Özgün araştırma / Original research

Robotik parsiyel nefrektomide renorafi için geleneksel poliglaktin ile dikenli dikiş materyallerinin karşılaştırılması

Comparison of barbed and conventional polyglactin sutures for renorraphy in robot assisted partial nephrectomy

Uğur Boylu, Cem Başataç, Eyüp Gümüş

Ümraniye Eğitim ve Araştırma Hastanesi, Üroloji Kliniği, İstanbul, Türkiye

Geliş tarihi (Submitted): 08.01.2014
Kabul tarihi (Accepted): 06.03.2014

Yazışma / Correspondence
Doç. Dr. Uğur Boylu
Ümraniye Eğitim ve Araştırma Hastanesi,
Üroloji Kliniği, İstanbul, Türkiye
Tel: 0216 632 18 18 (1984)
Faks: 0216 632 71 15
E-mail: ugur@ugurboylu.com

Özet

Amaç: Robotik parsiyel nefrektomi (RPN) esnasında renorafide geleneksel emilebilen dikiş materyalleri ile dikenli dikiş materyalleri kullanımının cerrahi sonuçlar üzerine etkisini değerlendirmek.

Gereç ve Yöntemler: 2009 ve 2011 yılları arasında böbrekte kitle sebebiyle RPN yapılan 38 hasta çalışmaya dahil edildi. Bu 38 hastanın 16'sında renorafi poliglaktin (Grup 1) ve 22'sinde ise dikenli poliglikonat dikiş materyali (Grup 2) ile yapıldı. Gruplar arasında ortalama operasyon süresi, tahmini kan kaybı, sıcak iskemi süresi, hastanede kalış süresi, komplikasyonlar ve onkolojik sonuçlar prospektif olarak değerlendirildi.

Bulgular: Gruplar arasında yaş, cinsiyet, komorbidite ve tümör karakteristikleri açısından istatistiksel olarak anlamlı farklılık izlenmedi. Ortalama operasyon süresi Grup 1'de 163±55 dakika iken Grup 2'de 137±18 dakika idi (p=0,001). Tahmini kan kaybı Grup 1'de 472±540 mil. iken Grup 2'de 185±110 mil. idi (p=0,001). Ortalama hematokrit düşüşü Grup 1'de %6,43±3,4 iken Grup 2'de %3,82±2,7 idi (p=0,015). Sıcak iskemi süresi Grup 1'de ortalama 28.7±9.3 dakika iken, Grup 2'de ortalama 20,9±6,9 dakika idi (p=0,001). Ortalama takip süresi gruplar arasında sırasıyla 24 ve 18 aydı. Takip süresince her iki grupta da tümör rekürrensine rastlanılmadı.

Sonuç: Robotik parsiyel nefrektomide renorafi için dikenli sütür materyallerinin kullanımı böbrek parankim onarımının hızlı, güvenli ve kuvvetli yapılmasını kolaylaştırmaktadır. Böbrek parankim onarımının dikenli dikiş materyalleri ile yapılması sıcak iskemi süresini ve tahmini kan kaybını azaltmaktadır.

Anahtar Kelimeler: Böbrek, kanser, robot, parsiyel nefrektomi

Abstract

Objective: To evaluate the effect of the barbed and the conventional absorbable sutures for renorraphy on the outcomes of robot assisted partial nephrectomy (RAPN).

Material and Methods: Between 2009 and 2011, a total 38 patients with a renal mass who underwent RAPN were included in this study. Of 38, renorraphy was performed with a polyglactin suture in 16 patients (Group 1) and, with a barbed polyglyconate suture in 22 patients (Group 2). The mean operative time, estimated blood loss (EBL), warm ischemia time (WIT), hospital stay, complications and oncologic outcomes were evaluated prospectively.

Results: There was no statistical difference between groups in terms of age, gender, comorbidities and tumor characteristics. The mean operative time was 163± 55 min in Group 1 and 137 ± 18 min Group 2 (p=0,001). The mean EBL was 472 ± 540 ml in Group 1 and 185± 110 ml in Group 2 (p=0,001). The mean decline in hematocrit was %6.43 ± 3.4 in Group 1 and %3.82 ± 2.7 in Group 2 (p=0.015). The WIT was 28.7 ± 9.3 min and 20.9 ± 6.9 min (p=0.005) in Group 1 and 2, respectively. The mean follow up was 24 and 18 months in Group 1 and 2, respectively. No tumor recurrence has occurred in both groups at the follow-up.

Conclusions: Utilization of barbed sutures for renorraphy during RAPN facilitates rapid, safe and potent renal parenchymal repair. Renorraphy with barbed suture results in reduced warm ischemia time and blood loss.

Key Words: kidney, cancer, robot, partial nephrectomy

Introduction

In recent years, with an increase in incidental diagnosis of small renal masses, nephron-sparing surgery gained traction. Nowadays, partial nephrectomy (PN) is a standard of care for clinical stage T1 renal cancers amenable to nephron-sparing approach (1-4). Compared to radical nephrectomy, PN has equivalent oncological outcomes and better preservation of renal function, improves quality of life, and reduces frequency of cardiovascular events (5-7). Laparoscopic (LPN), robot assisted (RAPN), and open PN all offer comparable outcomes in the hands of experienced surgeons.

In PN, rapid and safe repair of parenchyma has an important effect on the outcomes of this particular surgery in regards to warm ischemia time (WIT) and preservation of renal function. Although various techniques were described to decrease the WIT, no study has yet identified the perfect procedure (8-9). In recent years, a new class of suture material (barbed sutures) has been introduced to the surgeons' armamentarium. This study aims to compare the impact of the barbed and the conventional absorbable sutures for renorraphy on the outcomes of RAPN.

Materials and Methods

Between 2009 and 2011, a total of 38 patients with a renal mass who underwent RAPN were included in this study. Preoperative evaluation included medical history, physical examination, routine laboratory studies, including serum creatinine and urinalysis, chest X-ray and abdominal computerized tomography (CT) or magnetic resonance imaging. Tumor size is reported as the largest single dimension of the lesion, as measured on the CT. Pathological staging was performed according to the 2009 IUCC/American Joint Committee on Cancer TNM staging system (10). All tumors were graded according to R.E.N.A.L nephrometry score (11). Of 38, renorraphy was performed with a polyglactin suture (Vicryl, Ethicon, Cincinnati, OH, USA) in 16 patients (Group 1) and, with a barbed polyglyconate suture (V-loc, Covidien, Mansfield, MA, USA) in 22 patients (Group 2). The mean operative time, estimated blood loss (EBL), WIT, length of hospital stay, complications and oncological outcomes were evaluated prospectively. All complications were graded according to the modified Clavien-Dindo classification system (12). All statistical analyses were performed using SPSS Statistics v.20 (IBM, Armonk, NY, USA) software. The confidence interval was taken 95% and a p value less than 0.05 was considered statistically significant.

A 5-port transperitoneal approach was used in all patients. Following the endotracheal intubation under general anesthesia, the patient was placed in a 60 degree modified flank position and the pneumoperitoneum was achieved with a Veress needle. A 12 mm camera port was placed 4 cm lateral and 2 cm cranial to the umbilicus. An 8 mm robotic port was placed 3 cm medial to anterior superior iliac spine, and another 8 mm robotic port was placed 2 cm below the costal margin in the mid-clavicular line. A 12 mm assistant port was placed between the camera port and the caudal robotic port. A 5 mm assistant port was placed between the camera port and the cranial robotic port. The colon was reflected medially, followed by isolation of the gonadal vein, which was dissected up to the renal vein/vena cava. The renal hilum was dissected. Intraoperative laparoscopic ultrasound was used to identify the tumor and its depth. After the hilar preparation, renal capsule was scored using monopolar shears. Two 15-cm long 3-0 polyglactin sutures on SH needles (Vicryl) or 3-0 polyglyconate barbed sutures on a 1/2 circle 26 mm needle (V-loc) were placed in the abdominal cavity for renal parenchymal repair. Two laparoscopic bulldog clamps were placed on the renal artery and one clamp was placed on the vein. Afterwards, cold excision of the tumor was performed with robotic shears. Tumor bed was sutured continuously either with a Vicryl suture with a Hem-o-loc (Pilling Weck Canada Ltd., Markham, Ont., Canada) at the free end or a V-loc suture to stop the bleeders and approximate the renal parenchyma. The defect was then covered with hemostatic agent (Floseal, Baxter, Inc., Irvine, CA, USA) and renal parenchyma was further approximated using a running 0-0 polyglactin suture on a CT-1 needle. The bulldog clamps were removed and a final inspection for homeostasis was performed. A Jackson-Pratt drain was placed in all patients. In follow-up, all patients received comprehensive metabolic panel every 6 month for two years and then yearly. An abdominal ultrasound and chest radiography were done at 3rd month. Abdominal and thorax CT were performed at 6th month and yearly thereafter.

Table 1. Demographics of patients (ASA: American Society of Anesthesiology, CCI: Charlson comorbidity index)

	Group 1 (Polyglactin)	Group 2 (Barbed suture)	p value
Number of patients (n)	16	22	
Mean age (years)	51.1 ± 9.8	57.7 ± 11.6	0.73
Male/Female (n)	14/2	15/7	0.25
Mean ASA score (±SD)	1.63 ± 0.6	2.05 ± 0.8	0.84
Age-adjusted CCI (±SD)	2.13 ± 1.2	1.86 ± 1.1	0.49

Table 2. Perioperative and postoperative outcomes in patients undergoing RPN

	Group 1 (Polyglactin)	Group 2 (Barbed suture)	p value
Mean Operative time (min)	163 ± 55	137 ± 18	0.001
Mean Estimated blood loss (ml)	472 ± 540	185 ± 110	0.02
Mean fall in postoperative hematocrit (%)	6.43 ± 3.4	3.82 ± 2.7	0.015
Warm ischemia time (min)	28.7 ± 9.3	20.9 ± 6.9	0.005
Drain removal time (day)	3.31 ± 1.2	3.18 ± 1.4	0.77
Length of hospital stay (day)	5.0 ± 1.4	3.5 ± 1.3	0.003
Side (right/left)	4/12	11/11	0.18
Mean tumor size (cm)	3.94 ± 1.5	3.32 ± 1.2	0.2
RENAL nephrometry score (mean ± SD)	5.31 ± 1.1	5.23 ± 1.6	0.44
Pathology (Malignant/Benign)	16/0	16/6	-

Results

Table 1 summarizes the demographics of the patients. Renorraphy was performed with Vicryl in group 1 (n=16) and with V-Loc in group 2 (n=22). The mean age was 51.1 ± 9.8 years in group 1 and 57.7 ± 11.6 years in group 2 (p=0.73). The mean tumor size was 3.94 ± 1.5 cm in group 1 and 3.32 ± 1.2 cm in group 2.(p=0.2) The mean R.E.N.A.L. nephrometry scores were 5.31 ± 1.1 and 5.23 ± 1.6 in group 1 and 2, respectively (Table 2). There was no statistical difference between two groups in terms of R.E.N.A.L. nephrometry scores (p=0.44). The mean operative time was 163 ± 55 min in group 1 and 137 ± 18 min group 2 (p=0,001). The EBL was a mean of 472 ± 540 ml in group 1 and 185 ± 110 ml in group 2 (p=0,001). The mean decline in hematocrit was %6.43 ± 3.4 in group 1 and %3.82 ± 2.7 in group 2 (p=0.015). The WIT was 28.7 ± 9.3 min in group 1 and 20.9 ± 6.9 min in group 2 (p=0.005). The drain was removed in a mean of 3.31 ± 1.2 and 3.18 ± 1.4 days (p=0,77) and, the hospital stay was 5.0 ± 1.4 and 3.5 ± 1.3 days (p=0.003) in group 1 and 2, respectively. No complication has occurred intraoperatively. Post operatively, 5 patients have grade 2 (blood transfusion) and 2 patients have grade 1 complication (one patient had transient elevation of serum creatinine and the other had sub-ileus which resolved spontaneously at postoperative day 2) in group 1. There was one grade 1 complication (postoperative fever) in group 2. No open conversion was required in any patient and there were no robotic malfunctions, system failures or complications related to the robotic surgical system. Thirty-two tumors were malignant on the final pathology of the resected 38 tumors. Surgical margins were negative in all patients. The mean follow up was 24 and 18 months in group 1 and 2, respectively. No tumor recurrence has occurred in the follow-up.

Discussion

PN is the most appropriate surgical option in patients with small unilateral tumors or whenever preservation of renal function is a primary issue, such as in patients with solitary kidney or those with renal insufficiency, bilateral renal masses, or familial renal cell carcinoma. Both open and laparoscopic approaches can be considered depending on tumor size, location, and surgical experience. Various cold ischemia techniques for LPN were described (13-15). However, these techniques are very challenging and they did not get widely accepted. Thus, primary goal should be reduce the duration of warm ischemia as much as possible. In published series, there have been several techniques described to decrease the WIT since Gettman et al performed the first RAPN in 2004 (16).

Gill et al defined an early unclamping technique that has decreased the ischemia time by an average of 14 minutes (17). Recently, the authors described their innovative technique, which incorporates selective branch microdissection of the renal artery and vein under controlled hypotension (18). In another study aiming to reduce WIT during PN, the authors suggested "selective renal parenchymal clamping". With this technique, the renal parenchyma is regionally clamped only in the area of planned excision. Viprakasit et al described successful outcomes with this technique in three patients undergoing RAPN (19). Some surgeons have performed PN without any clamping of the renal hilum and have suggested that off-clamp PN can be safely performed in carefully

selected patients (20). Bahrami et al reported their off-clamp LPN series in 2011 and they concluded that LPN can be safely performed without any hilar clamping in cT1a-T2 renal tumors. The authors implied that complete dissection of the hilar vessels were imperative in all cases because of the need for conversion from the off-clamp to hilar clamping (21). Furthermore, Kowalcyzk et al reported their partial clamping technique in 2012. In this approach, renal artery was occluded only %50 or less of its diameter. The authors concluded that this approach offers a simple and reproducible technique that minimizes ischemia during RAPN and avoids surgical risks associated with dissection of the segmental renal arteries or the medically induced hypotension (22).

The attempts to reduce WIT and blood loss should not compromise oncological outcomes in patients undergoing RAPN. A bloodless surgical field with good visualization is the key factor to provide better oncological outcomes. In this study, we evaluated the effect of using barbed sutures for renorraphy during RAPN. Currently, there are 2 commercially available barbed suture products: the Quill SRS bidirectional barbed suture (Angiotech Pharmaceuticals, Inc., Vancouver, BC, Canada) and the V-Loc. Barbed sutures appear to be at least as strong as the conventional sutures. Moreover, conventional sutures lose tensile strength at and around the knots but this condition were not observed at the knotless barbed sutures. In our experience, this tensile strength facilitates rapid and effective suturing under warm ischemia where time has the utmost importance. In a preclinical study, Shikanov et al evaluated self-retaining barbed sutures in porcine model and they demonstrated equivalent outcomes in vascular and collecting system repair of the renal defect. However, they showed no better outcomes compared with traditional polyglyconate sutures (23). Sammon et al reported their clinical application of barbed suture in renorraphy during RAPN. The authors noted that incorporation of barbed sutures simplifies the renorraphy resulting a reduced WIT (24). Olweny et al compared perioperative outcomes with barbed polyglyconate and conventional polyglactin sutures in patients undergoing LPN. They concluded that the use of barbed suture for parenchymal repair during LPN is associated with significant reduction in WIT and decreased rates of clinically meaningful bleeding (25).

In the present series of 38 patients, we have demonstrated that barbed suture facilitates safe and rapid renorraphy in patients undergoing RAPN. We believe, as barbed suture self-anchors at approximately every 1 mm of tissue, a uniform distribution of tension is created across the suturing plane. This helps in reconstruction of the renal parenchymal defect and thus, results a decrease in WIT and blood loss.

In conclusion, utilization of barbed sutures for renorraphy during RPN facilitates rapid, safe and effective renal parenchymal repair. Renorraphy with barbed suture results in reduced warm ischemia time and blood loss.

Disclosures

None of the authors has anything to disclose.

1. Dr. Ugur Boylu: no conflict of interest
2. Dr. Cem Basatac: no conflict of interest
3. Dr. Eyup Gumus: no conflict of interest

References

1. Hollingsworth JM, Miller DC, Dunn RL, Montgomery JS, Roberts WW, Hafez KS, et al. Surgical management of low-stage renal cell carcinoma: Technology does not supersede biology. Urology 2006;67:1175-80.
2. Shuch B, Lam JS, Belldegrun AS. Open partial nephrectomy for the treatment of renal cell carcinoma. Curr Urol Rep 2006;7:31-38.
3. Novick AC, Campbell SC, Belldegrun AS, Blute ML, Chow GK, Derweesh IH, et al. Guidelines for management of the clinical stage 1 renal mass; in Novick AC, Campbell SC (eds): American Urological Association Education and Research (AUA) Guidelines. http://www.auanet.org, AUA, 2009, 2012,
4. Thompson RH, Kaag M, Vickers A, Kundu S, Bernstein M, Lowrance W, et al. Contemporary use of partial nephrectomy at a tertiary care center in the united states. J Urol 2009;181:993-97.
5. Weight CJ, Larson BT, Gao T, Campbell SC, Lane BR, Kaouk JH, et al. Elective partial nephrectomy in patients with clinical t1b renal tumors is associated with improved overall survival. Urology 2010;76:631-37.
6. Weight CJ, Lieser G, Larson BT, Gao T, Lane BR, Campbell SC, et al. Partial nephrectomy is associated with improved overall survival compared to radical nephrectomy in patients with unanticipated benign renal tumours. Eur Urol 2010;58:293-98.
7. Thompson RH, Siddiqui S, Lohse CM, Leibovich BC, Russo P, Blute ML. Partial versus radical nephrectomy for 4 to 7 cm renal cortical tumors. J Urol 2009;182:2601-06.

8. Benway BM, Bhayani SB, Rogers CG, Dulabon LM, Patel MN, Lipkin M, et al. Robot assisted partial nephrectomy versus laparoscopic partial nephrectomy for renal tumors: A multi-institutional analysis of perioperative outcomes. J Urol 2009;182:866-72.
9. Dulabon LM, Kaouk JH, Haber GP, Berkman DS, Rogers CG, Petros F, et al. Multi-institutional analysis of robotic partial nephrectomy for hilar versus nonhilar lesions in 446 consecutive cases. Eur Urol 2011;59:325-30.
10. Edge SB, Compton CC. The american joint committee on cancer: The 7th edition of the ajcc cancer staging manual and the future of tnm. Annals of surgical oncology 2010;17:1471-74.
11. Kutikov A, Uzzo RG. The R.E.N.A.L. Nephrometry score: A comprehensive standardized system for quantitating renal tumor size, location and depth. J Urol 2009;182:844-53.
12. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: A new proposal with evaluation in a cohort of 6336 patients and results of a survey. Ann Surg 2004;240:205-13.
13. Steffens J, Humke U, Ziegler M, Siemer S. Partial nephrectomy with perfusion cooling for imperative indications: A 24-year experience. BJU Int 2005;96:608-11.
14. Tatsugami K, Eto M, Yokomizo A, Kuroiwa K, Inokuchi J, Tada Y, et al. Impact of cold and warm ischemia on postoperative recovery of affected renal function after partial nephrectomy. J Endourol 2011;25:869-873; discussion 873-4.
15. Marley CS, Siegrist T, Kurta J, O'Brien F, Bernstein M, Solomon S, et al. Cold intravascular organ perfusion for renal hypothermia during laparoscopic partial nephrectomy. J Urol 2011;185:2191-95.
16. Gettman MT, Blute ML, Chow GK, Neururer R, Bartsch G, Peschel R. Robotic-assisted laparoscopic partial nephrectomy: Technique and initial clinical experience with Davinci robotic system. Urology 2004;64:914-18.
17. Gill IS, Kamoi K, Aron M, Desai MM. 800 laparoscopic partial nephrectomies: A single surgeon series. J Urol 2010;183:34-41.
18. Gill IS, Eisenberg MS, Aron M, Berger A, Ukimura O, Patil MB, et al. "Zero ischemia" partial nephrectomy: Novel laparoscopic and robotic technique. Eur Urol 2011;59:128-34.
19. Viprakasit DP, Altamar HO, Miller NL, Herrell SD. Selective renal parenchymal clamping in robotic partial nephrectomy: Initial experience. Urology 2010;76:750-53.
20. White WM, Goel RK, Haber GP, Kaouk JH. Robotic partial nephrectomy without renal hilar occlusion. BJU Int 2010;105:1580-84.
21. Rais-Bahrami S, George AK, Herati AS, Srinivasan AK, Richstone L, Kavoussi LR. Off-clamp versus complete hilar control laparoscopic partial nephrectomy: Comparison by clinical stage. BJU Int 2012;109:1376-1381.
22. Kowalczyk KJ, Alemozaffar M, Hevelone ND, Ulmer WD, Plaster BA, Lipsitz SR, et al. Partial clamping of the renal artery during robot-assisted laparoscopic partial nephrectomy: Technique and initial outcomes. J Endourol 2012;26:469-73.
23. Shikanov S, Wille M, Large M, Lifshitz DA, Zorn KC, Shalhav AL, et al. Knotless closure of the collecting system and renal parenchyma with a novel barbed suture during laparoscopic porcine partial nephrectomy. J Endourol 2009;23:1157-60.
24. Sammon J, Petros F, Sukumar S, Bhandari A, Kaul S, Menon M, et al. Barbed suture for renorrhaphy during robot-assisted partial nephrectomy. J Endourol 2011;25:529-33.
25. Olweny EO, Park SK, Seideman CA, Best SL, Cadeddu JA. Self-retaining barbed suture for parenchymal repair during laparoscopic partial nephrectomy; initial clinical experience. BJU Int 2012;109:906-09.