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Evaluation of Prescribing Pattern and Drug Therapy Problems in Patients with Hypertension: A Prospective Interventional Study

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ABSTRACT
In the study area, there was a scarcity of the evidence on prevalence, distribution, and management of Drug Related Problems (DRPs). The study aims to evaluate the prescribing pattern and Drug Therapy Problems (DTPs) present in hypertension. This is a prospective interventional study that was conducted in the general medicine department of a tertiary care hospital. All patients who are diagnosed with hypertension, both gender and co-morbidities were recruited in this study. The collected information was reviewed for the identification of DTPs. Patient-specific intervention was provided based on identified DTPs. All prescriptions were subjected to estimate the World Health Organization (WHO) prescribing indicators in hypertension. The study results have shown, 105 drug therapy problems were identified in 120 of 167 hypertensive patients with prevalence of 71.85%. There was a high rate of the occurrence of drug interactions (55, 32.93%) and adverse drug reactions (19, 11.38%) in hypertensive patients. The most commonly recommended interventions to overcome DTPs were dose reduction (20, 26.66%), monitoring of the patient (26, 34.66%), and drug discontinuation (9, 12.00%) respectively. There was poor adherence to WHO prescribing indicators in the management of hypertension. The study concludes that drug interaction and adverse drug reactions were the most common drug therapy problems identified in the hypertensive patients. Advanced age, males, presence of co-morbidity, and polypharmacy were the major predictors of DTPs in hypertension. Planning and implementation of continuous educational programs on rational use of drugs among healthcare professionals to meet the prescribing indictors as per the WHO standards.
Keywords: Drug-related problems, Prescribing pattern, Anti-hypertensive, Pharmacist recommendations

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INTRODUCTION

Globally, hypertension is the main cause of premature death [1]. Evidence shows that 1.13 billion people worldwide have hypertension, most are living in low- and middle-income nations. Hypertension is a serious medical disorder that increases the risk of heart, brain, kidney, and other diseases [2]. As per the global non-communicable diseases target, decrease the prevalence of hypertension by 25% by 2025 [3].Despite the availability of effective therapy for hypertension, majority of the patients fail to achieve a target level of blood pressure (<140 systolic and <90 diastolic). This was primarily due to drug therapy problems (DTPs) associated with the treatment of hypertension [4]. A DTP is any undesirable event experienced by the patient upon drug therapy, which will interfere with the actual goal of the treatment [5]. The most common DTP reported in literature are, drug interaction, adverse drug reaction, overdose, sub-optimal dose, medication non-adherence, drug duplication, drug used without indication, and indication not treated [6]. Drug therapy problems can adversely affect the quality of life, increase in the rate of hospitalization, and healthcare costs [7]. Early detection of DTPs present in hypertensive patients helps to prevent and manage. The clinical pharmacist plays an important role in planning interventions for DTPs in collaboration with other healthcare teams [8].World Health Organization (WHO) developed prescribing indicators to assess the optimal use of drugs in any healthcare settings [9]. Prescribing indicators will give clues for the identification of problems in prescribing patterns in hypertension. Prescribing patterns of antihypertensive medications and identification of DTPs in hypertension helps to

plan strategic interventions to reduce the burden of the occurrence of DTPs in hypertensive patients [10].In the study area, there was a scarcity of the evidence on prevalence, distribution, and management of DRPs. So, the study aims to evaluate the prescribing pattern and DTPs present in hypertension.

MATERIAL AND METHODS

This is prospective interventional study that was conducted in general medicine department of a tertiary care hospital in Tirupati. The hospital comprises about 1200 beds, and it serves people from various rural and urban settings of Tirupati.

Study duration

The study was conducted for a period of ten months from January 2019 to October 2019.

Study criteria

All patients who are diagnosed with hypertension, irrespective of gender and co-morbidities are recruited in this study after getting willingness for enrollment. Patients taking treatment on inpatient basis are eligible to enroll in this study. Patients who are not willing to participate, and taking treatment on out-patient or ambulatory basis are excluded from this study.

Ethical considerations

The study protocol was approved by the institutional review board with an IRB No. SPSP/2018-2019/PHD02. Participants were explained clearly about the study protocol and objectives in local language, and enrolled after getting informed consent form. Confidentiality of the data was maintained before, during, and after completion of the study.

Sample size and sampling technique

The sample size was determined by using Epi-Info statistical software given by Centre for Disease Control, USA. By considering 10% of DRP rate, 5% of margin error, 1% of design effect, and 95% of confidence interval, the sample size was estimated as 138. The final sample size was calculated as 150 by adding 10% to the actual sample size.

Data collection tool

The data collection form was prepared to collect information regarding socio-demographic details, clinical characteristics, drug therapy problems, and WHO prescribing indicators. The patient demographic and clinical characteristics include; age, gender, marital status, residence, suffering from co-morbidity, social habits, length of hospital stay, and number of drugs in the prescription. The data collection form also provided information regarding drug therapy problems (drug interactions, adverse drug reactions, overdose, sub-therapeutic dose, drug used without any indication, untreated indication, improper drug selection, and failure to receive drug) to be assessed among hypertensive patients. The WHO prescribing indicators like the average number of drugs per encounter, percentage of drugs prescribed by generic name, percentage of encounters prescribed with antibiotics, percentage of encounters prescribed with injections, and percentage of drugs prescribed from essential drug list (EDL)/formulary are presented in the data collection form.

Study procedure

The study was initiated after getting ethical clearance from the institutional review board (IRB). All in-patients who met the study criteria are enrolled in the study. After enrollment of the patient, a data collection form was used to collect information from the patient case sheets, lab reports, medication charts, nursing and physician notes, and direct patient interviews. After collection of information, the expert team comprising physician, pharmacist, and interns were reviewed for the identification of drug therapy problems present in the hypertensive patient. The expert team is also provided patient-specific intervention based on identified drug therapy problems. All clinical pharmacist-mediated interventions were documented in the data collection form. All prescriptions were subjected to estimate the WHO prescribing indicators in hypertension.

Data analysis

Descriptive statistics like mean, standard deviation, frequency, and percentage were used to represent the socio-demographic profile, clinical profile, DTPs, and WHO prescribing indicators. Inferential statistics like Chi-square test was used to associate independent variables (age, gender, residence, co-morbidities, number of drugs, and duration of hospital stay) with dependent variable (presence of DTP). *p*-value less than 0.05 was considered as statistically significant.

RESULTS

A total of 167 hypertensive patients were enrolled in the study from in-patient medical department. The mean (SD) age of the study participants was 63.37±8.27. The majority of the patients were aged more than 60 years (55, 32.93%), males (101, 60.58%), illiterate (152, 91.02%), from rural residence (140, 83.83%), not have any social habits (96, 57.48%), and suffering with co-morbidities (131, 78.44%). The

length of hospital stay was more than four days in many patients (121, 72.45%) and prescribed more than five drugs (139, 83.23%) in each prescription as shown in Table 1. The study results have shown, 105 drug therapy problems were identified in 120 of 167 hypertensive patients with a prevalence of 71.85%. There was a high rate of the occurrence of drug interactions (55, 32.93%) and adverse drug reactions (19, 11.38%) in hypertensive patients. The remaining drug therapy problems like drug without indication (4, 2.39%), untreated indication (5,2.99%), improper drug selection (9, 5.39%), sub therapeutic dose (7, 4.19%), overdose (3, 1.79%), failure to receive medications (3, 1.79%) were low as depicted in Table 2. A total of 75 pharmacist interventions were recommended towards healthcare workers and patients depending on the need of the individual patient. In these interventions, 61 got accepted and implemented to improve the outcomes of hypertension. The patient counseling to improve the medication adherence got 100% acceptance. The most commonly recommended interventions to overcome DTP were dose reduction (20, 26.66%), monitoring of the patient (26, 34.66%), and drug discontinuation (9, 12.00%) respectively. The remaining DTP and their acceptance rate were represented in Table 3.The findings of the WHO core prescribing indicators in hypertensive patients revealed that the average number of drugs per encounter was 6.97 which was very high compared to WHO standard. The percentage of generic prescribing (57.94%), antibiotics per encounter (63.47%), injections per encounter (86.82%), and drugs from the EDL (90.3%) was not optimal with WHO standards as represented in Table 4.The findings of the Chi-square results revealed that there was a significant association between age more than 60 years, male gender, presence of co-morbid conditions, and more than five drugs in the prescription for the development of drug therapy problems with a $p<0.05$ as shown in Table 4.

Table 1: Socio-demographic profile of the study participants (n=167)

Variable	Frequency (%)
Age in years (±SD)	63.37±8.27
30-40	13 (7.78)
41-50	49 (29.34)
51-60	50 (29.94)
>60	55 (32.93)
Gender	
Male	101 (60.48)
Female	66 (39.52)
Educational status	
Literate	15 (8.98)
Illiterate	152 (91.02)
Residence	
Rural	140 (83.83
Urban	27 (16.17)
Social habits	
Smoking	5 (2.99)
Alcohol	7 (4.19)
Smoking + Alcohol	57 (34.13)
Tobacco chewing	2 (1.19)
Nil	96 (57.48)
Co-morbidities	
Present	131 (78.44)
Absent	36 (21.56)
Hospital duration in days (Mean ± SD)	5.48±1.83
More than four days	121 (72.45%)
Less than or equal to four days	46 (27.54)
Number of drugs (Mean ± SD) More than five Less or equal to five	6.98±1.79 139 (83.23) 28 (16.7%)

SD=Standard deviation

DISCUSSION

Drug therapy problems are one of the major concerns in the treatment of hypertension which will increase the healthcare costs, morbidity, mortality, and reduces the quality of life. The majority of the

study participants were aged more than 60 years. Numerous studies support an advanced age is the non-modifiable risk factor for the development of essential hypertension [1,4,11,12]. Majority of the patients have co-morbidities. The presence of co-morbidities in hypertension will increases polypharmacy and DTPs. Timely screening of DTPs in hypertension and providing interventions as per the need of the patient will definitely improve the clinical outcomes [13]. In the current study, the majority of the hypertensive patients were males. Evidence shows that the risk of hypertension is very high in men compared to women, due to lifestyle habits that may increase blood pressure [14].The study findings reveal that the prevalence of drug therapy problems was 71.85%, which was low compared to the study conducted in Ethiopia (80.7%). The low rate of DTPs in this study may due to high adherence towards EDL/formulary in the hospital. Even evidence shows that prescribing from formulary will reduce the burden of DTPs [15]. Drug interaction is the highest reported (32.93%) drug therapy problem in our study. This is due to the majority of the patients were suffering from co-morbid conditions that require multiple medication therapy to achieve positive clinical outcomes. The study conducted in Indonesia also shown drug interaction was the most common (62.14%) drug therapy problem in the management of hypertension with co-morbid conditions [12]. These findings are in contrast with our study in the rate of reported drug interactions. The most common drug interaction found in our study was the combination of digoxin and amlodipine which may increase the risk of heart attack in five cases. Regular monitoring of electrolyte concentrations was recommended in all these cases. The next common drug interaction was the combination of enalapril with aspirin which may decrease the effectiveness of enalapril in four cases. This interaction was moderate, no intervention was provided in these four cases. The second most common drug therapy problem in our study was adverse drug reaction (ADRs) (11.38%). These results are in contrast with the findings of the Nigerian study where adverse drug reaction was the least type of drug therapy problem [16]. In the current study, the commonly found few ADRs were, atorvastatin induced rhabdomyolysis, propranolol induced vomiting, amlodipine induced pedal edema, losartan induced headache, enalapril induced dry cough, and nitroglycerine induced headache. These results suggest that in hypertension management regular monitoring and management of ADRs was very important to control the blood pressure and improve patient outcomes. The study findings revealed dosage errors (sub therapeutic dose and overdose) in the patients under antihypertensive medications. Drugs like enalapril, metoprolol, captopril, ceftriaxone, and atorvastatin are given in sub-optimal doses. Drugs like amlodipine, atorvastatin, and pantoprazole had given in high doses. The clinical pharmacist interventions were provided to tailor the dose as per the need of the patient. The dosage errors committed by the patients were nearly similar to the study conducted in Northern Ethiopia [11]. The major reason for the high dose of antihypertensive medication was frequent administration of the drug by the patients. The study conducted in South America and Brazil showed that low dose as DTP accounts for 44%, which was in contrast with our study. Of the total DTPs, unnecessary medication therapy was 2.39%. This was very less (11.2%0 compared to the study conducted in Northern Ethiopia. The probable reason for this low rate was due to high adherence towards formulary/EDL in the hospital. The study results show that very few patients (1.79%) failure to receive medications for the management of hypertension. These findings were in contrast with the study conducted in Ethiopia and China [17,18]. The primary reason for the low rate of failure to receive medications was due to the effective running of the patient counseling center in the hospital. There was a significant association between the age more than 60 years, male gender, presence of co-morbid conditions, and more than five drugs in the prescription for the development of drug therapy problems. Similar findings were also observed in various studies conducted in Ethiopia, and China [18,19].The findings of the WHO core prescribing indicators in hypertensive patients revealed that the average number of drugs per encounter was 6.97 which was very high compared to WHO standard. The percentage of generic prescribing (57.94%), antibiotics per encounter (63.47%), injections per encounter (86.82%), and drugs from the EDL (90.3%) was not optimal with WHO standards. There was a need to conduct continuous educational programs on the rational use of drugs among healthcare professionals to meet the prescribing indicators as per the WHO standards.

Table 2: Distribution of drug therapy problems in hypertension (n=167)

DTP	Frequency (%)
Drug without indication	4 (2.39)
Untreated Indication	5 (2.99)
Improper drug selection	9 (5.39)
Sub therapeutic dose	7 (4.19)
Over dose	3 (1.79)
Failure to receive medication	3 (1.79)
Drug interaction	55 (32.93)
Adverse drug reaction	19 (11.38)

DTP=Drug Therapy Problem

Table 3: Pharmacist recommended interventions and acceptance

Intervention	Recommended Frequency (%) N=75	Accepted Frequency (%)
Dose reduction	20 (26.66)	18 (90.00)
Drug discontinuation	9 (12.00)	8 (88.88)
Add drug to regimen	5 (6.66)	4 (80.00)
Change drug	7 (9.33)	3 (42.86)
Counselling	8 (10.66)	8 (100.0)
Monitoring	26 (34.66)	20 (76.92)

Table 4:Distribution of WHO Core prescribing indicators among hypertensive patients

Indicator	Average/Percentage	WHO standard derived or ideal (%)
Average number of drugs per encounter	6.97	1.6-1.8
Percentage of drugs prescribed by generic name	57.94	100
Percentage of encounters prescribed with an antibiotic	63.47	20.0-26.8
Percentage of encounters prescribed with an injection	86.82	13.4-24.1
Percentage of drugs prescribed from EDL/Formulary	90.3	100

EDL=Essential Drug List; World Health Organization

Table 5: Correlation between patient characteristics and drug related problems (n=167)

Variable	Total (n=167)	Presence of DRPs	Chi-square	*p* value
Age (Years)				
≥ 60	55 (32.93)	43 (78.18)	6.73	0.0062
<60	112 (67.06)	63 (56.25)		
Gender				
Male	101 (60.48)	57 (56.43)	4.718	0.0219
Female	66 (39.52)	49 (74.24)		
Location				
Rural	140 (83.83)	87 (62.14)	0.353	0.5148
Urban	27 (16.17)	19 (70.37)		
Co-morbidities				
Yes	131 (78.44)	95 (72.52)	19.677	<0.0001
No	36 (21.56)	11 (30.55)		
No. of drugs				
> 5	139 (83.23)	95 (68.34)	7.281	0.0050
≤ 5	28 (16.76)	11 (39.28)		
Hospital stays				
> 4 days	121 (72.45)	75 (61.98)	0.219	0.5912
≤ 4 days	46 (27.54)	31 (67.39)		

DRP=Drug Related Problem

STRENGTHS AND LIMITATIONS

The study provides evidence of the prevalence and types drug therapy problems in the hospital which providing services to the public in and around Tirupati. These findings were applicable to only in-patients under the treatment of anti-hypertensive medication therapy. Their will be a chance of recall bias in

medication adherence level measurement (interview based). Outcomes of the clinical pharmacist interventions were not studied.

CONCLUSION

The study concludes that drug interaction and adverse drug reactions were the most common drug therapy problems identified in hypertensive patients. Advanced age, male gender, presence of the co-morbid condition, and polypharmacy were the major predictors of DTPs in hypertension. There was poor adherence to WHO prescribing indicators in the management of hypertension. Planning and implementation of continuous educational programs on rational use of drugs among healthcare professionals to meet the prescribing indicators as per the WHO standards.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest

REFERENCES

1. Bromfield, S., Muntner, P. (2013). High blood pressure: the leading global burden of disease risk factor and the need for worldwide prevention programs. Curr Hypertens Rep.,15(3):134–6.
2. Mills, KT., Bundy, JD., Kelly, TN., Reed. JE., Kearney, PM., Reynolds, K., et al. (2016). Global Disparities of Hypertension Prevalence and Control: A Systematic Analysis of Population-Based Studies From 90 Countries. Circulation., 134(6):441–50.
3. Dugani, S., Gaziano, TA. (2016). 25 by 25: Achieving Global Reduction in Cardiovascular Mortality. Curr Cardiol Rep.,18(1):10.
4. Niriayo, YL., Kumela, K., Kassa, TD., Angamo, MT. (2018). Drug therapy problems and contributing factors in the management of heart failure patients in Jimma University Specialized Hospital, Southwest Ethiopia. PloS One.13(10):e0206120.
5. Belayneh, YM., Amberbir, G., Agalu, A. (2018). A prospective observational study of drug therapy problems in medical ward of a referral hospital in northeast Ethiopia. BMC Health Serv Res.,18(1):808.
6. Nasir, BB., Berha, AB., Gebrewold, MA., Yifru, YM., Engidawork, E., Woldu. MA. (2020). Drug therapy problems and treatment satisfaction among ambulatory patients with epilepsy in a specialized hospital in Ethiopia. PloS One.,15(1):e0227359.
7. Hailu, BY., Berhe, DF., Gudina, EK., Gidey, K., Getachew, M. (2020). Drug related problems in admitted geriatric patients: the impact of clinical pharmacist interventions. BMC Geriatr.,20(1):13.
8. Tefera, GM., Zeleke, AZ., Jima, YM., Kebede, TM. (2020). Drug Therapy Problems and the Role of Clinical Pharmacist in Surgery Ward: Prospective Observational and Interventional Study. Drug Healthc Patient Saf.,12:71–83.
9. Prasad, PS., Rudra, JT., Vasanthi, P., Sushitha, U., Sadiq, Mj., Narayana, G. (2015). Assessment of drug use pattern using World Health Organization core drug use indicators at Secondary Care Referral Hospital of South India. CHRISMED J Health Res.,2(3):223.
10. Franklin, SS., Jacobs, MJ., Wong, ND., L'Italien, GJ., Lapuerta, P. (2001). Predominance of Isolated Systolic Hypertension Among Middle-Aged and Elderly US Hypertensives: Analysis Based on National Health and Nutrition Examination Survey (NHANES) III. Hypertension.,37(3):869–74.
11. Weldegebreal, AS., Tezeta, F., Mehari, AT., Gashaw, W., Dessale, KT., Legesse, NY. (2019). Assessment of drug therapy problem and associated factors among adult hypertensive patients at Ayder comprehensive specialized hospital, Northern Ethiopia. Afr Health Sci.,19(3):2571–9.
12. Kusumawardani, L., Andrajati, R., Nusaibah, A. (2020). Drug-related problems in hypertensive patients: A cross-sectional study from Indonesia. J Res Pharm Pract.,9(3):140.
13. Burnier, M., Egan, BM. (2019). Adherence in Hypertension: A Review of Prevalence, Risk Factors, Impact, and Management. Circ Res.,124(7):1124–40.
14. Yang, MH., Kang, SY., Lee, JA., Kim, YS., Sung, EJ., Lee, K-Y., et al. (2017). The Effect of Lifestyle Changes on Blood Pressure Control among Hypertensive Patients. Korean J Fam Med.,38(4):173–80.
15. Shrestha, R., Prajapati, S. (2019). Assessment of prescription pattern and prescription error in outpatient Department at Tertiary Care District Hospital, Central Nepal. J Pharm Policy Pract.,12(1):16.
16. Blessing., Onyinye, U. (2020). Prevalence of Uncontrolled Blood Pressure and Drug Related Problems in Adult Hypertensive Patients: A Comparative Study. Biomed J Sci Tech Res.,31(5).
17. Tesfaye, A. (2015). Blood Pressure Control Associates and Antihypertensive Pharmacotherapy Patterns in Tikur Anbessa General Specialized Hospital Chronic Care Department, Addis Ababa, Ethiopia. Am J Biomed Life Sci.,3(3):41.

18. Zhang, M., Meng, Y., Yang, Y., Liu, Y., Dong, C., Xiao, J., et al. (2011). Major inducing factors of hypertensive complications and the interventions required to reduce their prevalence: an epidemiological study of hypertension in a rural population in China. BMC Public Health.,11(1):301.
19. Weldegebreal, AS., Tezeta, F., Mehari, AT., Gashaw, W., Dessale, KT., Legesse, NY. (2019). Assessment of drug therapy problem and associated factors among adult hypertensive patients at Ayder comprehensive specialized hospital, Northern Ethiopia. Afr Health Sci.,19(3):2571–9.

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