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Short Communication

Metabolic Syndrome and Knee Osteoarthritis: A Comprehensive Exploration of Emerging Connections

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DESCRIPTION

Knee Osteoarthritis (OA) has long been associated with age, genetics, and mechanical factors, but recent research is focused on the potential link between Metabolic Syndrome (MetS) and the risk of developing knee OA. Metabolic syndrome, characterized by a cluster of interconnected factors such as abdominal obesity, insulin resistance, hyperglycemia, dyslipidemia, and hypertension, has traditionally been implicated in cardiovascular diseases and type 2 diabetes. However, a growing body of evidence suggests that MetS may play a significant role in the pathogenesis of knee OA. This article will explore the emerging evidence connecting metabolic syndrome with knee osteoarthritis, emphasizing the underlying mechanisms, epidemiological findings, and clinical implications.

The link between metabolic syndrome and knee osteoarthritis

Metabolic syndrome and knee osteoarthritis share common risk factors, such as obesity and inflammation. Obesity, a central component of MetS, places excess mechanical stress on weight-bearing joints, particularly the knees. This increased load contributes to the wear and tear of cartilage, a distinctive characteristic of osteoarthritis. Additionally, adipose tissue, especially visceral fat, secretes pro-inflammatory cytokines and adipokines, creating a chronic inflammatory state that may further exacerbate joint damage [1-3].

Insulin resistance, another key feature of MetS, has been implicated in the development and progression of osteoarthritis. Insulin plays an important role in maintaining the integrity of joint tissues, and its dysregulation may lead to aberrant signaling pathways, ultimately contributing to the breakdown of cartilage and the development of OA [4]. Studies have demonstrated a higher prevalence of insulin resistance in individuals with knee OA, suggesting a potential mechanistic link between MetS and joint degeneration.

Epidemiological evidence

Several epidemiological studies have provided valuable insights into the association between MetS and knee osteoarthritis. A comprehensive analysis of large-scale population-based cohorts revealed a positive correlation between the number of MetS components and the prevalence of knee OA. Individuals with MetS were found to be at a higher risk of developing knee OA compared to those without MetS. Furthermore, the severity of MetS correlated positively with the severity of knee OA, emphasizing a dose-response relationship [5,6].

These findings were consistent across diverse populations, underscoring the robustness of the association. Notably, the link between MetS and knee OA remained significant even after adjusting for confounding factors such as age, sex, and physical activity. This suggests that MetS independently contributes to the risk of knee osteoarthritis, reinforcing the need for a deeper understanding of the underlying mechanisms.

Mechanistic insights

To comprehend the intricate relationship between metabolic syndrome and knee osteoarthritis, it is crucial to delve into the underlying mechanisms at the molecular and cellular levels. Chronic low-grade inflammation, a common feature of MetS, has been identified as a main object in the pathogenesis of osteoarthritis. Inflammatory mediators such as Interleukin-1 (IL-1), Tumor Necrosis Factor-alpha (TNF-α), and Interleukin-6 (IL-6) are elevated in individuals with MetS and have been implicated in the degradation of articular cartilage [7].

Adipokines, bioactive molecules secreted by adipose tissue, further contribute to the inflammatory milieu in both MetS and OA. Leptin, an adipokine elevated in obesity, has been shown to promote cartilage degradation and exacerbate inflammation within the joint. Conversely, adiponectin, another adipokine, exhibits anti-inflammatory properties but its levels are often reduced in MetS, potentially compromising its protective effects on joint tissues [8].

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In addition to inflammation, dyslipidemia, a characteristic feature of MetS, may influence the development of knee OA. Lipids, particularly cholesterol and fatty acids, have been implicated in modulating inflammatory responses and oxidative stress within the joint. Moreover, altered lipid metabolism may directly impact the composition and function of cartilage cells, contributing to the degenerative changes observed in osteoarthritis [9,10].

Clinical implications and future directions

The emerging evidence linking metabolic syndrome with knee osteoarthritis holds significant clinical implications. Understanding the interplay between MetS and OA may pave the way for targeted interventions aimed at mitigating the risk and progression of knee osteoarthritis in individuals with metabolic syndrome. Lifestyle modifications, such as weight management and exercise, are pivotal in addressing both MetS and OA risk factors simultaneously.

Pharmacological approaches targeting the inflammatory pathways implicated in MetS and OA may offer novel therapeutic strategies. Anti-inflammatory agents, including those targeting specific cytokines and adipokines, could potentially attenuate joint inflammation and slow the progression of osteoarthritis in individuals with metabolic syndrome. However, further research is needed to elucidate the efficacy and safety of such interventions.

CONCLUSION

In conclusion, the emerging evidence linking metabolic syndrome with the risk of knee osteoarthritis provides a compelling avenue for exploration in both research and clinical settings. The shared risk factors, epidemiological associations, and mechanistic insights underscore the intricate relationship between MetS and OA. As our understanding deepens, the potential for developing targeted interventions to mitigate the impact of metabolic syndrome on knee osteoarthritis becomes increasingly optimistic. Integrating these findings into clinical practice may open new avenues for preventive strategies and personalized treatments, ultimately improving the quality of life for individuals at the intersection of metabolic syndrome and knee osteoarthritis.

REFERENCES

1. Xie DX, Wei J, Zeng C, Yang T, Li H, Wang YL, et al. Association between metabolic syndrome and knee osteoarthritis: A cross-sectional study. BMC Musculoskelet Disord. 2017;18:1-17.
2. Shin D. Association between metabolic syndrome, radiographic knee osteoarthritis, and intensity of knee pain: Results of a national survey. J Clin Endocrinol Metab. 2014;99(9):3177-3183.
3. Maddah S, Mahdizadeh J. Association of metabolic syndrome and its components with knee osteoarthritis. Acta Med Iran. 2015:743-748.
4. Askari A, Ehrampoush E, Homayounfar R, Arasteh P, Naghizadeh MM, Yarahmadi M, et al. Relationship between metabolic syndrome and osteoarthritis: The fasa osteoarthritis study. Diabetes Metab Syndr. 2017;11:827-832.
5. Zhuo QI, Yang W, Chen J, Wang Y. Metabolic syndrome meets osteoarthritis. Nat Rev Rheumatol. 2012;8(12):729-737.
6. Li H, George DM, Jaarsma RL, Mao X. Metabolic syndrome and components exacerbate osteoarthritis symptoms of pain, depression and reduced knee function. Ann Transl Med. 2016;4(7).
7. Tan Q, Jiang A, Li W, Song C, Leng H. Metabolic syndrome and osteoarthritis: Possible mechanisms and management strategies. Med Nov Technol Devices. 2021;9:100052.
8. Tudorachi NB, Totu T, Eva I, Bărbieru B, Totu EE, Fifere A, et al. Knee osteoarthritis in relation to the risk factors of the metabolic syndrome components and environment of origin. J Clin Med. 2022;11(24):7302.
9. Zvekić SJ, Minaković I, Vojnović M, Miljković A, Mikov J, Bošković K. The role of metabolic syndrome in the development of osteoarthritis. Med Pregl. 2022;75(1-2):39-43.
10. Oreiro-Villar N, Fernandez-Moreno M, Cortes-Pereira E, Vazquez-Mosquera ME, Relaño S, Pertega S, et al. Metabolic syndrome and knee osteoarthritis impact on the prevalence, severity incidence and progression of the disease. Osteoarthr Cartil. 2017;25:286-287.