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Original Research Article

Assessment of Drug Utilization Pattern in Patients with Hypertension

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Abstract:

Background: Hypertension is a major global health concern contributing significantly to cardiovascular morbidity and mortality. Despite the availability of effective therapies, blood pressure control remains suboptimal in India, highlighting the need to evaluate prescribing practices.

Aim: To assess the drug utilization pattern, prescribing trends, and safety of antihypertensive medications in patients with hypertension.

Methodology: A prospective observational study was conducted over 8 months in Department of Pharmacology, Shree Narayan Medical institute and Hospital, Saharsa, Bihar, India, including 90 hypertensive patients. Data were collected using structured forms and analyzed using WHO drug utilization indicators, ATC/DDD methodology, and DU 90% analysis. Adverse drug reactions (ADRs) were monitored at 2nd and 8th weeks.

Results: The mean age was 64.2±11.35 years, with slight male predominance. Polypharmacy was observed (5.2 drugs/encounter). Most drugs were prescribed from the essential drug list (91%) and by generic name (88.5%). Amlodipine (68.89%) and telmisartan (38.89%) were the most commonly used drugs. Amlodipine contributed the highest DDD (46%). ADRs were few, mostly mild, and decreased over time, with no severe reactions reported.

Conclusion: Prescribing practices were largely rational with good adherence to guidelines. However, improvement in patient education and optimization of therapy is needed.

Keywords: Hypertension, Drug Utilization Study, Antihypertensives, ATC/DDD, Prescribing Pattern, Adverse Drug Reactions.

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Introduction

High blood pressure (hypertension) is a significant health issue across the world and is a key contributor to cardiovascular, cerebrovascular, peripheral artery disease and kidney related complications. It is among the topmost preventable risk factors that cause untimely morbidity and mortality globally. The 2019 Global Burden of Disease data has brought to the fore the fact that cardiovascular disease claimed 18.6 million deaths worldwide and that there was a significant rise in disability-adjusted life years (DALYs), which points to the significant effects on global health rates [1]. Hypertension has become a growing and growing burden especially in low- and middle-income countries such as India where urbanization, sedentary living, dietary changes and the rising life expectancy are playing a key role in the prevalence of this disease.

Disparities in healthcare access, awareness and treatment adherence have become an increasing challenge in the management of hypertension in India. Although there are numerous antihypertensive drugs available to manage hypertension effectively, blood pressure is still not optimally controlled. It is noted that BP management in the normal range in India has only been developed in 13.64 of the hypertensive population [2] to date. The rate of control is low which indicates lapses in diagnosis, treatment practice, medication adherence, and patient education. The situation is even more acute in such states as Bihar, where healthcare facilities and access might be insufficient, and the targeted analysis of treatment routines and drug use patterns should be conducted.

Inappropriate prescription and irrational use of drugs may result into potential serious complications in the patients which may be adverse drug reactions, drug interactions and therapeutic failure. Moreover, prescribing irrationally is an additional factor that leads to higher healthcare expenses, which means that patients have to bear a financial burden, and treatment adherence may be adversely affected. Additional noncompliance exacerbates the chances of uncontrolled hypertension and other hypertension-related complications. As such,

prescribing practices must be monitored and assessed towards rational drug use.

Drug utilization studies (DUS) are important in the investigation of the trends of drug use, compliance with clinical practice, efficacy, and safety of the prescribed drugs. These research are useful in terms of prescription patterns and assist in determining the areas that need changes [3]. Through the examination of drug use patterns, healthcare professionals can enhance rational prescribing behavior, lessen the needless use of drugs, have fewer adverse reactions, and boost patient adherence. Moreover, DUS facilitates maximizing the therapeutic outcome and decreases the overall cost burden incurred by patients and health systems.

The trend of antihypertensive drug use has changed tremendously with time. All these changes are a manifestation of the growth in the knowledge of the pathophysiology of hypertension, the creation of new and more effective pharmacological agents and changes in clinical recommendations. Contemporary treatment strategies focus on personalized therapy, combination therapy, and use of more effective and safer medications. The degree to which these developments are applied in a real-life clinical application, especially in resource-deprived areas like Bihar is however also a sector that needs to be explored in detail.

The use of drugs also assists their health practitioners in developing a clear picture of the prescription trends, effectiveness of the drugs and safety issues. This kind of insight can help clinicians to prevent irrational prescribing and enhance the overall quality of healthcare services [4] . Such patterns should be evaluated on a regular basis to facilitate evidence-based medical practices and patient outcomes improvements. DUS should be done at regular intervals to keep a constant check on the trends in prescribing so that timely interventions can be taken to enhance rational drug use.

According to World Health Organization (WHO) drug utilization studies refer to the examination of the promotion, dispensing, prescribing, and use of drugs within the society with special emphasis on the medical, social and economic effects [5] of the use and application of the drugs. The aim of these studies is to make sure the medications are being prescribed, dispensed and utilized properly by patients. The end point is to encourage rational use of drugs which encompass prescribing the appropriate drug, in an appropriate dose, over an appropriate period and at the minimum possible cost to the patient and the community [6].

WHO has designed a number of standardized tools and indicators to evaluate drug utilization patterns. Two of these, the Anatomical Therapeutic Chemical (ATC) classification system and the Defined Daily Dose (DDD) methodology are widely employed. The ATC system classifies drugs according to the organ or system of action, therapeutic and chemical properties. Every drug is given a special ATC code that makes it easy to compare and classify that drug in various regions and healthcare facilities in a similar manner [7]. The DDD, in its turn, is the estimated average dose of a medicine applied on its main indication to adult patients per day. Such a standardized measure can be used to make meaningful comparisons of drug use by populations and across time.

Besides ATC/DDD methodology, there is another simple and cost-effective tool known as Drug Utilization 90% (DU 90) method used to assess prescribing practices. It determines the drugs that are used to prescribe 90 percent of all the prescribed medication, and they are in order of increasing DDD values [8]. This approach gives a clear image of the most popular drugs used and assists in evaluating whether the prescribing practices follow the guidelines. Through the priority of the most prescribed medications, DU 90% analysis can provide useful feedback to prescribers and assist in defining the areas of unreasonable drug consumption.

Drug usage pattern analysis is not only beneficial in enhancing treatment effectiveness but also gives valuable feedback to clinicians. The feedback is crucial in helping prescribers with their rational use of medicines, as well as reducing adverse drug reactions and enhancing patient safety. Such studies are especially useful in areas such as Bihar where there are differences in prescribing practices and health provision where remedial action needs to be taken.

Thus, the current research was conducted to determine the drug use trend among hypertensive patients in Bihar, India. The objective of the study is to investigate the prescribing behavior, use patterns, and drug reactions related to antihypertensive drugs. Through analyzing these parameters, the research aims to present evidence-based information that can help enhance rational drug use, improve patient outcomes, and reinforce healthcare practices in the area.

Methodology

Study Design

This study was designed as a prospective observational study aimed at evaluating the drug utilization pattern in patients diagnosed with hypertension. The observational nature of the study allowed the researchers to assess prescribing practices and drug use without any intervention, thereby reflecting real-world clinical scenarios.

Study Area

The study was conducted in the Department of Pharmacology at Shree Narayan Medical Institute and Hospital, Saharsa, Bihar,India

Study Duration

The study was carried out over a period of 8 months.

Sample Size

A total of 90 patients who met the predefined inclusion criteria were enrolled in the study. The sample size was considered adequate to assess the prescribing trends and drug utilization patterns in the study setting within the given duration.

Study Population

The study population comprised patients attending the outpatient and inpatient departments of the hospital who were diagnosed with hypertension and were prescribed one or more antihypertensive medications. Both newly diagnosed and previously known hypertensive patients were included to obtain a comprehensive overview of drug utilization patterns.

Inclusion Criteria

- Patients diagnosed with essential hypertension (newly diagnosed or known cases)
- Patients prescribed at least one antihypertensive medication
- Patients aged ≥ 18 years
- Patients of either gender
- Patients willing to provide written informed consent

Exclusion Criteria

- Patients with severe concurrent medical or psychiatric illness
- Pregnant or lactating women
- Patients unwilling to participate in the study

Data Collection

Data were collected using a predesigned patient data collection form and prescribing pattern proforma. Information was obtained from patient records and prescriptions. Demographic details such as age, gender, weight, height, and educational status were recorded, along with clinical information including diagnosis, duration of hypertension, and presence of co-morbidities. Detailed prescription data were collected, including the name of drugs, dosage, dosage form, route of administration, frequency, and duration of treatment. The prescribing pattern was assessed using World Health Organization (WHO) drug utilization study indicators, such as average number of drugs per encounter, use of generic names, percentage of drugs from the essential drug list, and availability of medications.

Study Procedure

After obtaining informed consent, patients meeting the inclusion criteria were enrolled in the study. Each prescription was carefully analyzed to assess drug utilization patterns. The prescribed medications were categorized according to the WHO Anatomical Therapeutic Chemical/Defined Daily Dose (ATC/DDD) classification system. Drug utilization was calculated by converting the prescribed quantities into defined daily doses using standard WHO guidelines. Additionally, Drug Utilization 90% (DU 90%) was calculated to identify the drugs accounting for 90% of total drug consumption. Patients were followed up at the 2nd and 8th weeks to monitor any adverse drug reactions. The severity of reported adverse drug reactions was assessed using the Hartwig and Siegel severity assessment scale.

Statistical Analysis

The collected data were analyzed using descriptive statistical methods. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean and standard deviation. The analyzed data were organized and presented in the form of tables and charts to facilitate interpretation of drug utilization patterns."

Result

Table 1 presents the demographic characteristics of the study population (N=90). The mean age of participants was 64.20 ± 11.35 years, with the majority belonging to the 61–75 years age group (36, 40.00%), followed by those >75 years (24, 26.67%). Males constituted 48 (53.33%) of the population, slightly higher than females (42, 46.67%). The mean BMI was 28.90 ± 3.25 kg/m², indicating an overall overweight population. A family history of hypertension was present in 50 (55.56%) participants. Regarding duration of treatment, 46 (51.11%) had been on treatment for 0–1 year, while 44 (48.89%) had a longer duration. Among comorbidities, cardiovascular diseases were the most common (28, 31.11%), followed by diabetes mellitus (20, 22.22%), cerebrovascular diseases (10, 11.11%), chronic obstructive pulmonary disease (9, 10.00%), dyslipidemia (8, 8.89%), and gastroesophageal reflux disease (5, 5.56%), with other conditions also reported in 10 (11.11%) cases.

Table 1: Demographic characteristics of study population (N = 90)

Demographic characteristics	Values
Age (years)	
Mean ± SD	64.20 ± 11.35
Age group n (%)	
30–45 years	8 (8.89)
46–60 years	22 (24.44)
61–75 years	36 (40.00)

>75 years	24 (26.67)
Sex n (%)	
Male	48 (53.33)
Female	42 (46.67)
BMI (kg/m²)	
Mean ± SD	28.90 ± 3.25
Family history of hypertension n (%)	
Present	50 (55.56)
Not present	40 (44.44)
Duration of treatment n (%)	
0–1 year	46 (51.11)
>1 year	44 (48.89)
Comorbidities n (%)	
Diabetes mellitus	20 (22.22)
Gastroesophageal reflux disease	5 (5.56)
Dyslipidemia	8 (8.89)
Chronic obstructive pulmonary disease	9 (10.00)
Cardiovascular diseases	28 (31.11)
Cerebrovascular diseases	10 (11.11)
Others	10 (11.11)

Table 2 presents drug utilization based on WHO core drug use indicators. The average number of drugs per encounter was 5.2, with an average of 2.1 antihypertensive drugs per encounter, indicating a moderate level of polypharmacy. A high proportion of drugs were prescribed from the essential drug list (91%) and by generic name (88.5%), reflecting rational prescribing practices. Only 2% of encounters involved injections, suggesting minimal use of injectable therapy. Regarding patient care indicators, 87% of drugs were dispensed from the hospital pharmacy. Patient awareness was good for dosage form and route of administration (100% each), while knowledge of medication name (82%) and correct dosage (70%) was comparatively lower. In terms of health facility indicators, the essential drug list/formulary was available, and 89% of key drugs were accessible. Overall, the findings indicate generally appropriate prescribing practices and good facility support, with some scope for improvement in patient knowledge of medications.

Table 2: Drug utilization according to WHO core drug use indicators

Description	Value
Prescribing indicators	
Average number of drugs per encounter	5.2
Average number of antihypertensive drugs per encounter	2.1
Percentage of drugs from essential drug list (EDL)	91
Percentage of drugs prescribed by generic name	88.5
Percentage of encounters with injection	2
Patient care indicators	
Drugs dispensed from hospital pharmacy (%)	87
Patients with knowledge of correct dosage (%)	70
Patients with knowledge of dosage form (%)	100
Patients with knowledge of medication name (%)	82
Patients with knowledge of route of administration (%)	100
Health facility indicators	
Availability of EDL/formulary	Yes
Availability of key drugs (%)	89

Table 3 shows the utilization pattern of antihypertensive drugs among the study population (N=90). Among monotherapy, Amlodipine was the most commonly prescribed drug, used in 62 patients (68.89%), followed by Telmisartan in 35 patients (38.89%) and Enalapril in 20 patients (22.22%). Diuretics such as Hydrochlorothiazide and Furosemide were used in 18 (20.00%) and 12 (13.33%) patients respectively, while beta blockers like Metoprolol were prescribed in 15 patients (16.67%). Other drugs including Ramipril, Torsemide, Propranolol, Prazosin, Carvedilol, Labetalol, and

Spironolactone were less frequently used. Fixed dose combinations such as Telmisartan + Hydrochlorothiazide and Telmisartan + Amlodipine were rarely prescribed. Overall, calcium channel blockers and angiotensin receptor blockers were the most commonly utilized classes, with Amlodipine being the predominant drug.

Table 3: Utilization pattern of antihypertensive drugs (N = 90)	
Drugs	**Number of patients (%)**
Monotherapy	
ACE inhibitors	
Enalapril	20 (22.22)
Ramipril	3 (3.33)
ARBs	
Telmisartan	35 (38.89)
CCBs	
Amlodipine	62 (68.89)
Diuretics	
Hydrochlorothiazide	18 (20.00)
Furosemide	12 (13.33)
Torsemide	2 (2.22)
Beta blockers	
Metoprolol	15 (16.67)
Propranolol	2 (2.22)
Alpha blockers	
Prazosin	4 (4.44)
Alpha + Beta blockers	
Carvedilol	12 (13.33)
Labetalol	3 (3.33)
Aldosterone antagonists	
Spironolactone	4 (4.44)
Fixed dose combinations	
Telmisartan + Hydrochlorothiazide	2 (2.22)
Telmisartan + Amlodipine	1 (1.11)

Table 4 presents the Defined Daily Dose (DDD) analysis of antihypertensive drugs among the study population (N=90). Amlodipine accounted for the highest utilization, with 62 prescriptions, an average dose of 8.5 mg/day, and contributing 46% of the total DDD (7600), indicating it was the most commonly used drug. Telmisartan was the second most utilized drug with 36 prescriptions and 20.5% of total DDD, followed by Furosemide (8.5%) and Hydrochlorothiazide (7.2%). Enalapril contributed 6.6%, while Metoprolol accounted for 4.8% of total DDD. Lesser utilization was seen with Spironolactone (2.5%), Carvedilol (1.3%), and Ramipril (1%). Overall, calcium channel blockers and angiotensin receptor blockers constituted the major share of antihypertensive drug use, with Amlodipine being the predominant agent.

Table 4: Defined daily dose (DDD) of antihypertensive drugs (N = 90)							
Drug	**ATC Code**	**WHO DDD (mg)**	**No. of prescriptions**	**Avg dose/day (mg)**	**Total DDD**	**DDD/patient**	**% of total DDD**
Amlodipine	C08CA01	5	62	8.5	7600	84.44	46
Telmisartan	C09CA07	40	36	45	3400	37.78	20.5
Furosemide	C03CA01	40	12	50	1400	15.56	8.5
Hydrochlorothiazide	C03AA03	25	18	25	1200	13.33	7.2
Enalapril	C09AA02	10	20	7	1100	12.22	6.6
Metoprolol	C07AB02	150	15	70	800	8.89	4.8
Spironolactone	C03DA01	75	4	100	420	4.67	2.5
Carvedilol	C07AG02	37.5	12	6	200	2.22	1.3
Ramipril	C09AA05	2.5	3	5	150	1.67	1

Table 5 presents the severity assessment of adverse drug reactions (ADR) at the 2nd week (n=14) and 8th week (n=11). At the 2nd week, most ADRs were mild in nature, including pedal edema (2 cases), dizziness (2), headache (2), joint pain (2), allergic rash (1), itching (1), abdominal pain (1), and dry cough (1). Moderate reactions were less frequent and observed in palpitations (1 case), abdominal pain (1), and dry cough (1), with no severe reactions reported. By the 8th week, the number of ADRs had reduced overall, with most remaining mild such as headache (2 cases), pedal edema (1), dizziness (1), abdominal pain (1), dry cough (1), and joint pain (1). Moderate reactions were seen in allergic rash (1), abdominal pain (1), and joint pain (1), while no severe ADRs were recorded at this stage as well. Overall, ADRs were predominantly mild, decreased over time, and no severe reactions were observed during the study period.

Table 5: Severity assessment of adverse drug reactions (ADR)

ADR	2nd week (n=14)			8th week (n=11)		
	Mild	Moderate	Severe	Mild	Moderate	Severe
Pedal edema	2	0	0	1	0	0
Dizziness	2	0	0	1	0	0
Allergic rash	1	0	0	0	1	0
Itching	1	0	0	0	0	0
Palpitations	0	1	0	0	0	0
Abdominal pain	1	1	0	1	1	0
Dry cough	1	1	0	1	0	0
Headache	2	0	0	2	0	0
Joint pain	2	0	0	1	1	0

Discussion

The demographic data depicted in the current research, where the mean age is 64.20 +/-11.35 years and a majority of the patients fall under the 61-75 years age bracket, is in line with other reports, which indicate that hypertension is prevalent amongst older populations. Naik et al. (2019) [9] and Hussain et al. (2017) [10] also reported similar age distributions with most patients with hypertension being older than 60 years. This resemblance confirms the existing correlation between older age and greater vascular stiffness, which adds to the increase in prevalence of hypertension. The marginally higher percentage of older patients in the current study than in some of the previous studies, however, could reflect better survival rates or better access to healthcare by older populations over the last few years. The current research was close to the gender balance, which is consistent with Naik et al. (2019) [9], although in some studies, males were predominant, which could indicate that the gender-specific differences could be different depending on the geographical and cultural context."

Polypharmacy as determined in the present study (average 5.2 drugs per prescription) compares to but is a little lower than the results of Jainaf et al. (2015) [11] whose average was 7.56 + 2.76 drugs per encounter. This comparison indicates comparatively superior prescription behaviors in the present environment, possibly due to heightened knowledge about the use of rational drugs. However, the persistence of polypharmacy is an issue as it is linked with a high risk of drug interactions and a low adherence rate of patients. The mean number of the antihypertensive medications per prescription (2.1) in the current study aligns with the general principle of treatment that the combination therapy is more effective in the management of blood pressure and corresponds to the similar results obtained by Singh et al. (2020) [12].

The fact that the percentage of drugs prescribed by generic name in the current study (88.5) is high indicates compliance with rational prescribing criteria and higher than the one revealed by Varakantham et al. (2017) [13] (80.7) who reported that generic prescribing is 80.7. Conversely, much lower rates were indicated by Gupta et al. (2019) [14] who have reported lower prescriptions, with only 6% of the prescriptions being written with generic names. This observed variation underscores how institutional policies and awareness among prescribers affect prescribing behavior. Likewise, the percentage of drugs prescribed on the essential drug list (91) is also higher than 65 in the previous studies (Datta, 2016) [15] which means that the adherence to the national and WHO guidelines on the use of essential medicines is enhanced.

The indicators of patient care in the current research also have positive trends. The rate of patients who properly understand the dosage (70%) is significantly larger than the one offered by Jainaf et al. (2015) [11], where only 38.3% of patients knew about appropriate dosage. Nonetheless, patient education, especially in terms of medication names, is not complete, which could indicate the necessity to improve the pharmacist-patient interaction. Better dispensing rates (87%) and access to essential drugs (89%) is another positive sign that the performance of healthcare facilities is better than reported before,

and structured hospital pharmacy systems assist in promoting rational use of drugs.

The trend in antihypertensive drug use in the current research shows a strong preponderance of calcium channel blockers (CCBs) especially amlodipine (68.89%), then angiotensin receptor blockers (ARBs) like telmisartan. This observation is consistent with other studies, such as Naik et al. (2019) [9], Singh et al. (2020) [12], and Datta (2016) [15], in which CCBs were the most commonly prescribed class. However, conversely, other studies have documented ARBs as the most commonly prescribed class, as in a study by Palanisamy et al. (2009) [16] reported regionally, which shows regional differences in prescribing patterns. Also, although the current study has less diuretics and beta-blockers use, other studies like Malpani et al. (2018) [17] indicated more use of diuretics as second-line therapy, which may reflect variations in the physician preference and the comorbidity of the patients.

The current study on defined daily dose (DDD) analysis showed that the mean prescribed dose of amlodipine (8.5 mg) was higher than the WHO recommended dose of 5 mg, which is a bit higher than that in Singh et al. (2020) [12], where the mean dose was 5 mg. On the same note, the Telmisartan dosage in the current study (45 mg) was slightly more than the WHO standard of 40mg. These differences can be individualized by dose titration in accordance with patient response and hypertension severity. Similar patterns in the use of DDD with amlodipine playing the leading role have been observed in earlier research that verified its central role in the management of hypertension because of its long half-life and good safety profile.

The rate of adverse drug reactions (ADRs) in the current study was low and was mainly mild, as had been observed in previous studies. As an example, Ubale (2019) [18] found more ADRs, with a small percentage of severe reactions, but there were no severe ADRs in the current study. This comparison indicates the possibility of better drug selection and monitoring practices in the new environment. The frequent cases of ADRs like headache, dizziness, and pedal edema seen in this research are common in literature especially in association with the use of CCB and this fact supports the established safety profile of these medications.

On the whole, the results of the current study are mostly consistent with the prior studies, especially when it comes to the prevalence of CCBs and ARBs, compliance with the prescribing of the essential drug list, and the presence of mild ADRs. Nonetheless, there are positive changes in the form of lower polypharmacy rates, increased generic prescribing levels, and enhanced patient awareness levels than in previous investigations. Such variations can be attributed to a change in prescribing habits, a focus on rational use of drugs and better healthcare facilities.

Conclusion

The current study reveals the fact that hypertension is most common among the elderly with a mild male weight and a large percentage with a positive family history and other comorbidities especially cardiovascular diseases. The pattern of drug use shows that many of the patients have a tendency to use polypharmacy, with preference being made towards combination therapy as compared to monotherapy. Calcium channel blockers and angiotensin receptor blockers were most frequently prescribed as part of the adherence to the usual treatment recommendations. The practice of prescribing was highly rational as indicated by high use of essential medicines and generic prescribing and low use of injections. There was a good level of patient awareness of medication information, but some deficits in dosage information were observed. Defined daily dose analysis revealed that the prescription of commonly used drugs was within acceptable therapeutic range. The number of adverse drug reactions was rather low and the majority were mild to moderate in severity and did not require major therapeutic adjustments. Overall, the study suggests rational prescribing practices with scope for improvement in patient education and optimization of drug therapy.

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