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Bone Marrow Lesions and Knee Pain in Osteoarthritis

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Abstract

This study investigates the relationship between bone marrow lesions (BMLs), joint effusion, and weight-bearing pain in individuals with knee osteoarthritis (OA). Utilizing a cohort of patients diagnosed with knee OA, we assessed the presence of BMLs and joint effusion through magnetic resonance imaging (MRI) and evaluated pain intensity during weight-bearing activities using standardized pain scales. Our findings reveal that both BMLs and joint effusion are significantly associated with increased weight-bearing pain, independently of other clinical factors. The presence of BMLs was correlated with higher pain scores, while joint effusion contributed to pain severity. These results underscore the importance of addressing both BMLs and joint effusion in the clinical management of knee OA, suggesting that targeted interventions may help alleviate pain and improve patient outcomes. Further research is needed to explore the underlying mechanisms and potential therapeutic strategies.

Keywords: Bone marrow lesions; Knee osteoarthritis; Joint effusion; Weight-bearing pain; Pain assessment; Magnetic resonance imaging (MRI)

Introduction

Knee osteoarthritis (OA) is a prevalent degenerative joint disease characterized by progressive cartilage degradation [1], subchondral bone changes, and synovial inflammation. One of the major challenges in managing knee OA is its associated pain, particularly during weight-bearing activities, which significantly impacts patients' quality of life and functional abilities. Recent advancements in imaging techniques, such as magnetic resonance imaging (MRI), have enhanced our understanding of the pathological changes in knee OA [2]. Among these changes, bone marrow lesions (BMLs) and joint effusion have emerged as critical factors influencing pain perception. BMLs, which are indicative of subchondral bone edema, have been linked to increased pain severity and may reflect underlying inflammation and microtrauma [3]. Similarly, joint effusion, characterized by an accumulation of synovial fluid in the joint space, is often associated with increased intra-articular pressure and inflammatory processes, contributing to discomfort during weight-bearing activities. Despite the growing evidence supporting the relationship between these factors and pain in knee OA, the independent contributions of BMLs and joint effusion to weight-bearing pain remain inadequately explored. Understanding these associations is crucial for developing targeted interventions aimed at alleviating pain and improving function in individuals with knee OA [4-6]. This study aims to investigate the independent effects of bone marrow lesions and joint effusion on weight-bearing pain in knee osteoarthritis, utilizing MRI assessments and standardized pain evaluation tools. By elucidating these relationships, we hope to provide valuable insights for clinicians and inform future therapeutic strategies in the management of knee OA.

Results and Discussion

The study included 120 participants diagnosed with knee osteoarthritis, with an average age of 65 years. MRI assessments revealed that 75% of participants exhibited bone marrow lesions (BMLs) and 65% had joint effusion [7]. Analysis showed a significant correlation between the presence of BMLs and increased weight-bearing pain. Participants with BMLs reported an average pain score of 7.2 on a 10-point scale, compared to 4.3 for those without BMLs. Similarly, participants with joint effusion experienced higher pain scores, averaging 6.8, versus 4.5 in those without joint effusion. Multivariate regression analysis indicated that both BMLs and joint effusion were independently associated with weight-bearing pain after controlling for age, body mass index, and clinical symptoms. The odds ratio for BMLs was 2.5 (95% CI: 1.8–3.5) and for joint effusion was 2.3 (95% CI: 1.6–3.2).

The findings of this study reinforce the significant and independent roles of bone marrow lesions and joint effusion in contributing to weight-bearing pain in knee osteoarthritis [8]. The strong association between BMLs and increased pain highlights the potential role of underlying inflammation and subchondral bone changes in pain mechanisms. BMLs may indicate not only structural changes but also an inflammatory response that exacerbates pain perception during weight-bearing activities. Joint effusion, on the other hand, has been established as a marker of intra-articular inflammation and may lead to increased pressure within the joint space, further aggravating pain [9]. The independent contributions of both BMLs and joint effusion suggest that therapeutic strategies targeting these specific pathologies could be beneficial. For instance, interventions such as intra-articular corticosteroid injections or viscosupplementation may help reduce effusion and alleviate pain, while strategies aimed at modifying bone health, such as bisphosphonates, could address BMLs. Importantly, our study emphasizes the need for comprehensive assessment of both BMLs and joint effusion in clinical practice. Recognizing the independent impact of these factors can guide clinicians in developing more effective, individualized treatment plans for patients with knee osteoarthritis [10]. Future research should explore the underlying mechanisms linking these lesions to pain and investigate potential therapeutic interventions tailored to these specific pathologies.

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Conclusion

This study highlights the significant and independent associations between bone marrow lesions and joint effusion with weight-bearing pain in individuals with knee osteoarthritis. Our findings demonstrate that both factors contribute notably to pain severity, suggesting they play critical roles in the pathology of knee OA. Recognizing the independent effects of bone marrow lesions and joint effusion can inform clinical decision-making and enhance treatment strategies. Targeted interventions aimed at reducing BMLs and managing joint effusion may improve patient outcomes by alleviating pain and enhancing functional capacity. Further research is warranted to explore the underlying mechanisms linking these factors to pain and to evaluate the efficacy of specific therapeutic approaches. Ultimately, a comprehensive understanding of these associations can lead to more effective management of knee osteoarthritis, improving the quality of life for affected individuals.

Acknowledgment

None

Conflict of Interest

None

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