Feasibility and impact of laparoscopic sleeve gastrectomy after renal transplantation on comorbidities, graft function and quality of life.

Naif Alenazi (✉ dr.naifalenazi@gmail.com)

Prince Mohammed Bin Abdul Aziz Hospital

Khaled S Ahmad

Prince Mohammed Bin Abdul Aziz Hospital

Ilham A Elsamahy

Saudi German Hospitals Group

Mohamed S Essa

Benha University Faculty of Medicine

Research article

Keywords: Renal transplantation, sleeve gastrectomy, hypertension, dyslipidemia, graft function

Posted Date: March 18th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-17898/v1>

License: This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Version of Record: A version of this preprint was published at BMC Surgery on May 4th, 2021. See the published version at <https://doi.org/10.1186/s12893-021-01138-x>.

Abstract

Background

The aim of this study is to clarify the feasibility and effect of laparoscopic sleeve gastrectomy (LSG) on comorbidities, graft function and quality of life in patients under went renal transplantation (RT)

Methods

This is a retrospective review of 5 patients who underwent laparoscopic sleeve gastrectomy (LSG) after kidney transplantation. Patients demographic data, anthropometric parameters, effect on comorbidities, postoperative course, immunosuppressive medications, cause of renal transplantation (RT), renal function, survival of graft, and post-sleeve gastrectomy quality of life in obese patients with history of renal transplantation (RT) were assessed using BAROS–Moorhead–Ardelt survey

Results

From September 2015 to September, 2019, 5 renal transplant patients underwent underwent laparoscopic sleeve gastrectomy (LSG); 60% were female and 40 were male with an average body mass index (BMI) before surgery of 41.28 ± 5.8 kg/m² (range 36–55). Associated comorbidities: 100% of the patients had hypertension (HTN) and dyslipidemia (DSL), Whereas 3 patients (60%) had type 2 diabetes mellitus (T2D) and 1 patient had gout (20%). The average time between renal transplantation (RT) and laparoscopic sleeve gastrectomy (LSG) was 5.6 ± 5 years (range 3–9). Average operative duration was 61 ± 16.5 min (range 50–70), and there were neither postoperative morbidity nor mortality. At 17.9 ± 13.6 months (range 7–48) of follow-up period, body mass index (BMI) was 28.8 ± 6.3 kg/m² (range 25–42). Regarding patients with hypertension (HTN) and dyslipidemia (DSL), improvement in blood pressure, triglyceride and cholesterol levels was observed and all cases were able to decrease their medications. Regarding diabetic patients, insulin was stopped in all patients and replaced with oral hypoglycemic medication only (linagliptin). Renal graft function and proteinuria level decreased in all cases (100%). All patients claimed to have excellent quality of life.

Conclusion

LSG showed excellent outcomes regarding weight reduction, improvement and resolution of comorbidities, kidney function and quality of life in this high risk group of patients.

Background

Obesity has strong relationship with hypertension (HTN) and type 2diabetes (T2D) which are the most essential risk factors that lead to end stage renal disease (ESRD). Furthermore, HTN and T2D are the most common causes of chronic kidney disease (CKD). It is noted that CKD is constantly increasing at a rate of 7% per year. Interestingly, BMI has increased in CKD patients undergoing dialysis and also in patients on the waiting list for RT [1–6]. Several centers consider transplantation is contraindicated in morbidly obese patients because it is associated with high rate of morbidity [7, 8].

Weight gain and morbid obesity following renal transplantation are considered a major health concern[9]. Multiple factors may provoke post-renal weight gain including immunosuppressant, hormonal changes, and lack of physical activity[10, 11]. Obesity has a huge burden on both pre- and post-transplantation patients including a high risk of graft loss and delayed graft function[12]. Obesity can negatively influence wound repair and increase the risk of

postoperative hernias[13]. In addition, it is associated with shortening patient survival and decreased quality of life[12, 13]. Bariatric surgery, especially LSG, has been shown to be effective in reducing weight and obesity-related complications among post-renal transplantation population[14, 15]. Nonetheless, the efficacy of LSG for post-renal transplantation patients has not thoroughly investigated. This case series retrospectively reviews and highlights the outcomes of five cases underwent LSG following kidney transplant.

Methods

This study involves 5 patients underwent LSG post-RT at Saudi German Hospital, Riyadh, Saudi Arabia; the data of the patients were assessed retrospectively. Demographic data, anthropometric parameters, impact on comorbidities, perioperative informations (operative duration, hospital stay length, early and late postoperative complications), immunosuppressive medications, indications for transplantation, timing from RT to LSG, graft function and survival associated with post-RT sleeve gastrectomy for obese patients were assessed. BAROS–Moorhead–Ardelt score were used for evaluation of quality of life. This score assess the percentage of excess weight loss (%EWL), comorbidities resolution and quality of life score from 1 to 9. BAROS–Moorhead–Ardelt score are: failure (≤ 1), faire enough (1–3), good results (3–5), very good (5–7) and excellent (> 7 –9).

Surgical Technique:

Under direct vision 12-mm optical trocar was inserted for the camera in the midline supraumbilical position. After that, two other ports inserted (one 5 mm on the left hypochondrium and one 5 mm on the right hypochondrium) in addition a 10-mm trocar was inserted on the left flank. PretzelFlex liver retractor was introduced in the epigastric region. Dissection of the greater omentum and short gastric vessels from the gastric greater curvature till the left crus of the diaphragm using Harmonic scalpel. A 42-Fr bougie was inserted. Gastric division started approximately 4–6 cm from the pylorus and parallel to the lesser curvature of the stomach and extended vertically toward His angle using between 4 and 5 linear staplers such as Echelon 60. Black (4.2 mm), green (4.1 mm), gold (3.8 mm), or blue (3.5 mm) cartridges were applied based on the gastric wall thickness. Reinforcement of the staple line was done using absorbable suture in running fashion. The specimen was retrieved in a plastic bag.

Statistical analysis

Measurement data were expressed as mean $\pm$ standard deviation ($\bar{x} \pm s$) and analyzed with Student's t test. Count data were analyzed using the Chi-square test. All data were processed with a SPSS 17.0 software package. P- Value < 0.05 was defined as statistically significance.

Results

This study included five patients underwent post-RT laparoscopic sleeve gastrectomy between September 2015 and September 2019 at Saudi German Hospital. There were three female (60%) and two male (40%). BMI before RT was 27.7 ± 4.3 kg/m² (range 22–41) and before SG was 41.28 ± 5.8 kg/m² (range 36–55). Demographic data, comorbidities, timing from RT to LSG and operative duration are shown in Table 1. Anthropometric parameters pre-renal transplantation (RT), pre-SG, and post-SG are shown in Table 2.

The follow-up period was 17.9 ± 13.6 months (range 7–48). At that time, body BMI was 28.5 ± 6.3 kg/m² (range 25–42) (Fig. 1) and %EWL was $57 \pm 12.7\%$ (range 31–86) (Fig. 2). Associated comorbidities were HTN and dyslipidemia (DSL) in all patients. Three patients (60%) had T2D, and 2 had gout (40%).

Regarding comorbidities, the results were as follows: improvement in blood pressure occurred in 100% of patients from 149 /95 mmHg LSG to 125/80 mmHg after LSG ($p = \text{NS}$). Also reduction in cholesterol level has been observed, which was reduced from 322 ± 65 mg/dl before the surgery to 206 ± 25 mg/dl after surgery ($p = \text{NS}$). Triglycerides reduced from 195 ± 55 mg/ dl to 155 ± 25 mg/dl ($p = \text{NS}$) [Table 3]. Regarding diabetes mellitus (DM), 3 patients were T2D. All were receiving Novomix insulin (2 patients received Novomix 40U/day and 1 patient Novomix 60U/day) before surgery. After surgery linagliptin (5 mg/day) replace insulin in all cases. A1C was high in all patients before surgery and decrease postoperatively at 17.9 follow up period [Table 4].

Before kidney transplantation all patients were on hemodialysis. Post- RT, all cases received immunosuppressive medications: steroids and cyclosporine were given for all patients; in addition to, 4 patients (80%) received mycophenolate, 1 patient (20%) azathioprine, 1 patient (20%) tacrolimus and 1 patient everolimus[Table 5]. Indications for RT were systemic lupus erythematosus (SLE), HTN, DM, interstitial nephritis and glomerulonephritis. The average time between RT and LSG was 5.6 ± 5 years (range 3–9). Operative duration for SG was 61 ± 16.5 min (range 50–70). Average length of hospital stay was 4.8 ± 1.83 days (range 4–6). Postoperative recovery was uneventful. There were no complications or mortality after surgery in this series.

Average creatinine level was 1.6 ± 0.6 mg/dl (range 1.2–2.2) preoperatively, after LSG, it decreased to 1.17 ± 0.2 mg/dl (range 0.9–1.5) ($p = \text{NS}$), creatinine levels improved in all cases (100%) (Fig. 3). Proteinuria improved from 19.7 ± 6 (range 10–37) before the surgery to 11.3 ± 4 (range 8–18) after surgery ($p = \text{NS}$) (Fig. 4). As creatinine levels, proteinuria decreased in all patients (100%) post-LSG. The BAROS–Moorhead–Ardelt survey was used to assess quality of life after surgery in all cases. All patients pretended to have an excellent quality of life (7–9 points). They were satisfied with the results after surgery.

Table (1)

Demographic data, comorbidities, timing from RT to LSG and operative time

Number	Age(ys)	Sex	Medical history	Time from RT to LSG (ys)	Operative time (min)
Patient 1	40	Male	HTN, Dyslipidemia, Gout	6	62
Patient 2	52	Female	HTN, DM, dyslipidemia	6	58
Patient 3	33	Female	HTN, Dyslipidemia, DM	4	65
Patient 4	38	Male	HTN, dyslipidemia	3	50
Patient 5	36	Female	HTN, DM, dyslipidemia	9	70
HTN: Hypertension, DM: Diabetes milletus, LSG: Laparoscopic sleeve gastrectomy, ys: years, BMI: Body mass index, min: minute					

Table (2)

Anthropometric parameters

Anthropometric data	Mean $\pm$ SD (range)
BMI before RT (kg/m ²)	27.7 $\pm$ 4.3 (22–41)
BMI before LSG (kg/m ²)	41.28 $\pm$ 5.8 (36–55)
Weight before LSG (kg)	102.7 $\pm$ 8.5 (92–130)
BMI after LSG (kg/m ²)	28.5 $\pm$ 6.3 (25–42)
Follow-up after LSG (months)	17.9 $\pm$ 13.6 (7–48)
RT: Renal transplantation, LSG: laparoscopic sleeve gastrectomy, BMI: Body mass index	

Table (3)
Evolution in cholesterol, triglyceride and blood pressure post-SG

Comorbidities		Patient 1	Patient 2	Patient 3	Patient 4	Patient 5
Cholesterol (mg/dl)	Pre-SG	345 $\pm$ 25	325 $\pm$ 20	310 $\pm$ 15	310 $\pm$ 35	320 $\pm$ 20
	Post-SG	215 $\pm$ 5	200 $\pm$ 5	205 $\pm$ 10	195 $\pm$ 4	208 $\pm$ 6
Triglycerides (mg/dl)	Pre-SG	215 $\pm$ 25	185 $\pm$ 30	205 $\pm$ 20	195 $\pm$ 20	195 $\pm$ 50
	Post-SG	175 $\pm$ 15	140 $\pm$ 20	145 $\pm$ 5	155 $\pm$ 10	155 $\pm$ 35
Blood pressure (mmHg)	Pre-SG	150–90	145–100	155–95	157–89	142–100
	Post-SG	125–85	125–90	130–80	130–85	130–78
SG: sleeve gastrectomy						

Table (4)
Improvement in A1C and medications after SG

Patients	Type of DM	Timing	A1C	Medications
Patient 2	T2D	Pre-LSG	8.6	Biphasic insulin70:30 (Novomix) 40 U daily
		Post-LSG	6.4	Linagliptin 5 mg/day
Patient 3	T2D	Pre-LSG	8	Biphasic insulin70:30 (Novomix) 40 U daily
		Post-LSG	6.2	Linagliptin 5 mg/day
Patient 5	T2D	Pre-LSG	9	Biphasic insulin70:30 (Novomix) 60 U daily
		Post-LSG	6.7	Linagliptin 5 mg/day
T2D: Diabetes mellitus type2, A1C: glycosylated hemoglobin, LSG: Laparoscopic sleeve gastrectomy				

Table (5)
Immunosuppressive medications before and after LSG

Timing from surgery	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5
Pre-SG	Cyclosporine (100 mg/day) Mycophenolate (1500 mg/day) Methylprednisone (5 mg/day) Everolimus (1.5 mg/day)	Cyclosporine (200 mg/day) Mycophenolate (1000 mg/day) Methylprednisone (5 mg/day)	Cyclosporine (100 mg/day) Mycophenolate (2160 mg/day) Methylprednisone (5 mg/day)	Cyclosporine (50 mg/day) Azathioprine (100 mg/day) Methylprednisone (5 mg/day)	Cyclosporine (100 mg/day) Mycophenolate (2160 mg/day) Methylprednisone (5 mg/day)
Post-SG	Mycophenolate (1500 mg/day) Methylprednisone (5 mg/day) Everolimus (1.5 mg/day)	Cyclosporine (150 mg/day) Mycophenolate (1000 mg/day) Methylprednisone (5 mg/day)	Cyclosporine (50 mg/day) Mycophenolate (1080 mg/day) Methylprednisone (5 mg/day)	Azathioprine (100 mg/day) Cyclosporine (50 mg/day) Methylprednisone (5 mg/day)	Cyclosporine (100 mg/day) Mycophenolate (1080 mg/day) Methylprednisone (5 mg/day)
SG: sleeve gastrectomy					

Discussion

Weight gain and obesity are common conditions affecting around half of the post-kidney transplant patients. Post-grafting weight gain is associated with the incidence of hypertension, diabetes mellitus, hyperlipidemia, graft rejection, and decreased graft survival [4, 16]. Thus, efficacious weight reduction procedures are essential to preclude these complications. Bariatric surgery is an effective ingrained management choice for morbid obesity in particular cases [14]. Of note, LSG, compared to other bariatric operations, has promising efficacy and reliability [14, 15].

The American Society of Metabolic and Bariatric Surgery (ASMBS) has recently approved the LSG as the first-stage procedure for sustained weight reduction [17]. Previous reports have indicated that LSG has several salutary features including short operative time, low morbidity, and it is considered a non-complex procedure compared to gastric bypass, these advantages are of the greatest value for patients who are largely liable to incidence of complications [18, 19]. Furthermore, LSG has been considered as the first-choice intervention for pre-transplant candidates, as well as post-liver transplant population [20, 21]. Thus, we believe that LSG is the proper decision for morbid obesity and weight reduction in post-renal transplant patients. A major advantage of LSG is that it does not interfere with the absorption of immunosuppressant drugs [22]. These drugs play an intrinsic role in preventing acute graft rejection and lengthening the graft survival. In contrast, malabsorptive procedures such as Roux-en-Y gastric bypass (GB) and biliopancreatic diversion may manipulate the pharmacokinetics of immunosuppressant drugs. This has been stated in Golomb et al. study, whereas two patients required a higher dose of tacrolimus while the dose was decreased in one patient [23].

Golomb et al. performed LSG for 10 post-renal transplant patients and concluded a successful procedure in 80% of cases without graft rejection or dysfunction [16]. In addition, urinary protein and serum creatinine markedly decline following LSG which is consistent with our findings as well as previously published reports [23–24]. In another recent study, creatinine levels were normalized following bariatric surgery and kidney function slightly improved 12 months after surgery. The exact value and impact of this improvement have not yet clearly understood [25]. However, proteinuria has been recognized as a poor prognostic marker and risk factor of mortality among kidney transplant patients [26]. Thus, it is plausible that this improvement might have a long-term effect on graft function and survival [23].

This retrospective case series had several limitations. First, it included only five subjects which encounter the generalization and reliability of LSG as a standard measure for weight reduction in kidney transplant patients. Second, the follow-up extended to 4 years; however, it may be not sufficient to accurately examine graft function and graft survival. Therefore, our findings need to be further advocated by large-scale random studies with extended follow-up. In addition, future studies are recommended to compare their inferences with kidney transplant patients who were not subjected to bariatric surgery.

Conclusion

Our study showed that there were no pre- or post-operative complications reported. Diabetes and hypertension were managed and the patients discontinued the medications after bariatric surgery. Urinary proteins and lipid levels were settled, graft function was improved, and all patients reported enhanced quality of life.

List Of Abbreviations

RT	Renal transplantation
LSG	laparoscopic sleeve gastrectomy
SG	Sleeve gastrectomy
HTN	Hypertension
DSL	Dyslipidemia
BMI	Body mass index
ESRD	End stage renal disease
CKD	Chronic kidney disease
DM	Diabetes mellitus
T2D	Diabetes mellitus type 2
A1C	Glycosylated hemoglobin
NS	Non significant
GB	Gastric bypass
ASMBS	American Society of Metabolic and Bariatric Surgery

Declarations

Acknowledgements:

Not applicable

Ethical approval and consent to participate:

This data collection was approved by the Ethical Committee at Saudi German Hospital. IRB NO: 17918

Consent for publication:

Written consent was obtained for publication of this series

Availability of data and materials:

The datasets used and/or analysed during the current study available from the corresponding author on reasonable request.

Competing Interest:

There is no conflict of interest to disclose

Funding:

There are no sources of funding to acknowledge

Authors' contributions: All authors have read and approved the manuscript

NA: Study concept, design, data collection, interpretation, literature review, writing

KA: Data collection, writing

ME: Literature review, writing:

IE: literature review, writing

References

- 1-Wickman C, Kramer H.** Obesity and kidney disease: potential mechanisms. *Semin Nephrol.* 2013;33(1):14–22.
- 2- Kramer HJ, Saranathan A, Luke A, et al.** Increasing body mass index and obesity in the incident ESRD population. *J Am Soc Nephrol.* 2006;17(5):1453–9.
- 3- Ejerblad E, Fored CM, Lindblad P, et al.** Obesity and risk for chronic renal failure. *J Am Soc Nephrol.* 2006;17(6):1695–702.
- 4- Friedman AN, Miskulin DC, Rosenberg IH, et al.** Demographics and trends in overweight and obesity in patients at time of kidney transplantation. *Am J Kidney Dis.* 2003;41(2):480–487.
- 5- Imes CC, Burke LE.** The obesity epidemic: the United States as a cautionary tale for the rest of the world. *Curr Epidemiol Rep.* 2014;1(2):82–8.

- 6-Lysaght MJ.** Maintenance dialysis population dynamics: current trends and long-term implications. *J Am Soc Nephrol.* 2002;13:S37–40.
- 7-MacLaughlin HL, Cook SA, Kariyawasam D, et al.** Nonrandomized trial of weight loss with orlistat, nutrition education, diet and exercise in obese patients with CKD: 2-year followup. *Am J Kidney Dis.* 2010;55(1):69–76.
- 8-Kälble T, Lucan M, Nicita G, et al.** EAU guidelines on renal transplantation. *Eur Urol.* 2005;47(2):156–66.
- 9-Hasse J.** Pretransplant obesity: a weighty issue affecting transplant candidacy and outcomes. *Nutrition in Clinical Practice.* 2007;22(5):494-504.
- 10-Weiss H, Nehoda H, Labeck B, et al.** Organ transplantation and obesity: evaluation, risks and benefits of therapeutic strategies. *Obesity surgery.* 2000;10(5):465-469.
- 11-Kokot F, Więcek A, Adamczak M, et al.** Pathophysiological role of leptin in patients with chronic renal failure, in kidney transplant patients, in patients with essential hypertension, and in pregnant women with preeclampsia. *Artificial organs.* 1999;23(1):70-74.
- 12-Pischon T, Sharma AM.** Obesity as a risk factor in renal transplant patients. *Nephrology Dialysis Transplantation.* 2001;16(1):14-17.
- 13-Hakeem AR, Cockbain AJ, Raza SS, et al.** Increased morbidity in overweight and obese liver transplant recipients: a single-center experience of 1325 patients from the United Kingdom. *Liver Transplantation.* 2013;19(5):551-562.
- 14-Gloy VL, Briel M, Bhatt DL, et al.** Bariatric surgery versus non-surgical treatment for obesity: a systematic review and meta-analysis of randomised controlled trials. *Bmj.* 2013;347:f5934.
- 15-Tichansky DS, Madan AK.** Laparoscopic Roux-en-Y gastric bypass is safe and feasible after orthotopic liver transplantation. *Obesity surgery.* 2005;15(10):1481-1486.
- 16-Rogers CC, Alloway RR, Alexander JW, et al.** Pharmacokinetics of mycophenolic acid, tacrolimus and sirolimus after gastric bypass surgery in end-stage renal disease and transplant patients: a pilot study. *Clinical transplantation.* 2008;22(3):281-291.
- 17-Deitel M, Crosby RD, Gagner M.** The first international consensus summit for sleeve gastrectomy (SG), New York City, October 25–27, 2007. *Obesity surgery.* 2008;18(5):487-96.
- 18-Lee CM, Cirangle PT, Jossart GH.** Vertical gastrectomy for morbid obesity in 216 patients: report of two-year results. *Surgical endoscopy.* 2007;21(10):1810-1816.
- 19-Leyba JL, Aulestia SN, Llopis SN.** Laparoscopic Roux-en-Y gastric bypass versus laparoscopic sleeve gastrectomy for the treatment of morbid obesity. A prospective study of 117 patients. *Obesity Surgery.* 2011;21(2):212-6.
- 20-Lin MY, Tavakol MM, Sarin A, et al.** Laparoscopic sleeve gastrectomy is safe and efficacious for pretransplant candidates. *Surgery for Obesity and Related Diseases.* 2013;9(5):653-658.
- 21-Lin MY, Tavakol MM, Sarin A, et al.** Safety and feasibility of sleeve gastrectomy in morbidly obese patients following liver transplantation. *Surgical endoscopy.* 2013;27(1):81-85.

22- Alexander JW, Goodman HR, Gersin K, et al. Gastric bypass in morbidly obese patients with chronic renal failure and kidney transplant. *Transplantation*. 2004;78(3):469–474.

23- Golomb I, Winkler J, Ben-Yakov A et al. Laparoscopic sleeve gastrectomy as a weight reduction strategy in obese patients after kidney transplantation. *American Journal of Transplantation*. 2014;14(10):2384-2390.

24- Navarro-Díaz M, Serra A, Romero R, et al. Effect of drastic weight loss after bariatric surgery on renal parameters in extremely obese patients: long-term follow-up. *Journal of the American Society of Nephrology*. 2006;17(12 suppl 3):S213-217.

25- Elli EF, Gonzalez-Heredia R, Sanchez-Johnsen L, et al. Sleeve gastrectomy surgery in obese patients post-organ transplantation. *Surgery for Obesity and Related Diseases*. 2016;12(3):528-534.

26- Fernández-Fresnedo G, Plaza JJ, Sánchez-Plumed J, et al. Proteinuria: a new marker of long-term graft and patient survival in kidney transplantation. *Nephrology Dialysis Transplantation*. 2004;19(suppl_3):iii47-51.

Figures

Figure 1

BMI before RT, before and after SG.

Figure 2

%EWL.

Figure 3

Graft function (creatinine level) before and after SG.

Figure 4

Graft function (Proteinuria) before and after SG.