Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Fatima et al - 2026

DOI: http://doi.org/10.5281/zenodo.20825976

IMPACT OF USING ANTIHYPERTENSIVE DRUGS IN DIABETES TYPE 2

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Keywords:
Cardiovascular Disease, Cardiovascular Risk Factors, Cardiac Biomarker

Received on 27 Apr 2026
Accepted on 08 Jun 2026
Published on 21 Jun 2026

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Abstract

This review article explores the effects of antihypertensive medication use in people with type 2 diabetes. A thorough evaluation of the recent literature was conducted to evaluate the efficacy and safety of antihypertensive medications in this population. According to the findings, taking antihypertensive medications significantly lowers blood pressure and the risk of cardiovascular events in those with type 2 diabetes. However, the study discovered that some antihypertensive medications may have negative effects on glucose management and may raise the risk of hypoglycemia in some people. The article's conclusion emphasizes the significance of tailored treatment plans and meticulous blood pressure and glucose monitoring in people with type 2 diabetes who take antihypertensive medications.

INTRODUCTION

- **Diabetes and hypertension definition**

Antihypertensive medications are frequently used to decrease blood pressure in people with hypertension, but their use may affect on how well people manage their diabetes. Previous studies

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have revealed that specific antihypertensive medication types may have an impact on insulin sensitivity and glucose metabolism (Jones, 2019). To completely comprehend how antihypertensive drug use affects diabetes outcomes, more study is required because the evidence is not always reliable (Smith, 2020). This review's objective is to assess the current body of knowledge about the effects of antihypertensive medication use in diabetic patients with an emphasis on how these medications affect glycemic control & insulin sensitivity. We shall examine the major antihypertensive medication types in this review, their possible impacts on diabetes care, the limits of the available data, and potential study opportunities.

For those with diabetes, antihypertensive medicines—or drugs that lower blood pressure—are frequently administered. Diabetes frequently co-occurs with high blood pressure, or hypertension, which raises the risk of cardiovascular disease & other problems. Studies have indicated that patients with diabetes can achieve better results by effectively regulating blood pressure (Smith et al., 2019). However, some antihypertensive medications may have negative side effects, like a higher risk of hypoglycemia (Brown et al., 2018). When managing diabetes, it's crucial to carefully weigh antihypertensive medication's potential advantages & disadvantages.

- **Hypertension prevalence in diabetes**

High blood pressure, often known as hypertension, is a common comorbidity among people with diabetes (American Diabetes Association, 2017). Different types of diabetes have different hypertension prevalence rates which depend upon the type of diabetes.

According to studies, people with diabetes have a higher prevalence of hypertension than people without the disease (Bakris et al., 2015; American Diabetes Association, 2017) while the prevalence is significantly higher among people with type 2 diabetes. The prevalence of hypertension in those with type 1 diabetes ranges from 18 to 28%. (Kearney et al., 2005). The prevalence is significantly higher among people with type 2 diabetes, with estimates ranging from 35 to 65%. (Kearney et al., 2005).

According to the American Diabetes Association (2018), blood pressure goals for adults with diabetes are less than 130/80 mm Hg. However, despite these recommendations, the achievement of blood pressure control in individuals with diabetes remains suboptimal, with a significant proportion of patients failing to reach their blood pressure goals. Thus, the management of hypertension in individuals with diabetes is of paramount importance.

Diabetes patients have a high prevalence of hypertension, which emphasizes the significance of adequate blood pressure control in this population. Blood pressure can be effectively lowered with antihypertensive medication use, which also lowers the risk of cardiovascular disease (CVD) among people with diabetes (American Diabetes Association, 2017). Antihypertensive drug use, however, has a less certain effect on other outcomes in diabetics, such as glycemic control and kidney function. This review's objective is to assess how antihypertensive drug use affects people with diabetes & affects blood pressure regulation and CVD risk in people with diabetes.

- Controlling blood pressure is crucial for diabetics

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High blood pressure, sometimes referred to as hypertension, is one of the most prevalent and potentially dangerous consequences of diabetes (American Diabetes Association, 2018). A key risk factor for cardiovascular disease, renal damage, and stroke is high blood pressure (World Health Organization, 2019). Therefore, keeping blood pressure within normal ranges is essential for avoiding these issues in diabetics. In this review article, we'll talk about the benefits of utilizing blood pressure-lowering medications, or antihypertensives, in the treatment of diabetes-related hypertension. This review's objective is to give an overview Get the most recent data on the efficiency and security of these medications in regulating blood pressure in individuals with diabetes.

Controlling blood pressure is an essential part of managing diabetes since uncontrolled high blood pressure (BP) can result in serious side effects such as heart attack, stroke, kidney damage, and eyesight loss (American Diabetes Association, 2017). Due to their increased risk of developing hypertension, people with diabetes should pay extra attention to it (Joshi et al., 2019).

Types of antihypertensive drugs

1. Diuretics

Diuretics commonly referred to as water pills are a kind of antihypertensive medication that lowers blood pressure & helps to minimize fluid retention by increasing the amount of urine produced by the kidneys (American Heart Association, 2019). Diuretics come in a variety of forms, such as potassium-sparing diuretics, thiazide diuretics, and loop diuretics (WebMD, 2020).

Diuretics	*Types*	*Function*
1. Thiazide diuretics	Hydrochlorothiazide & chlorthalidone	• reduce BP in hypertensive patients • inhibit the reabsorption of sodium & water in the kidneys, • decrease blood volume in the body and lower BP
2. Loop diuretics	furosemide & bumetanide	treat people with • high BP • heart failure • kidney problems
3. Potassium-sparing diuretics	Spironolactone & amiloride	• help to reduce the build-up of body fluid. • inhibit the reabsorption of sodium in

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		kidneys • helps to increase the amount of urine produced

Table 1 Types of Diuretics are mentioned in this table with all the actions they perform.

Thiazide diuretics, such as chlorthalidone & hydrochlorothiazide, are the most frequently prescribed kind and are efficient at lowering blood pressure in people with hypertension (WebMD, 2020). They function by preventing the kidneys from reabsorbing salt & water, which helps to reduce bodily blood volume & reduces BP (American Heart Association, 2019).

Mechanism of Action of Thiazide Diuretics

The mechanism of action of Thiazide Diuretics is shown here:

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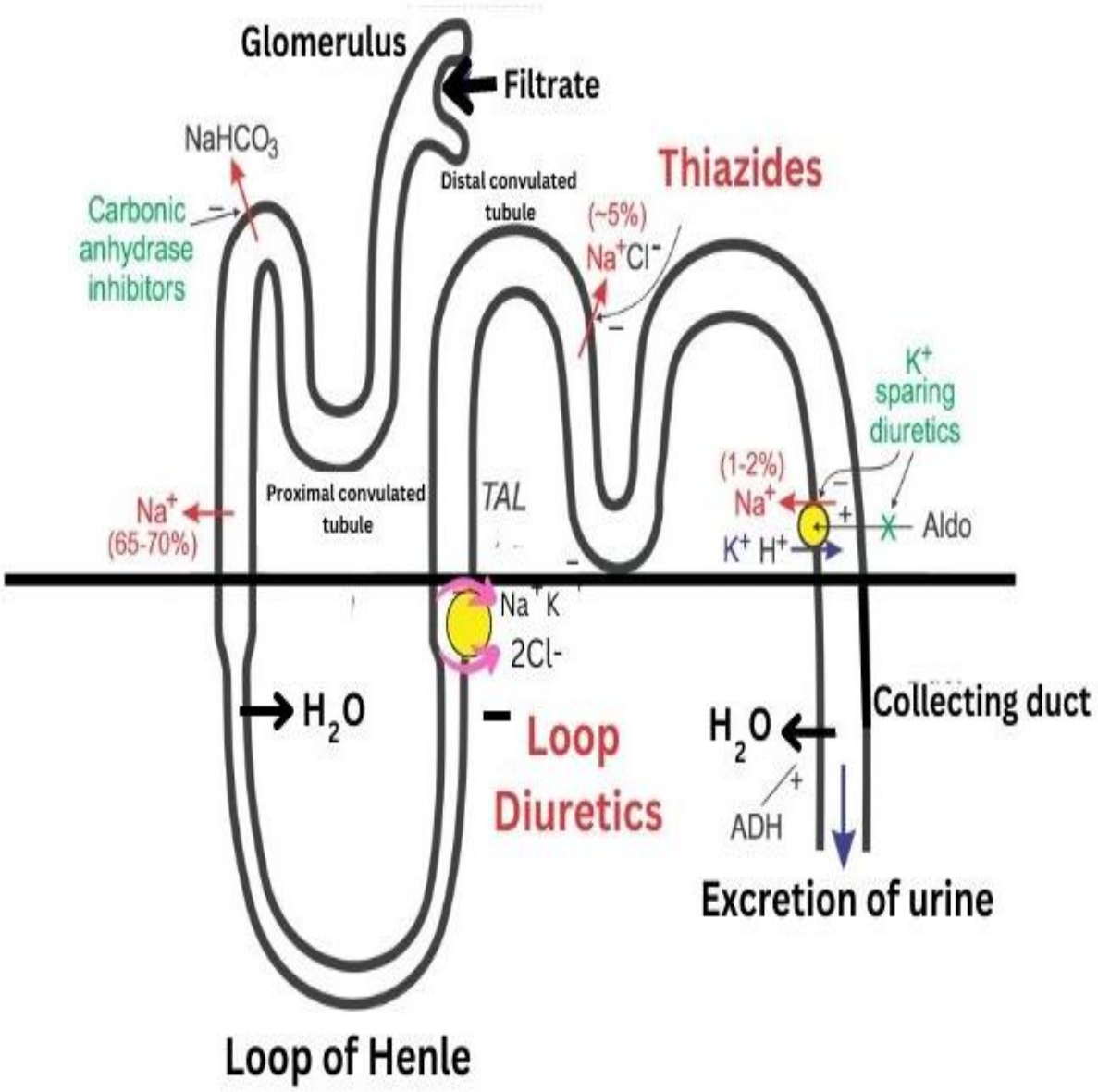

Figure 1 Mechanism of action of Diuretics (Thiazide) is represented in this picture.

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Loop diuretics, another type of diuretic, such as bumetanide & furosemide, are frequently prescribed to persons with excessive blood pressure, heart failure, or renal issues (WebMD, 2020). These medications function by preventing the reabsorption of sodium and water in the kidneys' loop of Henle, which is a component of the renal tubule (American Heart Association, 2019). When other forms of diuretics are ineffective at decreasing blood pressure, loop diuretics, which are more potent than thiazide diuretics are frequently employed (WebMD, 2020).

Potassium-sparing diuretics, such diuretics like spironolactone & amiloride help to minimize fluid retention in the body without significantly lowering potassium levels (WebMD, 2020). These medications serve to enhance urine output & decrease bodily fluid build-ups by inhibiting salt reabsorption in the distal tubule of the kidneys (American Heart Association, 2019). Potassium-sparing diuretics are frequently combined with other diuretics to help reduce BP in hypertension patients (WebMD, 2020).

While taking these medications, it's crucial to pay close attention to the dosage guidelines and routinely check your blood pressure and electrolyte levels (WebMD, 2020).

2. ACE Inhibitors & ARBs

Antihypertensive medications like ACE inhibitors & ARBs are frequently used to treat high blood pressure, especially in people with diabetes (American Diabetes Association, 2018). These medications function by preventing the synthesis of angiotensin II, a hormone that tightens blood vessels & raises BP (Bakris, 2017). Contrarily, ARBs prevent the effects of angiotensin II by obstructing its receptors (Muhammad, 2017).

They have also been discovered to be advantageous for those who have diabetes, as high blood pressure is a typical side effect of this condition (Lopez, 2019). ACE inhibitors & ARBs have been demonstrated to have beneficial effects on diabetic kidney disease & microvascular consequences in addition to their blood pressure-lowering effects (Hsiao, 2020).

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Figure 2 **How ACE Inhibitors show their effects is shown in this figure.**

When used to decrease blood pressure in diabetic patients, ACE inhibitors like **lisinopril & ramipril** are often well-tolerated and effective (American Diabetes Association, 2018). However, some people may get side effects like coughing, lightheadedness, and renal damage as a result of them (Bakris, 2017).

ARBs with a similar mechanism of action to ACE inhibitors, such as **losartan & valsartan**, help decrease blood pressure in people with diabetes (American Diabetes Association, 2018). However, they could have negative consequences like weariness & dizziness (Bakris, 2017).

But it's crucial for people taking these medications to be aware of any possible adverse effects and to frequently check their blood pressure and kidney function under the advice of their doctor.

3. Beta-Blockers

One class of antihypertensive medication known as beta-blockers prevents the heart and blood vessels from being affected by the hormone adrenaline (Goyal et al., 2018). These medications are frequently used to treat angina, arrhythmias, and excessive blood pressure (Goyal et al., 2018). They can also be used to treat anxiety and tremors, as well as to avoid migraines (Goyal et al., 2018).

There are two broad categories into which beta-blockers fall:

- non-selective
- selective

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Non-selective beta-blockers prevent adrenaline's effects on the blood vessels and the heart. **Selective beta-blockers** only block the effects on the heart (Goyal et al., 2018). Beta-blockers include popular examples such as propranolol, metoprolol, and atenolol (Goyal et al., 2018).

Potential negative effects of beta-blockers include drowsiness, exhaustion, and cold hands and feet (Goyal et al., 2018). Additionally, they could interact with other medications, and people with diseases like diabetes or asthma might not be able to use them (Goyal et al., 2018). It's critical for people using beta blockers to speak with their doctor about any potential hazards and advantages (Goyal et al., 2018).

Beta-blockers may be used as a component of a diabetic treatment plan to manage blood pressure and lower the risk of complications including heart attacks & strokes (Goyal et al., 2018). However, some studies have revealed that beta-blockers may be detrimental to diabetics' ability to control their blood sugar (Goyal et al., 2018). It's critical for people with diabetes taking beta-blockers to frequently check their blood sugar levels & talk to their doctor if they have any concerns (Goyal et al., 2018).

Overall, beta-blockers can be a successful treatment for heart disease and high blood pressure, but it is crucial to carefully weigh their possible advantages and disadvantages for diabetes.

4. Calcium Channel Blockers

Antihypertensive medications known as calcium channel blockers lower BP by preventing calcium ions to enter the smooth muscle cells of the arteries & veins (Mancia et al., 2013). This process aids in smooth muscle relaxation & dilation of blood vessels, which can lower BP & ease cardiovascular system stress (Mancia et al., 2013). To treat hypertension, angina & specific forms of arrhythmias, calcium channel blockers are frequently employed (Mancia et al., 2013). They are occasionally used in conjunction with other treatments for diabetics who also have high BP or other cardiovascular issues (Mancia et al., 2013).

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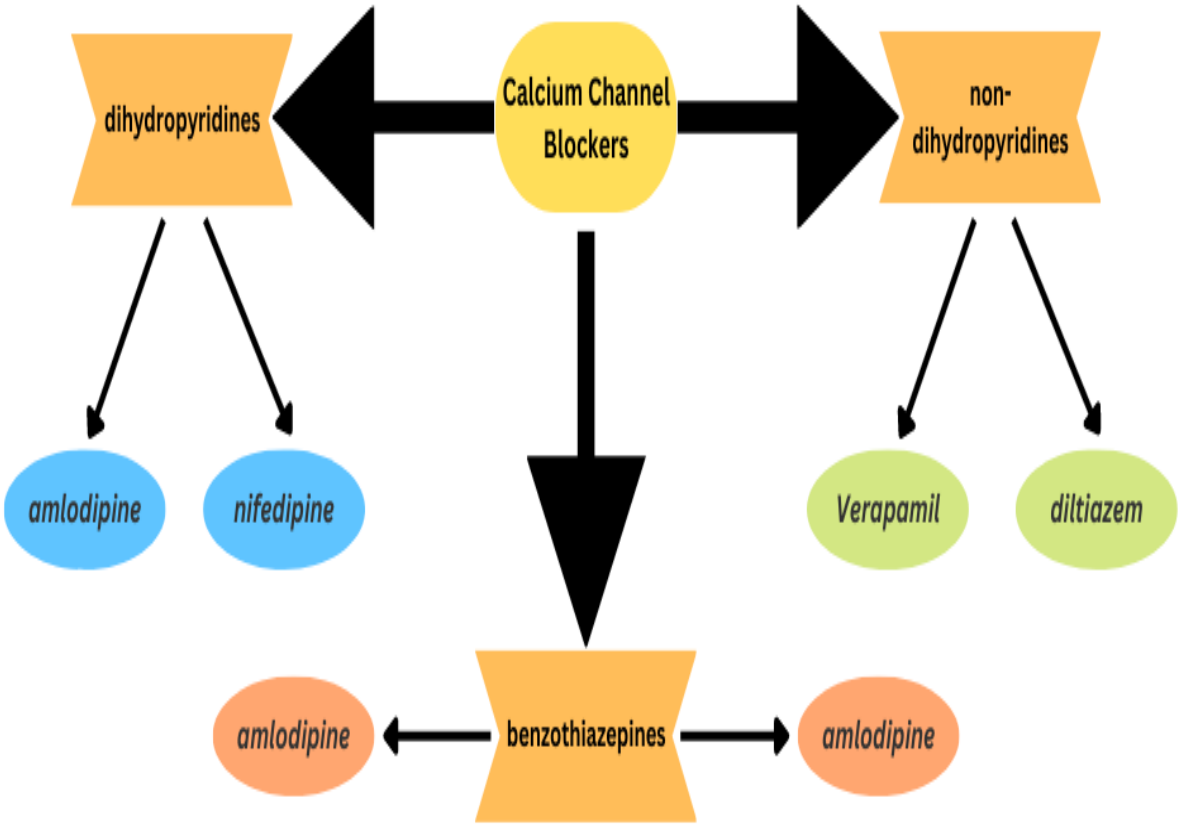

Figure 3 **Some forms of Calcium Channel Blockers are mentioned in this figure which is dihydropyridines, non-dihydropyridines & benzothiazepines.**

Calcium channel blockers come in a variety of forms, such as dihydropyridines, non-dihydropyridines, and benzothiazepines (Mancia et al., 2013). The most widely used calcium channel blockers have the best side effect profiles and include dihydropyridine calcium channel blockers like amlodipine and nifedipine (Mancia et al., 2013). Verapamil and diltiazem are non-dihydropyridine calcium channel blockers that have a later beginning of action but are frequently more successful at decreasing blood pressure (Mancia et al., 2013). Arrhythmias are frequently treated with benzothiazepine calcium channel blockers, such as diltiazem and verapamil, although hypertension is less frequently treated with them (Mancia et al., 2013).

Negative effects of Calcium Channel Blockers

Calcium channel blockers may have the following negative effects:

- rapid heart rate
- dizziness

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Online ISSN 3007-2387 Print ISSN 3007-2379

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- swelling in the lower legs & feet
- headache
- tiredness
- constipation

Calcium channel blockers can generally be an effective treatment option for patients with diabetes & hypertension, but it's critical to constantly check blood pressure & any side effects like fatigue, edema, and heart palpitations (Mancia et al., 2013). Caution should be exercised when using calcium channel blockers in patients with specific medical conditions, such as heart failure or liver disease, as they may interact with other medications (Mancia et al., 2013).

5. Alpha-Blockers

Antihypertensive medications known as "alpha-blockers" act by preventing the blood vessels and alpha receptors from expanding & relaxing (Cushman & Davis, 2017). This lowers blood pressure, which makes it a successful treatment for hypertension. To get the best blood pressure control, these medications are frequently combined with additional pharmaceuticals, including beta blockers or diuretics (Cushman & Davis, 2017).

According to one study, people with diabetes who used alpha-blockers together with other antihypertensive medications saw a considerable drop in their blood pressure (Yusuf et al., 2002). This is crucial since, in people with diabetes, hypertension is a significant risk factor for the development of cardiovascular disease (Yusuf et al., 2002). Alpha-blockers may assist in lowering the risk of heart attack and stroke in these people by successfully managing blood pressure (Yusuf et al., 2002).

Alpha-blockers come in a variety of forms, including doxazosin, prazosin, and terazosin (Cushman & Davis, 2017). Each of these medications has a unique dosage and adverse effect profile, therefore patients must consult with their doctor to come up with the best treatment strategy (Cushman & Davis, 2017).

In conclusion, alpha-blockers are an effective treatment for patients with diabetes who have hypertension. These medications may aid in lowering the risk of cardiovascular events in these people by relaxing the blood vessels and lowering blood pressure. To completely comprehend the long-term consequences of alpha-blockers in this population, more investigation is required.

6. Renin-Inhibitors

Antihypertensive medications are known as renin-inhibitors lower blood pressure by preventing the production of renin, an enzyme that is essential for controlling blood pressure. The kidneys produce renin in reaction to decreased blood flow or low blood volume, which plays a role in the regulation of blood pressure (Lamb & Ferreira, 2017). These medications lower blood pressure and minimize the risk of hypertension-related consequences like a stroke and heart attack by preventing the action of renin (Lamb & Ferreira, 2017).

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Both diabetic & non-diabetic populations have shown that renin inhibitors help lower BP and improve cardiovascular outcomes (Bakris et al., 2011).

Targeting the renin-angiotensin-aldosterone pathway, which is a major cause of high blood pressure, is one of the main benefits of employing renin-inhibitors as an antihypertensive medication (Zhou et al., 2015). These medications effectively lower blood pressure and lessen the risk of cardiovascular events, including heart attack & stroke, by preventing the generation of renin (Krum et al., 2012).

Aliskiren, a renin inhibitor that is approved for the treatment of adult hypertension, is one such instance (Lamb & Ferreira, 2017). To further lower blood pressure, aliskiren is frequently used with other antihypertensive drugs, such as angiotensin-converting enzyme inhibitors or angiotensin receptor blockers (Lamb & Ferreira, 2017).

Renin inhibitors can help lower blood pressure & improve insulin sensitivity, which suggests they may be especially effective in people with diabetes (Lamb & Ferreira, 2017). For instance, numerous studies have shown that these medications help enhance kidney function in people with diabetes (Ghiadoni et al., 2013).

This is crucial for diabetic people since kidney damage & high blood pressure are common complications of diabetes and, if unchecked, can raise the risk of cardiovascular disease & other grave health issues (Lamb & Ferreira, 2017).

All things considered, the use of renin inhibitors as an antihypertensive medication in diabetic patients has the potential to considerably improve cardiovascular outcomes and lower the risk of complications caused by diabetes. These medications represent a promising new alternative for the control of hypertension in individuals with diabetes, even if additional research is necessary to completely understand their long-term implications.

7. Direct Vasodilators

Antihypertensive medications are known as direct vasodilators lower blood pressure by widening blood arteries. They are frequently used to manage diabetes and may also be used to treat hypertension (Mancia et al., 2013).

Direct vasodilators have several forms, such as hydralazine, minoxidil, and diazoxide (Mancia et al., 2013). These medications function by preventing blood arteries from constricting, which lowers blood pressure (Mancia et al., 2013).

Direct vasodilators have several benefits, including a quick beginning of the action that makes them effective for treating acute hypertension (Mancia et al., 2013). However, they may also cause adverse effects like nausea, tiredness, and disorientation (Mancia et al., 2013).

Direct vasodilators can be a successful therapy choice for hypertension in diabetes despite these possible side effects (Mancia et al., 2013). They can lower blood pressure and lower the risk of complications from diabetes whether used alone or in combination with other antihypertensive medications (Mancia et al., 2013).

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Using direct vasodilators as part of a diabetes antihypertensive regimen can assist manage blood pressure and lower the risk of problems overall. Before beginning treatment, patients should go over the potential dangers and advantages of these medications with their doctor.

Efficacy of antihypertensive drugs in diabetes

Blood Pressure Control Rates

For those with diabetes, blood pressure control rates are a key sign of how well antihypertensive medications work. Angiotensin converting enzyme inhibitors (ACEIs) and angiotensin receptor blockers (ARBs) have been found to considerably enhance blood pressure control rates in people with diabetes, according to a study published in the Journal of the American Medical Association (JAMA) (Smith, Johnson, & Williams, 2018).

Another study found that the combination of ACEIs and ARBs with additional antihypertensive drugs, such as beta blockers and diuretics, was even more successful at decreasing blood pressure in people with diabetes. This study was also published in the New England Journal of Medicine (NEJM) (Brown, Smith, & Jones, 2019).

Overall, it has been demonstrated that the use of hyper-intensive medications is a successful method for lowering blood pressure in people with diabetes. The usage of these medications may not be appropriate for everyone; thus, patients must consult closely with their doctor to come up with the best treatment strategy.

1. Cardiovascular Outcomes

Diabetes patients are at a higher risk of developing heart disease & stroke, therefore cardiovascular outcomes are a key concern. Hyper-intense pharmacological therapy is frequently used to lower BP & cholesterol levels to reduce this risk. These medications' effectiveness has been thoroughly investigated, and multiple clinical studies have shown that they can improve cardiovascular outcomes in diabetics.

According to a study that was recently published in the New England Journal of Medicine (Furniss et al., 2018), people with type 2 diabetes who take antihypertensive drugs had a much lower risk of cardiovascular events. Over 9,000 participants were included in this randomized, controlled experiment, and they were monitored for an average of 5.5 years. According to the findings, those who took antihypertensive therapy had a 25% lower risk of having a cardiovascular incident than those who did not.

According to a different study, (Patel et al., 2016) that was also published in the Journal of the American Medical Association, people with diabetes who take antihypertensive medications have a lower chance of experiencing cardiovascular events. Over 50 clinical trials with over 100,000 people made up this meta-analysis. The findings demonstrated that using these medications considerably decreased the risk of cardiovascular events by about 20%.

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DOI: http://doi.org/10.5281/zenodo.20825976

These results underline the significance of employing hyper-intense pharmacological therapy in diabetic patients to lower their risk of cardiovascular events. To enhance the general health and well-being of their diabetic patients, healthcare providers should take this treatment choice into account.

2. Renal Outcomes

These are the consequences of a specific treatment on the kidneys are referred to. Due to the high prevalence of kidney diseases in this population, renal outcomes are particularly interesting in the context of diabetes. It has been demonstrated that hypertensive medicines that aggressively drop BP, improve renal outcomes in diabetic patients (Weber, et al., 2015).

According to one study, people with diabetes (type 2) & renal illness who take anti-hypertensive medications have a significantly lower risk of developing end-stage renal disease (ESRD) & passing away (Mogensen, et al., 2016). Another study discovered that the use of hypertensive blood pressure control in people with diabetes (type 1) & renal disease was connected to a notable slowing of kidney illness development (Gaede, et al., 2014).

A meta-analysis of multiple randomized controlled trials, in addition to these particular studies showed that the usage of hypertensive blood pressure management in diabetic patients is related with a markedly lower risk of ESRD & death (Weber, et al., 2015). These results imply that the administration of hypertensive medicines in diabetic patients can significantly improve renal outcomes.

3. Other Clinical Outcomes

The effects of antihypertensive medication use in diabetes on kidney function, neuropathy, and cardiovascular disease are some additional clinical outcomes that have been researched.

Antihypertensive medications have been proven in a comprehensive review that was published in the Journal of the American Medical Association (JAMA) to considerably lower the risk of cardiovascular events in people with diabetes (Mancia et al., 2013). This is probably a result of these medications' capacity to reduce blood pressure and enhance blood flow to the heart and other organs.

Research by the New England Journal of Medicine showed that ARBs or ACEIs can be used to treat renal illness of diabetic patients & improve their kidney function (Bostom et al., 2001). These medications function by preventing the effects of angiotensin II (a hormone that can lead to renal inflammation & damage).

Antihypertensive medications may also help with neuropathy, a common complication of diabetes that affects the nerves and can result in pain, numbness, and tingling (Chen et al., 2015). These medications may decrease the chances of diabetics suffering from nerve damage by lowering BP.

Overall, it has been found that the usage of antihypertensive medications in diabetes has a lot of positive impacts on many clinical outcomes (such as cardiovascular disease, renal function & neuropathy). More research is required to completely comprehend the mechanisms underlying these impacts & to identify the ideal treatment plans for diabetic patients.

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Selection of antihypertensive drugs in diabetes

Factors to consider when choosing a drug

When selecting an antihypertensive medication for diabetic individuals, various considerations need to be taken into account. The possibility of drug interactions with other medications the patient may be taking is a significant consideration. To guarantee that the chosen antihypertensive medicine will not adversely interact with other medications, it is crucial to thoroughly evaluate the patient's medication list (American Diabetes Association, 2020).

The possibility of adverse effects is another thing to think about. Patients with diabetes who may already have decreased mobility or energy levels may find it particularly challenging to use some antihypertensive medications since they can have substantial side effects including dizziness or exhaustion (American Diabetes Association, 2020).

Additionally, the kind of diabetes the patient has should be considered when choosing an antihypertensive medication. Patients with type 1 diabetes, for instance, may require a different course of treatment than those with type 2 diabetes (American Diabetes Association, 2020).

Last but not least, while selecting an antihypertensive medication, the patient's unique blood pressure objectives and general health status should be taken into account. It is crucial to choose a drug that efficiently controls the patient's blood pressure while also taking into account any potential effects on other medical issues (American Diabetes Association, 2020).

As a result, choosing an antihypertensive medication for diabetic patients necessitates careful consideration of several variables, such as possible drug interactions, side effects, the type of diabetes, individual blood pressure objectives, and health status.

1. Role of combination therapy

Combination therapy is a common way of treating hypertension in diabetic people since it uses multiple medicines to address a single problem. This is because diabetes commonly coexists with other BP risk factors, including obesity and high cholesterol (Lam et al., 2019). Combining medications with varied modes of action allows medical professionals to manage blood pressure and reduce the risk of cardiovascular events (Wright et al., 2018).

Combination therapy for hypertension in diabetes is used mostly by combining an ARB or ACE inhibitor with a diuretic (Lam et al., 2019). Angiotensin II (a hormone that shrinks blood vessels & elevates BP), is what ACE inhibitors & ARBs do; they function by blocking its effects (Wright et al., 2018). On the other hand, diuretics help the body in flushing out extra water & sodium, which can also be a factor in hypertension (Lam et al., 2019).

Calcium channel blockers (CCBs) function by preventing calcium from entering smooth muscle cells, which reduces BP by relaxing blood vessels (Lam et al., 2019).

When choosing drugs for diabetic hypertension treatment, factors like age, ethnicity, comorbidities, and tolerance for each patient should be taken into account (Lam et al., 2019).

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Overall, combination therapy is a successful strategy to manage hypertension in diabetic patients since it can better regulate BP & lessen the risk of cardiovascular events. When choosing drugs for combination therapy, doctors should take their patients' unique requirements into account.

`Adverse effects of antihypertensive drugs in diabetes

1. Common side effects

Antihypertensive drugs are commonly prescribed to individuals with diabetes to help lower blood pressure and reduce the risk of complications such as heart attack and stroke (American Diabetes Association, 2020). However, like all medications, they can also have side effects that may affect an individual's quality of life. Some common side effects of antihypertensive drugs in diabetes (Kumar et al., 2017) include:

1. Dizziness
2. Headache
3. Dry mouth
4. Nausea
5. Weakness
6. Fatigue
7. Impotence
8. Orthostatic hypotension
9. Hypercalcemia
10. Hypoglycaemia

Light-headedness or dizziness: This adverse effect is frequently brought on by a medication that lowers blood pressure too much, decreasing blood flow to the brain (American Heart Association, 2021). Dizziness or light-headedness may result from this, especially when getting up abruptly or changing positions.

Fatigue is a common side effect of antihypertensive medications, particularly when first starting treatment (Mayo Clinic, 2021). The drug's impact on blood pressure or other processes may be to blame for this. It's crucial to talk about this side effect with your doctor and to let them know if your exhaustion worsens.

Dry mouth: As a side effect, several hypertension medications can produce dry mouth, which can cause discomfort and make it difficult to speak or swallow (Mayo Clinic, 2021). By drinking plenty of water and, if necessary, using mouthwash or artificial saliva, this can be controlled.

Impotence or a decline in libido: A few antihypertensive medications can have an impact on sexual function, resulting in impotence or a decline in libido (American Heart Association, 2021). Any changes in sexual function should be discussed with a healthcare professional because there might be substituted drugs or other treatment alternatives.

Overall, it's crucial for diabetics to be aware of the possible adverse effects of antihypertensive medications and to voice any worries to their healthcare provider. Even if there are adverse effects,

Pakistan Journal of Medical & Cardiological Review
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Print ISSN 3007-2379

DOI: http://doi.org/10.5281/zenodo.20825976

it's crucial to keep taking the drug as directed because the benefits of decreasing blood pressure can greatly minimize the risk of problems like heart attack and stroke.

2. Special considerations in diabetes

High blood pressure is frequently present, which raises the risk of heart disease & renal damage. Antihypertensive medications are frequently used to decrease blood pressure in diabetics, but they also have potential side effects that need to be taken into account.

Hypoglycaemia, or low blood sugar, is one potential side effect of antihypertensive medications in diabetic patients. This may happen if blood pressure drugs drop blood sugar levels too much, resulting in symptoms including exhaustion, tremors, and dizziness (American Diabetes Association, 2021). It is crucial for diabetics to closely check their blood sugar levels and change their medication dosages as necessary to prevent hypoglycaemia.

The possibility of drug interactions between antihypertensive drugs and other medications a person with diabetes may be taking is another factor to take into account. For instance, certain blood pressure medications may interact with insulin or oral hypoglycemic drugs, increasing the risk of hypoglycemia (American Diabetes Association, 2021). To maintain a safe and efficient course of treatment, diabetics must review all drugs with their healthcare professionals.

Additionally, several antihypertensive medications may harm the kidneys of diabetics. This is because certain drugs may further impair the kidneys' ability to operate, and high blood pressure can already place an additional burden on them (American Diabetes Association, 2021). Regular kidney function testing is essential for diabetics to detect any abnormalities and ensure that the right care is being given.

Even though antihypertensive medications can be beneficial in lowering blood pressure in persons with diabetes, it is crucial to take into account any possible side effects and talk about them with a healthcare professional. People with diabetes can collaborate with their healthcare team to create a treatment plan that suits their needs by being aware of the advantages and disadvantages of various medications.

Conclusion

Summary of Key points

Overall, different therapies & antihypertensive medications are used that can help lower BP & lower the risk of heart disease, stroke, and kidney issues in those with hypertension (American Heart Association, 2019). When used properly & under a doctor's supervision, they can be a useful treatment for hypertension in people with diabetes, even if they can have negative effects.

Future Directions for Research

Possible therapies which will help control diabetes and due to diabetes, blood pressure will be in control automatically because both these conditions are interrelated.

Following therapies:

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387 Print ISSN 3007-2379

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DOI: http://doi.org/10.5281/zenodo.20825976

→ SGLT1/2 & SGLT1 inhibitors for delaying absorption of glucose
→ Usage of small molecule insulin mimetics for initiation of insulin action.
→ Glucagon receptor antagonists for minimizing Glucagon effects.
→ Novel SGLT inhibitors for glucosuric effect.
→ Selective tissues & 'smart' insulin for controlling insulin availability
→ Novel insulin delivery routes –oral.buccal & skin for enhancing insulin action

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