นิพนธ์ต้นฉบับ

การผ่าตัดและภาวะแทรกซ้อนของผู้ป่วยที่ให้การบริจาคไต ในโรงพยาบาลรามาธิบดี

กิตติวุฒิ วุ่นดี, พชรพงศ์ เจนจิตรานันท์, เปรมสันติ์ สังฆ์คุ้ม, เจริญ ลีนานุพันธุ์, กิตติณัฐ กิจวิกัย, วิทย์ วิเศษสินธุ์, ปกเกศ ศิริศรีตรีรักษ์, วิสูตร คงเจริญสมบัติ

หน่วยศัลยศาสตร์ระบบปัสสาวะ ภาควิชาศัลยศาสตร์ คณะแพทยศาสตร์ โรงพยาบาลรามาธิบดี มหาวิทยาลัยมหิดล กรุงเทพ ฯ

บทคัดย่อ

วัตถุประสงค์: เพื่อวิเคราะห์ผลการผ่าตัดและภาวะแทรกซ้อนของผู้ป่วยที่ให้การบริจาคไตแบบส่องกล้องช่วยการผ่าตัด และการผ่าตัดแบบเปิด

ผู้ป่วยและวิธีการศึกษา: ศึกษาข้อมูลผลการผ่าตัดและภาวะแทรกซ้อนของผู้ป่วย แบบย้อนหลังจากแฟ้มข้อมูลทางการแพทย์ของผู้ป่วยที่ให้การบริจาคไตระหว่างมกราคม พ.ศ. 2549 ถึง พ.ศ. 2558

ผลการศึกษา: ผู้ป่วยซึ่งได้รับการผ่าตัดเพื่อบริจาคไต จำนวน 333 คน ได้รับการผ่าตัดแบบส่องกล้องช่วยผ่าตัด 183 คน และผ่าตัดแบบเปิด 150 คน โดยข้อมูลที่มีความแตกต่างทางสถิติ ได้แก่ จำนวนวันนอนโรงพยาบาล พบว่า การผ่าตัดแบบส่องกล้องช่วยผ่าตัดและการผ่าตัดแบบเปิด มีระยะเวลา 4.6 และ 5.3 วันตามลำดับ (p-value 0.002) การศึกษาข้อมูลการเสียเลือดระหว่างการผ่าตัด พบว่า การผ่าตัดแบบส่องกล้องช่วยผ่าตัดและการผ่าตัดแบบเปิด มีการเสียเลือด 100 และ 250 มิลลิลิตร ตามลำดับ (p-value < 0.001) สำหรับสภาวะขาดเลือดที่อุณหภูมิปกติระหว่างการผ่าตัด พบว่า การผ่าตัดแบบเปิดใช้เวลา 2.2 นาที และการผ่าตัดแบบส่องกล้องช่วยผ่าตัด ใช้เวลา 4.1 นาที (p-value < 0.001) ส่วนระยะเวลาการผ่าตัด การผ่าตัดแบบเปิดใช้เวลา 146.2 นาที และการผ่าตัดแบบส่องกล้องช่วยผ่าตัด ใช้เวลา 180.1 นาที (p-value < 0.001) ส่วนภาวะแทรกซ้อนของผู้ป่วยที่เกิดขึ้น ได้แก่ การบาดเจ็บต่อหลอดเลือดใหญ่ 6 ราย, การบาดเจ็บต่อไต 4 ราย, ภาวะไตวายฉับพลัน 7 ราย, ภาวะน้ำเหลืองรั่ว 2 ราย, ภาวะซีดต้องให้เลือด 3 ราย และภาวะแทรกซ้อนเพียงเล็กน้อย 9 ราย ซึ่งภาวะแทรกซ้อนที่เกิดขึ้นทั้งหมดนั้น ไม่มีผู้ป่วยเสียชีวิตและต้องได้รับการผ่าตัดใหม่ โดยมีค่าเฉลี่ยของการนอนโรงพยาบาลของผู้ป่วยที่เกิดภาวะแทรกซ้อน 7.4 วัน

สรุป: การผ่าตัดไตในผู้บริจาคที่มีชีวิต มีผลกระทบเพียงเล็กน้อยต่อสุขภาพโดยรวมของผู้บริจาค ถึงแม้จะเกิดภาวะแทรกซ้อนที่สำคัญขึ้น แต่ไม่มีความแตกต่างทางด้านสถิติระหว่างการผ่าตัดแบบส่องกล้องช่วยผ่าตัด และการผ่าตัดแบบเปิด ดังนั้น การผ่าตัดไตในผู้บริจาคที่มีชีวิต เป็นการผ่าตัดที่ทำได้และมีความปลอดภัย

คำสำคัญ: การผ่าตัดไตในผู้บริจาคที่มีชีวิต, ภาวะแทรกซ้อน, ผลการผ่าตัด

Original article

Perioperative results and complications of living donor nephrectomy in Ramathibodi Hospital

Kittiwut Wundee, Pocharapong Jenjitranant, Premsant Sangkum, Charoen Lee-nanupunth, Kittinut Kijvikai, Wit Viseshsindh, Pokket Sirisreetreerux, Wisoot Khongcharoensombat

Division of Urology, Department of Surgery, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

Abstract

Objective: To determine perioperative results and complications in patients who underwent laparoscopic donor nephrectomy (LDN) compared with open donor nephrectomy (ODN).

Material and methods: We retrospectively reviewed the medical records of living donor nephrectomies between January 2006 and December 2015 for perioperative results and complications.

Results: All 333 living donor nephrectomies were performed successfully, including 183 LDNs and 150 ODNs. There was no statistically significant difference in demographic data. LDNs had a shorter length of hospital stay (4.6 vs 5.3 days, p-value 0.002) and less operative blood loss (100 vs 250 ml, p-value < 0.001) than ODNs. However, ODNs had shorter warm ischemic time (2.2 vs 4.1 minutes, p-value < 0.001) and operative time (146.2 vs 180.1 minutes, p-value < 0.001). Perioperative complications that occurred in these donors included 6 cases of vascular injury, 4 cases of kidney injury, 7 cases of acute renal failure, 2 cases of chyle leaks, 3 cases of anemia with blood transfusion, and 9 cases of miscellaneous complications. None of the living donors died or required re-operation with a mean length of hospital stay of 7.4 days.

Conclusion: Living donor nephrectomy has minimal adverse effects on overall health donor status, although major complications may occur. There was no statistically significant difference between LDN and ODN in terms of complications. Therefore, living donor nephrectomy is a safe and feasible surgical procedure.

Keywords: living donor nephrectomy, complication, perioperative results

Introduction

The number of patients with end-stage renal diseases has increased from the past. Kidney transplantation from living or deceased donors improves the quality of life more than dialysis[1-3]. At present, there is an imbalance between the number of kidney donors and the demand of potential recipients for kidney transplantation. Thus, many countries have increased the rate of living kidney donation. As a result, there has been an increase in living kidney donors throughout the world. Living donor kidney transplantations important to the recipients because of better graft function and shorter waiting times than with deceased donor kidney transplantation[3,4].

In our institution, we have performed living donor nephrectomies since 1986, and laparoscopic donor nephrectomies since 1997. At present, we perform living donor nephrectomies using 2 surgical techniques, including open and laparoscopic donor nephrectomies. Although living donor nephrectomies have been performed on healthy patients with minimal adverse effect on overall health donor status[5,6], social perceptions still exist concerning the safety of living donor nephrectomy. The objective of this study is to analyze the data on perioperative results and complications in order to improve perceptions regarding the safety of living donor nephrectomy.

Material and methods

After the study was approved by the Ethics Committee on Human Experimentation Involving Human Subjects at the Faculty of Medicine, Ramathibodi Hospital, Mahidol University, we retrospectively reviewed the medical records of 333 living donor nephectomies between January 2006 and December 2015 for demographic data, perioperative results and complications, and compared laparoscopic donor nephrectomy (LDN) with open donor nephrectomy (ODN). Basically, the type of procedure was chosen based on the surgeon's preference with patient acceptance.

Statistical analysis

All the data were statistically analyzed by STATA program version 14. Categorical variables were analyzed in terms of frequency with percentages using chi-square tests. Continuous variables were analyzed in terms of mean with standard deviations using the t-test. The threshold for statistical significance was set at p-value < 0.05.

Results

The medical records of 333 living donor nephrectomies were retrospectively reviewed, including 150 ODN and 183 LDN. We analyzed data including demographics, perioperative results and complications between ODN and LDN.

Demographics are presented in Table 1. There were no statistically significant differences between ODN and LDN in terms of age, gender, height, weight, body mass index (BMI), blood pressure (BP), pulse rate (PR), occupation, medical history, surgical history, smoking, drinking, and ASA classification.

Perioperative results are presented in Table 2. There were statistically significant differences, including ODNs had shorter worm ischemic time (2.2 vs 4.1 minutes, p-value < 0.001) and operative time (146.2 vs 180.1 minutes, p-value < 0.001), LDNs had a shorter length of hospital stay (4.6 vs 5.3 days, p-value 0.002) and less operative blood loss (100 vs 250 ml, p-value < 0.001). There were no statistically significant differences between ODN and LDN in terms of donor side, number of renal vessels, duration of drain and complications.

Perioperative complications occurred in 31 patients (9.31%). They were analyzed with other factors that are presented in Table 3. There were statistically significant differences between complication and non-complication cases in terms of longer length of hospital stay (7.4 vs 4.7 day, p-value < 0.001), more operative blood loss (300 vs 150 ml, p-value 0.009) and longer duration of drain (4 vs 3 days, p-value

< 0.001). There were no statistically significant differences in terms of method, age, gender, height, weight, BMI, BP, PR, occupation, medical history, surgical history, smoking, drinking, ASA classification, donor side, number of renal vessels, warm ischemic time, operative time, preoperative creatinine, and preoperative glomerular filtration rate.

We stratified perioperative complicationsand managements according to the Clavien-Dindo classification[7,8], which is presented in Table 4. The perioperative complications that occurred in these donors included 6 cases of vascular injury, 4 cases of kidney injury, 7 cases of acute renal failure, 2 cases of chyle leaks, 3 cases of anemia with blood transfusion, and 9 cases of miscellaneous complications. The serious complications, including vascular injuries and kidney injuries, were corrected during surgery. None of the living donors died or required re-operation. The mean length of hospital stay in cases with complications after donor nephrectomy was 7.4 $\pm$ 3.4 days.

Discussion

Living donor nephrectomies are performed on healthy patients. Currently, we perform living donor nephrectomies using two surgical techniques, ODN and LDN.

In general, we prefer to use the left kidney with either ODN or LDN because of the longer left renal vein, in order to avoid vascular complications, such as renal vein thrombosis when the vein graft is used to lengthen the renal vein. But if the left kidney has a complex vascular configuration, we prefer to use the right kidney with open donor nephrectomy, because we have to make the wedge excision and repair the inferior vena cava, which is more feasible using ODN than LDN. For ODN, the patient is placed in the lateral decubitus position for the flank incision, which can be made with or without resection of the 12th rib to allow retroperitoneal access to the kidney. For LDN, the donor is placed in the lateral decubitus position for introducing the trocars into the abdomen for intraperitoneal access to the kidney[9]. A technical point between ODN and LDN, LDN has less post-operative pain and a better cosmetic outcome than ODN.

In our study comparing ODN with LDN, the demographic data were similar in both groups, but there were differences in perioperative results, including ODNs had shorter warm ischemic time (2.2 vs 4.1 minutes, p-value < 0.001) and operative time (146.2 vs 180.1 minutes, p-value < 0.001), LDNs had a shorter length of hospital stay (4.6 vs 5.3 days, p-value 0.002) and less operative blood loss (100 vs 250 ml, p-value < 0.001). Our results are similar to previous studies[6,14-18].

The perioperative complication rate varied in previous studies, such as the reported incidences of 7.9% in the NIS study by Schold et al[10], 10.6% in the study by Patel et al[11], and 18.4% identified by Friedman et al[12]. In our study, complications occurred in 31 patients (9.31%). All major complications could be corrected with intraoperative management and conservative management; none of the living donors died or required re-operation. In our study, blood loss was associated with perioperative complications, with more blood loss leading to longer hospital stays and duration of drains. Other factors such as old age, obesity, and predonation hypertension, which were previously reported to increase the risk of perioperative complications[11-13], were not significantin our study.

Our study has several limitations. First, this study is a retrospective review. Furthermore, we did not evaluate late complications, graft function of the recipients and renal function after living donor nephrectomies. However, we still believe that the results from our study represent the safety of living donor nephrectomies when conducted by experienced surgeons, although major complications may occur.

Conclusion

The results of our study show that living donor nephrectomy has minimal adverse effects on overall health donor status. There was no statistically significant difference between LDN and ODN in terms of complications. Therefore, living donor nephrectomy is a safe and feasible surgical procedure.

Table 1: Demographic data of the donor nephrectomy patients

Factor	Donor Nephrectomy		P-Value
	Open (N=150)	Laparoscopic (N=183)	
Age : mean (SD)	38.2 (11.1)	38.3 (10.3)	0.917
Gender			
Male	59 (39.3)	61 (65.8)	0.257
Female	91 (60.7)	122 (66.7)	
Height : mean (SD)	160.3 (8.4)	160.2 (8.0)	0.892
Weight : mean (SD)	62.2 (12.5)	61.1 (10.5)	0.383
BMI : mean (SD)	24.1 (4.1)	23 (3.9)	0.259
SBP : mean (SD)	120.5 (18.9)	121.7 (12.5)	0.480
DBP : mean (SD)	72.6 (12.0)	72.2 (10.0)	0.721
PR : mean (SD)	76.7 (11.8)	76.9 (8.4)	0.822
Occupation			
1 Government	15 (10.1)	26 (14.4)	0.512
2 Administrator	19 (12.8)	27 (14.9)	
3 Sale	34 (23.0)	37 (20.4)	
4 Contractor	37 (25.0)	34 (18.8)	
5 Farmer	43 (29.1)	57 (31.5)	
Medical History			
DM	18 (12.0)	25 (13.7)	0.653
DLP	5 (3.3)	9 (4.9)	0.473
Cardio	4 (2.7)	8 (4.4)	0.406
Neuro	3 (1.8)	1 (0.5)	0.331
Other	18 (12.0)	27 (14.8)	0.465
Risk Factor			
Surgical History	34 (22.8)	43 (23.8)	0.841
Smoking	39 (26.0)	33 (18.1)	0.083
Drinking	44 (29.3)	49 (26.9)	0.626
ASA Classification			
1	100 (66.6)	129 (70.4)	0.438
2	50 (33.4)	54 (29.6)	

Table 2: Perioperative variables of the donor nephrectomy patients

Factor	Donor Nephrectomy		P-Value
	Open (N=150)	Laparoscopic (N=183)	
LOH : mean (SD)	5.3 (2.4)	4.6 (1.6)	0.002
Donor side			
Left	93 (62.0)	183 (100.0)	<0.001
Right	57 (38.0)	0 (0.0)	
Number of Renal artery			
One	128 (85.3)	162 (88.5)	0.388
More than one	22 (14.7)	21 (11.5)	
Number of Renal vein			
One	139 (92.7)	181 (98.9)	0.004
More than one	11 (7.3)	2 (1.1)	
Warm ischemic time : mean (SD)	2.2 (1.4)	4.1 (1.9)	<0.001
Operative time : mean (SD)	146.2 (39.9)	180.1 (38.4)	<0.001
Blood loss : median (range)	250 (50, 1600)	100 (10, 2000)	<0.001
Tube Drain			
Yes	148 (100.0)	99 (54.4)	<0.001
No	0 (0.0)	83 (45.6)	
Duration of Drain : mean (SD)	3.7 (1.4)	3.6 (1.4)	0.485
Complication			
Yes	14 (10.0)	17 (9.3)	0.770
No	136 (90.0)	166 (90.7)	

Table 3: Complications of the donor nephrectomy patients

Factor	Complication of donor nephrectomy Yes (N=31)	No (N=302)	P-Value
Method			
Open	14 (45.2)	136 (45.1)	0.998
Laparoscopic	17 (54.8)	166 (54.9)	
Age : mean (SD)	41.0 (11.6)	38.0 (10.6)	0.142
Gender			
Male	15 (48.4)	105 (35.0)	0.140
Female	16 (51.6)	195 (65.0)	
Height : mean (SD)	161.5 (6.0)	160.2 (8.25)	0.417
Weight : mean (SD)	64.2 (9.2)	61.3 (11.7)	0.195
BMI : mean (SD)	24.4 (3.1)	23.8 (4.1)	0.428
SBP : mean (SD)	118.2 (26.5)	121.5 (14.2)	0.268
DBP : mean (SD)	70.7 (15.2)	72.6 (10.4)	0.358
PR : mean (SD)	72.5 (15.4)	77.2 (9.3)	0.143
Medical history			
DM	3 (9.7)	40 (13.3)	0.569
DLP	1 (3.2)	13 (4.3)	1.000
Cardio	1 (3.2)	11 (3.7)	1.000
Neuro	1 (3.2)	3 (1.0)	0.326
Other	5 (16.1)	40 (13.3)	0.589
Risk factor			
Surgical History	10 (32.3)	66 (22.2)	0.204
Smoking	8 (26.7)	64 (21.3)	0.494
Drinking	12 (40.0)	81 (26.9)	0.128
ASA Classification			
1	16 (51.6)	213 (70.5)	0.106
2	15 (48.4)	89 (29.5)	
LOH	7.4 (3.4)	4.7 (1.7)	<0.001
Donor side			
Left	24 (77.4)	252 (83.4)	0.401
Right	7 (22.6)	50 (16.6)	
Number of renal artery			
One	24 (77.4)	252 (83.4)	0.401
More than one	7 (22.6)	50 (16.6)	
Number of Renal vein			
One	29 (93.6)	291 (96.4)	0.347
More than one	2 (6.4)	11 (3.6)	
Warm ischemic time : median (range)	2.5 (1.0, 18.0)	3.0 (0.4, 12.0)	0.998
Operative time : mean (SD)	176.8 (49.5)	163.5 (41.7)	0.099
Blood loss : median (range)	300 (30, 2000)	150 (50, 1400)	0.009
Tube drain			
Yes	27 (87.0)	223 (73.8)	0.116
No	4 (13.0)	79 (26.2)	
Duration of drain : median (range)	4 (0, 14)	3 (0, 6)	<0.001
Pre-operative serum Creatinine : median (range)	0.8 (0.5, 1.5)	0.7 (0.5, 81)	0.259
Pre-operative glomerular filtration Rate : median (range)	100.8 (60.0, 132.5)	105.4 (46.7, 136.7)	0.280

Table 4: Surgical complications (Clavien-Dindo Classification)

Grade	Open donor nephrectomy (14 cases)	
	Detail	**Treatment**
I	- Post operative (3 cases)	- Antibiotic therapy
II	- Anemia with blood transfusion (1 case)	- Blood transfusion
	- Chyle leak (2 cases)	- Dietary manipulation (low-fat diet with medium-chain triglycerides)
	- Acute renal failure (4 cases)	- Intravascular fluid management with renal recovery at 2 wk (consult nephrologist)
IIB	- Accidental tear IVC (2 cases)	- Immediate primary repair
	- Accidental tear renal capsule (1 case)	- Continuous operation with repair renal capsule in allograft preparation
	- Partial tear upper pole renal capsule due to adhesion (1 case)	
Grade	**Laparoscopic donor nephrectomy (17 cases)**	
	Detail	**Treatment**
I	- Post operative (5 cases)	- Antibiotic therapy
	- Bowel ileus (1 case)	- Conservative treatment
II	- Anemia with blood transfusion (2 cases)	- Blood transfusion
	- Acute renal failure (3 cases)	- Intravascular fluid management with renal recovery at 2 wk (consult nephrologist)
IIB	- Accidental tear aorta (1 case)	
	- Tear lower pole branch (1 case)	- Convert to open with 1st repair
	- Renal vein injury after clip (1 case)	
	- Accidental slip hemolock clip of gonadal vein (1 case)	- Laparoscopic re-ligation
	- Accidental tear renal capsule 0.5 cm (1 case)	- Continuous operation with repair renal capsule in allograft preparation
	- Subcapsular hematoma (1 case)	- Continuous operation with repair renal capsule in allograft preparation
		- Continuous operation

References

1. Liem YS, Bosch JL, Arends LR, et al. Quality of life assessed with the Medical Outcomes Study Short Form 36-Item Health Survey of patients on renal replacement therapy: A systematic review and meta-analysis. Value Health 2007;10:390.
2. Salazar A, Pelletier R, Yilmaz S, et al. Use of a minimally invasive donor nephrectomy program to select technique for live donor nephrectomy. Am J Surg 2005; 189(5):558-62.
3. Wilson CH, Sanni A, Rix DA ,et al. Laparoscopic versus open nephrectomy for live kidney donors. Cochrane Database Syst Rev 11, 2011. CD006124. doi:10.1002/14651858.CD006124. pub2.
4. Mehrabi A, Fonouni H, Golriz M, et al. Living-donor kidney transplantation. Chirurg 2010 81(9):794.
5. Matas AJ, Bartlett ST, Leichtman AB, et al. Morbidity and mortality after living kidney donation, 1999-2001: Survey of United States transplant centers. Am J Transplant 2003;3(7): 830-4.
6. Shokeir AA: Open versus laparoscopic live donor nephrectomy: A focus on the safety of donors and the need for a donor registry. J Urol 2007;178:1860.
7. 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.
8. Clavien PA, Barkun J, de Oliveira ML, et al. The Clavien-Dindo classification of surgical complications: Five-year experience. Ann Surg 2009;250:187-96.
9. Dols LF, Kok NF, Ijzermans JN. Live donor nephrectomy: A review of evidence for surgical techniques. Transpl Int 2010;23(2):121-30.
10. Schold JD, Goldfarb DA, Buccini LD, et al. Comorbidity burden and perioperative complications for living kidney donors in the United States. Clin J Am Soc Nephrol 2013;8: 1773-82.
11. Patel S, Cassuto J, Orloff M, et al. Minimizing morbidity of organ donation: Analysis of factors for perioperative complications after living donor nephrectomy in the United States. Transplantation 2008;85:561-5.
12. Friedman AL, Cheung K, Roman SA, Sosa JA. Early clinical and economic outcomes of patients undergoing living donor nephrectomy in the United States. Arch Surg 2010;145:356-62
13. Segev DL, Muzaale AD, Caffo BS, et al. Perioperative mortality and long-term survival following live kidney donation. JAMA 2010; 303:959-66.
14. Power RE, Preston JM, Griffin A, et al. Laparoscopic vs open living donor nephrectomy: A contemporary series from one centre. BJU 2006; Int 98:133.
15. Brown SL, Biehl TR, Rawlins MC, et al. Laparoscopic live donor nephrectomy: A comparison of the conventional open approach. J Urol 2001; 165:766.
16. Nanidis TG, Antcliffe D, Kokkinos C et al. Laparoscopic versus open live donor nephrectomy in renal transplantation: a meta-analysis. Ann Surg 2008;247(1):58-70.
17. Antcliffe D, Nanidis TG, Darzi AW, et al. A meta-analysis of mini-open versus standard open and laparoscopic living donor nephrectomy. Transpl Int 2009;22(4):463-74.
18. Yuan H, Liu L, Zheng S, et al . The safety and efficacy of laparoscopic donor nephrectomy for renal transplantation: An updated meta-analysis. Transplant Proc 2013;45(1):65-76.