Hopkins, C. D., Wessel, C., Chen, O., El-Kersh, K., Cave, M. C., Cai, L., & Huang, J. (2023). Potential roles of metals in the pathogenesis of pulmonary and systemic hypertension. *International Journal of Biological Sciences*, *19*(16), 5036-5054. https://doi.org/10.7150/ijbs.85590

Definitions

- **Pulmonary Hypertension (PH)**: High blood pressure in the arteries of the lungs.
- **Systemic Hypertension (SH)**: High blood pressure in the arteries throughout the body.
- **Vasoconstriction**: Narrowing of blood vessels.
- **Oxidative Stress**: Damage caused by free radicals (unstable molecules) in the body.
- **Metals**: Elements like iron, copper, and lead that can affect health.
- **Right Ventricular (RV) Dysfunction**: Problems with the right side of the heart.

Key Findings

- Metals can contribute to both pulmonary and systemic hypertension.
- Metal exposure leads to oxidative stress, inflammation, and blood vessel changes.
- Essential metals (like iron and copper) and non-essential metals (like lead and cadmium) can both affect blood pressure and heart function.
- More research is needed to fully understand how metals influence these conditions.

Introduction

This study reviews how different metals might play a role in causing pulmonary and systemic hypertension. Both types of hypertension involve high blood pressure, but they affect different parts of the circulatory system. The study explores how metals can cause blood vessel changes, oxidative stress, and heart problems.

Main Content

Background

Pulmonary hypertension (PH) is a condition characterized by high blood pressure in the arteries of the lungs. This condition can lead to serious heart and lung issues. Systemic hypertension (SH), on the other hand, is high blood pressure in the arteries throughout the body, which can cause heart disease and stroke. Understanding the roles of metals in these conditions can help us find better ways to treat and prevent them.

Methods

- **Literature Review**: Examined previous studies on metals and hypertension.

- **Comparative Analysis**: Compared effects of essential and non-essential metals on PH and SH.
- **Mechanistic Study**: Investigated how metals cause oxidative stress and inflammation.

Results

Metals and Hypertension

- **Lead (Pb)**:
    - Increases oxidative stress and disrupts nitric oxide production, causing blood vessels to narrow.
- **Cadmium (Cd)**:
    - Leads to increased oxidative stress and disrupts blood vessel function.
- **Copper (Cu)**:
    - High levels cause oxidative stress, while normal levels are essential for heart health.
- **Iron (Fe)**:
    - Both deficiency and excess can lead to oxidative stress and blood vessel changes.
- **Zinc (Zn)**:
    - Necessary for enzyme function, but high levels can cause oxidative stress.

Mechanisms of Metal-Induced Hypertension

- **Oxidative Stress**: Metals can cause an imbalance of free radicals and antioxidants, damaging cells and tissues.
- **Inflammation**: Metals can trigger immune responses, leading to chronic inflammation.
- **Blood Vessel Changes**: Metals can cause blood vessels to narrow and stiffen, increasing blood pressure.

Conclusion

Metals, both essential and non-essential, play significant roles in the development of pulmonary and systemic hypertension. They cause oxidative stress, inflammation, and blood vessel changes, which contribute to high blood pressure and heart problems. More research is needed to develop treatments that address metal-induced hypertension and to understand the specific mechanisms involved.

Word Count: 452