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Original article

Self-retaining barbed suture during laparoscopic partial nephrectomy

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ABSTRACT

Objective: This study was conducted to investigate the safety and feasibility of self-retaining barbed absorbable suture application in laparoscopic partial nephrectomy (LPN).
Materials and methods: From January 2010 to September 2014, 38 cases of LPN were performed at Changhua Christian Hospital, Changhua, Taiwan. The patients were divided into two groups: the nonself-retaining barbed suture (non-SRBS) group ($n = 21$) and the SRBS group ($n = 17$). There was no significant difference in age, RENAL (Radius, Exophytic/Endophytic properties, Nearness of the tumor to the collecting system or sinus, Anterior/Posterior, Location relative to polar lines) nephrometry score, and tumor type between the two groups. Clinical data and outcomes were analyzed retrospectively.
Results: All 38 cases of LPN were successfully performed, without conversion to open surgery or serious intraoperative complications. In the SRBS group, renorrhaphy time and length of hospital stay were significantly shorter than those of the non-SRBS group ($p = 0.015$ and $p = 0.009$, respectively).
Conclusions: The application of SRBS in LPN could shorten renorrhaphy time and hospital stay with good safety and feasibility.

1. Introduction

Since laparoscopic partial nephrectomy (LPN) was reported in 1993, it has become an alternative to nephron-sparing surgery.[1–3] Compared with open partial nephrectomy (OPN), LPN provides comparable oncologic and functional outcomes with less postoperative pain and quicker recovery.[4–6] Gill et al[7] reported their experience of LPN by duplicating OPN without the need for an energy-based sealing instrument, which has become the most widely accepted LPN technique.[7] However, the challenge of LPN includes shortening the warm ischemia time (WIT), achieving hemostasis, and closure of collecting system.[8]

Murtha et al[9] reported the use of self-retaining barbed suture (SRBS) during plastic surgical procedures. Greenberg and Clark[10] and Greenberg and Einarsson[11] also reported the application of SRBS for wound closure in gynecology. SRBS consists of an absorbable material with unidirectional barbs to pull through tissue, maintain tension, and avoid knot tying. Using SRBS, urologists may increase efficiency and shorten suture time during LPN. Since January 2011, SRBS (V-Loc 180; Covidien, Mansfield, MA, USA) has been applied during LPN consecutively in our division. All investigators used to compare roughly the WIT, which consists of tumor resection and renorrhaphy time. In fact, the SRBS should only be able to determine the renorrhaphy time, rather than the resection time. We believe this is the first article to clarify clearly the influence of SRBS on renal reconstruction, which should not be muddled together with resection time as WIT.

2. Materials and methods

2.1. Patients

From January 2010 to September 2014, 38 cases of LPN were performed at Changhua Christian Hospital (Changhua, Taiwan), and SRBS was used in 21 of these cases. Clinical data and outcomes were analyzed retrospectively. All patients were diagnosed with renal carcinoma or angiomyolipoma by computed tomography or magnetic resonance imaging prior to the operation. All patients were divided into two groups: the SRBS group ($n = 21$) and non-SRBS ($n = 17$) group. There were no significant differences in age, sex, tumor size, RENAL (Radius, Exophytic/Endophytic properties, Nearness of the tumor to the collecting system or sinus, Anterior/Posterior, Location relative to polar lines) nephrometry score (RNS), location, preoperative creatinine level, or preoperative estimated

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glomerular filtration rate (eGFR) between the two groups (Table 1). The anatomic characteristics according to RNS are listed in Table 2. No hilar involvement was detected in all the renal tumors in the study.[12] Prior to the study, the protocol was approved by the Institutional Review Board at the Changhua Christian Hospital and in accordance with the ethical guidelines of the 1975 Helsinki Declaration.

2.2. Surgical procedure

LPNs were performed according to standardized protocols. Warm ischemia was established using the vascular Bulldog clamp. WIT was measured from the moment of hilar clamping until unclamping.

In the non-SRBS cohort, control of the deep tumor bed and collecting system was performed using running 3-0 polyglactin sutures. An optional bolster of cellulose matrix with running polyglactin sutures was used according to the preferences of the operating surgeon or surgical condition. In the SRBS cohort, the same protocol was applied to the deep tumor bed. The superficial layer renorrhaphy was performed using a continuous SRBS with one or two threads depending on the length of the defect. As the final bite of the suture is placed, a Hem-o-Lock clip (Weck Closure System, Research Triangle Park, NC, USA) was placed on the loose end. To secure and tighten, the end of the suture is pulled with the needle holders, and tension is created vertical to the capsule to minimize the risk of tearing. Using the needle holder with slightly opened jaws, the surgeon slides the clip toward the kidney.[13] Proper tension is recognized when the surface of the kidney is mildly dimpled—that is, only one Hem-o-Lock clip was used for each SRBS. Fibrin sealants or gelatin hemostatic agents (Floseal/Tisseel) were not necessary for most of the cases.

2.3. Variables assessed

RNS describes tumors according to the anatomical features of renal masses on image study such as computed tomography or magnetic resonance imaging. Serum creatinine level was measured in the pre- and postoperative periods. The chronic kidney disease (CKD) Epidemiology Collaboration (CKD-Epi) glomerular filtration equation was used to calculate pre- and postoperative eGFR.[14] Complications were divided into intraoperative and postoperative complications (until 30 days after the operation). Postoperative complications were classified according to the Clavien–Dindo classification.[15]

Table 2
Anatomic characteristics as based on RENAL nephrometry score.

Characteristics	Total	Percentage (%) ($n = 38$)
RENAL nephrometry score sum		
4–6	16	42.1
7–9	21	55.3
10–12	1	2.6
R component		
1	17	44.7
2	16	42.1
3	5	13.2
E component		
1	23	60.5
2	14	36.8
3	1	2.6
N component		
1	21	55.3
2	6	15.8
3	11	28.9
A component		
a	12	31.6
p	18	47.4
x	8	21.1
L component		
1	17	44.7
2	9	23.1
3	12	36.1

RENAL = Radius, Exophytic/Endophytic properties, Nearness of the tumor to the collecting system or sinus, Anterior/Posterior, Location relative to polar lines.

2.4. Statistical analysis

Statistical analyses were performed using SPSS software for Windows (Statistical Product and Service Solutions, version 18.0; SSPS Inc., Chicago, IL, USA). Categorical variables were compared using the Chi-square test; continuous variables were compared using the Mann–Whitney *U* test. A p value < 0.05 was considered statistically significant.

Table 1
Baseline characteristics of laparoscopic partial nephrectomy with non-SRBS and SRBS suture.

Characteristics	Non-SRBS group ($N = 21$)	SRBS group ($N = 17$)	p
Age (y), median [range]	63 [39–85]	55 [32–79]	0.179
BMI, median [range]	24.7 [18.1–35.5]	24.5 [18.6–32.8]	0.885
Sex			0.029
Male, *n* (%)	11 (52.4)	3 (17.6)	
Female, *n* (%)	10 (47.6)	14 (82.4)	
Tumor size (cm), median [range]	5.89 [2.10–30.0]	5.90 [1.60–13.0]	0.486
RENAL score, median [range]	7 [4–8]	7 [4–10]	0.407
Tumor type			
Angiomyolipoma	12	8	0.385*
Oncocytoma	0	1	
Renal cell carcinoma	9	9	0.510
Clear cell	7	5	
Papillary	2	2	
Chromophobe	0	1	
Unclassified	0	1	
Preoperative creatinine (mg/dL), median (SD)	0.730 (0.521)	0.660 (0.395)	0.523
Preoperative eGFR, median (SD)	94.0 (36.2)	96.0 (34.4)	0.404

*p value shows no statistical significance on benign or malignant renal tumor.
BMI = body mass index; eGFR = estimated glomerular filtration rate; RENAL = Radius, Exophytic/Endophytic properties, Nearness of the tumor to the collecting system or sinus, Anterior/Posterior, Location relative to polar lines; SD = standard deviation; SRBS = self-retaining barbed suture.