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Pharmacist Interventions and Drug-Related Problems in CVD Patients: An ECPIS-Based Study

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Abstract

Background: Cardiovascular diseases (CVDs) are rapidly becoming an alarming and more common reason for morbidity and mortality. Drug-related problems (DRPs) are more common among hospitalized patients, and they can increase patient morbidity and mortality.

Objectives: The present study aimed to investigate the effect of pharmacist interventions on DRPs using the Electronic Clinical Pharmacists Intervention Sheet (ECPIS) in patients with CVDs.

Methods: A prospective study conducted in Iraq - Baghdad at Ibn-AL-Bitar Center for Cardiac Surgery, in 2024 for 5 months (from January to May), used the ECPIS. The hospital pharmacists who participated in this study were 10 out of 30 pharmacists who worked in the three internal cardiology wards. The pharmacists' hospital screened the files of patients from the first day of admission and follow-up until discharge. They reviewed patients' medication to identify DRPs and medication errors, and the classification of DRPs was conducted by the ECPIS, which is implemented in all Iraqi hospitals. They also documented the interventions made by pharmacists to address these problems.

Results: The total number of drugs that caused problems detected by the pharmacists was 187. Proton pump inhibitors were the most frequent drugs found (16.6%), followed by heparin (14.4%), and antibiotics (11.8%). A total of 175 problems were detected, with adverse drug reactions (ADRs) being the most common problem detected (52.6%). The acceptance of interventions provided by the pharmacists to the physicians was 82.9%, while the not accepted interventions were 17.1%.

Conclusions: This study highlights the importance of pharmacist involvement in identifying and preventing DRPs in patients with CVDs. Pharmacist interventions were frequently successful, demonstrating their role in improving patient safety.

Keywords: Cardiovascular, Pharmacists' Intervention, ECPIS, Drug-Related Problems

1. Background

Any incident or circumstance involving drug therapy that prevents or may prevent the patient from receiving the best possible medical care is considered a drug-related problem (DRP) (1). Cardiovascular diseases (CVDs) is a common term used to describe conditions related to the heart (2). Cardiovascular diseases are rapidly becoming an alarming and more common reason for morbidity and mortality (3). Reports from 2016 indicate that on a global scale, 17.9 million fatalities were caused by CVD, which is 31% of all deaths (4). In the 2018 World Health Organization (WHO) report, Iraq had 11,205 registered deaths (6.53%) caused by stroke and 32,463 deaths (18.92%) caused by coronary heart disease (HD) (world health rankings, 2021). In 2019, the ministry of health (MOH) in Iraq reported that 27% of total deaths are (5). Drug-related problems are more common among hospitalized patients, and they can increase patient morbidity and mortality. Compared to outpatients with CVDs, hospitalized patients experienced DRPs nearly three times as frequently (6). When it comes to collaborating with other medical

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professionals on patient care, clinical pharmacists have a significant role to play. Numerous studies have demonstrated that pharmaceutical treatment (dose adjustments, monitoring drug interactions, ensuring adherence to medication regimens, and correct management of the drugs) lowers problems related to medication (PRM) status by 50 - 80% by lowering maintenance expenses, the number of adverse drug reactions (ADRs), and hospital stay duration (7). Pharmacists who actively evaluate patients' responses help raise patient adherence and satisfaction, reduce the number of medications given, medication-related issues, and prescription-related expenses (8). The part played by the pharmacists is vital to drug monitoring and dosage adjustment. Therefore, they play a major role in all the hospital departments, in general, and in the coronary care unit (CCU), in particular, in maintaining patient safety (9). The study conducted at a public cardiac center in Iraq in 2018 by Jabria et al. demonstrated that the important discharge drugs prescribed by cardiologists for patients with acute coronary syndrome (ACS) were significantly improved by pharmacists' intervention, potentially leading to better patient outcomes and reducing the number of potential prescribing problems (4). This study is the first of its kind as a prospective study, employing the ECPIS classification system to classify therapeutic problems and errors, focusing on enhancing clinical outcomes (Appendix 1 in Supplementary File).

2. Objectives

The present study aimed to reveal the effect of pharmacist interventions on DRPs by using the Electronic Clinical Pharmacists Intervention Sheet (ECPIS) in patients with CVDs.

3. Methods

3.1. Study Design and Setting

The present study was a prospective study conducted in Iraq - Baghdad at Ibn-AL-Bitar Center for Cardiac Surgery, in 2024 for 5 months (from January to May).

3.2. Participants Identification and Recruitment

The pharmacists in the hospital detected DRPs in 97 patients. The patients involved in this study were > 18 years old who suffered from CVDs. The hospital pharmacists who participated in this study were 10 out of 30 pharmacists, two pharmacists who graduated from the post-graduated year clinical pharmacy program (PGY2) specializing in anticoagulants, two pharmacists who completed their internship year, and six pharmacists currently in their internship year.

3.3. Drug-Related Problems Classification Tool

This study used the ECPIS. A classification released by the MoH in 2019, the ECPIS, is an electronic program created by the information technology (IT) center in partnership with the clinical pharmacy section of the directorate of technical affairs (10). The ECPIS consists of 10 problems and 9 types of pharmacist action to solve the problems. Doctors' responses to interventions were also determined. The medication errors report form is a part of the ECPIS, which categorizes medication errors into four categories (prescribing, transcription, administration, and monitoring). There were four categories of the causes of medication errors (patient knowledge deficiency, medication knowledge deficiency, non-adherence to policies and procedures, and miscellaneous). Each of these categories has subcategories.

3.4. Data Collection

The pharmacists' hospitall screened patients' files in the cardiology wards from the first day of admission and follow-up until discharge. They reviewed patients' medication to identify DRPs and medication errors. The pharmacists identified DRPs and proposed appropriate interventions to the physicians. During the morning tour, these interventions were discussed face-to-face, and the pharmacists recorded whether the physician accepted and implemented them or not. The classification of DRPs was conducted by the ECPIS, which is implemented in all Iraqi hospitals. They also documented the interventions made by pharmacists to address these problems. The collected data post-interventions aimed to capture the outcomes more comprehensively and ensure that the effects of the intervention were adequately observed and recorded. Patient treatments were assessed based on the most recent therapeutic strategies recommended in the evidence-based guidelines (European Society of Cardiology 2021). The interventions included patient education, medication dose adjustment, and stopping

medications. The acceptance of these interventions by physicians was also assessed.

3.5. Inclusion Criteria

(1) Patients >18 years old.

(2) Patients residents in the internal cardiology hospital wards with medication-related problems or errors.

3.6. Exclusion Criteria

(1) Patients younger than 18 years of age.

(2) Patients admitted to surgical cardiology wards.

(3) Patients without identified DRPs.

(4) Patients unwilling to participate in this study.

3.7. Data Analysis

The data were analyzed using SPSS software version 25. Descriptive statistics (frequencies and percentages) were conducted for all study items.

4. Results

The study sample involved 97 patients with a mean age of 57.94 years. Of these, 66 (68.0%) patients were male, 31 (32.0%) patients were female, 91 (93.8%) of patients were married, 5 (5.2%) of patients were single, 57.7% of patients were unemployed, and 24.7% of patients were retired, as shown in (Table 1). Patients in this study suffered from ischemic heart disease (IHD), heart failure (HF), diabetes mellitus (DM), and chronic kidney disease (CKD) (59.8%, 37.1%, 26.8%, 21.6%) respectively, as seen in (Table 2). The total drugs that caused problems detected by the pharmacists were 187. Proton pump inhibitors were the most frequent drugs found (16.6%), followed by heparin (14.4%), and antibiotics (11.8%), as seen in (Table 3). The total number of problems detected by the pharmacists was 175. Adverse drug reaction was the most problem detected (52.6%), and there were 45.7% of problems unclassified, as seen in (Table 4). There were 175 causes of problems detected by the pharmacists according to ECPIS. Unavailable drugs were the most common cause of the problem detected (25.7%), followed by no monitoring (25.1%), no adherence (15.4%), and drug-drug interaction (11.4%), as seen in (Table 5). The most frequently prescribed unavailable drugs in the hospital detected were pantoprazole (31.1%), bisoprolol (28.9%), and warfarin (28.9%), as seen in (Table 6). Some drugs needed frequent monitoring, and the most common missed monitoring tests were activated partial thromboplastin time (50.0%), kidney function tests (22.7%), and electrolyte (18.2%), as seen in (Table 7). The pharmacists provided 140 planned interventions to the physicians and patients. Suggest monitoring (31.4%) was the most frequent intervention provided, followed by suggesting an alternative (17.9%), patient education (17.1%), and stopping the drug (10.7%), as shown in (Table 8). The acceptance of interventions provided by the pharmacists to the physicians was 82.9%, while the not accepted interventions were 17.1%, as seen in (Table 8).

5. Discussion

Drugs can be a significant contributing factor to DRPs, even while drug therapy has positive outcomes like lowering symptoms and enhancing the quality of life (11). The pharmacist enhances organizational structures by ensuring safe and effective medication therapy. Drug-related problems and medication errors can be identified, addressed, and prevented by pharmacists with their level of experience. These procedures have been shown to have a beneficial effect on patient safety (12). A variety of DRPs can arise in individuals using cardiovascular medicines (13, 14). Male patients were significantly more likely than female patients to have CVDs in this study; a study by Naser Safaie et al. in Iran found that male patients were 73% and female patients were 27% (15). This could be due to the fact that males are more likely than females to engage in unhealthy habits and lifestyles like heavy drinking, smoking, and stressful work. Ischemic heart disease and HF were the most common reasons for hospitalization because they require several medications to manage the illness, prevent complications, and improve quality of life. Additionally, many patients with HD also have other health problems like diabetes or kidney disease. The most DRPs found with PPI (pantoprazole, omeprazole), heparin, and antibiotics (azithromycin, levofloxacin, ceftriaxone). Patients who take omeprazole (PPI that inhibits cytochrome P450 2C19) along with clopidogrel have a higher chance of developing ischemic stroke because omeprazole has a higher inhibitory potency compared to the other PPI class members. Omeprazole use dramatically decreased the antiplatelet action of clopidogrel in high-risk individuals receiving clopidogrel treatment (16). In this study, the second

Table 1. Demographic Data of Patients

Item Name and Categories	Values [a]
Gender	
Male	66 (68.0)
Female	31 (32.0)
Age in years	57.94 ± 13.984
Hospitalization days	8.46 ± 10.244
Social state	
Married	91 (93.8)
Single	5 (5.2)
Divorced	1 (1.0)
Education level	
Primary education	34 (35.1)
Secondary education	22 (22.7)
No formal education	21 (21.6)
Bachelor's degree	15 (15.5)
Others	5 (5.2)
Place of residence	
Baghdad	74 (76.3)
Diyala	5 (5.2)
Babil	4 (4.1)
Al-Anbar	5 (5.2)
Wasit	3 (3.1)
Salah-Alden	4 (4.1)
Others	2 (2.0)
Employment status	
Unemployed	56 (57.7)
Retired	24 (24.7)
Employed	17 (17.5)

[a] Values are presented as No. (%) or mean ± SD.

Table 2. Diagnosis of Patients with Drug-Related Problems

Item Name and Subcategory	Values [a]
Diagnosis	
IHD	58 (59.8)
HF	36 (37.1)
DM	26 (26.8)
CKD	21(21.6)
AF	12 (12.4)
Valvular HD	15 (15.5)
Venous thromboembolism	6 (6.2)
Anasarca	3 (3.1)
VF	3 (3.1)
Liver impairment	3 (3.1)
Shock	1 (1.0)
Others	5 (5.2)

Abbreviations: HF, heart failure; ACS, acute coronary syndrome; IHD, ischemic heart disease; DM, diabetes mellitus; CKD, chronic kidney disease; AF, atrial fibrillation; VF, ventricular fibrillation; HD, heart disease.

[a] Values are presented as No. (%).

drug with the most frequent DRPs was heparin, where the dose was too low, and the dosage regimen was too frequent. Another problem found was a combination of heparin (or enoxaparin) with ceftriaxone, which led to increasing prothrombin time. The (enoxaparin-ceftriaxone) drug interaction was also detected in a study done in India by Biradar et al. in 2022, which constituted 10.7% of the total drug-drug interactions detected in this study (17). Another interaction reported in the current study was between ceftriaxone and calcium gluconate, which will lead to the precipitation of calcium in the kidney and lung, causing organ failure. These results are supported by a study conducted in Iraq in 2015 by Al-Jumaili et al., where this interaction was one of the most serious interactions found (18). The medications azithromycin, hydroxychloroquine, and chloroquine were frequently used to treat coronavirus illness 2019. These medications have a history of causing torsades de pointes and prolonging the QT interval (19). Like this study, the ADRs (54%) of these problems were identified in a study conducted in Cyprus in 2016 by Gökçekuş et al. (20). This finding contrasted with research by Celin et al., where the most common DRP was found to be drug interaction, which accounted for 25.0% of total DRPs, followed by drug use without indication (15.0%) and ADR (15.0%) (21). The most common cause of problems found in this study was "prescribed drugs not available, no monitoring". These

Table 3. Drugs That Caused Problems Were Detected by the Pharmacists

Item Name and Subcategory	Values [a]
Drugs related problem	
PPI	31 (16.6)
Heparin	27 (14.4)
Antibiotic	22 (11.8)
Beta-blockers	16 (8.6)
Antiplatelet	16 (8.6)
Warfarin	15 (8.0)
Antiarrhythmic drugs	12 (6.4)
Lasix	10 (5.3)
Statins	8 (4.3)
Sodium-glucose cotransporter-2 inhibitors	5 (2.7)
Ivabradine	3 (1.6)
Potassium sparing diuretic	3 (1.6)
Calcium amp	2 (1.1)
Calcium channel blockers	2 (1.1)
Miscellaneous (non-cardiovascular drugs)	9 (4.8)
Miscellaneous (cardiovascular drugs)	6 (3.2)

Abbreviations: PPI, proton pump inhibitor; ACEI, angiotensin-converting enzyme inhibitor; KCL, potassium chloride; ARBs, angiotensin receptor blockers.

[a] Values are presented as No. (%).

Table 4. Problems Were Found by the Pharmacists According to Electronic Clinical Pharmacists Intervention Sheet

Problem	Values [a]
ADR	92 (52.6)
Prescription written for wrong drug	3 (1.7)
Unclassified problems	80 (45.7)
Total	175 (100)

Abbreviation: ADR, adverse drug reaction.

[a] Values are presented as No. (%).

Table 5. The Causes of Problems Found by the Pharmacists

Item Name	Values [a]
Unavailable drug	45 (25.7)
No monitoring	44 (25.1)
Not adherence	27 (15.4)
Drug-drug interaction	20 (11.4)
Drug food interaction	5 (2.9)
Dosing frequency	4 (2.3)
Prescription written for wrong drug	3 (1.7)
Unclassified causes	27 (15.4)

[a] Values are presented as No. (%).

Table 6. Unavailable Drugs in the Hospital Were Detected

Unavailable Drug	Values [a]
Pantoprazole	14 (31.1)
Bisoprolol	13 (28.9)
Warfarin	9 (20)
Amiodarone	5 (11.1)
Levofloxacin	2 (4.4)
Candesartan	1 (2.2)
Isosorbide dinitrate	1 (2.2)

[a] Values are presented as No. (%).

results contradict that of a study done in 2014 in India, where the major DRPs were sub-therapeutic dose, overdose, and drug use without indications (22). A possible explanation for prescribing drugs that are not available may be that many essential drugs are not supplied or provided in small quantities by the State

Table 7. Drug-Related Problems Are Caused by No Monitoring

No Monitoring	Values [a]
Activated partial thromboplastin time	22 (50.0)
Kidney function test	10 (22.7)
Electrolyte	8 (18.2)
INR	4 (9.1)

[a] Values are presented as No. (%).

Table 8. Planned Intervention Was Provided to the Physician and Patient by the Pharmacists, and Interventions Acceptance Status by the Physician

Planned Interventions	Values [a]
Suggest monitoring	44 (31.4)
Suggest alternative	25 (17.9)
Patient education	24 (17.1)
Stop the drug	15 (10.7)
Instruction for used changed	13 (9.3)
Correct the dose	11 (7.9)
Nurse education	6 (4.3)
Food correction	2 (1.4)
Intervention accepted	116 (82.9)
Intervention not accepted	24 (17.1)

[a] Values are presented as No. (%).

Company for Marketing Drugs and Medical Appliances (KIMADIA), but sub-purchasing committees purchase them within the hospital depending on financial allocation. KIMADIA is a governmental entity in Iraq that works under the regulation of the Iraqi MoH and is responsible for the procurement, storage, and distribution of drugs, medical supplies, and equipment for use in public health facilities, such as public hospitals and primary care settings, throughout all 18 provinces of Iraq (23). "Suggest monitoring" and "suggest alternative" were the most common interventions provided by the pharmacists, while in a study conducted by Biradar et al. in India, there were 204 DRPs found, and the team offered 74 interventions for them, comprising 30 (41.6%) drug withdrawals, 24 (33.3%) new drug additions, 4 (5.55%) dosage form changes, and 14 (19.4%) dose reductions (17). As in this study, a study conducted by Ukoha-Kalu et al. in Nigeria found that the majority of interventions (586, 91.0%) were accepted (24), and another study conducted by Wattanaruengchai et al. found that out of 790 interventions, 770 (97.4%) were accepted (25).

Supplementary Material

Supplementary material(s) is available here [To read supplementary materials, please refer to the journal website and open PDF/HTML].

Footnotes

Authors' Contribution: The authors confirm contribution to the paper as follows: Study conception and design: F. A. and M. Y. J.; Data collection: F. A.; Analysis and interpretation of results: F. A. and M. Y. J.; Draft manuscript preparation: F. A. and M. Y. J. All authors reviewed the results and approved the final version of the manuscript.

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Data Availability: The data presented in this study are uploaded during submission as a supplementary file and are openly available for readers upon request.

Ethical Approval: The ethics committee of the College of the Pharmacy\University of Baghdad approved this study (acceptance number REAUBCP312024G).

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