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Original Research Article

Assessment of drug therapy problems among hypertensive patients at integral institute of medical science and research

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ABSTRACT

Background: Drug therapy problems (DTP) encompass a range of categories. These include untreated indications, overdose, wrong choice of drugs, adverse drug reaction, drug-drug interaction, need for monitoring, and non-adherence etc. by recognizing and addressing these various drug related problems, healthcare professionals can optimize treatment outcomes and ensure patient safety. Aim was to assess DTP among hypertensive patients at IIMS&R hospital
Methods: Over a period of six months, a prospective observational study involving 107 subjects was conducted at IIMS&R hospital, Lucknow department of general medicine. Information about patient demographics, co-morbidities, and drug therapy problems in treatment of hypertension were collected and analyzed, and the results were expressed as percentages.
Results: In the study, 12 different types of antihypertensive medications were prescribed in a total of 225 drugs. Telmisartan, amlodipine, torsemide, and furosemide emerged as the most commonly prescribed medications. Telmisartan was frequently prescribed orally, while furosemide was primarily administered intravenously. Drug therapy problems such as untreated indication, lack of patient compliance, adverse drug reactions (ADRs) and potential interactions were found
Conclusions: The study highlighted the importance of monitoring and addressing potential drug interactions, medication adherence were common drug therapy problems. This underscores the immediate need for health education and sensitization initiatives targeted at individuals with hypertension, aiming to improve the overall quality of life for these patients.

Keywords: Drug therapy problems, Hypertension, Treatment pattern, Medication adherence

INTRODUCTION

Hypertension being a silent killer leads to various cardiovascular diseases.[1] It triggers symptoms of a broader issue that can significantly impact one's health, leading to detrimental and incapacitating effects.[2] It is one of the world's most difficult medical conditions. An estimated one billion people worldwide are believed to suffer from hypertension.[3] Diastolic or systolic blood pressure consistently remains elevated above the threshold 140/90 mmHg, the standard reference value for blood pressure, is known as hypertension, a disruption of hemodynamic function.[4]

Any DTP is any unfavorable occurrence a patient has that involves, or is considered to involve, pharmacological therapy and prevents them from attaining the intended goals of their therapy.[5] Unnecessary drug therapy, the need for extra drug therapy, ineffective drugs, dosages that are excessively low or high, ADRs, and noncompliance are the

several types of DTPs.[6] DTP encompass a range of categories. These include untreated indications, where medical conditions or symptoms that require drug therapy remain unaddressed. Improper or inappropriate drug selection refers to instances when medications are chosen that may not be the most suitable or effective option for a particular condition. Sub-therapeutic dosage occurs when the prescribed dose of a medication is insufficient to achieve the desired therapeutic effect. Failure to receive medication happens when patients do not receive their prescribed medications due to errors, non-adherence, or other factors. Over dosage involves the administration of medication in excessive amounts. Drug interactions occur when medications interact with each other or with other substances, potentially affecting their efficacy or safety.

Medication use without indication refers to the inappropriate use of medications without proper medical justification or prescription. ADRs encompass unintended harmful effects resulting from the normal use of medications. By recognizing and addressing these various DTP, healthcare professionals can optimize treatment outcomes and ensure patient safety.[7]

METHODS

This is a prospective observational study and was conducted over six months from January 2023 to June 2023 at the IIMS&R hospital, Lucknow, involving the department of medicine and the faculty of pharmacy. The study site included both the inpatient department (IPD) and outpatient department (OPD). A total of 107 patients diagnosed with hypertensive diseases were evaluated. Ethical approval was obtained from the institutional research and ethics committee, adhering to WHO guidelines. Informed consent, both oral and written, was obtained from parents, while subjects themselves provided verbal informed consent; written informed consent was not pursued due to the anticipated inclusion of illiterate participants who might struggle with comprehension. Inclusion criteria required patients to be diagnosed with hypertension with or without comorbidities such as diabetes mellitus, asthma, etc. Both genders were considered and all the patients included over age of 18.

Exclusion criteria involved patients with psychological conditions, those not undergoing treatment for hypertension, patients unable to adhere to the prescribed treatment plan, and drug abuse patients. Data sources included physician's prescribing records, patient's medication chart, patient's progress chart, and nurse assessment chart.

RESULTS

Demographics age and gender

A total of 107 patients were analyzed, among which 51 (47.7%) were male and 56 (52.3%) were female. Patients aged 39-48 and 49-58 were more prone to develop hypertension, with 27.1% and 28.03% in these age ranges, respectively, followed by the age group of 59-68 at 18%

Table 1: Demographics.

Variables	N	Percentage (%)
Gender		
Male	51	47.7
Female	56	52.3
Total	107	100
Age range (in year)		
8-28	4	3.7
29-38	8	0.5
39-48	28	26.1
49-58	30	27.1
59-68	20	18.6
Above 68	15	14.1

Class of drugs used and commonly used agents of each class

Telmisartan, an angiotensin II receptor blocker, was the most commonly prescribed antihypertensive drug, accounting for 69.2% of the prescriptions. Amlodipine, a calcium channel blocker, was the second most prescribed, with 52.3%. diuretics, including torsemide, furosemide, and hydrochlorothiazide, were also frequently prescribed, making up 21.5%, 17.8%, and 15.0% of the prescriptions, respectively.

Other drugs like metoprolol (12.1%) and nifedipine (6.5%) were less commonly prescribed, while drugs like minoxidil and labetalol were the least prescribed, each accounting for 1.9% of the total prescriptions.

Table 2: Class of drugs used and commonly used agents of each class.

Class of drug	Commonly used agents	N	Percent (%)
CCB	Amlodipine	56	52.3
	Nifedipine	7	6.5
β-blocker	Metoprolol	13	12.1
	Atenolol	5	4.6
	Labetalol	2	1.8
Diuretics	Furosemide	19	17.7
	Torsemide	23	21.4
	Hydro-chlorothiazide	16	14.9
	Spironolactone	5	4.6
Angiotensin II blocker	Telmisartan	74	69.1
A+B blocker	Minoxidil	2	1.8
Alpha agonist	Clonidine	3	2.8

Number of antihypertensive medications per prescription

Among the 107 patient's prescription studied, total of 225 antihypertensive medicines were prescribed. Averaging 2 per prescription.

The distribution of the number of hypertensive medications per prescription is as follows: One medication: 52 prescriptions, two medications: 34 prescriptions and three medications: 13 prescriptions.

Table 3: Number of antihypertensive medications in prescription.

Number of medications	No. prescription
One medication	52
Two medications	34
Three medications	13

Mode of administration

Oral administration: The majority of antihypertensive drugs were administered orally. Telmisartan had the highest number of oral prescriptions (74), followed by amlodipine (56) and torsemide (21).

Intravenous (IV) administration: Only a few drugs were administered intravenously. Furosemide was the most commonly given IV drug with 11 patients receiving it this way. Torsemide administered intravenously to 2 patients.

Table 4: Mode of administration.

Drug name	Mode of administration	Number of patients
Telmisartan	Oral	74
Amlodipine	Oral	56
Torsemide	Oral	21
Furosemide	IV	11
Torsemide	IV	2

DTP

The 67 patients had 171 DTP with mean of 1.37. Need of monitoring and potential interaction are the most common ones, followed by medication adherence.

Untreated indication

In the study, it was found that 6 out of 107 patients (5.6%) had untreated indications. In this research one patient was found to have both hypertension and diabetes but the diabetes was left untreated. Another patient was found to have untreated COPD.

Inappropriate drug selection

Inappropriate drug selection was found in 2 (1.9%) of the patients. Beta-blocker (Propranolol) was given to COPD (contraindicated) patient and methyldopa (first line antihypertensive in pregnancy) was not preferred for a pregnant patient.

Table 5: DTP with hypertension.

Drug related problems	N	Percentage (%)
Untreated indication	6	5.6
Inappropriate drug selection	2	1.9
Failure to receive the medication	7	6.5
Overdose	2	1.9
ADR	5	4.7
Drug-drug interaction	1	0.9
Potential interaction	35	32.7
Drug not indicated or drug duplication	2	1.9
Lack of medication adherence	24	22.4
Prescription error	3	2.8
Need for additional drug	4	3.7
Need for monitoring	41	38.3

Failure to receive medication

Seven of the patients have missed one or more dose of their antihypertensive medications at a certain point during their treatment in the hospital.

The major reason for it was cost of the medication, negligence of the patient's attendant to bring the medicine, misunderstanding and sometime the workload of attending staff.

ADRs

Fatigue and bradycardia appear in 3 patients treated with beta-blockers. Dizziness and headache were also recorded in 2 patients treated with ARBs.

Potential interaction

Spironolactone increases the risk of hyperkalemia that may lead to cardiac arrhythmias and muscle weakness. NSAIDs may reduce the effectiveness of diuretics. Beta blockers with calcium channel blockers can cause excessive bradycardia and hypotension, etc.

Lack of medication adherence

Lack of adherence to medication was found 24 times among the patients. These includes skipping doses on the days the patients are feeling fine, some comorbid patients having diabetes were found to be taking insulin after meals instead of pre-meals as directed, some patients stop taking their medication at some time due to fear of side effects, etc.

Clinical characteristics

Several clinical characteristics such as comorbidities, duration of treatment etc. signify how the severity of hypertension plays a crucial role in determining drug therapy.

Table 6: Clinical characteristics.

Clinical characteristics	N	Percentage (%)
No. of comorbidities		
One	64	60
Two	14	13
More than two	9	8
None	20	19
Types of comorbidities		
Diabetes mellitus	42	39
CKD	31	29
Others	14	13
Duration of treatment		
Less than 1 week	47	44
More than 1 week	60	56
Life style factor		
Alcohol	14	13
Exercise	41	36
Salt diet	38	35
Smoking	32	30

Need for monitoring

Monitoring is required to: Assess patient response to medication, manage side effects, and preventing long-term health issues associated with uncontrolled hypertension. Monitor BP frequently to detect missed/inappropriate doses. There is need for monitoring for patients taking two or more antihypertensive medications. Patients treated simultaneously for comorbid conditions.

Risk factors

There are several risk factors that are responsible for the emergence of DTP in hypertensive patients. Stress (56.07%) being the most common one.

Table 7: Risk factors.

Risk factor	N	Percentage (%)
Genetics	7	6.54
Smoking	32	29.9
Alcohol	14	13.0
Lack of physical activity	41	66.3
Stress	60	56.07
Sleep disorder	41	38.3
Unhealthy diet	59	55.1
Obesity	42	39.2

Polypharmacy is a major risk factor of DTP in the cases of hypertension documented in this research. Since hypertension comes with a lot of comorbidities making polypharmacy a great risk factor.

Table 8: Challenges.

Risk factor	N	Percentage (%)
Polypharmacy	65	60.7
Uncontrolled blood pressure	27	25.2
Comorbidity condition	63	58.9

DISCUSSION

Hypertension is a prevalent chronic condition that necessitates meticulous management to prevent complications. This comparative discussion aims to analyze the findings of this study, particularly focusing on the DTP, associated comorbidities, utilization patterns of antihypertensive drugs, types and number of medications given and routes of administration.

This study demonstrated notable problems (132) in drug therapy in 67 among the 107 patients. In comparison to studies conducted in various settings across Indonesia, which reported 66 problems among 193 patients and 66 among 107 patients respectively.[5,8] our study exhibited a higher prevalence of DTPs. These findings suggest that managing hypertensive individuals is a more challenging task, complicated by numerous challenges. Variations in factors such as the size of the study population may influence the outcomes. the duration of the study, and the expertise of professionals involved in the identifying therapy problems may account for these prevalence disparities.

Our study revealed a lack of medication adherence rate of 22.4%, whereas poor adherence to antihypertensive medication is common globally, especially in low- and middle-income countries. A meta-analysis of 27 million patients found nonadherence rates of 27% to 40% between 2010 and 2020.[9] This could be attributed to patients' lack of carefulness, which was observed in both studies, Medication adherence in hypertensive patients is crucial for effective blood pressure management and the prevention of complications such as heart attack, stroke, and kidney disease.

Additionally, in our study, 5 suspected ADRs accounted for 4.7% of cases, with symptoms such as fatigue and bradycardia found in 3 patients treated with beta-blockers, dizziness and headache recorded in 2 patients treated with ARBs. In the previous study of Kurshid et al a total of 21 ADRs were observed among 192 hypertensive patients.[10] ADRs in hypertensive patients can significantly impact treatment outcomes and patient quality of life. It is essential for healthcare providers to monitor for these reactions, educate patients about potential side effects, and make necessary adjustments to treatment regimen to ensure the effective and safe management of the hypertension.

Among the various DTPs identified is the lack of proper monitoring accounting for 38.3% of cases. Monitoring blood pressure frequently is needed to assess patient response to medication, manage side effects, detect missed/inappropriate doses and preventing issues associated with uncontrolled hypertension. The need for monitoring of patients taking two or more antihypertensive medications to avoid additive hypotensive effect. Monitoring patients treated simultaneously for comorbid conditions to detect and prevent drug interactions. All these are essential in the management of hypertensive patients to ensure effective treatment, detect complications early, and make necessary adjustments to therapy.

Another significant finding was the potential drug interactions, which were observed in approximately 32.7% of cases. Some antihypertensive medications exhibit synergistic effects when taken together, leading to conditions such as bradycardia and hypotension, aspirin has been found to reduce the efficacy of metoprolol, Spironolactone increases the risk of Hyperkalemia and NSAIDs may reduce the effectiveness of diuretics.

A previous study revealed about 51 drug interactions were identified, with amlodipine and atenolol being the most common pair. Aspirin frequently interacted with enalapril, furosemide, spironolactone and metoprolol.[11]

The study identified comorbid conditions such as type 2 diabetes, coronary artery disease (CAD), and chronic kidney disease (CKD). These findings reinforce the existing knowledge that hypertension is often associated with other health conditions. The presence of multiple comorbidities can contribute to the complexity of drug therapy and increase the likelihood of encountering DTP.[12]

Inappropriate drug selection refers to prescribing a medication that is not the best choice for the patient's condition. This can adversely affect drug therapy treatment for hypertension by not adequately controlling blood pressure, potentially causing ADRs, and not addressing the patient's specific health needs. First line medication for pregnant lady which is methyldopa was not preferred which can lead to suboptimal control of hypertension and increased risk of complications. Failure to receive medication in the context of hypertension treatment can have serious consequences. When patients do not receive their prescribed medications, their blood pressure remains uncontrolled, which can lead to several adverse health outcomes.

The study observed variations in the utilization patterns of antihypertensive drugs. Telmisartan (69%) and amlodipine (52%) were the most commonly prescribed agents, with telmisartan-amlodipine combination therapy being frequently used. A study conducted by Santos et al reveals the most commonly used antihypertensive medications were angiotensin-converting enzyme inhibitors or angiotensin receptor blockers, with diuretics becoming less commonly used over time These variations in drug utilization patterns might be influenced by elements like local prescribing practices, availability of medications, and treatment guidelines.[13]

Another factor undermining the treatment of hypertension is the untreated indications. Untreated indications in the context of hypertension mean that certain health conditions or risk factors that require treatment were not addressed. This can significantly affect drug therapy treatment for hypertension because untreated indications can lead to worsening health conditions, increased risk of cardiovascular events, and overall poor management of hypertension. In this research one patient was found to have both hypertension and diabetes but the diabetes is left untreated, the uncontrolled blood sugar levels can exacerbate hypertension and increase the risk of complications such as heart attack or stroke, another patient was found to have untreated COPD which can interfere with hypertension treatment by worsening respiratory function, and increasing the risk of cardiovascular complications, thereby reducing the effectiveness of antihypertensive therapy.[14]

In the present study, only two types of routes of administration were investigated. Oral administration was the predominant mode for antihypertensive drugs, with only furosemide and torsemide being used intravenously for some patients. This finding highlights the preference for oral administration in hypertensive patients, emphasizing the convenience and patient adherence linked to these routes. The choice of specific medications and routes of administration should be tailored to individual patient needs and characteristics. in comparison to previous studies in different regions, suggesting that the management of hypertension in this population is more complex.[15,16]

The study also analyzed the demographics details of the patients: Age range of patients utilizing drugs, with highest falling within the age range of 49-58 years; gender wise distribution reveals a higher proportion of female (52.3%) compared to male (47.7%), this shows a significant increase in the prevalence of the disease in women as compared to men.

CONCLUSION

The findings of this study revealed several significant observations regarding the prescribing practices of antihypertensive medications, these insights offer valuable knowledge for healthcare professionals on DTP in the treatment of hypertension the study highlights several areas in need of improvement, including the rationalization of antihypertensive medication use, the necessity for enhancing medication adherence, addressing the health indications, the importance of ongoing monitoring, the need to minimize polypharmacy and reduce the incidence of ADRs etc. These findings will assist healthcare providers and regulatory agencies in developing and refining guidelines pertaining to drug therapy, improve

cost effectiveness, patient safety and optimal drug therapy in the treatment of hypertension. Implementing these recommendations could lead to more effective and safer management practices, ultimately enhancing patient outcomes and contributing to more efficient healthcare delivery.

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