Brief Report
Volume 13:06, 2024

Journal of Hypertension: Open Access

ISSN: 2167-1095 Open Access

The Sodium-chloride Cotransporter Involved in Reducing Angiotensin II-induced Hypertension is Negatively Regulated by Peroxiredoxin

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Introduction

Hypertension, commonly referred to as high blood pressure, is a major risk factor for various cardiovascular diseases, including stroke, heart attack and kidney failure. It is one of the most prevalent and dangerous conditions globally, affecting millions of people and contributing significantly to morbidity and mortality rates. Among the various factors involved in the regulation of blood pressure, the Renin-Angiotensin System (RAS) plays a pivotal role in modulating vascular tone and fluid balance, thus influencing the development of hypertension. The sodium-chloride cotransporter (NCC) has emerged as a critical player in regulating blood pressure by controlling sodium reabsorption in the kidneys, which directly affects extracellular fluid volume and systemic vascular resistance. The relationship between NCC function, angiotensin II (Ang II) signaling and oxidative stress is of particular interest when exploring potential targets for hypertension therapy [1].

Description

Angiotensin II is a potent vasoconstrictor peptide that exerts significant effects on the cardiovascular system by promoting vasoconstriction, increasing sodium retention and stimulating the release of aldosterone. These actions collectively lead to an increase in blood pressure, making Ang II a key contributor to the pathogenesis of hypertension. The regulation of NCC activity is intimately linked to the actions of Ang II, as the cotransporter plays a critical role in sodium reabsorption in the renal distal convoluted tubule. Ang II enhances NCC activity through multiple signaling pathways, ultimately leading to an increase in sodium retention, extracellular fluid volume and blood pressure. Given the central role of NCC in the control of blood pressure, understanding the molecular mechanisms that govern its regulation is crucial for identifying therapeutic strategies aimed at treating hypertension.

One such regulatory mechanism involves the enzyme peroxiredoxin 5 (Prx5), a member of the peroxiredoxin family of antioxidant proteins. Peroxiredoxins are involved in the regulation of oxidative stress by scavenging Reactive Oxygen Species (ROS) and maintaining cellular redox homeostasis. Prx5, in particular, is known to be expressed in various tissues, including the kidney and has been implicated in modulating cellular responses to oxidative stress. Recent studies have highlighted the potential role of Prx5 in the regulation of NCC activity and, by extension, its impact on blood pressure control. Specifically, Prx5 has been shown to negatively regulate NCC function, thereby influencing the renal handling of sodium and contributing to the development of hypertension in response to Ang II [2].

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Received: 03 December, 2024, Manuscript No. jhoa-25-159560; **Editor Assigned:** 05 December, 2024, PreQC No. P-159560; **Reviewed:** 17 December, 2024, QC No. Q-159560; **Revised:** 23 December, 2024, Manuscript No. R-159560; **Published:** 30 December, 2024, DOI: 10.37421/2167-1095.2024.13.490

The increased sodium retention induced by Ang II contributes to the development of hypertension by increasing extracellular fluid volume and vascular resistance. Chronic elevation of Ang II levels, as seen in conditions like renovascular hypertension and certain forms of essential hypertension, leads to sustained activation of NCC and an increased risk of high blood pressure. Given its importance in sodium homeostasis and blood pressure regulation, NCC has become an attractive target for therapeutic interventions aimed at reducing the impact of Ang II-induced hypertension.

In addition to its direct effects on blood pressure, Ang II also promotes oxidative stress in various tissues, including the kidney. Ang II-induced oxidative stress results from the increased production of Reactive Oxygen Species (ROS), which can damage cellular components and interfere with normal cellular function. Oxidative stress has been implicated in the dysregulation of NCC activity and the development of hypertension. The interplay between Ang II, oxidative stress and NCC regulation is a critical area of research in understanding the molecular mechanisms underlying hypertension.Peroxiredoxins are a family of antioxidant enzymes that play a crucial role in maintaining cellular redox homeostasis by scavenging Reactive Oxygen Species (ROS). These enzymes protect cells from oxidative damage by reducing hydrogen peroxide (H_2O_2) and other ROS, thus preventing the harmful effects of oxidative stress. Prx5, a member of the peroxiredoxin family, is particularly important in regulating oxidative stress in various tissues, including the kidney [3].

Recent studies have suggested that Prx5 may also regulate NCC activity. Specifically, Prx5 has been shown to negatively regulate NCC function by modulating the redox state of the transporter. In the presence of increased oxidative stress, Prx5 can reduce ROS levels, thereby preventing the activation of signaling pathways that would otherwise enhance NCC activity. This regulatory effect of Prx5 is important in controlling sodium reabsorption in the kidneys and maintaining normal blood pressure.

The interaction between Prx5 and Ang II signaling is a critical factor in the regulation of NCC activity and blood pressure. Ang II induces oxidative stress through the generation of ROS, which can activate various signaling pathways that enhance NCC activity. However, Prx5 acts as a counterbalance to this oxidative stress by reducing ROS levels and inhibiting the activation of NCC. In this way, Prx5 serves as a negative regulator of NCC, preventing excessive sodium reabsorption and helping to maintain normal blood pressure [4,5].

Conclusion

Hypertension remains a significant public health challenge and understanding the molecular mechanisms underlying its pathogenesis is essential for developing effective treatments. The sodium-chloride cotransporter plays a central role in regulating sodium balance and blood pressure and its activity is tightly controlled by various signaling pathways, including those involving angiotensin II (Ang II). Recent research has highlighted the role of peroxiredoxin 5 (Prx5), an antioxidant enzyme, in regulating NCC function by modulating oxidative stress. Prx5 negatively regulates NCC activity, helping to maintain blood pressure homeostasis in the face of Ang II-induced hypertension. Given the importance of this regulatory pathway, targeting the Prx5-NCC axis may provide a promising therapeutic strategy for managing hypertension. Further research into the molecular interactions between Prx5, NCC and Ang II signaling will be crucial for identifying novel interventions to

combat hypertension and its associated complications.

References

1. Hadchouel, Juliette, Céline Delaloy, Sébastien Fauré and Jean-Michel Achard, et al. "Familial hyperkalemic hypertension." *J Am Soc Nephrol* 17 (2006): 208-217.
2. Wilson, Frederick H., Sandra Disse-Nicodeme, Keith A. Choate and Kazuhiko Ishikawa, et al. "Human hypertension caused by mutations in WNK kinases." *Science* 293 (2001): 1107-1112.
3. Boyden, Lynn M., Murim Choi, Keith A. Choate and Carol J. Nelson-Williams, et al. "Mutations in kelch-like 3 and cullin 3 cause hypertension and electrolyte abnormalities." *Nature* 482 (2012): 98-102.
4. Knighton, Daniel R., Jianhua Zheng, Lynn F. Ten Eyck and Victor A. Ashford, et al. "Crystal structure of the catalytic subunit of cyclic adenosine monophosphate-dependent protein kinase." *Science* 253 (1991): 407-414.
5. Elkins, Jonathan M., Vita Fedele, Marta Szklarz and Kamal R. Abdul Azeez, et al. "Comprehensive characterization of the published kinase inhibitor set." *Nat Biotechnol* 34 (2016): 95-103.

How to cite this article: Hall, Muntner. "The Sodium-chloride Cotransporter Involved in Reducing Angiotensin II-induced Hypertension is Negatively Regulated by Peroxiredoxin." *J Hypertens* 13 (2024): 490.