

INTRODUCTION

Laparoscopic partial nephrectomy (LPN) for the treatment of selected patients with a renal mass has gained popularity over recent years, although it remains a challenging and highly advanced laparoscopic procedure. The most demanding step during LPN is the suturing of the renal defect both because it requires advanced laparoscopic suturing skills and because the suture is performed under time pressure to minimize warm ischemia time. In addition to sutures, hemostatic agents such as glues, bolsters and argon laser, either alone or in combination, are often used during this step to achieve hemostasis (1).

The purpose of this study is to describe a technique of suturing renal defects during LPN that is quick and reliable, does not require additional hemostatic agents, and therefore represents an attractive option for urologic laparoscopic surgeons.
SURGICAL TECHNIQUE

The standard transperitoneal approach is used with 3-4 trocars as described elsewhere (2). Briefly, once the tumor has been identified and the incision track marked by cautery, the renal artery is clamped and the tumor excised in a standard fashion using cold scissors and suction. The specimen then is removed from the field.

The closure of the renal defect proceeds in two layers: the first layer comprises the tumor bed and the collected system, if opened. A single running suture is used for this deep layer and secured on both ends by absorbable clips (LapraTy®, Ethicon, Cincinatti, OH). Ureteral catheters or stents are not used in our institution to verify watertight closure or to protect collecting system closure. The second suture layer comprises the remaining kidney parenchyma. For this layer we use an interrupted running suture as illustrated in Figures 1A and B: the suture thread is prepared with an absorbable clip on its edge. At each passage through the parenchyma, a clip is applied to the thread after approximating the edges, so that the suture is secured with clips on both parenchymal edges upon completion of the first passage (Figure-1C). For subsequent passages, the clips are applied only on one side of the defect (Figures 1D and E). An additional clip may be applied proximally to increase tension. Additional suture passages are carried out as necessary, depending on the size of the renal defect (Figures 1G-F).

No adjunctive hemostatic measures, such as bolsters or glues, are taken, and so the suture is the exclusive means of hemostasis. The renal artery is then unclamped and adequate hemostasis is verified. The remaining of the procedure is carried out in the standard fashion.

The above-described suture technique in LPN was performed on 34 patients over the last 1.5 years (from July 2007 to February 2009). Patient and tumor characteristics are detailed in Table-1. We considered hilar tumors as those in direct contact with major renal vessels and/or renal pelvis, and central tumors were defined as masses abutting the collecting system; the remainder of the masses were considered peripheral. The median tumor size was 30 mm (range 17-85). The surgical

<table>
<thead>
<tr>
<th>Table 1 - Patient and tumor characteristics.</th>
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<tbody>
<tr>
<td>Variable</td>
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<tr>
<td>Age, years</td>
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<tr>
<td>Gender</td>
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<td>Male</td>
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<tr>
<td>Medial</td>
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<tr>
<td>Posterior</td>
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<tr>
<td>Operative time, mins</td>
</tr>
<tr>
<td>WIT</td>
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<tr>
<td>EBL, cc</td>
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<tr>
<td>Tumor pathology</td>
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<tr>
<td>RCC</td>
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<tr>
<td>AML</td>
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<tr>
<td>Oncocytoma</td>
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<tr>
<td>Cystic nephroma</td>
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| WIT: Warm ischemia time         |
| EBL: Estimated blood loss       |
| RCC: Renal cell carcinoma       |
| AML: Angiomyolipoma             |
margins were positive in one case. The median warm ischemia time was 23 min (range 12-45) and estimated blood loss was 55 mL (range 30-1000). There were no intraoperative complications and none of the 34 procedures was converted to open surgery. No urine leak was observed in the postoperative period. One delayed bleeding occurred 2 weeks after the procedure and was treated angiographically.

**COMMENTS**

Renal defect closure in LPN is usually accomplished by additional hemostatic measures (bolsters, glues, argon laser) on top of sutures (1). The simplified method of renal defect closure we devised and now describe does not require the use of additional hemostatic maneuvers other than suturing. This technical modification may reduce warm ischemia time and, therefore, possible damage to the organ. Although no direct comparison is made, the median warm ischemia time in this series was 23 minutes indicating a possible advantage of this hemostatic technique. Warm ischemia time during LPN can be divided into ischemia due to tumor resection and ischemia due to defect closure. The technique we describe affects the latter and, in our experience, is able to sensibly reduce warm ischemia time during this procedure by obviating the need to use bolsters, sealant or argon laser for achieving hemostasis.

Weight et al. (3) were able to avoid bolstered renorrhaphy in select patients using single layered suturing and thrombin sealant. Similarly, Nadu et al. (4) reported using no bolsters in renorrhaphy and closing the defect in two layers and enhancing hemostasis with biological glue. Orvieto et al. (5) used bolstered only in larger defects that could not be approximated by sutures alone, and Agarwal et al. (6) concluded that bolsters were not instrumental for hemostasis. Although a recent review article (7) referred to suturing over

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Figure 1 - Sequential steps of renal defect closure during laparoscopic partial nephrectomy with a refined technique

A, B, C, D, E, F, G, H
the bolster as the gold standard, to the best of
our knowledge, no study has demonstrated the
advantage of the bolster over conventional suture-
ing for renal defect closure. Nevertheless, many
laparoscopic surgeons use bolstered renorrhaphy,
probably because it “feels” safer.

Synthetic and biological glues for hemo-
statics were introduced to facilitate hemostasis dur-
ing LPn and a variety of different compounds is
commercially available. However, several authors
have reported that they do not use sealants during
LPN and have equally satisfactory results (2,5,6).
To date, the advantages of such sealants have yet
to be clarified. It is our impression that the use of
these materials also often falls under the category
of the aforementioned surgeon’s “feeling” safer.

We did not carry out a cost analysis, but it is
reasonable to assume that avoiding routine ap-
lication of additional hemostatic agents may re-
duce surgical costs without compromising surgi-
cal outcome. In our center, routine use of bolsters
and sealants in LPN has been abandoned since the
introduction of this new technique.

Standardizing the surgical technique is
beneficial not only for the surgeon performing
LPN but for those who learn it as well. Closing
the defect in 2 layers regardless of whether or not
the collecting system is opened represents an-
other advantage of this technique refinement that
brings to a further standardization of the surgical
technique in LPN that may increase reproducibil-
ity and facilitate learning.

Finally, this technique does not preclude
the use of additional hemostatic maneuvers if nec-
essary. Although additional hemostasis maneu-
vers may be required in some cases, their routine
use, in our experience, does not seem to provide
substantial benefits. It seems to us that whenever
the wound requires suturing, the latter may be
relied upon as the only hemostatic measure. The
advantages and disadvantages of each surgical
technique are clearly difficult to compare, but
large randomized studies may help provide hard
evidence in this surgeon-depending setting.

We no longer routinely use additional
hemostatic methods during LPN when the renal
defect is sutured. During this study period, 46 pa-

tients underwent LPN in our institution and in 34
cases suturing was the only hemostatic maneu-
ver, whereas the remaining 12 cases either pertain
to the initial experience when this technique was
developing or did not require suturing (superfi-
cial tumors). We did not directly compare cases
with and without additional hemostatic modal-
ities because of inherent multiple biases that would
have affected the applicability of the findings.
This study demonstrates the feasibility of renor-
raphy without additional hemostatic maneuvers
and suggests that the routine use of bolsters, glues
and/or argon laser should be reconsidered.

Our technique obviates the use of bolsters
and glues for hemostasis during LPN and may rep-
resent an attractive option for many urologists for
several reasons. First, this technique is simple and
applicable whether or not the collecting system is
opened. Second, with this technique it is reason-
able to expect reduced costs since no hemostatic
bolsters or glues are used. In our opinion, addi-
tional hemostatic agents such as bolsters and seal-
ants should be reserved for selected cases and not
be used routinely.

CONFLICT OF INTERESt

None declared.

REFERENCES

1. Msezane LP, Katz MH, Gofrit ON, Shalhav AL, Zorn KC: He-
mostatic agents and instruments in laparoscopic renal sur-
2. Tsivian A, Shtricker A, Benjamin S, Sidi AA: Laparoscopic
partial nephrectomy for tumor excision in a horseshoe kid-
3. Weight CJ, Lane BR, Gill IS: Laparoscopic partial nephrec-
tomy for selected central tumors: omitting the bolster. BJU
Int. 2007; 100: 375-8.
4. Nadu A, Mor Y, Laufer M, Winkler H, Kleinmann N, Kitrey
N, et al.: Laparoscopic partial nephrectomy: single center
experience with 140 patients—evolution of the surgical
technique and its impact on patient outcomes. J Urol. 2007;
5. Orvieto MA, Chien GW, Tolhurst SR, Rapp DE, Steinberg
GD, Mikhail AA, et al.: Simplifying laparoscopic partial ne-
phrectomy: technical considerations for reproducible out-


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