Hand-Assisted Nephrectomy Predisposes Incisional Herniation in Obese Living Donors

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ABSTRACT

Background. Living kidney donation from donors with a body mass index (BMI) over 30 can bring risks for the donor and the recipients. In this retrospective study, we evaluated the effect of a donor's obesity on a donor's long-term surveillance and the recipient outcomes.

Method. We performed hand-assisted retroperitoneoscopic donor nephrectomy in 565 living kidney transplantations between February 2009 and December 2015. One hundred fifty-two donors (26.9%) had a BMI > 30 and were described as the obese group. Four hundred thirteen donors (73.1%) were described as the nonobese group and had a BMI < 30. Incision to kidney removal time, mean follow-up period, postoperative complications, weight gained after surgery, and serum creatinine level (postop day 1-end of follow-up) were recorded for the donors. Serum creatinine level (postop day 5-end of follow-up) and immediate function of transplanted kidney were recorded for the recipients.

Results. The obese donors were older, and the female sex was dominant. Mean incision to kidney removal period was longer in the obese patients ($P = .012$). The mean follow-up period was 49.97 ± 28.40 months for the donors. There was no significant difference in donor kidney function between the groups. The incidence of herniation was significantly higher in the obese group ($P = .021$). There was no significant difference between the recipient early and late serum creatinine levels and slow and delayed graft functions after the transplantation.

Conclusion. Postoperative kidney functions concerning the outcomes of the obese and nonobese living donors were similar in our series. Donor BMI had no influence on early and late kidney functions of the recipients. There was no difference in postoperative complications, except incisional hernia, that was statistically more significant in the obese donors.

LONG waiting times for deceased donor kidney transplantations and the superior outcomes of live donor transplantations have increased the volume of live donor transplants [1]. The relative shortage of renal donors and deceased kidneys with a rise in prevalence of obesity necessitates the inclusion of morbidly obese patients into the pool of potential donors who are in good health. Several studies revealed obesity as a strong risk factor for glomerular disease [2,3] and end-stage renal disease [4]. Moreover, obesity can be the reason for glomerular hyperfiltration and the elevated measured glomerular filtration rate [5]. Praga et al declared a long-term study among the nondonor population that

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underwent unilateral nephrectomy, revealing significantly lower proteinuria-free and chronic renal failure-free rates in obese patients when compared with the nonobese [6]. Although long-term studies suggest that donor nephrectomy has no negative impact on a donors' survival or renal function [7,8] and short-term studies reveal no differences in perioperative and early outcomes between obese and nonobese donors [9,10], little is known about the long-term outcomes of obese living kidney donors. Since the donor selection was restricted to a selected group before the millennium, the donors' long-term outcomes were excellent. Due to a persistent donor shortage, the rate of obese individuals in the donor pool is expanding every day. Therefore, the current donor population may have an increased renal risk when compared with the former, healthy group [11].

Open donor nephrectomy in obese subjects is associated with more incision-site related postoperative complications [12]. The introduction of the laparoscopic surgical technique having the advantages of minimal invasive surgery, with similar perioperative results between obese and nonobese patients [9,13]. Hand-assisted retroperitoneoscopic (HARP) donor nephrectomy provides the advantages of minimal invasive surgery and increases the safety by protecting the integrity of the abdominal cavity; it is our preferred surgical technique. Unfortunately, the perioperative data assessing the impact of HARP on obese donor outcomes are sparse.

The primary aim of this study is to evaluate the effect of a donor's obesity on a donor's perioperative incision site complications and long-term renal surveillance. The secondary aim is to assess the association between the recipients immediate and early kidney function outcomes and donor obesity.

MATERIALS AND METHOD

We retrospectively reviewed 565 consecutive living kidney transplantation donors who underwent HARP donor nephrectomy and their recipients between February 2009 and December 2015. We divided donors into 2 main groups and defined them as obese if their body mass index (BMI) was over 30 and nonobese if their BMI was below 30. In our center, we have a strict follow-up program that is maintained by nephrologists and a transplant coordinator nurse; therefore, we are able to access the medical records for the majority of our patients. All data was collected from the patient's medical records. Incision to kidney removal time, mean follow-up period, postoperative complications, weight gained after kidney donation, and serum creatinine level (postop day 1-end of last follow-up) were recorded for the donors. Serum creatinine level at postoperative day 5 and end of follow-up period and immediate function of the transplanted kidney, including slow graft function (SGF) and delayed graft function (DGF), were recorded for recipients. Any dysfunction of a transplanted kidney described was as SGF if the creatinine level of the recipient was over 2.5 mg/dL at postoperative day 5 and DGF if the recipient needed a hemodialysis in the first week after transplantation. A weight gain of more 3than 5 kg was accepted as significant for the donors after nephrectomy during the follow-up period. All results were compared across BMI groups.

Surgical Technique

All donor nephrectomies were performed by 2 surgeons. A 7 to 8 cm paramedian incision below the umbilical line was applied for the majority of the donors for handport insertion to facilitate the surgery, while a significant minority of nonobese donors, who had cosmetic concerns, had a chance to have a Pfannenstiel incision. After the kidney extraction, both layers of fascia were closed with a single layer interrupted polydioxanone suture (PDS 1–0; Ethicon GmbH, Ethicon Inc, Johnson & Johnson, Somerville, NJ). The subcutaneous tissue was closed with a polyglactin 910 suture (Vicryl 0-UR6; Ethicon GmbH). All skin defects were sutured intracutaneously with a polyglactin 910 suture (Vicryl rapide 4–0; Ethicon GmbH). Fascial defects caused by the 12 mm trocars were sutured using an interrupted polyglactin 910 suture (Vicryl 0-UR6; Ethicon GmbH).

Statistical Analysis

Statistical analysis was performed by the NCSS (Number Cruncher Statistical System) 2007 Statistical Software (NCSS LLC, Kaysville, Utah, USA). Differences in continuous variables were compared with the Mann-Whitney U test. Categorical variables were analyzed by the χ^2 test. Qualitative data was analyzed by the Fisher exact test and Fisher-Freeman-Halton exact test. For comparison with norm values, sample t tests were calculated. Wilcoxon signed ranks was used in quantitative variables that are not normally distributed. A P value of less than .05 was considered statistically significant.

RESULTS

Baseline characteristics and laboratory data are shown in Table 1. There were 565 renal donors (318 women, 247 men). Mean age was 44.34 ± 12.27 years. The donors in the obese group were significantly older (48.54 ± 10.46 vs 42.79 ± 12.54; $P < .001$) and in the female sex (66.4% vs 33.6%; $P = .003$). There were no statistically significant differences regarding the follow-up period, weight gained after kidney donation, right versus left kidney used, or total ischemia time. Due to the advantages of hand-assisted surgery, warm ischemia time of the procured kidneys was never longer than 150 seconds. Although the rate of unilateral nephrectomy with multiple arteries was higher in the nonobese group (18.9%/12.5%), mean incision to kidney removal time was significantly longer in the obese (99.23 ± 27.4 vs 106.37 ± 34.99, $P = .012$). No conversion to open surgery or blood transfusions were required in any group. The rate of wound-site infection was slightly higher in the obese, but it was not statistically significant (2.1%/1.3%). During follow-up, 12 (2.2%) donors were presented with incisional hernias. Seven (4.8%) of those donors were included in the obese group, and it was significantly high when compared to the nonobese group ($P = .021$). Another small group of donors was created in the study; this was separate from the obese group and included donors having a BMI over 35 to evaluate the effect of morbid obesity on perioperative morbidity. It was seen that 3/38 morbid obese patients presented with incisional hernia (7.3%) during the follow-up period, and the rate of herniation was significantly high when compared to nonobese patients. Moreover, when this group was excluded

Table 1. Donor Demographics, Perioperative Morbidities, and Renal Function Related to Obesity

	Sum	Body Mass Index (kg/m^2)		Test Value
		< 30 (n = 413)	≥ 30 (n = 152)	*P*
Age (years)				
Min-Max (Median)	18–76 (44)	18–76 (42)	22–73 (48.5)	t:–5.044
Mean ± SD	44.34 ± 12.27	42.79 ± 12.54	48.54 ± 10.46	.001†,‡
Sex				
Female	318 (56.3)	217 (52.5)	101 (66.4)	χ^2:8.731
Male	247 (43.7)	196 (47.5)	51 (33.6)	.003†,§
Follow-up (months)				
Min-Max (Median)	1–108 (48)	1–108 (47)	1–104 (53.5)	Z:-.550
Mean ± SD	49.97 ± 28.40	49.38 ± 28.09	51.42 ± 29.20	.582‖
Incision to kidney removal time (min)				
Min-Max (Median)	30–300 (100)	30–220 (100)	46–300 (100)	t:–2.533
Mean ± SD	101.15 ± 29.84	99.23 ± 27.49	106.37 ± 34.99	.012*,‡
Total ischemia time				
Min-Max (Median)	20–215 (76.5)	30–215 (78)	20–205 (75)	t:.048
Mean ± SD	81.85 ± 27.03	81.88 ± 26.69	81.76 ± 28.04	.961‡
Weight gained after donation				
No	468 (86.5)	346 (87.4)	122 (84.1)	χ^2:.952
Yes	73 (13.5)	50 (12.6)	23 (15.9)	.329§
S creat. (Po day 1)				
Min-Max (Median)	0.4–9 (0.9)	0.4–9 (0.9)	0.6–1.2 (0.9)	Z:–1.706
Mean ± SD	0.90 ± 0.42	0.92 ± 0.49	0.87 ± 0.15	.088‖
S creat. (Last control)				
Min-Max (Median)	0.5–2.1 (1)	0.5–2.1 (1)	0.5–1.8 (1)	t:-.368
Mean ± SD	1.03 ± 0.22	1.03 ± 0.22	1.04 ± 0.23	.713‡
Kidney side				
Right	111 (19.6)	88 (21.3)	23 (15.1)	χ^2:2.685
Left	454 (80.4)	325 (78.7)	129 (84.9)	.101§
Incisional hernia				
No	524 (97.8)	386 (98.7)	138 (95.2)	χ^2:6.086
Yes	12 (2.2)	5 (1.3)	7 (4.8)	.021*,¶
Wound infection				
No	528 (98.5)	386 (98.7)	142 (97.9)	χ^2:.449
Yes	8 (1.5)	5 (1.3)	3 (2.1)	.452¶

Abbreviation: SD, standard deviation.
*$P < .05$.
†$P < .01$.
‡Student *t* test.
§Pearson χ^2 test.
‖Mann-Whitney U test.
¶Fisher's exact test.

from the obese group, it was determined that there was no significant difference, including the perioperative morbidity, between the obese and nonobese groups (Table 2).

Kidney Function

After unilateral nephrectomy, serum creatinine levels showed no difference between the donor groups at the first postoperative day and the end of the follow-up period. When comparing the functional outcomes of transplanted kidneys, no differences were seen according to the donor BMI groups. Donor BMI showed no influence on a recipient's early and late serum creatinine levels during the follow-up period after kidney transplantation (Table 3). Four percent of the recipients who received kidneys from nonobese donors had slow graft function and 1% of them had delayed graft function, while these numbers were 2% and 0.7%, respectively, in recipients who received kidneys from the obese donors. These outcomes showed no significant difference to a donor's BMI.

DISCUSSION

HARP donor nephrectomy is a feasible and safe approach for the procurement of living kidney donors and has become our preferred surgical technique since 2009. The technique has reduced intraoperative complication rates [14,15], but Halgrimson et al [16] suggested in their meta-analysis that donors who underwent hand-assisted donor nephrectomy have greater incision morbidity compared with pure minimal invasive surgery. In literature, the incisional hernia rate in a hand-assisted donor nephrectomy series was stated as between 0.7% and 3.8% including different types of skin incisions [16,17]; in another study, Heimbach et al [9]

Table 2. Donor Perioperative Morbidity Related to Morbid Obesity

	Body Mass Index (kg/m^2)			Test Value
	< 30	30–34.9	≥ 35	*P*
Incisional hernia				
No	386 (98.7)	100 (96.2)	38 (92.7)	χ^2:7.231
Yes	5 (1.3)	4 (3.8)	3 (7.3)	.019*,‡
Wound infection				
No	386 (98.7)	101 (97.1)	41 (100.0)	χ^2:1.668
Yes	5 (1.3)	3 (2.9)	0 (0.0)	.448‡
Weight gained after donation				
No	346 (87.4)	88 (84.6)	34 (82.9)	χ^2:1.024
Yes	50 (12.6)	16 (15.4)	7 (17.1)	.599†

*$P < .05$.
†Pearson χ^2 test.
‡Fisher-Freeman-Halton test.

declared in their 553 consecutive hand-assisted donor nephrectomy series that wound complications, consisting of infections and hernia, were the most frequent procedure-related complications in all the BMI groups and significantly increased with increasing donor BMI. In their study, they declared the rate of hernia as 2% to 4% and wound infection as 1% to 3% in the nonobese group, while these rates were 9% to 10% and 5% in the obese group, respectively. Our results indicate lesser wound complication rates when compared with these results; however, the incision-site hernia rates saw similar increments with the increase of BMI. Therefore, obesity and hand-assisted surgery techniques seem to be the 2 major risk factors that predisposes incision site herniation. Nevertheless, our obese donor population was older and primarily female, and these factors might be the secondary reasons for a high herniation rate. In the duration of a donor nephrectomy, incision to kidney removal times were longer for obese donors; however, this aspect did not cause any effect on perioperative morbidity. In contrast with the literature, weight gained during the follow-up period in renal donors who were already obese at the time of donation showed no differences between the BMI groups [18].

Obesity has been found to be a common and strong risk factor for chronic kidney disease [2] and end-stage renal disease [4]. Nogueira et al reported in their study that living kidney donation from obese individuals has a higher risk of hyperfiltration injury as a risk for progressive chronic kidney disease [19]. In another study, Rook et al declared that after kidney donation, older age and higher BMI were independently associated with a lower renal reserve capacity [20]. Contrary to these studies, we did not find any significant increase in a donor's creatinine levels with elevated BMI, compared with nonobese donors, in our medium-term study. In their short-term study, Reese et al showed no renal functional difference between the obese and nonobese donors; moreover, recipients of kidneys from the obese live donors had an increased risk of primer nonfunction and

Table 3. Recipient Early- and Late-Graft Function Related to Donor BMI Groups

		Body Mass Index (kg/m^2)		Test Value
	Sum	< 30	≥ 30	*P*
S creat. (Po day 5)				
Min-Max (Median)	0.2–9.9 (1.1)	0.3–9.9 (1.1)	0.2–9.2 (1)	Z:–1.863
Mean ± SD	1.20 ± 0.81	1.23 ± 0.81	1.13 ± 0.80	.063‡
S creat. Last control				
Min-Max (Median)	0–4 (1.1)	0.5–4 (1.1)	0–4 (1.2)	Z:–1.588
Mean ± SD	1.26 ± 0.52	1.24 ± 0.51	1.29 ± 0.55	.112‡
DGF				
No	545 (99.1)	398 (99.0)	147 (99.3)	χ^2:0.122
Yes	5 (0.9)	4 (1.0)	1 (0.7)	1.000§
SGF				
No	537 (96.6)	388 (96.0)	149 (98.0)	χ^2:1.321
Yes	19 (3.4)	16 (4.0)	3 (2.0)	.250†
Rp follow-up period (months)				
Min-Max (Median)	0.03–94.1 (43.8)	0.03–94.1 (40.7)	1.2–93.8 (51)	Z:–2.717
Mean ± SD	45.21 ± 25.06	43.43 ± 24.80	50.04 ± 25.22	.007*,‡

Abbreviation: SD, standard deviation.
*$P < .05$.
†Pearson χ^2 test.
‡Mann-Whitney U test.
§Fisher's exact test.

DGF, but most had an excellent 1-year outcome [21]. In our study, the recipients who received kidneys from the obese donors had a longer follow-up period compared with nonobese donors. During this follow-up period, SGF, DGF, early, and medium-term renal functions of the recipients showed no difference regarding BMI groups.

In this retrospective assessment, despite having a strict follow-up program, there is still missing data that limit our study. However, the proportions of missing data did not differ between the obese and nonobese donors. In conclusion, our findings suggest that donor BMI has no impact on donors' or recipients' early- or late-renal functional outcome. Although wound infection rates were similar, our study suggests that in living kidney donation, hand-assisted surgery in the obese donors increases the rate of incisional hernia.

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