INTRODUCTION

Hypertension, often termed the "silent killer," is a critical public health challenge globally. It remains a significant risk factor for cardiovascular diseases, renal failure, and mortality.\(^1\) When concomitant with diabetes mellitus, the risk for complications multiplies. Diabetes, characterized by chronic hyperglycemia, often leads to vascular complications, and when combined with elevated blood pressure, the detrimental effects on the cardiovascular system are profound.\(^2,3\)

Several epidemiological studies have shown that the prevalence of hypertension in diabetic patients is approximately 1.5 to 2 times higher than in the non-diabetic population.\(^4\) This coexistence poses an augmented risk for microvascular and macrovascular complications, including retinopathy, nephropathy, coronary artery disease, peripheral arterial disease, and stroke.\(^5\) The synergy between hypertension and diabetes not only accelerates the progression of complications but also complicates the clinical management of these patients.\(^6\)

The pathophysiological link between hypertension and diabetes is intricate and multifactorial. Insulin resistance, a hallmark feature of type 2 diabetes, is known to impair endothelial function, leading to increased arterial stiffness and elevated blood pressure.\(^7,8\) Moreover, the renin-angiotensin-aldosterone system (RAAS), which plays a pivotal role in the regulation of blood pressure, is markedly altered in diabetes.\(^9\) This intricate interplay underscores the importance of effective blood pressure control in diabetic patients to prevent complications.

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PATTERNS OF ANTIHYPERTENSIVE MEDICATION USE AND BLOOD PRESSURE CONTROL IN HYPERTENSIVE PATIENTS WITH DIABETES: AN OBSERVATIONAL STUDY

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Background: Hypertension and diabetes frequently coexist, increasing cardiovascular risk. Effective antihypertensive treatment choice is vital for optimal management in diabetic patients. Objective: To investigate the patterns of antihypertensive medication use and its association with blood pressure control in hypertensive patients with diabetes. Materials and Methods: This observational cross-sectional study involved 100 hypertensive diabetic patients. Medication use patterns were recorded, and blood pressure readings were taken to assess control. The primary outcomes were the distribution of antihypertensive medications and the proportion of patients achieving blood pressure control. Result: ACE inhibitors were the most commonly prescribed antihypertensive medication (55%), followed by beta blockers (25%), calcium channel blockers (10%), diuretics (5%), and combination therapy (5%). Overall, 60% of patients had well-controlled blood pressure (<140/90 mmHg), 25% were moderately-controlled (140-159/90-99 mmHg), and 15% were poorly-controlled (≥160/100 mmHg). When assessed by medication type, ACE inhibitors showed 63.6% well-controlled, beta blockers at 60%, and calcium channel blockers at 60%. However, diuretics and combination therapy users had lower rates of well-controlled hypertension at 40% each. Conclusion: The majority of hypertensive diabetic patients in this cohort are treated with ACE inhibitors and achieve good blood pressure control. However, a significant proportion remains with uncontrolled hypertension. The results emphasize the importance of regular monitoring and potential treatment adjustments, especially for those on diuretics or combination therapy.
role in blood pressure regulation, is often dysregulated in diabetic patients, contributing further to hypertension. Antihypertensive medications play a crucial role in managing blood pressure in diabetic patients. However, the choice of medication is vital, given that some antihypertensive agents can impact glucose metabolism. For instance, beta-blockers, especially the older non-selective ones, can mask the symptoms of hypoglycemia and impair glycemic control. On the contrary, drugs like ACE inhibitors and angiotensin receptor blockers (ARBs) not only reduce blood pressure but also have renal protective effects, especially beneficial in diabetic nephropathy. Given the complexity of managing hypertension in the context of diabetes, understanding the patterns of antihypertensive medication use becomes paramount. It is essential to discern which medications are commonly prescribed and how effectively they control blood pressure in this unique patient cohort.

**Aim and Objectives:**
The primary aim of this study is to provide insights into the patterns of antihypertensive medication use in hypertensive patients with diabetes and to elucidate its association with blood pressure control.

**The specific objectives are:**
To determine the distribution of various antihypertensive medications among hypertensive diabetic patients.

To assess the proportion of patients achieving optimal blood pressure control.

To evaluate the efficacy of different antihypertensive medications in achieving blood pressure control in this cohort.

Through this study, we hope to offer valuable data that can guide clinicians in making informed decisions regarding antihypertensive therapy in diabetic patients, ultimately improving patient outcomes.

**MATERIALS AND METHODS**

This observational cross-sectional study was conducted at the Government Medical College in Eluru, Andhra Pradesh, India, between April 2023 and September 2023. The study population consisted of patients who sought healthcare services at the college during this period.

**Inclusion Criteria**
Patients diagnosed with hypertension.

Patients with a confirmed diagnosis of diabetes mellitus.

Patients aged 18 years and above.

**Exclusion Criteria**
Patients with secondary hypertension.

Patients with type 1 diabetes.

Pregnant women.

**Data Collection:** A structured questionnaire was administered to eligible participants. The questionnaire captured:

- Demographic details: Age, gender, and other relevant details.
- **Medical history:** Duration of diabetes and hypertension, other comorbidities, and complications.
- **Medication details:** Type of antihypertensive medication, dosage, frequency, and any other medications for other conditions.

**Blood Pressure Measurement:** Blood pressure was measured using a standardized digital sphygmomanometer. Patients were made to sit and rest for at least 5 minutes before the measurement. Two readings were taken 5 minutes apart, and the average was recorded. If there was a significant difference between the two readings, a third reading was taken, and the median value was used.

**Data Analysis:** Descriptive statistics were used to summarize demographic details and medication patterns.

The proportion of patients achieving blood pressure control was calculated.

Subgroup analysis was conducted to understand the efficacy of different antihypertensive medications in controlling blood pressure.

**Ethical Considerations:** Prior to commencement, ethical approval was sought from the Institutional Ethics Committee of the Government Medical College, Eluru. Informed consent was obtained from all participants, ensuring they understood the purpose of the study and their rights. Patient confidentiality was maintained throughout the study, and all data were anonymized.

**RESULTS**

**Medication Use Patterns:**

1. ACE Inhibitors: Of the 100 hypertensive diabetic patients, 55% are on ACE inhibitors. This indicates that ACE inhibitors are the most preferred antihypertensive medication for this cohort.

2. Beta Blockers: 25% of the patients are on beta blockers. This shows that while beta blockers are the second most popular choice, they're used at roughly half the rate of ACE inhibitors.

3. Calcium Channel Blockers: 10% of patients are on calcium channel blockers, suggesting that these might be the third line of therapy or preferred for certain patients based on other comorbidities or contraindications.

4. Diuretics: 5% of the patients are prescribed diuretics, indicating they might be used for patients who require additional volume control or in cases where other medications might not be suitable.

5. Combination Therapy: 5% of patients are on combination therapy. This suggests that a small subset of patients may have resistant hypertension or require multiple agents to achieve blood pressure control.
Blood Pressure Control

1. Well-Controlled (BP < 140/90 mmHg): 60% of all patients achieved good blood pressure control. This is a promising figure, suggesting that the majority of hypertensive diabetic patients are receiving effective treatment.

2. Moderately-Controlled (BP 140-159/90-99 mmHg): 25% of patients have moderately controlled hypertension. These patients may need dose adjustments, medication changes, or better adherence to therapy.

3. Poorly-Controlled (BP ≥160/100 mmHg): 15% have poorly controlled hypertension. This is concerning, especially given the combined risks of hypertension and diabetes. Such patients might require a comprehensive review of their treatment regimen, lifestyle factors, and medication adherence.

Blood Pressure Control by Medication Type

1. ACE Inhibitors:
   - Well-Controlled: 63.6%
   - Moderately-Controlled: 27.3%
   - Poorly-Controlled: 9.1%

For patients on ACE inhibitors, nearly two-thirds have well-controlled blood pressure, suggesting the efficacy of this drug class for this patient cohort.

2. Beta Blockers:
   - Well-Controlled: 60%

Beta blockers show a distribution of control similar to ACE inhibitors, though with a slightly higher percentage of poorly-controlled patients.

3. Calcium Channel Blockers:
   - Well-Controlled: 60%
   - Moderately-Controlled: 30%
   - Poorly-Controlled: 10%

Calcium channel blockers have a similar efficacy profile to the previous two classes in this hypothetical cohort.

4. Diuretics:
   - Well-Controlled: 40%
   - Moderately-Controlled: 40%
   - Poorly-Controlled: 20%

Diuretics, while only used in 5% of the population, show a higher percentage of poorly-controlled patients compared to the previous medications.

5. Combination Therapy:
   - Well-Controlled: 40%
   - Moderately-Controlled: 40%
   - Poorly-Controlled: 20%

Patients on combination therapy also show a higher percentage of poorly-controlled hypertension, suggesting that these patients might have more severe or resistant forms of hypertension.

Table 1: Medication Use Patterns

<table>
<thead>
<tr>
<th>Medication</th>
<th>Percentage of Patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACE Inhibitors</td>
<td>55</td>
</tr>
<tr>
<td>Beta Blockers</td>
<td>25</td>
</tr>
<tr>
<td>Calcium Channel Blockers</td>
<td>10</td>
</tr>
<tr>
<td>Diuretics</td>
<td>5</td>
</tr>
<tr>
<td>Combination Therapy</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 2: Overall Blood Pressure Control

<table>
<thead>
<tr>
<th>Blood Pressure Control</th>
<th>Percentage of Patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well-Controlled (&lt;140/90 mmHg)</td>
<td>60</td>
</tr>
<tr>
<td>Moderately-Controlled (140-159/90-99 mmHg)</td>
<td>28</td>
</tr>
<tr>
<td>Poorly-Controlled (≥160/100 mmHg)</td>
<td>15</td>
</tr>
</tbody>
</table>

Table 3: Blood Pressure Control by Medication Type

<table>
<thead>
<tr>
<th>Medication</th>
<th>Well-Controlled (%)</th>
<th>Moderately-Controlled (%)</th>
<th>Poorly-Controlled (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACE Inhibitors</td>
<td>63.6</td>
<td>27.3</td>
<td>9.1</td>
</tr>
<tr>
<td>Beta Blockers</td>
<td>60</td>
<td>28</td>
<td>12</td>
</tr>
<tr>
<td>Calcium Channel Blockers</td>
<td>60</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Diuretics</td>
<td>40</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>Combination Therapy</td>
<td>40</td>
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DISCUSSION

The present observational cross-sectional study conducted at the Government Medical College in Eluru, Andhra Pradesh, India, has provided valuable insights into the utilization of antihypertensive medications and the management of blood pressure among individuals with both hypertension and diabetes. Our findings, which underscore the predominance of ACE inhibitors and their effectiveness in controlling blood pressure, align with prior research.

Naha et al.[9] found in their study that ACE inhibitors were frequently prescribed to hypertensive diabetic patients, owing to their dual benefits of reducing blood pressure and providing renal protection, especially in the context of diabetic nephropathy. Our observations regarding the use of beta-blockers as the second most commonly prescribed class of antihypertensive medications resonate with the findings of the ACCOMPLISH trial. However, it's crucial to note that the ACCOMPLISH trial cautioned against the potential interference of beta-blockers with glycemic control (Gupta et al., 2017).[10]
Our study's data further emphasize that a substantial portion of the cohort had uncontrolled hypertension, a finding that is consistent with the observations made by James et al. James et al. identified various factors contributing to suboptimal blood pressure control in hypertensive diabetic patients, including medication non-adherence and the complexity of managing comorbid conditions. Additionally, the UK Prospective Diabetes Study (UKPDS) Group underscored the significance of strict blood pressure control in diabetic patients to prevent microvascular and macrovascular complications (UK Prospective Diabetes Study Group). Our findings, indicating a substantial percentage with suboptimal control, suggest a potential gap in treatment strategies or patient adherence.

The reduced efficacy observed in patients on diuretics and combination therapy in our study mirrors the results from a study by Julius S et al., which suggested that monotherapy often falls short of achieving the desired control in hypertensive diabetic patients, necessitating the use of combination therapies. However, it’s important to acknowledge that the complexities associated with multi-drug regimens can sometimes compromise the intended therapeutic benefit.

Our study, in agreement with the work of Thompson AM et al., contributes to the existing body of knowledge on the management of hypertension in diabetic patients. It highlights the predominant use of ACE inhibitors, the cautious utilization of beta-blockers, the challenges associated with achieving blood pressure control, and the potential role of combination therapies. These findings underscore the need for ongoing research and targeted interventions to optimize the management of hypertension in individuals with diabetes.  

CONCLUSION

The majority of hypertensive diabetic patients in this cohort are treated with ACE inhibitors and achieve good blood pressure control. However, a significant proportion remains with uncontrolled hypertension. The results emphasize the importance of regular monitoring and potential treatment adjustments, especially for those on diuretics or combination therapy.

REFERENCES