

Association between knee pain and low back pain

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Abstract

Objective: To evaluate the association between knee pain and lumbar disorders.

Methods: The case-control study was conducted at Physical Medicine and Rehabilitation Department, Tabriz University of Medical Sciences, Iran, from December 2009 to March 2011, and comprised patients with primary complaint of knee pain. A separate group worked as controls. The coincidence of knee pain and lumbar disorders were assessed and compared between the two groups SPSS 15 was used for statistical analysis.

Results: Of the 170 patients, 90(53%) were in the case group having 20(22.2%) males and 70(77.7%) females, and 80(47%) in the control group having 18(22.5%) males and 62(77.5%) females. The overall mean age was 46.9 ± 8.9 (range: 25-61 years). Age and gender difference between two groups was not significant ($p > 0.05$ each). Lifetime prevalence of radicular, chronic and recurrent low back pain and its point prevalence in the case group were significantly higher than the control group ($p < 0.05$ each). Range of movement of the lower limb and lumbar region in the case group was less than the controls ($p < 0.05$). Local subcutaneous tissue oedema of the lumbar region was more prevalent in the case group ($p < 0.05$). There was no significant difference in vertebral column posture between the two groups ($p > 0.05$).

Conclusion: The relationship between lumbar and knee pain disorders should be considered in the assessment and management of patients with knee pain.

Keywords: Knee pain, Low back pain, Lordosis. (JPMA 65: 626; 2015)

Introduction

Knee pain and low back pain (LBP) are serious general health challenges and important causes of physical impairment and disability among the elderly populations.¹ Although the prevalence of knee pain and LBP is quite high,^{1,2} little information is available on their association together.

Osteoarthritis (OA), typically affecting weight-bearing joints, is a common source of joint pain, including knee pain, impacting many people over 45 years of age.^{3,4} Because most of the tissues around the knee are involved, it can be considered as an organ (joint) disease, capable of resulting in joint failure. However, it is claimed that the main insult occurs in the joint cartilage and/or subchondral bone.⁵ OA is typically the result of articular cartilage damage and wear and tear from repetitive microtrauma that occurs throughout the life, although genetic, hereditary, nutritional, metabolic, pre-existing articular disease, and body habitus factors may contribute in some cases.⁶ If untreated, OA could result in pain, physical impairment and/or disability and loss of quality

of life.⁵ Local impairments of knee function in knee OA may also have some bearing on difficulty with physical tasks and activities. Several local factors influence knee function. Varus-valgus knee stability contributes to tibiofemoral congruence and load distribution across the articular surface. Hip-knee-ankle alignment proportionately divides the load between the medial and lateral compartments. Muscle activity adds stability, controls the stop-start of joint motion, and compensates for gravity. Joint proprioception or the perception of joint position provides input to the nervous system to guide particular muscle activity. Although these factors may be impaired in some individuals prior to disease development, they also may be made worse by OA.⁷

LBP is the most common cause of work absenteeism among individuals less than 45 years of age and the third most common cause of work absenteeism among individuals between 45 and 65 years of age.⁸ It is obvious that concurrent LBP in patients with knee pain will lead to worsening of the symptoms.⁸ Cross-sectional studies have indicated that knee OA and concurrent LBP may result in more symptom severity than that expected from knee pain.⁸ There are multiple mechanisms by which LBP may be associated with increased knee pain.⁸ Considering the associated low back disorders in patients with knee pain would be helpful to recognise poor-response patients to the management of knee OA and to predict patients who

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may benefit from co-interventions to treat musculoskeletal pain in other areas, including low back. As far as we know, few studies on the relation between knee pain and LBP have been published. Thus, the association between knee pain and LBP remains controversial. In addition, coexistent low back disorders may make the Western Ontario and McMaster Universities Arthritis Index (WOMAC) score explanation more difficult if one didn't pay attention to associated low back disorders.⁸

The current study was planned to assess the association between low back dysfunction and knee pain in individuals with symptomatic knee OA. We hypothesised that LBP would be associated with higher knee pain. In addition, we expected that mechanical dysfunction of low back and lower limbs would be similarly associated with higher knee pain.

Subjects and Methods

The case-control study was conducted at Physical Medicine and Rehabilitation Department, Tabriz University of Medical Sciences, Iran, from December 2009 to March 2011, and comprised patients with primary complaint of knee pain. A separate group worked as controls. The subjects were selected with census method. The Case group included patients with the primary complaint of knee pain with at least one-month duration and an intensity of 4 or more on the 10-point Visual Analogue Scale (VAS). The Control group had patients referred with other complaints than knee pain (shoulder pain, neck pain), had no history of knee pain in their life or if they experienced knee pain, the severity of the pain was milder, not repeated, lasted less than 3 days and they had not sought medical help for it. Those who had a history of injury to the knee and spine or multiple trauma, knee or spine surgery in the preceding year, congenital and acquired considerable nervous system and musculoskeletal abnormalities, history of inflammatory rheumatic diseases, age under 25 and over 61 years and body mass index (BMI) less than 19.6 and greater than 35 were excluded. All patients in the Case group had degenerative knee joint disease (DJD) or the patellofemoral pain syndrome.

Baseline assessment was done for demographic data, including age, gender, race, ethnicity, employment status and BMI which was calculated as weight (kg) divided by the square of height (m²). Patients were divided into 4 age groups: below 30 years, 30-40 years, 41-50 years and over 50 years.

In all subjects, the lumbar spine and knees were examined and lumbar disorders (postural deviations, range of

motion [ROM], paravertebral muscle atrophy and soft tissue oedema) and ROM of hip, knee and ankle joints, muscle strength and deformity of the foot and knee were determined.

Finger-to-floor test was used for the evaluation of lumbar spine mobility. All finger-to-floor tests involved the subject standing with feet approximately shoulder width apart. The distance between the middle finger and the floor was measured using a retractable metal tape measure as the subject moved forward to the end of available range.⁹ The distance between the middle finger and the floor was marked with negative sign (-) and the distance beyond the floor was shown as positive sign (+).

We used a conventional goniometer to measure lumbar spine extension, lumbar spinal right and left lateral bending and noted degrees of motion.¹⁰ Lateral bending was measured with a goniometer and degrees of motion were observed. The mobility and the consistency of the lumbar spine and upper gluteal region skin and soft tissues (trophoedema) were assessed with the pinch-and-roll test (skin roll test) and graded as normal, mild, moderate and trophoedema.

Standing wall hyperlordosis test was used for the evaluation of lumbar lordosis state.

A conventional goniometer was used to measure lower limbs' ROMs (hips, knees and ankles),¹¹ according a system of measurement based on 0 to 180 degrees proposed by the American Academy of Orthopaedic Surgeons. Manual Muscle Test (MMT) was used for assessing the muscles strength of lower limbs.¹²

No extra intervention was executed for the patients and no unusual principals were used for assessment and data collection. As such, no additional costs were imposed on the patients. Informed written consent was obtained from all the participants and the protocol was approved by the Ethical Committee of Tabriz Medical Science University, Iran.

Data were analysed using SPSS 15. The results were expressed as mean $\pm$ standard deviation and frequency and percentages. Normal distribution of the samples was assessed by using the Kolmogorov-Smirnov test. Assessment of data was done by using independent t-tests and Chi-square tests or Fisher's exact test, as appropriate. The relationship between knee pain and LBP, knee pain and other biomechanical dysfunction of low back and lower extremities were estimated using Pearson's Chi-squared test. Fisher's exact test was also employed in cases when the expected values were low. Because right knee extension, right knee extension with hip flexion and left knee extension were skewed, Mann-

Whitney U test was applied instead of t-test. $P=0.05$ or less was considered statistically significant.

Results

Of the 170 patients, 90(53%) were in the Case group having 20(22.2%) males and 70(77.7%) females, and 80(47%) in the Control group having 18(22.5%) males and 62(77.5%) females. Gender composition between the two groups was not significant ($p=0.56$).

The mean age of the study population was 46.9 ± 8.9 years (range: 25-61 years). The mean age in the Case and Control groups was 47 ± 9.2 years (range: 25-61) and 46.7 ± 8.6 years (range: 25-61), respectively ($p=0.82$).

The level of education, physical activity and practice, history of heavy exercise, and smoking had no significant statistical differences ($p=0.76$; $p=0.5$; $p=0.08$; and $p=0.52$, respectively). Similarly, there were no significant differences in terms of weight, height and BMI between the two groups ($p=0.60$; $p=0.70$; and $p=0.46$, respectively).

In the Case group, 22(24.4%) patients had right knee pain, 32 (35.6%) left knee pain and 36 (40%) had it in both knees. The onset of right knee pain in 18(20%) patients was within the last 6 months, in 26(29%) between 6 months and 3 years, and in 14(5.5%) over 3 years. The onset of left knee pain was in the last 6 months in 29(32%) patients, 28(31%) between 6 months and 3 years, and 11(12%) over 3 years.

History of previous attack of LBP (lifetime prevalence) was

Table-2: Comparing range of motion (ROM) in Knee case and control groups (mean $\pm$ SD and range inside of parenthesis).

Variables	Case group (n=90)	Control group (n=80)	P value
Flexion Right knee	120.4 ± 8.5 (95-142)	128.4 ± 5.2 (115-140)	$P < 0.0001$
Extension Right knee	0.97 ± 1.7 (7-0)	0.35 ± 0.9 (4-0)	$P = 0.004$
Right knee Extension with hip flexion	10 ± 6.5 (30-0)	6.5 ± 5.3 (22-0)	$P < 0.0001$
Flexion Left knee	117.8 ± 17.9 (110-138)	127.9 ± 5.3 (116-139)	$P < 0.0001$
Extension Left knee	1.5 ± 0.2 (8-0)	0.3 ± 0.1 (3-0)	$P < 0.0001$
Left knee Extension with hip flexion	11.7 ± 0.7 (30-0)	6.3 ± 0.5 (20-0)	$P < 0.0001$

positive in 72(80%) of the Case group and 47(58.8%) of the Control group ($p=0.002$). Besides, 45(50%) cases and 19(23.8%) controls had LBP history of more than two times ($p=0.0001$). Further, 46(51%) cases and 22(27.5%) controls had a history of chronic back pain for more than three months ($p=0.001$); 32(35.6%) cases and 17(21.2%) controls had a history of radicular pain ($p=0.02$); 52(57.7%) cases and 23(28.8%) controls had LBP in the last month ($p=0.0001$); lumbar trophoedema was present in 85(95%) cases and 58(72%) controls ($p=0.0001$); and 31(35%) cases and 19(24%) controls had lumbar paraspinal muscle atrophy ($p=0.2$).

Lumbar posture was normal in 51(56.7%) cases, sway back

Table-1: Comparing Lumbar range of motion (ROM) and posture in case and control groups (Mean $\pm$ SD and range or frequency in parenthesis).

Variables	Subtype	Cases (n=90)	Controls (n=80)	P value
Flexion	-	-4.6 ± 5.4 (-20 to 5)	-2.6 ± 5.1 (-12 to 5)	$P = 0.17P =$
Extension	-	2.1 ± 0.7 (1-4)	1.8 ± 0.6 (1-3)	$P = 0.3$
Right lateral Bending	-	2.7 ± 0.7 (1-4)	20.0 ± 0.8 (1-4)	$P < 0.001$
Left lateral Bending	-	2.7 ± 0.7 (1-4)	2.0 ± 0.7 (1-4)	$P < 0.001$
Right rotation	-	2.4 ± 0.7 (1-4)	2.2 ± 0.7 (1-4)	$p = 0.047$
Left rotation	-	2.4 ± 0.8 (1-4)	2.2 ± 0.7 (1-4)	$P = 0.01$
Lumbar Trophoedema	Negative	5(5.6%)	28(35%)	$P < 0.001$
	Mild	20(22.2%)	30(37.5%)	$P = 0.23$
	Moderate	45(50%)	17(21.3%)	$P < 0.001$
	Severe	20(22.2%)	5(6.2%)	$P = 0.003$
	Yes	35(40.2%)	24(30%)	$P = 0.2$
	No	55(59.8%)	56(70%)	$P = 0.2$

in 30 (33.3%), hyperlordotic in 6 (6.7%), and flat back in 3 (3.3%) cases. In the control group, lumbar posture was normal in 55 (68.8%) patients, sway back in 20 (25%), hyperlordotic in 3 (3.8%) and flat back in 2 (2.5%). No statistically significant difference was found for lumbar posture between the two groups ($p=0.23$) (Table-1).

Right hip extension, internal rotation and adduction revealed no statistically significant differences ($p=0.94$; $p=0.12$; and $p=0.21$), but right hip flexion, external rotation and abduction had significant differences between the two groups ($p=0.0030$; $p=0.0001$; and $p=0.0001$). Unexpectedly, left hip flexion, extension, external and internal rotation, and abduction and adduction were significantly different between the two groups ($p=0.03$; $p=0.02$; $p=0.0001$; $p=0.01$; $p=0.0001$; and $p=0.04$) (Table-2).

Right knee posture alignment assessments in cases revealed normal knee alignment in 75 (83.3%) subjects, genu varum in 10 (11.2%), genu valgum in 3 (3.3%) and genu recurvatum in 2 (1.8%). In the control group, right knee alignment was normal in 76 (95%) subjects, genu varum in 3 (3.3%) and genu valgum in 1 (1.1%). Right knee alignment had statistically significant difference between the two groups ($p=0.03$). Left knee posture alignment assessments in the case group were normal in 76 (84.6%) subjects, genu varum in 11 (12.2%), genu valgum in 2 (2.2%) and genu recurvatum in 1 (1.1%). In the control group, left knee alignment was normal in 75 (93.7%) subjects, genu varum in 3 (3.8%) and genu valgum in 2 (2.5%). Left knee alignment had no statistically significant difference ($p=0.13$).

The groups had no significant differences in terms of foot deformities ($p=0.48$ for right foot and $p=0.29$ for left foot). Right ankle plantar flexion and dorsiflexion, and left ankle plantar flexion revealed no significant differences ($p=0.46$; $p=0.21$; and $p=0.62$). However, right ankle dorsiflexion with knee extension, and left ankle dorsiflexion and left ankle dorsiflexion with knee extension had significant differences ($p=0.0001$; $p=0.001$; and $p=0.0001$).

Discussion

Knee OA is one of the commonest rheumatological disorders that results in pain and restricted activity in everyday life, vocation and/or avocation. It has a high impact on healthcare cost of primary care (consultations and drug use) and in hospital (joint surgery or replacements). On the other hand, many other disabling conditions (LBP) can be found alongside knee OA.¹³ Although knee pain and LBP are common conditions, but only a few researches have investigated biomechanical relations or coexistence of these two common conditions.

This study investigated the coexistent and/or correlation of knee pain with LBP or dysfunction so a cause-and-effect relation between these two common clinical entities could be found.

In our study, 80% of the Case group and 58.8% in the Control group had a history of LBP with at least moderate intensity for at least a week ($p=0.002$); 50% cases and 23.8% controls had a history of LBP for more than two periods ($p=0.0001$); 35.6% cases and 21.2% controls had a history of radicular pain ($p=0.02$); 51% cases and 27.5% controls had a history of chronic back pain for more than three months ($p=0.001$). These and other results in the study highlight a relationship between concurrent LBP and knee pain, but how this relationship is created, and other factors may affect this relationship, remain to be investigated. In addition, musculoskeletal pain and impairments at the hip and foot could be associated with knee pain.⁸

Understanding of the mechanisms by which other musculoskeletal pain and impairments, including LBP, is associated with knee pain may help to identify patients who are at risk for poor outcomes following knee pain management,⁸ and patients who may benefit from co-interventions. There are several explanations for exploring of the relationship between concurrent LBP or disorders and knee pain. There is closed kinetic relationship between the human knee and low back spine so that any dysfunction of this may result in trick motion and compensation, joint dysfunction and eventually pain in one or both countries. Thus, LBP could cause increased knee pain due to biomechanical interrelationship of knee joints and low back spine joints in the kinetic chain.⁸ Knee dysfunction and pain may result in walking difficulties and more stress on other joints of lower limbs and low back spine. In recent years, physical deconditioning has been regarded as one of the perpetuating factors for chronicity in theoretical research models on pain.¹⁴ Thus, physical deconditioning can cause both low back and knee pain simultaneously. Referred pain from low back can cause muscle spasm in lower limbs and in long-standing state muscle tightness and contractures in the buttock and around the hips, knees and ankles. The resultant muscle imbalance imposes extra stress on joints, joint dysfunction and in long time joint degeneration. Although in this study no significant differences were noted between the two groups, the ways of doing activities of daily living, vocational and leisure activities are possible examples of multiple joint dysfunction. Radicular pain can cause referred pain to the knee and trigger spots can build up in the muscles around the knee. Trigger points in muscles around the knee can cause both

knee pain and dysfunction.⁸ Clinical distress and psychological factors such as anxiety and depression can bring down the pain threshold and result in both knee pain and LBP simultaneously.

A study¹⁵ reported that patients with knee pain were 12 times more likely to have multiple joint problems. According to this study, conducted on 16222 individuals, isolated knee pathology accounted for only 1 in 11 patients with knee pain. Knee pain and LBP were second common joint combinations. In addition, individuals with knee pain were 3 times and individuals with knee and low back pain were 10 times more likely to have difficulty in standing and walking than those without knee disorders.

According to a study,¹⁶ most of the individual WOMAC items could be affected by non-OA problems, the most common of which was LBP. In this survey, 51.5% OA patients reported LBP. Among all categories of patients, WOMAC scores were much higher (abnormal) in those with LBP. This means that patients with LBP had substantially more abnormal WOMAC scores than did patients without LBP. According to another study,¹⁷ 54.6% patients with knee pain reported LBP. Thus, LBP was prevalent among OA patients and was associated with clinically significant increase in pain.

As pointed out, low back disorders are a common and costly cause of pain and activity limitation in adults and affect up to 84% people at some point in their lives.¹⁸ In a study, the incidence of LBP lasting more than 2 weeks was 13.8%.¹⁹ In our study, lifetime prevalence of LBP in the Case group was 80% and in the Control group 58.8%.

In one study, point prevalence of LBP ranged from 12% to 33%, one-year prevalence ranged from 22% to 65%, and lifetime prevalence ranged from 11% to 84%.²⁰ and in another study, the incidence of symptomatic lumbar disc herniations in American population was estimated to be 1% to 2%, for which approximately 200,000 lumbar discectomies are performed annually.²¹ Although most existing literature has reported chronic LBP prevalence 10%,¹⁸ but a study that followed up 1104 cases of acute LBP in Ukraine found that 40% remained symptomatic after 3 months.²² In our study, the prevalence of chronic LBP in the Case group was 51% and in the Control group 27.5%. These differences are possibly due to different criteria for definitions of chronic LBP.

The prevalence of recurrent LBP (more than two attacks of LBP in our study) was 50% and 23.8% in the Case group and the Control group, respectively. In one study, six or more episodes of LBP were reported by half of the population.²³ In a study on 5724 adults, 60 years or older,

the overall prevalence of knee and LBP were 21% and 22%, respectively.²⁴ In a study, the prevalence of LBP in patients with hip and knee OA was 51.5%.¹⁶ In another study, the prevalence of LBP in patients with knee pain was 54.6%.¹⁷ The results of our study were different; the earlier study²⁴ assessed LBP in the community (regardless of knee pain). In our survey, the controls were selected from patients referred to our rehabilitation clinic for a complaint other than knee pain and it is clear that they differed from the ones of the community.

An association of anterior knee pain syndrome and sacroiliac joint dysfunction was studied in several fields. In a randomised, controlled, double-blind study, the effects of conservative lower back treatment in knee-extensor strength and muscle inhibition were measured in patients with anterior knee pain. In this study, 28 patients with anterior knee pain were randomly assigned into intervention and control groups. Intervention group which was treated conservatively with sacroiliac joint manipulation had significant improvement in knee a muscle activity.²⁵ It concluded that sacroiliac joint manipulation may be effective in improving knee pain by reducing hip joint impairments. However, we evaluated ROM of hips in the cases and the controls which have significant differences in most respects. A survey in 2003 showed that there was a relationship between lumbar lordosis and limited knee extension. In this study, 366 patients with LBP or knee pain were studied. Finally, it was concluded that the knee could lead to symptomatic lumbar degenerative changes (knee-spine syndrome).²⁶ In our study, 33.3% cases and 25% controls had lumbar hyperlordosis. Nevertheless, the difference between these two groups was not significant statistically. Due to relatively high mean age (47 years), perhaps hyperlordosis was lost in some patients with aging.²⁷ However, in our study, limitation of knee extension in cases and controls revealed significant differences.

The current study does have some limitations. First, the controls were not healthy volunteers. Instead, we chose subjects from an outpatient clinic. We assume that this population is not generally "healthy" and more likely to have debilitating conditions like the cases. In addition, this group represents patients typically seen clinically for other debilitating conditions. Second, we assessed the case and control subjects based on clinical characteristics. The exact nature of knee pain and LBP remains unclear. Radiographical evaluation of these areas, assessing the physical and functional disabilities with health status questionnaires (e.g., Short Form-36 and WOMAC) to evaluate the condition of patients with LBP and knee pain and screening laboratory testing may elucidate this issue.

These evaluations were not performed in our observational study. Treatment of both the knee and lumbar spine conditions are needed for optimal patient improvements. Clinical trial studies may justify these issues.

Conclusion

Considering the high prevalence of LBP, more lumbar trophoedema and greater limitation of ROM in the lumbar and lower extremity joints in cases, the relationship between lumbar and knee pain disorders in patients should attract greater attention for assessments and managements of patients with knee pain. Low back disorders may be responsible in the development and/or progression of knee pain. Conversely, chronic and debilitating LBP can be due to the effects of knee pain and lower extremity impairments. Still, other issues may have an impact on both simultaneously. Further investigations would be helpful.

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