



# Changes in kidney function markers after bariatric surgery in morbidly obese patients

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Obesity is a global health problem that is strongly associated with developing type 2 diabetes mellitus (DM), cardiovascular disease, cerebrovascular accidents, and some malignancies. Additionally, obesity is a major risk factor for the development and progression of chronic kidney disease (CKD) [1].

Bariatric surgery is a proven and effective method for sustaining weight loss, lowering blood pressure, improving glycemic control, and inducing the remission of DM [2]. Additionally, renal parameters may be improved in obese patients after bariatric surgery. A meta-analysis showed that bariatric surgery reduced the unindexed measured glomerular filtration rate (mGFR) in patients with a normal or high GFR, which is suggestive of a return to normofiltration from the hyperfiltration of single nephron GFR [3]. Our previous study also found the GFR in obese patients decreased to an age- and sex-matched normal GFR range after surgery [4]. The presence of albuminuria or proteinuria also decreased after surgery-induced weight reduction [5].

Is bariatric surgery safe or beneficial in patients with

CKD or end-stage renal disease? Recently, bariatric surgery has been reported to be relatively safe in patients with CKD, although postoperative complications were slightly more frequent in these patients than in the general obese population [6]. In short, bariatric surgery is beneficial for obese patients with CKD who have preserved kidney function. Although several studies have reported that obesity is paradoxically associated with better outcomes in advanced CKD, the presence of morbid obesity in CKD patients is related to the progression of kidney dysfunction [7]. Thus, nephrologists should consider bariatric surgery for morbidly obese patients with CKD.

In this issue of *Kidney Research and Clinical Practice* (KRCP), Khalil et al [8] showed improvement in kidney function biomarkers after bariatric surgery. Their single-center prospective study enrolled 44 obese patients, and the eGFR, albuminuria, and kidney injury molecule (KIM-1) were assessed both before and six months after bariatric surgery. They found that bariatric surgery decreased the serum KIM-1 level and produced albuminuria as well as a lower BMI. The serum KIM-1 level was weakly but significantly correlated with albuminuria and the serum creatinine level before and after surgery. KIM-1 is a type 1 transmembrane glycoprotein with two extracellular domains. Following injury, the extracellular domains of KIM-1 separate from the cell surface and enter the systemic circulation and then the urine [9]. Treatment of kidney disease could decrease urinary KIM-1 levels [10]. Thus, the urinary KIM-1 level is a biomarker for early detection of kidney injury and for assessing a patient's therapeutic response to kidney disease. Accumulating evidence indicates that circulating (blood) KIM-1 as well as the urinary KIM-1 levels can be a diagnostic and prognostic biomarker in various kidney diseases, such as

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Received April 21, 2020; Revised May 3, 2020;

Accepted May 4, 2020

Edited by Gheun-Ho Kim, Hanyang University, Seoul, Republic of Korea

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**Table 1.** A literature review of the circulating kidney injury molecule-1 (KIM-1) in kidney disease

Author (year)	Serum/plasma	Number of patients	Summary of results
Sabbiseti et al [9] (2014)	Plasma	18	Increased KIM-1 levels in acute kidney injury patients.
		46	Increased KIM-1 levels in chronic kidney disease of various etiologies.
	Serum	124	KIM-1 levels predicted the rate of eGFR loss and risk of end-stage renal disease in type 1 diabetes.
Scelo et al [11] (2018)	Plasma	380	KIM-1 levels predicted the RCC incidence for up to five years.
Krzemień et al [12] (2019)	Serum	101	Increased KIM-1 levels are associated with the presence of febrile urinary tract infection in infants.

eGFR, estimated glomerular filtration rate; RCC, renal cell carcinoma.

acute kidney injury, renal cell carcinoma, urinary tract infection, and diabetic nephropathy (Table 1) [9,11,12]. We found that the urinary KIM-1 was elevated in obesity but decreased following bariatric surgery [10]. Glomerular hyperfiltration, high blood pressure, and concomitant DM in obese patients may trigger tubular cell injury. Consistent with this information, the authors found that circulating KIM-1 levels decreased after weight reduction in association with improved glycosylated hemoglobin levels.

Interestingly, the reduction in the circulating KIM-1 level was greater in obese patients without albuminuria than it was in those with microalbuminuria [8]. The authors assumed that albuminuria would represent a more severe degree of kidney injury, and weight reduction after bariatric surgery would not improve kidney function in the albuminuria group. However, the link between microalbuminuria and tubular injury remains unclear. In addition, the levels of circulating KIM-1 before surgery did not differ according to the presence of albuminuria.

The change in albuminuria in CKD patients after treatment may be a surrogate endpoint for the progression of kidney diseases [13]. Whether the reduction of blood or urine KIM-1 levels due to treatment may lead to favorable renal outcomes is yet to be investigated. Thus, it is unclear whether the considerable reduction of KIM-1 after bariatric surgery would be beneficial in obese patients.

The use of sleeve gastrectomy in bariatric surgery is a crucial strength of this study. This strategy offers important metabolic advantages over other surgical techniques for weight reduction, such as laparoscopic adjustable gastric banding, roux-en-Y gastric bypass, and biliopancreatic diversion with duodenal switch. Different surgeries could variably alter kidney function parameters; this effect is likely due to anatomic and functional differences

induced by the specific surgical procedures. In addition, the participants in this study demonstrated preserved eGFRs and no overt albuminuria. A homogenous patient population with mild renal injury might have produced more favorable results in this study.

However, this investigation did not measure the urinary KIM-1 level in obese patients. The assessment of urinary and circulating KIM-1 levels both before and after surgery may have revealed more precise KIM-1 behavior according to the patients' BMI status. Additional large prospective studies are warranted to determine if different surgical procedures may influence the levels of urinary and circulating KIM-1 and whether the degree of KIM-1 reduction would be associated with an improvement in kidney function in obese patients.

In summary, the level of KIM-1 was reduced by sleeve gastrectomy, and bariatric surgery may be associated with improvement of renal tubular injury in obese patients. Taken together, the role of tubular injury in the mechanisms of obesity-related renal outcomes needs to be determined. Further studies are required to determine whether urinary and circulating KIM-1 levels are earlier biomarkers than microalbuminuria in obesity-induced renal injury.

### Conflicts of interest

The author has no conflicts of interest to declare.

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