ORIGINAL RESEARCH

Prevalence and comparative analysis of potential drug-drug interactions among hospitalized patients at a tertiary care cardiac institutes

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ABSTRACT
Introduction: Drug-drug interactions (DDIs) are a frequent challenge in clinical settings, especially among hospitalized patients with complex, often chronic, medical conditions that require multiple medications. **Objective:** The main objective of the study is to find the prevalence and comparative analysis of potential drug-drug interactions among hospitalized patients at different cardiac institutes.**Methodology:** This retrospective cross-sectional study was conducted and data were collected from 284 patients admitted to various cardiac institutes. Patient medical records were thoroughly reviewed to gather essential information for this study. Data collected included demographic details such as age, gender, and weight, alongside clinical information, including diagnoses at admission, comorbidities, and past medical history.**Results:** Data were collected from 284 patients with a mean age of 59.01±5.67 years, of whom 60% were male and 40% female. On average, patients were prescribed five medications during their hospital stay, and a substantial 75% had comorbid conditions. Approximately 69.7% of patients experienced at least one pDDI, with 45% of interactions classified as major. Cardiovascular drugs, particularly antithrombotic agents, beta-blockers, and calcium channel blockers, were frequently involved in major DDIs. **Conclusion:** It is concluded that potential drug-drug interactions (pDDIs) are highly prevalent among hospitalized cardiac patients, particularly among older adults and those with complex comorbidities.
Keywords: Patients, DDIs, Cardiac, Drugs, Interaction

INTRODUCTION

Drug-drug interactions (DDIs) are a frequent challenge in clinical settings, especially among hospitalized patients with complex, often chronic, medical conditions that require multiple medications. Patients with confirmed cardiovascular diseases are often managed in tertiary care cardiac institutes hence come with one or multiple comorbid conditions which on treatment will require multiple medications with potential for DDIs [1]. CVDs are the primary reason for admission worldwide and several cardiac patients present with polypharmacy practices in cardiac care using anticoagulants, antihypertensive, antiarhythmic, and lipid-lowering medications [2]. It may also cause one or several adverse effects or simply reduce the therapeutic effects of both the drugs administered separately while when taken together with other medications, these drugs may lead to life threatening complications [3]. The frequency of DDIs in cardiac patients remains a research issue of interest since interactions in patients with cardiac disorders can produce severe effects because of the precise equilibrium required in cardiac medications [4]. Most cardiovascular performing drugs belong to a class of drugs that have a small therapeutic range, and therefore small changes in the dosage or drug concentration can lead to bad results. For instance, the coumarin derivatives like warfarin and one or other other drugs can produce disastrous effects with hemorrhagic complications [5]. This class of drugs also interacts with some antibiotics and antifungal agents in leading arrhythmias or QT interval prolongation which may be fatal. Some of these cases illustrate the reasons why potential DDIs should be thought through before starting treatment so that drug therapy has to be as efficient and safe as possible [6]. DDIs are acknowledged to be among the most preventable causes of ADRs which, nonetheless, if not

avoided, could have dire life-threatening effects with potentially adverse therapeutic outcomes [7]. In many cases, when DDIs occur, there may be ADRs that can cause morbidity and may lead to death of patients consequently, it requires early identification and prevention. Annual health care-related ADRs result in approximately 5% of hospitalization while DDIs are responsible for between 0.25% to 25% of subsequent hospitalization [8]. The research has also revealed that when staff members demonstrate skills in the identification and handling of DDIs, adverse effects that result from the interactions can be averted enhancing the improvement of therapy outcomes while reducing health risks linked to the DDIs [9]. In their study on hospitalized patients, especially patients admitted in CCU, the authors found high incidence of DDIs pointing to the fact that patients with cardiovascular diseases require many medications. Such patients take two or more drugs at a time, and therefore, the possibilities of an interaction are higher. In the context of hospitals, there are numerous papers available regarding the rates of DDI found within different wards and among different patients and this means that there is a lot of knowledge about why patients are being admitted to hospitals, what drugs are causing the harm [10]. They have also added that DDIs are not only confined to in-patient care; outpatient departments (OPDs) of health care facilities and, especially in Pakistan, very few studies have been conducted regarding the prevalence of DDI and much of it remains concealed. But as the publication of various cross-sectional studies from developed countries indicate, the incidence of DDIs in OPDs ranges from 28 percent to 83 percent [11].

OBJECTIVE

The main objective of the study is to find the prevalence and comparative analysis of potential drug-drug interactions among hospitalized patients at different cardiac institutes.

METHODOLOGY

This retrospective cross-sectional study was conducted and data were collected from 284 patients admitted to various cardiac institutes. Patient medical records were thoroughly reviewed to gather essential information for this study. Data collected included demographic details such as age, gender, and weight, alongside clinical information, including diagnoses at admission, comorbidities, and past medical history. For each patient, a comprehensive record of all prescribed medications during their hospital stay was compiled, documenting dosages, frequency, and duration of administration.

DDI Identification and Classification

To identify potential DDIs, each patient's medication list was analyzed using a recognized drug interaction database. These were further stratified to interactions in terms of severity as minor, moderate or major and type; pharmacodynamic or pharmacokinetic. Major interactions were those in which serious adverse effects might occur if a flaw in the interaction were left unresolved. Pharmacodynamic interaction was observed when the coexistence of two drugs seemed to potentiate or weaken each drug's action, and pharmacokinetic interaction was observed when one drug could affect the handling of another in terms of absorption, distribution, metabolism or excretion.

Statistical Analysis

The prevalence of potential DDIs was calculated by determining the proportion of patients who experienced at least one interaction. A comparative analysis was conducted to examine the frequency and distribution of DDIs across different drug classes, with particular attention to cardiovascular medications, which are often associated with high DDI risk.

Ethical Considerations

This study prioritized patient confidentiality, ensuring that all personal identifiers were removed from the data before analysis.

RESULTS

Data were collected from 284 patientswith a mean age of 59.01±5.67 years, of whom 60% were male and 40% female. On average, patients were prescribed five medications during their hospital stay, and a substantial 75% had comorbid conditions. This high rate of comorbidities and polypharmacy highlights a population at increased risk for drug-drug interactions (DDIs), emphasizing the need for vigilant monitoring and individualized treatment strategies in the cardiac care setting.

Table 1: Demographic and Baseline Values of Patients

Characteristic	Values
Total Patients	284
Age (Mean ± SD)	59.01±5.67
Gender - Male (%)	60
Gender - Female (%)	40
Average Number of Medications	5
Patients with Comorbidities (%)	75

The analysis of potential drug-drug interactions (pDDIs) revealed that 50% of interactions were classified as major, involving a high risk of serious adverse effects that require careful monitoring or

dosage adjustments. Moderate interactions accounted for 33% of the total, indicating the need for possible adjustments and ongoing monitoring. Contraindicated interactions, which should be strictly avoided due to high risks outweighing the benefits, made up 5% of the pDDIs.

Table 2: Potential Drug-Drug Interactions (pDDIs) - Micromedex

pDDI Severity	Number of Interactions	Percentage of Total pDDIs (%)	Description
Contraindicated	12	5	Combination should be avoided as risk outweighs benefit
Major	128	50	Potential for serious adverse effects; requires careful monitoring or dosage adjustment
Moderate	85	33	Moderate effects; may require adjustment or monitoring

The assessment of potential drug-drug interactions (pDDIs) showed that 52% were classified as major, requiring careful management due to the risk of serious harm. Moderate interactions comprised 33% of pDDIs, indicating significant interactions that may necessitate monitoring and adjustments. Contraindicated interactions, which should be strictly avoided due to high risks, accounted for 6% of the total.

Table 3: Potential Drug-Drug Interactions (pDDIs) - Lexicomp

pDDI Severity	Number of Interactions	Percentage of Total pDDIs (%)	Description
Contraindicated	15	6	Use of combination is contraindicated due to high risk
Major	140	52	Requires avoidance or careful management due to potential serious harm
Moderate	90	33	Significant interaction; monitoring and adjustments may be needed

The combination of warfarin and NSAIDs was linked to an increased risk of severe bleeding, while ACE inhibitors with diuretics posed a risk of severe hypotension and potential kidney injury. Co-administration of beta-blockers with calcium channel blockers increased the likelihood of bradycardia and hypotension, and the pairing of digoxin with amiodarone heightened the risk of digoxin toxicity.

Table 4: Most Frequently Identified Drug Pairs in Major pDDIs and Potential Consequences

Drug Pair	Potential Consequence
Warfarin + NSAIDs	Increased risk of severe bleeding
ACE Inhibitors + Diuretics	Risk of severe hypotension and kidney injury
Beta-blockers + Calcium Channel Blockers	Increased risk of bradycardia and hypotension
Digoxin + Amiodarone	Potential for digoxin toxicity

DISCUSSION

This study highlights a considerable prevalence of potential drug-drug interactions (pDDIs) among patients hospitalized in a tertiary care cardiac institute, with findings underscoring the high risk of pDDIs due to the complexity of cardiovascular treatment regimens. Studies by others have also noted that DDIs are very common at least with patients on multiple drugs within a hospital setting and the analysis showed that 69.7% of the patients had at least one DDI [12]. These high percentages draw attention to the need for early interventions in regard to medication administration in order to reduce on ADRs and therapeutically ineffectiveness among cardiac patients. Unsurprisingly, the most frequent major interactions were identified as number 45%, involving cardiovascular drugs including antithrombotic agents, beta-blockers and calcium channel blocker [13]. The same research also noted that antithrombotic agents were also commonly involved in serious DDIs and which when administered alongside NSAIDs often cause complications that lead to bleeding. This result implies that although these drugs are useful in cardiovascular disorders, appropriate focus on possible interactions cannot be overemphasized [14]. Similarly, synergistic interactions of beta-blockers with calcium channel blockers were associated with an increased risk of bradycardia and hypotension. As seen in these examples constant observation should be done since such engagements may pose severe consequences resulting in loss of lives. The differences in pDDI classifications was further established by comparing pDDI results obtained from both Micromedex and Lexicomp databases [15]. As

with the other aspects, both databases divided the interactions into contraindicated and major, moderate, and minor classifications; however, the severity ratings were not entirely congruence between the two sources. For instance, some interactions labelled as "major" in Micromedex were labelled "contraindicated" in Lexicomp. This clearly shows that though there is a disparity in types of interaction, care must be taken to check many medical references in order to get the best estimation of the level of interaction [16]. On this note, study revealed that all major pDDIs had greater clinical implications, where 65% of these portrayed ADRs and 20% of the patients stayed longer in hospital or require other measures. These findings sensitize the imperative of preventive approaches including integration of clinical decision support systems (CDSS) that can offer notification of DDIs during prescription. When CDSS is implemented in EHRs, the likelihood of serious DDIs is minimized health care givers can be quickly identify these interactions, and initiated a proper dose adjustment in light of patient characteristics.

CONCLUSION

It is concluded that potential drug-drug interactions (pDDIs) are highly prevalent among hospitalized cardiac patients, particularly among older adults and those with complex comorbidities. The study highlights the need for vigilant monitoring and proactive measures, such as clinical decision support systems, to minimize adverse outcomes. Effective DDI management is crucial to enhancing patient safety and optimizing therapeutic efficacy in cardiac care settings.

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