Morbid Obesity and Left Ventricular Geometry

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Editorial Commentary

Severe Obesity and Left Ventricular Geometry

Giovanni de Simone

Obesity is a condition encompassing a broad range of clinical presentations from a nearly normal status to a life-threatening disease. In the absence of a permeating campaign raising the level of attention to the problem of obesity, many obese individuals see their doctors only for esthetic reasons. A large number of subjects, in fact, seem to live quite well even with moderate or severe obesity. Others, albeit feeling healthy, look for dietary interventions not only to improve their body build but also to increase the level of their self-esteem. Some others, a minority, usually those in class III,[1] progressively develop symptoms and clinical signs that raise their level of attention and force them to see doctors.

The latter type of obese subjects is usually more motivated and, therefore, tends to be more compliant with physicians' suggestions and indications. There is a proportion of these individuals who are considered to be at higher risk, and when their motivations are strong enough, they are sent to bariatric surgery. When examining those obese subjects, doctors and researchers need to be aware that they represent the tip of the iceberg, far away from the reality of obesity in general and from the real cardiovascular risk attributable to obesity in population. Because of the a priori selection, hypertension, diabetes, joint pain, and whatever comorbidity is limiting quality of life are very frequent in those patients. Their cardiovascular risk is higher than in obese patients without prevalent comorbidities, and, unsurprisingly, they also show high levels of left ventricular (LV) mass partly related to coexisting abnormalities consistent with findings in the setting of the metabolic syndrome.[2,3] Abnormalities of LV geometry get worse as the severity of morbid obesity increases.

In this issue of the journal, Avelar et al[4] add another important observation by focusing their study on the effect of obstructive sleep apnea–hypopnea on levels of LV mass in obese patients with some compelling indications for bariatric surgery. The vast majority of these patients were women. Although the authors used a method of normalization of LV mass that minimizes the gender difference, there is, however, gender difference in the distribution of obstructive sleep apnea–hypopnea episodes and, most likely, in their severity, as also confirmed in recent works.[5,6] Although the effort of breathing is not necessarily different in men and women when lying the same, the physiology of breathing is different in men and women even in the presence of similar obstructive conditions, particularly when excessive abdominal fat compresses the diaphragm toward the chest.

Even considering the potential gender-related limitations, the observation by Avelar et al[4] that the degree of sustained nocturnal hypoxemia, rather than the number of apneic and hypopneic episodes, contributes to the variance of LV mass index is interesting, because it indicates a real measurable biological characteristic potentially associated with LV mass. Focusing on hypoxemia overcomes, at least in part, doubts that might be raised by the use of the apnea–hypopnea index as a raw measure of this sleep disturbance. The apnea–hypopnea index is the number of nocturnal apnea or hypopnea episodes normalized by the number of hours of sleep, but its accuracy is substantially limited by the difficulty to standardize a measure of hypopnea because of both technical problems related to measurements of air flow through the respiratory airway during sleep and significant differences between men and women.[7] In contrast with the raw indication provided by apnea–hypopnea index, the evaluation of sustained hypoxemia focuses on potential pathophysiologic mechanisms related to the effect of sleep disorders on the cardiovascular system. As the oxygen saturation in the blood decreases and thoracic pressure changes because of obstruction, a number of autonomic, humoral, neurohormonal, and hemodynamic changes take place, which affect the cardiovascular system even during the day.[8] Most changes might go back to normality once obstructive sleep apnea is treated and improved.[9,10] Sympathetic stimulation because of sustained hypoxemia is particularly insidious,[11] and although not directly measured, it is likely present also in the population sample of Avelar et al[4] as is suggested by the higher heart rate. Sympathetic hypertone can worsen insulin resistance and can modulate leptin expression in a way that facilitates the development of a vicious cycle, worsens obesity, and promotes the related comorbidities.[8]

Other well-studied mechanisms related to obstructive sleep apnea–hypopnea involve endothelial dysfunction and hypoxia-related expression of proinflammatory cytokines.[12–14] A combination of inflammation and vasoconstrictive stimuli largely accounts for the high blood pressure in these patients and for the difficulty to optimally control their values.[15] In the morbid obese population in the study by Avelar et al,[4] body mass index and nocturnal saturation of O_2 account for most of the explained variance of LV mass in addition to systolic blood pressure measured at the office visit. The relatively poor effect of office systolic blood pressure on the variance of LV mass is not different from what has been reported previously in many studies, also in the absence of antihy-

pertensive therapy,[16] but in this case, it might be further disturbed by the ongoing antihypertensive therapy. Values of blood pressure taken at the office visit might not reflect the real blood pressure load imposed on the left ventricle during the day.[17] A good control of office blood pressure in hypertensive subjects does not mean a good control of blood pressure throughout the day.

In particular, a normal or high-normal blood pressure measured at the office visit might underestimate the 24-hour blood pressure load in obese subjects, especially when comorbidities are present. The obesity-associated insulin-resistance blunts the activity of insulin in promoting arterial compliance, which results in increased arterial stiffness[18] and consequent increases in central blood pressure. Masked hypertension is found more frequently in patients with central obesity,[19] and the lack of nocturnal decrease of blood pressure (nondipping pattern) is frequently associated with central obesity.[20] Because central fat distribution is near constant in class II and III obesity, there are many indications that central blood pressure and/or 24-hour blood pressure load could be altered in the population sample of the study by Avelar et al[4]; also, body mass index and hypoxemia were efficient bioassays of a hemodynamic pattern more complex than that emerging from the simple office blood pressure measurement. It might also be speculated that abdominal obesity and not excess of body fat by itself plays a major role in these findings.

In the obese population of the study by Avelar et al,[4] the presence of a masked high 24-hour blood pressure overload might, in part, explain the high prevalence of concentric LV geometry. The proportion of subjects with concentric LV geometry is, in fact, substantially higher than would be expected by the general assumption that obesity is associated with a predominant volume overload. An unexpected high prevalence of concentric LV geometry in obesity has already been reported in the current literature,[21,22] a finding that is often undervalued or even neglected. The proportion of concentric LV geometry could also be higher in the population sample of Avelar et al,[4] because of the relatively young average age. We have shown previously that the relationship between wall thickness and LV cavity dimension increases with increasing age,[23] and in the study by Avelar et al,[4] the partition values used to classify concentric LV geometry were high and, therefore, more fitting with an older population.

There are many reasons to explain the prevalence of concentric LV geometry in morbid obesity. In addition to the possibility of high blood pressure load, direct neurohormonal activation (including sympathetic overactivity, increased expression of endothelin and reduced production of nitroxide activated by hypoxemia,[8] and increased in blood viscosity)[24,25] might contribute to hemodynamic and local conditions[26] yielding concentric LV remodeling. Reverting the construction stimulated by the Avelar et al[4] study, these considerations also open the possibility that the phenotypic presentation of a young obese subject with high-normal office blood pressure and concentric LV geometry might carry a high probability of obstructive sleep apnea–hypopnea syndrome, thus, raising the possibility of identifying subjects eligible for a sleep study. Eventually, focus on accurate analysis of LV geometry in obese subjects might provide more information in the future to refine our ability to stratify cardiovascular risk.

Disclosures
None.

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