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IMPACT OF OBESITY ON FUNCTIONAL STATUS IN PRIMARY KNEE OSTEOARTHRITIS

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Abstract

To find out is there any difference in functional status (self reported as well as actual) among various BMI categories in non-radiographic knee osteoarthritis individuals; and to see the correlation between Body Mass Index and six minute walking test , subscales of Knee injury and Osteoarthritis Outcome Score. Present study was a cross sectional survey involving 274 subjects aged between 41-79 years (mean 58.76yrs) with primary knee joint OA. After passing inclusion criteria, following measurements were taken: age, sex, body weight, height, 6 MWT, self reported KOOS. Data was analyzed using one way Analysis of variance, Pearson correlation, and linear regression tests. Results shows there is a significant difference in 6 MWT and all KOOS subscales ($p < 0.001$) among different BMI groups. There is a significant negative correlation of 6 MWT (r -0.86) and all sub scales of KOOS (r ranges -0.52 for ADL to -0.82 for Quality of Life, $p < 0.001$) with BMI. Results indicate decreased functional status as the BMI increases that may be related to pain and symptoms of knee OA individuals.

Keywords: BMI, Primary OA Knee, six minute walking test, KOOS.

Introduction

Among the various types of Arthritis, Osteoarthritis (OA) is a growing menace among the older individuals which affects joint articular cartilage with or without changes in underlying bone at joint margins. It manifested with persistent pain, swelling, stiffness, bony tenderness, bony enlargement, crepitus and decreased functional activity all of which leads to poor quality of life and disability, making the person depressed. This ailment is more prevalent in women than in men; and in aged people. The prevalence of knee pain is 46.2% in the general population (32.2% in men and 58.0% in women) and increases with age in women[1]. It is basically understood that OA progresses with aging and obesity enhances this process to early incidence there by associated functional impairments leading to poor quality of life and disability. There is disagreement among the medical fraternity regarding clinical and radiographic diagnosis of osteoarthritis. But, however it is generally believed that radiography as an imaging procedure, is insensitive to early disease[2]. *Hart et al (1991*) have examined 'normal' women from the general population in an age group with the highest incidence of 'new osteoarthritis' to assess the prevalence and

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reproducibility of clinical signs and their relation with symptoms and x-ray changes. They have confirmed that diagnosis based on clinical signs alone is useful research tool[3].

Obesity, high BMI is associated with an increased risk for early death, heart disease, stroke, disability and several other co-morbidities. Since it affects almost every system and part of the body, it increases the burden on health care services especially older adults[3]. In musculoskeletal system, it affects weight bearing joints (i.e) knee, hip, foot, spine in that order. Generally knee OA is process of aging and obesity enhances this process faster. *Creamer et al (2000*), have found that function was determined by pain and obesity rather than by structural changes as seen on X-ray[4] and radiographic score was not closely associated with functional impairement.[5,6].

In clinical rehabilitation self reported questionnaire are commonly used to assess clinical symptoms and functional status as an indirect method since it takes time to measure them reality. A good questionnaire must well correlate with real functional activity measurement (i.e reliable and valid). Knee injury and osteoarthritis outcome score (KOOS) is a most commonly used outcome measure tool in Knee joint. It has been shown to be a valid, reliable, and responsive measure of overall knee joint function in people with OA[7].The original purpose of the six minute walk was to test exercise tolerance in chronic respiratory disease and heart failure[8]. The test has since been used as a performance-based measure of functional exercise capacity in other populations including healthy older adults, people with knee or hip arthritis. It is considered a reliable, valid test in other conditions like heart failure and in arthritis [9,10].

Current literature supports that 6 minute walking distance is increased by height and decreased by weight however didn't explain about the combined effect ie. BMI especially in OA where pain and associated muscle weakness has an impact on functional mobility. There is also paucity in influence of BMI on various subscales of KOOS. Thus, primary aim of this study was to find out is there any difference in functional status (self reported as well as actual) among various BMI group in non-radiographic knee osteoarthritis (OA) individuals; and to see the correlation between BMI and six minute walking test (6 MWT), subscales of KOOS.

Methods

Study design

Cross-sectional study was used to collect the data from individuals with clinical and non radiologic primary knee joint osteoarthritis based on American College of Rheumatology criteria. Obesity was classified into four categories of BMI 20-24.9 kg/m^2 (Normal), 25-29.9 (overweight), 30-34.9 (class-I obese & >35kg/m^2 (class-II, III obesity). Clinical diagnosis of idiopathic knee OA was based on knee pain in either knee on most days for at least 1 month in the previous year and at least two of the following symptoms: stiffness, crepitus, bony tenderness and bony enlargement. Individuals with any evidence of secondary OA, inflammatory arthritis, and those with neurologic conditions were excluded. 274 participants (130 males and 144 females) met the criteria and included for the present study.

Measurements

Anthropometrics

Measurement of height was made using a clinical stadiometer in bare or stocking feet. Body weight was measured with a calibrated precision scale with subjects wearing minimal cloth. BMI was derived from the available height (in meters) and weight (in kilograms) data recorded.

Self reported questionnaire

Knee injury and osteoarthritis outcome score (KOOS) is a most commonly used outcome measure tool in Knee joint. It is an extension of the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)[11]. It was developed for use with younger and/or physically active patients with knee injury and osteoarthritis but it is also valid for elderly patients[12,13]. KOOS is a 42-item self-administered, self-explanatory questionnaire that covers 5 patient-relevant dimensions: pain (9 items), other symptoms (7 items), activities of daily living (ADL) (17 items), sports and recreational function (sport/recreation) (5 items), and knee-related quality of life (QOL) (4 items). Responses were graded on a 5-point Likert scale. A score from 0 to 100 is calculated for each subscale, with 100 representing the best result.

Physical Performance

The 6-minute walk test (6-MWT) was used to study physical performance. The walking track was a 30-m-long empty hospital corridor. OA knee patients were asked to walk back and forth along the 30-m track and to cover the longest possible distance in 6 minutes as per the American Thoracic Society Guidelines[14]. Two weekly test-retest reliability of walking distance was reported to be 0.87 for patients with knee OA[15].

Statistical analysis

All statistical analyses were performed by using SPSS 10.0 statistical software (SPSSFW, SPSS, Inc., Chicago, IL). Results were presented as mean, standard deviation, correlation between BMI and functional status (KOOS-domains and 6MWD) respectively. Significant level set at '$p<0.05$'.

Results

Descriptive statistics- Table (1) of KOOS subscales and 6 MWD among different BMI groups in symptomatic OA knee patients. In general the values decrease as the BMI increases in all subscales of KOOS and 6 MWT. This indicates that there was a decreased scores in ADL, Sports & recreation and QOL domains, whereas worsening of pain and symptoms in primary OA Knee patients.

In BMI 20-24.9kg/m^2 group sports & recreation subscale was the most effected subscale (77%) while symptom subscale is the least effected subscale (93.5%). The same trend continuous in other subscales also with progressively lowered values in subsequent BMI groups (for BMI >35 group, sports &recreation subscale 15.98% and symptoms subscale 56.01%). 6MWD is maximum in BMI 20 -24.9 with the value of 309.85 meters . This progressively decreased in subsequent BMI groups with the least distance (200.67meters) covered in BMI >35 kg/m^2 group.

Table No. 01: Descriptive statistics of various subscales of KOOS and 6 MWT among different BMI groups in primary OA knee patients

Parameter	BMI 20-24.9	BMI 25-29.9	BMI 30-34.9	BMI > 35kg/m^2
KOOS–Pain (in %)	90.90± 7.75	75.16±.5734	62.60±13.04	47.30±.15.28
KOOS-Symptoms (in %)	93.50±2.12	79.84±12.11	66.76±13.46	56.01±14.83
KOOS-ADL (in%)	91.80±12.37	75.81±15.21	66.69±14.30	53.94±17.73
KOOS-Sports & recreation (in%)	77.00±18.73	47.46±19.40	30.00±2.90	15.98±11.22
KOOS-QOL (in%)	81.50±12.66	66.12±9.78	34.34±20.45	23.00±9.82
6MWT (in meters)	309.85±8.43	280.34±21.15	238.91±40.48	200.67±34.85

KOOS-subscales values are in mean and SD for each group

Table No. 02: Correlation and linear regression analysis of various sub scales of self reported questionnaire (KOOS) and functional ability (6 MWT) with BMI (n=274)

S No	Parameter	Mean	SD	r value
1.	KOOS- Pain (in %)	62.91	17.65	-.647***
2.	KOOS- Symptom (in %)	68.36	16.56	- .6212***
3.	KOOS- ADL (in %)	66.64	18.03	- .518***
4.	KOOS- Sports and recreation (in %)	32.62	23.97	- .6021 ***
5.	KOOS- QOL (in %)	41.54	23.84	- .6946 ***
6.	Functional ability (6 MWT) (in meters)	242.38	46.49	- .6908 ***

*, **, *** indicates $p<0.05$, $p<0.01$, $p<0.001$ respectively.

The correlation coefficients (r) from Table (2) a chosen sub-set of outcome measures reveals that there was highly significant negative correlation observed between BMI and with each KOOS subscale as well with six minute walking distance. Coefficient of correlation (r) between KOOS-pain subscale with BMI was observed to be r = -.647 there exists negatively significant relationship between the observed parameter. The coefficient of correlation between subscale of KOOS-symptom with BMI was found to be r = - .6212 i.e. significant negative correlation found between observed parameter. The correlation coefficient of KOOS-ADL subscale with BMI was observed to

be r = - .5180 which indicates significant negative relationship observed between parameters. Also significant negative correlation observed between BMI and KOOS-sports & recreation subscale and was seen to be r = - .6021 which also indicates significant negative relationship observed between parameters. As well KOOS –QOL subscale also shown significant negative correlation with BMI where r = - .6946. The functional ability (6 MWT) of all the patients when compared to BMI was also shown significant negative correlation between the parameters observed (r = - .6908).

Discussion

To the Researchers knowledge, the present study is the first to examine different BMI groups and their effects on Functional status (physical performance measure such as 6MWD & self-reported KOOS domains) in non-radiographic primary knee osteoarthritis individuals in terms of ethnic values in Indian population. *Anderson and Felson (1988*) showed that the risk of knee OA is increased by 15% for every additional unit increase[16] in BMI above 27 kg/m^2. For a relatively large sample size, the cohort was heterogeneous in weight (60kg-114 kg) and BMI ranged (23.03 kg/m^2 - 43.37 kg/m^2). The participants had a mean BMI of 32.22 kg/m^2 (23.03-43.37 kg/m^2) indicating class I obesity. A 10 year follow up study also concluded that a high BMI was significantly associated with knee OA[17].

Our study is related to the work done by *Stratford et al., 1991* and confirm that performance-specific assessments of pain and function offer a more distinct method of assessing these variables than can be obtained by self-reported outcomes alone[18].

As the BMI increases there is a definite decline in physical performance test (6MWD) and subscales of KOOS. Poor physical functioning measured with self-reported items, has previously been shown to be related to excess body weight among older persons[19]. Recently, performance-based measures have also been used to assess the relationship between physical functioning and body weight status[20].Our study is contrary to study done by Aoyagi et al, 2002; Avi Elbaz et al, 2011; Stephanie et al, 2013[21,22,23]in terms of pain increment with increased BMI. Knee symptoms and functional difficulties worsens as the BMI increases[22,23,24]. Mobility limitation increased with obesity[25].Physical function improved better with weight loss as measured by WOMAC scale.[26,22,24]. Paradowski et al., (2006) who observed highly significant difference in sports and recreation domain[27].Research done by Rosemann et al., 2008 had proved that QOL in patients with knee OA is inversely correlated with the BMI[28] .In one study Maly et al, 2005 have stated that body weight is one among the reasons for decline in physical performance levels[29]. 6mwd was also improved with decreased weight.[26,24] . A 4 year functional outcome study showed that functional decline in obese people with knee osteoarthritis[30].

Conclusion

Weight gain would definitely declines functional status in knee arthritis patients. We recommend weight reduction and early diagnosis based on clinical criteria and functional assessment would prevent or halt the progression of the disability to some extent, leading to a better Quality of Life in osteoarthritis population.

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