Prevalence, risk factors, and management of Conn’s syndrome; a systematic review

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ABSTRACT
Conn syndrome, named after J. W. Conn in 1955, denotes a condition marked by hypertension (HTN) with an aldosterone-producing adenoma. This adenoma triggers heightened aldosterone secretion from the adrenal glands, resulting in suppressed plasma renin, HTN, and hypokalemia. This systematic study aimed to explore the prevalence, risk factors, and management of Conn’s syndrome. PubMed/Medline and Scopus databases were scrutinized for English-language articles from 2010 to 2023, adhering to Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. Among 142 studies identified, 10 met the criteria for inclusion. Surveys and analyses of national databases were the predominant research methods. Formerly deemed uncommon, Conn’s syndrome now accounts for 5%-15% of hypertensive patients. The deleterious impact of aldosterone extends beyond HTN, affecting various organs. Timely intervention, whether pharmacological (aldosterone antagonists) or surgical [adrenalectomy (ADX)], proves effective in mitigating these effects. Early diagnosis and appropriate testing are imperative. Salt intake reduction is crucial, given its association with aldosterone-mediated damage. However, patients often exceed the recommended 5 g/day, posing a challenge for lifestyle interventions. ADX, in addition to lowering cardiovascular risk, naturally reduces salt intake. Clinical research underscores the role of dietary salt in predicting cardiovascular risk, emphasizing its significance even with adequate treatment.

Keywords: Conn syndrome, Cushing syndrome, aldosterone, cortisol, adrenal tumor, primary aldosteronism, hypertension.

Introduction
Conn syndrome, initially identified by J. W. Conn in 1955, is characterized by aldosterone-producing adenoma (APA) and hypertension (HTN). The condition manifests through heightened secretion of aldosterone by the adrenal glands, leading to hypokalemia, HTN, and suppressed plasma renin. Currently categorized as primary hyperaldosteronism, Conn syndrome encompasses cases with or without adenomas. Accurately diagnosing Conn syndrome involves distinguishing it from idiopathic adrenal hyperplasia, managed with medication, and aldosteronomas. This diagnostic challenge is crucial due to potential contributors like ectopic secretion, adrenocortical carcinomas, familial disease, and aldosterone-producing renin-responsive adenomas, all of which can elevate aldosterone levels [1,2].

Adrenal hyperplasia, adrenal adenoma, aldosterone-secreting adrenal carcinoma, and familial hyperaldosteronism (FH) are potential contributors to aldosteronism. Aldosterone hypersecretion arises from rare familial forms of the disease, mostly affecting calcium influx and membrane depolarization. Type 1 FH involves an unequal crossover of homologous CYP11B2 and CYP11B1 genes, creating a chimeric...
gene regulated by adrenocorticotrophin. Type 2, which is autosomal dominant and heterogeneous, may be linked to chromosome 7p22. KCNJ5 gene mutations cause type 3, associated with milder forms of aldosteronism. Mutations in other genes encoding membrane proteins induce increased aldosterone production through calcium influx and activated calcium signaling pathways. A single-nucleotide polymorphism of the NR3C2 gene is associated with elevated activation of the renin-angiotensin-aldosterone system (RAS) and blood pressure. Aldosteronomas typically originate from the zona fasciculata, displaying marked glandular hyperplasia. Increased RAS activation and blood pressure have been correlated with a single-nucleotide polymorphism of the NR3C2 gene [3,4].

Primary hyperaldosteronism, prevalent in 6%-20% of adult hypertensive patients, is a leading cause of secondary HTN, especially in those with resistant HTN. Utilizing the aldosterone-to-renin ratio (ARR) as a screening tool increases the prevalence to 30%. Among cases, 50%-60% involve aldosterone-producing adenomas, with idiopathic or bilateral adrenal hyperplasia (BAH) being more common in women [5].

Primary hyperaldosteronism, triggered by various conditions, elevates the body’s aldosterone levels, promoting potassium excretion and renal sodium reabsorption. This process contributes to fibrosis, tissue inflammation, and HTN in vital organs such as the kidneys, heart, and vasculature. Potential complications encompass stroke, ischemic heart disease, congestive heart failure, chronic kidney disease, and atrial fibrillation (AF). Patients also manifest metabolic alkalosis and hypokalemia. Notably, approximately one-fifth of individuals with Conn syndrome exhibit impaired glucose tolerance due to hypokalemia’s inhibitory effects on insulin secretion [6,7].

Various histological characteristics, including diffuse hyperplasia, atrophy, and hyperplasia of the adrenal cortex, serve as indicators of Conn syndrome. Patients commonly report symptoms such as fatigue, palpitations, cramps, headaches, and muscle weakness. Polydipsia and polyuria may also occur due to nephrogenic diabetes insipidus induced by hypokalemia. In many cases, persistent hypokalemia and HTN contribute to the development of Conn syndrome, and the initiation of diuretics can lead to severe arrhythmias in some individuals. Treatment-resistant HTN may be observed in certain patients. Physical findings may include HTN-associated abdominal distension, ileus, bruises, altered mental status, and retinopathy [5].

Primary hyperaldosteronism is a prevalent condition characterized by hypokalemia in hypertensive patients, yet up to 38% of patients, particularly those with adrenal hyperplasia or familial aldosteronism, may exhibit normal serum potassium levels. Bloodwork may reveal hypokalemia, hypernatremia, and metabolic alkalosis due to aldosterone’s impact on the distal convoluted tubule. Diagnosis relies on elevated urinary potassium excretion and non-suppressible aldosterone secretion. The ARR test exhibits high variability in cut-off values, necessitating additional confirmatory studies. Following the confirmation of autonomous aldosterone production, the subsequent step involves assessing for potential adenoma. While computed tomography (CT) scans may identify adenomas in 70% of cases, idiopathic hyperaldosteronism stands as the most prevalent cause. Studies to verify the unilateral nature of adrenal hypersecretion have inherent limitations. Plasma 18-hydroxycorticosterone levels are elevated in adenomas and normal in adrenal hyperplasia. Considering the diurnal rhythm of the hormone is crucial before measuring aldosterone levels, with the lowest concentrations typically observed around midnight and peaking in the morning between 7 and 8 am [8,9].

The treatment for HTN involves normalizing blood pressure, electrolyte levels, and aldosterone levels. Depending on the underlying cause, treatment options encompass medication for idiopathic hyperaldosteronism or unilateral adrenalectomy (ADX) for unilateral adenoma (Conn syndrome). Aldosterone antagonists like eplerenone or spironolactone are employed to lower blood pressure. In situations involving fragile patients with multiple comorbidities, nonsurgical treatment is a viable option [5,10].

Unilateral lesions are removed through ADX, with spironolactone treatment initiated 4-6 weeks prior to the procedure. Although it may take 6-12 months for blood pressure to stabilize, the majority of patients (approximately two-thirds) recover from surgery and achieve normotension. However, only 50% of patients maintain normotension after 5 years. Patients who do not respond to spironolactone before surgery may still have high blood pressure [10].

Conditions that characterize Conn syndrome include HTN, metabolic alkalosis, renal artery stenosis, malignant HTN, licorice intake, preeclampsia, Gitelman syndrome, Barter syndrome, and adrenal carcinoma. The primary causes of high morbidity and mortality, if left untreated, are hypokalemia and HTN. Complications may include acute myocardial infarction, stroke, heart failure, retinopathy, end-stage renal disease, and issues following Conn syndrome surgery. Diagnosing and managing Conn syndrome is complex and requires an interprofessional team. Diagnosis is challenging due to the absence of standardized tests and potential false-negative results in patients with chronic kidney disease, potassium supplements, or beta-blockers. Treatment options encompass diuretics, angiotensin-converting enzyme inhibitors, and angiotensin receptor blockers. Unilateral ADX can cure HTN in 30%-60% of cases, but only 19% in patients with idiopathic hyperaldosteronism. Pharmacists play a crucial role in diuretic selection and dosing, checking for drug interactions, and reporting concerns to the clinical team. Nurses should be familiar with the pathophysiology and expected abnormalities in laboratory testing [5,11]. This review provides a comprehensive assessment of the latest research on the
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Methods
The current systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) standards.

Search
Keywords and medical subjects headings phrases were utilized to search PubMed/Medline (2010 to August 2023) and Embase (2010 to August 2023) for pertinent concepts: prevalence, risk factors, and management of Conn’s syndrome. Only English-language items were included, with additional studies identified through reference examination. Upon retrieving all full texts, 10 articles were included in this review. The PRISMA technique facilitated search screening and article shortlisting (Figure 1).

Inclusion criteria
English articles, articles, and reviews demonstrating the prevalence, risk factors, and management of Conn’s syndrome.

Exclusion criteria
Incomplete data was excluded. Research data predating 2010 and studies not discussing Conn’s syndrome were excluded.

Data collection
Out of the 142 studies initially identified, 42 papers were considered after checking titles and abstracts. Following full-text reading, 10 papers qualified for analysis (Figure 1).

Data extraction
Table 1 presents a concise overview of the data, encompassing author(s) name and year, prevalence of Conn’s syndrome, risk factors, and management.

Discussion
Conn’s syndrome management, risk factors, and prevalence are elucidated in this review. Ten publications addressing Conn’s syndrome were identified in this systematic review. Unlike Cushing’s syndrome, Connshing syndrome, a persistent condition, has traditionally been primarily associated with primary aldosteronism (PA). However, recent developments have reshaped conventional paradigms, revealing that Conn syndrome and Cushing syndrome are just two of over 15 causes of endocrine HTN. Although Connshing syndrome appears to represent a cluster of interconnected conditions, further investigations in translational molecular genetics are necessary to determine whether it constitutes a distinct ailment. The 2022 WHO classification underscores the evolving understanding in endocrinology, recognizing previously conflated entities, such as pituitary neuroendocrine tumors distinguished by unique immunostaining and transcription factor profiles, now having distinct designations [22,23].
Table 1. Brief description of the data.

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<tr>
<th>Author and year</th>
<th>Prevalence</th>
<th>Risk factors</th>
<th>Management</th>
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<td>Monticone et al., 2017 [12]</td>
<td>The study included 1,672 primary care patients with HTN in total, 569 with a new diagnosis and 1,103 with an existing diagnosis of arterial HTN. A total of 91 patients (27 with an APA and 64 with BAH) had conclusive subtype differentiation by AVS, out of the 99 patients (5.9%) who received a PA diagnosis. From 3.9% in stage 1 HTN to 11.8% in stage 3 HTN, the overall prevalence of PA rose as the severity of HTN increased. Regardless of confounding variables, patients with PA exhibited a higher frequency of cardiovascular events and target organ damage than patients without PA. The two mainstay treatments for PA - adrenaectomy and MRAs - have long been thought to be equally effective.</td>
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<td>Yozamp and Vaidya, 2019 [13]</td>
<td>Although exact prevalence rates are difficult to determine, estimates of patients with resistant HTN and sleep apnea range from 1.0% to 36%. Even in people with normotension, the prevalence might be significant, but these patients are rarely checked for the condition. For PA, MRAs and surgical ADX can be beneficial treatments with good results. Uncertainty surrounds radiofrequency ablation as a new treatment. Recent research indicates that surgical ADX produces better cardiovascular outcomes than medical treatment, indicating that the former should be preferred whenever feasible. On the other hand, the effectiveness of surgical ADX may be approached by MR antagonist treatment at a dose high enough to increase plasma renin activity.</td>
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<td>Vilela and Almeida, 2017 [14]</td>
<td>With an estimated prevalence of 4% among hypertensive patients in primary care and roughly 10% among referred patients, PA is the most prevalent type of secondary HTN. Compared to age- and sex-matched patients with EH and the same degree of blood pressure elevation, patients with PA have higher cardiovascular morbidity and mortality. Spironolactone, a mineralocorticoid antagonist, can cause gynecomastia and loss of libido in men and menstrual irregularities in females. It can also cause breast tenderness and enlargement. To reduce side effects, amiloride or thiazide diuretic can be used. It should be administered cautiously in patients with stage III chronic kidney disease or older patients due to hyperkalemia and worsening renal function. Eplerenone, a selective mineralocorticoid antagonist, is less associated with endocrine side effects but has a higher cost and may be less effective in treating prostate cancer.</td>
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<td>Stowasser et al., 2018 [15]</td>
<td>Only 8 (33%) of the 24 patients with confirmed PA tested positive by recumbent SIT, while 23 (96%) tested positive by seated SIT. We advise case detection of PA in high-risk groups of hypertensive patients and hypokalemic patients by measuring the ARR under standard conditions. A widely used confirmatory test should be used to confirm or rule out the condition. It is recommended that patients who are not candidates for surgery or who have BAH be treated primarily with a MRA.</td>
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<td>Dick et al., 2017 [16]</td>
<td>Globally, adrenal adenoma and adrenal hyperplasia are the most frequent causes of PA, which has a prevalence of 5%-12%. In patients with PA, there is a higher chance of TOD and cerebro-cardiovascular events due to excess aldosterone. Therefore, imaging tests like magnetic resonance imaging or CT, as well as invasive research like adrenal catheterization, are required to determine the subtype of PA. The best course of action for each subtype of PA must be provided; for APA, this means surgery; for AH, it means medication, such as spironolactone and amiloride.</td>
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<td>Ceccato et al., 2023 [17]</td>
<td>Up to 5%-10% of patients with elevated BP are affected by a specific and potentially reversible cause that is known as secondary HTN. Age of HTN onset and serum potassium level. A few key steps comprise the diagnostic and therapeutic pathways for PA: screening tests in high-risk individuals, PA subtype identification, and treatment (mineralocorticoid receptor antagonist therapy if surgery is not an option for unilateral adenoma).</td>
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<td>Seccia et al., 2019 [18]</td>
<td>The most prevalent sustained arrhythmia is AF, which affects 1%-2% of the general population and over 15% of those over the age of 80.</td>
<td>The need for ongoing pharmaceutical treatment and the resulting higher risk of heart failure and hospitalization due to population aging place an increasing strain on the healthcare system. Finding the risk factors for AF is therefore extremely important.</td>
<td>Unhealthily elevated levels of aldosterone are present in a number of conditions, primarily PA and severe or treatment-resistant forms of arterial HTN. Aldosterone in these forms can seriously harm target organs, primarily the kidney, heart, and vasculature. This review looks at the clinical and experimental evidence supporting the hypothesis that hyperaldosteronism and AF are related, and how this information should alter how we treat hypertensive patients who present with AF.</td>
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<td>Valsan et al., 2017 [19]</td>
<td>RH may affect 10 million people in the USA alone, and it may also affect a similar number of people abroad.</td>
<td>Improved control is essential because there is a strong linear correlation between cardiovascular outcomes and HTN.</td>
<td>We prefer a multifaceted strategy. Using pharmaceuticals to treat this might not be enough. It is important to pay close attention to modifiable risk factors, especially sodium intake, follow a healthy diet (such as dietary approaches to stop hypertension), and refrain from using medications that can raise blood pressure, such as non-steroidal anticoagulants. Control can be significantly impacted by home blood pressure monitoring and routine follow-up to determine the best course of treatment. Lastly, in the future, thinking about device therapy might be a more practical choice.</td>
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<td>Pan et al., 2020 [20]</td>
<td>Along with arterial HTN and electrolyte imbalance, excessive aldosterone production is considered a major factor in the pathophysiology of AF. Furthermore, several translational and clinical investigations have documented the important roles that electrical remodeling with arrhythmogenicity brought on by an excess of aldosterone and structural remodeling associated with atrial fibrosis play in the genesis of AF. Clinical research from multiple registries as well as meta-analyses have shown that PA patients have a higher prevalence and risk of AF than EH patients.</td>
<td>Secondary HTN is most frequently caused by primary aldosteronism, or PA. There is mounting evidence that patients with PA have a higher risk of cardiovascular events than those with EH. This risk includes AF, the most common arrhythmia in adults, which is linked to an increased risk of subsequent cerebro-cardiovascular adverse events.</td>
<td>The risk of new-onset AF following ADX has also been shown to decrease in recent trials; however, the outcomes of medical treatment with MRAs have been mixed.</td>
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<td>Adolf et al., 2020 [21]</td>
<td>Nowadays, PA, which affects 5%-10% of hypertensives, is widely recognized as a significant contributor to secondary HTN.</td>
<td>The fact that PA is a potentially treatable form of HTN and that it causes harmful target organ damage in addition to raising blood pressure make it important to take into account. In addition to the known link between high dietary salt intake and cardiovascular disease and arterial HTN, high dietary salt intake is required for patients with PA to experience the harmful effects of aldosterone on target organ damage.</td>
<td>As a result, educating patients about the need of consuming less salt is crucial to treating PA and minimizing cardiovascular damage. Regrettfully, the World Health Organization’s recommended daily intake of 5 g of salt is significantly exceeded by the high salt intake of PA patients. Enhancing effects of aldosterone on salt appetite through central and gustatory pathways can exacerbate patients’ lack of motivation for lifestyle interventions. In this case, treating PA with an ADX causes a natural decrease in salt intake in the diet, which may further lower the cardiovascular risk in PA than specialized medical treatment alone. Additionally, there is proof from clinical studies that dietary salt intake is still a significant prognostic factor for PA even after adequate treatment.</td>
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Connshing syndrome represents a multifaceted and dynamic endocrine disorder marked by the excessive production of cortisol and aldosterone from the adrenal glands. In recent times, Conn syndrome has garnered increased attention, distinguishing it from more well-established endocrine disorders like Cushing syndrome. In 2017, the University of Birmingham research team identified a subgroup displaying glucocorticoid excess during their investigation of steroid metabolomics in individuals with PA. This subgroup has since been acknowledged as a distinct cause of secondary HTN. However, a specific nomenclature for this hormonal combination has not yet been universally adopted [24,25].

The leading cause of secondary HTN, constituting 4%-10% of cases and up to one-fifth of individuals with resistant HTN, is Conn syndrome. This condition exerts cardiovascular effects, contributing to neurological and renal complications, uncontrolled HTN, abnormal electrolyte levels, and a pro-inflammatory state. Despite its prevalence, Conn syndrome is often underdiagnosed. Its association with an increased risk of diabetes mellitus, characteristics of metabolic syndrome, osteoporotic fractures, depression, insulin release, and insulin resistance underscores its significant impact on health. In contrast, adrenal Cushing syndrome is linked to benign adenomas, bilateral adrenal lesions, or adrenocortical carcinoma. The autonomous cortisol secretion underlying clinical expression can manifest as overt or subclinical Cushing syndrome. The clinically apparent Cushing syndrome and even mild hypercortisolism carry a substantial medical and social burden due to the increased morbidity and mortality associated with heart failure, diabetes, thromboembolism, obesity, myopathy, osteoporosis, infections, depression, and neurocognitive impairment. Subclinical Cushing syndrome, typically found in 5%-50% of adrenal incidentalomas, can have a prevalence of up to 2% in individuals aged 60 and older, with potentially higher rates in adults experiencing impaired renal function. Ongoing clinical trials are evaluating promising options for high-risk populations with reduced renal function. Ongoing clinical trials are evaluating their efficacy. Nonsteroidal MRAs, with their high affinity and selectivity for the mineralocorticoid receptor, present potential advancements in the treatment of PA, offering more effective options for patients. Future ADX patient selection for unilateral PA will necessitate more precise techniques. Given the significant reduction in long-term cerebro-cardiovascular events and mortality associated with early diagnosis and targeted treatment approaches, maintaining a low screening threshold for PA is imperative [29-31].

The measurement of renin concentration is gradually replacing the ARR in plasma renin activity (PA) screening, resulting in approximately tenfold changes in cutoff points. Confirmation tests, such as saline infusion tests (SITs), are employed as exclusion tools to eliminate the possibility of disease in patients with negative test results. Pre-catheterization, a CT scan is recommended to exclude large masses indicative of aldosterone-producing carcinoma and provide vascular anatomical information. Adrenal vein sampling (AVS) is typically utilized to detect aldosterone overproduction, whether unilateral or bilateral. A novel index, the relative aldosterone secretion index (RASI), enhances diagnostic performance with 100% specificity. To ensure accurate diagnosis and rule out other conditions, AVS is recommended before considering treatment options. Prompt and appropriate treatment significantly improves the prognosis of patients with PA. Early intervention, guided by precise diagnostic methods, is crucial for enhancing patient outcomes [32,33].

Renin concentration measurement is replacing plasma renin activity screening, changing cutoff points by a factor of roughly 10. When a patient’s test results are negative, confirmation tests are performed to rule out illness. Before catheterization, a CT scan is advised to rule out large masses that could be signs of an aldosterone-producing carcinoma and to provide vascular information. The technique known as AVS is used to detect excess aldosterone. The 100% specificity of the RASI enhances diagnostic performance. Patients with PA have better prognoses when properly evaluated and treated promptly [34].

Unilateral ADX is an effective intervention for patients with unilateral PA, leading to the reversal of hypokalemia and improvement in HTN. The TAIPAI registry documented that patients who underwent ADX for unilateral hyperaldosteronism experienced reduced carotid intimal thickness and a reversal of myocardial structural alterations. The vasculotoxic effects of hyperaldosteronism can be more effectively mitigated through unilateral ADX compared to using MRAs. However, it remains uncertain whether the observed reductions in blood pressure and end-organ protection translate into improved long-term survival. Several factors are associated with the postoperative resolution of
HTN, including the absence of first-degree relatives with HTN, the use of fewer than three types of antihypertensive medications before surgery, a lower preoperative serum creatinine level, and a shorter duration of HTN. Persistent postoperative HTN is more likely in cases of extended preoperative HTN, unknown etiology, and advanced age. While blood pressure typically returns to normal or improves within 1-6 months following unilateral ADX, some reports suggest that complete resolution may take up to a year or longer [35-37].

Aldosterone antagonists, such as spironolactone, are commonly employed in the treatment of bilateral adrenal diseases like bilateral aldosterone hyperplasia, bilateral aldosterone-producing adenomas, and glucocorticoid-remediable aldosteronism. Despite their widespread use, there is a lack of randomized placebo-controlled trials assessing the efficacy of these medications in treating PA. For over four decades, spironolactone has been the preferred treatment for PA, initially dosed at 12.5-25 mg daily and potentially increased to 50-100 mg if needed. However, high dosages may lead to unfavorable effects. Observational studies suggest a mean reduction of 25% in systolic blood pressure and 22% in diastolic blood pressure with spironolactone treatment. Most patients typically require doses ranging from 25 to 50 mg per day after several months. Regular monitoring of serum potassium and creatinine levels is recommended, especially for individuals with abnormal renal function [38,39].

Because spironolactone acts on sex steroid receptors, it can have adverse effects on men and women that include erectile dysfunction, gynecomastia, decreased libido, and irregular menstruation. Patients who receive more than 150 mg per day may experience a 50% increase in gynecomastia. Gynecomastia is dose-related. An adverse effect that can be fatal is hyperkalemia, particularly in patients who are taking other medications that retain potassium or have impaired kidney function. Digoxin’s half-life may also be lengthened by spironolactone, so the dosage needs to be changed. Salicylate reduces the effectiveness of spironolactone [40,41].

With fewer side effects and negligible effects as an anti-androgen and progesterone agonist, eplerenone is a selective MRA. In certain nations, it is authorized for the treatment of essential HTN (EH) and heart failure following myocardial infarction. Its potency is 25%-50% less than that of spironolactone, though. It is advised to start with 25 mg twice daily and work your way up to 100 mg twice daily for HTN. Spironolactone proved to be more effective than eplerenone in treating patients with peripheral artery disease (PA), according to a randomized trial. For the treatment of PA, eplerenone is more expensive and unavailable in some countries. Hyperkalemia and clinically significant renal insufficiency are precautions to be taken. Dizziness, headaches, exhaustion, diarrhea, elevated liver enzymes, and hypertriglyceridemia are among the side effects. There is still a need for examination of the clinical judgment that balances availability and efficacy against side effects [42,43].

Distal sodium epithelial channel antagonists include amiloride and triamterene; amiloride has been studied in PA patients the most. Without the well-known side effects of spironolactone, amiloride is a well-tolerated medication that can treat both HTN and hypokalemia. However, it does not seem to have the same positive effects on endothelial function [44].

Conclusion

Previously considered uncommon, PA now accounts for 5%-15% of hypertensive patients, challenging the perception of its rarity. Beyond its association with HTN, aldosterone, when left unchecked, can inflict damage on various organs. The detrimental effects extend beyond high blood pressure and necessitate intervention. Both pharmacological (aldosterone antagonists) and surgical (ADX) approaches can significantly mitigate these side effects. Early diagnosis and appropriate testing are imperative for effective management. Reducing salt intake is a critical aspect of PA management, as excessive dietary salt exacerbates aldosterone-mediated damage. Paradoxically, PA patients tend to consume high amounts of salt, surpassing the World Health Organization’s recommended limit of 5 g per day. Motivating patients for lifestyle changes poses a complex challenge. ADX, as a treatment, may naturally lead to a reduction in dietary salt intake, potentially decreasing cardiovascular risk more effectively than specific medical treatments alone. Clinical research underscores the significance of dietary salt intake as a robust predictor of cardiovascular risk, irrespective of treatment adequacy.

List of Abbreviations

- ADX  Adrenalectomy
- ARR  Aldosterone-to-renin ratio
- AVS  Adrenal vein sampling
- FH  Familial hyperaldosteronism
- MRA  Mineralocorticoid receptor antagonists
- PA  Primary aldosteronism
- RAS  Renin-angiotensin-aldosterone system
- RASI  Relative aldosterone secretion index
- TOD  Total oxidative stress

Conflict of interests

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Consent for publication

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