

RELAÇÃO ENTRE HIPERTENSÃO ARTERIAL, DOENÇA RENAL E HIPERTROFIA VENTRICULAR ESQUERDA: UMA REVISÃO DE LITERATURA

RELATIONSHIP BETWEEN ARTERIAL HYPERTENSION, KIDNEY DISEASE, AND LEFT VENTRICULAR HYPERTROPHY: A LITERATURE REVIEW

João Pedro Cardoso Faccio ¹; Livia Cristina Canton ²

1: Professor do curso de medicina na Afya Pato Branco

2: Acadêmica do curso de medicina da faculdade Afya Pato Branco medliviacanton@gmail.com

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RESUMO

Introdução: A hipertensão arterial constitui um importante fator de risco para o desenvolvimento de doenças cardiovasculares e renais, apresentando relação bidirecional com a disfunção renal. A alteração da função renal pode favorecer a elevação persistente da pressão arterial, enquanto a hipertensão crônica pode contribuir para a progressão da lesão renal e aumentar a sobrecarga cardiovascular. **Objetivo:** Analisar a relação entre hipertensão arterial, doença renal e hipertrofia ventricular esquerda, com ênfase nos mecanismos fisiopatológicos envolvidos nessa associação. **Método:** Foi realizada uma revisão de literatura descritiva e qualitativa, baseada principalmente em dois artigos científicos que abordaram a relação entre hipertensão arterial, doença renal, regulação de sódio e água, sistema renina-angiotensina aldosterona e controle da pressão arterial. Os estudos foram analisados e os achados foram organizados de acordo com os principais mecanismos fisiopatológicos relacionados à disfunção renal, à hipertensão e ao remodelamento cardíaco. **Resultados:** Os estudos analisados indicaram que a redução da capacidade renal de excretar sódio e água, associada à ativação do sistema renina-angiotensina-aldosterona, pode contribuir para a manutenção da hipertensão arterial. A hipertensão persistente, por sua vez, aumenta a pós-carga ventricular e favorece o desenvolvimento da hipertrofia ventricular esquerda. **Conclusão:** A interação entre doença renal, hipertensão arterial e hipertrofia ventricular esquerda é complexa e bidirecional. O controle adequado da pressão arterial e o manejo da doença renal são fundamentais para reduzir a sobrecarga cardiovascular e limitar a progressão das alterações renais e cardíacas.

Palavras-chave: Doenças Cardiovasculares; Doenças Renais; Hipertensão; Hipertrofia Ventricular Esquerda.

ABSTRACT

Introduction: Arterial hypertension is an important risk factor for the development of cardiovascular and renal diseases, presenting a bidirectional relationship with renal dysfunction. Impaired renal function may contribute to persistent elevation of blood pressure, while chronic hypertension may contribute to the progression of renal injury and increase cardiovascular workload. **Objective:** To analyze the relationship between arterial hypertension, kidney disease, and left ventricular hypertrophy, with emphasis on the pathophysiological mechanisms involved in this association. **Method:** A descriptive and qualitative literature review was conducted, based primarily on two scientific articles addressing the relationship between arterial hypertension, kidney disease, sodium and water regulation, the renin–angiotensin–aldosterone system, and blood pressure control. The studies were analyzed, and the findings were organized according to the main pathophysiological mechanisms related to renal dysfunction, hypertension, and cardiac remodeling. **Results:** The studies analyzed indicated that reduced renal capacity to excrete sodium and water, associated with activation of the renin–angiotensin–aldosterone system, may contribute to the maintenance of arterial hypertension. Persistent hypertension, in turn, increases ventricular afterload and promotes the development of left ventricular hypertrophy. **Conclusion:** The interaction between kidney disease, arterial hypertension, and left ventricular hypertrophy is complex and bidirectional. Adequate blood pressure control and appropriate management of kidney disease are essential to reduce cardiovascular overload and limit the progression of renal and cardiac alterations.

Keywords: Cardiovascular Diseases; Hypertension; Kidney Diseases; Left Ventricular Hypertrophy

INTRODUCTION

Arterial hypertension is a condition of major clinical importance because of its association with cardiovascular and renal complications. Persistent elevation of blood pressure imposes increased workload on the cardiovascular system and may contribute to structural changes in the heart. Among these changes, left ventricular hypertrophy is characterized by an increase in left ventricular mass as an adaptive response to chronic elevation of cardiac workload. Initially, this process may represent a compensatory mechanism; however, its persistence may be associated with cardiac dysfunction and increased cardiovascular risk.

The relationship between arterial hypertension and kidney disease is bidirectional. The kidneys play a fundamental role in maintaining fluid and electrolyte balance and regulating blood pressure. When renal function is impaired, the ability to adequately excrete sodium and water is reduced, favoring expansion of extracellular fluid volume and elevation of blood pressure. In addition, activation of the renin–angiotensin–aldosterone system may promote sodium retention and vasoconstriction, contributing to persistent hypertension. On the other hand, chronic hypertension may cause progressive damage to the renal vasculature and contribute to deterioration of renal function.¹

This interaction between kidney disease and hypertension may establish a continuous cycle in which renal dysfunction contributes to persistent elevation of blood pressure, while hypertension contributes to progressive renal injury. In addition to its effects on the kidneys, persistent elevation of blood pressure increases the afterload against which the left ventricle must eject blood. Consequently, the myocardium may undergo structural remodeling, characterized by thickening of the ventricular wall and development of left ventricular hypertrophy.¹

The importance of this relationship lies in the fact that the association between kidney disease, hypertension, and cardiac alterations may simultaneously increase renal and cardiovascular risks. Despite the clinical relevance of this interaction, understanding the mechanisms connecting impaired renal function, persistent elevation of blood pressure, and cardiac remodeling remains important for understanding the progression of cardiovascular complications in individuals with kidney disease.

Therefore, the objective of this literature review was to analyze the relationship between arterial hypertension, kidney disease, and left ventricular hypertrophy, with emphasis on the pathophysiological mechanisms related to sodium and water regulation, activation of the renin–angiotensin–aldosterone system, increased blood pressure, and cardiac overload.

METHOD

This study consisted of a descriptive and qualitative literature review addressing the relationship between arterial hypertension, kidney disease, and cardiovascular complications, with emphasis on the mechanisms involved in the development of left ventricular hypertrophy. The literature search presented in the source material was based primarily on two scientific articles. The first was the study by Hall et al., published in 2003, entitled Obesity-associated hypertension and kidney disease, published in *Current Opinion in Nephrology and Hypertension*. The second was the study by Mitchell, published in 2013, entitled Arterielle Hypertonie und Nierenerkrankungen [Arterial hypertension and chronic kidney disease], published in *MMW Fortschritte der Medizin*.^{1,2}

The selected studies were analyzed with particular attention to the relationship between arterial hypertension and renal dysfunction, including alterations in sodium and water handling, blood pressure regulation, and activation of the renin–angiotensin–aldosterone system. Hall et al. were considered because of their discussion of the mechanisms linking obesity-associated hypertension and kidney disease, whereas Mitchell contributed information regarding the diagnosis, treatment, and blood pressure targets in patients with arterial hypertension and chronic kidney disease.^{1,2}

The information obtained from the studies was subsequently synthesized and organized according to the main pathophysiological mechanisms described in the literature. The analysis established the relationship between renal impairment, chronic elevation of blood pressure, increased ventricular afterload, and the development of left ventricular hypertrophy.

The source material did not specify the exact search period, databases used, formal inclusion and exclusion criteria, or the application of a specific review protocol such as PRISMA, JBI, or another systematic review framework. Therefore, these methodological elements were not added to avoid introducing information that was not documented in the original material.

RESULTS

The results of the literature review demonstrated a bidirectional relationship between arterial hypertension and kidney disease. Renal function plays a fundamental role in maintaining blood pressure through the regulation of sodium and water balance. When the kidneys have a reduced ability to adequately excrete these substances, extracellular fluid volume increases, contributing to elevated blood pressure. In addition, activation of the renin–angiotensin–aldosterone system promotes sodium retention and vasoconstriction, increasing systemic vascular resistance and contributing to the maintenance of hypertension.¹

The relationship between the two conditions does not occur in only one direction. Chronic arterial hypertension may progressively damage the renal vasculature and impair kidney function. At the same time, renal dysfunction may further aggravate hypertension. This process establishes a cycle in which hypertension and renal impairment may reinforce one another, increasing the risk of cardiovascular complications.¹

Another important finding was the relevance of adequate blood pressure control in patients with kidney disease. Regular blood pressure assessment, appropriate therapeutic targets, and antihypertensive treatment are important measures for reducing both renal and cardiovascular damage. Blood pressure management in this population is not intended only to reduce blood pressure levels but also to limit the progression of renal impairment and decrease cardiovascular risk.²

Persistent elevation of blood pressure also has important effects on the heart. Chronic elevation of the pressure against which the left ventricle must eject blood results in increased ventricular afterload. As an adaptive response to this overload, myocardial remodeling occurs, characterized by thickening of the ventricular wall and development of left ventricular hypertrophy. Initially, left ventricular hypertrophy may represent a compensatory response that allows the heart to maintain adequate function despite increased workload. However, when the overload persists, this remodeling may become maladaptive. Increased myocardial mass may be associated with greater oxygen requirements, impaired ventricular relaxation, and progressive cardiac dysfunction.

Therefore, the findings analyzed demonstrate a pathophysiological sequence in which impaired renal function may contribute to sodium and water retention and activation of the renin angiotensin–aldosterone system, favoring hypertension. Persistent hypertension, in turn, increases cardiovascular workload and may contribute to the progression of renal injury and the

development of left ventricular hypertrophy. This continuous interaction demonstrates the importance of an integrated approach to renal and cardiovascular conditions.

CONCLUSION

The literature review demonstrated that the relationship between arterial hypertension, kidney disease, and left ventricular hypertrophy is complex and bidirectional. Impaired renal function may contribute to persistent hypertension through alterations in sodium and water balance and activation of the renin–angiotensin–aldosterone system, whereas chronic hypertension may contribute to progressive renal injury. At the same time, persistent elevation of blood pressure increases ventricular afterload and promotes cardiac remodeling, which may result in the development and progression of left ventricular hypertrophy.

The findings reinforce the importance of early diagnosis, continuous monitoring, and adequate blood pressure control in individuals with kidney disease. Integrated management of renal and cardiovascular alterations may contribute to reducing cardiac overload and limiting the progression of renal and cardiac damage. Future studies involving a larger body of evidence and broader review methods may further clarify the mechanisms involved and evaluate strategies aimed at reducing the occurrence and progression of left ventricular hypertrophy in patients with kidney disease.

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