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Factors Influencing Pain and Functional Impairment in Patients with Knee Osteoarthritis

Mazen Mohamed El-Sheikh[1], Reham Mohamed El Shabrawy[2], Mai Adel Alsayed Khalel[*1], Marwa Hammad[1]
Departments of [1]Rheumatology and Rehabilitation and [2]Medical Microbiology and Immunology,
Faculty of Medicine, Zagazig University, Sharkia, Egypt
***Corresponding author:** Mai Adel Alsayed Khalel, **Email:** mood672@yahoo.com

ABSTRACT

Introduction: Arthritic pain and impairment are all too prevalent with osteoarthritis (OA), the most common form of the illness. Numeric scoring systems can be used to assess knee osteoarthritis (OA) patients' levels of pain. **Objective:** This study aimed to evaluate the possible factors that increase pain and functional impairment in knee OA leading to increased VAS and WOMAC score.

Patients and Methods: On 58 osteoarthritis patients, at Zagazig University Hospitals' Rheumatology and Rehabilitation Department, we conducted this cross-sectional trial. An extensive physical examination, a set of lab tests, and a series of X-rays were all performed on each patient. We utilized the WOMAC index from the Western Ontario and McMasters Universities as well as Visual Analogue Scale (VAS "0-10 cm") to assess functions and pain. For determining the severity, we utilized grading scale of Kellgren and Lawrence.

Results: BMI, deformity, ESR, radiological grading are indicators of functional impairment and pain index among cases who had knee osteoarthritis.

Conclusion: Presence of knee deformities and advanced X-ray grading were associated with higher pain score and more functional impairment, so we should prevent their progression. BMI is a main risk factor for higher pain scores and functional impairments.

Keywords: Severity of OA, VAS, WOMAC.

INTRODUCTION

About ten percent of the global population is affected by osteoarthritis [(1)]. If you're over 65 years old, you're more likely to suffer from arthritis than anyone else in the world [(2)]. As the most common joint disease, OA affects people of all ages and races and in all parts of the world. In addition, it is the most frequent kind of arthritis in the elder population [(3)].

The most frequent type of OA is primary generalized OA (PGOA), which affects more women than men. Localized OA and secondary OA, on the other hand, are more common in men than in women [(4)]. Bakry [(5)] observed that the prevalence of OA was 23.3 percent in Al-Sharkia Governorate, with 1652 individuals, and that knee OA was more common in rural regions than in urban ones.

When it comes to OA, biological, metabolic as well as mechanical factors all play a part. Changes among the composition and mechanical characteristics of articular cartilage result from the interaction of these processes [(6)]. The chondrocyte's attempts to repair damage as a result of deterioration are the root cause of OA. Pro-inflammatory cytokines, such as IL-1, as well as proteolytic enzymes are among the chemical components that cause destruction [(7)]. Articular cartilage loss and the growth of osteophytes, as well as the presence of synovial inflammation (synovitis) in a significant number of patients, are hallmarks of this condition [(8)].

Obesity, advanced age, and the presence of a female gender all contribute to this disease's complexity. A person's age is the single most significant predictor of developing OA. Up to eighty percent of people globally over 75 are affected by OA, which is the most frequent chronic illness in later years. As people become older, radiologic alterations in OA become more prominent [(9)].

OA is more prevalent in women than in men, with an estimated two-to-one ratio. The prevalence of osteoarthritis (OA) in women increases dramatically beyond the age of 50, particularly in the knee [(10)]. Another key risk factor for OA is obesity. Knee OA is more common in men and women with a higher BMI, while hip OA is not [(11)].

Treatment options are still limited to analgesia, chondroprotective, intraarticular injection, and arthroplasty in this multifactorial environment [(12)].

Bony anomalies (osteophytes, subchondral sclerosis) and synovitis attacks as well as functional ratings in OA patients are all variable in their clinical presentation. The purpose of this study was to determine which factors will lead to a higher VAS and WOMAC score in patients with knee OA.

PATIENTS AND METHODS

At Zagazig University Hospitals' Rheumatology and Rehabilitation Department, Faculty of Medicine, we conducted this cross-sectional trial.

Ethical considerations:

The study was reviewed and approved by the Institutional Review Board of Zagazig University

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(ZU-IRB). Each and every patient signed an informed consent form. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

There were 58 patients in the study, 8 men and 50 females, who were diagnosed to have knee osteoarthritis according to the American College of Rheumatology (ACR) criteria matched with radiographic and clinical and criteria [(13)]**.** Those with secondary OA, infection, cerebrovascular illness, hepatic or renal failure, malignant tumours, or any other condition were not included in the research.

Data on demographics (age, gender, BMI, race, disease duration, and years of formal education) were collected from the study participants. Muscle weakness, effusion, thickness of the synovium and limitation of movement were all utilized to assess the severity of the pain and inflammation. When it came to evaluating knee pain, the VAS "0-10 cm" scale was used [(14)].

The VAS is a 100-mm-long (10-cm-long) horizontal line with word descriptions at either end. The patient notes the spot on the line that he/she believes best reflects his/her current state of mind. The VAS score is calculated by measuring in millimeters from the line's left end to the point marked by the patient. The WOMAC questionnaire was also used to assess pain and function in patients with knee OA. It comprised a set of 24 questions that the patient had to answer.

The index score is based on a maximum of 96 points and consists of three parts[(15)]: 1st section (A): 5 questions evaluating the pain. 2nd section (B): 2 questions indicating the mobility. 3rd section (C): 17 questions showing the functional level. ESR and C-reactive protein were two other laboratory tests performed on all of the individuals in the study.

Radiologic Grading:

OA knee severity was assessed by the Radiologic OA Grading of Kellgren and Lawrence [(16)]**.** Radiographs were rated for Kellgren and Lawrence (KL) grade where grades Zero means normal; one means questionable osteophyte; two means definite mild; three means moderate; and four means severe by a single trained observer. A wide range of grades, from 0 (no osteophytes or joint space constriction) to 4 (severe narrowing of space of joint in addition to subchondral sclerosis) were recorded.

Statistical Methods

SPSS 20.0 for Windows was used for all data collection, tabulation, and statistical analysis (SPSS Inc., Chicago, IL, USA). Several research variables were correlated using the Spearman's rank correlation coefficient. Quantitative data were expressed as mean ± SD (Standard deviation), and range. Qualitative data were expressed as frequency and percentage. Independent samples t-test was used to compare between two independent groups of normally distributed variables (parametric data). P value < 0.05 was considered significant.

RESULTS

Characteristics of the Population and Disease:

Table 1 shows the demographics of osteoarthritis patients. On average, OA patients were 54.88 years of age.

Table (1): Demographic data, of osteoarthritis patients (n. 58)

Items	No.	%
Age per years		
Mean ± SD	54.88±9.72	
range	35-80	
Sex		
Females	50	86.21
Males	8	13.79
Occupation		
White collar	15	25.86
Unemployed	43	74.14
Residence		
Urban	9	15.52
Rural	49	84.48
BMI		
Normal	1	1.72
Overweight	1	1.72
Obese	56	96.55

Table 2 displays that the most prevalent symptom of osteoarthritis was pain-induced mobility restriction (96.7%). For osteoarthritis, the average duration was four years.

Table (2): Clinical characteristics of osteoarthritis patients (n. 58)

Items		
Clinical assessment		
Duration per years	4.5 (1-20)	
WOMAC score	70.96±15.88	
VAS score	8.52±1.6	
Muscle wasting		
Redness	25 (43.10%)	
Hotness	7 (12.07%)	
Tenderness	36 (62.07%)	
Synovial thickness	50 (86.21%)	
Limitation movement	39 (67.24%)	
Swelling	56 (96.55%)	
Deformity	30 (51.72%)	
Bone prominence	12 (20.69%)	
Duration M.S	15 (0-30)	
Duration inactivity stiffness	5 (0-15)	
Laboratory finding		
Hb	10.88±0.94	
ESR	29.22±9.02	
CRP	9(5-20)	
Family History	51	87.93%
X ray grade		
0	2	3.45%
1	2	3.45%
2	15	25.86%
3	18	31.03%
¼	21	36.21%
Treatment		
Trauma	13	22.41%
Operation knee	8	13.79%
Physical setting	35	60.34%
NASID	48	82.76%
Chondroprotective	39	67.24%
Topical	54	93.10%
Injection	14	24.14%
Corticosteroids	14	24.14%
Hyaluronic	0	0.0%
PRP	4	6.90%

Quantitative data are expressed as mean ± SD (Standard deviation), and range. Qualitative data are expressed as frequency and percentage.

Factors influencing VAS and WOMAC score in patients with knee OA

Table (3) demonstrates factors influencing WOMAC score of patients with knee osteoarthritis and shows significant correlation between WOMAC score and X- ray grade and knee deformity.

Table (3): Factors influencing WOMAC score of patients with knee OA (n.58)

Factors influencing WOMAC score	t	P
Demographic data		
Sex	1.56	0.14
Occupation	1.76	0.09
Residence	1.43	0.157
BMI	2.6	0.085
Clinical assessment		
Muscle wasting	1.05	0.29
Synovial thickness	0.13	0.89
Limitation of movement	0.093	0.93
Swelling	1.96	0.052
Deformity	5.3	**0.0001**
Past History		
Trauma	0.26	0.79
Operation knee	1.75	0.086
Family history	0.31	0.76
X-ray grade	F=22.1	**0.0001**

(t): t test, F= ANOVA test, **: Significant p < 0.01.

Table (4) demonstrates factors influencing VAS score of patients with knee osteoarthritis patients.

Table (4): Factors influencing VAS score of patients with knee osteoarthritis patients (n.58)

Items	t	p
Demographic data		
Sex	1.62	0.11
Occupation	0.3	0.74
Residence	0.36	0.72
BMI	0.568	0.57
Family history	0.043	0.96
Clinical assessment		
Muscle wasting	0.59	0.56
Synovial thickness	0.7	0.49
Limitation movement	1.19	0.23
Deformity	1.94	0.057
Trauma	0.083	0.93
Kellgren Lawrence		
Bone prominence	1.03	0.315
Grade 4	6.1	F=0.22

(t): t test, F= ANOVA test

Table (5) demonstrates correlation matrix of WOMAC score and VAS score. The table shows positive significant correlation between WOMAC score, X-ray score, BMI, ESR and morning stiffness.

Table (5): Correlation matrix of WOMAC score and VAS score (n.58)

	WOMAC score		VAS score	
	r	p	r	p
WOMAC score	1	.		
VAS score	0.244	0.065	1	.
Kellgren Lawrence Grade.	**0.463****	**0.0001**	0.231	0.08
Age	0.183	0.168	-0.223	0.093
Duration of disease per years	-0.016	0.908	-0.057	0.672
Duration of morning stiffness	**0.374****	**0.004**	0.124	0.356
Duration of inactivity	0.209	0.115	0.233	0.078
BMI	**0.369****	**0.004**	0.158	0.238
Hb	0.017	0.9	-0.013	0.924
ESR	**0.268***	**0.042**	0.07	0.604
CRP	0.086	0.522	0.247	0.061

(r) Correlation coefficient *significant p < 0.05. **significant p < 0.01.

The current table shows positive significant correlation between WOMAC score and X-ray grade, BMI, ESR and morning stiffness.

DISCUSSION

OA of the knee is a major cause of morbidity, disability, and function loss. It can also lead to a significantly reduced quality of life if the illness is left untreated [17]. Osteoarthritis is a common cause of joint replacement surgery in the hips and knees. Additionally, the most commonly affected body parts are the knees, hands, feet, hips, and spine [18]**.** Articular cartilage is damaged at the molecular level and then proceeds to the joint's higher structural architecture [19]**.** Inflammatory cytokines may be generated by immune cells and synovial fibroblasts found in the synovium [20]**.**

This research aimed to evaluate factors influencing functional abnormalities and pain in patients who had osteoarthritis affecting knee. This study included 58 patients suffering from knee OA. In the current study the mean age was (54.88 ± 9.72), including 8 males and 50 females. About 96.55% suffered from limitation of movement, 51.72% suffered from knee effusion, the mean±standard deviation of WOMAC score was (70.96 ± 15.88) and of VAS score was (8.52 ± 1.6). Patients showed variable radiographic severity where 36.21% of patients were grade (4), 31.03% were grade (3), 25.86% were grade (2), and 3.45% were grade (1).

The WOMAC questionnaire was created with patients with lower limb OA in mind. This solely reflects those who have self-reported their disability, not people who have actual disabilities [18]. In our study there were significant correlations between WOMAC score with knee deformities, X-ray grading, BMI and ESR.

Another important factor in osteoarthritis patients' functional impairment was obesity [21]**.** It is most likely due to the fact that a person's ability to do physical tasks, particularly those involving the lower extremities, is compromised due to obesity. Obesity has been linked to voluntary quadriceps muscle weakening even in those without osteoarthritis (OA) of the knees [22]. The combination of weight loss and moderate exercise has been demonstrated to improve knee OA patients' ability to do daily tasks [23]. Obesity has an impact on WOMAC, hence this study found a strong relationship between obesity and OA. According to **Krupp *et al.*** [24] there was no correlation between BMI and pain scale scores**.** Patients with higher BMIs experienced much more knee pain, as **Lichtenberg *et al.*** [25] observed. Clinicians who are recommending weight loss as a treatment option for obese patients with OA-related knee pain should do so.

In patients with knee OA, individual radiographic features (osteophyte, narrowing) were found to have unadjusted correlations of 0.23–0.26 with self-reported disability by **van Baar *et al.*** [26]**.**

We were unable to find a substantial link between osteophyte or narrowing and impairment, on the other hand. Our patients exhibited different degrees of radiological illness and discomfort, with no discernible differences. In patients with early disease, it's possible that function has a bigger influence on radiographic change. **Creamer *et al.*** [27] wrote that joint space narrowing and disability, for example, were substantially stronger in patients with less than 5 years of symptoms (r = 0.64; P = 0.017) than in those with 5 or more years of symptoms (r = 0.10; P = 0.54). As the disease progresses, other criteria may become more relevant in determining disability. However, other authors [28] showed that a disparity has been seen between the change in radiography and symptom data over time in studies.

The present study showed that presence of knee deformity increased functional impairment and WOMAC score. In a study comparing varus and valgus alignment with normal alignment, **Teichtahl *et al.*** [29] found that varus alignment was more closely associated with progression than valgus alignment. Medial cartilage volume loss was reduced by 0.44 percent for every 1 degree of genu valgum deformity, whereas deformity toward varus alignment reduced the volume by 0.45 percent every year.

In the current study there was significant correlation between ESR and WOMAC but ESR was not elevated to high level. In agreement with our study**, Hanada *et al.*** [30] found that there was an association between elevated levels of ESR and high-sensitivity C-reactive protein (hsCRP) and the swelling and soreness associated with osteoarthritis (OA) of the knee compared to healthy controls. As hsCRP levels rise earlier in knee OA than ESR, it may be a more relevant biomarker of OA development.

In contrast to our study, clinical and radiographic severity of knee osteoarthritis were not associated with elevated CRP or ESR, according to a study by **Keenan *et al.*** [31]. Knee osteoarthritis symptoms including pain, deformity, and instability can all be explained by sources other than chronic inflammation. **Kerkhof *et al.*** [32] observed no significant link between serum CRP levels and knee OA, which is in keeping with our findings.

Despite received traditional OA medication and intervention WOMAC and pain scores increased. Recently guidelines recommend against vitamin D, bisphosphonate, glucosamine, chondroitin sulphate, intra articular hyaluronic acid and botulinum toxin injection and PRP [33].

This study had certain limitations. To conduct a prospective longitudinal study, more research is needed with a larger sample size and an even broader spectrum of participants. As a hospital-based patient population, our study sample may not be representative of all knee OA sufferers; our findings may not be applicable to the general public.

CONCLUSION

Finally we conclude that BMI, knee deformities and radiological grade are main risk factors for higher pain scores and functional impairments. Early correction of

deformity is necessary, weight reduction program is mandatory and follow up of radiographic progression should be done. New medications are needed to delay disease progression.

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