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Renal involvement in Takayasu's arteritis; a mini-review study

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ABSTRACT

Takayasu's arteritis is a chronic inflammatory disease affecting the aorta and its branches. It can also involve other organs, such as the kidneys. Inflammation of the renal artery can lead to hypertension, proteinuria, and progressive loss of kidney function over time. This condition is known as renovascular hypertension. The treatment for Takayasu's arteritis involves managing symptoms with medications like corticosteroids, immunosuppressants, and antihypertensive drugs. Surgical intervention may be necessary if there are complications, such as aneurysms or blockages in the affected blood vessels. Lifestyle modifications such as maintaining a healthy weight, regular exercise, and smoking cessation can also help manage better disease management.

Keywords: Takayasu's arteritis, Vascular inflammation, Interferon-gamma, Interleukin-6, Takayasu's disease, Hypertension, Proteinuria, Renovascular hypertension, Granulomatous inflammation

Mini-Review

Implication for health policy/practice/research/medical education:
Takayasu's arteritis, also known as Takayasu's disease, is a rare chronic inflammatory disease that primarily affects the large blood vessels, especially the aorta and its branches. Although the disease primarily affects the arteries, it can also involve other organs, including the kidneys. Dysregulation of T cells, particularly CD4+ and CD8+ T cells, is thought to play a significant role in developing vascular inflammation. The imbalance of pro-inflammatory and anti-inflammatory cytokines, such as interferon-gamma and IL-6, also contributes to renal involvement in this disease. Furthermore, individuals with Takayasu's arteritis should regularly monitor kidney function, including blood pressure checks, urine tests, and kidney function tests such as serum creatinine and estimated glomerular filtration rate. Early detection and effective management of kidney involvement prevent or minimize the complications. Consulting with a healthcare professional, such as a rheumatologist or nephrologist, is crucial for proper evaluation and treatment.

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Introduction

Takayasu's arteritis is characterized by granulomatous inflammation of the arterial wall of large and medium-sized arteries, especially the aorta and its major branches, which leads to stenosis, occlusion, or aneurysmal dilatation (1). The disease predominantly affects young females, with the highest incidence reported in Asian countries, and can lead to significant morbidity and mortality if not diagnosed and managed promptly (2). This mini-review aims to summarize recent findings in the pathogenesis, diagnosis, and management of renal involvement in Takayasu's arteritis.

Search strategy

For this review, we searched PubMed, Web of Science, EBSCO, Scopus, Google Scholar, Directory of Open Access Journals (DOAJ), and Embase, using different keywords including Takayasu's arteritis, vascular inflammation, interferon-gamma, interleukin-6, Takayasu's disease, hypertension, proteinuria, renovascular hypertension and granulomatous inflammation.

Etiology of Takayasu's arteritis

Takayasu's arteritis is a rare chronic inflammatory disease that primarily affects the large arteries, especially the aorta and its branches. Over the past few years, several studies have shed light on various aspects of this condition, including its pathogenesis, clinical features, diagnostic approach, and treatment options. Here are some of the recent findings (3,4).

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Genetic factors

Genetic studies have identified specific gene variations associated with an increased susceptibility to Takayasu's arteritis. Variants in genes involved in immune regulation, such as HLA-B52, IL12B, and IL6, are more common in individuals with Takayasu's arteritis. These findings help understand the disease's underlying mechanisms and may aid in early diagnosis (5,6).

Pathogenesis

Recent studies have highlighted the role of immune dysregulation in the pathogenesis of Takayasu's arteritis. Aberrant T-cell responses, particularly Th1 and Th17 cells, along with pro-inflammatory cytokines such as interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-α), contribute to vascular inflammation. Genetic studies have identified several susceptibility loci associated with Takayasu's arteritis development (7).

Vascular inflammation

Studies have shown increased levels of pro-inflammatory cytokines, such as TNF-α and IL-6, in patients with Takayasu's arteritis, suggesting their involvement in vascular inflammation (8,9).

Imaging techniques

Advances in imaging modalities have improved the diagnosis and assessment of Takayasu's arteritis. Magnetic resonance imaging (MRI) remains the gold standard for evaluating arterial involvement in Takayasu's arteritis because it can visualize wall thickening, stenosis, and aneurysmal changes non-invasively. Positron emission tomography (PET) scans using fluorodeoxyglucose (FDG) have shown promising results in identifying active inflammation in the vessel walls and may be useful for disease monitoring (10,11).

Biomarkers

Researchers have explored various biomarkers to aid in the diagnosis and management of Takayasu's arteritis. Serum markers of inflammation, such as C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR), are commonly used to assess disease activity. However, newer biomarkers like vascular endothelial growth factor (VEGF), matrix metalloproteinases (MMPs), and pentraxin-3 (PTX3) have shown promise in predicting disease relapses and response to treatment (12).

Renal involvement in Takayasu's arteritis

The inflammation of the renal arteries can lead to narrowing or stenosis of these blood vessels. This can result in reduced blood flow to the kidneys, leading to decreased kidney function and potentially causing hypertension (13). In some cases, Takayasu's arteritis can cause dilation or aneurysm formation in the renal arteries. These aneurysms may be asymptomatic or may rupture, leading to severe bleeding and potentially life-threatening complications (14). Moreover, in rare instances, Takayasu's arteritis can cause blockage of the renal arteries, leading to inadequate blood supply to the kidneys and infarction. This can result in acute kidney injury and associated symptoms such as flank pain and hematuria (13). Besides, Takayasu's arteritis has been associated with glomerulonephritis, which is inflammation of the tiny filters within the kidneys called glomeruli. Glomerulonephritis can lead to proteinuria, hematuria, and impaired kidney function (15). Furthermore, uncontrolled high blood pressure is a common manifestation of renal involvement in Takayasu's arteritis. Inflammation and narrowing of the renal arteries can lead to decreased blood flow to the kidneys, causing the body to release hormones that increase blood pressure (13,16). Similarly, severe and prolonged blood flow impairment to the kidneys can result in renal insufficiency or even kidney failure. Likewise, inflammation and damage to the kidneys may cause proteinuria and hematuria. These abnormalities can be detected through urine tests and may indicate kidney involvement (13,17). The severity of renal involvement varies among individuals with Takayasu's arteritis. Some patients may have mild or no renal symptoms, while others may experience significant kidney dysfunction requiring medical intervention or even dialysis

Treatment options

Managing Takayasu's arteritis typically involves a combination of immunosuppressive medications and glucocorticoids to control inflammation and prevent vessel damage. Recent studies have evaluated the efficacy of newer immunosuppressive agents, such as tocilizumab (an IL-6 receptor inhibitor) and ustekinumab (an interleukin-12/23 inhibitor), in refractory cases of Takayasu's arteritis. Biologic therapies targeting specific immune pathways are being explored as potential treatment options (18,19).

Management of renal involvement in Takayasu's arteritis

A multidisciplinary approach is necessary to manage renal involvement in Takayasu's arteritis. Rheumatologists, nephrologists, and vascular surgeons collaborate to develop a treatment strategy. Here are some strategies that may be employed (20,21).

Blood pressure control

Hypertension (high blood pressure) is a common complication of renal artery stenosis in Takayasu's arteritis. Effective blood pressure control is essential to minimize the risk of further kidney damage. Medications like angiotensin-converting enzyme inhibitors or angiotensin receptor blockers may be prescribed (22,23).

Immunosuppressive therapy

Corticosteroids, such as prednisone, and other

immunosuppressive medications, like methotrexate or azathioprine, often control the inflammation associated with Takayasu's arteritis. These medications help reduce the immune system's activity and slow disease progression (24,25).

Interventional procedures

In some cases of severe renal artery stenosis, angioplasty or stenting may be performed. Angioplasty involves inflating a balloon within the narrowed artery to widen the lumen, while stenting involves placing a mesh-like tube called a stent to keep the artery open. These procedures can help improve blood flow to the kidneys (26).

Regular monitoring of kidney function, blood pressure, and urine analysis is necessary to evaluate the response to treatment and detect any progress of renal involvement. Additional tests like renal artery duplex ultrasound or renal scintigraphy may also be used to assess kidney blood flow (13,27).

In more severe cases, when renal involvement leads to end-stage renal disease with significant loss of kidney function, renal replacement therapy may be required. This can involve either dialysis or kidney transplantation (13,28).

Individuals with Takayasu's arteritis need to undergo regular monitoring of kidney function, including blood pressure checks, urine tests, and kidney function tests (such as serum creatinine and estimated glomerular filtration rate). Early detection and effective management of renal involvement can help prevent or minimize complications. Consulting with a healthcare professional, such as a rheumatologist or nephrologist, is crucial for proper evaluation and treatment (25,29).

Conclusion

Takayasu's arteritis is a rare but potentially devastating disease that requires prompt recognition and appropriate management. Recent advances in our understanding of its pathogenesis and clinical manifestations have improved our ability to diagnose and treat this condition effectively. However, further research is needed to develop more targeted therapies and improve patient outcomes.

Authors' contribution

Conceptualization: Sarah Hosseinpoor.
Data curation: Mansour Salesi, Sarah Hosseinpoor.
Investigation: Sarah Hosseinpoor.
Resources: Mansour Salesi.
Supervision: Sarah Hosseinpoor.
Validation: Sarah Hosseinpoor, Mansour Salesi.
Visualization: Mansour Salesi.
Writing–original draft: Sarah Hosseinpoor.
Writing–review and editing: Mansour Salesi.

Conflicts of interest

The authors declare that they have no competing interests.

Ethical issues

Ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the authors.

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