Influence of sarcopenic obesity on osteoporosis and vertebral fragility fractures in post-menopausal women

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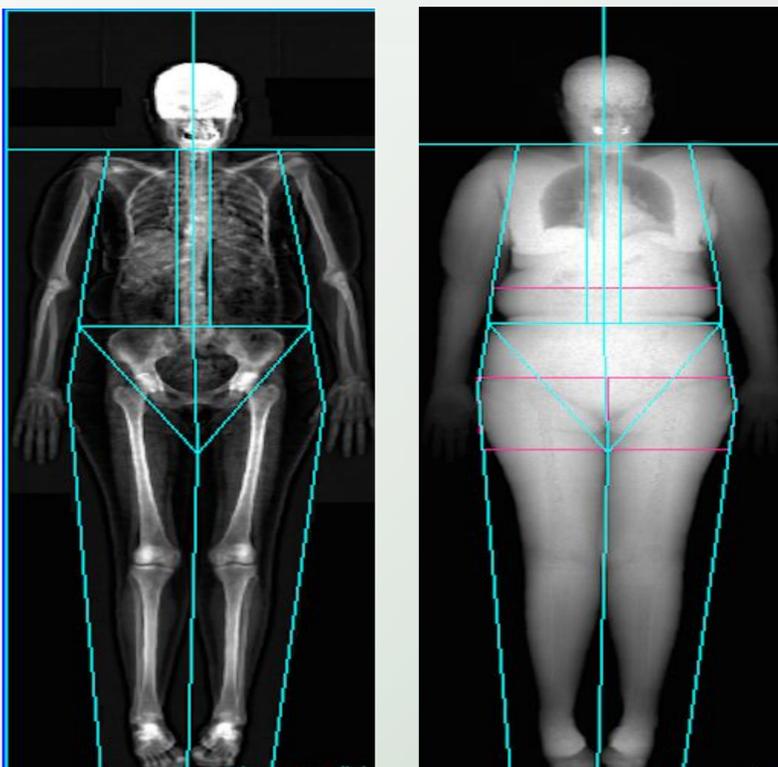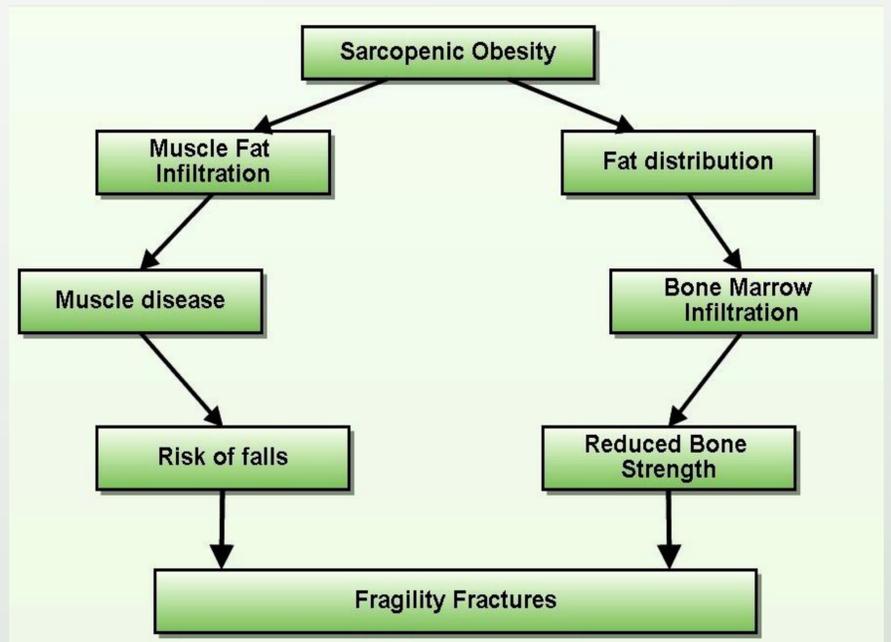
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Introduction

Recent evidences suggest that osteoporosis, sarcopenia and obesity share physiopathological features.[1] Since 1996, the involuntary loss of skeletal muscle mass coexisting with excess body fat has been defined as sarcopenic obesity.[2] Recently, this condition has been identified as a key risk factor for fractures in obese postmenopausal women.[3] In fact, in obese subjects, there is an increased risk of all osteoporotic fractures after adjusting for BMD data, suggesting an independent effect of obesity on fracture risk.[4] The hypothesis is that obesity increases the percentage of intramuscular fat mass infiltration, lowering muscle quality and physical performance, with increased risk of falls and fractures.[1,5] The recommended method for the quantification of muscle mass is Dual energy X-ray Absorptiometry (DXA),[6] based on assessment of total fat mass and appendicular lean mass.[7]

The aim of our study is to evaluate the influence of sarcopenic obesity on osteoporosis and vertebral fragility fractures in post-menopausal women.

Methods

In our retrospective case-control study, participants were recruited among post-menopausal women, aged 50 years or older, with a BMI ≥ 30 kg/m², that referred to our Outpatient Rehab Department for management of osteoporosis. We excluded people with current or previous HRT (Hormone Replacement Therapy), secondary osteoporosis or pathological fractures.

We measured body composition indices (ASM - appendicular skeletal muscle mass; FM – total fat mass), and Bone Mineral Density (BMD) with DXA scans (iDXA-GE Healthcare densitometer) of the lumbar spine (LS), femoral neck (FN) and total body less head (TBLH). Diagnosis of osteoporosis (T-score <-2.5 and/or presence of a fragility fracture) and obesity (BMI > 30 kg/m²) were made according to the World Health Organization classification system. Vertebral fracture assessment (VFA) was performed using the lateral vertebral assessment (LVA) of the toraco-lumbar spine (T4–L4 vertebrae) by DXA. The presence of vertebral fragility fractures was defined using the Genant semiquantitative (SQ) approach.[8] For each patient we reported anthropometric characteristics, BMI, ASM (residuals), total-body BMD and T-score, FN BMD and T-score, LS BMD and T-score, and number, type and severity of vertebral fragility fractures. According to Newman's definition,[7] based on appendicular lean mass adjusted for height and total fat mass (residuals), our population was classified in two groups: sarcopenic obese and non sarcopenic obese women.

Results

We evaluated 133 women mean aged 63.71 years ± 8.59 with a mean BMI of 34.31 ± 3.96 kg/m². Forty-seven patients (35.33%) of our population had sarcopenic obesity, with a mean BMI of 35.28 ± 4.86 kg/m², mean FN BMD of 0.848 ± 0.13 g/cm²; 19 of these patients (40.43%) were osteoporotic and 15 (31.91%) had a vertebral fracture: 8 (17.02%) with a single vertebral fracture and 7 (14.89%) with multiple vertebral fractures. Eighty-six patients (64.67%) of our population had non-sarcopenic obesity, with a mean BMI of 33.78 ± 3.29 kg/m² and a mean FN BMD of 0.856 ± 0.13 g/cm²; 31 of these patients (30.05%) were osteoporotic and 24 (27.90%) had vertebral fractures: 14 (16.28%) with a single vertebral fracture and 10 (11.63%) with multiple vertebral fractures.

Sarcopenic obesity was associated with a higher risk of osteoporosis (OR 1.20; 95% CI 0.58-2.50) and a higher risk of vertebral fractures (OR 1.21; 95% CI 0.56-2.62).

	Study population (n=133)	Sarcopenic obeses (n=47)	Non-sarcopenic obeses (n=86)
Age (years)	63.71 ± 8.59	63.15 ± 8.60	64.20 ± 8.62
Weight (kg)	84.44 ± 10.16	88.02 ± 11.94	82.49 ± 8.49
Height (m)	1.57 ± 0.06	1.58 ± 0.06	1.56 ± 0.06
Body Mass Index (BMI) (kg/m²)	34.31 ± 3.96	35.28 ± 4.86	33. 78 ± 3.29
Appendicular Lean Mass (ALM) (kg)	18.27 ± 2.31	17.20 ± 2.27	18.86 ± 2.13
Appendicular Skeletal Muscle Mass Index (ASMMI) (kg/m²)	7.42 ± 0.87	6.89 ± 0.86	7.71 ± 0.72
Total Fat Mass (FM) (kg)	40.23 ± 7.82	44.90 ± 8.56	37.67 ± 6.05
ASM Residuals*	-0.94 ± 2.22	-3.25 ± 1.26	0.33 ± 1.50
*Appendicular lean mass adjusted for height and body fat mass (residuals).			
Total Body Less Head (TBLH) BMD (g/cm²)	1.029 ± 0.11	1.023 ± 0.12	1.033 ± 0.11
Total Body Less Head (TBLH) T-score (SD)	-0.47 ± 1.09	-0.54 ± 1.18	-0.44 ± 1.05
Hip BMD (g/cm²)	0.853 ± 0.13	0.848 ± 0.13	0.856 ± 0.13
Hip T-score (SD)	-1.06 ± 1.08	-1.11 ± 1.09	-1.03 ± 1.08
Spine BMD (g/cm²)	1.061 ± 0.17	1.026 ± 0.19	1.080 ± 0.15
Spine T-score (SD)	-0.99 ± 1.39	-1.29 ± 1.56	-0.82 ± 1.26
Vertebral fragility fractures (n) (%)	39 (29.32%)	15 (31.91%)	24 (27.90%)
Single vertebral fragility fractures (n) (%)	21 (15.79%)	7 (14.89%)	14 (16.28%)
Multiple vertebral fragility fractures (n) (%)	18 (13.53%)	8 (17.02%)	10 (11.63%)
Osteoporotic patients (n) (%)	50 (37.6%)	19 (40.43%)	31 (30.05%)

Conclusion

In our cohort of post-menopausal women sarcopenic obesity was associated with a mild risk of osteoporosis and vertebral fragility fractures. Our results support the hypothesis that osteoporosis is not only a condition of lower bone mass but also of poor bone quality, that could be related to fat redistribution at bone tissue and bone marrow levels, modifying the intimate cross-talk between adipocytes and osteoblasts in the bone milieu. The effect of obesity is site-dependent, since it might exert a protective effect for some fracture sites (hip, pelvis, and wrist), while it seems to increase the risk for proximal humeral fractures.[3]

Data about the role of obesity on vertebral fragility fractures are still inconclusive. However, a recent study investigating the association among presence and number of vertebral fragility fractures and sarcopenia in osteoporotic women showed a higher risk of low muscle mass in the cohort of subjects with multiple fractures, after adjusting the results for age (OR 2.56).[9] In the present study, sarcopenic obese women showed only a mild increased risk of vertebral fragility fractures, probably related to the small sample size.

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