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Nature of Prescribing and incidence of medication prescription errors in general practice

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Abstract
Introduction: Medication use involves a complex process that is subject to errors at many points in health care settings. According to the stage of the medication use cycle in which they occur, medication errors can be broadly divided into four levels – prescription or prescribing, transcription, dispensing and administration errors. Prescription errors that constitute the bulk of medication errors are common in government as well as private setting.
Materials and methods: Our study was aimed to analyse the prescription errors in general practice. The prescriptions were photographed after the consent of the patient and returned back to them. Almost all the prescriptions contained brand names which were then converted into their respective generic names and analysed for errors.
Results: A total of 1015 prescriptions were analysed during a 15 month period. Out of these, 415 (40.88%) prescriptions had errors. A few prescriptions had more than one type of prescribing errors. The total number of errors thus amounted to 577. Most of the errors were related to prescription of CNS drugs followed by chemotherapeutic drugs. Our study reveals that combination errors are the commonest followed by indication, dosing and kinetic types of prescription errors.
Discussion: Medication errors are common in general practice and in hospitals and can result in harm to patients. We analysed the prescription errors into 4 categories- indication, dosing, kinetic and combination errors. The study revealed a maximum of combination errors thus confirming our assertion that doctors do not give proper thought when they prescribe FDCs.
Keywords: Indication errors, kinetic errors, combination errors, dosing errors, irrational fixed dose combinations

1. Introduction

Medication use involves a complex process that is subject to errors at many points in health care settings. The multiple steps in the medication chain from when a drug is prescribed to when a patient receives the drug, leads to significant scope for errors. Medication safety is one of the major components in patients' safety but unfortunately medication errors do occur and often go undetected.

The National Co-ordinating Council for Medication Errors (NCCMER) defines a medication error as "any preventable event that may cause or lead to inappropriate medication use or patient harm, while the medication is in the control of health care professional, patient or consumer [1, 2]

According to the stage of the medication use cycle in which they occur, medication errors can be broadly divided into four levels – prescription or prescribing errors, transcription errors, dispensing errors and administration errors.

Prescription errors encompass those related to the act of writing a prescription, whereas prescribing faults encompass irrational prescribing, inappropriate prescribing, under prescribing, overprescribing, and ineffective prescribing, arising from erroneous medical judgments or decisions concerning treatment or treatment monitoring[3,4]

Prescription errors account for around 39% of medication errors. Most errors go unnoticed as they may not alter the final health outcome of the patients but draws considerable attention and concern when it causes harm to the patients, in the form of adverse effects which in turn increases the cost of treatment. Although the market is flooded with newer and newer drugs it can only benefit the patients when used rationally.

Prescribing errors are common in the government as well as in private setting. Since the private practitioners are not actively involved in the teaching or learning process, they may be at times unaware of the newer trends or protocol in the management of certain diseases or prescribing knowledge of certain drugs. Hence they tend to rely upon the information provided by the medical representatives. Medical representatives on the other hand hide the real facts and project information that would benefit or bring profit to their company.

In view of the above, we planned to undertake a study of medication prescription errors in the state of Goa and classify these errors systematically to acknowledge the medical fraternity about the need to be extra cautious and vigilant while prescribing.

2. Materials and methods

Our study was aimed to analyse the prescription errors in general practice. Approval was taken from Institutional Ethics Committee, Goa Medical College, to start the study. Our study was restricted to pharmacies from north Goa. Four pharmacies were chosen to collect the prescriptions for our study. One of these was the largest and the busiest pharmacy in the state of Goa and is known for the availability of most of the drugs in the market.

Permission from the owner was taken to work in the pharmacy. It was planned to collect a minimum of 1000 prescriptions. The pharmacies were visited twice a week for period of 15 months. The prescriptions were photographed after the consent of the patient and returned back to them.

The consent from the doctors was not taken as it was not feasible, since patients would come from different corners of Goa with prescriptions and many of the prescriptions did not have the doctor's contact numbers. However, due care was taken to hide the doctor's details while photographing the prescriptions for the sake of anonymity.

Almost all the prescriptions contained brand names which were then converted into their respective generic names and analysed for errors. The errors were classified as indication errors, dosing errors, kinetic errors, and combination errors. Indication errors were further classified as overuse, underuse and misuse. Dosing errors were further grouped into overdose, under-dose, and wrong dose, whereas combination errors were divided into irrational fixed dose combinations and wrong combinations.

After classifying the errors, they were further categorised under different system like Central Nervous System (CNS), Respiratory System (RS), Cardiovascular System (CVS), Gastrointestinal (GIT) system, Endocrine system and Chemotherapy based on the type of drugs involved. After categorising the errors system wise, percentage of each type of error was calculated.

3. Results

A total of 1015 prescriptions were analysed during a 15 month period. Out of these, 415 (40.88%) prescriptions had errors. A few prescriptions had more than one type of prescribing error. The total number of errors thus amounted to 577.

Most of the errors (172) were related to prescription of CNS drugs (29.8%), followed by chemotherapeutic drugs (141; 24.43%). Table 1 gives the breakup of the different types of errors category wise.

Our study reveals that combination errors are the commonest followed by indication, dosing and kinetic types of prescription errors. Most of the combination errors were seen with drugs related to CNS, followed by RS and GIT. Indication errors were made most often while prescribing drugs related to CNS, CVS and RS, and chemotherapeutic drugs. Dosing errors were most common with chemotherapeutic drugs. Kinetic errors were seen with chemotherapeutic, GIT and endocrine drugs.

Table 1: Medication prescription errors

	CNS	RS	CVS	ENDO	CHEM	GIT	TOTAL	%
Indication								
1.Overuse	19	11	6	2	2	6	46	
2.Underuse	-	-	-	-	-	-	-	**22.53**
3.Misuse	19	14	19	3	19	10	84	
Dosing								
1.Overdose	14	1	3	3	20	16	57	
2.Underdose	6	1	1	6	32	4	50	**20.28**
3.Wrong dose	2	-	1	-	5	2	10	
Kinetic	-	-	2	5	9	8	24	**4.16**
Combination								
Wrong combination	3	46	2	1	2	1	55	
IFDCs	109	19	1	7	52	63	251	**53.03**
Total	172	92	35	27	141	110	577	
Percentage	**29.8**	**15.94**	**6.06**	**4.67**	**24.43**	**19.06**		

Many prescriptions had irrational FDCs prescribed to the patients. Out of 1015 prescriptions 211 had 1 IFDC and 20 of them had 2 IFDCs. Tables 2 and 3 enlist the commonly encountered indication and dosing errors in our study respectively.

Table 2: Common indication errors observed in our study

Sr. No	Overuse	Misuse
1	Lorazepam for >1 week	Antibiotics in viral condition
2	Azithromycin for >3 days	Allopurinol in acute gout
3	Two syrups with similar composition	Multiple antihypertensive in single patient
4	2-3 metformin brands that exceed the daily dose	

Table 3: Common dosing errors seen in our study

Overdose	Under dose	Wrong dose
Nimesulide TDS	Diacerin 50 mg OD	Etoricoxib 90 mg for gout
Piroxicam BD	Acyclovir 400 mg TDS for herpes zoster	Fexofenadine 120 mg for skin allergy
Pantoprazole BD	Erythromycin 500mg BD	Acyclovir 400 mg TDS for chicken pox
Co-amoxyclav 625 mg TDS for pharyngitis		

4. Discussion

Medication errors are common in general practice and in hospitals. Both errors in the act of writing (prescription errors) and prescribing faults due to erroneous medical decisions can result in harm to patients.

In the current study, a total of 1015 prescriptions were analysed over a one year period, out of which 415 (40.88%)showed different types of prescription errors.

We analysed the prescription errors into 4 categories- indication, dosing, kinetic and combination errors. Use of an irrational FDC was considered as an error as it reflected ignorance on the part of the practising doctors about the rationality of the combination they prescribed.

Interestingly, the study revealed a maximum of combination errors thus confirming our assertion that doctors do not give proper thought when they prescribe FDCs. Often it is seen that the medical representatives misguide the doctors into the authenticity and rationality of a wrong FDC and, due to lack of knowledge the medical practitioners fall prey and are involved in massive prescribing of such irrational FDCs. This amounts to rise in knowledge–based errors in clinical practice.

In our study, we came across a number of irrational FDCs, a few of which need to be discussed for their irrationality.

4.1Norfloxacin/Ciprofloxacin/Ofloxacin + Tinidazole/Ornidazole

These combinations of fluoroquinolones and nitroimidazoles are widely used for all types of diarrhoea and dysentery. The practitioners ought to realise that in amoebic dysentery fluoroquinolones are useless, and in bacterial dysentery nitroimidazoles are ineffective. Both conditions may rarely co-exist, thus making the FDC irrational [5].

4.2 Ampicillin/Amoxycillin + Cloxacillin

Ampicillin/Amoxycillin are effective only against gram negative bacilli but not against beta lactamase producing staphylococci. Cloxacillin is antistreptococcal penicillin with no effect on gram negative bacilli. Both these infections rarely co-exist. Secondly, doses used in these combinations are half the usual recommended dose which may lead to therapeutic failure [6, 7].

4.3 Non-steroidal Anti-inflammatory Drugs (NSAIDs) combinations

Adding paracetamol to another NSAID (diclofenac, aceclofenac, and ibuprofen) does not offer additional benefit, but increases the chances of nephrotoxicity [8].

Serratiopeptidase is a proteolytic enzyme supposed to relieve inflammation. This claim is not based on controlled clinical trials and FDCs containing this compound offer no additional anti-inflammatory advantage except higher cost to the patient [9].

4.4 H_2 blockers (ranitidine/famotidine) or PPI (omeprazole/ pantoprazole/ lansoprazole/ rabeprazole) with Antiemetic (domperidone/ondansetron)

H_2 blockers and PPI are effective in peptic ulcer and it is irrational to combine these drugs with an antiemetic as peptic ulcer is not always associated with vomiting [10].

4.5 Dicyclomine + Paracetamol

An analgesic like paracetamol will not add to the effect of dicyclomine, an antispasmodic. This FDC is not only irrational but it could be harmful to the patient. Paracetamol promotes sweating and helps in heat dissipation; on the contrary dicyclomine, an anticholinergic drug inhibits sweating. This combination can therefore, lead to dangerous elevation of body temperature [9].

4.6 Levocetirizine/Bambuterol + Montelukast

These FDCs are irrationally recommended for asthma. Levocetirizine, an antihistaminic has no role in asthma [11]. Montelukast is recommended only as an alternative to inhaled steroids in mild persistent asthma. Bambuterol, a long acting beta-2 agonist is indicated in moderate to severe persistent asthma. Thus, there is no indication for bambuterol and montelukast together in asthma.

4.7 Glimepiride + Metformin + Voglibose

Glimepiride is administered 10-15 minutes before a meal usually once daily, while metformin is administered after meals. Voglibose, an alpha glucosidase inhibitor has to be taken at the first bite of each meal. All the diabetic patients may not require all these three drugs and even if required, the titration of doses will be impossible in a FDC. Importantly, time of administration of all three components is different.

Similarly combining two drugs wrongly is fairly common in practice. Most of the wrong combinations in our study relate to the respiratory drugs. A few combinations seen in our study need elaboration:

- Combining bronchodilators, antitussives and antihistaminics (dry the secretions) contradict each other. Addition of these to antibiotics has no additional benefit.
- Betahistine and cinnarizine have been commonly used in combination for vertigo. The former is a histamine agonist and the latter a H1 antagonist. Thus there is pharmacological antagonism between the two and failure of therapy.
- PPIs work best in acidic medium. Addition of antacids nullifies their efficacy.
- Two antibacterial with similar spectrum not only are not recommended but they add to the cost for the patient. A lot of such combinations are seen in our study e.g. Levofloxacin and cefuroxime axetil.

Not surprisingly the combination errors are the least in case of CVS drugs as most of the FDCs available in the market are pharmacologically rational.

Indication errors were seen while prescribing most of the common drugs in general practice including antibacterial and CNS, RS, CVS drugs. This again reflects lack of knowledge on the part of the treating doctor. Misuse followed by overuse was the major reasons that could be analysed from the available information in our study samples.

Table 2 enlists a few examples of indication errors (overuse, under use and misuse) in our study. A few need to be discussed:

- It is wrong to use two syrups with similar composition and can cause additional dose and hence toxicity.
- Allopurinol is contraindicated in acute gout and can worsen the condition. It is a drug of choice for chronic gout.
- Practice of prescribing multiple antihypertensive (4 to 5 at a time) in a single patient needs to be condemned. A lot of practitioners instead of going to the maximum dose of an antihypertensive keep on adding a new drug thus increasing the drug burden on the patient.
- Prescribing antibacterial in common viral condition has become a routine thing in clinical practice and has to stop.
- Sedatives are generally not recommended for more than a week in the elderly. Long term use can cause tolerance and habituation and can lead to more harm than good.
- Azithromycin is the only antibacterial recommended only for 3 days and not for a minimum 5 days like the rest.

Dosing errors were the third most common type of prescription errors in our study. Not surprisingly most of the dosing errors were with reference to the chemotherapeutic drugs. Antibacterial and chemotherapeutic agents are rampantly used by the practitioners in wrong doses. Both overdosing as well as under dosing was equally seen in the study. This needs to be given a serious thought because both the habits of overprescribing and under prescribing have their own pitfalls with reference to antibiotic use. Under prescribing can often be a cause for development of resistance and overprescribing can cause unnecessary toxicity.

Table 3 enlists a few common dosing errors that were observed in our study. A few need discussion:

- Long acting drugs like nimesulide, piroxicam, pantoprazole, and naproxen were commonly given BD or TDS thus increasing the chances of toxicity to the patient.
- A lot of drugs were prescribed in wrongly recommended doses. Etoricoxib is to be administered in a dose of 120 mg OD for gout, fexofenadine dose for skin allergy is 180 mg OD and acyclovir has to be prescribed in the dose of 800 mg QID (4 times daily) for chicken pox.
- Similarly some drugs were under dosed with wrong administration schedule. Acyclovir has to be administered 5 times daily for a case of herpes zoster.

Kinetic errors were seen in 45 of our prescriptions and the number is again misleading. We could find the faults only in the cases where relation to food was mentioned. As is the normal practice, many doctors probably explain the time with relation to meals verbally to the patient and fail to make a note on the prescription. Similarly many doctors fail to explain to the patients the need to follow the relationship with food.

A few common kinetic errors observed in the study need a mention:

- Azithromycin has to be strictly prescribed on an empty stomach (1 hour before or 2 hours after meals)

- Pantoprazole and other PPIs are recommended 1 hour before breakfast as the proton pump is most active at this time of the day.
- Albendazole is often prescribed after dinner. This is wrong practice as albendazole is totally absorbed after meals and its site of action is in the intestinal tract for the elimination of helminths.
- Iron has to be prescribed 1 hour after meals. Prescribing iron immediately after meals decreases its bioavailability and iron on an empty stomach can cause gastritis. Similarly calcium can decrease absorption of iron and vice-versa if both are ingested at the same time.
- Retard tablets should never be halved or used thrice daily.

We all make errors from time to time. There are many sources of medication errors and different ways of avoiding them. However, we must start by being aware that error is possible and take steps to minimize the risks [12].

The use of automated prescribing systems is recommended as an effective tool to reduce medication errors. They can reduce the risk of harm that arises from prescribing faults and improve the quality of medical care by reducing errors in drug dispensing and administration [13].

Education of medical students and junior doctors is highly advocated which will help to a great extent in a long run. Training and feedback control of prescribing by tutors and senior doctors should be encouraged [14].

5. Limitations of the study

Indication of the prescribed drug could not be ascertained in all the prescriptions as it is not mentioned most of the times. Thus this number of errors can be misleading. The number in fact could be much higher if the actual reason and the patient's diagnosis were known in all the patients. This could be considered as the major limitation of our study**.**

Kinetic errors were seen in 45 of our prescriptions. The faults could be identified only in cases where kinetic instructions were mentioned. The number of prescriptions where these instructions were not given cannot be ascertained. This number hence could be wrong and can in actual analysis be very high if every patient is interviewed and individually asked whether he is told about how to take the drugs.

6. Summary

Medication use involves a complex process that is subject to errors at many points in health care settings. Prescribing errors occurring during the actual process of writing a prescription are known to account for 39% of all medication errors.

We analysed 1015 prescriptions written by medical practitioners during a 15 month period. Out of these 415 [40.88%] prescriptions had errors. Combination errors were the commonest [53.03%] followed by indication errors [22.53%], dosing errors [20.28%] and kinetic errors [4.16%].

Antibacterial and chemotherapeutic agents were rampantly used by the practitioners in wrong doses. Drugs like azithromycin, pantoprazole, albendazole and iron are wrongly prescribed with regard to meals by the doctors.

7. Conclusion

In our study many prescriptions had irrational FDCs prescribed to the patients. Many drugs were combined wrongly leading to antagonism of effect. This confirms the assertion that doctors do not give proper thought when they prescribe FDCs or combine multiple drugs.

Practitioners must start by being aware that error is possible and take steps to minimise the risks. The essential components of this are monitoring for and identifying the errors, reporting them in a blame- free environment, analysis of their root causes, changing procedures according to the lessons learnt and further monitoring.

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