

Research Article

# Is there improvement in renal function in patients undergoing bariatric surgery?

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## Abstract

**Introduction:** Obesity may cause progressive chronic kidney disease. Weight loss in the postoperative follow-up of bariatric surgery may improve renal function in these patients. Thus, the purpose of this study was to give insight on the subject using a sensible biomarker.

**Methods:** This cross sectional study was performed in the Obesity Department from Campina Grande – Paraíba, Brazil. It was randomly enrolled 23 postoperative patients (7 bypass and 16 sleeve), with at least two years of follow-up, from the outpatient Department and 29 (18 bypass and 11 sleeve) in the preoperative period for bariatric surgery. They were homogeneously from both genders with ages ranging from 25 to 57 years. Serum levels of creatinine and cystatin C were measured, and the glomerular filtration rate (GFR) was estimated using the CKD Epi (chronic kidney disease epidemiology collaboration) cystatin-creatinine equation. The investigation was approved by the Ethics Committee.

**Results:** The mean body mass index (BMI) of the preoperative group was significantly greater than the postoperative group ( $p \leq 0.0001$ ). The mean serum levels of C cystatin was significantly greater in the postoperative group as compared to preoperative ( $p = 0.0197$ ). However, there was no mean difference between creatinine serum concentrations comparing the two groups ( $p = 0.3252$ ). The mean glomerular renal function rates of the groups were similar ( $p = 0.1240$ ).

**Conclusion:** There is no definitive evidence for supporting the hypothesis that there is improvement in the kidney renal function after bariatric surgery in obese patients. Prospective cohorts are necessary to enlighten the answer for this important question.

## Introduction

Obesity, a serious global public health problem, is due to unhealthy habits and lifestyle, bringing health problems such as diabetes mellitus, hypertension, cardiovascular diseases (CVD) as well as kidney disease [1-3]. The mechanisms of renal dysfunction in obese patients are not entirely clear, although inflammation, oxidative stress and hyper activation of the renin-angiotensin-aldosterone system and / or the sympathetic system, induced by the increase in fat mass, may play a predominant role, besides recruiting functional renal reserve with glomerular hyper filtration. Obesity may

promote hypo filtration and is an isolated risk factor for the development of chronic kidney disease (CKD) [4-9].

In an attempt to reduce and slow down the onset and development of obesity and its manifestations, as well as improve quality of life of these individuals, treatment strategies have been used since lifestyle modifications, medications as well as surgical interventions. In this context, bariatric surgery is proposed as one of the treatments for obese patients, with evidence of control of associated comorbidities [10-14].

The effect of bariatric surgery on renal function has been

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investigated and, in some studies, improvement of the glomerular filtration rate (GFR), reduction of hyperfiltration and reduction of microalbuminuria can be observed, preventing the onset of CKD and its progression [15-28]. However, there is no agreement on this issue [29]. Therefore more research is needed to be done to make the evidence more consistent.

The purpose of this study was to evaluate the impact of bariatric surgery on renal function of the patients through a more sensitive biological marker.

## Methods

An observational, cross sectional and analytical study was performed. The patients who participated in the study signed an informed consent form (TCLE), after approval of the study by the Ethics Committee of the Faculty of Medical Sciences - Campina Grande-Paraíba, Brazil.

The criteria for performing bariatric surgery followed the recommendation of the National Consensus of Health Institutes with body mass index (BMI)  $\geq 40\text{kg}/\text{m}^2$  without comorbidities or  $\geq 35\text{kg}/\text{m}^2$  associated with comorbidities. BMI was obtained by weight, in kilograms, divided by height, by meter squared, and classified according to the values established by the World Health Organization (WHO) [8].

It was randomly enrolled 23 patients who underwent bariatric surgery (7 bypass and 16 sleeve) with follow-up of, at least two years and 29 patients in the preoperative period of bariatric surgery (18 bypass and 11 sleeve) with ages between 25 and 57 years. Those who declared themselves to be carriers of renal disease, as well as those with thyroid disease, were excluded from the study [30].

The weight was measured using Tanita BC533® portable scale (Brazil), with the patient standing and barefoot, in light clothes and without props. Height was measured by Alturaexata® (Brazil), with the subject standing, barefoot, with heels together, back straight and arms extended at the side of the body.

Blood samples were collected in the morning after a fasting period of at least 12 hours.

The creatinine dosage was performed by the Jaffé reaction, with a result expressed in mg/dl, from the IDMS (isotope dilution mass spectrometry) methodology, according with organizations involved with laboratory quality management programs, for monitoring of total analytical error linked to the method [31].

The cystatin C was measured by nephelometry and later calibrated to most recente cystatin C standardization, with a result expressed in mg/L [9].

The estimated glomerular filtration rate (GFR) was calculated using Nefrocalc 2.0 through the CKD-EPI equations

cystatin-creatinine. After the calculation of the GFR, a correction was made for the corresponding body surface [8]. It was defined normal GFR between 120 and 90 mL/min/1.73 m<sup>2</sup>, hyperfiltration was defined by GFR > 120 mL/min/1.73 m<sup>2</sup>, and GFR hypo filtration < 90 mL/min/1.73 m<sup>2</sup> [6,32-34].

The adjustment for body surface was made as follows:

- Calculation of BSA (body superficial area),  $\text{Weight}.425 (\text{kg}) \times \text{Height}.725 (\text{cm}) \times .007184$  [5].
- Adjustment to standard BSA,  $\text{mGFR} (\text{mL}/\text{min}) \times 1.73 / \text{BSA} (\text{m}^2) = \text{mGFR} (\text{mL}/\text{min}/1.73\text{m}^2)$  [5].
- De-adjustment from standard BSA,  $\text{eGFR} (\text{mL}/\text{min}/1.73 \text{m}^2) \times \text{BSA} (\text{m}^2) / 1.73 \text{m}^2 = \text{eGFR}$  in mL/min [5].

The samples were gathered at random from the obesity outpatient department when they were either coming for follow-up or in the preoperative period.

Quantitative variables were expressed by their means and standard deviation. Qualitative variables were expressed by their absolute and relative frequencies. These parameters were fed into excel spreadsheets, and then analyzed using GraphPad InStat3 software.

The Student's t test was used for assessing difference between means. Fisher exact test was used to evaluate possible differences between frequencies.

$p \leq 0.05$  was established for rejection of the null hypothesis.

## Results

In the preoperative group nine patients were males and 20 were females, the age ranged from 25 to 57 years, mean age  $39.5 \pm 8.9$ , median was 39 years. In the postoperative group the age range was from 29 to 54 years; the mean age was  $38.6 \pm 8.1$ , median was 36 years. There was no difference between the two mean ages ( $p = 0.6185$ ). Similarly, there was no difference regarding to gender. In the postoperative group there were 10 males and 13 females ( $p = 0.3969$ ).

The body mass index (BMI) of the pre-operative group was significantly greater than the post-operative group (preoperative - mean:  $40.7 \pm 6.6$  versus post-operative group  $27.4 \pm 3.0$  - Student' t test = 9.512 -  $p \leq 0.0001$ ).

In the preoperative sample (29 patients), 10 had controlled blood hypertension and 10 had diabetes. All of them were receiving medication and apt to major surgery. In the postoperative sample (23 patients) one was bearer of diabetes and two had controlled hypertension. Patients with no comorbidities were 15 out of 29 patients (preoperative); and 20 out of 23 (postoperative) respectively - ( $p = 0.0086$ ).

The mean serum levels of C cystatin was significantly greater in the postoperative group as compared to preopera-



tive (postoperative –  $0.85 \pm 0.22$  versus preoperative  $0.73 \pm 0.09$  – Student' t test = 2.409 p = 0.0197). However, there was no mean difference between creatinine serum concentrations comparing the two groups (postoperative –  $0.84 \pm 0.11$  versus preoperative  $0.87 \pm 0.13$  – Student' t test = 0.9936 p = 0.3252).

The mean glomerular renal function rates of the groups were similar (postoperative –  $107.7 \pm 12.1$  versus preoperative –  $118.4 \pm 31.0$  – Student' t test = 1.565 p = 0.1240).

## Discussion

According to the literature, bariatric surgery is the best strategy for obesity with regard to effective and sustained weight loss. One can observe in this study, through the analysis of homogeneous samples for age and sex, a mass index significantly lower in the postoperative group [12,13,35,36].

Studies have pointed the improvement of renal function after bariatric surgery, either with increased glomerular filtration rate in patients with chronic kidney disease [37], or reduction of hyper filtration in patients with no evidence of kidney disease [15,16,19]. However, in some studies the sample is too small and in others the biomarkers presents low sensitivity [17,18]. Additionally, in other studies, the follow-up is too short. Furthermore, in the majority of the studies, the renal function estimation uses less precise equations [20-24,33].

The literature suggests that the use of markers that suffer less interference due to loss of muscle mass, such as cystatin C, may be a better and more reliable alternative for estimating renal function in patients who lose weight sharply, especially when at the same time uses cystatin C and creatinine by CKD Epi, based on this evidence the analysis of the present study [27,34,37].

There was a significant increase in the level of cystatin C in the post-bariatric group, but there was no difference between the two groups in relation to the serum creatinine concentration, which is in contrast to what is found in the literature, in order to observe reduction of creatinine levels due to loss of muscle mass in most studies. Regarding cystatin C, the studies point to an unchanged dosage in the postoperative period of bariatric surgery, and in some cases, even with increased levels of cystatin C, which does not mean changes in the glomerular renal filtration [38,39].

In this study, no statistically significant difference was observed in relation to the glomerular filtration rate when compared to the pre and post-bariatric surgery groups, corroborating other studies that do not evidence the effect of bariatric surgery on the improvement of renal function. On the other hand, some even suggest a worsening of the renal function after the surgical approach [28,29,40,41]. Thus,

adding cystatin C for increasing sensitivity and specificity for better use of renal function equations did not give evidence for supporting improvement of renal function after bariatric surgery in obese patients.

As regard to comorbidities (blood hypertension and diabetes) it seems that the prevalence of these diseases decreased significantly after bariatric surgery. However, one needs caution on this statement since the groups were not paired and the research was a cross sectional investigation.

## Limitations

First, the sample sizes of the two groups are too small for definitive evidence on this important question. Second, these samples are unpaired and may represent different biological parameters for the researched variables. Third, the follow-up time of the postoperative group (median 37 months) could be not sufficient for assessing renal function after bariatric surgery in obese patients. Fourth, the frequencies of bariatric surgery types were different between the two groups. Even though, the study has made a contribution for this challenging question – Is there improvement in renal function in patients undergoing bariatric surgery?

## Conclusion

In this study, no statistically significant difference was observed in relation to the glomerular filtration rate when compared the pre and post-bariatric surgery groups, corroborating other studies that did not evidence the effect of bariatric surgery on the improvement of renal function, and some even suggest a worsening of the function after the surgical approach. Further prospective cohorts are required for better answer of the main purpose of this issue.

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