The analysis of factors causing functional disabilities in osteoarthritis of the knee: A prospective study

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Abstract
Osteoarthritis(OA) of the knee is one of the most common diagnoses made in the Orthopaedic out patient department and is also the most common type of arthritis in India. The prevalence of OA is high in the elderly, especially obese individuals which leads to increased rate of disability. With increasing life expectancy of the Indian population and the increased incidence of obesity due to sedentary lifestyle, the overall prevalence of OA is on the rise. The very alarming factor is the relatively younger age of patients(40-49 years) who present with OA in Outpatient clinics. In our study 17% of patients from 40-49 years age group, 46% of patients from 50-59 years age group , 30% of patients from 60-69 years age group and 7% from 70-79 years age group.
Key Word:

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INTRODUCTION

Osteoarthritis (OA) of the knee is one of the most common diagnoses made in the Orthopaedic out-patient department and is also the most common type of arthritis in India. The prevalence of OA is high in the elderly, especially obese individuals which leads to increased rate of disability. With increasing life expectancy of the Indian population and the increased incidence of obesity due to sedentary lifestyle, the overall prevalence of OA is on the rise. The very alarming factor is the relatively younger age of patients (40-49 years) who present with OA in Outpatient clinics. In our study 17% of patients from 40-49 years age group, 46% of patients from 50-59 years age group, 30% of patients from 60-69 years age group and 7% from 70-79 years age group. OA has predilection to certain joints and spares other joints. The joints commonly affected are cervical and lumbosacral spine, hip and knee joints, first metatarso-phalangeal joint(MTP).Also the proximal and distal interphalangeal joints and base of the thumb are affected in the hands. The wrist, elbow and ankle joints are usually spared. In this study we focus on analysis of factors causing functional disability in OA knee patients. The xray changes in OA knee are decreased joint space due to cartilage loss and osteophytes. Many patients with radiological evidence of OA knee, does not have symptomatic disease. The radiological severity of osteoarthritis does not always correlate with the amount of functional disability in patients. Symptomatic OA Knee has implication in the economic productivity and multiple causative factors to be analysed in detail in determining the treatment selection of the patient and treatment outcomes and lifestyle modifications.

Of the multiple factors the most significant ones are:
1. Age(Less common before 40 years and has high prevalence after 60 years)
2. Sex(More common in women than men)
3. Obesity

4. Repeated joint use
5. Joint abnormalities

Hence it is imperative to study the individual causative factorsinfluence the functional limitations due to the disability caused by the disease and must be evaluated individually to planthe management of OA for a successful outcome from symptomatic OA and to reduce the disease burden in public health perspective.

We have focused on the following parameters in our study:

1. Xray grading of OAby Kellgren Lawrence grading system(Radiological grading)
2. Body Mass index (Obesity)
3. Age
4. Functional Disability by WOMAC Knee score

MATERIALS AND METHODS

The study was conducted in the outpatient clinic in the department of Orthopaedics in Government Medical College, Omandurar Government Estate, Chennai from March 2018 to August 2018. Total of 100 patients with clinical diagnosis of Osteoarthritis knee were included in the study. All the patients were sent for standing X-ray of the knee joint of the affected limb.

1. The X-rays were graded for stage of Osteoarthritis by the KellgrenLawrence grading system
2. The tibio-femoral angle was calculated.
3. The Height and weight of the patients were measured and BMI was calculated.
4. The age and sex of the patients
5. The functional disability due to OA knee was measured using the WOMAC knee score in which three parameter pain, stiffness and disability were measured.

Inclusion Criteria

1. Age > 40 years and <80 years
2. Patients with varus deformity of the knee
3. K-L Grading of "0"
4. BMI >= 20 AND <= 40

Exclusion criteria

1. Age <40 years and >80 years
2. Patients with valgus deformity of the knee
3. K-L Grading of "1-4"
4. BMI <= 20 AND >= 40

Table 1: Age

S. No	Age	Number of patients
1	40-49	17
2	50-59	46
3	60-69	30
4	70-79	7
Total		100

KL Grading

Radiologic features of osteoarthritis as described by Kellgren and Lawrence[12] The severity of knee osteoarthritis (OA) classified commonly by Kellgren and Lawrence system using five grades. In 1957, Kellgren *et al*. proposed this classification and later accepted by WHO in 1961.In applying the system, the prevalence of chronic knee pain in a postal survey of 2000 swedes aged 35-54 was 15%1. Of these respondents, 1% showed radiographic knee OA, based on bilateral weight bearing plain films.

Classification

1. No radiographic features of OA are present
2. Doubtful joint space narrowing (JSN) and possible osteophytic lipping
3. Definite osteophytes and possible JSN on anteroposterior weight-bearing radiograph
4. Multiple osteophytes, definite JSN, sclerosis, possible bony deformity
5. Large osteophytes, marked JSN, severe sclerosis and definite bony deformity

K-L Grade	Number of patients
Grade 1 K-L	18
Grade 2 K-L	23
Grade 3 K-L	35
Grade 4 K-L	24

Grade	Description
Grade 1	Doubtful narrowing of the joint space, possible osteophytic lipping
Grade 2	Definite osteophytes, possible narrowing of the joint space
Grade 3	Moderate multiple osteophytes, definite joint space narrowing some sclerosis, possible deformity of bone ends
Grade 4	Large osteophytes, Marked joint Space narrowing , Severe Sclerosis and definite bony end deformity.

Adapted: Kellgren jh, Lawrence js, radiological assessment of osteo-arthrosis. Ann Rheum dis, 1957 Dec 1957 Dec; 16(4); 494-502.

Out of 34,478 TKAS registered in the joint registry(13) by ISHKS, contributed by 42 surgeons across India, 8612 were males (25%) and 25,866 were females (75%). The average age was 64.4 years (osteoarthritis range: 45 to 88 years; rheumatoid arthritis range: 22 to 74 years). The average body mass index was 29.1 (range: 18.1 to 42.9). The indication for TKA was osteoarthritis in 33,444 (97%) and rheumatoid arthritis in 759 (2.2%). In the coming decades, the demand for TKA surgery is expected to grow exponentially.

BMI Formula

What is BMI? Body mass index which is also referred as BMI in short is the investigative measurement of the fat present in the body. It is calculated basically by the height and weight of the person. Actually it is not supposed to measure the amount or percentage of fat present in the body instead it measures the percentage of fat based on the weight and height of the body. The BMI formula is used to indicate that whether you are normal, underweight, obese or overweight. If the BMI scores between 20 and 25 then the person is supposed to be healthy. The score less than 20 indicates being underweight whereas the BMI value of greater than 25 indicate overweight. A BMI score of 30 or greater indicates a person is obese. To calculate your BMI the formula is weight divided by height (squared) multiplied by 703. So for example to figure out my BMI; you would take my weight of 238 pounds/ 72*72 (5184) = .0459104938 * 703 = 32.27 (BMI).

Categories of BMI	
Category	**BMI**
Underweight	15-19.9
Normal weight	20-24.9
Overweight Preobesity	25-29.9
Class I Obesity	30-34.9
Class II Obesity	35-39.9
Class III Obesity	>= 40

Abbreviation: Body mass index (BMI)

WOMAC Scoring

The Western Ontario and McMaster Universities Arthritis Index (WOMAC) is widely used in the evaluation of Osteoarthritis of Hip and knee. It consists of 24 items of self-administered questionnaire divided into 3 subscales:

Pain (5 items):
1. During walking,
2. Using stairs,
3. In bed,
4. Sitting or lying, and
5. Standing upright

Stiffness (2 items)
1. After first waking and
2. Later in the day

Physical Function (17 items)
1. Descending stairs,
2. Ascending stairs,
3. Rising from sitting,
4. Standing,
5. Bending to floor ,

6. Walking on flat surface,
7. Getting in / out of a car,
8. Going shopping,
9. Putting on socks
10. Taking off socks,
11. Rising from bed,
12. Lying in bed,
13. Getting in / out of bath,
14. Sitting,
15. Getting on / off toilet,
16. Heavy domestic duties,
17. Light domestic duties

WOMAC Index was developed in 1982 at Western Ontario and McMaster Universities. WOMAC is available in over 100 languages and has been linguistically validated.[16]

Area of Assessment

Activities of Daily Living; Functional Mobility; Gait; General Health; Quality of Life

Intended Population

WOMAC Index was developed for Hip and Knee Osteoarthritis, however it has been used with other rheumatic conditions such as: Rheumatoid Arthritis, Juvenile Rheumatoid Arthritis, Fibromyalgia, Systemic Lupus Erythematosus and Low back pain.

Method of Use

The WOMAC takes approximately 12 minutes to complete, and can be taken on paper, over the telephone or computer. Both the computerized and the mobile versions of the test have been found to be comparable to the paper form, with no significant difference. In our study we carried out the WOMAC in paper ormat. The test questions are scored on a scale of 0-4, which correspond to: None[0], Mild[1], Moderate [2], Severe[3], and Extreme[4]. The scores for each subscale are summed up, with a possible score range of 0-20 for Pain, 0-8 for Stiffness, and 0-68 for Physical Function. Usually a sum of the scores for all three subscales gives a total WOMAC score, however there are other methods that have been used to combine scores.[1]

Higher scores on the WOMAC indicate worse pain, stiffness, and functional limitations: Evidence Reliability The test-retest reliability of the WOMAC varies for the different subscales. The pain subscale has not been consistent across studies, but it generally meets the minimum standard. The physical function subscale is more consistent and has a stronger test-retest reliability. The stiffness subscale has shown low test-retest reliability.[1] Validity Responsiveness The WOMAC Index has been used extensively in clinical trials, and has generally been shown to exhibit greater or comparable responsiveness to change than other tests. This varies, however, for different subscales and types of

interventions. The 2 potential weaknesses of the WOMAC are: 1. The low test-retest reliability OF stiffness subscale, and there is little evidence for its measurement properties. 2. Some studies report inadequate factorial validity in the pain and physical function subscales of the WOMAC. Thus, the physical function subscale might be limited in its ability to detect change if the association between pain and function is weak.

S.NO	WOMAC SCORE	NO.OF PATIENTS
1	24-31	0
2	32-47	14
3	48-71	35
4	72-96	51
TOTAL		**100**

The results were tabulated and analysis was done using pearson correlation value to measure the strength of association of 3 variables (BMI, KL Grade, functional Deformity) with the functional limitation due to OA Knee(Womac score) were measured. Deformity was measured as the variation from normal valgus angle of 7 degrees. Pearson's correlation coefficient is the test statistics that measures the statistical relationship, or association, between two continuous variables. It is known as the best method of measuring the association between variables of interest because it is based on the method of covariance. The Pearson correlation coefficient, often referred to as the Pearson R test, is a statistical formula that measures the strength between variables and relationships. To determine how strong the relationship is between two variables, you need to find the coefficient value, which can range between -1.00 and 1.00. Pearson's Correlation Coefficient. Correlation is a technique for investigating the relationship between two quantitative, continuous variables, for example, age and blood pressure. Pearson's correlation coefficient (r) is a measure of the strength of the association between the two variables. In our study we are measuring the relationship between:

RESULTS

The strength of correlation to functional limitations due to OA knee was most with the age followed by obesity, Womac score. All the parameters had a linear correlation with increasing functional limitations EXCEPT height.

DISCUSSION

Though Radiological feature of osteoarthritis of knee joint are the same, the functional impairment is not directly related to the Radiological severity in all cases. Many other variables like BMI, Deformity, BMD cartilage volume influence the functional outcome. Even outcome following a TKR depends on similar factors despite reproducible surgical technique. Hence these factors must be evaluated properly and their significant effects on the disability due to Osteoarthritis must be very well discussed with patient. BMI and BMD are modifiable factors and the need to correct them before and after surgery must be discussed with patients for an optimal management and good functional outcome following any modality of treatment.

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