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Original Research Article

Depression as a determinant of pain severity and functional limitation in patients with knee osteoarthritis: a cross-sectional study

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ABSTRACT

Background: Knee osteoarthritis (OA) is a leading cause of chronic pain and disability worldwide. Psychosocial factors especially depression-could greatly affect pain perception and functional outcomes in people who are affected. Objectives were to assess the prevalence of depressive symptoms and their relationship with pain severity and functional limitation in knee OA patients.

Methods: This is a hospital-based cross-sectional study that included 110 adult patients with primary knee OA diagnosed according to American College of Rheumatology Criteria. Depressive symptoms were assessed by the patient health questionnaire-9 (PHQ-9). A cut-off score of ≥10 was considered clinically significant depression. Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) assessed pain intensity and physical function. Continuous variables were summarized as mean±SD. Group comparisons were performed with independent t tests and correlations assessed using Spearman's coefficient.

Results: The prevalence of clinically significant depressive symptoms was 20.9%. Patients with depression had mean WOMAC pain (19.2±8.1 vs 17.1±7.4; p=0·001) and function (67.5±22·5 vs 62.1±21·4; p<0·001) scores significantly higher than non-depressed patients. There was a positive correlation between PHQ-9 scores and WOMAC pain (r=0.33, p=0·002). PHQ-9 scores correlated positively also to function (r=0.41, p<0 ·001). A stepwise increase in pain and disability was observed according to the severity of depression.

Conclusions: Depressive symptoms are common for knee OA patients and significantly associated with high pain intensity level and functional limitation. Routine psychological screening can be performed using validated tools such as the PHQ-9, which may improve comprehensive management of OA.

Keywords: Knee osteoarthritis, Depression, PHQ-9, WOMAC, Pain, Functional limitation

INTRODUCTION

Knee osteoarthritis (OA) is one of most common chronic musculoskeletal disorder and the first cause of disability worldwide. OA is one of the leading causes of years lived with disability globally and its burden continues to rise due to demographic aging and increasing prevalence of obesity.[1] Epidemiological evidence indicates that the lifetime risk of developing symptomatic knee OA is nearly 45%, with even higher estimates in overweight populations.[2] Aside from structural joint decay, knee OA significantly decreases mobility, autonomy and the overall quality of life. The main symptom leading to health-care use in OA is pain. However, it is well known that the magnitude of pain correlates only modestly with radiographic findings and thus structural damage cannot completely account for symptom severity.[3,4] This gap has led to a focus on non-structural factors, particularly psychological and neurobiological mechanisms as mediators of pain perception. There is growing evidence for the hypothesis that OA pain is a function of both peripheral nociceptive input as well as central sensitization and affective factors.[5] Depression is one of the most commonly reported psychological comorbidities in chronic musculoskeletal pain patients. The association of depression and pain is complex, mutually reinforcing, and bidirectional. Chronic pain can decrease physical activity, disturb sleep and interfere with social activities, in turn making individuals more vulnerable to depression. At the other hand, pain perception can be increased by depression due to changes in the process of central system neurotransmitter (especially serotonin and norepinephrine pathways), and maladaptive cognitive processes such as catastrophizing.[6,7] Neuro in flammatory pathways have also been suggested as common biological pathways underlying depression and chronic pain states.[8] In patients with knee OA, various international studies have shown that the coexistence of depression is linked to higher pain intensity and worse physical function as well as health-related quality of life (HRQoL).[9,10] Population-based studies likewise have found that depressive symptoms are independently associated with greater functional limitation even after controlling for demographic and clinical characteristics. In addition, depression has also been associated with greater healthcare utilization, less than optimal response to conservative management and poor outcomes after joint arthroplasty.[11] These results indicate that depression may not work just as a comorbid but determine mood severity. Although the link is increasingly recognized, depression continue to be under-detected in clinical practice of OA especially in LMIC. In South Asia where knee OA is highly prevalent, clinical practice may concentrate on pharmacological pain management and structural evaluation rather than psychological screening. There are cultural taboos and resource limitations which add to underreporting. Therefore, the potential role of depressive symptoms on which to affect their level of pain perception and functional limitation in this population is not well defined. As many other developing countries it has been undergoing rapid demographic transition, characterized by increasing life expectancy and a growing burden of non-communicable diseases (NCDs) in the country. Epidemiological studies of a smaller scale also demonstrated that OA is a major cause of disability with both urban and rural population.[12] Yet, relatively few studies in this field have systematically assessed the psychological dimensions of OA-related disability with professionally-developed screening instruments. Given the heterogeneous nature of OA, knowledge about the extent to which depression accounts for pain severity and functional limitation is relevant from a clinical perspective. Recognition of such modifiable psychological factors may be useful in developing integrated patient care and improving patient-based outcomes. This study therefore was designed to evaluate the frequency of depressive symptoms in patients with knee OA and to determine its association with pain intensity and physical function, based on validated instruments. We expected that patients with depression would have more pain and functional limitation than those without depression.

METHODS

This distemper-patients' group- based cross-sectional analytical study was carried out in the Department of Medicine and Physical Medicine, CMCH, Chattogram Bangladesh over a period from January 2019 to June 2019. Patients: One hundred and ten adult patients with primary knee OA who visited our OPD were consecutively recruited. The aim of the study was to examine the relationship between depressive symptoms and pain severity and physical function in patients with knee OA.

Inclusion criteria

Patients with age ≥40 years, clinically diagnosed primary knee OA and willingness to participate and provide written informed consent were included in the study.

Exclusion criteria

Patients with secondary osteoarthritis, history of significant psychiatric disease other than depression, cognitive dysfunction and difficulty in filling out of the questionnaire and severe systemic illness were excluded from the study.

Data collection

Following informed consent, structured interviews and clinical assessment were administered. Age, sex, body mass index (BMI), disease duration and other comorbidities were recorded using a predefined data collection tool for each patient.

Assessment of depression

Depressive symptoms were measured using the PHQ-9, a 9-item screening instrument that has been validated and is

widely used in clinical and epidemiological studies. The PHQ-9 is a 9-item version of the full PHQ in which each item matches to one of the nine diagnostic criteria for major depressive disorder from the diagnostic and statistical manual of mental disorders. Each item is scored from 0 ("not at all") to 3 ("nearly every day") for a total score of 0 to 27. Clinically significant depressive symptoms were defined as a cut-off score ≥10. In order to minimize missing data and stimulate accuracy in answers, we performed face-to-face interviews when administering the questionnaire.

Pain and physical function measurement

Pain and functional disability were measured by Western Ontario McMaster OCC Index (WOMAC). Three domains of the WOMAC (pain, stiffness and physical function) were applied. The dimensions of pain and physical function were analyses in this study. A higher score indicates more pain intensity and worse functional impairment.

Statistical analysis

Data analysis was performed with the statistical package for social sciences (SPSS) 26.0. Data of the continuous variables were expressed as mean±SD while categorical data in number agreed of percentages. Differences between patients with and without depression were tested for continuous measures using independent sample t-tests and for categorial data according to chi-square tests. To examine association between scores on the PHQ-9 and WOMAC pain and function, we utilized Spearman correlation coefficients. P<0.05 was considered to be statistically significant.

Ethical considerations

The study protocol was reviewed and approved by the Institutional Ethical Review Committee of the respective hospital. Written informed consent was obtained from all participants prior to enrollment, and confidentiality of data was strictly maintained.

RESULTS

Table 1 compares the baseline demographic and clinical characteristics between non-depressed (n=87) and depressed (n=23) patients. The mean age was slightly higher in the depressed group (59.3±9.4 years) compared to the non-depressed group (56.1±8.7 years), but this difference was not statistically significant (p=0.082). Female participants were more common in both groups, with 69.0% in the non-depressed group and 78.3% in the depressed group; however, the gender distribution did not differ significantly (p=0.372). BMI was significantly higher among depressed patients (28.9±4.1 kg/m²) compared to non-depressed patients (27.2±3.6 kg/m²), and this difference was statistically significant (p=0.041). Disease duration was also significantly longer in the depressed group (7.6±3.8 years) compared to the non-depressed group (5.8±3.1 years), with a p-value of 0.018. Comorbid conditions such as hypertension and diabetes mellitus were more frequent in the depressed group (56.5% and 43.5%, respectively) compared to the non-depressed group (44.8% and 35.6%), but these differences were not statistically significant (p=0.327 and p=0.481, respectively).

Table 2 presents the comparison of clinical outcome measures between depressed and non-depressed patients using the WOMAC. The mean WOMAC pain score was significantly higher in the depressed group (19.2±8.1) compared to the non-depressed group (17.1±7.4), indicating greater pain severity among depressed patients (p=0.001). Similarly, the mean WOMAC Function score was significantly higher in depressed patients (67.5±22.5) than in non-depressed patients (62.1±21.4). This difference was highly statistically significant (p<0.001).

Table 3 correlation of WOMAC score with depression severity as measured by the PHQ-9. The correlation between PHQ-9 and WOMAC pain was weak to moderate (r=0.33), it was also statistically significant (p=0.002). This indicates that abnormal depression scores are linked with more severe pain. A moderate positive correlation had been noted between PHQ-9 and WOMAC function score (r=0.41) with very high statistical significance (p<0.001). This suggests that the worse level of functioning is a result of more severe depression.

Table 1: Baseline clinical characteristics according to depression status.

Variables	Non-depressed (n=87)	Depressed (n=23)	P value
Age (in years)	56.1±8.7	59.3±9.4	0.082
Female	60 (69.0%)	18 (78.3%)	0.372
BMI (kg/m²)	27.2±3.6	28.9±4.1	0.041
Disease duration (in years)	5.8±3.1	7.6±3.8	0.018
Hypertension	39 (44.8%)	13 (56.5%)	0.327
Diabetes mellitus	31 (35.6%)	10 (43.5%)	0.481

Table 2: Comparison of WOMAC pain and function scores.

Outcome measure	Non-depressed (n=87)	Depressed (n=23)	P value
WOMAC pain score, mean±SD	17.1±7.4	19.2±8.1	0.001
WOMAC function score, mean±SD	62.1±21.4	67.5±22.5	<0.001

Table 3: Correlation between PHQ-9 and WOMAC scores.

Variables	Correlation coefficient (r)	P value
PHQ-9 vs WOMAC pain	0.33	0.002
PHQ-9 vs WOMAC function	0.41	<0.001

Table 4: WOMAC scores according to depression severity.

Depression category	WOMAC pain (Mean±SD)	WOMAC function (Mean±SD)
No depression	16.8±7.2	60.9±20.8
Mild	17.9±7.5	63.4±21.6
Moderate	19.8±8.3	69.1±22.9
Moderately severe/severe	22.4±8.7	74.6±24.1

The progressive change in WOMAC scores throughout the different stages of depression severity is shown in Table 4. There were lower average scores for the WOMAC Pain (16.8±7.2) and WOMAC function (60.9±20.8) in non-depressed patients. With increasing severity of depression, the increase in pain scores and function gradually rose. Patients with mild depression had scores slightly higher-pain (17.9±7.5, function: 63.4±21.6). The patients who had moderate depression scores further increased it (Pain: 19.8±8.3; function: 69.1±22.9). The best scores were noticed in moderately severe/severe depression group of patients (Pain: 22.4±8.7; function: 74.6±24.1).

DISCUSSION

The current research examined the link between depressive symptoms and clinical outcome in knee OA patients. The prevalence of depressive (PHQ-9≥10) symptoms was 20.9% (23/110). This prevalence is similar to that reported internationally amongst OA patients, which varied from 15% to 30% depending on population and tools used.[2,10] The results support the increasing awareness of depression as a common and clinically relevant comorbidity in osteoarthritis. Baseline comparisons showed that patients in the depressed group had a significantly higher mean BMI (28.9±4.1 kg/m²) compared with those in the non-depressed group (27.2±3.6 kg/m²; p=0.041). The mean disease duration was also longer in depressed ones (7.6±3.8 years versus 5.8±3.1 years; p=0.018). Approximately, age and female predominance were also present in the depressed patients (78.3 vs 69.0%), which was not significant as well. Previous observational studies demonstrated that obesity was independently associated with OA progression and depressive symptoms which might be mediated by inflammatory cytokines and weakened capacity for movement.[4,13] Higher disease duration may be the result of accumulated pain and chronic disability, both acknowledged as contributors to psychological distress.[14] One key finding of the present article is the combined WOMAC pain score being significantly higher in depressed patients (19.2±8.1) than in non-depressed subjects (17.1±7.4). Here we find some indication that depression may serve to enhance the subjective severity of pain. Structural joint damage cannot directly account for the varied degree of pain severity in OA and is only poorly associated with symptoms on radiographs.[3] There are neurobiological mechanisms that may explain this: altered serotonergic and noradrenergic pathways lead to a decrease in descending pain inhibition and an increase in central sensitization among depressed patients. Cognitive variables, as catastrophizing and negative appraisal, worsen pain perception. Comparable findings were also found in the study by Kim et al who confirmed that comorbid depression significantly escalated pain intensity for patients with knee OA.[9] Similar patterns were observed with respect to functional disability. Average WOMAC function score was significantly higher, 67.5±22.5 compared to 62.1±21.4, and there was a strong correlation between the two (p<0.001). This is consistent with earlier longitudinal research suggesting that depressive symptoms are an independent predictor of poor physical function in osteoarthritis.[15,16] Depression may decrease amount of physical activity, adherence to physiotherapy and muscle weakness leading to greater disability.[17] These relationships are also confirmed by the correlation analysis. The PHQ-9 scores correlated moderately with WOMAC pain (r=0.33, p=0.002) and even stronger with WOMAC function (r=0.41, p<0.001).

Findings

The results of this study suggest that the more severe depression is, the higher intensity of pain and functional disability are. Similar associations have also been observed in community and hospital-based OA samples highlighting the robustness of this finding.[5] The patients without depression exhibited the lowest mean of pain (16.8±7.2) and function (60.9±20.8) scores, while. Gradual increments across mild depression (Pain: 17.9±7.5; Function, 63.4±21.6), moderate depression (Pain, 19.8±8.3; function, 69.1±22.9) and moderately severe/severe depression (Pain: 22.4±8.7; function:74.6±24.1) were noted for both pain and function score). This dose-response relationship serves as a strong counter-argument to the view that depression is simply an association, rather it suggests that depression functions as one of many determinants of severity. Similar graded relationships have been reported previously in population-based studies from Europe and Asia, with higher depressive symptom scores correlating with more severe patient-reported outcomes.[18] In addition to symptom burden, comorbid depression may impact treatment response and healthcare use. Patients with both OA and depression are more likely to express dissatisfaction with treatment, increased use of analgesics, and a worse postoperative recovery after TKA.[19] They suggest the

clinical utility of occult depressive symptoms. From a global standpoint, the context of osteoarthritis is biopsychosocial. Pain is influenced by intrinsic joint pathology, systemic components such as obesity and psychological factors. These finding emphasize the importance of incorporating mental health screening in routine OA care. Simple tools like the PHQ-9 can be introduced into outpatient care, including in low- and middle-income countries where assessment of psychological functioning is often ignored. Several limitations warrant consideration. The cross-sectional nature of the study does not allow causal inference, as depression and pain could have a reciprocal relationship. Self-reported outcomes may suffer from reporting bias. However, the similar findings in statistically associated measures across the analyses of frequency, mean±SD comparisons and correlation testing strengthen the internal validity of our results.

CONCLUSION

The present study shows that depression, when present is highly associated with severity of pain and functional limitation in patients with knee OA. Participants with depressive symptoms had greater WOMAC pain and physical function scores, and a dose-response relationship between depression severity and clinical features was identified. Such results underscore the multi-faceted nature of OA, whereby psychological processes account for much of the symptom experience over and above structural joint disease. Regular screening for depression among patients with knee OA could facilitate the early detection of those at risk for less favorable outcomes. Optimizing psychological assessment and management should be standard practice in the treatment and management of osteoarthritis to mitigate pain amplification, enhance physical function, and improve quality of life. A holistic biopsychosocial perspective seem crucial in order to accommodate patient-centred care in this population.

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