Jin, L., Lorkiewicz, P., Xie, Z., Bhatnagar, A., Srivastava, S., & Conklin, D. J. (2021). Acrolein but not its metabolite, 3-Hydroxypropylmercapturic acid (3HPMA), activates vascular transient receptor potential Ankyrin-1 (TRPA1): Physiological to toxicological implications. *Toxicology and applied pharmacology*, *426*, 115647. https://doi.org/10.1016/j.taap.2021.115647

Definitions

- **Acrolein:** A harmful chemical found in smoke, pollution, and some foods.
- **Metabolite:** A substance made when the body breaks down chemicals.
- **TRPA1:** A protein that helps detect harmful substances and can cause pain or inflammation.
- **Vasorelaxation:** The relaxation of blood vessels, which can affect blood flow.
- **Vasotoxicity:** Damage to blood vessels.

Key Findings

- Acrolein activates the TRPA1 protein, causing blood vessels to relax at low levels but damaging them at high levels.
- The metabolite of acrolein, 3HPMA, does not activate TRPA1 and is less harmful to blood vessels.
- High levels of acrolein can cause blood vessel spasms and permanent damage.

Introduction

The study investigates how acrolein, a harmful chemical found in the environment, affects blood vessels. It focuses on acrolein's interaction with the TRPA1 protein, which can lead to both beneficial and harmful effects on the cardiovascular system.

Main Content

Background

Acrolein is present in smoke from fires, tobacco, and vehicle emissions. It is also found in some foods and drinks. Acrolein can penetrate cell membranes and cause significant harm, including cardiovascular problems.

Methods

The researchers used mice to study the effects of acrolein on blood vessels. They measured how acrolein and its metabolite, 3HPMA, affect blood vessel relaxation and contraction. They also tested various inhibitors to understand the mechanisms involved.

Results

Acrolein's Effects on Blood Vessels

- Acrolein caused significant relaxation of blood vessels at low concentrations but led to spasms and damage at high concentrations.
- This relaxation was dependent on the TRPA1 protein, nitric oxide, and guanylyl cyclase activity.
- TRPA1 was found in the endothelial cells lining the blood vessels.

3HPMA's Effects on Blood Vessels

- 3HPMA did not activate TRPA1 and caused less relaxation compared to acrolein.
- 3HPMA did not cause spasms or significant damage to the blood vessels.

Inhibitor Studies

- Blocking TRPA1, nitric oxide synthase, or guanylyl cyclase reduced the relaxation effects of acrolein.
- These findings suggest that TRPA1, nitric oxide, and guanylyl cyclase play crucial roles in acrolein-induced vasorelaxation.

Conclusion

Acrolein activates the TRPA1 protein in blood vessels, leading to relaxation at low levels and damage at high levels. Its metabolite, 3HPMA, does not activate TRPA1 and is less harmful. Understanding these mechanisms can help develop strategies to mitigate the harmful effects of acrolein exposure on the cardiovascular system. Reducing acrolein exposure from environmental sources could improve heart health and prevent vascular damage.

Word Count: 387