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Role of lipoprotein (a) in kidney diseases; a review of recent data

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Abstract

Lipoprotein (a) is a type of lipoprotein that consists of a cholesterol-rich low-density lipoprotein particle bound to a unique protein called apolipoprotein (a). A strengthened risk of vascular diseases, such as stroke and coronary artery disease is accompanied by elevated levels of this protein. However, recent research has also highlighted the potential role of lipoprotein (a) in kidney-related conditions. Lp (a) appears to play a significant role in kidney diseases. An increased risk of kidney disease development and progression, diabetic nephropathy and renal artery stenosis, and renal transplant dysfunction accompanies high plasma values of Lp (a).

Keywords: Lipoprotein (a), Chronic kidney disease, Cardiovascular disease, Inflammation, Dyslipidemia, Oxidative stress, Endothelial dysfunction, Diabetic nephropathy, Atherosclerosis, Hemodialysis

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Introduction

Lipoprotein (a) (Lp (a)) is a unique lipoprotein that consists of a low-density lipoprotein (LDL) particle combined with a glycoprotein called apolipoprotein (a) [apo(a)] (1). High plasma values of Lp (a) have been identified as a risk factor for cardiovascular disease (CVD) (2). Chronic kidney disease (CKD) patients often exhibit dyslipidemia, including increased levels of Lp (a), which contributes to their increased risk of CVD (3).

Moreover, hemodialysis patients often have dyslipidemia, characterized by elevated levels of triglycerides and low levels of HDL cholesterol. Lp (a) levels are also commonly elevated due to impaired clearance or increased production. Previous studies have suggested that elevated Lp (a) levels have been associated with increased arterial stiffness and vascular calcification, both of which are common complications in this population (3,4).

In CKD patients, several factors contribute to the elevation of Lp (a) levels. First, impaired kidney function leads to a decrease in the clearance of Lp (a), resulting in its accumulation in the bloodstream. Additionally, CKD patients often exhibit increased hepatic Lp (a) production, further exacerbating the elevated levels (5,6).

Lp (a) has also been implicated in the pathogenesis of diabetic nephropathy, a common complication of diabetes that can lead to CKD. High levels of Lp (a) have been found in individuals with diabetic nephropathy, and it has been suggested that Lp (a) may contribute to the development and progression of this condition through various mechanisms. These include promoting inflammation, endothelial cell dysfunction and oxidative stress, while these conditions play a role in the pathogenesis of diabetic nephropathy (7,8).

Furthermore, Lp (a) has been associated with other kidney-related conditions such as renal artery stenosis and renal transplant dysfunction (5, 6). In patients with renal

Key point

Lipoprotein (a) is a cholesterol-rich lipoprotein that, due to its unique composition of low-density lipoprotein and Apo-lipoprotein (a), has been linked to an elevated risk of vascular diseases, including stroke and coronary artery disease. Recent research has expanded our understanding of Lp (a), revealing its significant role in kidney health, where high plasma levels are associated with an increased risk of developing and progressing kidney diseases, such as chronic kidney disease, diabetic nephropathy, renal artery stenosis, and complications following renal transplantation. This highlights the importance of assessing Lp (a) levels in clinical practice, as early identification of elevated Lp (a) could facilitate timely interventions to mitigate risks associated with both cardiovascular and renal health.

artery stenosis, elevated levels of Lp (a) have been observed, suggesting a potential role in the pathogenesis or progression of this condition (7). In renal transplant recipients, high levels of Lp (a) have been associated with graft dysfunction and reduced graft survival (9).

Lipoprotein (a) has been shown to play a role in the pathogenesis of atherosclerosis and CVD. It promotes endothelial cell dysfunction, inflammation, and thrombosis, since these conditions attribute to the development of cardiovascular complications (10). CKD patients already have an increased risk of CVD due to several factors, including oxidative stress, inflammation, and endothelial dysfunction. The presence of elevated Lp (a) levels in these patients further contributes to their cardiovascular burden (11).

Several studies have suggested that Lp (a) may promote inflammation, oxidative stress, and endothelial dysfunction, all of which can contribute to the development and progression of kidney diseases (12). Lp (a) has been shown to activate inflammatory pathways in the kidneys, leading to the production of pro-inflammatory cytokines and chemokines. This can cause damage to the renal tubules and glomeruli, leading to kidney dysfunction (13). Lp (a) can also increase oxidative stress in the kidneys by promoting the production of reactive oxygen species (ROS). This can cause damage to the renal cells and tissues, leading to kidney dysfunction. Meanwhile, Lp (a) can impair endothelial function by inhibiting the production of nitric oxide (NO), a key mediator of vascular function. This can lead to vasoconstriction, reduced blood flow to the kidneys, and ultimately kidney dysfunction (14, 15). In addition, Lp (a) may contribute to the development of kidney diseases by promoting the accumulation of cholesterol and other lipids in the renal tissues. This can lead to the formation of lipid deposits in the kidneys, which can impair renal function and finally, Lp (a) has been shown to promote fibrosis in the kidneys by stimulating the production of extracellular matrix proteins such as collagen. Excessive deposition of collagen leads to fibrotic changes in renal tissue, impairing its normal function (16, 17). Likewise, Lp (a) has been found to induce apoptosis (programmed cell death) in renal cells Increased apoptosis contributes to loss of functional renal cells and progressive decline in kidney function (18).

Conclusion

Studies have shown that high levels of Lp (a), a cholesterol-rich lipoprotein particle consisting of LDL bound to apolipoprotein (a), can contribute to the development and progression of kidney failure through various mechanisms, including the promotion of inflammation, oxidative stress, and fibrosis within the kidneys, as well as direct damage to renal cells and impairment of kidney function; moreover, Lp (a) can interact synergistically with other established risk factors for kidney diseases, such as hypertension, diabetes, and obesity, to significantly increase the risk of kidney damage and accelerate the decline in renal function, underscoring the importance of considering Lp (a) levels as a potential target for early intervention and management in patients with or at risk of developing chronic kidney disease.

Authors' contribution

Conceptualization: Sara Ghaseminejad Kermani and Tayabeh Bahmani.
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Writing–original draft: All authors.
Writing–review and editing: All authors.

Conflicts of interest

The authors declare that they have no competing interests.

Ethical issues

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