

Original Article

PHARMACIST INTERVENTION ON IDENTIFICATION OF DRUG INTERACTIONS IN TERTIARY CARE HOSPITALS

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ABSTRACT

Objective: The aim of this study was to assess the potential drug interactions (pDIs) among hospitalized patients in cardiac and neurology wards in 3 tertiary care hospitals.

Methods: A prospective, observational study was carried out for a period of 12 mo. A sample of 1330 patients was assessed for pDDIs using Micromedex[®]-2.7 and drugs.com and www.dugs.com.

Results: A total of 1330 patients were analyzed and it was found that 685 were cardiac and 645 were neurology patients. The study identified 524 (76.49%) cardiac patients and 425 (65.89%) neurology patients, with potential drug-drug interactions (pDDIs) higher in male cardiac [298 (56.87%)] and male neurology [235 (55.29%)] patients, compared to females. Incidences of pDDIs were found to be higher in the age group of 60-70 y in cardiac [193 (36.83%)] and neurology [165 (38.84%)] patients and incidences of interactions based on duration of (4-6 d) hospital stays in cardiac were 380 (72.53%) and 275 (64.70%) in neurology patients respectively. Moreover, 51.90% cardiac patients and 57.41% neurology patients were found to be prescribed with more number of drugs in cardiac and neurology (7 drugs) patients, were found to have developed higher incidences of pDDIs. The most common drug interacting pair was between aspirin and clopidogrel combination, observed in 245 cardiac and 316 in neurology patients. Drug-food interactions (DFIs) were found with between atorvastatin-citrus fruits in cardiac and phenytoin-protein rich foods in neurology patients. The most common drug-disease interaction (D-DIs) was found to between isosorbide dinitrate-myocardial infarction in cardiac and carbamazepine-seizures in neurology respectively.

Conclusion: It is recommended that physicians should be aware of the interactions among those drugs while prescribing, and careful monitoring is also required.

Keywords: Cardiac, pDDIs, Neurology, Aspirin and clopidogrel, Carbamazepine-seizures

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INTRODUCTION

Drug-drug interactions are defined as two or more drugs interacting in such a manner that the effectiveness or toxicity of one or more drugs is altered [1, 2]. Drug-drug interactions (DDIs) are an important subgroup of Adverse Drug Events (ADE) [3], which are highly prevalent in patients receiving multiple-drug treatment [4]. The majority of the interactions occur because, either prescriber's do not consider them relevant [5, 6], or prescriber may be receiving less information in the DDIs area. Polypharmacy, geriatric and patients with co-morbidities are considered as one of the major risk factors in the precipitation of Drug-Drug interactions (DDIs) [5].

Neurological illnesses are one among the most common causes of hospitalization. It is estimated that DDIs account for approximately 2.8% of hospital admission every year [6]. The issue of drug interactions is a global concern, a study of the US reported that 30.3% patients aware at risk of DDIs [7]. A recent study in Iran has reported that in 35.5% of the patients in the neurology department encountered at least one pDDIs (Potential Drug-Drug Interactions) [8]. The burden of neurological disorders in India is estimated at over 30 million, which often warrant complex therapeutic regimen [9]. In India, a study identified 66% of DDIs in a medicinal department of a tertiary care hospital in Karnataka, India [10], while another study in Chandigarh reported that 8.3% prescriptions had multiple DDIs [11]. It was estimated that about 46.3% drug interactions were seen in neurological patients in a cross-sectional study conducted in Karnataka and majority of the DDIs were moderate in severity and required therapeutic monitoring [12]. An exhaustive literature search did not reveal as many published

reports on DDIs in neurological disorders in Indian population or other countries, however similar studies in other hospital wards has been done.

The present study was aimed to determine the prevalence and assessment of pDDIs in patients admitted to cardiology and neurology department and to identify pDDIs risk factors. In view of the above-mentioned statistics, we purposefully conducted this study in a tertiary care hospital in Erode as there are no studies targeted this region of the country.

Diet and lifestyle can sometimes have a significant impact on drugs. These may occur out of accidental misuse or due to lack of knowledge about the active ingredients involved in the relevant substances. Interactions between food and drugs may inadvertently reduce or increase the drug effect. Major side effects of some diet (food) on drugs include alteration in the absorption of fatty, high protein and fiber diets. Sixteen cohort and case-control studies reported an elevated risk of hospitalization in patients who were exposed to pDDIs [13]. Studying the drug-drug interactions, drug-food interactions and drug-disease interactions are essential for the management of drug therapy. As per our knowledge, there are no studies were conducted in our study area. Hence we carried out a study to assess the prevalence of drug-drug interactions, drug-food interactions, and drug-disease interactions.

MATERIALS AND METHODS

The research was conducted in three tertiary care hospitals, the work was reviewed and approved by the Institute Ethics Committee

(Human Studies), ethics number is PP/2015/01 and hospital approved number is EMC/PhD/0130T15. Erode for a period of 12 mo in the hospitalized cardiac and neurology patients. 1330 patients were taken in for the study, out of these; there were cardiac 685, neurology 645 patients. Exclusion criteria were outpatients and patients less than 18 y of age, medical disability, as well as the patients who are on Ayurveda, Siddha or other alternative systems of medicine. The consent form was obtained from the hospital authority and hospitalized patients. The data were collected from case sheets of hospitalized patients and direct patient interview from cardiac and neurology departments. Demographic information (age and sex), length of hospital stay, main diagnosis, number of drugs and details of comorbidities were obtained from the clinical records. pDDIs were detected using the Drug Interactions Checker within *Micromedex*®-2.7 and www.drugs.com

RESULTS

A total of 1330 patients were admitted in the department of cardiac and neurology during the study period. Among these, 685 were cardiac and 645 were neurology patients. Out of 685 cardiac patients, 524 (76.49%) had found to be pDDIs. 856 pDDIs were found in 524 cardiac patients. 795 pDDIs were found in 645 neurology patients. Out of which [298 (56.87%)] cardiac male and [235(55.29%)] neurology male was found to be higher pDDIs, compared to females. Incidences of pDDIs were found to be higher in the age group of 60-70 y in cardiac [193(36.83%)] and neurology [165 (38.84%)] patients and incidences of interactions based on duration of (4-6 d) hospital stays in cardiac were 380 (72.53%) and 275 (64.70%) in neurology patients respectively. 51.90% patients and 57.41%, cardiac and neurology patients prescribed with more than 7 drugs in cardiac and neurology patients were found to have developed higher incidences of pDDIs.

Table 1: Demographic profile of cardiac and neurology patients

S. No.	Parameter	Cardiac total no of patients (n=524)	Neurology total no of patients (n=345)
1.	Gender wise distribution		
	Male	298 (56.87%)	235 (55.29%)
	Female	226 (43.13%)	190 (44.71%)
2.	Age wise distribution		
	18-30	21 (4.00%)	31 (7.29%)
	31-45	69 (13.17%)	56 (13.17%)
	46-59	164 (31.29%)	125 (29.41%)
	60-70	193 (36.85%)	165 (38.84%)
	Above 70	77 (14.69%)	48 (11.29%)
3.	Number of hospital stay (In days)		
	<3	83 (15.83%)	95 (22.35%)
	4-6	380 (72.53%)	275 (64.70%)
	>7	61 (11.64%)	55 (12.95%)
4.	Number of prescribed drugs per day		
	<4	94 (17.93%)	67 (15.64%)
	5-6	158 (30.15%)	114 (26.82%)
	>7	272 (51.90%)	244 (57.41%)

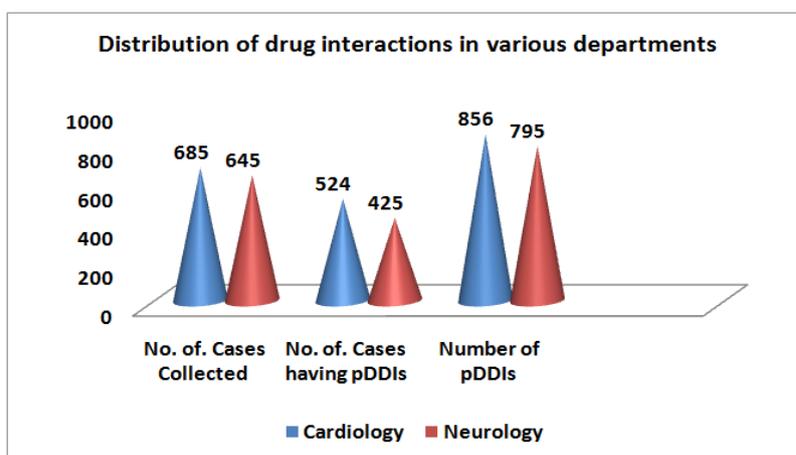


Fig. 1: Distribution of drug interactions in various departments

Table 2: Types of diseases in each department

Cardiology (n=524)		Neurology (n=425)	
Type of diseases	No. of patients	Type of diseases	No. of patients
Myocardial Infarction	87 (16.60%)	Stroke	187 (44.00%)
Angina+Diabetes mellitus	111 (21.18%)	Stroke+Alzheimer's disease	21 (04.94%)
Hypertension	165 (31.48%)	Stroke+Parkinson's disease	32 (07.52%)
Ischaemic Heart Disease	46 (08.77%)	Stroke+Epilepsy	43 (10.11%)
Coronary Artery Disease	34 (06.48%)	Epilepsy	117 (27.52%)
Chronic Heart Failure	81 (15.45%)	Parkinson's disease	25 (05.88%)

On average, each patient had one or two coded diagnoses, in which hypertension was the most common condition 165 (31.48%), followed by Angina with Diabetes mellitus 111(21.18%) in cardiac patients and Stroke 187 (44.00%), followed by Epilepsy 117 (27.52%) in neurology patients (table 2).

Table 3: Highest potential drug-drug interaction combinations in cardiology

pDDIs combination	Type	Severity	Frequency (n=856)	Percentage (%)
T. Aspirin+T. Clopidogrel	PD	Major	245	28.62%
T. Aspirin+T. Enalapril	PD	Moderate	69	8.06%
T. Atorvastatin+T. Clopidogrel	PK	Moderate.	78	9.11%
T. Aspirin+T. Atenolol	PD	Moderate	25	2.92%
T. Clopidogrel+T. Amlodipine	PK	Moderate	80	9.34%
T. Atenolol+T. Metformin	PK	Major	25	2.92%
T. Spironolactone+T. Enalapril	PD	Moderate	18	2.10%
T. Enalapril+T. Metformin	Unknown	Major.	15	1.75%
T. Enalapril+T. Furosemide	PD	Moderate	12	1.40%
T. Aspirin+T. Spironolactone	PD	Major	41	4.78%

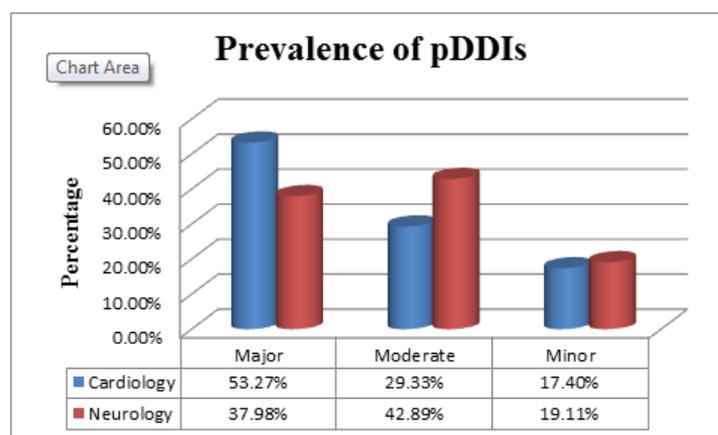
Note: PD= Pharmacodynamics, PK= Pharmacokinetics

Table 5: Highest potential drug-drug interaction combinations in neurology

pDDIs combination	Type	Severity	Frequency (n=795)	Percentage (%)
T. Aspirin+T. Clopidogrel	PD	Major	316	39.74%
T. Carbamazepine+T. Phenytoin	PK	Major	92	11.57%
T. Aspirin+T. Metformin	PD	Major	70	8.80%
T. Amlodipine+T. Clopidogrel	PK	Major	49	6.61%
T. Atorvastatin+T. Clopidogrel	PK	Moderate	37	4.24%
T. Clonazepam+T. Theophylline	PD	Moderate	25	3.14%
T. Phenytoin+T. Clonazepam	PK	Moderate	78	9.81%
T. Clobazam+T. Carbamazepine	PK	Minor	45	5.66%
T. Amitriptyline+T. Fluoxetine	PK+PD	Major	42	5.28%
T. Diazepam+T. Phenytoin	Unknown	Major	41	5.15%

Table 7: Prevalence of pDDIs

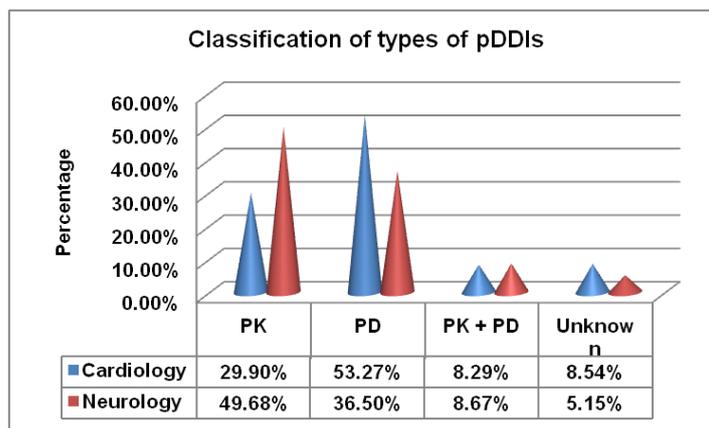
S. No.	Type of prevalence	Cardiology	Neurology
	Severity of pDDIs	Frequency (n=856)	Frequency (n=795)
1.	Major	456 (53.27%)	302 (37.98%)
2.	Moderate	251 (29.33%)	341 (42.89%)
3.	Minor	149 (17.40%)	152 (19.11%)

**Fig. 2: Prevalence of pDDIs****Table 8: Distribution of potential drug-food interactions in cardiology**

pDFIs	Anticipated effects	Type of DFIs	Severity	Frequency (n=457)
T. Atorvastatin with citrus fruits	Decreased first pass metabolism and increased bioavailability	PK	Moderate	144(31.50%)
T. Enalapril with Banana	Hyperkalaemia	Unknown	Moderate	47(10.28%)
T. Atenolol with orange juice	Decrease the mean peak plasma concentration of atenolol; excretion of the drug into urine decreased	PK	Moderate	79(17.28%)
T. Diazepam with Tea/Coffee	Antagonistic Effect. Caffeine generally antagonized the diazepam-induced ratings of sedation and impairment of psychomotor performance	PD	Minor	83(18.16%)
T. Bisacodyl with Milk	Increase the risk of stomach upset and nausea.	Unknown	Minor	91(19.91%)
T. Paracetamol with Cabbage	Decrease effectiveness of the drug.	PK	Moderate	38(8.31%)

Table 9: Distribution of potential drug-food interactions in neurology

pDFIs	Anticipated effects	Type of DDI	Severity	Frequency (n=385)
T. Phenytoin with Protein Rich Foods (Fish, Milk, Egg, Meat)	Altered Phenytoin concentration	PK	Moderate	97 (25.19%)
T. Carbamazepine with Black tea	Decreased Carbamazepine bioavailability	PK	Moderate	65 (16.88%)
T. Acetaminophen with Cabbage	Decreased Acetaminophen Effectiveness	PD	Moderate	23 (5.97%)
T. Diazepam with Tea/Coffee	Reduced Sedative and Anxiolytic effect of Diazepam	PD	Minor	45 (11.68%)

**Fig. 3: Classification of types of pDDIs****Table 10: Distribution of potential drug-disease interactions in cardiology**

pD-DIs	Anticipated effects	Severity	Frequency (n=289)
T. ISDN with MI	Systemic hypotension and tachycardia	Major	42(14.53%)
Inj. Furosemide With DM	(latent diabetes may become overt: insulin requirements in established diabetes may increase: stop furosemide before a glucose tolerance test)	Moderate	56(19.37%)
T. Atenolol with DM	Inhibit catecholamine-mediated glycogenolysis, thereby potentiating insulin-induced hypoglycemia and delaying the recovery of normal blood glucose levels.	Major	24(8.30%)
T. Enalapril with CHF	Oliguria and/or progressive azotemia and, rarely, renal failure, myocardial ischemia, and death.	Major	28(9.68%)
T. Amlodipine with CAD	Unknown Mechanism	Major	18(6.22%)

Note: pD-DIs=Potential Drug-disease interactions, ISDN= Isosorbide dinitrate, MI= Myocardial Infarction, DM= Diabetes mellitus, CHF= Congestive heart failure, CAD= Coronary artery diseases.

Table 11: Distribution of potential drug-disease interactions in neurology

pD-DIs	Anticipated effects	Severity	Frequency (n=215)
T. Carbamazepine with Seizures	Increased frequency of generalized convulsions	Moderate	46 (21.39%)
T. Atorvastatin with DM	Increased HbA1C and Fasting blood sugar levels	Moderate	45 (20.93%)
T. Diazepam with seizures	Increased frequency of seizure episodes	Major	21 (9.76%)
T. Telmisartan with DM	Increased risk for new onset of Diabetes	Major	16 (7.44%)
T. Clopidogrel with Intracranial Haemorrhage	Increased risk of Bleeding	Major	15 (6.97%)

Note: DM= Diabetes mellitus

DISCUSSION

DDIs are a major area of concern these days for the effective management of patient illness. It may create a considerable health hazard to the patients when the risk-benefit ratio of combining interacting drugs is not accurately estimated. It has already been approximated that the effect of drug interactions can range from any minor morbidity to fatal consequences. The study of drug-drug, drug-food, and drug-disease interactions and of genetic factors affecting pharmacokinetics and pharmacodynamics is expected to improve drug safety and will enable individualized drug therapy.

The present study identified a total of 1330 patients were admitted to the department of cardiology and neurology during the study period. Among these, 685 were cardiac and 645 were neurology patients. Out of 685 cardiac patients, 524 (76.49%) had found to be pDDIs. 856 pDDIs were found in 524 cardiac patients. Our study showed that cardiac male 298 (56.87%) patients, neurology 235 (55.29%) patients had more interactions than female cardiac 226 (43.13%), neurology 190 (44.71%), which are similar to the study has shown [14]. Another study has shown [15]. Also reports that male patients are higher cardiology (50.94%), neurology (54.73%), and a number of male patients, when compared to females in the

present study, may be the primary reason. Another reason possibly will be the greatest risk of cardiovascular, neurological disorders among male gender when compared to female and hence there is a need for multiple drugs which ultimately result in drug interactions.

The study the majority of the Incidences of pDDIs were found to be higher in the age group of 60-70 y in cardiac [193 (36.83%)] and neurology [165 (38.84%)] patients. A study [16] has reported an age group of 59-69 y, whereas, a study [17, 34] has reported that the majority of patients ages were between 70-74 y. Older people are at high risk of developing an ADR due to pDDIs for several reasons. They are likely to have higher comorbidities and thus take several prescriptions and over the counter drugs. As people get older, the liver loses the ability to metabolize drugs. Also, older people are more than twice as susceptible to ADRs as younger people. As people age, the amount of water in the body decreases and the amount of fat tissue relative to water, increases. Also, as people age, the kidneys are less able to excrete drugs into the urine, and the liver is less able to metabolize many drugs.

The study revealed that [380 (72.53%)] cardiac, [275 (64.70%)] neurology of patients, and reported that the number of days hospital stay was between 4-6 d (table 1). A study [18], which showed that the majority of the cases, the number of hospital stay were less than 6 d. The likelihood of getting the multiple drugs increases with the increased length of hospital stay which in turn will increase the likelihood of pDDIs.

In our study, 51.90% cases, per day more than 7 drugs were prescribed in the cardiology department (table 1). The study [19] has shown that 40.60% cases have been reported as the prescribing between 13 to 16 drugs. 57.41% neurology department more than 7 drugs were prescribed (table 1); a study [20] has shown, whereas 62% cases are reported to prescribe more than 8 medications in the neurology department. Similar to another study [21] has reported the concurrent use of three or more drugs increases the risk of ADE's by 9.8 times. More the medications that are prescribed, the more the possibility of irrational polypharmacy. A study [22] has determined the probability of potent cytochrome P450 (CYP 450) interactions in older hospitalized people taking more than five concurrent medicines. Potential drug-drug interactions are present in 80% of people taking more than 5 concurrent medicines. People taking 5 concurrent medicines have a 50% probability of at least one drug interaction, each additional medicine adds a 12% increase in the risk of drug interactions.

The most common interacting pair in the cardiac department in the present study was found to be between aspirin and clopidogrel; which is a major pharmacodynamic interaction, with a frequency of 245 (table 3). The similar study by [23] in which most common interacting pair was identified as aspirin-clopidogrel followed by clopidogrel-Fondaparinux. Another study [24] observed an increased risk of bleeding when aspirin combined with another thrombolytic agent. The most common interacting pair in the neurology department in the present study was found to be between Aspirin and Clopidogrel; which is a major pharmacodynamic interaction, with a frequency of 316 (table 5). This interacting pair increases the risk of bleeding; which is managed by monitoring blood counts. The similar study [25] has reported in which most common interacting pair was identified as aspirin-clopidogrel. Another study [8] which is quite different from this study identifies the most common interacting pair as clopidogrel-omeprazole.

The prevalence of pDDIs in the cardiac department in our study was 53.27% (table 7). A similar study was [26] showed an overall 77.5% pDDIs prevalence rate among randomly selected cardiac patients. A study [23] has reported to the department of cardiology showed that the prevalence rate of the bodice was 91.6% among the studied cardiac patients. The prevalence of pDDIs in the neurology department in our study was 42.89% (table 7). A similar study [27] in the department of Neurology showed that the prevalence rate of pDDIs was 71.6% among the patients.

In our study, the prevalence of pDDIs was more in major severity in cardiology. Moderate severity in neurology (table 7). A similar study [28] has reported pDDIs of major severity in 13% patients and [26]

has reported in 24.25% patients. Prevalence of pDDIs of moderate severity was 30.94%. Another study [24] has reported moderate severity in 60.3% of patients. This study contrasts the other studies which report moderate severity. These potential DDIs suggest that there is a need for modification or alteration of therapy such as dosage adjustment. In order to prevent these DDIs, health care providers should have adequate information about DDIs not only via drug information center, which can provide evidence-based information to health care professionals, but also through encouraging the empowerment of clinical pharmacists that can provide evidence-based approach to drugs and thereby prevent drug therapy problems of which DDIs is one.

Out of 524 cardiac cases, there was 82 interacting pair identified during the study. Among 856 pDDIs, 256 (29.90%) were pharmacokinetic interactions, 456 (53.27%) were pharmacodynamic interactions. 71 (8.29%) showing both mechanisms and 73 (8.54%) were the unknown mechanisms. Among 256 pharmacokinetic drug interactions, 39 (15.23%) were due to absorption, 41 (16.01%) were due to distribution, 141 (55.07%) were due to metabolism and 35 (13.67%) were due to excretion. Among 456 pharmacodynamic interactions, 28 (6.14%) were synergistic, 115 (25.21%) were antagonistic, 294 (64.47%) were additive and 19 (4.18%) with both additive and antagonistic effects. A similar study [29] has reported, among 423 pDDIs, 50.83% were pharmacodynamic drug interactions, 38.53% pharmacokinetic, and 10.64% showing both kinds of mechanisms. From the 163 pharmacokinetic pDDIs, 45.41% have altered the absorption, 28.99% have altered the metabolism, and 25.60% have altered the excretion. Of the 215 pharmacodynamic pDDIs, 67.44% were synergistic, 30.70% antagonistic and 1.86% unknown in nature. The similar study [34] has reported, the majority being pharmacodynamic interaction is that these types of interactions derive from modification of the action of one drug at the target site by another drug, independent of a change in its concentration. This may result in an enhanced response (synergism), an attenuated response (antagonism) or an abnormal response.

Out of 425 neurology cases, there was 72 interacting pair identified during the study. Among 795 pDDIs, 396 (49.68%) were pharmacokinetic interactions, 289 (36.50%) were pharmacodynamic interactions. 69 (8.67%) showing both mechanisms and 41 (5.15%) were the unknown mechanisms. Among 396 pharmacokinetic drug interactions with the neurology department, 282 (71.21%) were due to metabolism. 289 pharmacodynamic interactions, 158 (54.67%) were Additive which is in contrast with the study by [29], where 67.44% were synergistically followed by 30.7% antagonistic.

Diet and lifestyle can sometimes have a significant impact on drugs. These may occur out of accidental misuse or due to lack of knowledge about the active ingredients involved in the relevant substances. Interactions between food and drugs may inadvertently reduce or increase the drug effect. Major side effects of some diet (food) on drugs include alteration in the absorption of fatty, high protein and fiber diets.

According to this study, a total of 1330 patients were admitted to the department of cardiac and neurology during the study period. Among these, 685 cardiac patients and 645 neurology patients. Out of 685 cardiac patients, 290 (42.33%) had found to be drug-food interactions. 457 pDFIs were found in 290 cardiac patients. Out of 645 neurology patients, 235 (34.55%) had found to be pDFIs. 385 pDFIs were found in 235 neurology patients. The Most of the cardiac cases had pDFIs between atorvastatin-citrus fruits interactions (table 6), with a frequency of 144, which may cause decreased first-pass metabolism and increased bioavailability of atorvastatin that further results in muscle breakdown, liver damage, digestive problems, increased blood sugar and neurological side effects. The reason for these interactions is due to furanocoumarins. The interaction between citrus fruits and medications poses dangers only if a drug is taken orally because the interaction occurs in the digestive tract. The second most common interaction was banana interacting with the ACE inhibitors, with a frequency of 83, to cause hyperkalemia [30]. Bananas are high in potassium. Too much potassium can cause an irregular heartbeat, and heart palpitations.

Out of 385 drug-food interactions with the neurology department, 97 cases reported phenytoin with protein-rich foods (fish, milk, egg, meat) (table 7). Moderate, as the drug, must be taken on an empty stomach. This interaction results in altered phenytoin concentrations. A similar study by [31] conducted a study which reported that a simultaneous intake of green vegetables and heparin causes a decreased anticoagulant effect. The total number of drug-food interactions and its prevalence is 230 and 48.42% respectively.

According to this study, a total of 1330 patients were admitted to the department of cardiac and neurology during the study period and conducted direct patient interview, among these, 685 cardiac patients and 645 neurology patients. Out of 685 cardiac patients, 175 (42.06%) had found to be potential drug-disease interactions. 289 pD-DIs were found in 175 cardiac patients. Out of 645 neurology patients, 148 (35.57%) had found to be pD-DIs. 215 pD-DIs were found in 148 neurology patients. The most common drug-disease interaction was found to be ISDN with MI (table 8). The interaction may result in systemic hypotension and tachycardia. It may also exacerbate myocardial ischaemia. The second common pD-DIs interaction was found to be furosemide-DM. This interaction may result in latent diabetes may become overt: insulin requirements in established diabetes may increase. So it is advisable to stop furosemide before a glucose tolerance test. The most common pD-DIs in neurology was found to be carbamazepine-seizures (table 9). The interaction may result in increased frequency of generalized convulsions. So it should be used with caution in patients with a mixed seizure disorder that includes atypical absence seizures. The second common pD-DIs was found to be atorvastatin-DM. This interaction may result in increased HbA1C and fasting blood sugar levels. So caution should be exercised when using these agents in diabetic patients and close monitoring is recommended. So it is advisable to stop atorvastatin before glucose test; a contradiction to our study by [32], which reported that the effects of furosemide may contribute to the decrease in glucose utilization.

LIMITATION

The study was carried out in a hypothetical way of approach to find the prevalence of drug interactions. The active possibilities of DIs respect to the time of drug administration, the half-life of drugs, elimination time were not assessed. The study also could not assess the outcomes of DIs in the selected hospitalized patients.

CONCLUSION

Our study concluded that the overall incidence of pDDIs was very high in the Department of Cardiology. It was found that the incidence of pDDIs was associated with older age, polypharmacy, increased lengths of hospital stay and increased number of prescribed drugs. DDIs are real with uncertain clinical implications. Therefore, our study highlights the DDIs, which is high among cardiac and neurology patients prescribed with aspirin drug with clopidogrel. Whereas in food-drug interactions in cardiac patients with atorvastatin drug with citrus fruits and neurology patients with phenytoin drug with protein-rich foods and disease-drug interactions in cardiac patients with ISDN drugs with MI, neurology patients with carbamazepine-seizures in a tertiary care teaching hospital. It is recommended that physicians should be aware of the interactions among those drugs while prescribing, and careful monitoring is also required.

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AUTHORS CONTRIBUTIONS

All the author have contributed equally

CONFLICT OF INTERESTS

The authors declare no conflict of interest

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