# Comparison of Clinical Signs Associated with Lumbar Spine in Patients with Simultaneous Knee Osteoarthritis and Lumbar Spine Osteoarthritis before and after Knee Arthroplasty

Mohammadkazem Emamimeybodi[1], Alireza Rahimnia[2], Hamid Hesarikia[3], Sajjad Mohammadnabi[3], Mohammad Mahdi Shater[4,*]

[1] Associate Professor, Trauma Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran
[2] Professor, Trauma Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran
[3] Assistant Professor, Trauma Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran
[4] Resident, Department of Orthopedic Surgery, School of Medicine, Baqiyatallah University of Medical Sciences, Tehran, Iran

*Corresponding author: Mohammad Mahdi Shater; Department of Orthopedic Surgery, School of Medicine, Baqiyatallah University of Medical Sciences, Tehran, Iran. Tel: +98-21-26214542, Email: mohammad.shater@gmail.com

## Abstract

**Background:** Knee osteoarthritis (OA) and low back pain (LBP) are common and co-occur in the elderly. The LBP in patients who are candidates for knee arthroplasty affects the outcome and prognosis after surgery. In this study, we investigated the LBP in patients with simultaneous knee and lumbar spine OA after total knee arthroplasty.

**Methods:** In this cross-sectional study, 41 candidates for knee arthroplasty suffering from LBP were included. Demographic and visual analogue scale (VAS) questionnaires for LBP and the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) questionnaire for knee pain and function were completed by patients before surgery. Patients were graded according to VAS index. They were followed up for at least six months to two years.

**Results:** The mean age of 41 patients was 64.30 ± 6.46 years. The mean of the preoperative VAS index was 5.15 ± 2.75, while postoperative VAS decreased to 4.34 ± 3.53 (P = 0.024). Of the total number of patients in preoperative evaluation, 24.4% were in low grades based on the VAS index, followed by moderate (41.5%) and severe (34.1%) grades. The greatest improvement in the VAS index was related to those in mild and moderate grades before surgery. The mean preoperative WOMAC index was 55.1 ± 23.7, while it was postoperatively reduced to 42.9 ± 30.6 (P < 0.001). Postoperative WOMAC was found to be correlated with postoperative VAS (P = 0.004).

**Conclusion:** In patients with mild to moderate LBP and knee OA, their back pain would improve if they had knee arthroplasty. However, in patients with severe LBP and knee OA, the spine should be examined further.

*Keywords:* Knee Osteoarthritis; Back Pain; Knee Arthroplasty

## Background

The knee is the largest and most complex joint in the body. It is a modified hinge joint with three compartments, including the medial and lateral compartments (internal and external), the tibiofemoral joint, and the patellofemoral compartment. The knee joint is capable of allowing flexion, extension, and medial and lateral rotation (1). Osteoarthritis (OA) is the most common disease in the elderly. This disease is usually associated with other diseases (2). Knee OA and low back pain (LBP) are common in people over the age of 65, both of which affect the patient's gait and quality of daily activity and reduce the performance of this group of people (3).

Total knee arthroplasty is one of the most common lower extremity surgeries performed (4), especially on people over the age of 40 with knee OA (5). The number of knee arthroplasty surgeries is increasing due to regenerative measures for improving the performance of patients with progressive joint disorders (6, 7); nearly 5% of the general population have a history of knee arthroplasty (8). Diseases associated with knee OA in patients undergoing knee arthroplasty should be considered because of its direct effect on prognosis and patient satisfaction after surgery (9). Identifying the true cause of the pain may be difficult at diagnosis, and sometimes the cause of persistent pain after knee arthroplasty may be other conditions associated with OA (10). Patients with severe preoperative pain, severe deformity, severe functional limitations, or other underlying comorbidities usually have a poorer prognosis and more adverse treatment outcomes (11). As a result, the clinical signs of spinal OA affect the outcome and prognosis after surgery in patients who are candidates for knee arthroplasty due to knee OA (12). Overall, taking preventive measures and improving treatment outcomes will be of particular importance to improve the final treatment prognosis, resulting in patient satisfaction (13). Simultaneous spine and knee OA are common complaints, especially in older patients. In advanced cases where surgery is needed to treat the disease, knee arthroplasty often takes precedence over spinal surgery. Due to the lack of studies in this field, this study aims to investigate whether knee arthroplasty is effective in exacerbating or alleviating the signs and symptoms of the spinal disease, such as back pain as well as changing the treatment plan for OA of the spine. Therefore, the clinical signs and symptoms of the lumbar spine in patients with knee OA were investigated, and lumbar spine OA was evaluated simultaneously after knee arthroplasty.

## Methods

*Patient Collection:* This cross-sectional study was performed on patients admitted to the orthopedic ward of Baqiyatallah Hospital, Tehran, Iran, for knee arthroplasty in 2018-2020 and has been firstly approved by the Ethic Committee of Baqiyatallah University of Medical Sciences, Tehran (code: IR.BMSU.REC.1399.484).

Study inclusion criteria included: 1) severe OA of the knee, 2) being a candidate for knee arthroplasty, and 3) having back pain. Exclusion criteria were as follows: 1) patients who were unable to complete postoperative care or visits, 2) patients who had another orthopedic disease in the spine or lower limbs during the study, and 3) patients for whom we were not able to record data for any reason.

*Data Collection Tools:* The data collection tool was a three-part checklist. The first part was general characteristics of the patients, including demographic information (i.e., age, gender, time of surgery, height, weight, and contact number completed by the patient or the patient's companion). The second part included the visual analogue scale (VAS) scoring table completed by the patient. The third part included the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scoring table completed by the patient. Forty-three patients were admitted for knee arthroplasty and had LBP at enrollment.

*Procedure:* This cross-sectional study was performed on 43 patients referred to our orthopedic clinic. Based on radiographic and clinical diagnostic criteria, patients with severe OA of the knee (candidate for knee arthroplasty), LBP, as well as clinical and radiological symptoms were included in the study.

Demographic information was collected by the data collection form. Moreover, demographic information questionnaire, VAS, and WOMAC were completed by patients before surgery. Patients were followed up for six months to two years. Three patients were excluded from the study due to lacking inclusion criteria. Finally, 41 patients underwent surgery. The patients were treated in the operating room of our clinic by orthopedic surgeons under the same preoperative protocol. Surgery was started for all patients with anterior and midline approach, and the posterior cruciate ligament (PCL) was then removed in all patients. The posterior-stabilized prosthesis was then implanted, and the patella was incised. After discharge, they were revisited at two weeks, six weeks, three months, and six months. Patients were followed up for at least six months to two years. Finally, VAS and WOMAC questionnaires were filled out for patients. In this study, participation was voluntary, and patients' names were not recorded anywhere.

*Statistical Analysis:* Data analysis was performed using SPSS statistical software (version 26, IBM Corporation, Armonk, NY, USA). For quantitative variables, mean and standard deviation (SD) were considered, and qualitative variables were presented with frequency and percentage. In the data analysis section, first, the normality of the quantitative variables was checked by the Kolmogorov-Smirnov test. Wilcoxon, Pearson, Spearman, chi-square, and Kruskal-Wallis tests were used to examine the relationship between the variables. A P-value of less than 0.05 was considered to be statistically significant.

## Results

A total of 44 people were included in the study, of which three were excluded from the study according to

the exclusion criteria. Of the remaining 41 (87.8%), 36 were women, and 12.3% were men. The mean age of the participants was 64.30 ± 6.46 years. The minimum age was 53 years, and the maximum was 80 years. The average body mass index (BMI) was 30.1 ± 5.1; the lowest was 23.14, and the highest was 45.33. Of these patients, 21 (51.2%) underwent right knee surgery, and 20 (48.8%) patients underwent left knee surgery. The mean VAS index before surgery was 5.15 ± 2.75, while this index decreased to 4.34 ± 3.53 after surgery. This decrease was found to be statistically significant (P = 0.024). Of the total number of patients in preoperative examinations, 10 (24.4%) were in the low-grade category based on the VAS index, followed by 17 patients (41.5%) in the moderate-grade category and 14 patients (34.1%) in the severe category.

In postoperative evaluation, 20 patients (48.8%) were in the low-grade category based on the VAS index, followed by eight patients (19.5%) in the moderate-grade category and 13 (31.7%) in the severe-grade category. In other words, the greatest improvement in the VAS index was related to those in the moderate group before the operation.

Postoperative VAS grade was significantly reduced compared to preoperative VAS (P < 0.001) (Table 1).

**Table 1.** Frequency of patients based on visual analogue scale (VAS) before and after surgery

| Indicator | Postoperative VAS severity | | | |
|---|---|---|---|---|
| | Low | Moderate | High | Total |
| **Preoperative VAS severity** | | | | |
| Low | 10 | 0 | 0 | 10 |
| Moderate | 8 | 5 | 4 | 17 |
| High | 2 | 3 | 9 | 14 |
| Total | 20 | 8 | 13 | 41 |

VAS: Visual analogue scale

The mean preoperative WOMAC index was 55.1 ± 23.7, while this value dropped to 42.9 ± 30.6 postoperatively. This decrease was statistically significant (P < 0.001). Based on the tests performed, WOMAC and VAS indexes before and after surgery had no significant relationship with age and gender (P > 0.05). In addition, WOMAC and VAS indexes had no significant correlation with BMI before and after surgery (P > 0.05). Furthermore, they had no significant correlation with the surgical side before and after surgery (P > 0.05).

Correlation of demographic variables with back and knee pain is summarized in table 2.

**Table 2.** Correlation of demographic variables with back and knee pain based on P-value

| Indicator | VAS before surgery | VAS after surgery | WOMAC before surgery | WOMAC after surgery |
|---|---|---|---|---|
| Age | 0.266 | 0.254 | 0.691 | 0.494 |
| Gender | 0.768 | 0.510 | 0.613 | 0.121 |
| BMI | 0.909 | 0.642 | 0.914 | 0.559 |
| Surgical side | 0.317 | 0.675 | 0.855 | 0.990 |

VAS: Visual analogue scale; WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index; BMI: Body mass index

Our results showed that postoperative WOMAC had a significant relationship with postoperative VAS (P = 0.004). It was found that changes in WOMAC index before and after surgery (mean: 12.2, minimum: -15, maximum: 50) had a direct and significant relationship with changes in the VAS index before and after surgery (mean: 0.8, minimum: -3, maximum: 6) (P < 0.001).

## Discussion

In this study, the amount of lumbar pain was assessed by scoring the VAS system. Knee pain and function were assessed with the WOMAC system. The relationship

between VAS and WOMAC index as well as their relationship with age, gender, arthroplasty side, and BMI indices were examined. In this study, 41 patients underwent arthroplasty surgery. The majority of patients included in the study (87.7%) were women, which was similar to the study by Collados-Maestre et al. (3). Unlike the study of Chang et al., in which the postoperative VAS index was not measured (12), the VAS index was measured before and after surgery in the present study, and its relationship with other indices was investigated. In this study, the mean of the postoperative VAS index was significantly reduced compared to the preoperative VAS index. In other words, patients' LBP was significantly reduced, which was not consistent with the study of Collados-Maestre et al. (3).

In the study of the VAS index, most patients (41.5%) were in the moderate category before surgery, which was reduced to 19.5% after surgery. In other words, it can be concluded that knee arthroplasty had the greatest effect on the moderate and mild groups for reducing LBP, while it had no significant effect on the severe group. This result was consistent with the study of Chang et al. (12) and Collados-Maestre et al. (3). In the current study, the postoperative VAS index of knee arthroplasty was associated with a higher WOMAC index. In other words, more postoperative knee pain and function were directly related to more postoperative LBP. This result was consistent with the findings of several studies (2, 3, 12). Moreover, the changes in the VAS index were significantly related to changes in the WOMAC index. As a result, better improvement of pain and postoperative knee function led to better improvement of LBP.

The rate of VAS changes was not significantly related to age, gender, arthroplasty position, and BMI, which was consistent with the results of the study by Boyle et al. (2) and Collados-Maestre et al. (3). In contrast, the results of a study by Schroer et al. showed conflicting results (14).

The mean WOMAC index of the knee joint improved significantly after surgery, which was consistent with previous studies (2, 3, 12, 14).

One of the limitations of this study is its low generalizability due to the small number of patients participating in this study, which is hoped to be addressed in future studies. Besides, more detailed examinations for the spine were not performed in this study. Therefore, examination with complementary imaging such as magnetic resonance imaging (MRI) and the use of more accurate scoring tables for pain measurement and spinal function can be the basis for further studies.

*Conclusion*

Our findings showed that back pain could be improved in patients with mild to moderate LBP and OA of the knee if they first underwent knee arthroplasty. However, patients with severe LBP are less likely to improve after arthroplasty; therefore, more attention should be paid to LBP in these patients. In addition, in patients with severe LBP and OA of the knee, more attention should be paid to the spine, where the spine should be further examined, or at least patients should be aware of the potential consequences.

A lumbar computed tomography (CT) scan or MRI may provide better information about the condition of the lumbar spine, but the cost and practical value for screening purposes in patients undergoing arthroplasty are questionable.

## References

1. Singh JA. Epidemiology of knee and hip arthroplasty: A systematic review. *Open Orthop J*. 2011;5:80-5. doi: 10.2174/1874325001105010080. [PubMed: 21584277]. [PubMed Central: PMC3092498].
2. Boyle JK, Anthony IC, Jones BG, Wheelwright EF, Blyth MJ. Influence of low back pain on total knee arthroplasty outcome. *Knee*. 2014;21(2):410-4. doi: 10.1016/j.knee.2013.12.003. [PubMed: 24457058].
3. Collados-Maestre I, Lizaur-Utrilla A, Martinez-Mendez D, Marco-Gomez L, Lopez-Prats FA. Concomitant low back pain impairs outcomes after primary total knee arthroplasty in patients over 65 years: A prospective, matched cohort study. *Arch Orthop Trauma Surg*. 2016;136(12):1767-71. doi: 10.1007/s00402-016-2576-8. [PubMed: 27699468].
4. Weber M, Vollner F, Benditz A, Schwarz T, Worner M, Craiovan B, et al. Total knee arthroplasty in the elderly. *Orthopade*. 2017;46(1):34-9. [In German]. doi: 10.1007/s00132-016-3363-5. [PubMed: 27921128].
5. Ravi B, Croxford R, Reichmann WM, Losina E, Katz JN, Hawker GA. The changing demographics of total joint arthroplasty recipients in the United States and Ontario from 2001 to 2007. *Best Pract Res Clin Rheumatol*. 2012;26(5):637-47. doi: 10.1016/j.berh.2012.07.014. [PubMed: 23218428].
6. Kim HA, Kim S, Seo YI, Choi HJ, Seong SC, Song YW, et al. The epidemiology of total knee replacement in South Korea: National registry data. *Rheumatology (Oxford)*. 2008;47(1):88-91. doi: 10.1093/rheumatology/kem308. [PubMed: 18077497].
7. Mahomed NN, Barrett J, Katz JN, Baron JA, Wright J, Losina E. Epidemiology of total knee replacement in the United States Medicare population. *J Bone Joint Surg Am*. 2005;87(6):1222-8. doi: 10.2106/JBJS.D.02546. [PubMed: 15930530].
8. Weinstein AM, Rome BN, Reichmann WM, Collins JE, Burbine SA, Thornhill TS, et al. Estimating the burden of total knee replacement in the United States. *J Bone Joint Surg Am*. 2013;95(5):385-92. doi: 10.2106/JBJS.L.00206. [PubMed: 23344005]. [PubMed Central: PMC3748969].
9. Hilton ME, Gioe T, Noorbaloochi S, Singh JA. Increasing comorbidity is associated with worsening physical function and pain after primary total knee arthroplasty. *BMC Musculoskelet Disord*. 2016;17(1):421. doi: 10.1186/s12891-016-1261-y. [PubMed: 27717340]. [PubMed Central: PMC5055707].
10. Duygun F, Aldemir C. The frequency of spinal stenosis in patients who underwent total knee arthroplasty. *Med Sci*. 2017;6(4):721-3. doi: 10.5455/medscience.2017.06.8677.
11. Lingard EA, Katz JN, Wright EA, Sledge CB. Predicting the outcome of total knee arthroplasty. *J Bone Joint Surg Am*. 2004;86(10):2179-86. doi: 10.2106/00004623-200410000-00008. [PubMed: 15466726].
12. Chang CB, Park KW, Kang YG, Kim TK. Coexisting lumbar spondylosis in patients undergoing TKA: How common and how serious? *Clin Orthop Relat Res*. 2014;472(2):710-7. doi: 10.1007/s11999-013-3298-7. [PubMed: 24065173]. [PubMed Central: PMC3890207].
13. Healy WL, Della Valle CJ, Iorio R, Berend KR, Cushner FD, Dalury DF, et al. Complications of total knee arthroplasty: Standardized list and definitions of the Knee Society. *Clin Orthop Relat Res*. 2013;471(1):215-20. doi: 10.1007/s11999-012-2489-y. [PubMed: 22810157]. [PubMed Central: PMC3528930].
14. Schroer WC, Diesfeld PJ, LeMarr AR, Morton DJ, Reedy ME. Functional outcomes after total knee arthroplasty correlate with spine disability. *J Arthroplasty*. 2016;31(9 Suppl):106-9. doi: 10.1016/j.arth.2016.06.015. [PubMed: 27452138].