Open Access Mini-Review

Journal of Renal Endocrinology

J Ren Endocrinol 2023;9:e25128.
https://www.jrenendo.com
doi: 10.34172/jre.2023.25128

Nickan Research Institute

Renal endocrine aspects of exercise-induced acute kidney injury (gym nephropathy)

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Abstract
The important renal endocrine aspect implicated in gym nephropathy is the activation of the renin-angiotensin-aldosterone system (RAAS). Intense exercise can lead to increased sympathetic nervous system activity, resulting in the release of renin from the juxtaglomerular cells in the kidneys. Renin acts on angiotensinogen, leading to the generation of angiotensin II, a potent vasoconstrictor. Angiotensin II stimulates the secretion of aldosterone from the adrenal glands, which promotes sodium reabsorption and potassium excretion in the kidneys. The persistent activation of the RAAS in gym nephropathy may contribute to renal damage by causing vasoconstriction and promoting renal inflammation.
Keywords: Gym nephropathy, Exercise-induced nephrotoxicity, Exercise, Bodybuilding, Renin-angiotensin-aldosterone system
Citation: Moonesan MR. Renal endocrine aspects of exercise-induced acute kidney injury (gym nephropathy). J Ren Endocrinol. 2023;9:e25128. doi: 10.34172/jre.2023.25128.

Introduction

Gym nephropathy, also known as exercise-induced acute kidney injury, is a condition characterized by the sudden onset of kidney dysfunction following intense physical activity or exercise (1,2). While the exact mechanisms underlying gym, nephropathy are not fully understood, there are several renal endocrine aspects that may contribute to its development.

Search strategy

For this mini-review, I conducted a comprehensive search using various databases: PubMed, Google Scholar, Directory of Open Access Journals (DOAJ), Web of Science, EBSCO, Scopus, and Embase. We utilized different keywords such as gym nephropathy, exercise-induced nephrotoxicity, exercise, bodybuilding and renin-angiotensin-aldosterone system.

Potential factors of gym nephropathy

Gym nephropathy is a multifactorial condition, and these renal endocrine aspects may interact with other factors such as individual susceptibility, pre-existing medical conditions, and hydration status. Further research is needed to fully understand the complex pathophysiology of gym nephropathy and develop effective preventive strategies (2).

Anabolic steroids

The illegal use of anabolic steroids is sometimes associated with gym nephropathy. Anabolic steroids are synthetic derivatives of testosterone that can have potent effects on muscle growth. However, their use can also have adverse effects on the kidneys. Anabolic steroids can cause an increase in blood pressure and disrupt the hormonal balance in the body, potentially leading to kidney damage (3,4).

Growth hormone and insulin-like growth factor-1

Some individuals involved in bodybuilding may misuse growth hormone and insulin-like growth factor-1 (IGF-1) to enhance muscle growth. These substances can affect the kidneys in several ways. Growth hormone can increase the production of insulin-like growth factor-binding proteins, which may lead to kidney damage. Additionally, excessive growth hormone and IGF-1 can cause enlargement of organs, including the kidneys, potentially affecting their function (5,6).

Dehydration and diuretic use

Bodybuilders may engage in practices to reduce water retention and achieve a more defined muscle appearance. This can include excessive sweating, dehydration, and the use of diuretics. Dehydration can strain the kidneys and

Received: 23 May 2023, Accepted: 14 July 2023, ePublished: 24 July 2023

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Implication for health policy/practice/research/ medical education

Gym nephropathy (exercise-induced nephrotoxicity) refers to the kidney damage and dysfunction that can occur as a result of intense and prolonged exercise, across with excessive use of certain substances in the context of bodybuilding or weightlifting.

impact their function. Diuretics, when misused or taken in excessive amounts, can also put additional stress on the kidneys (7,8).

It is important to note that gym nephropathy is not limited to these endocrine aspects, and other factors such as overexertion, high-protein diets, and dietary supplement use may also contribute to kidney damage (9,10).

While the main mechanisms behind gym nephropathy are still being studied, there is evidence to suggest involvement of renal endocrine aspects. The suggesting parameters are the following mechanistic impacts:

Renin-angiotensin-aldosterone system (RAAS) Activation

Intense exercise can lead to activation of the RAAS, which plays a crucial role in regulating blood pressure and fluid balance. The release of renin from the kidneys stimulates the production of angiotensin II, a potent vasoconstrictor that increases blood pressure (11). Angiotensin II also stimulates the release of aldosterone from the adrenal glands, promoting sodium and water reabsorption in the kidneys. Excessive activation of the RAAS can lead to vasoconstriction and reduced renal blood flow, potentially contributing to kidney injury (11,12).

Catecholamine release

During intense exercise, there is an increased release of catecholamines such as epinephrine and norepinephrine from the adrenal glands. These hormones help mobilize energy reserves and increase cardiac output. However, excessive catecholamine release can cause vasoconstriction in the renal arteries, reducing renal blood flow and oxygen delivery to the kidneys (13,14).

Inflammatory response

Intense exercise can trigger an inflammatory response in various tissues, including the kidneys. Inflammatory mediators such as cytokines and chemokines can directly damage renal cells and impair kidney function. Additionally, inflammation-induced oxidative stress may further contribute to kidney injury. Furthermore, exercise-induced oxidative stress is another factor that can affect renal endocrine function in gym nephropathy (15,16). Intense physical activity leads to an increased production of reactive oxygen species (ROS) in the body. ROS can directly damage renal cells and impair their function. It has been found that excessive ROS can disrupt the delicate balance of various renal hormones, including vasopressin and atrial natriuretic peptide (ANP) (17,18). Vasopressin is responsible for regulating water reabsorption in the kidneys, while ANP plays a role in maintaining sodium and water balance. Disruptions in the secretion or actions of these hormones due to oxidative stress may contribute to the development of kidney dysfunction in gym nephropathy (19,20).

Fluid and electrolyte imbalance

Prolonged or intense exercise can result in significant fluid and electrolyte losses through sweating. Dehydration and electrolyte imbalances, particularly sodium depletion (hyponatremia), can disrupt normal kidney function and impair renal blood flow (21,22).

Rhabdomyolysis

In rare cases, intense exercise can lead to rhabdomyolysis, a condition characterized by the breakdown of muscle tissue and the release of myoglobin into the bloodstream. Myoglobin can cause direct kidney injury by obstructing renal tubules and triggering inflammation (23,24).

Conclusion

Gym nephropathy involves various renal endocrine aspects, including the activation of the RAAS and the disruption of renal hormonal balance due to oxidative stress. Understanding these mechanisms can help in identifying potential therapeutic targets for the prevention and treatment of gym nephropathy. However, it is important to note that further research is needed to fully understand the complex interactions between exercise, renal endocrine function, and kidney damage.

Conflicts of interest

The author declares that he has no competing interests.

Ethical issues

Ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the author.

Funding/Support

Nil.

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