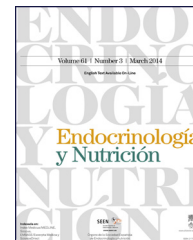




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EDITORIAL

Bariatric surgery and bone mineral metabolism[☆]



Cirugía bariátrica y metabolismo mineral óseo

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Bariatric surgery is associated to an involvement of bone mineral metabolism whose pathophysiology and long-term clinical consequences are not well known. The impact of weight loss on bone metabolism is attributed to a combination of mechanical and nutritional effects. Neurohormonal regulation of bone turnover known as the adipose tissue-bone axis has also been involved in recent years.

Factors involved in bone mass decrease following bariatric surgery include mechanical, nutritional and hormonal disorders.^{1–5}

Bone mass is increased in obese subjects, particularly in weight-bearing areas due to mechanical stimulus. When skeleton loses mass due to weight loss, osteocytes increase synthesis of sclerostin, which negatively regulates osteoblast function and leads to net bone mass. On the other hand, the impact of bariatric surgery on bone may also depend on the degree of sarcopenia. While in some studies decreased bone mineral density (BMD) is directly associated to bone loss, lean mass loss is the determinant factor in other studies.

From the nutritional viewpoint, calcium and vitamin D deficiency is associated to bone mass loss. It is estimated that 80% of patients pending bariatric surgery have vitamin D deficiency, and 30–50% have secondary hyperthyroidism. Calcidiol levels do not usually improve after surgery, and more than 50% of patients experience PTH increases, which are even greater in patients undergoing malabsorptive procedures. In restrictive procedures,

although there is no malabsorptive component, overall reduction in nutrient intake and acid secretion by the stomach occurs. This and the frequent lactose intolerance are factors that decrease intestinal calcium absorption. The procedure and the optimal dose to prevent and treat calcium and vitamin D deficiency after bariatric surgery in these patients are still unknown. The American Association of Clinical Endocrinologists, the Obesity Society, and the American Society for Metabolic & Bariatric Surgery (AACE/TOS/AMBS)⁶ recommend for patients undergoing bariatric surgery an intake of 200 g/day of elemental calcium, and 2000 g/day (in diet and as calcium citrate in divided doses) for those undergoing malabsorptive procedures. As regards vitamin D requirements, at least 3000 IU of vitamin D/day (titrated to therapeutic calcidiol concentrations higher than 75 nmol/L or 30 ng/mL) are currently recommended.

When weight and fat reserve decrease, estrogen levels are reduced, resulting in a decreased protective effect of estrogens on bone. Decreased body fat after bariatric surgery causes in turn a change in the synthesis of hormones produced by the adipocytes (leptin, adiponectin), intestinal peptides (ghrelin, GIP, GLP-1), and hormones secreted by pancreatic beta cells (amylin), which have an effect on bone remodeling.⁷ However, the results obtained in human studies relating BMD and the above hormones have been conflicting, and the role of each of them in bone homeostasis is not elucidated yet.

Changes in BMD after bariatric surgery have been analyzed in several cross-sectional studies which found no significant differences between BMD in femoral neck and spine in operated women for a mean time of up to four years as compared to those with overweight or obesity. Prospective studies after mixed and malabsorptive surgery suggest that weight loss preferentially affects BMD in

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the femoral neck, with a 9–10% reduction.⁸ BMD loss was greater during the first year after surgery, when the greatest weight reduction occurs. In most studies, patients received calcium and vitamin D supplements, although at lower doses than currently recommended. Although the studies showed non-significant losses in the second and third years after bariatric surgery, long-term studies are still scarce. In a study conducted after biliopancreatic diversion, no significant decrease was seen in femoral neck BMD at 10 years. A 3–4% loss one year after gastric bypass (GB) and a 4–8% after biliopancreatic diversion have been reported in the spine.

Even after the reported BMD decreases, Z-score analysis allows for concluding that BMD in the femoral neck and spine do not differ from the expected decrease based on age and sex after bariatric surgery. As these patients have a higher baseline BMD and continue to be overweight after surgery, their BMD is higher due to the greater mechanical load on the skeleton. The AACE/TOS/AMBS recommends that in patients undergoing GB and malabsorptive procedures, DXA of the spine and proximal femur may be indicated before surgery and at 2 years.

The clinical consequences of this decrease in BMD are still little known. In a group of women with a mean age of 45 years undergoing GB, progression to osteoporosis was seen in 6.8% after a three-year follow-up⁹. Women who progressed to osteoporosis were all postmenopausal. However, fracture risk, as estimated by FRAX®, was very low (3.1% in postmenopausal women, and 1.89% in premenopausal women). A retrospective study comparing patients with history of bariatric surgery (60% gastric sleeve, 29% GB) to age and sex-matched patients found no increased risk of osteoporotic and non-osteoporotic fractures¹⁰. However, a trend was seen to an increased risk of fracture 3–5 years after surgery in patients with a greater BMI decrease, but did not reach statistical significance. Another retrospective study comparing the fracture rate in 258 patients undergoing bariatric surgery (mainly GB) followed up for a mean of 7.7 years was recently reported.¹¹ An increased risk of fracture due to mild to moderate trauma was seen, specifically in the hip, spine, wrist, or humerus. The risk was greater in appendicular fractures; half the fractures occurred in feet, legs, or hands. Prior studies are, however, limited by their retrospective design and the difficulties for selecting adequate controls.

Based on current data, it may be concluded that bariatric surgery does not appear to have a harmful effect on bone in the short or middle term. Close monitoring is,

however, needed of patients undergoing surgery, especially postmenopausal women, maintaining adequate nutritional status with adequate calcium and vitamin D provision. Although a discordant study has recently been reported, the risk of development of osteoporosis and bone fractures does not appear to be increased in the first few years after surgery. Prospective studies will be needed to elucidate whether bone loss after surgery leads to an increase in fractures in the long term.

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