



Knee Spine Syndrome Mechanism in Knee Osteoarthritis: Review Article

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ABSTRACT

Introduction: Osteoarthritis (OA) is the most common arthritis and one of the main causes of disability. This injury can occur in any joint, but the most common OA occurrence globally, especially in Indonesia, is Knee OA (KOA). Damage caused by KOA's degenerative process affects the knee and affects the surrounding structures, such as the lumbar vertebra, which increases symptoms of low back pain (LBP). The occurrence of symptoms of LBP is thought to be caused by knee spine syndrome, which is a condition reduced lumbar lordosis angle due to the degenerative phase of KOA. The mechanism of this syndrome has not yet been discussed in detail, so further discussion is needed in the future.

Methods: We searched articles using a list of keywords, including "knee osteoarthritis and low back pain", "knee osteoarthritis and knee contracture", "knee contracture and muscle weakness", "knee contracture and spinal alignments", "knee osteoarthritis and spinal

alignment", "knee osteoarthritis and sagittal spinal alignment", and "muscle activation and spinal imbalance" on the data sources of PubMed, ScienceDirect, and Google Scholar. The argumentative, descriptive analysis was used for the data analysis technique.

Results: Based on the literature search, the author found four related articles. This study provides evidence of the effect of KOA on lumbar proprioception. These articles explained that an impact on knee posture could have long-term effects both in the spine and pelvis, such as lumbar lordosis.

Conclusion: Knee spine syndrome results from a reduced angle of lumbar lordosis, increasing pressure between discs, which might increase LBP symptoms. In the future, it is hoped that there will be studies that raise the relationship between KOA and symptom of LBP.

Keywords: knee osteoarthritis, knee spine syndrome, spinal alignment

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INTRODUCTION

Osteoarthritis (OA) is the most common arthritis and one of the leading causes of disability. This injury can occur in any joint, but the most common occurrence of OA in the world, especially in Indonesia, is Knee OA (KOA), with 87% of sufferers being women, 37% are obese, and 60% have bilateral OA.¹⁻⁴

The occurrence of KOA can be caused by several risk factors, both systemic and local. Systemic risk factors are related to age, hormones, or gender. Meanwhile, local risk factors included a history of knee trauma, which increased knee OA risk by 3.86 times, being overweight, physical activity, alignment, and joint weakness. All risk factors play a role in the degenerative process of OA.⁵ The average KOA occurs at the age above 40, and the damage would continue to increase with age.⁶

The damage caused by KOA affects the knee and affects the surrounding structures, such as the lumbar vertebra, which increases complaints of low back pain (LBP). A previous study found that 57.4% of samples of KOA sufferers experienced LBP as the WOMAC knee pain score increased (6.5 ± 4.1).⁷

The occurrence of this LBP complaint is thought to be caused by the knee spine syndrome, which is a condition of reduced lumbar lordosis angle caused by the degenerative phase of KOA. Although the cause is due to knee spine syndrome, in fact, the mechanism of this syndrome is still not discussed in detail. The authors try to discuss the mechanism of knee spine syndrome more deeply so that there is a theoretical basis that explains the mechanism and relationship of increased LBP complaints in KOA.

METHODS

Sources of data used in this paper are literature sources obtained from research articles that have a validity level that can be justified. The type of data obtained can be quantitative or qualitative. The data used are data that have gone through the literature review method, which is based on the results of the study of data sources (including PubMed, ScienceDirect, and Google Scholar) whose validity has been tested and has a relevant relationship with the written study so that it can support the description or analysis of the discussion.

The data that has been collected will be processed

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by compiling it systematically and logically. We used keywords “knee osteoarthritis and low back pain”, “knee osteoarthritis and knee contracture”, “knee contracture and muscle weakness”, “knee contracture and spinal alignments”, “knee osteoarthritis and spinal alignment”, “knee osteoarthritis and sagittal spinal alignment”, and finally “muscle activation and spinal imbalance”.

The data analysis technique used was argumentative, descriptive analysis. A synthesis process will carry out the analysis process that has been completed by gathering general conclusions and recommendations for several things to transfer ideas.

RESULTS

Based on the literature search with the keywords “knee osteoarthritis and low back pain”, “knee osteoarthritis and knee contracture”, “knee contracture and muscle weakness”, “knee contracture and spinal alignments”, “knee osteoarthritis and spinal alignment”, “knee osteoarthritis and sagittal spinal alignment”, and finally “muscle activation and spinal imbalance” searched on several journal sites, such as PubMed, ScienceDirect, and Google Scholar and we found four articles that explain, as follows; based on research conducted by Alfeky, Draz, and Elsayed in 2016, participants in the study were 60 people with unilateral (degree II) KOA, evaluated and assessed for lumbar proprioceptive accuracy using the Biodex system 3, Pro Multi-joint system isokinetic dynamometer.⁸ This study provides evidence of the effect of KOA on lumbar proprioception. This will certainly impact knee posture, which can have long-term effects both in the spine and pelvis.

In line with this study, the systematic review by Raghav and Singh in 2020, also describes patients with lumbar lordosis of 30° or less having significantly greater knee joint extension limitations and patients with 5° or more limited knee joint extension, lumbar lordosis reduced significantly.⁹ This systematic review also explains that the combination of trunk flexion at 30° and a straight knee can increase pressure on the lumbar region. So that in the future it will cause pain in that section.

Yasuda Research, et al. in 2020, said that people aged 50 years or older with severe KOA (KL4) have a poor lumbopelvic sagittal line. So that it can reduce the degree of lordosis in the lumbar which will have an impact on lumbar degeneration. This is what causes the LBP in KOA.¹⁰

Oshima's research in 2016 stated that lower limb muscle weakness and limited knee extension in people with KOA will reduce the angle of lumbar

lordosis and cause posture abnormalities.¹¹ In addition, the aging factor will worsen the condition of the vertebra, causing deformity and reducing the flexibility of the vertebra. This is what causes LBP in elderly KOA sufferers.

DISCUSSION

The occurrence of KOA will release matrix metalloproteases (MMPs) or degenerative enzymes that becomes excess, which disrupts the balance of components in the joint. In the initial phase of KOA, chondrocyte secretes tissue of inhibitors of MMPs (TIMPs) as an enhancer of proteoglycan synthesis to fight degenerative processes is impaired so that the reparative ability is still lacking.

The disruption of the TIMPs balance results in reduced proteoglycan, collagen damage, and finally, the elasticity of the cartilage tissue has decreased elasticity. Macroscopically, these changes result in cracking and fissuring of the cartilage tissue, and finally, erosion occurs on the surface of the cartilage tissue.¹²

The cartilage tissue damage in the KOA will cause structural changes both in the knee and globally changes in the knee. The weakness of the quadriceps muscle and shortening of the hamstring muscles due to flexion contracture, varus thrust due to medial KOA can also affect the structure of the spine. This phenomenon is termed knee spine syndrome.^{13,14}

The occurrence of knee spine syndrome can be caused by structural changes in the degenerative KOA process. KOA with flexion contracture causes increased backward femoral inclination, hip flexion, and forward spinal inclination. If there is an increase in the angle >10° in the backward femoral inclination, it will reduce the lumbar lordosis angle, which affects the sagittal alignment, precisely on the spine pelvis-lower extremity axis. These changes will affect the overall balance and will increase the compensation for loading on the lumbar spine in the future. The reduction in the lumbar lordosis angle will increase pressure between the disc, which might increase LBP complaints.^{13,15,16}

This theory is also supported by retrospective research from Gilbert, J. W. et al.,¹⁷ which states that if there is a decrease in the lumbar lordosis angle (Cobb angle <20°), it will cause an increase in pressure between disc, which spurs the protective mechanism of the paraspinal muscles (erector spine). The existence of a protective mechanism by the paraspinal muscles will cause an overuse of this muscle, thereby increasing the risk of spasm in the muscle and increasing LBP complaints in the future.

CONCLUSION

The knee spine syndrome mechanism starts from flexion contracture in the knee, which increases backward femoral inclination, hip flexion, and forward spinal inclination, which decreases the angle of lumbar lordosis. The reduced angle of lumbar lordosis results in increased loading on the lumbar spine, causing activation of the paraspinal muscles to protect against lumbar loading. This overuse of muscle will cause pain. In the future, it is hoped that there will be research that raises the relationship between KOA and LBP complaints.

CONFLICT OF INTEREST

No commercial party having an interest in this study and no any benefit was received by the authors or authors' affiliations.

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AUTHOR CONTRIBUTIONS

IMBK carried out the study design, data collection, and drafting the article; GAAT conceived the study design, data interpretation, and drafting the article.

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