



BIOLOGICAL AND CLINICAL DIMENSION OF SEX DIFFERENCE IN ATHEROSCLEROSIS

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ABSTRACT :

Atherosclerosis is a disease that gradually develops in the arteries. starting early in Gender differences play a critical role in atherosclerosis development and clinical progress. While the women have protection from cardiovascular disease before menopause. These have declined afterwards. Men are more likely to develop atherosclerosis earlier. The review covered gender-based differences in atherosclerosis, covering risk factors, clinical processes, and therapeutic responses.

Introduction

Atherosclerosis is a disease that gradually develops in the arteries starting early in life. It builds up fat in the artery wall, causing inflammation. This can lead to plaque formation fat deposits that block the blood flow. Observations have shown a difference between men and women in how this condition arises and progresses. Current research shows that both biological sex and gender-based social influence develop atherosclerosis. Men are typically diagnosed earlier and often develop more extensive, calcified plaque that will carry a higher risk of rupture. The women experience disease later in life, without major blockages, making it harder to detect traditional methods. These gender-based differences include delays in diagnosis and treatment, especially in women. The review will consider differentiating gender-based atherosclerosis covering the area of clinical signs, risk factors, and plaque structure.

Epidemiology of atherosclerosis

Atherosclerosis, a long-term inflammatory disorder characterized by plaque buildup in arterial walls, has significant epidemiological variation among men and women. Men develop atherosclerosis earlier than women, with a higher prevalence among middle-aged men. This difference is attributable in part to estrogen's preventative actions in premenopausal women, which may delay the onset of the disease. However, after menopause, women's risk increases considerably, often matching or exceeding that of males. Epidemiological studies show that, while men are more likely to suffer an early myocardial infarction due to atherosclerosis, women usually present with more diffuse disease and unique symptoms, perhaps contributing to a delay in diagnosis. Smoking, hypertension, dyslipidemia, and diabetes are all risk factors for the both sexes, although diabetes is poses a significantly higher cardiovascular risk in the women. Understanding these as sex-specific characteristics is critical for the effective atherosclerosis prevention and control measures.

Plaque composition and structure

In men, plaques tend to be large and highly calcified and structurally weak. These unstable plaques often have large areas of dead tissue and a thin outer layer. Making them more likely to rupture and trigger sudden cardiovascular disease such as heart attack. In women, plaques are smaller and widely spread across the vessel walls. They show more signs of inflammation and affect the smaller vessels. These plaques have thick fibrous caps and show the signs of rupture, like chain pain and reduced blood flow. Particularly dysfunction the endothelium.

Risk factors

Common risk factors include higher blood pressure, diabetes, tobacco use, and obesity. Female-specific risk factors include hormonal changes in menopause, such as the decline in estrogen leading to worsening lipids, increased inflammation, and reduced blood vessel function. Males tend to experience issues like high cholesterol levels and elevated blood pressure at a younger age. In male lifestyle habits like higher use of smoking, alcohol consumption, and physical inactivity are leading to atherosclerosis

Sex based biological differences in atherosclerosis

Biological sex has a notable impact on how atherosclerosis develops and progresses. In women, the hormone estrogen provides cardiovascular protection before menopause by encouraging blood vessel relaxation, boosting nitric oxide levels, and reducing inflammation and oxidative stress. These effects support healthier blood vessel function and slow down the buildup of plaque. Estrogen also helps maintain a favorable cholesterol balance by raising HDL (good cholesterol) and lowering LDL (bad cholesterol). On the other hand, testosterone's role is more complex and may, in some cases, promote inflammation and contribute to negative changes in lipid profiles. Once women reach menopause, the drop- in estrogen removes these protective effects, increasing their risk of heart disease. Additionally, the immune system responds differently in men and women, with women typically having a stronger adaptive immune response, which can influence plaque stability in unique ways. Research suggests that men often develop plaques that are more likely to rupture, while women tend to have more stable but fibrotic plaques that still cause symptoms. These sex-related biological variations highlight the importance of approaching cardiovascular disease with a gender-sensitive perspective.

Clinical Manifestations and Diagnostic Challenges

Females frequently experience non-typical symptoms such as tiredness, nausea, or discomfort in the back, which often leads to delayed or incorrect diagnosis. These subtle and less recognized signs can postpone necessary medical intervention, potentially worsening health outcomes. Additionally, traditional cardiovascular risk assessment tools, including the Framingham Risk Score, may not accurately reflect women's true risk, underscoring the need for more tailored, sex-specific evaluation methods. In terms of disease pathology, women are more likely to exhibit microvascular dysfunction and develop stable atherosclerotic plaques, while men tend to present with plaque rupture and significant blockage in major arteries. These differences reinforce the need for greater diagnostic precision and increased awareness of sex-specific cardiovascular presentations

Conclusion

Gender has a major impact on the development and management of atherosclerosis. Gender-based medical techniques can improve the effectiveness of treatment and prevention. Women are more prone to get broad disease and more serious consequences later in life, particularly after menopause because of hormonal changes, even though atherosclerosis usually manifests sooner in men. More research is required to fully comprehend these distinctions and enhance individualized care strategies for both men and women.

REFERENCE

1. Pankaj mathur,Bahuslav ostadal, Francesco Romeo, Jawahar L.mehta:Gender-related differences in Atherosclerosis
2. Gender Differences in Atherosclerotic Vascular Disease:From Lipids to Clinical Outcomes Tamar Vakhtangadze1, Rajeeeka Singh Tak 1, Utkarsh Singh1, Mirza S. Baig2 and Evgeni Bezsonov 3,4
3. Sex-specific differences in cardiovascular risk factors and implications for cardiovascular disease prevention in women Aardra Rajendrana · Anum S. Minhasb · Brigitte Kazzia Eunjung Choib · Aarti Thakkar
4. Sex as a Biological Variable in Atherosclerosis Joshua J. Man, Joshua A. Beckman, Iris Z. Jaffe
5. Pathophysiology of Atherosclerosis Plaque Progression Kenichi Sakakura, MD, Masataka
6. Nakano, MD, Fumiyuki Otsuka, MD,Elena Ladich, MD, Frank D. Kolodgie, PhD and Renu Virmani, MD
7. Atherosclerosis: Recent development:Johan L.M. Bjo,rkegren1,2,* and Aldons J. Lusise
8. Ishar K. Thak *, Pooja R. Hatwar, Ravindra L. Bakal and Om N. Ajmir:Atherosclerosis:
9. Pathophysiology, risk factors, diagnosis and treatment