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Original article

Effect of weight loss after bariatric surgery on kidney function in a multiethnic Asian population

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Abstract

Background: Current literature reports improvement in kidney function in obese patients after bariatric surgery in non-Asian centers. It is unclear how kidney function is affected by postoperative body composition changes in obese Asian patients.

Objectives: To evaluate kidney function and its relationship to body composition in a multiethnic Asian population after bariatric surgery.

Q6 **Setting:** .

Methods: Data of 68 obese patients who were followed for 1 year after surgery were retrieved from our university hospital clinical care database. Body composition was obtained by bioimpedance analysis. Kidney function was calculated as glomerular filtration rate (GFR) using the following formulas: (1) Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) (estimated GFR [eGFR], mL/min/1.73 m^2); (2) absolute GFR (aGFR, mL/min); and (3) lean weight–adjusted Cockcroft-Gault creatinine clearance (CG-LBW, mL/min). Patients were further examined by 2 subgroups: eGFR < 90 and > 90 mL/min/1.73 m^2.

Results: One year after surgery, body mass index (BMI) declined from 41.9 ± 5.7 to 29.6 ± 4.2 kg/m^2 ($P < .001$), body surface area (BSA) decreased from 2.15 ± 0.23 to 1.86 ± 0.18 m^2 ($P < .001$), and fat mass (FM) reduced from 45.8 ± 9.4 to 25.6 ± 10.5 kg ($P < .001$). There were significant differences in percentage excess weight loss (%EWL) among Chinese, Malays, Indians, and other ethnicities. Similar results were found with percentage fat mass loss (%FML). Changes in aGFR were associated with reductions in FM ($P = .010$), BSA ($P = .049$), and %EWL ($P < .001$). In the eGFR > 90 subgroup, eGFR decreased from 143 ± 22 to 122 ± 19 mL/min/1.73 m^2. Conversely, in the eGFR < 90 subgroup, eGFR had a trend of improvement from 69 to 79 mL/min/1.73 m^2.

Conclusion: Changes in eGFR after bariatric surgery in the obese Asian patient are strongly associated with reduction in FM, BSA, and %EWL. More work is required to investigate if certain

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ethnicities have better postoperative renal profiles. (Surg Obes Relat Dis 2015;▌:00–00.)

Keywords: Bariatric surgery; Ethnicity; Fat mass; Body composition; Glomerular filtration rate; Hyperfiltration

Kidney dysfunction is common in obese cohorts [1–4]. Obesity is also a major risk factor for diabetic kidney disease and the development and progression of chronic kidney disease (CKD) [1–3,5]. The spectrum of kidney dysfunction in obesity includes glomerular hyperfiltration, proteinuria, and, eventually, glomerular hypofiltration [5,6]. Current literature from non-Asian centers reports improvement in kidney function in obese patients after bariatric surgery [4,7,8].

Changes in kidney function are reported using glomerular filtration rates (GFR), or creatinine clearances, usually estimated from serum creatinine-based equations such as the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) formula and the Cockcroft-Gault (CG) equation [9,10]. For comparisons between individuals, GFR is usually normalized to body surface area (BSA). Serum creatinine concentration is influenced by muscle mass. It is unclear how body composition changes in obese Asian patients after bariatric surgery affect kidney function and whether this is further influenced by ethnicity. In Asian patients with preexisting CKD, it is also uncertain how kidney function is affected by bariatric surgery.

We aimed to study postoperative kidney function change and its relationships to serum creatinine and body composition changes determined using bioimpedance analysis in a multiethnic Asian population. We hypothesized that GFR changes after bariatric surgery are influenced by changes in fat mass and BSA.

Materials and methods

We retrieved from a clinical care database relevant data of 68 severely obese patients who had undergone bariatric surgery at our hospital between July 2010 and June 2013 and had follow-up visits for at least 1 year postoperatively. Patients met surgical criteria according to the 2012 Interdisciplinary European Guidelines on Metabolic and Bariatric Surgery [11]. The surgical technique performed was either gastric bypass or sleeve gastrectomy. Exclusion criteria were incomplete clinical and biochemical data and pregnancy or malignancy. This study was approved by the National Healthcare Group Domain Specific Review (2014/00239), and all participants gave informed consent.

Laboratory methods

Serum creatinine was measured using a creatinase assay, calibrated to standardized creatinine using mass spectrometry reference material (National Institute of Standards and Technology SRM967) [12]. Kidney function before and 1 year after bariatric surgery was calculated as follows:

(1) Estimated glomerular filtration rate (eGFR, mL/min per 1.73 m^2) using the CKD-EPI formula [9]

$$= 141 \times \min(\mathrm{Scr}/\kappa, 1)^{\alpha} \times \max(\mathrm{Scr}/\kappa, 1)^{-1.209} \times .993^{\mathrm{age}} \times 1.018\,[\text{for women}] \times 1.159\,[\text{for blacks}]$$

where Scr is serum creatinine (µmol/L), $\kappa = .7$ [for females]; .9 [for men]

$$\alpha = .329\,[\text{for women}];\ -0.411\,[\text{for men}]$$

Max and *min* indicate the maximum and minimum of Scr/κ or 1, respectively.

(2) Absolute GFR (aGFR, mL/min), = eGFR × BSA where BSA is calculated using the Dubois and Dubois equation as follows [13]:

$$0.007184 \times \text{weight (kg)}^{0.425} \times \text{height (cm)}^{0.725}$$

(3) Lean weight-adjusted Cockcroft-Gault formula (CG-LBW, mL/min) [14],

$$= \frac{(140\text{–age}) \times \text{LBW (kg)} \times (1.04 \text{ for women};\ 1.23 \text{ for men})}{\text{serum creatinine } (\mu\text{mol/L})}$$

where LBW is calculated as follows [15]:

$$\text{In women: } 1.07 \times \text{weight (kg)} - .0148 \times \text{body mass index (BMI)} \times \text{weight (kg)}$$

$$\text{In men: } 1.1 \times \text{weight} - .0128 \times \text{BMI} \times \text{weight}$$

Glomerular hyperfiltration was defined as eGFR > 120 mL/min per 1.73 m^2 [16,17].

Bioimpedance measurements

Body composition in terms of fat mass (FM, kg), percentage fat mass loss (%FML, %), fat-free mass (FFM, kg), and total body water (TBW, L), were determined using the DF50 bioimpedance analyzer, before and 1 year after bariatric surgery (ImpediMed, Carlsbad, CA, USA). The analyzer performs single-frequency (50 kHz) bioimpedance analysis with an obese participant–based algorithm. This algorithm has been validated previously [18].

Statistical analysis

The data were analyzed collectively as a cohort and in 2 subgroups based on eGFR < 90, and > 90 mL/min