Obesity Facts

Case Report

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High Risk of Acute Kidney Failure in Kidney Transplant Recipients Early after Bariatric Surgery

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Abstract
Bariatric surgery is routinely proposed to patients suffering from obesity including kidney transplant recipients. In this specific population, bariatric surgery has a positive impact in long-term outcomes in terms of patient and graft survival. We report here the cases of 4 patients with five post-kidney transplantation bariatric surgeries who experimented acute renal injury early after surgery. Creatinine rising occurred between day 14 and day 20 after surgery. In all cases, it was due to dehydration leading to a pre-renal acute renal failure. The specific care of kidney transplanted patients is discussed: single kidney associated with pre-existing altered kidney function associated with concomitant use of nephrotoxic drugs. Specific education intervention before surgery associated with careful early management of hydration after surgery is mandatory for these patients.

Introduction

The prevalence of obesity keeps increasing worldwide [1]. Obesity is therefore a real challenge to the health financing sustainability all over the word in high-income and low-/middle-income countries [2–4]. Obesity is a cause of chronic kidney disease [5] or can worsen pre-existing kidney disease [6]. CKD patients suffering from obesity have reduced access to kidney transplantation (KT) compared to non-obese patients [7, 8]. Obesity at the time of KT is associated with poor outcomes [9, 10]. Bariatric surgery (BS) performed before KT accelerates access to kidney transplant and ameliorates post-transplant outcomes [11–13]. However, BS can also be discussed after KT. Indeed, significant weight gain frequently appears in the first year after transplant [14].

When performed after KT, because of preexisting obesity or important weight gain after KT, BS allows sustained short-term weight loss [13, 15] with stable allograft function [12, 15] and improvement in diabetes, hypertension, and dyslipidemia [15] at 1-year post-BS.

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Table 1. Demographic and medical characteristics of the 4 patients

	Gender	Date of birth	Date of KT	Underlying nephropathy	BS	Delay, months	PTDM	Resolutive PTDM
Case 1	F	1958	2008	Nephroangiosclerosis	Sleeve	82	Yes	Yes
Case 2	F	1966	2009	Polycystic disease	Sleeve	57	Yes	Insulin withdrawal
Case 3a	F	1989	2011	Nephronophthisis	Sleeve	26	No	
Case 3b	F	1989	2011	Nephronophthisis	Bypass	104	No	
Case 4	M	1982	2017	Focal segmental glomerulosclerosis	Bypass	46	No	

F, female; M, male; KT, kidney transplantation; BS, bariatric surgery; PTDM, post-transplant diabetic mellitus.

Therefore, BS now appears to be a safe and reasonable approach for losing weight after KT and is now recommended as part of the routine care for KTR when BMI is ≥40 kg/m^2 or when BMI is ≥35 kg/m^2 with at least one major obesity-related condition [16]. However, these situations need a careful follow-up of the patients.

We report here 4 cases of acute kidney injury that happens early in patients who had been treated with BS after KT (Tables 1–3). Clinical data were collected from the R@N medical records database (approved by the National Commission for Informatics and Liberties, number 1357164). Patients gave their informed consent to use anonymous data. This study protocol was reviewed and approved by the Ethic Committee of the CHU of Bordeaux, Bordeaux France, and approval number was CHUBX2020RE0286.

Case Report

Case 1

A 50-year-old woman with a history of nephroangiosclerosis received her first kidney transplant in 2008. At the time of KT, her body weight (BW) was 99 kg and body mass index (BMI) 32 kg/m^2. Maintenance immunosuppression associated tacrolimus BID and azathioprine. After KT, weight gain occurred rapidly to a maximum of 153 kg, i.e., BMI 50 kg/m^2 82 months later, and she developed a post-transplant diabetes mellitus (PTDM). Sleeve gastrectomy was then performed. At the time of BS, serum creatinine was 1.45 mg/dL and at day 16 post-BS, while the patient had lost 17 kg, she had ARF (serum creatinine 1.79 mg/dL) with dehydration. After intravenous rehydration, serum creatinine slowly recovers. No kidney biopsy was performed. Tacrolimus trough levels were always in the therapeutic range (6–8 ng/mL). At month 12, BW was 101 kg (BMI 33 kg/m^2) and serum creatinine 1.53 mg/dL. All the antidiabetic treatments were stopped.

Case 2

A 43-year-old woman with a polycystic disease received a kidney transplant from a living donor in 2009. Before transplantation, her BW was 103 kg and BMI was 35.6 kg/m^2. BW then increased to its highest point in month 49 after KT (129 kg, BMI 44.6 kg/m^2) with development of PTDM. Sleeve gastrectomy occurred at month 57 after KT (125 kg, BMI 43.3 kg/m^2). Eighteen days after BS, serum creatinine increased from 0.8 mg/dL to 1.5 mg/dL. The patient was admitted into the renal transplant unit to start intravenous rehydration, with a rapid recovery of renal function. At month 12, BW was 101 kg (BMI 34.9 kg/m^2) and serum creatinine 1.01 mg/dL. Discontinuation of insulin therapy was followed by use of oral antidiabetic medication.

Case 3

A 22-year-old woman with nephronophthisis received a first kidney transplant from a deceased donor in 2009. At the time of KT, her BW was 94 kg (BMI 37.7 kg/m^2). BW increased to reach a maximum level 2 years after KT (105 kg, BMI 42.1 kg/m^2), without PTDM. Sleeve gastrectomy was performed 26 months after KT (2011). Fourteen days later, after a BW loss of 10 kg, the patient experienced acute renal failure and serum creatinine increased from 1.04 to 4.14 mg/dL. Intravenous rehydration was initialized during a 5-day hospitalization. Serum creatinine slowly decreased to 1.92 mg/dL. The patient declined kidney graft biopsy. With dietary counseling after returning home, serum creatinine decreased to its reference value at month 6 and then remained stable (1.03 mg/dL at month 12). BW decreased to 84 kg (BMI 33.6 kg/m^2) at month 12 post-SG. Nine years later, after two pregnancies, BW increased steadily up to 102 kg (BMI 40.9 kg/m^2). Roux-en-Y gastric bypass surgery was performed in 2020, January. Serum creatinine was 1.22 mg/dL at the time of surgery. BW decreased (92 kg at month 1, 87 kg at month 3, 85 kg at month 6, and 82 kg at month 12). No significant change in serum creatinine occurred during this period (1.19 mg/dL at month 1, 1.13 mg/dL at month 3, 1.16 mg/dL at month 6, and 1.12 mg/dL at month 12).

Case 4

A 35-year-old man suffering from obesity-related focal segmental glomerulosclerosis received a first kidney transplant from a deceased donor in 2017. The maximum BW before transplantation was 150 kg (BMI 50.7 kg/m^2). The patient lost BW and BW was 100 kg (BMI 33.8 kg/m^2) at the time of KT. Soon after transplantation, BW increased to 131 kg (BMI 44.3 kg/m^2) when Roux-en-Y gastric bypass surgery was performed (2021, February) and serum creatinine at this time was 1.46 mg/dL. A few days later (day 19 post-BS), the patient was

Table 2. Evolution of weight (kg) and BMI (kg/m^2) before and after BS

	Time of KT		Time of BS		Month 1		Month 3		Month 6		Month 12	
	BW	BMI	BW	BMI	BW	BMI	BW	BMI	BW	BMI	BW	BMI
Case 1	99	32.3	153	50.0	130	42.4			111	36.2	101	33.0
Case 2	103	35.6	125	43.3	117	40.5	113	39.1	102	35.3	101	34.9
Case 3a	94	37.7	105	42.1	97	38.9	95	38.1	92	36.9	84	33.6
Case 3b	94	37.7	102	40.9	92	36.9	87	34.9	85	34.0	82	32.8
Case 4	100	33.8	131	44.3	121	40.9	100	33.8	98	33.1	91	30.8

KT, kidney transplantation; BS, bariatric surgery; BW, body weight; BMI, body mass index.

Table 3. Evolution of serum creatinine (mg/dL) before and after BS

	Creatinine at the time of BS	Highest creatinine after BS	Delay post BS, days	Creatinine month 3	Creatinine month 6	Creatinine month 12
Case 1	1.45	1.79	16		1.61	1.53
Case 2	0.8	1.5	18	0.98	0.93	1.01
Case 3a	1.04	4.14	14	1.18	0.97	1.03
Case 3b	1.22	1.19	/	1.13	1.16	1.12
Case 4	1.46	4.23	19	1.64	1.37	1.37

BS, bariatric surgery.

hospitalized with a severe dehydration and acute renal injury (BW 121 kg, serum creatinine 4.23 mg/dL). Dietary counseling was provided, with intravenous saline rehydration. At discharge, creatinine was 1.78 mg/dL. Ten days later, creatinine increased again (3.05 mg/dL) and the patient was back in hospital. Hydration was initialized intravenously with subcutaneous relay at home. Recovery of renal function was not obtained after 10 days and a kidney biopsy was performed revealing tubular necrosis. After 3 months, serum creatinine was still higher than prior to surgery (1.64 mg/dL). Functional recovery was observed at month 6.

Discussion

In this small monocentric case series of BS performed after KT, we report a high risk of dehydration with acute renal failure in the very early post-operative period. A theoretical risk of acute kidney injury exists following BS. In a retrospective large cohort study including 4,722 patients, 42 patients experienced AKI in the early post-operative period. 88% had pre-renal ARF and 90% fully recovered [17]. In patients with chronic kidney disease, perioperative ARF is more frequent after gastric bypass than after sleeve gastrectomy [18]. Cohen et al recently reported a cohort of 21 kidney transplanted patients that had been through BS [11]. Post-transplant BS was associated with a decreased risk of all-cause allograft injury and mortality. Acute renal injury was not described. In an oldest report, only one acute renal injury (over 87 patients) was reported within 30 days post-BS [19]. However, this was due to a primary cause of acute rejection.

Dehydration after BS can occur. Indeed, we have previously shown that oral hydration significantly decreased early after BS [20] in non-CKD patients. We can therefore anticipate that this decrease of fluid intake in patients with CKD can lead to acute renal injury.

The lack of hydration after BS can be worsened by the occurrence of early and repeated vomiting leading to aphagia, dehydration, electrolytes disturbances, and renal insufficiency. In all patients, anatomic post-surgical complication has to be ruled out in case of recurrent vomiting episodes after BS. In kidney transplant recipients, vomiting episodes should also be reminiscent of acute renal injury. Indeed, the risk of acute renal injury is increased in these patients due to several combined factors: preexisting altered GFR together with pre-operative use of combination of nephrotoxic drugs (calcineurin inhibitors, diuretics, RAAS inhibitors)

Therefore, in kidney transplant recipients, close monitoring of creatinine levels and kidney function is mandatory. Although we had shown that oral hydration was more decreased after bypass [20], this prevention must concern all patients whatever the type of BS according to our current data. A specific education intervention prior to BS should be offered to all kidney transplant recipients to recognize clinical signs of dehydration and to alert the medical team early. The risk zone for ARF post-BS appears to be relatively narrow, between 2 and 3 weeks after surgery since all the patients developed acute renal disease between day 14 and 19. The physicians must be particularly vigilant during this period. No guidelines recommend evaluation of BS patients earlier than 1 month after BS [21]. This is obviously not the case in patients after kidney transplant who do need a closer and specific follow-up.

Only 1 case of ARF occurred in the patient that had been twice through BS (case 3). Interestingly, acute kidney injury only happened after the first BS. We can therefore speculate that prevention, and education, allowed avoiding this complication after the second BS. That means that ARF is not systematic and can be prevented.

The question of the longitudinal evolution of renal function can be raised in the case of BS with large modification of weight, body composition (fat and muscle mass), and body surface area [22]. Regarding rapid changes in renal function, monitoring of serum creatinine is usually recommended. But serum creatinine is biased in this situation with large variation of muscle mass after losing weight. It is then difficult to interpret acute and repeated variations in serum creatinine. Very narrow variations of serum creatinine should alert. If rehydration fails to restore renal function, a kidney graft biopsy should be performed without delay to exclude other causes of ARF, especially if immunosuppressive drugs are poorly absorbed. In this series, no significant variations of residual CNI levels were observed. This is not consistent with pharmacokinetic study performed after BS, but measurements were not realized after KT (end-stage renal disease patients) later after BS (9–12 months) [23].

As largely previously demonstrated, BS in these kidney transplanted patients resulted in a sustained weight loss. Apart from weight loss, BS is associated with metabolic changes and the efficiency of BS for the treatment of type 2 diabetes mellitus is well established [24]. To our knowledge, there are no data about improvement of PTDM after BS. Two of the 4 patients developed PTDM after KT. In case 1, BS was effective to achieve a complete PTDM remission. In case 2, glycemic control was strongly improved with a complete withdrawal of insulin therapy (oral therapy alone) [21].

In conclusion, BS after KT is efficient to obtain significant weight loss with metabolic improvement. However, BS exposes kidney transplant recipients to a risk of ARF, which occurs 2-3 weeks after the surgery, mainly due to dehydration. The patients must be informed and a specific educational intervention before surgery and careful monitoring of renal function followed by prompt intervention if necessary after surgery are really mandatory to avoid pre-renal ARF. This specific multidisciplinary care of obesity in CKD patients is underlined in a recent published multidisciplinary workshop [25].

Statement of Ethics

Written informed consent was obtained from the patients for publication of the details of their medical case and any accompanying images. The study protocol was reviewed and approved by the Ethic Committee of the CHU of Bordeaux, Bordeaux France, and approval number was CHUBX2020RE0286.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

K.M. collected the data; K.M. and B.G.C. analyzed the data and wrote the manuscript; K.M., L.C., H.K., P.M., M.M.H., E.P., C.G., and BGC were involved in the critical revision of the manuscript; and all authors approved the final version of the manuscript.

Data Availability Statement

Data are not publicly available due to ethical reasons. Further inquiries can be directed to the corresponding author.

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