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Research Article

ROLE OF CLINICAL PHARMACIST IN ASSESSMENT OF DRUG RELATED PROBLEMS OF CARDIOVASCULAR AGENTS IN DEPARTMENT OF CARDIOLOGY IN A TERTIARY CARE HOSPITAL – A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

In total of 173 prescriptions of the patient, the total number of 329 drug interactions (DIs) was found, in which the 240 interactions were found in male and 89 in the female bearing 72.90% and 27.10%, respectively. Patient was of various age groups, in which the maximum frequency was seen in the age group of 61–70 years having 105 interactions bearing the percentage of 31.9%. According to the participation of different age group of the male and female with their corresponding age. The participation of male is high having frequency of 240 (72.9%) than female participation of frequency 89 (27.1%). The participation of male in the age group of 61–70 years is 83 and the female is 40 in the age group of 51–60 years. Potential DIs (PDIs) were categorized based on the gender. In that compared to 13 (40.6) females, males 19 (59.4%) were found to have more PDIs. Our study is more PDIs in adult patients. Because in adults lacking of nutrition's and in elderly patients multiple prescribers, multiple drugs and multiple diseases. The number of potential drug-DI (PDDI) increased with an increase in the number of drugs prescribed. The numbers of drug prescribed increase with age. This DI has a potential to increase or decrease the therapeutic effect or to increase the risk of adverse drug reaction. An increased awareness of PDDIs, rational coprescription of drugs, and a close monitoring of patients in whom these drugs are prescribed are recommended. The recommendation is based on the special monitoring and the perspiration of the clinical pharmacist. The DI observed in the geriatric patient is more severe and common in compared to the other groups of study. The geriatric patient is physiological disability in correspond with the first-pass metabolism and the presence of the other diseases which also enables the multiple prescriptions causing polypharmacy. The gender specification also the cause of the interaction, the female is more prone to the DI due to the hormonal distribution in the body and inability of the physiological function to absorb and the distribution. The special training should be provided to the pharmacist for looking forward of the geriatric patient and female patient. The training regarding the prescription their adherence, use, toxicity, and dosage regimen is being properly enabled in the training for the practical application. This study helps to know the different interaction related to the cardiovascular agent with own class of the drug and the other class of drugs used therapeutically to care the disease.

Keywords: Drug interactions, Drug-related problems, Cardiovascular drugs, Micromedex.

INTRODUCTION

All pharmacists working in clinical settings, whether dispensing medicines or advice, require a well-grounded knowledge of drug interactions (DIs) to prevent harm to patients from medicine combinations. This is an area, in which a pharmacist's expertise a valued by other professionals and where a pharmacist's knowledge of pharmacology can be recognized and appreciated. On the ongoing diagnostics, prevention, treatment in the different department of the hospital in the various types of the patient grouping in correspondence of the age, polypharmacy, gender, race, and hereditary, many DIs are been found. Those interactions are simple, usual, or the life threatening which may affect the loss of pharmacological action of the body and other activities of the body. The interaction of the drug is more evenly found in the cardiac department in prevalence with the cardiac disease; patient is more commonly found with the hypertension, ischemic heart disease, myocardial infarction, etc.

A drug-DI (DDI) may be defined as the pharmacological or clinical response to the administration of a drug combination which is different from that anticipated from the known effects of the two agents when given alone. The clinical result of a DDI may manifest as antagonism, synergism, or idiosyncratic.

DDIs are changed in drug's effects caused by another drug taken during the same time period. Potential DIs (PDIs) may include, drug contraindications, drug combinations that require monitoring and possible dosage adjustment when given concomitantly. It is important not only to identify PDIs that are clinically meaningful but also to understand options to approach the potential loss efficacy or toxicity that may result when combinations of drugs are administered together.

PDI not only presents a danger to the patients but they can also greatly increase health-care costs. The outcome can be harmful if the interaction causes an increase in the toxicity of the drugs [1].

In epidemiology, it is difficult to have an accurate estimate of the incidence of DIs mainly because published studies have frequently used different criteria for defining a DI, particularly in distinguishing between clinically significant and non-significant interactions. Some of the early studies uncritically compared prescribed drugs with list of possible DIs without taking into account their potential clinical significance. A review of nine studies of the epidemiology of DDIs in hospital admissions found that reported incidence ranged from 0% to 2.8%. Out of nine studies, one study was like are DIs are important in clinical practice and have been estimated to account for 6–30% of all adverse drug reactions (ADRs). One more in the Harvard Medical Practice Study of adverse events, 20% in acute hospital in-patients settings were drug related. Of these, 8% were considered to be due to DDIs [2].
DDIs are changed in drug's effects caused by another drug taken during the same time period [3].

Potential DDIs (PDDIs) may include, drug contraindications, drug combinations that require monitoring and possible dosage adjustment

when given concomitantly. It is important not only to identify PDIs that are clinically meaningful but also to understand options to approach the potential loss efficacy or toxicity that may result when combinations of drugs are administered together [4].

In many cases, potentially interacting drugs can be given concurrently provided; the possibility of DIs is kept in mind and any necessary changes to dose or therapy are initiated promptly. However, concurrent use of potentially interacting drugs should be avoided altogether [4].

The clinical management of PDIs generally implies monitoring of symptoms related to a possible side effect and laboratory parameters such as serum-creatinine, internationalized ratio, and blood glucose, to prevent potentially serious adverse patient outcomes [5].

PDI not only presents a danger to the patients but they can also greatly increase health-care costs. The outcome can be harmful if the interaction causes an increase in the toxicity of the drugs [6].

The most important step in avoiding adverse clinical consequences is knowledge of the potential toxicity of drug combinations so that a rational prescription can be made. For example, the clinician may administer the antibiotic if the interaction is unlikely to be important or can choose an alternative antibiotic that does not have the potential for DI [14].

Objectives

General objective

Prospective study on PDIs of cardiovascular agents in the department of cardiology in a tertiary care teaching hospital.

Specific objectives

The specific objectives of this study were as follows:

1. To assess the pattern of drug/drug class involved in these interactions
2. To assess the severity of DIs
3. To assess the onset of DI
4. To assess the outcome of the DIs.
5. To evaluate and assess the individual DIs.

METHODS

Study site

This study was conducted at Government General Hospital, Guntur. It is a 3000-bedded multispecialty/superspecialty tertiary care teaching hospital. This hospital provides primary and specialized health-care facilities to people in and around Guntur area. It is a major government-owned multispecialty hospital in Guntur having the department such as cardiology, neurology, pediatrics, obstetrics, and gynecology. Approximately 1500–2000 patients are being treated every day. The patient is usually referred to this hospital by general practitioners.

Study design

This was a prospective and observational study.

Study period

The study period of 6 months was from October 2015 to March 2016.

Study criteria

Inclusion criteria

The following criteria were included in the study:

- Inpatients of the department of cardiology with length of stay more than 24 h
- Patients on multiple drug therapy, with minimum of two drugs with at least one are a cardiovascular agent.

Exclusion criteria

The following criteria were excluded from the study:

- Patients not on any cardiovascular agent
- Patients on single-drug therapy with cardiovascular agent
- Outpatients of the department of cardiology
- Patients whose length of stay in hospital are <24 h.

Sources of data

All the necessary data were collected from the important of all the four units of cardiology department. The main source of data collection included:

- Patient case studied
- Treatment chart
- Laboratory report
- Patient interview.

Study procedure

An approval from the Institutional Ethical Committee of Government General Hospital, Guntur, was obtained before the study. All patients admitted to cardiology wards during the study period were screened for case of any anti-cardiology agent. Those who met the inclusion criteria were included for the study purpose enroll for the study. Follow was carried out till the day of discharge from the hospital. After the patient was included in the study, the data including, demographic data such as the age, gender, medical history, reason for admission, and comorbidities; clinical data such as hematology and biochemistry; and therapeutic data including dose, duration, frequency, route, time of administration, and concomitant medication were collected and documented in the suitably designed data collection form (Annexure 1); probable DIs were identified using the software MICROMEDEX and the standard textbooks (Martindale, Dipiro, Herdindal, and Kodakinalde). The potential outcome of the interaction was accessed based on literature patient interview and discussion with clinician. Those interactions which were assumed to have happened in the patient were evaluated for various parameters. Nature of interaction were evaluated with regard to onset, severity, and documentation was evaluated. Data were accessed to evaluate the individual drugs and drug class involved in interactions. Data on interaction of the individual drugs were evaluated based on demographic (age and gender) and characteristics of interaction (onset and severity). Data were evaluated using suitable statistical tools.

Criteria for evaluation criteria for severity

The potential severity of the interaction is important in assessing the risk versus benefits of therapeutic alternatives. With appropriate dosage adjustments or modification of the administration schedule. The negative effect of most interactions can be avoided.

1. Major interactions may be life threatening, or intoxication or permanent damage may be induced. Normally, these drugs should not be administered together
2. Moderate interactions frequently cause therapeutic difficulties, but the combination may be administered if the patient is carefully monitored (laboratory parameter, for example, quick value or clinical symptoms)
3. Minor interaction may cause increased or reduced effects or interactions only concerning a certain subgroup (for example, patient with renal or hepatic failure, slow acetylizers).

Criteria for onset

How rapidly the clinical effects of interactions can occur to determine the urgency with which preventive measure should be instituted to avoid the consequences of the interaction.

Two levels of onset are used

Rapid

The effect will be evident within 24 h of administration of the interacting drug. Immediate action is necessary to avoid the effects of interactions.

Delayed

The effect will not be evident until the interacting drug is administered for a period of days or weeks. Immediate action is not required.

Criteria for frequency
Frequency of PDIs was calculated as the total number of potential DDIs per total number of patients.

Statistical analysis
Descriptive statistical analysis has been carried out in the present study. Results on continuous measurement are presented on mean ± standard deviation (min-max) and results on categorical measurements are presented in number, percentage, etc. Confidence interval (CI) has been computed to find the significant features. CI with lower limit >50% is associated with statistical significance. Student's t-test has been used to find the continuous scale.

Statistical software
The statistical software, namely, SPSS 20 Ver. and Microsoft Excel and diagrams advance analysis with Chi-square test with 95% CI.

RESULTS

The DDI based on age group was found with ranging from the age of 25 above. The highest frequency was in the age duration of 61–70 age group with prevalence of the 105 frequency with the percentage of 31.9%.

The gender-based participation was studied well and the participation was differentiated based with the age group and their gender specific with male and female. A total of 329 interactions were found in along with the 173 prescriptions, in which the 89 DIs are found in male with high frequency in the age group of 51–60 having the frequency of DDI 40. The interaction on the male group is found to be 240 having high frequency in the age group of 61–70 years having frequency 83.

The participation of male and female with total expression with the percentage was statistically calculated and presented with the tables and the graphs. The maximum frequency in male and female is found to be 240 and 89, respectively, with the percentage of 72.9% and 27.1%.

The main focus of the research is to determine the severity of interaction among the interactions. The major, moderate, and minor were evaluated with the frequency of 170, 158, and 1, respectively, having the percentage of 51.7%, 48.0%, and 0.03%, respectively.

The main focus of the research is to determine the onset of interaction among the interactions. The delayed, not specified, and rapid were evaluated with the frequency of 95, 215, and 19, respectively, having the percentage of 28.9%, 65.3%, and 5.8%, respectively.

This was evaluated with the corresponding excel sheet report and using the software.

MICROMEDEX

The atorvastatin calcium reacts with the interacting drugs azithromycin, clopidogrel, digoxin, fentanyl, and ranolazine with times of, respectively, 3, 4, 1, 3, and 4 with a total of 15 interaction was found in this study.

The clopidogrel interacts with the interacting drug dabigatran etexilate mesylate, enoxaparin sodium, fondaparinux, heparin calcium, indomethacin, rivaroxaban, and torsemide with the number of, respectively, 1, 5, 2, 7, 1, 1, and 1 with a total of 18 interactions was found in this study.

The insulin human isophane interacts with the interacting drug dextrose, levofloxacin, metformin, metoprolol tartrate, ramipril, and sitagliptin phosphate with the number of, respectively, 1, 1, 1, 4, 2, and 1 with a total of 10 interaction was found in this study.

The aspirin interacts with the interacting drug atenolol, bisoprolol fumarate, carvedilol, cilostazol, clopidogrel, dabigatran etexilate mesylate, diclofenac, enoxaparin sodium, enoxaparin sodium, fondaparinux sodium, furosemide, heparin, heparin calcium, heparin sodium, human insulin, insulin, insulin aspart, insulin human isophane, lisinopril, magnesium hydroxide, metoprolol tartrate, nebivolol, NPH, perindopril erbumine, ramipril, sodium bicarbonate, spironolactone, ticagrelor, and torsemide with the number of, respectively, 3, 3, 8, 1, 23, 1, 1, 11, 1, 2, 5, 11, 1, 19, 2, 1, 8, 2, 6, 1, 9, 29, 1, 1, 1, 10, 1, 4, 30, and 3 with a total of 199 interactions was found in this study.
The distribution of gender among the study sample was done and the value of frequency among the age group of below 60 years is 163 with total percentage bearing 49.55% having Chi-square=0.027 and p=0.192. The 95% CI of upper bond and lower bond is 0.197 and 0.906, respectively, and the age group of above 60 years having the frequency of 166 bearing 50.45%.

DISCUSSION

Clinical pharmacists get an opportunity to work in a team and utilize the professional skills, knowledge, and expertise for better patients care.

It is impossible to remember all DIs of potential clinically significance. Health-care staff should be the continually alert to the possible of DIs and take appropriate steps to minimize their occurrence.

This is an area in which a pharmacist's expertise a valued by other professionals and where a pharmacist's knowledge of pharmacology can be recognized and appreciated. On the ongoing diagnostics, prevention, treatment in the different department of the hospital in the various types of the patient grouping in correspondence of the age, polypharmacy, gender, race, and hereditary, many DIs are been found.

Those interactions are simple, usual, or the life threatening which may affect the loss of pharmacological action of the body and other activities of the body. The interaction of the drug is more evenly found in the cardiac department in prevalence with the cardiac disease, patient is more commonly found with the hypertension, ischemic heart disease, myocardial infarction, etc.

It would be worth assessing the incidence and patterns of DIs for antimicrobials among these patients. Very few studies have been reported in literature to study the nature of DIs specifically among cardiovascular agents. Such data can be helpful in understanding opportunities for improving drug use. Hence, this study is taken to understand the incidence and pattern of DIs to cardiovascular agent in the cardiovascular department.

In total of 173 prescriptions of the patient, the total number of 329 DI was found, in which the 240 interactions were found in male and 89 in the female bearing 72.90% and 27.10%, respectively.

Age
As shown in Table 1, in the current study, the involvement of the patient was of various age groups, in which the maximum frequency was seen in the age group of 61–70 years having 105 interactions bearing the percentage of 31.9%. As in the other age groups, less interaction was found which are as 25–30, 31–40, 51–60, 71–80 are 4, 20, 37, 102, 55, 6

Table 1: Drug interaction differentiated based on age group

Age group	Frequency	Percent
25–30	4	1.2
31–40	20	6.1
41–50	37	11.2
51–60	102	31.0
61–70	105	31.9
71–80	55	16.7
Above 80	6	1.8
Total	329	100.0

bearing the percentage as respectively 1.2%, 6.1%, 11.2%, 31%, 16.7%, 1.8%.

In the reference study, the adults are exposed to more single and multiple regimens than younger. Majority 9 (28.1%) of patients with PDIs are more in 51–60 years. More than one potential drug – laboratory interaction was present in majority 19 (50%) of patients. Similar findings are found in a study conducted by Hovastadivs BO, Astrand B, and Petresson G, which concluded multiple medications should be regarded as a risk in forms of PDIs and ADR in all age groups.

Johnelli, Kristina, Klarin, Inga, which states that there seems to be a strong relationship between number of dispensed drugs and PDIs, especially for potentially serious DDIs, which has implications for the importance of trying to minimize the number of drugs prescribed in the elderly, it was also found that the probability of potentially serious DDIs decreases with increasing age among the elderly and that elderly woman has a lower probability of potentially serious DDIs.

Gender

As per Tables 2 and 3 and also Figs. 2 and 3 represent the participation of different age group of the male and female with their corresponding age. The participation of male is high having frequency of 240 (72.9%) than female participation of frequency 89 (27.1%). The participation of male in the age group of 61–70 years is 83 and the female is 40 in the age group of 51–60 years.

In Tables 3 and 4 and Figs. 3 and 4 showed that PDIs were categorized based on the gender. In that compared to 13 (40.6) females, males 19 (59.4%) were found to have more PDIs. Our study is more PDIs in adult and patients. Because, in adults lacking of nutrition's and in elderly patients multiple prescribers, multiple drugs and multiple diseases. The study conducted by Hersh EV states that particularly important that involvement of health-care professional audit on these interactions would prevent potentially serious and life-threatening interactions of the antibiotics.

Table 2: Drug interaction differentiated based on gender wise with age

Age group	Gender		Total
	Female	Male	
25–30	0	4	4
31–40	9	11	20
41–50	3	34	37
51–60	40	62	102
61–70	22	83	105
71–80	10	45	55
Above 80	5	1	6
Total	89	240	329

Table 3: Drug interaction classified according to gender wise

Gender	Frequency	Percent
Female	89	27.1
Male	240	72.9
Total	329	100.0

Table 4: Drug interaction classified based on severity in the department of cardiology

Severity	Frequency	Percent
Major	170	51.7
Moderate	158	48.0
Minor	1	0.3
Total	329	100.0

Wards

In our study, the various ward patients were studied in the Government General Hospital, Guntur. The patient in the intensive care unit was prescribed with the multiple drugs and the age was above 50 years. The male patient was found more as compared to the female with the

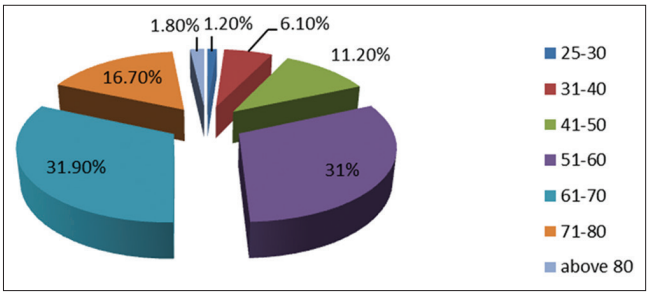

Fig. 1: Drug interaction differentiated based on age group

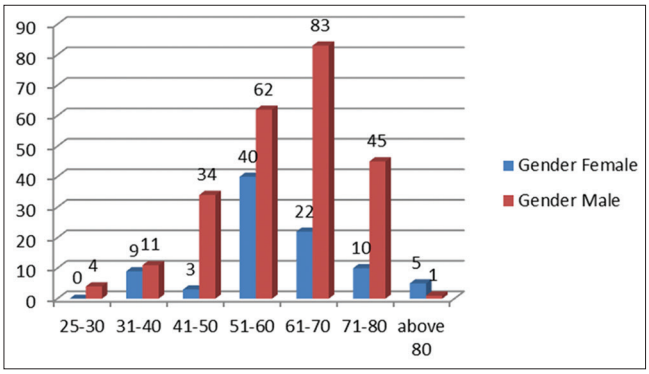

Fig. 2: Drug interaction differentiated based on gender wise with age

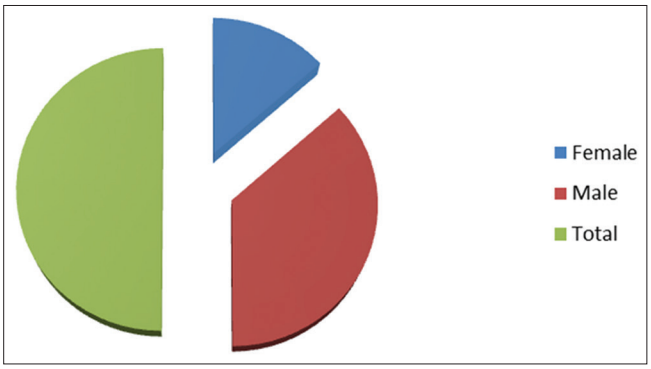

Fig. 3: Drug interaction classified according to gender

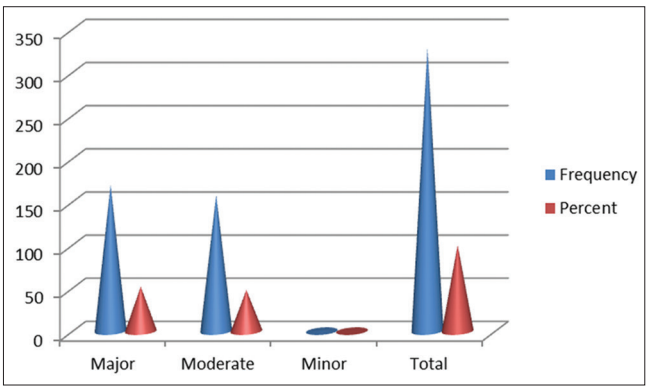

Fig. 4: Drug interaction classified based on severity in the department of cardiology

age group of specification 61–70 years and 51–60 years, respectively. The intensive critical care unit was also found with the different aspect depending on their disease and the instability of conscious. The prescription of the drugs was followed up and the male patient was found to be 72.9% followed by female patient 27.1%.

PDI

A DDI may be defined as the pharmacological or clinical response to the administration of a drug combination which is different from that anticipated from the known effects of the two agents when given alone. The clinical result of a DDI may manifest as antagonism, synergism, or idiosyncratic.

DDIs are changed in a drug's effects caused by another drug taken during the same time period. PDIs may include, drug contraindications, drug combinations that require monitoring and possible dosage adjustment when given concomitantly. It is important not only to identify PDIs that are clinically meaningful but also to understand options to approach the potential loss efficacy or toxicity that may result when combinations of drugs are administered together.

PDI not only presents a danger to the patients but they can also greatly increase health-care costs. The outcome can be harmful if the interaction causes an increase in the toxicity of the drugs.

The age bearing 61–70 years of male (geriatric patient) and 51–60 years of female (geriatric patient) have more interaction due to their physiological and the kinetics of the body with the gastrointestinal and the other factors. Female is more contraindicated to the drugs as the results also show that the lees age of female is interacted with the drugs than the male. The multiple prescriptions also indicate the potential interaction due to their multiple interaction of therapy. Furthermore, the multiple diseases are observed in the patient having the age group above than the 50 years.

Severity

The severity of interaction major, moderate, and minor is indicated with the use of standard software MICROMEDEX. The prevalence of the study of the interaction of severity is classified based on their priority of interaction. As shown in Table 4 and Fig. 4, the majority, moderate, and minor were found with the frequency of 170, 158, and 1 bearing the percentage of 51.7%, 48%, and 0.3% in the total of 329 prescriptions.

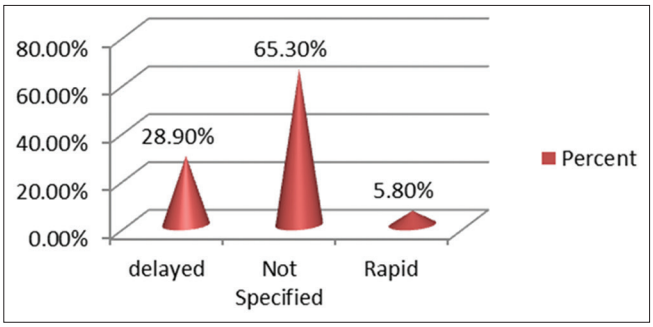

Fig. 5: Drug interaction classified based on onset in the department of cardiology

Table 5: Drug interaction classified based on onset in the department of cardiology

Onset	Frequency	Percent
Delayed	95	28.9
Not specified	215	65.3
Rapid	19	5.8
Total	329	100.0

Onset

The onset of interaction delayed, not specified, and rapid is indicated with the use of standard software MICROMEDEX. The prevalence of the study of the interaction of onset is classified based on their priority of interaction. As shown in Table 5 and Fig. 5, the delayed, not specified, and rapid were found with the frequency of 95, 215, and 19 bearing the percentage of 28.9%, 65.3%, and 5.8% in the total of 329 prescriptions.

Outcome of DIs

A total of 173 prescriptions were analyzed. A total of 329 PDDIs were detected, which were graded according to severity as serious, significant, minor, and contraindicated (Medscape, 2013 and Micromedics).

The prescriptions of every alternate patient were evaluated for PDDIs using freely accessible web-based DI checkers of Medscape (Medscape,

Table 6: Individual drug–drug interactions

Index drug	Interacting drug	Total
Atorvastatin calcium	Azithromycin	3
	Clopidogrel	4
	Digoxin	1
	Fentanyl	3
	Ranolazine	4
	Total	15
Clopidogrel	Dabigatran etexilate mesylate	1
	Enoxaparin sodium	4
	Enoxaparin sodium	1
	Fondaparinux sodium	2
	Heparin calcium	7
	Indomethacin	1
	Rivaroxaban	1
	Torsemide	1
	Total	18
Insulin human isophane	Dextrose	1
	Levofloxacin	1
	Metformin	1
	Metoprolol tartrate	4
	Ramipril	2
	Sitagliptin phosphate	1
	Total	10
Aspirin	Atenolol	3
	Bisoprolol fumarate	3
	Carvedilol	8
	Cilostazol	1
	Clopidogrel	23
	Dabigatran etexilate mesylate	1
	Diclofenac	1
	Enoxaparin sodium	11
	Enoxaparin sodium	1
	Enoxaparin sodium	2
	Fondaparinux sodium	5
	Furosemide	11
	Heparin	1
	Heparin calcium	19
	Heparin sodium	2
	Human insulin	1
	Insulin	8
	Insulin aspart	2
	Insulin human isophane	6
	Lisinopril	1
	Magnesium hydroxide	9
	Metoprolol tartrate	29
	Nebivolol	1
	NPH	1
	Perindopril erbumine	1
	Ramipril	10
	Sodium bicarbonate	1
	Spironolactone	4
	Ticagrelor	30
	Torsemide	3
	Total	199

2003) and current index of medical specialties (CIMS) (CIMS, 2012), the average number of drugs prescribed, average number of PDDIs per prescription, and age-wise distribution of PDDIs. Nearly one-third of PDDIs were either serious or clinically significant. Polypharmacy was frequent in the present study with >50% prescription consisting of more than eight drugs and only 6.29% with <5 drugs. The average number of drugs prescribed per prescription was 5.28. Polypharmacy was also observed in a study conducted in geriatric hospitalized patients at Nepal (Joshi *et al*., 1997). Polypharmacy increases risk of DDIs (Linn *et al*., 2011) and ADRs (Satoskar *et al*., 2011) and, hence, should be avoided. An average of 7.3 PDDIs was detected per prescription in the present study. The risk of DDIs increases with an increase in number of drugs prescribed (Tripathi, 2010). Accordingly, the average number of potential DDIs per prescription increased from 1.2 in prescriptions with <5 drugs to 16.33 in prescriptions with more than seven drugs. In the study, we came to know the age, polypharmacy, and presence of disease with gender specification play the role of PDI.

Individual DIs

The individual DI depends on the age, gender, and the concurrent use with the other medications. The different drugs have shown different number of interaction based on their class and their use with the reference of the disease. As in this study, the atorvastatin calcium reacts with the interacting drugs azithromycin, clopidogrel, digoxin, fentanyl, and ranolazine with times of, respectively, 3, 4, 1, 3, and 4 with a total of 15 interactions was found. Furthermore, the clopidogrel interacts with the interacting drug dabigatran etexilate mesylate, enoxaparin sodium, fondaparinux, heparin calcium, indomethacin, rivaroxaban, and torsemide with the number of, respectively, 1, 5, 2, 7, 1, 1, and 1 with a total of 18 interactions was found in this study. The insulin human isophane interacts with the interacting drug dextrose, levofloxacin, metformin, metoprolol tartrate, ramipril, and sitagliptin phosphate with the number of, respectively, 1, 1, 1, 4, 2, and 1 with a total of 10 interactions was found in this study. Similarly, the aspirin interacts with the interacting drug atenolol, bisoprolol fumarate, carvedilol, cilostazol, clopidogrel, dabigatran etexilate mesylate, diclofenac, enoxaparin sodium, enoxaparin sodium, fondaparinux sodium, furosemide, heparin, heparin calcium, heparin sodium, human insulin, insulin, insulin aspart, insulin human isophane, lisinopril, magnesium hydroxide, metoprolol tartrate, nebivolol, NPH, perindopril erbumine, ramipril, sodium bicarbonate, spironolactone, ticagrelor, and torsemide with the number of, respectively, 3, 3, 8, 1, 23, 1, 1, 11, 1, 2, 5, 11, 1, 19, 2, 1, 8, 2, 6, 1, 9, 29, 1, 1, 1, 10, 1, 4, 30, and 3 with a total of 199 interactions was found in this study. The severity of interaction among the interactions as major, moderate, and minor was evaluated with the frequency of 170, 158, and 1, respectively, having the percentage of 51.7%, 48.0%, and 0.03%, respectively. The onset of interaction among the interactions of delayed, not specified, and rapid was evaluated with the frequency of 95, 215, and 19, respectively, having the percentage of 28.9%, 65.3%, and 5.8%, respectively. This was evaluated with the corresponding excel sheet report and using the software MICROMEDEX.

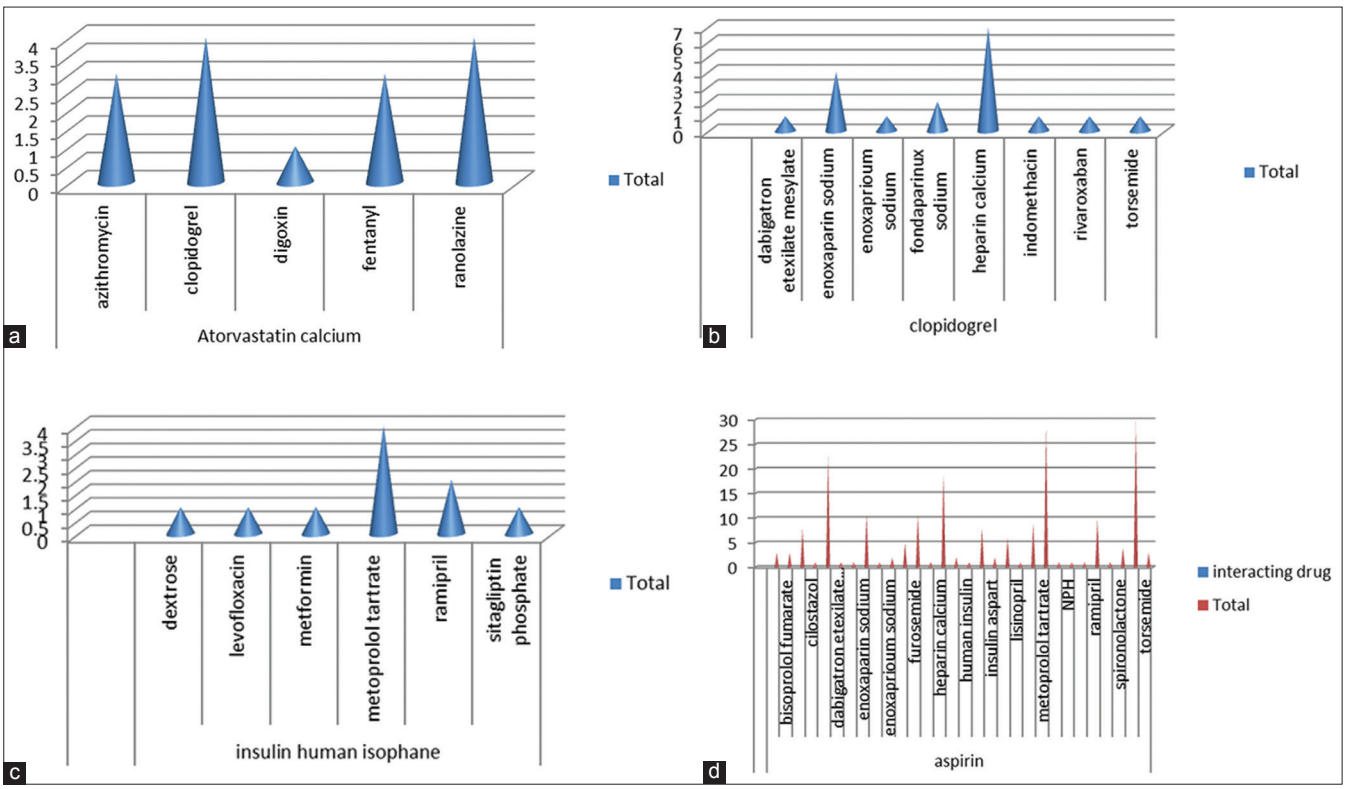

Fig. 6: (a-d) Individual drug–drug interactions

Table 7: The distribution of gender among study sample

Age group	Frequency	Percent	Chi-square value	p-value	95% confidence interval	
					Upper bond	Lower bond
≤60 years	163	49.55	0.027	0.912	0.917	0.906
>60 years	166	50.45				
Total	329	100				

Chi-square value and p-value show that there is no statistically significant difference between the age groups in the study sample

CONCLUSION

DIs mean two or more drugs given at the same time may exert their effects independently or may interact. PDIs may include, drug contraindications, drug combinations that require monitoring and possible dosage adjustment when given concomitantly. It is important not only to identify PDIs that are clinically meaningful but also to understand options to approach the potential loss efficacy or toxicity that may result when combinations of drugs are administered together.

The number of PDDI increased with an increase in the number of drugs prescribed. The numbers of drug prescribed increase with age. This DI has a potential to increase or decrease the therapeutic effect or to increase the risk of ADR. An increased awareness of PDDIs, rational coprescription of drugs, and a close monitoring of patients in whom these drugs are prescribed are recommended. The recommendation is based on the special monitoring and the perspiration of the clinical pharmacist. The DI observed in the geriatric patient is more severe and common in compared to the other groups of study. The geriatric patient is physiological disability in correspond with the first-pass metabolism and the presence of the other diseases which also enables the multiple prescriptions causing polypharmacy. The polypharmacy shows the differential DI based on the drug specification and their therapeutic action monitoring. The polypharmacy increases the interaction so it should be minimized to certain extent and need to be prescribe only if necessary. The gender specification also the cause of the interaction, the female is more prone to the DI due to the hormonal distribution in the body and inability of the physiological function to absorb and the distribution. The special training should be provided to the pharmacist for looking forward of the geriatric patient and female patient. The training regarding the prescription their adherence, use, toxicity, and dosage regimen is being properly enabled in the training for the practical application. During the prescription of the medication for the each patient, the history, background, the past medication, past allergies, and interaction are being studied in correspond with the individual patient and the prescription is being followed up to decrease the DI. Furthermore, the drugs are being evaluated with the various diagnostic data and the observation of the patient demographically and the correlation is done according to the requirement. The change of dosage route, dosage regimen, dose, duration of administration, and combination therapy is being employed to minimize the interaction. This study helps to know the different interaction related to the cardiovascular agent with own class of the drug and the other class of drugs used therapeutically to care the disease.

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CONFLICTS OF INTEREST

Authors declare that there are no conflicts of interest.

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