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Sarcopenia among Patients with Knee Osteoarthritis: An Observational Descriptive Study

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Abstract: ***The Objective of our study was to assess theprevalence and predictors of sarcopenia among patients with knee osteoarthritis (KOA). This cross sectional study included 150 female patients with KOA Sociodemographic and clinical characteristics of the patients were recorded. Sarcopenia was assessed bya dual energy x-ray absorptiometry scan for the body composition analysis, Fat mass, lean mass, and bone mineral density. Sarcopenia was present in 14 (9.3%) patients with KOA. BMI was the only significant negative independent factor that correlates with sarcopenia (OR=0.740, 95% CI 0.646 – 0.848, p=<0.001) Sarcopenia was frequent in KOA. BMI was negatively and significantly predict sarcopenia.***

Keywords: Sarcopenia, Knee osteoarthritis, Osteoarthritis, disease severity, body composition

1. Introduction

Osteoarthritis (OA):is the most common form of arthritis worldwide and strongly associated with aging (1).It is characterized by gradual loss of articular cartilage, combined with thickening of the subchondral bone, osteophytes at the joint margins, and mild chronic nonspecific synovial inflammation. Although the etiology of OA is not established, the main risk factors are well known and commonly include mechanical, biochemical and genetic factors (2).Sarcopenia is age-related loss of muscle mass and low muscle function, and may be the most prominent component of frailty, disability, and morbidity in older people (3, 4).

Many factors lead to sarcopenia including inflammation, insulin resistance, changing endocrine function, chronic diseases, nutritional deficiencies and low levels of physical activity. Disuse coupled with aging is the major underlying cause, poor blood flow to muscle, especially the muscle capillaries due to a decline in nitric oxide production, is another important age-related cause of sarcopenia (5, 6).Recent observations clearly show that changes in quantitative and qualitative intakes of dietary protein are able to counteract some pathophysiological processes related to muscle loss progression. Thus, a multimodal approach combining nutrition, exercise, hormones and specific anabolic drugs may be an innovative treatment for limiting the development of sarcopenia with aging (7).Up to our knowledge, there is no previous study on sarcopenia in KOA so This study was designed to assess the prevalence and predictors of sarcopenia in patients with KOA.

2. Patients and Methods

2.1 Study design

This was a cross sectional study conducted at Baghdad Teaching Hospital, Rheumatology Unit from October 2017 to the end of June 2018 after approval of the study protocol by University of Baghdad, College of Medicine, Department of Medicine, Rheumatology and Medical Rehabilitation Unit.

2.2 Participants

A total of 150 females were enrolled in the study. Patients were included in the study if they had: age 50 year and older with knee osteoarthritis (KOA) diagnosed according to the American College of Rheumatology clinical criteria (8), knee pain with a Kellgren/Lawrence ≥ grade 2 on the radiographic study (9). The exclusion criteria were : History of knee trauma or surgery, post infection arthropathy, malignancy, systemic inflammatory diseases such as rheumatoid arthritis and systemic lupus erythematosus (SLE), endocrinopathy like diabetes mellitus , incapable of lying in a supine position, overweight (>159 kg), Having received an injection of radio contrast material within the previous 7 days or radioisotope in the previous 3 days, and unwillingness to undergo a DXA scan.

2.3 Data Collection

Data were collected using a pre-constructed data collection sheet, protocol for each participant The protocol consisted of:

1) Socio-demographics data including (the age, gender, education, smoking, duration of menopause. Height was measured in meters (m) without shoes using a stadiometer, and weight was measured in kilogram (Kg), body mass index (BMI) was calculated according to the following equation (weight in kilogram divided by the square of height in meters according to the international classification system of the World Health Organization (10).
2) Clinical characteristics: Knee OA assessment: the presence of knee pain was defined by asking the participant whether they had experienced arthralgia of the knee for >1 month of the past 3 months. Plain X-rays of the weight bearing bilateral knee joints were obtained from the antero-posterior and lateral aspects with 30º of knee flexion. The severity of knee osteoarthritis was assessed according to the Kellgren-

Lawrence (KL) grading system (9). The Kellgren-Lawrence uses four radiographic features: joint space narrowing, osteophytes, subchondral sclerosis, and deformity. The severity of radiographic changes increases from grade 0 to 4 with grade 0 meaning no radiographic features of osteoarthritis while grade 4 means large osteophytes marked joint space narrowing, severe sclerosis, and definite bony deformity [9]. X-ray were taken for both knee joints for all patients, if obvious difference was present between knees, the most severely affected one's grading was recorded.

Quality of life and disease impact assessment was done by using Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) (11), WOMAC is a self-administered health status measure that assesses the dimensions of pain, stiffness and function (either separately or as an overall it is available in 5-point Likert, 11- point numerical rating and 100-mm visual analogue scale (VAS) formats, The WOMAC consists of 24 items divided into 3 subscales:

- Pain (5 items): during walking, using stairs, in bed, sitting or lying, and standing
- Stiffness (2 items): after first waking and later in the day
- Physical Function (17 items): stair use, rising from sitting, standing, bending, walking, getting in / out of a car, shopping, putting on / taking off socks, rising from bed, lying in bed, getting in / out of bath, sitting, getting on / off toilet, heavy household duties, light household duties (12).

The patient's response to each question produces a score that is then summed to derive an aggregated score for each dimension and a total score (WOMAC index) that reflects disability overall (11).

3) Outcome measurements: Assessment of Sarcopenia
Body composition measurements: a dual energy x-ray absorptiometry scan (DXA) scan (393 rue Charies Lindbergh, 34130 Mauguio France) was used for the body composition analysis. Fat mass, lean mass, and bone mineral density (BMD) were measured by DXA. Body fat percentage was defined as the percentage of fat mass of the whole body weight. The total femur BMD was selected to correlate with the knee joint (13). Total ASMM was based on the sum of the lean body mass (LBM) of the extremities (upper and lower limbs). Relative ASMM was calculated by dividing the total muscle mass (kg) by the height squared (m^2). Using the relative ASMM mean value of -2 SDs of the young reference sample, the cutoff value for sarcopenia for our study was ≤ 5.66 kg/m^2 (14). Muscle strength: handgrip strength was measured using electronic hand dynamometer (CAMRY), the width of the dynamometers grip was individually adjusted to the hand size of the participant. Tests were performed in an upright standing position, arms down by the side. Two test trials were performed, both for the dominant and non-dominant hand, the best trial was included in the analysis (11). Handgrip strength < 20 kg to determine cutoff values for our female (15).

Ethical approval and patients consent

1) The study protocol was approved by the University of Baghdad, College of Medicine, Rheumatology and Medical Rehabilitation Unit. According to the declaration of Helsinki.
2) Patients and controls verbal consents were obtained prior to participation in the study.
3) Data and information of the participants were kept confidentially and each personal or private information that identify the participant were kept secret.

3. Statistical Analysis

Binary logistic regression analysis used to calculate the odd ratio (OR) and their 95% confidence intervals, when the outcome can be categorized into 2 binary levels, and if appropriate probability plot used to present the relationship. While ordinal regression analysis used to analyze the risk of osteoporosis (compared to osteopenia and normal bone status), and the odd ratio (OR) and its 95% confidence interval used to present the relationship. SPSS 20.0.0, Graph Pad Prism 7.0 software package used to make the statistical analysis, p value considered when appropriate to be significant if less than 0.05.

4. Results

A total of 150 patients with KOA were involved in the study. Mean age was 58.98 ± 6.12 years, with mean BMI 32.5 ± 6.3. Ten patients (6.7%) were smokers, 147 (98.0%) had menopause with mean duration of menopause 10.7 ± 6.9 years (from ½ months – 30.0 years). About 76 (50.7%) had grade III Kellgren-Lawrence scale, Mean WOMAC score 53.0 ± 14.2 (16.0 - 91.0) as in table 1.

The prevalence of sarcopenia was 14(9%) of patients with KOA (figure 1). Binary logistic regression analysis to find predicators of sarcopenia in KAO rvealed that only BMI was negatively and significantly predict sarcopenia.

Table 1: Baseline socio-demographic and clinical characteristics of knee osteoarthritis patients (n=150)

Variables	Value
Age (years), mean ± SD (range)	58.98 ± 6.12 (50 – 82)
BMI, mean ± SD (range)	32.5 ± 6.3 (15.2 – 48.1)
Smoker, no. (%)	10 (6.7%)
Menopause, no. (%)	147 (98.0%)
Menopause duration (years); mean ± SD (range)	10.7 ± 6.9 (0.5 – 30.0)
Disease duration (years); mean ± SD	6.8 ± 5.4 (0.5 – 25.0)
Kellgren-Lawrence scale; no. (%)	
Grade I	-
Grade II	53 (35.3%)
Grade III	76 (50.7%)
Grade IV	21 (14.0%)
WOMAC score total; mean ± SD (range)	53.0 ± 14.2 (16.0 - 91.0)

WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index; NSAIDs: non-steroidal anti-inflammatory drugs.

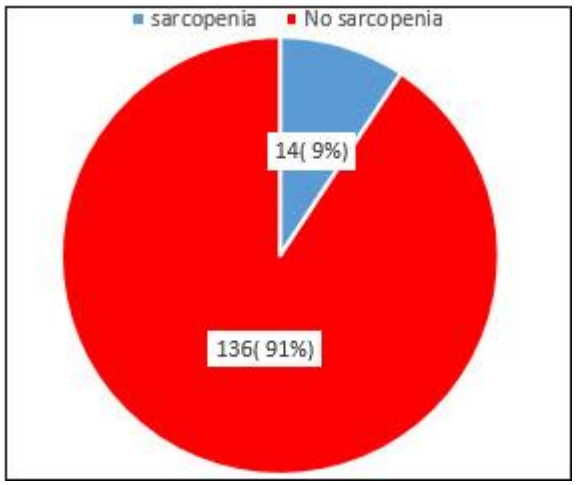

Figure 1: Sarcopenia in patients with knee osteoarthritis

Table 3: Binary logistic regression analysis to find predictors of sarcopenia

Variables	OR (95%CI)	P value
Age	1.065 (0.979 – 1.159)	0.143
BMI	0.740 (0.646 – 0.848)	<0.001 [S.]
Disease duration	1.008	0.933
Menopause duration	1.052 (0.978 – 1.132)	0.173
Kellgren-Lawrence scale	0.834 (0.362 – 1.925)	0.671
WOMAC	0.995 (0.957 – 1.035)	0.802

Binary logistic regression used. OR: odd ratio, CI: confidence interval, BMI: bone mass index, WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index.

5. Discussion

In the current study the prevalence of sarcopenia was 9.3%, this study included 150 female patients with knee OA. The patients included in the study had mean age 58.98 ± 6.12 years ranging from 50 – 82 years, our patients were younger than those reported by German study which included 1325 females and mean age 76.4 ± 4.9 years, the overall prevalence of sarcopenia in the German study was lower (4.5% for all sample; for 70–79 years it was 2.8%, while ≥80 years it was 9.9%), so the current sample in fifty years had similar prevalence of sarcopenia to the subgroup of eighty years in the German study (14), there were wide variations in the prevalence of sarcopenia in the literature in Landi et al (16) study 29.1% of the patients had sarcopenia their mean age was 85.8 ± 4.9 years (which is older than current study),with 66.7% of the patients were females], this higher frequency could be attributed to different criteria for defining sarcopenia (they use the European Working Group on Sarcopenia in Older People (EWGSOP) criteria) (17),in Beaudart et al study (18) they found the prevalence of sarcopenia is between 6.58% to 20.2% for female with mean age of 73.8 ± 6.2 years, in this study they examined the effect of choosing different cut for defining sarcopenia using EWGSOP algorithm and found that the prevalence of sarcopenia is increased with advancing in age ranged from 1.18% to 4.71% for 65 – 69 years and 16.7% to 38.1% for patient ≥80 years, so the current study shows similarity to their prevalence at the lower range. Other studies like Patil et al show lower prevalence of sarcopenia compared to current study 0.9 and 2.7 % according to the EWGSOP and IWG, in this study women had mean age of 74.2 ± 3.0 years (19). It is natural for the SMM to diminish after the adolescent period, and the decrease can be as much as 0.5% to 1% per year after 25 years of age (20). Loss of SMM, quality, and strength in association with the advance of age refers to sarcopenia as a degenerative process (21).

The variation in sarcopenia prevalence may be related to difference of body-composition assessment (i.e., DXA vs. segmental multi frequency BIA devices) that used in these studies and variation in age group included, and ethnicity.

The relation between SMI and KOA may be suggestive of a pathogenic relation between sarcopenia and development of OA with aging. The altered body composition may not be substantial until the end of the fifth decade (22), however, loss of fat free mass is augmented and the effects are more prominent in older people. But the non-significant result of the relation between the severity of knee osteoarthritis and Sarcopenia in current study related to the high percentage of overweight (33%), obese (84%), and morbid obesity (18%) of our sample versus normal weight (12%) and underweight (3%), the association between OA and obesity may be explained by factors other than biomechanical stress. Obesity is associated with OA not only in the weight-bearing joints, but also in the joints of the hand (23). Adipose tissue is an endocrine organ that secretes various adipokines (24). Data obtained in vitro have suggested a role of adipokines, including leptin, adiponectin, resistin, and visfatin, in the pathophysiology of OA (25). Recently, leptin, acting synergistically with other inflammatory cytokines, was shown to have a catabolic effect on articular cartilage metabolism via the up-regulation of proteolytic enzymes (26).

In the current study there was inverse correlation between BMI and sarcopenia; in which as BMI decreased there is increased risk of sarcopenia, our findings were in agreement with Antoun et al in which they found that sarcopenia was present in 72% of patients with BMI less than 25 kg/m2 and in 34% of those with a BMI greater than 25 kg/m2 (27), also in agreement with large epidemiological in New Mexico in which they reported inverse correlation between obesity with sarcopenia (OR: 95%CI = 0.07 (0.03 – 0.14) (28), also in agreement with Baumgartner et al in which they reported lower mean BMI in sarcopenia women compared to non-sarcopenia (20.5 ± 2.1 vs. 24.2 ± 2.0, p-value < 0.01) (29).

In the current study there was no significant association between WOMAC score (quality of life indicator) and both sarcopenia and osteoporosis in women with knee OA, while indicators of physical capability had inverse significant correlation with sarcopenia (gripe strength both right and left), similar findings were reported by another study (30).

This study has some limitations. Firstl, lower limb strength was not measured in this study. Second, we used Bio-impedance analysis (BIA)that estimates the volume of fat and lean body mass. Third, this is a cross-sectional study and further prospective longitudinal studies are needed to confirm the causal relationship between sarcopenia and KOA development. However up to best of our knowledge this is the first study among Iraqi patients with KOA with strict inclusion and inclusion criteria.

In Conclusion: Sarcopenia was frequent in KOA. BMI was negatively and significantly predict sarcopenia. Sarcopenia may interactively correlate with age-related knee osteoarthritis. This suggest early diagnosis and treatment of KOA may decrease sarcopenia and subsequently its morbidity and complications.

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