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23 - 25 MAGGIO 2024
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NAXOS



CHIRURGIA BARIATRICA E FUNZIONE RENALE

RELATORE: DOTT. GUIDO GEMBILLO

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Benessere.**

Chronic Kidney Disease Worldwide

CHRONIC KIDNEY DISEASE...

10%

of the population worldwide is affected by CKD.

Half of people aged

75

or more have some degree of CKD



Kidney disease can affect people of all ages and races.

WHO IS AFFECTED?

1 in 5 **MEN**
and 1 in 4 **WOMEN**
between the ages of 65 and 74 have CKD



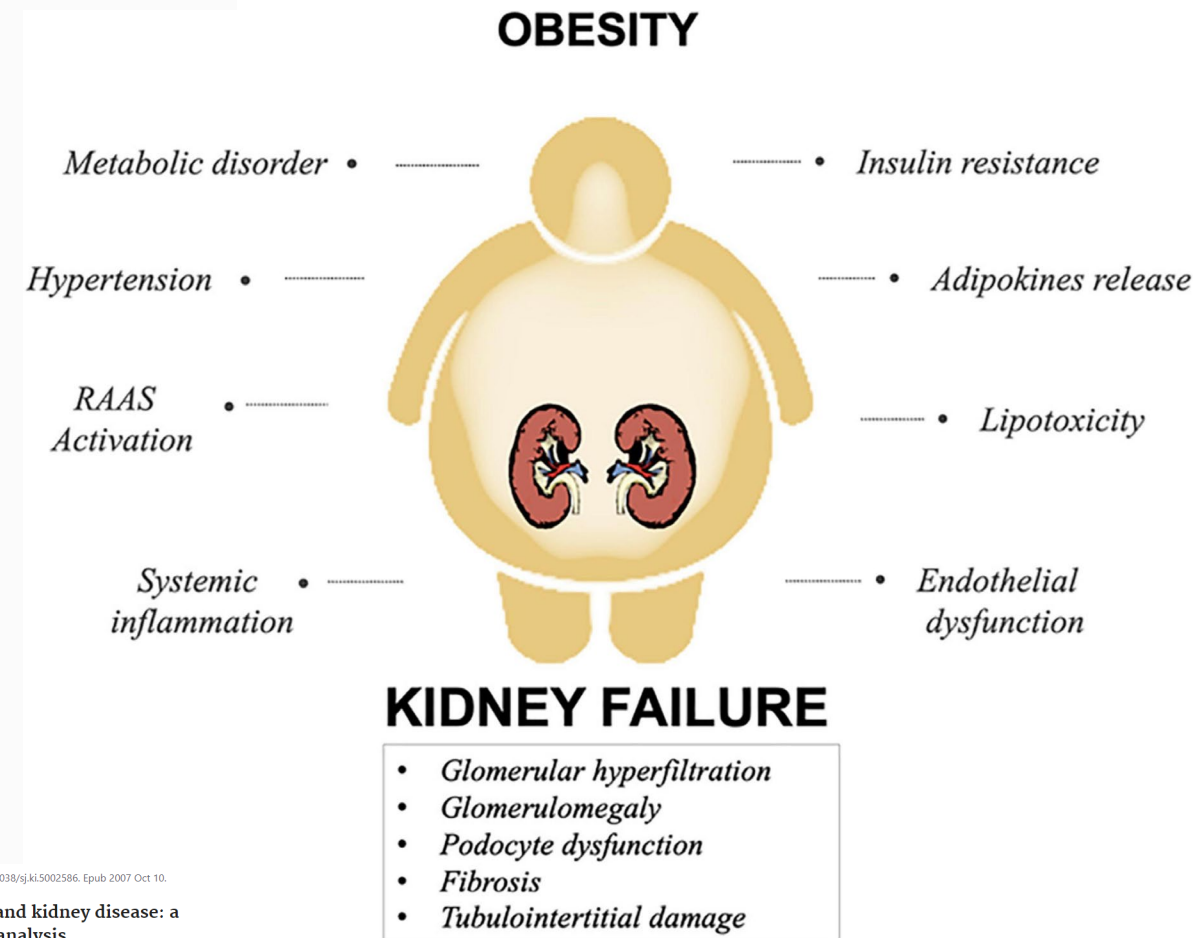
- There is an increase in the incidence of CKD, which is usually diagnosed relatively late when nephroprotective actions bring little benefit. For this reason, the number of people requiring RRT, including dialysis and kidney transplantation, is also increasing. CKD is divided into five stages according to the glomerular filtration rate (GFR). RRT is usually started when the GFR is lower than 15 mL/min/1.73 m² or earlier when it is accompanied by, among others, malnutrition, overhydration, and severe uremia.

Obesity and CKD

Obesity contributes to chronic oxidative stress, inflammation, and renal fibrosis, leading to progressive kidney damage and the need for renal replacement therapy.

Obesity increases the risk of developing CKD, the incidence of which is 10.6% at stages 3–5. Studies show that CKD is more common than diabetes.

In observational studies, obesity has been associated with higher risk of incident CKD and end-stage renal disease, as well as nephrolithiasis and renal cell cancer.



Review > PLoS One. 2016 Jul 6;11(7):e0158765. doi: 10.1371/journal.pone.0158765. eCollection 2016.

Global Prevalence of Chronic Kidney Disease – A Systematic Review and Meta-Analysis

Nathan R Hill¹, Samuel T Fatoba¹, Jason L Oke¹, Jennifer A Hirst¹, Christopher A O'Callaghan², Daniel S Lasserson¹, F D Richard Hobbs¹

Affiliations + expand
PMID: 27383068 PMCID: PMC4934905 DOI: 10.1371/journal.pone.0158765

Review > Nephron. 2021;145(6):609-613. doi: 10.1159/000515418. Epub 2021 Apr 21.

From Obesity to Chronic Kidney Disease: How Can Adipose Tissue Affect Renal Function?

Marina Martin-Taboada¹, Rocío Vila-Bedmar¹, Gema Medina-Gómez¹

Affiliations + expand
PMID: 33882485 DOI: 10.1159/000515418
Free article

Review > Kidney Int. 2008 Jan;73(1):19-33. doi: 10.1038/sj.ki.5002586. Epub 2007 Oct 10.

Association between obesity and kidney disease: a systematic review and meta-analysis

Y Wang¹, X Chen, Y Song, B Caballero, L J Cheskin

Affiliations + expand
PMID: 17928825 DOI: 10.1038/sj.ki.5002586
Free article

Obesity and CKD

A big meta-analysis of cohort studies, including 600,000 cases, assessed the effect of obesity on the CKD risk beyond its association with T2DM: obesity could be associated with a 51% increase in the risk of new-onset albuminuria and 18% in the risk of new onset of CKD stage 3 at 5 years.

In addition, obesity may accelerate the loss of function in a variety of renal conditions such as polycystic disease, IgA nephropathy, renal transplant, and diabetic renal disease

[Review](#) > [Kidney Int.](#) 2017 May;91(5):1224-1235. doi: 10.1016/j.kint.2016.12.013.

Epub 2017 Feb 7.

A systematic review and meta-analysis suggests obesity predicts onset of chronic kidney disease in the general population

[Carlo Garofalo](#)¹, [Silvio Borrelli](#)¹, [Roberto Minutolo](#)¹, [Paolo Chiodini](#)², [Luca De Nicola](#)¹, [Giuseppe Conte](#)³

Affiliations + expand

PMID: 28187985 DOI: 10.1016/j.kint.2016.12.013

[Free article](#)

> [Nephrol Dial Transplant.](#) 2013 Nov;28 Suppl 4:iv160-6. doi: 10.1093/ndt/gft286. Epub 2013 Sep 11.

Overweight/obesity revisited as a predictive risk factor in primary IgA nephropathy

[Francois Berthoux](#)¹, [Christophe Mariat](#), [Nicolas Maillard](#)

Affiliations + expand

PMID: 24026246 DOI: 10.1093/ndt/gft286

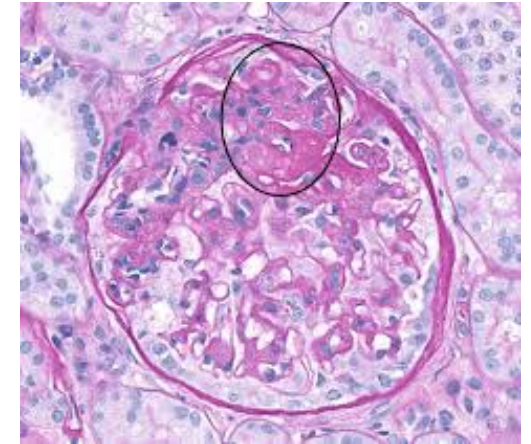
Obesity and CKD

Excess body weight leads to chronic inflammation, oxidative stress, lipotoxicity, and impaired adipokine secretion, which also adversely affects kidney function.

Obesity leads to *functional and structural changes in the kidneys*. **Hyperfiltration and proteinuria**, which are caused by glomerulosclerosis and tubulointerstitial fibrosis, are observed. These disorders are called obesity-related glomerulopathy (ORG)

Patients with obesity show **glomerular hypertrophy** associated with **low glomerular density** with or without a characteristic form of **focal segmental glomerulosclerosis (FSGS)**, **increased renal plasma flow (RPF)**, and **glomerular filtration rate (GFR)**. In adaptation to the glomerular expansion, **podocyte increase in size** but cannot keep up with it, leading to podocyte failure and detachment that results in an **increase in glomerular permeability** followed by lesions of FSGS.

Proximal tubular hypertrophy, with a higher cross-sectional area and its lumen, has been described in proteinuric obese individuals compared to non-obese patients with proteinuria.



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Review Article | Published: 06 June 2016

Obesity-related glomerulopathy: clinical and pathologic characteristics and pathogenesis

[Vivette D. D'Agati](#) , [Avry Chagnac](#), [Aiko P.J. de Vries](#), [Moshe Levi](#), [Esteban Porrini](#), [Michal Herman-Edelstein](#) & [Manuel Praga](#)

[Nature Reviews Nephrology](#) **12**, 453–471 (2016) | [Cite this article](#)

Obesity and CKD

The risk associated with obesity may be reversible: a randomized controlled trial of patients with type 2 diabetes demonstrated that weight loss decreased the risk of adverse CKD outcomes.

[Clinical Trial](#) > [Lancet Diabetes Endocrinol.](#) 2014 Oct;2(10):801-9.
doi: 10.1016/S2213-8587(14)70156-1. Epub 2014 Aug 10.

Effect of a long-term behavioural weight loss intervention on nephropathy in overweight or obese adults with type 2 diabetes: a secondary analysis of the Look AHEAD randomised clinical trial

[Look AHEAD Research Group](#)

[Collaborators](#) + [expand](#)

PMID: 25127483 PMCID: [PMC4443484](#) DOI: [10.1016/S2213-8587\(14\)70156-1](#)



BS techniques in CKD patients

Among BS procedures, sleeve gastrectomy (SG) is most commonly performed in these patients, reflecting the overall trend in the generic BS population.

An advantage of SG is the lack of association with kidney stones or oxalate nephropathy and the lack of interference with absorption of immunosuppressive medications after KT, risks well recognized post Roux-en-Y gastric bypass.

Four cohort studies involving 4196 chronic dialysis and 732,204 non-dialysis patients undergoing bariatric surgery were included. Sleeve gastrectomy (61%), and Roux-en-Y gastric bypass (29%)

Meta-Analysis > [Obes Res Clin Pract.](#) 2021 Sep-Oct;15(5):473-484.

doi: [10.1016/j.orcp.2021.06.010](https://doi.org/10.1016/j.orcp.2021.06.010). Epub 2021 Jul 4.

Postoperative outcomes after bariatric surgery in patients on chronic dialysis: A systematic review and meta-analysis

D Palamuthusingam¹, A Singh², P Palamuthusingam³, C M Hawley⁴, E M Pascoe⁵,
D W Johnson⁶, M Fahim⁷

Affiliations + expand

PMID: 34233859 DOI: [10.1016/j.orcp.2021.06.010](https://doi.org/10.1016/j.orcp.2021.06.010)

Renal Function after BS

Obese persons submitted to BS reduce in approximately 58% their decline of GFR by $\geq 30\%$ and the risk of doubling serum creatinine at 5 years.

Comparative Study > *Kidney Int.* 2016 Jul;90(1):164-71. doi: 10.1016/j.kint.2016.02.039.

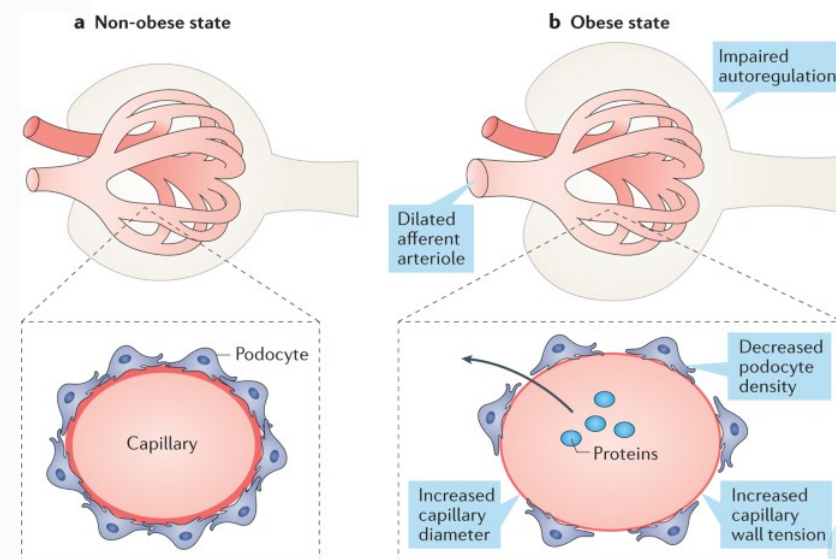
Epub 2016 May 12.

Bariatric surgery is associated with improvement in kidney outcomes

Alex R Chang¹, Yuan Chen², Christopher Still³, G Craig Wood³, H Lester Kirchner⁴, Meredith Lewis⁴, Holly Kramer⁵, James E Hartle⁶, David Carey⁴, Lawrence J Appel⁷, Morgan E Grams⁸

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PMID: 27181999 PMCID: PMC4912457 DOI: 10.1016/j.kint.2016.02.039



Effect of Bariatric Surgery on Kidney Function in Patients

In support of a beneficial effect of bariatric surgery on future renal risk, a number of studies and meta-analyses have shown that **albuminuria and proteinuria decrease after bariatric surgery.** Metabolic surgery, *by reducing intraabdominal pressure, improves renal vein pressure, increases renal blood flow, and normalizes GFR, plasma renin activity, and aldosterone levels, all of them involved in proteinuria.* Two case reports observed complete resolution of proteinuria after bariatric surgery in patients with obesity-related FSGS. However, all of these studies were of short duration (1–2 years), and often lacked comparison groups.

Review > Clin J Am Soc Nephrol. 2009 Oct;4(10):1565-74. doi: 10.2215/CJN.02250409.

Epub 2009 Sep 17.

Weight loss interventions in chronic kidney disease: a systematic review and meta-analysis

Sankar D Navaneethan¹, Hans Yehnert, Fady Moustarah, Martin J Schreiber, Philip R Schauer, Srinivasan Beddhu

Affiliations + expand

PMID: 19808241 PMCID: PMC2758256 DOI: 10.2215/CJN.02250409

Filtration Markers in Estimating GFR After Bariatric Surgery

There are important limitations of all observational studies of kidney disease and bariatric surgery, including potential residual confounding and the use of creatinine-based eGFR, which correlates with muscle mass. Massive weight loss might result in overestimation of eGFR after bariatric surgery.

Friedman *et al.* measured GFR by iothalamate clearance, serum creatinine, and cystatin C in 33 patients with normal or supranormal kidney function. Cystatin C correlated better with mGFR than creatinine both before and after surgery, although neither had very good accuracy in estimating GFR alone. Use of the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) combined creatinine-cystatin C equation estimated GFR within 30% of mGFR more than 80% of the time before and after surgery. This suggests that the use of multiple filtration markers could be beneficial in future research studying kidney function changes after bariatric surgery.

› Am J Nephrol. 2014;39(1):8-15. doi: 10.1159/000357231. Epub 2013 Dec 19.

Predicting the glomerular filtration rate in bariatric surgery patients

Allon N Friedman¹, Sharon Moe, William F Fadel, Margaret Inman, Samer G Mattar, Zak Shihabi, Sara K Quinney

Affiliations + expand

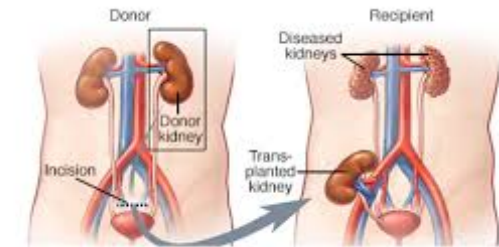
PMID: 24356416 PMCID: PMC3945154 DOI: 10.1159/000357231

Role of BS Kidney Transplantation

Obesity may be an obstacle in qualifying for kidney transplantation. Both donors and transplant recipients may be disqualified due to excess body weight.

The body weight cut-offs that qualify for transplantation depend on the principles of the treatment center and the individual state of health of the patient. In most centers, BMI over 40 kg/m² is a contraindication to the procedure, and over 35 kg/m² is a relative contraindication.

The number of kidney transplant recipients with a BMI over 30 kg/m² doubles every 15 years. **Obesity during transplantation is associated with poorer perioperative outcomes in terms of length of surgery and hospitalization, wound infections, delayed graft function, incisional hernia, and other complications.**



Review > [Am J Kidney Dis.](#) 2010 Jul;56(1):143-56. doi: 10.1053/j.ajkd.2010.01.017.
Epub 2010 May 10.

Obesity in kidney transplant recipients and candidates

Kavitha Potluri¹, Susan Hou

Affiliations + expand

PMID: 20452710 DOI: [10.1053/j.ajkd.2010.01.017](#)

KTX Candidates

BS is performed on CKD patients treated conservatively, on dialysis, before and after kidney transplantation. Weight loss in the above-mentioned groups of patients brings positive effects. Rapid and sustained weight loss due to BS enables patients with ESRD to stop dialysis treatment and receive a transplant. Additionally, pre-transplant metabolic surgery may reduce the risk of mortality and graft failure. **On the other hand, it increases the pool of people who can donate an organ.** Weight loss slows disease progression in non-dialysis patients.

Clinical Trial > [Am J Transplant. 2020 Feb;20\(2\):422-429. doi: 10.1111/ajt.15650.](#)

Epub 2019 Nov 16.

Long-term outcomes in patients with obesity and renal disease after sleeve gastrectomy

Al-Faraaz Kassam ¹, Ahmad Mirza ¹, Young Kim ¹, Dennis Hanseman ¹, E Steve Woodle ¹, Ralph C Quillin 3rd ¹, Bobby L Johnson ¹, Amit Govil ², Michael Cardi ³, Daniel P Schauer ², Eric P Smith ², Tayyab S Diwan ¹

Affiliations + expand

PMID: 31605562 DOI: 10.1111/ajt.15650

BS outcomes in Hemodialysis patients

SG has an overall **low post-procedure mortality rate**, albeit higher than in the general bariatric population (0.7% vs 0.3% 30-day mortality risk on patients on HD vs not, respectively; $P = .02$). Importantly, however, the risk of death is 47% higher among the patients with CKD stage 5D in the first year post-procedure compared with well-matched non-SG controls. Although the mortality risk subsequently improves, better outcomes are mainly, but not exclusively, driven by the higher KT rates.

Patients who remain on HD continue to face high mortality risk (5-year cumulative incidence of 31.6% in patients post SG vs 44% nonsurgical controls).

Improving the overall health of these patients may lead to lower mortality and, subsequently, even higher transplant rates.

[Surg Endosc.](#) 2023 Sep;37(9):7106-7113. doi: 10.1007/s00464-023-10200-z. Epub 2023 Jul 3.

Comparative outcomes of bariatric surgery in patients with ESRD on dialysis in the modern era of renal transplantation: analysis using the 2015–2020 MBSAQIP database

Sara Alothman ¹, Jorge Cornejo ², Gina Adrales ³, Christina Li ², Raul Sebastian ²

Affiliations + expand

PMID: 37444005 DOI: 10.1007/s00464-023-10200-z

[JAMA Surg.](#) 2020 Jul 1;155(7):581-588. doi: 10.1001/jamasurg.2020.0829.

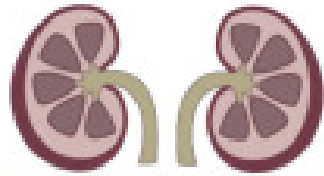
Bariatric Surgery and Long-term Survival in Patients With Obesity and End-stage Kidney Disease

Kyle H Sheetz ^{1 2}, Laura Gerhardinger ², Justin B Dimick ^{1 2}, Seth A Waits ^{1 2}

Affiliations + expand

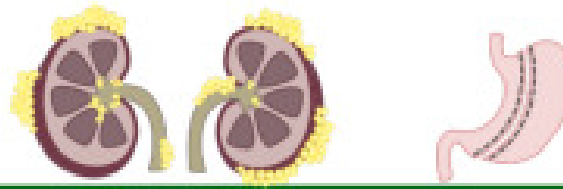
PMID: 32459318 PMCID: PMC7254435 DOI: 10.1001/jamasurg.2020.0829

Nutritional recommendations after BS

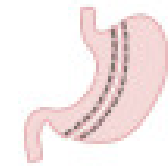


Nutritional recommendations of patients with CKD

	Conservative management for CKD	Dialysis	After kidney transplant
Energy	25–35 kcal/kg BW	30–35 kcal/kg BW	maintaining IBW
Protein	0.6–0.8 g/kg BW 0.3–0.6 g/kg BW + ketoanalogues	1.1–1.4 g/kg BW	1.1–1.2 g/kg BW
Fluids	over 1.5 liters	500–750 ml + diuresis	over 1.5 liters

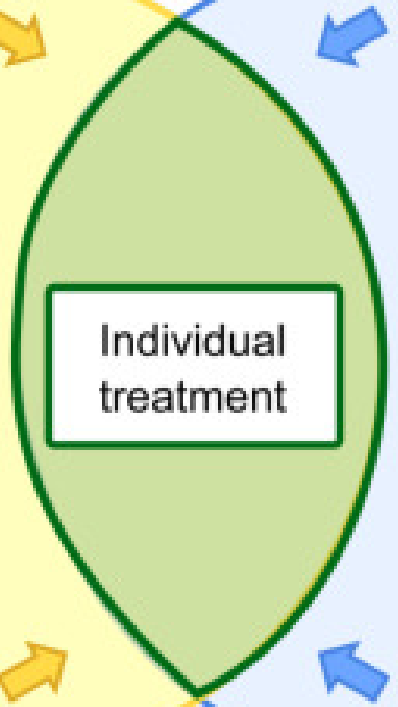


Nutritional recommendations of patients with CKD after bariatric surgery



Nutritional recommendations of patients after bariatric surgery

Energy	1200–1500 kcal
Protein	1.5 g/kg BW
Fluids	over 1.5 liters



Variable	No kidney disease	CKD stage 4-5	CKD stage 5D (HD/PD)
Fluid intake	At least 2 L daily	Before SG: At least 2 L daily; individualized based on fluid status	Before SG: Up to 1000 mL/d above daily urine output to prevent large intradialytic volume gains
		After SG: At least 2 L daily, intravenous fluids may need to be given postoperatively to prevent dehydration Avoid fluid intake 30 min before or after each meal	After SG: Up to 1000 mL/d above daily urine output (required protein supplement drinks included) Limit additional fluids to prevent large intradialytic volume gains. Avoid fluid intake 30 minutes before or after each meal
Calories	After SG: 400-600 calories/d for up to the first month 600-900 calories/d for the next 2 months 1200 calories/d thereafter	After SG: up to 600-800 calories/d for the first 2 weeks	After SG: up to 800-1200 calories/d for the first 2 weeks
		Gradual increase up to 1200 calories/d thereafter or adjust as needed for desired weight loss	At least 1200 calories/d thereafter or adjust as needed for desired weight loss
Protein	Before SG: 0.8 g/kg body weight daily	Before SG: 0.6 g/kg per day in non-diabetics 0.6-0.8 g/kg in diabetics	Before SG: 1.0-1.2 g/kg per day
	After SG: Acute postop: 60-80 g daily or 1.1-1.5 g/kg of IBW daily Weight maintenance: 0.8 g/kg body weight daily	After SG: Acute postop: 60-80 g daily or 1.1-1.5 g/kg of IBW for healing after surgery Long term: 0.6-0.8 g/kg per day of IBW or ABW once resumes solid foods	After SG: Acute postop: At least 80 g daily or 1.1-1.5 g/kg of IBW for healing after surgery Long term: 1.0-1.2 g/kg per day once resumes solid foods
Sodium	<2300 mg/d; consider Na intake	liberalization if hypotension is present and no clinical volume overload	
K and P	Per RDA/DRI recommendations	Individualized to maintain serum levels within goal range	
Calcium	Before SG: 1200-1500 mg/d After SG: 1500-2000 mg/d Take calcium supplements with meals in 2-3 divided doses	800-1000 mg/d, if not taking vitamin D analogs	Adjust calcium intake with consideration of any vitamin D analogs to avoid hypercalcemia or calcification
Vitamin D	2000 IU daily	Consider D2 or D3 supplement to correct insufficiency	
Other vitamin/mineral supplements	Before SG: Per RDA/DRI recommendations	Before SG: Renal vitamin, if needed Oral iron, as needed	Before SG: Renal vitamin Intravenous iron, as needed
	After SG: Monthly B12 injection Daily multivitamin/mineral, 200% of daily value in divided	After SG: 1000 µg B12 injection monthly Iron, as needed	

Conclusion

- Bariatric procedures are more and more often used in patients with obesity and simultaneously with CKD.
- In addition to standard procedures before and after bariatric surgery, there should be cooperation with a nephrologist.
- It is also necessary to emphasize the role of an experienced dietician or nutritionist in the field of nutrition in nephrology.
- Weight loss surgery in patients with CKD improves short-, medium-, and long-term kidney outcomes as well as obesity comorbidities. Consequently, BS could be considered as a renoprotective intervention in patients with pre-existing CKD and it should not be discouraged depending on CKD etiology.
- BS is of pivotal importance for KT potential recipients with high BMI.
- Nevertheless, these potential benefits must always be counterbalanced with eventual adverse events in multidisciplinary teams. Additional surgical risks should always be considered in order to be prepared and therefore avoid a negative impact not only on hospital length of stay but also complications and survival rate.

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Grazie per l'attenzione

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