Original Article

Prescription Pattern of Antihypertensive Drugs: An Experience from a Secondary Care Hospital in the United Arab Emirates

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Abstract

Objective: The aim of the study was to examine the prescription pattern of antihypertensive drugs used in a secondary care hospital in the United Arab Emirates (UAE). **Methods:** It was a prospective, observational study carried out in 588 adult hypertensive patients presenting to medicine outpatient and inpatient departments of Dibba Hospital, Fujairah, UAE. The study was conducted for a period of 6 months from December 2017 to May 2018. Demographic and clinical data were collected from electronic patient case records and documented. Prescriptions were studied overall for drug use details and for specific types of antihypertensive drugs. The World Health Organization Anatomical Therapeutic Chemical/Defined Daily Dose methodology was further used to calculate utilization. Statistical analysis of data was performed using Statistical Package for the Social Sciences 24.0. **Findings:** Of the 588 study participants, majority of the patients were on two-drug combination antihypertensive therapy (n = 210, 35.5%) followed by monotherapy (n = 188, 32.1%) and three-drug combination (n = 136, 23.1%). Calcium channel blockers were the most frequently (51%) prescribed class both in monotherapy and in combination therapy while angiotensin receptor blockers and angiotensin-converting enzyme inhibitors (55.9%) were the most preferred agents for monotherapy. Among individual antihypertensive drugs, amlodipine was prescribed the most (266 prescriptions), irrespective of monotherapy or combination therapy. **Conclusion:** Our study represents the current prescribing trends of antihypertensive drugs in a secondary care hospital in the UAE. The use of antihypertensive drugs largely conforms to international guidelines, but still, there is room for improvement in terms of rational drug utilization.

Keywords: *Antihypertensive drugs, drug utilization, hypertension, prescription pattern*

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Introduction

The increasing prevalence of hypertension and associated morbidity and mortality is a major challenge worldwide,[1] more so in the Arab countries where the prevalence of hypertension is higher compared to the US and Sub-Saharan Africa.[2]

Management of hypertension with antihypertensive drugs is associated with a significant reduction in cardiovascular morbidity and mortality.[3] Different antihypertensive drug classes, angiotensin-converting enzyme inhibitors (ACEIs), angiotensin receptor blockers (ARBs), beta-blockers (BBs), calcium channel blockers (CCBs), and diuretics are available as monotherapy or as combination therapy, for the effective management of hypertension. Selection of appropriate antihypertensive drug should be made by positive indications, contraindications, presence or absence of comorbidities, and conditions requiring careful usage of the drugs.[4-6]

Despite the advances in the management of hypertension, achievement and maintenance of guideline recommendations[5,6] of blood pressure (BP) control

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remain a challenge. Noncompliance with antihypertensive drugs and nonadherence to recommended lifestyle modifications accounts for inadequate BP control.[7]

Evaluating antihypertensive drug utilization and assessing BP control of hypertensive patients can play crucial roles in the efforts to alleviate the burden of hypertension. Prescription pattern-focused drug utilization research is an essential tool as it offers an unbiased assessment of prescribing, dispensing, and distributing drugs. It also helps in identifying the profile and extent of drug use and trends and compliance with local and international treatment guidelines.[8,9]

The World Health Organization Anatomical Therapeutic Chemical/Defined Daily Dose (WHO ATC/DDD) methodology serves as a technical tool for analyzing the drug utilization patterns and the quality of drug use.[10] For each drug and its route of administration, the WHO ATC/DDD methodology defines the DDD as the assumed average maintenance adult dose per day[11] and the prescribed daily dose (PDD) as the average daily amount of drug actually prescribed. The PDD may not always correspond to the DDD as PDD may vary as per individual patient characteristics and disease factors.[12] The ratio of PDD to DDD indicates adequate, under, or over utilization of drugs.[12,13]

Understanding the antihypertensive drug utilization in the United Arab Emirates (UAE) population is important for a number of reasons; the increasing prevalence of hypertension in the region,[14] cardiovascular diseases being the leading cause of mortality,[15] and paucity of data on whether the antihypertensive prescription pattern align with local government and international guidelines. On the background of these observations, we conducted this study to examine the antihypertensive prescription patterns and to compare the PDD with the DDD of different antihypertensive drugs used in a secondary care hospital in the UAE.

Methods

This study was a prospective observational study involving patients with hypertension attending the Internal Medicine Department of Dibba Hospital, Fujairah, UAE. Dibba hospital is one of the three hospitals present in Fujairah, UAE. It is a multispecialty hospital with accident and emergency medicine, internal medicine, dermatology, ophthalmology, obstetrics and gynecology, orthopedics, otorhinolaryngology, pediatrics, physical medicine and rehabilitation, and radiology departments. The study was conducted for a period of 6 months from December 2017 to May 2018. Convenience sampling technique was used to select the study sample. The sample size was calculated depending on the number of patients visiting inpatient and outpatient departments of the hospital during the 6-month study period with 20% drop-out consideration. A total of 588 patients, 500 outpatients and 88 inpatients, were enrolled in the study. Adult patients of either gender with a confirmed diagnosis of hypertension and on antihypertensive drugs visiting the outpatient and inpatient facilities of the Internal Medicine Department of the study site were included in the study. Patients with malignant hypertension, significant renal and hepatic diseases, and pregnancy were not included in the study.

Demographic and clinical data were collected by the study investigators from the electronic patient case records and documented in the data collection form designed for the study. Demographic and clinical data included age, gender, marital status, nationality, number and type of comorbidities, dose, frequency and duration of antihypertensive drugs, and concomitant medications. All data were collected and checked for completeness by the study investigators.

Antihypertensive prescriptions were studied overall for drug use details and for specific types of antihypertensive drugs. The drugs were categorized as per the WHO ATC/DDD classification.[10] The PDD was calculated by taking the average of the daily doses of each antihypertensive drug and the corresponding DDD was taken from the WHO ATC/DDD classification.[11] The PDD of each antihypertensive drug was compared with its corresponding DDD (expressed as ratio). A PDD/DDD ratio of 1 indicated that the PDD was equal to the DDD. A ratio of >1 suggested that the PDD was greater than the DDD. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) for Windows, Version 24.0. (IBM Corp., Armonk, N.Y, USA). Descriptive analyses were carried out to examine the sociodemographic and clinical characteristics of the patients. A logistic regression model was used to assess the association between the predictor variables and prescription of a particular antihypertensive drug class. Results were expressed as odds ratios (OR) and 95% confidence intervals (CI). $P < 0.05$ was considered statistically significant.

The study was approved by Ras Al Khaimah (RAK) Medical and Health Sciences University Research and Ethics Committee (Number: RAKMHSU REC 3-2017-PG-P) and RAK Research and Ethics Committee (RAK REC 34-2017-PG-P), UAE.

Results

Out of 588 patients enrolled in the study, 252 (42.9%) patients were male and 336 (57.1%) patients were female. The mean age of the patients was 63.2 ± 14.33 years,

with majority of them aged between 58 and 67 years (182, 31%). Majority of the patients belonged to the Emirati nationality (79.6%). Diabetes mellitus and hyperlipidemia were the most common comorbidities (192, 32.7%) in our hypertensive patients. Combinations of antidiabetic, antiplatelet, and antihyperlipidemic drugs were the most common concomitant medications (21.6%). The sociodemographic and clinical parameters of the hypertensive patients are shown in Table 1.

Majority of our patients were on two-drug combination therapy (210, 35.5%) followed by monotherapy (188, 32.1%) and three-drug combination (136, 23.1%). A small proportion of patients (n = 48, 8.2%) were on four-drug combination therapy. CCBs were the most frequently (51%) prescribed class both in monotherapy and in combination therapy followed by ARBs (46.7%), diuretics (37.5%), ACEIs (31.5%), and BBs (33.7%). ARBs and ACEIs (55.9%) were the most preferred agents for monotherapy. In combination therapy, ARBs/ACEIs + CCBs (52.8%) were prescribed to the majority of the hypertensive patients. Among the individual antihypertensive drugs, amlodipine was prescribed the most (266 prescriptions) followed by valsartan (220 prescriptions), perindopril (155 prescriptions), indapamide (137 prescriptions), and bisoprolol (84 prescriptions), irrespective of monotherapy or combination therapy. The prescription pattern of antihypertensive drugs at the study site is presented in Table 2.

Multiple logistic regression analysis revealed that patients aged ≤55 years were more likely to receive ACEIs and ARBs compared to patients aged >55 years (OR: 2.14, 95% CI 1.46–3.14; OR: 1.43, 95% CI 1.12–1.83). However, diuretics and CCBs were less likely to be prescribed to patients aged ≤55 years compared to >55 years (OR: 0.54, 95% CI 0.36–0.81; OR: 0.67, 95% CI 0.46–0.96). In our study population, ACEIs were more likely to be prescribed to males as

Table 1: Sociodemographic and clinical characteristics of hypertensive patients

Variable	Overall (n=588)	Male (n=252)	Female (n=336)	P*
Age, years (%)				0.692
18-27	1.4	2.4	0.6	
28-37	3.4	4.0	3.0	
38-47	8.3	8.7	8.0	
48-57	18.0	16.3	19.3	
58-67	31.0	30.6	31.2	
68-77	23.3	23.8	22.9	
78-87	10.2	9.9	10.4	
88 and above	4.4	4.4	4.5	
Nationality (%)				0.019
Emirati	79.6	75.4	82.7	
Expatriate	20.4	24.6	17.3	
Number of comorbidities (%)				0.413
No comorbidity	23.6	22.6	24.4	
One comorbidity	37.5	40.5	35.1	
Two comorbidity	38.9	36.9	40.5	
Type of comorbidities (%)				0.081
Diabetes mellitus	8.2	7.1	8.9	
Hyperlipidemia	23.2	24.6	22.0	
Ischemic heart disease	6.0	8.7	4.2	
Diabetes mellitus + hyperlipidemia	32.7	29.0	35.4	
Diabetes mellitus + ischemic heart disease	6.3	7.9	5.1	
Concomitant medications (%)				
Antidiabetic	6.2	5.2	6.8	0.253
Antihyperlipidemic	12.8	11.5	13.7	0.255
Antiplatelet	3.0	4.4	2.1	0.090
Antidiabetic + antihyperlipidemic	16.6	12.7	19.6	0.016
Antidiabetic + antiplatelet	2.7	2.8	2.7	0.568
Antihyperlipidemic + antiplatelet	15	19.4	11.6	0.006
Antidiabetic + antihyperlipidemic + antiplatelet	21.6	23.4	20.2	0.205
Other medications	22.1	24.4	19.7	0.256

*Chi-square test

Table 2: Prescription pattern of antihypertensive drugs

Antihypertensive drug class	Number of prescriptions	Percentage of prescriptions (%)	Percentage of prescription with monotherapy or combination therapy (%)
Drugs of monotherapy	188	32.1	
ARBs	67	35.7	11.39
CCBs	39	20.8	6.63
ACEIs	38	20.2	6.46
BBs	30	15.9	5.23
Diuretics	12	6.4	2.04
Other antihypertensive class	2	1	0.34
Two drug combination	210	35.5	
ARBs + CCBs	65	30.9	11.05
ACEs + CCBs	46	21.9	7.73
ACEIs + Diuretics	29	13.8	4.84
ACEIs + BBs	26	12.4	4.40
ARBs + Diuretics	17	8.1	2.89
ARBs + BBs	13	6.2	2.21
Diuretics + BBs	8	3.8	1.36
CCBs + BBs	5	2.4	0.85
Diuretics + CCBs	1	0.5	0.17
Three drug combination	136	23.1	
ARBs + CCBs + diuretics	35	25.8	5.95
ACEIs + CCBs + diuretics	23	16.9	3.91
ARBs + CCBs + BBs	22	16.1	3.74
ARBs + diuretics + BBs	15	11	2.55
ACEIs + CCBs + BBs	14	10.3	2.38
ACEIs + diuretics + BBs	11	8.1	1.85
ARBs + 2 diuretics	4	3	0.68
Diuretics + CCBs + BBs	3	2.2	0.51
CCBs + 2 diuretics	2	1.4	0.34
ACEIs + 2 diuretics	2	1.4	0.34
ACEIs + diuretics + other antihypertensive class	2	1.4	0.34
ARB + diuretics + other antihypertensive class	1	0.8	0.17
Diuretics + diuretics + BBs	1	0.8	0.17
CCBs + CCBs + ARBs	1	0.8	0.17
Four drug combination	48	8.2	
ARBs + CCBs + BBs + diuretics	25	52	4.25
ACEIs + CCBs + BBs + diuretics	10	20.8	1.70
ARB + BB + 2 diuretics	6	12.5	1.02
ACEIs + BBs + 2 diuretics	3	6.3	0.51
CCBs + ARBs + 2 diuretics	2	4.2	0.34
CCBs + ACEIs + 2 diuretics	1	2.1	0.17
CCBs + BBs + 2 diuretics	1	2.1	0.17
Five drug combination	5	0.9	
BBs + CCBs + ARBs + 2 diuretics	2	40	0.34
ACEIs + CCBs + BBs + diuretics + other antihypertensive class	2	40	0.34
BBs + 2 ACEIs + 2 diuretics	1	20	0.17
Six drug combination	1	0.2	
BBs + CCBs + ACEIs + 2 diuretics + other antihypertensive class	1	100	0.17

ACEIs=Angiotensin-converting enzyme inhibitors, ARBs=Angiotensin receptor blockers, CCBs=Calcium channel blockers, BBs=Beta-blockers

compared to females (OR: 1.71, 95% CI 1.20–2.44) whereas men were less likely to receive BBs and ARBs compared to women (OR: 0.65, 95% CI 0.45–0.95; OR: 0.64, 95% CI 0.46–0.91). Prescriptions of any hypertensive drugs were not associated with either nationality or number of comorbidities.

Patients with ischemic heart disease were more likely to receive BBs, ACEIs, ARBs, and diuretics compared to patients without any comorbidity (OR: 4.03, 95% CI 2.01–8.07; OR: 2.17, 95% CI 1.09–4.32; OR: 1.08, 95% CI 0.55–2.11; OR: 2.64; 95% CI 1.35–5.15). Patients with diabetes mellitus were more likely to be prescribed ARBs compared to patients with no comorbidity (OR: 1.85, 95% CI 1.17–2.93). The results of multiple logistic regression analyses are shown in Table 3.

In our study, the PDDs of ACEIs such as lisinopril and perindopril (12.73 mg and 4.5 mg) were similar to their respective DDDs (10 and 4 mg). The PDD-to-DDD ratio for ACEIs members ranged from 1.12 to 4 with the ratios of lisinopril and perindopril close to 1. For ARBs, the PDDs of the individual members were candesartan (10 mg), irbesartan (220 mg), losartan (75.96 mg), telmisartan (66.66 mg), and valsartan (149.37 mg). The PDD/DDD ratios for the different ARBs ranged from 1.25 to 1.87. The PDDs for the CCBs such as amlodipine, diltiazem, nifedipine, and verapamil were 6.16, 143, 42, and 480 mg, respectively, with only amlodipine having the PDD close to the DDD. The PDD-to-DDD ratios for CCB members ranged from 0.60 to 2. The PDD-to-DDD ratios of the antihypertensive drugs prescribed at the study site are depicted in Figure 1. The PDDs for BBs and diuretics were lower than the respective DDDs. The DDDs and PDDs of antihypertensive drugs prescribed to the study participants are presented in Table 4.

Discussion

To our knowledge, this is the first study which examines the prescription pattern of antihypertensive drugs in Dibba Hospital, Fujairah, UAE. Our results revealed that seven different classes of antihypertensive drugs were prescribed at the study site, which were ACEIs, ARBs, CCBs, BBs, diuretics, and others including alpha-blocker and centrally acting antihypertensive drugs.

Among all the classes of antihypertensive drugs, CCBs were the most frequently prescribed class (51%) both in monotherapy and in combination therapy followed by ARBs, diuretics, ACEIs, and BBs. This is ascribed to the fact that majority of our patient pool was above the age of 55 years and as per the NICE guidelines,[6] CCBs are the recommended antihypertensive class for this age group. Some prescription pattern studies also support this finding where CCBs were prescribed more compared to the other types of antihypertensive drugs.[16,17] A number of factors guide the choice of antihypertensive treatment including comorbidities, concomitant medications, physician's preference as per the patient characteristics, guidelines followed by the hospital, as well as the availability of medicines.

Table 3: Multiple logistic regression showing variables associated with prescribing of antihypertensive drugs

Variable	ACEIs		ARBs		Diuretics		CCBs		BBs	
	OR (95% CI)	*P**	OR (95% CI)	*P**	OR (95% CI)	*P**	OR (95% CI)	*P**	OR (95% CI)	*P**
Age (>55 years)										
≤55 years	2.14 (1.46-3.14)	<0.001	1.43 (1.12-1.83)	0.004	0.54 (0.36-0.81)	0.003	0.67 (0.46-0.96)	0.033	0.80 (0.53-1.19)	0.280
Gender (Female)										
Male	1.71 (1.20-2.44)	0.003	0.64 (0.46-0.91)	0.013	1.02 (0.72-1.45)	0.882	1.44 (1.03-2.02)	0.32	0.65 (0.45-0.95)	0.026
Nationality (Expatriate)										
Emirati	0.71 (0.47-1.09)	0.122	1.20 (0.78-1.83)	0.401	0.84 (0.55-1.29)	0.432	1.38 (0.91-2.09)	0.126	0.56 (0.37-0.87)	0.10
Number of comorbidities (Two)										
One	0.62 (0.35-1.09)	0.102	0.98 (0.57-1.69)	0.957	1.14 (0.65-1.98)	0.642	0.83 (0.48-1.42)	0.504	0.64 (0.35-1.16)	0.145
Comorbidity type (No comorbidity)										
Diabetes mellitus	1.49 (0.92-2.40)	0.105	1.85 (1.17-2.93)	0.008	1.08 (0.67-1.73)	0.737	0.83 (0.53-1.29)	0.411	1.11 (0.68-1.83)	0.659
Ischemic heart disease	2.17 (1.09-4.32)	0.027	1.08 (0.55-2.11)	0.050	2.64 (1.35-5.15)	0.004	0.60 (0.31-1.15)	0.129	4.03 (2.01-8.07)	<0.001
Hyperlipidemia	2.27 (1.04-4.97)	0.040	1.30 (0.62-2.74)	0.484	0.89 (0.41-1.92)	0.782	1.47 (0.70-3.06)	0.304	2.76 (1.23-6.16)	0.13

*Multiple logistic regression analysis. CI=Confidence interval, ACEIs=Angiotensin-converting enzyme inhibitors, ARBs=Angiotensin receptor blockers, CCBs=Calcium channel blockers, BBs=Beta-blockers, OR=Odds ratio

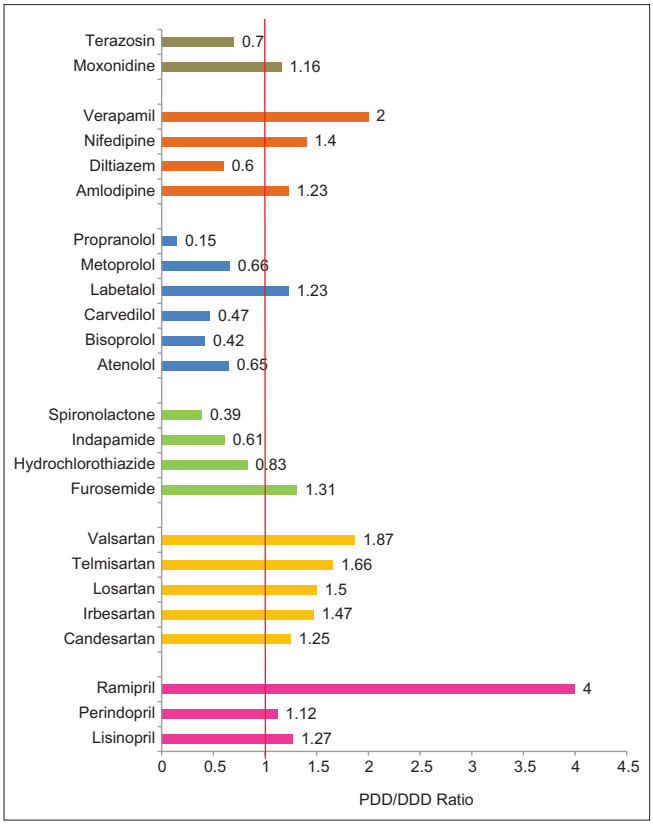

Figure 1: Prescribed daily dose to defined daily dose ratios of antihypertensive drugs prescribed at the study site

Majority of our study participants (67.9%) were on combination antihypertensive therapy, and the remaining 32.1 percent of patients were on monotherapy. These results are in agreement with the findings of studies conducted in India[17,18] and Ethiopia.[19] Our results are in disagreement with a study conducted in Ajman, UAE,[20] which reported that the majority of the hypertensive patients (63.6%) were on monotherapy. Use of combination therapy is increasingly recognized as an essential step in controlling hypertension in patients with comorbidities.

Our results showed that in monotherapy, ARBs and ACEIs were the most preferred agents (55.9%). This finding is in line with a study conducted in a tertiary care hospital in India[21] where ARBs and ACEIs were prescribed to 76% of the patients on monotherapy. This prescription pattern may be attributed to the fact that majority of our hypertensive patients were diabetic and ARBs or ACEIs are the preferred agents for the management of hypertension in diabetics. Our results for monotherapy prescription patterns are also in accord with the JNC guidelines[22] for the management of hypertension. The beneficial effects of ACEIs and ARBs for hypertensive patients are well documented, and guidelines recommend them as the first class of choice for monotherapy of hypertensive patients under 55 years of age.[6]

Table 4: Defined daily doses and prescribed daily doses of antihypertensive drugs prescribed to the study participants

Drug	ATC code	DDD (mg)	PDD (mg)
ACEIs			
Lisinopril	C09AA03	10	12.73
Perindopril	C09AA04	4	4.5
Ramipril	C09AA05	2.5	10
ARBs			
Candesartan	C09CA06	8	10
Irbesartan	C09CA04	150	220.3
Losartan	C09CA01	50	75.96
Telmisartan	C09CA07	40	66.66
Valsartan	C09CA03	80	149.37
Diuretics			
Furosemide	C03CA01	40	52.22
Hydrochlorothiazide	C03AA03	25	20.83
Indapamide	C03BA11	2.5	1.52
Spironolactone	C03DA01	75	29.54
BBs			
Atenolol	C07AB03	75	49.16
Bisoprolol	C07AB07	10	4.18
Carvedilol	C07AG02	37.5	17.75
Labetalol	C07AG01	60	73.75
Metoprolol	C07AB02	100	66.66
Propranolol	C07AA05	160	24
CCBs			
Amlodipine	C08CA01	5	6.16
Diltiazem	C08DB01	240	143
Nifedipine	C08CA05	30	42
Verapamil	C08DA01	240	480
Other antihypertensives			
Moxonidine	C02AC05	0.3	0.35
Terazosin	G04CA03	5	3.5

ATC=Anatomical Therapeutic Chemical Classification, DDD=Defined daily dose, PDD=Prescribed daily dose, ACEIs=Angiotensin-converting enzyme inhibitors, ARBs=Angiotensin receptor blockers, CCBs=Calcium channel blockers, BBs=Beta-blockers

In our study, 35.5% of prescriptions had a two-drug combination, and 23.1% of prescriptions contained three-drug combination. Our results are in line with a drug utilization study conducted in India.[18] Concerning the prescriptions of three-drug combination, we report a higher percentage (23.1%) compared to other studies[18,19] on antihypertensive prescription patterns. This can be attributed to our aged study population (mean age 63.2 ± 14.33 years) with increased severity of disease and different comorbid conditions. Among the individual antihypertensive drugs, amlodipine was prescribed the most (266 prescriptions) both in monotherapy and in combination therapy followed by valsartan, perindopril,

indapamide, and bisoprolol. This prescription pattern of amlodipine has also been observed in other drug utilization studies.[16,17] Amlodipine has acceptable safety and efficacy, also strong evidence from many randomized controlled trials for cardiovascular event reduction.[23]

Indapamide, a thiazide diuretic, was prescribed to 23.3% of the patients both in monotherapy and in combination therapy. This prescription pattern is as per the recommendations of JNC and NICE guidelines[5,6] which recommend that thiazide diuretics can be used in monotherapy (for initial treatment) as well as combination therapy. These results are also in agreement with the results of a prescription pattern study conducted in Taiwan.[24] Their good antihypertensive efficacy and low cost have made them vital components of hypertension management for more than half a century.

In our study, multiple logistic regression analyses revealed that patients aged ≤55 years were more likely to receive ACEIs and ARBs compared to patients aged >55 years. However, diuretics and CCBs were less likely to be prescribed to patients aged ≤55 years compared to >55 years. These findings are as per the NICE guidelines[6] which recommended that ARBs and ACEIs should be prescribed to patients less than 55 years and CCBs should be preferred for patients above 55 years.

Our results revealed that patients with diabetes mellitus were more likely to be prescribed ARBs compared to patients with no comorbidity. These results are supported by the fact that ARBs are the preferred agents for the treatment of hypertension in diabetic patients. The effectiveness of ARBs in retarding the development and progression of diabetic nephropathy is well known.[25] In our study population, ACEIs were more likely to be prescribed to males as compared to females. This can be explained by the fact that female gender is considered as a risk factor for ACEIs induced angioedema.[26] In our study, patients with ischemic heart disease were more likely to receive BBs, ACEIs, ARBs, and diuretics compared to patients without any comorbidity. These results are in line with the American Heart Association recommendation that hypertensive patients with ischemic heart disease should be treated with a regimen including BBs, ACEIs, ARBs, and thiazide diuretics.[27]

DDDs are used as a standard for the measurement of drug utilization. PDD may not always correspond to the DDD as PDD may vary as per individual patient characteristics and disease factors. PDD/DDD ratio indicates whether the drug is adequately, under, or over-utilized. Our results showed that in ACEIs class, the PDDs of lisinopril and perindopril were similar to DDDs with the PDD/DDD ratios close to 1, indicating appropriate utilization of these drugs. In our study, the PDD/DDD ratios for the ARBs ranged from 1.25 to 1.87 which were similar to a German study where ratios ranged from 1.1 to 1.91.[12]

Drugs such as hydrochlorothiazide, indapamide, spironolactone, diltiazem, and terazosin were under-utilized in our study population as their PDDs were lower than the recommended DDDs. Most of the BBs such as atenolol, bisoprolol, carvedilol, metoprolol, and propranolol prescribed in our study had PDD/DDD ratio of less than 1, indicating the under-utilization of these drugs. Overall, the PDDs were higher than the DDDs for ACEIs, ARBs, and CCBs and lower than the DDDs for BBs and diuretics. Such divergences have also been identified in some studies on antihypertensive drugs,[12,28] as well as other drugs.[29] Reasons for these inconsistencies may be the patient's characteristics, severity of disease, local therapeutic traditions, and use of drugs under study for indications other than hypertension.

Our results revealed that the prescription pattern of antihypertensive drugs at the study site largely concur with the international guidelines for hypertension management. There is considerable use of different antihypertensive drug combinations for the management of hypertension. Overall, prescription pattern evaluations remain understudied in the UAE, and our study provided an overview on antihypertensive drug utilization in one of the secondary care hospitals in the UAE. The present study can serve as a stepping stone for further research in the region, and its findings can guide and support the prescribers and dispensers in their efforts to achieve rational drug use and better therapeutic outcomes.

Our study had some limitations. First, being a single-center study carried out in a government hospital, the sample may not be a complete representation of whole UAE patient population. Second, the study was conducted in a secondary care setting, patients receiving treatment at primary or tertiary centers may have different patterns of antihypertensive drug use. Third, observational nature of the study limited the evaluation of other factors influencing prescription patterns such as physicians' background and knowledge, influence of hospital administration and pharmaceutical companies, and availability of drugs. In addition, there is a possibility that for some patients' antihypertensive drugs may have been prescribed for conditions other than hypertension.

The present study represents the current prescribing trends of antihypertensive drugs in our hospital and can serve as a foundation for further research in this area in the UAE. Our findings showed that majority of the study participants were on combination antihypertensive therapy. CCBs were the most frequently prescribed class both in monotherapy and in combination therapy while ARBs and ACEIs were the most preferred agents for monotherapy. The use of antihypertensive drugs in our secondary care hospital largely conforms to the international guidelines, but still, there is significant room for improvement in terms of rational drug utilization.

Authors' Contribution

Syed Arman Rabbani was involved in conceptualization of the study, study design, literature search, data analysis, and manuscript preparation, editing, and review. Maryam Salem Alkaabi was involved in conceptualization of the study, literature search, conduct of the study, and data acquisition for the study. Padma G. M. Rao was involved in the conceptualization of the study, study design, manuscript editing, and review. Syed Rashid Ali was involved conceptualization of the study, study design, manuscript editing, and review.

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Conflicts of interest

There are no conflicts of interest

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