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RESEARCH ARTICLE

PRESCRIPTION ANALYSIS IN MEDICINE WARD OF SECONDARY CARE HOSPITAL FOR DRUG TO DRUG INTERACTIONS

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ABSTRACT

Whenever two or more drugs are being taken, there is a chance of interaction among the drugs. This may increase or decrease the effectiveness of the drugs or the side effects of the drugs. The likelihood of drug interactions increases as the number of drugs being taken increases. Therefore, people who take several drugs are at the greatest risk for interactions. The study was conducted at General medicine ward of a secondary care hospital for a period of 6 months. There were mainly four steps followed during the study. They are Collection of Prescriptions (by schedule method), Categorizing the prescriptions, Analyzing the prescriptions (by the help of standard books and website), Categorizing the interactions. 200 prescriptions were collected and analyzed. From those 39 prescriptions, i.e. 19.5% of the total prescriptions were found with drug interactions. There was 24 pair of interactions. From that 15 were moderate and 9 major interactions. From the total interactions it was found that most frequently interacting pair was digoxin and furosemide (12.7% of interactions), causing digoxin toxicity. From the individualized study it was found that digoxin was interacted with (6 other drugs) maximum number of drugs. From the study it may be concluded that the most frequently interacting pair was digoxin and furosemide. The drug most commonly implanted in drug-drug interaction is digoxin.

Key Words: - drug interaction, digoxin, prescriptions and furosemide.

INTRODUCTION

Definition

A drug interaction can be defined as an interaction between a drug and another substance that prevents the drug from performing as expected. This definition applies to interactions of drugs with other drugs (drug- drug interactions), as well as drugs with food (drug – food interactions) and other substances.

Drug interactions overview [1-4]

Whenever two or more drugs are being taken, there is a chance for interaction among the drugs. The interaction may increase or decrease the effectiveness of the drugs or the side

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effects of the drugs. The likelihood of drug interactions increases as the number of drugs being taken increases. Therefore, people who take several drugs are at the greatest risk for interactions. Drug interactions contribute to the cost of healthcare because of the costs of medical care that are required to treat problems caused by changes in effectiveness or side effects. Interactions also can lead to psychological suffering that can be avoided.

Drug Interactions are an important cause of drug related problems and this includes significant morbidity and mortality. The ability to recognize and manage drug interactions is a crucial role of the pharmacist in optimizing patient outcomes. An important skill is to be able to recognize clinically significant drug interactions and provide management advice to the patient and their doctor. This advice may include discussing dose alteration strategies or alternative non-interacting drug combinations. Not all drug interactions listed in texts and tables are clinically significant and individual variability in pharmacokinetics (what the body does to the drug) and pharmacodynamics (what the drug does to the body) means that even clinically significant interactions are often unpredictable in the magnitude of their effect.

There are several mechanisms by which drugs interact with other drugs, food, and other substances. An interaction can result when there is an increase or decrease in: the absorption of a drug into the body; distribution of the drug within the body; alterations made to the drug by the body (metabolism); and elimination of the drug from the body. One notable system involved in metabolic drug interactions is the enzyme system comprising the cytochrome P450 oxidases. This system may be affected by either enzyme induction or enzyme inhibition.

Most of the important drug interactions result from a change in the absorption, metabolism, or elimination of a drug. Drug interactions also may occur when two drugs that have similar (additive) effects or opposite (canceling) effects on the body are administered together. For example, there may be major sedation when two drugs those have sedation as side effects are given, such as, narcotics and antihistamines.

Another source of drug interactions occurs when one drug alters the concentration of a substance that is normally present in the body. The alteration of this substance reduces or enhances the effect of another drug that is being taken. The drug interaction between warfarin (Coumadin) and vitamin K-containing products is a good example of this type of interaction. Warfarin acts by reducing the concentration of the active form of vitamin K in the body. Therefore, when vitamin K is taken, it reduces the effect of warfarin.

METHODOLOGY

The study has been conducted to find out the drug to drug interactions in a secondary care hospital for a period of 6 months. There were mainly four steps followed during the study. They are

1. Phase1:- Collection of Prescriptions
2. Phase 2:- Categorizing the prescriptions
3. Phase3:- Analyzing the prescriptions
4. Phase4:- Categorizing the interactions

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Collection of the prescriptions

The prescription has been collected from the medical ward for a period of 6 months. The study was done in retrospective manner. The method of collection was – Collection of data through schedules. This method involves the Performa with some set of questions which has to be answered by an enumerator.

Categorizing the prescriptions

The collected prescriptions have been categorized under five systems. They are cardiovascular system, renal system, Respiratory system, gastrointestinal system and Endocrine system

The categorization was done on the basis of the presenting complaints for which the patient is being admitted. A large number of patients are having multiple diseases which cover the different systems. In such cases also the presenting complaint is taken into consideration.

Analyzing the prescription

The selected prescriptions have been analyzed for the drug to drug interactions, by selecting each prescription and the drugs in each of them have been evaluated for the drug interactions. If a medication contained two or more pharmacologically active agents each drug is counted individually in the analysis (e.g. sulfamethoxazol combined with trimethoprim).

This was done by different sources like standard books and websites. The obtained data were cross referenced to each for getting the maximum data. The observed DDI's has been analyzed for its mechanism and the remedy to avoid the unwanted effect to the patients.

Categorizing the interactions

The observed interactions were categorized according to the systems involved. This was done to find out how many interactions are there in prescriptions of each system and also to find out in which system the interaction is more and which drug is mostly interacting with the others in our hospital.

For each individual drug we had found out the number of drugs interacting and we had listed out the same. This helps to find out the drug which is having more drug to drug interaction on the basis of our study.

Along with this each pair of the interacting drugs and its frequency of occurrence in the prescriptions also had been listed out to find the most frequent pair of interaction.

RESULTS AND DISCUSSION

In the study, 200 prescriptions were selected retrospectively from the medical ward of the hospital in a period of 6 months and has been separated according to the systems to which the patients presenting complaint is.

From the 200 case sheets collected 68 cases were admitted for the cardiovascular diseases, 61 for respiratory system diseases, 27 for renal complaints, 25 for diseases related with

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endocrine system and 19 cases for the GIT complaints.

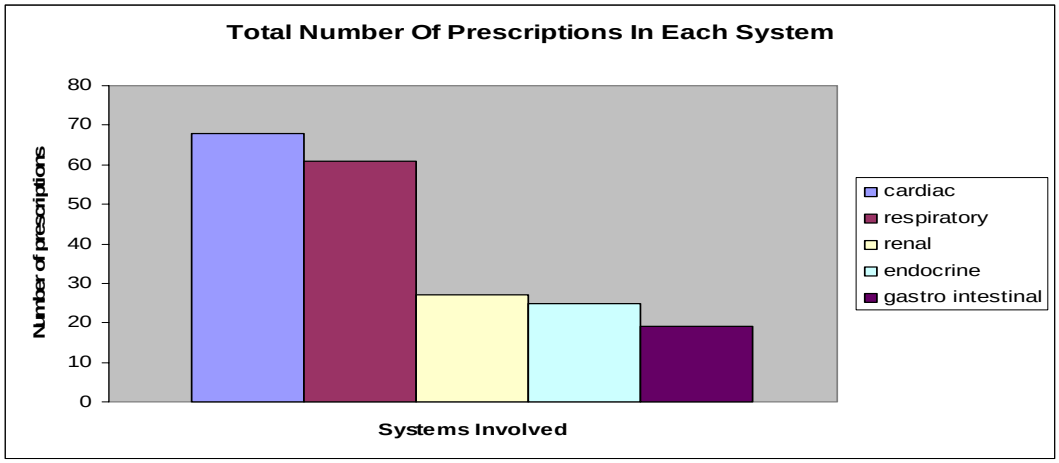
On analyzing the prescriptions it has been found out that there are 39 cases of drug interaction from the 200 case sheets collected. The 161 case sheets were free of DDI's. From the study we found out that from the total case sheet collected there is an overall interaction of 19.5%. The total number of prescriptions in each system has been given in the table no:1 and is being graphically represented in figure no:1.

Table No: 1

Total Number of Prescriptions Screened

Systems	Interaction	Without interaction	Total no of case	Percentage
Cardiac	20	48	68	29.4
Renal	7	20	27	25.9
Endocrine	3	22	25	12.0
Respiratory	7	54	61	11.5
GIT	2	17	19	10.5
Total	**39**	**161**	**200**	**19.5**

Figure No: 1



From analyzing the prescription it is found that, in cardiovascular system, from the 68 cases analyzed 20 cases were having drug-drug interaction and it comprises 29.4% of the cardiovascular prescriptions. From the 27 prescriptions of the renal system 7 cases were having interaction i.e. 25.9%. Prescriptions from

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endocrine system are having 12% of interaction i.e. 3 out of 25. In respiratory system there are 7 prescriptions with interaction from the 61 and it is 11.5%. The gastrointestinal system consists of 10.5% interaction i.e. 2 out of 19 prescriptions.

From the 39 case sheets having DDI's we found 25 different types of interactions with the involvement of 25 different drugs. From this some of the drugs are interacting with many other drugs and causing major and moderate interactions. The interactions were listed out. For each pair of interacting drugs the effect they may cause and the remedy to reverse the effect or to avoid the interaction also has been listed. This data is given in the Table No: 2.

Table No: 2 Interactions in the prescriptions

Sl. No	Interacting drugs		Effect	Remark
	Drug 1	Drug 2		
1*	Digoxin	Furosemide	Hypokalemia	Oral KCl
2*	Digoxin	Cavedilol	Risk of bradycardia	Caution
3*	Digoxin	Atorvastatin	Digoxin toxicity	Dose adjustment
4*	Digoxin	prednisolone	Hypokalemia	Oral KCl
5**	Digoxin	Amioderon	Increase digoxin concentration upto 100%	Adjust dose
6**	Amioderon	Furosemide	Prolongation of QT interval	avoid
7**	Amioderon	Ofloxacin	Prolongation of QT interval	avoid
8**	Ramipril	Spironolactone	hyperkalemia	caution
9**	Theophyllin	Carvedilol	Fatal bronchospasam	Avoid
10*	Heparin	Ramipril	hyperkalemia	caution
11**	Clarithromycin	atorvastatin	Increases serum concentration of atorvostatin	Avoid
12*	Enalapril	Heparin	hyperkalemia	Caution
13*	Cefotaxime	Amikacin	Nephrotoxicity	Avoid /Adjust dose
14**	Ciprofloxacin	Theophylline	Theophylline toxicity	Avoid
15*	Cefotaxime	Furosemide	Nephrotoxicity	Avoid
16**	Ketoralac	Diclofenac	Serious NSAID ADR	Contraindicated
17*	Furosemide	Indapemide	Electrolyte imbalance	Caution
18*	Ceftriaxone	Amikacin	Nephrotoxicity	Avoid /Adjust dose
19*	Spiranolactone	Digoxin	Hyperkalemia	Caution
20*	Ceftriaxone	Furosemide	Nephrotoxicity	Avoid
21*	Spiranolactone	Enalapril	Hyperkalemia	Caution
22**	Pantoprazole	Clopidogrel	Reduced cardioprotective effect of clopidogrel	Avoid
23*	Furosemaide	Carvedilol	Risk of hyperglycemia	Monitor, avoid in diabetes patient
24*	Metformin	Nifedipine	Risk of lactic acidosis	Cautious titration of metformin dose
25*	Ciprofloxacin	Pioglitazone	Hypoglycemia and less frequently hyperglycemia	Monitor closely

* moderate interaction ** major interaction

We had made the list of 25 drugs which was found to cause interaction in the 39 prescriptions, and the interacting drugs to each of the drug have been listed out. This list shows us that digoxin is the mostly interacting drug in the list. Digoxin itself is interacting with 6 other drugs in the list.

Furosamide comes next. It will interact with 5other drugs. Amiodarone, Carvedilol and spironolactone is interacting with 3 other drugs. This list is being given in the table no: 3. the individual drugs and the number of drug to which it is interacting
can be plotted on the pie chart as shown in the Figure No: 2.

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Table no: 3 Drugs Interacting With Each Drug

Sl.No	Drug	Class	Interacting drugs	No. of drugs interacting
1	Digoxin	Cardiac glycosides	Amiodarone Atorvastatin Carvedilol Furosemide Prednisolone Spironolactone	6
2	Furosemaide	Loop diuretics	Amiodarone Carvedilol Cefotaxime Ceftriaxone Digoxin	5
3	Amiodarone	Antiarrhythmic	Digoxin Furosemide Ofloxacin	3
4	Carvedilol	Beta blocker	Digoxin Furosemaide Theophylline	3
5	Spironolactone	Potassium sparing diuretics	Digoxin Enalapril Ramipril	3
6	Amikacin	Aminogycoside	Cefotaxime Ceftriaxone	2
7	Atorvastatin	HMG CoA reductase inhibitor	Clarithromycin Digoxin	2
8	Ciprofloxacin	Fluoroquinolone	Pioglitazone Theophylline	2
9	Cefotaxime	3rd generation cephalosporin	Amikacin Furosemide	2
10	Ceftriaxone	3rd generation cephalosporin	Amikacin Furosemide	2
11	Enalapril	ACE inhibitor	Heparin Spironolactone	2
12	Heparin	Anticoagulant	Enalapril Ramipril	2
13	Ramipril	ACE inhibitor	Heparin Spironolactone	2
14	Theophylline	Xanthine derivatives	Carvedilol Ciprofloxacin	2
15	Clarithromycin	Macrolide antibiotic	Atorvastatin	1
16	Clopidogrel	Antiplatelet drug	Pantoprazole	1
17	Diclofenac	NSAID	Keterolac	1
18	Indapemide	Indole derivative diuretic	Furosemide	1
19	Ketorolac	NSAID	diclofenac	1
20	Metformine	Oral hypoglycemics	Nifedipine	1
21	Nifedipine	Calcium channel blocker	Metformine	1
22	Ofloxacin	Fluoroquinolone	Amiodarone	1
23	Pantoprazole	Proton pump inhibitor	Clopidogrel	1
24	Pioglitazone	oralhypoglycemics	Ciprofloxacin	1
25	Prednisolone	glucocorticoid	digoxin	1

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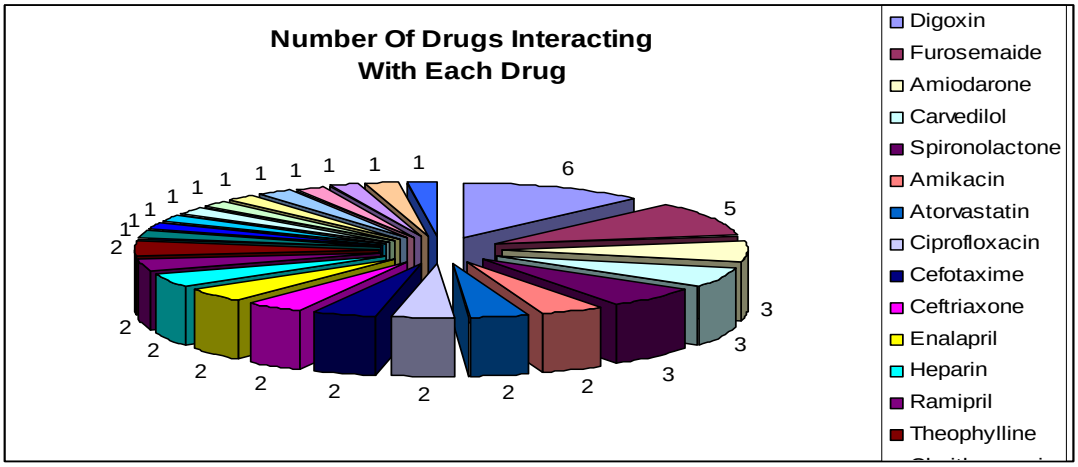
Figure No:-2



When analyzed on the basis of diseases most of the interacting prescription is of multiple diseases i.e. the patient is having more than one disease. On percentage reporting 71.8% prescription is of multiple diseases and 28.2% is of single disease. In prescriptions without interaction the percentage of single disease was more when compared to the multiple diseases. So as the number of disease increases the chances of poly pharmacy and drug interaction also will increase.

From Table No: 2 we can conclude that there are 16 moderate interactions and 9 major interactions from the 25 interactions. Most of the major interactions are for the combination to be avoided or those combinations which are contraindicated. The moderate interactions can be managed by adjusting the dose or even by giving the supportive therapy.

SUMMARY AND CONCLUSION

The present study was to analyze the prescription in the medical ward of a secondary care hospital for drug to drug interactions. We had conducted the study in a secondary care hospital, for a period of six months. 200 prescriptions were collected in this time period. From this 68 were of cardiovascular disorder, 61 of respiratory disorder, 27 of renal disorder, 25 of endocrine disorder and 19 of gastrointestinal disorders.

The selected prescriptions were analyzed by using standard book and websites for drug to drug interactions. The obtained data were cross referenced to each for getting the maximum data.

From the total prescriptions collected 39 were having drug to drug interactions. 20 prescriptions were from cardiovascular cases, 7 each from respiratory and renal system, 3 from endocrine cases and 2 from gastrointestinal cases. From the total interactions cardiovascular system is having the major part that is 51.3% of the total interactions. Renal and respiratory system were having 17.9% interactions. Endocrine and gastrointestinal systems were having 7.7% and 5.1% respectively. From this we can conclude that in the hospital

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large number of interactions is occurring in the cardiovascular system cases when compared to the other systems. Renal and respiratory systems are showing a same percentage of interactions. In the other two systems the percentage of interactions is very less.

The interactions of these 39 case sheets were individually studied. There are 25 different drug combinations causing interactions. These combinations are made by 25 individual drugs. Some drugs are interacting with more than one drug in the list. From this individualized study it is found that the drug which is interacting with maximum of other drugs is Digoxin, which is a cardio tonic mainly used in case of congestive cardiac failure. Digoxin is interacting with 6 other drugs (Amiodarone, Atorvastatin, Carvedilol, Furosemide, Prednisolone and Spironolactone). Furosemide, a loop diuretic, is next to digoxin and is interacting with five other drugs (Amiodarone, Carvedilol, Cefotaxime, Ceftriaxone and Digoxin)

From the 25 drug combinations causing interaction, the combination which is repeated mostly is digoxin and furosemide. This combination has repeated in the prescriptions for six times with out any remedy for avoiding the interaction. This constitutes around 10.9% of the total interactions.

From the total of 39 prescriptions having interactions 27 were having a single interaction (69.2%) and remaining 12 prescriptions with 2 or more interactions.(i.e. 23.1% with 2 interactions, 5.1% with 3 interactions and 2.6% with 4 interactions).

When analyzed on the basis of diagnosed diseases it has been found that 71.8% of interactions were found in prescriptions with multiple diseases and in prescriptions with out interaction only 29.8 were with multiple diseases. This shows the involvement of polypharmacy in drug interaction due to multiple diseases.

From the total interactions 64% were found to be moderate interactions and 36% were severe interactions. The drug combinations causing severe interactions are those to be avoided and the moderate interactions can be managed by dose adjustment or any other supportive measures.

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