

The Pharmacist Role in Clinical Audit at an Indian Accredited Hospital: An Interventional Study

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ABSTRACT

Objective: Irrational use of drugs in medical practice is a major health problem. The objective of this study was to audit the prescriptions, categorize the types of errors identified by a clinical pharmacist, improve the prescription practice along with generation of information on the core prescribing pattern and demonstrate the common therapeutic interventions that can be done in NABH accredited hospital. **Methods:** This prospective interventional study included 245 cases for the audit. The prescription audit was performed in accordance with manual of prescribing indicators by WHO. The therapeutic audit was conducted using hospital antibiotic policy, ISMP guidelines, standard ADRs assessment scales and databases like Stockley's drug interaction, Micromedex, Clinirex, Medscape and Lexicomp. **Results:** Upon prescription audit, drugs prescribed by generic names were in 77.5% of cases. Only 5.06% of total drugs were found to be Fixed Dose Combinations (FDCs) but were used in 37.5% of cases. Injectable dosage forms were in majority (45.14%). Diseases of respiratory system (40.42%) were found to be highest. The total numbers of prescribed drugs for all 245 cases were 2074, which is approximate equals to 8.46 ± 0.27 drugs per case. Out of 40 interventions, 15% were noncompliance to antibiotic policy, 7.5% therapeutic duplications, 22 ADRs, 5% contraindications, 7.5% dose adjustment and 5% untreated indication. **Conclusion:** There is still huge scope for improvement in prescribing pattern in NABH accredited hospital. The clinical pharmacist can revolutionize the face of Indian healthcare setup by working closely with medical and nursing staff with assurance of the most optimized treatment for patients.

Key words: Therapeutic Audit, Clinical Pharmacist, Medication Error, Irrational Drug Use, Polypharmacy, Intervention.

INTRODUCTION

Major health problem is the irrational use of drugs in medical practice today. It includes inadequate treatment, inappropriate drug selection (particularly antimicrobials even for non-bacterial infections), polypharmacy, excessive use of injections when oral forms are available, self-medication and non-compliance to dosage regimens. These lead to exacerbation of the disease, health hazards, wastage of resources, increase in serious adverse effects and huge economic burden on both patients and society.¹⁻³

To maintain the level of confidence or faith of public on hospitals services, concepts of accreditation have been brought. Accreditation is a process in which an entity, separate and distinct from the healthcare organization, usually non-governmental, assess the healthcare

organization to determine if it meets a set of requirements designed to improve quality of care (as defined by the Joint Commission International, USA). Accredited hospitals deliver evidence-based continuous quality assured services and are committed to the patient's best interest/satisfaction. Most of the hospitals in India are competing to get accredited by NABH (National Accreditation Board for Hospitals and Healthcare Providers) whose standards are in turn certified by ISQua (International Society for Quality in Healthcare). The increase in such accreditation rate caused high demand to include Clinical Pharmacists (CPs) as the essential healthcare provider of a healthcare team to push evidence-based medicine and rational treatment. Pharmaceutical care carried out by pharmacy practice department plays a central role in improving the overall

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delivery of quality of care and generate revenue for hospitals. Clinical pharmacists are going to be important patronage to the Indian healthcare system in near future by revolutionizing the country's healthcare scenario.⁴ In spite of several attempts to bring rationality in the prescribing pattern, no effective impacts of any attempts have brought potential minimization in the medication errors and still, there is the need for vigorous surveillance. Therefore, the objective of this study was to audit the prescriptions, categorize the types of errors, improve the prescription practice along with generation of information on the core prescribing pattern and demonstrate the common therapeutic interventions done by a clinical pharmacist in an NABH accredited hospital.

MATERIALS AND METHODS

Data source and data collection instruments

This study was a prospective interventional study conducted for the period of one year (July 2017-June 2018) duration at an NABH accredited hospital in the southern part of India. The random daily review and evaluation of patient's case sheets from the different inpatient departments (medicine, surgery, pediatrics, nephrology, neurology and rheumatology) on regular ward rounds with consultants were carried out. The medication details of patients were collected randomly since their admission at the hospital to till their discharge. Separate medication history interview was conducted with the patient and their bystander to collect complete information that was possibly missed during medication reconciliation. Apart from 245 case sheets, we also used available medication at patient bedside and hospital information database, Sage Acc Pac (version 5.5, mimsys) to assemble the data. The standard audit forms provided by the Department of Pharmacy Practice was used to audit the prescription systematically. Appropriate profile form was designed to transcribe all essential information from the case sheet.

Analysis and assessment of data

All collected data were recorded and analyzed using MS Excel spreadsheet (Microsoft Office 2010). The validity of these data were confirmed against the databases like Micromedex, Hospital antibiotic policy, ISMP guidelines, and Clinirex, Lexicomp, Stockley's drug interaction, Medscape and Medline. Each case was subjected to analysis by using SOAP format (Subjective evidence, Objective evidence, Assessment and Plan). After the detailed analysis, the same were presented to pharmacy practice department. Any dispute or confusion or alteration in the treatment with possible

positive outcome and justification of the therapy was discussed with the faculties during the presentation session.

Casualty assessment of the Adverse Drug Reactions (ADRs) was done by using WHO and Naranjo scales.⁵ Subsequently, the severity was assessed using the Hartwig's severity assessment scale. For preventability assessment, Schumock and Thornton scale was used which classifies the ADR as "definitely preventable", "probably preventable" and "not preventable".⁶ Finally, each ADR found was documented in suspected adverse drug reaction reporting form issued by the Central Drug Standard Control Organization (CDSCO) and reported to the Pharmacovigilance Programme of India (PVPI).

The fate of analyzed data

After data transcription and data cleaning, various prescribing indicators were calculated using the following formula adopted from manual of prescribing indicators by WHO.

- An average number of drugs per prescription = $\frac{\text{Total numbers of drugs prescribed}}{\text{Total number of prescriptions encountered}}$.
- Percentage of drugs prescribed by generic name = $\frac{\text{Number of drugs prescribed by generic name}}{\text{Total number of drugs prescribed}} * 100$
- Percentage of the prescription with an antibiotic prescribed = $\frac{\text{Number of the prescription with antibiotics}}{\text{Total number of prescription}} * 100$
- Percentage of the prescription with an injection prescribed = $\frac{\text{Number of prescriptions with an injection prescribed}}{\text{Total number of prescription}} * 100$

In addition to these, the proportion of disease with a particular organ system is calculated as a number of diseases of a particular system (in 245 prescriptions) divided by the total number of disease in all prescription (500). The average number of drugs per prescription was represented as mean \pm std. the error of the mean. Following the careful audit of all data, the crucial findings (contraindications, major drug interactions, severe ADRs, major medication errors) of prescription components were discussed with the concerned physician by supplying supportive documents like corresponding research articles, incidence rate or tertiary reference. The relevant findings were also documented and reported to the quality control department and respective Head of Departments (HODs) of the hospital. It helped them to take a better decision and improve quality standards. The

overall methodology is outlined with the help of Figure 1.

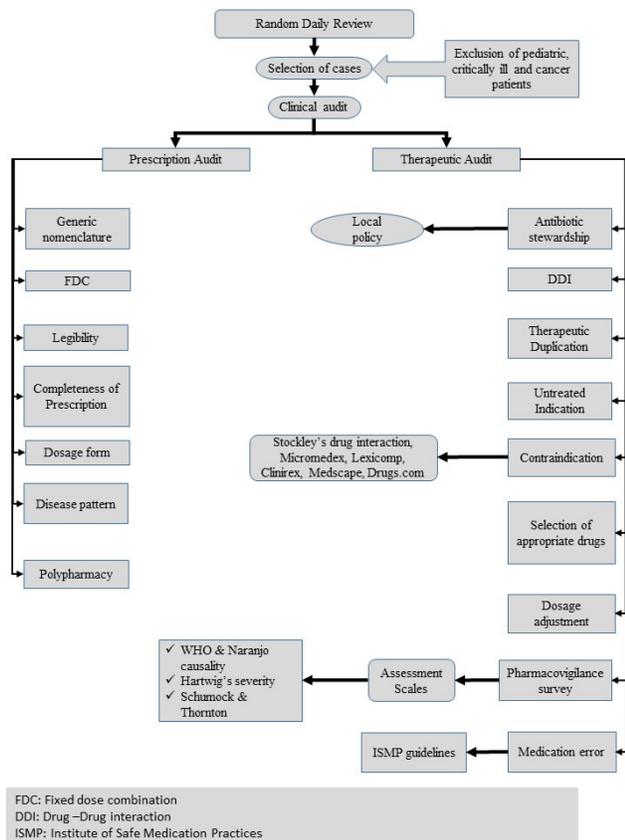


Figure 1: Illustration of the Overall Methodology Used in the Study.

RESULTS

Prescription Audit

In the total number of cases, the male patient proportion was higher (70%). All the patients were categorized into six age groups with most in age-group of above 60 years. The age distribution of the cases is illustrated in Figure 2. Basic information (Name, Age, Sex and Complete address) of patients and the complete diagnosis was documented in 97.5% and 75% of cases respectively. All prescriptions were complete in terms of dose, route, strength, frequency and dosage form. Duration of administration of drugs was documented in 50% of cases. Only 82.5% of prescriptions were legible. Total numbers of disease involved in all 245 cases were 500. Diseases of the respiratory system (40.42%) were found to be most prevalent followed by cardiovascular system (19.14%), endocrine system (7.44%), central nervous system (4.25%), gastro-intestinal system (7.44%) and musculoskeletal system (2.12%). Infectious and parasitic diseases were seen in 14.9%. Other diseases constituted remaining 4.25%. The total numbers of prescribed drugs for all 245 cases were 2074, which is approximate equals to 8.46 ± 0.27 drugs per case. At least 10 drugs per prescription were prescribed in 56% of cases. Four drugs in 8%, Five drugs in 3%, Six drugs in 5%, Seven drugs

in 8%, Eight drugs in 10% and Nine drugs in 10% of cases were prescribed. Drugs were prescribed by generic names in 77.5% of cases. Out of all drugs used, 42% of them were antibiotics, 29% cardiovascular drugs, 10% expectorants, 9% opioid analgesics, 6% hormones, 3% antihistamine and 1% Non-Steroidal Anti-Inflammatory Drugs (NSAIDs). More than one antibiotic were prescribed in 45% of cases. Only 5.06% of total drugs were found to be Fixed-Dose Combinations (FDCs) but were used in 37.5% of cases. Vitamin supplements constituted 4.43% of total drug use. In dosage forms; injectable forms were in majority (45.13%) followed by oral (34.47%), inhalational (0.43%) and topical (0.21%).

Therapeutic Audit

The 40 interventional findings noted in our study were about antimicrobial stewardship, Drug-Drug Interaction (DDIs), therapeutic duplication, pharmacovigilance survey, the recommendation to select alternate drugs, monitoring parameters, dosage adjustment, medication errors and contraindication (Figure 3). Out of 40 interventions, 15% of interventions were about non-compliance to the antibiotic sensitivity pattern. Few patients were receiving the antibiotics to which they were already resistant. DDIs represented in Table 1 are

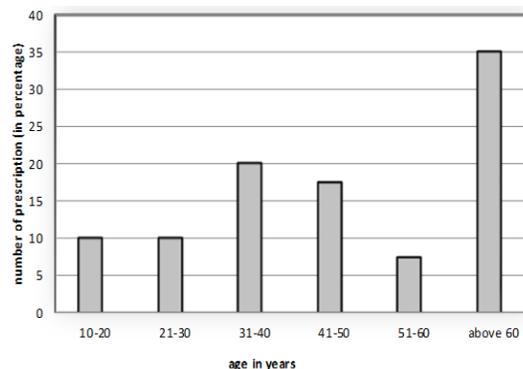


Figure 2: Demographic Characteristics of the Study Population.

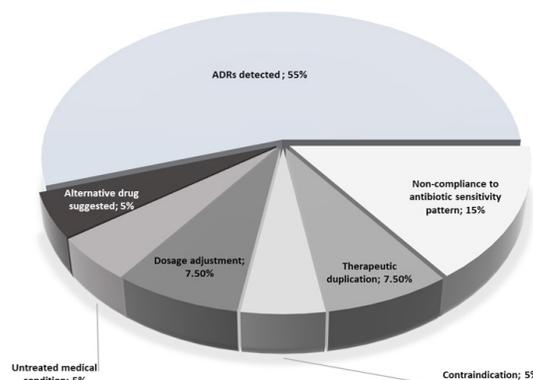


Figure 3: Illustration of Some Important Interventional Findings.

Table 1: Identification of Major Drug Interactions.

| Category of interaction | Interacting drugs | Effects of interaction |
|-------------------------|---|---|
| QTc prolongation | Metronidazole + ondansetron Azithromycin + amiodarone Ciprofloxacin + ondansetron | Ventricular tachycardia, torsades de pointes. |
| Antagonistic | Vasopressin + furosemide MgOH ₂ + furosemide | Therapeutic failure of drugs. Laxative with constipation effect. |
| Coagulation | Aspirin + Clopidogrel Enoxaparin + heparin Heparin + Clopidogrel Cefoperazone + heparin Aspirin + heparin | Bleeding |
| Absorption | Promethazine + metoclopramide = contraindicated Aluminum and magnesium containing antacids with azithromycin | Increased risk of extra pyramidal effects. |
| Excretion | Digoxin + spironolactone | increased Digoxin exposure |
| Electrolyte imbalance | Potassium sparing diuretics + ACE inhibitors | Hyperkalemia. |

ACE: Angiotensin Converting Enzymes.

major and most of them also were found to be clinically significant. Most common DDIs were associated with the anticoagulants and least were with antacids.

We encountered 7.5% of interventions about therapeutic duplication. The prescribers were totally unaware of such duplications unless we intervened. The duplications were; a patient was on two Proton Pump Inhibitors (PPI); tablet pantoprazole 40 mg and capsule domperidone 30 mg + rabeprazole 20 mg (Rabera-DSR capsule), concomitant use of syrup Cofstop A (ambroxol, guaifenesin and terbutaline) and syrup Rem cc XP (ambroxol, guaifenesin and albuterol) and use of furosemide and torsemide concomitantly. The detection of such duplications were quite easy as duplicated drugs were from the same class. The WHO-UMC causality assessment demonstrated, none of the ADRs to be “definite” or “unlikely”. Therefore, all of the identified ADRs (22) were either “probable” or “possible”. As per preventability scale, neither of them was “definitely preventable”. Few of them were “probably preventable” while remaining were “not preventable”. Most of the ADR’s severity were of level 3 and level 4A as per the Hartwig’s severity scale. Statins, NSAIDs, antibiotics and benzodiazepines were common classes of drugs associated frequently with the ADR as shown in Table 2. One patient in our study was found to have developed anaphylactic reaction following administration of injection piperacillin-4000 mg + tazobactam-500 mg.

Concomitant use of amiodarone and fluconazole was the one typical contraindication (drug-drug) in our study. Use of mannitol to reduce the intracranial pressure in an anuric patient without doing dialysis was another

example drug-disease contraindication. Suggesting alternative drugs to individualize and optimize the therapy contributed 5% of intervention. In patients with pedal edema, cilnidipine was suggested as an alternative to amlodipine. Most of the dosage adjustments were carried out in patients with kidney and liver disease. There were few patients with low GFR (<20ml/min), but still were receiving an unadjusted dose of antibiotics. The dose of injection piperacillin-4000 mg + tazobactam-500 mg every six hourly was reduced to piperacillin-2000 mg, tazobactam-250 mg thrice daily in such patients. After noting a few patients being underdosed for insulin, adherence to sliding scale regimen was recommended. In a few cases, we also suggested to hike up the dose of antihypertensives as the blood pressure was not being controlled with the previous dose being given to the patients. All the adjustment were appreciated and acknowledged by consultants.

Recommendations made for the untreated condition constituted 5% of total intervention. The addition of antidiarrhoeal (cyfolac forte) was done to patients suffering from watery diarrhea associated with the use of a broad-spectrum antibiotic. The complaints of watery diarrhea by the patients was noticed post morning round when the patient counseling session was being conducted. Other categorical recommendations were to add capsule levo-carnitine 500 mg in some emaciated elderly patient. The recommended monitoring parameters were like coagulation profile (PT, INR, APTT) after starting on acenocoumarol/warfarin, checking electrolyte levels in inpatients on diuretics, Creatine Phospho Kinase (CPK) for the suspected myopathy (those who were on statins and protease inhibitors concomitantly), magnesium and

Table 2: Detection of Suspected Adverse Drug Reactions.

| Class of the drugs | Drug name | ADR | WHO Causality assessments | Number of ADR |
|----------------------------------|---|--|----------------------------------|---------------|
| HMG-CoA reductase inhibitors | Atorvastatin Rosuvastatin | Muscle cramps(myopathies) | Possible | 2 |
| Anticonvulsants | Phenytoin Carbamazepine | Skin lesion Steven johnson syndrome | Prablabe Probable | 1 1 |
| NSAIDs | Diclofenac Aspirin | Vomiting, loose stool and GI irritation | Possible possible | 2 |
| Benzodiazepines | Lorazepam,chlordiazepoxide | Respiratory depression Hepatotoxicity | Possible Possible | 1 1 |
| Diuretics | Furosemide | Hypokalemia | Probable | 3 |
| Antibiotics | Sulfasalazine Cefoperazone Penicillin | DRESS Loose stool Anaphylaxis | Probable Possible probable | 1 5 1 |
| Antiplatelets and anticoagulants | Ticagrelor Asprin Acitrom | Bleeding | Probable Possible Possible | 1 2 1 |

NSAIDS: Non-steroidal anti-inflammatory drugs, DRESS: Drug Rash with Eosinophilia and Systemic Syndrome. GI: Gastro-intestine.

Table 3: Inappropriate Abbreviations Used.

| Abbreviations used | Intended meaning | Misinterpretation | Correction |
|--------------------|--------------------|--|---|
| OD | Once daily | Mistaken as right eye (oculus Dexter) | Use "daily" |
| QD | Every day | Mistaken as QID, tail of q is misunderstood as i | Use "daily" |
| IU | International unit | Mistaken as IV or 10 (ten) | Use "units" |
| HCT | Hydrocortisone | Mistaken as hydrochlorothiazide | Use complete drug name |
| MTX | Methotrexate | Mistaken as mitoxantrone | Use complete drug name |
| HCL | Hydrochloric acid | Mistaken as potassium chloride | Use complete drug name unless expressed as a salt of a drug |
| Ug | Microgram | Mistaken as mg | Use "mcg" |
| SC | Subcutaneous | Mistaken as SL (sublingual) | Use "subcut" or "subcutaneously" |
| PCT | Paracetamol | PCV | Use "acetaminophen" |

PCV= Packed Cell Volume, QID = four times a day, IV = intravenous.

calcium level in patients on prolonged PPIs and ECG for elderly patient who were on more than two QTc-prolonging drugs. All the recommendations were adopted and appreciated.

Few of the error-prone abbreviations and symbols that were found during the audit are presented in Table 3. The medications error observed in our study were not limited to any specific categories; still, those seen most commonly are depicted in Table 4.

DISCUSSION

Prescription audit

Legibility problem encounters the major medication error in wards and sometimes proven to be fatal in emergency cases. We encountered an instance when a nurse administered tablet flupenthixol instead of tablet

fluoxetine to a patient. However, the patient remained safe since it was intervened just after the first dose. On encountering such illegible prescription, the attention of the prescribing residents was sought to re-prescribe same in a legible manner. The frequent intervention on the same mandated the hospital to introduce the practice of prescribing all drugs in the capital and generic names only. The drugs prescribed by generic names (in 77.5% of cases) is much higher than as compared to other Indian studies around the year 2013.^{2,7,8} This positive increase in generic prescription shows the improvement in prescribing pattern of the physician which reduces the chances of occurrence of versatile sources of medication error and also decreases the economic burden on the patients.

In contrast to our study, a study by Balbir *et al.*⁷ accounted cardiovascular system most while our study

Table 4: General Medication Errors.

| Medication error found | Category of error |
|--|------------------------------|
| Calculation of wrong age of the patient form provided the date of birth (≥ 10 years difference) | Skill-based technical error. |
| Most of the drugs were not administered within the ordered time | Administration error |
| Uncalculated creatinine clearance and an accordingly unadjusted dose of antibiotics in CKD patient (in $>10\%$ of cases) | Knowledge-based error. |
| Tablets formulation were written as a capsule in drug chart | Knowledge-based error |
| Sensitivity and culture test was not done in most of the patients prescribed with restricted antibiotics. | |
| Findings of drugs of different brands at the bedside than that doctors had prescribed | |
| The drugs that were discontinued were found to be stored with regular drugs in the same drawer at the bedside | Rule-based error |
| After shifting the patient from one bed to another bed, the details were not updated in-hospital database system and patient chart | |

CKD: Chronic Kidney Disease

demonstrated respiratory system (45%) most followed by the cardiovascular disease (35%). In all parts of India, CVD is the largest cause of mortality.⁹ The high incidence of respiratory and infectious disease in our study can be attributed to the environmental factors as well as the lifestyle of the people. Use of FDCs in 37.5% is higher than the study by Balbir *et al.* but still lower than as reported by Kastury *et al* and Chakrabarti *et al.*^{7,10,11} Vitamins/mineral supplement, antianemia FDCs are also not free from ADR and hence they should be prescribed wisely.¹² More than 6000 FDCs are available in India and hence Indian market is considered to be a world leader of FDC.¹³ With more prescribing of FDCs, poly-pharmacy is practiced which can lead to adverse effects and drug reactions including the emergence of drug resistance.¹¹ Unless stringently required, use of fixed-dose combinations should be demoralized.⁷ An average of 8 drugs prescribed per patients in our study is much higher than the recommended limit of 2.¹⁴ As reported by various studies, polypharmacy is a very common practice these days.¹⁵ It is difficult to keep the mean number of drugs per prescription below four, but higher figures always ought to be justified because of the increased risk of DDIs¹⁶ and errors of prescribing with polypharmacy.¹⁷ Sometimes polypharmacy may be practiced unintentionally when the medication history of the patient is not collected in a legitimate manner. Use of injectable forms (45.14%) is still lower than a study conducted by Rathod *et al.*¹⁸ The explanation for this wide variation could be the difference in the proportion of patients suffering from the acute critical condition. Overuse of injectables leads to an unnecessary burden on patients. Developing local guidelines for the injection usage along with educational sessions in the hospital for the doctors can minimize the issue.

Therapeutic audit and interventions

Antibiotic stewardship

Out of all drugs, use of 42% of antibiotics is fairly high compared to data reported by Afroz *et al.* But this value is less when compared to a study by Gupta *et al.* in which half of the patients received more than one antibiotics^{3,19} Such irrational prescribing of antibiotics contributes to the staggering problem of resistance which is the biggest threat to human health today as stated by WHO.²⁰ Most of the acute respiratory and acute gastroenteritis cases are viral in nature and may not need antibiotics. Irrational practice again augments the risk of further resistance and economic burden to the patients. Therefore, the antibiotics policy should be formulated and revised periodically in each hospital.

Pharmacovigilance survey and DDIs

ADRs cannot be avoided completely, hence the occurrence of the ADRs are common in all sort of health setup.²¹ It is a physician who keeps note of each and every new complaints of patients in every morning rounds. The challenging part is to differentiate the cause of that new complaint (symptoms) between drugs that the patient is taking and the disease s/he is suffering. As usual in practice, the perspectives of physicians is focused around the association of new symptoms with pathophysiology rather than drug reaction. It is the CPs who should think differently and always be highly suspicious about those new symptoms to be associated with any drugs that the patient is on. Such practice will definitely help to detect and prevent a number of ADRs and hence improving the quality of care. As polypharmacy is heavily seen in our data, the prevalence of DDIs were also not less. Pharmacodynamic interactions were more when compared with the pharmacokinetic interactions.

Whenever the discontinuation of the interacting drugs or drugs suspected to cause ADR were not possible, essential monitoring parameter based on the expected effects were suggested.

Therapeutic duplication

Therapeutic duplication is the practice of prescribing more than one drugs for the same indication. Upon critical evaluation, we discovered number of reasons for such duplications. Few of them were; prescription practice by multiple doctors for same patient, forgetting to discontinue the previous order after writing new order and not having the complete knowledge about all composition of branded drugs available in market and hospital formulary. Taking improper medication history of the patient at the time of admission have also contributed to therapeutic duplication as physician had prescribed same drug which the patient was taking previously before admission. Due to above limits, an individual can certainly end up with taking more than one drug with similar action, sometimes leading serious side effects.

Contraindication

Certain fluoroquinolones and antimalarials, macrolides/ketolides, azole antifungal are few classes of antimicrobials which are associated with the QTc prolongation.²² Apart from that, antiarrhythmics like amiodarone, dofetilide, quinidine and sotalol are known to be most potent medication to cause QTc prolongation.²³ According to most of the standard resources, concomitant use of amiodarone and fluconazole is contraindicated. But when the detail evaluation of the case was done in our study, concomitant uses of both were found to be intentional from the physician point of view. Researchers have revealed that low dose of amiodarone acts synergistically with fluconazole against *Candida Albicans* and other resistant strains which unfold the new methods to combat against those resistant microbes.²⁴

Osmotic diuretics like mannitol are used in a various condition like raised intracranial pressure (ICP), rhabdomyolysis and glaucoma.²⁵ We encountered one patient with hypertensive emergency probably due to pontine hemorrhage. She was anuric from last 12 h (acute kidney failure according to RIFLE criteria) and was being treated with mannitol for decreasing ICP. The choice (mannitol) was not deemed to be rational realizing the fact; complications associated with mannitol therapy are hypernatremia, hyperkalemia and volume expansion.²⁶ Volume expansion in such cases may cause difficult to lower the ICP. The suggested intervention, in this case, was to start hemodialysis.

Selection of appropriate drug

Though both amlodipine and cilnidipine are proven to be equivalent in exerting an antihypertensive effect, cilnidipine inhibits both N-type and L-type calcium channel in contrast to another dihydropyridine.²⁷ In different clinical studies, an incidence of peripheral edema with the use of amlodipine is found to be between 1.7% and 32%. Due to the same reason, almost 9.3% of patients terminate its use.²⁸ Apart from that we also suggested using polymyxin B instead of colistin in CKD patient as former is known to be comparatively less nephrotoxic.²⁹

Untreated condition and medication errors

It is noted that average time for which an Indian doctor see patients is only two min.³⁰ Within this small frame of time, patients fail to express their all complaints effectively and few complaints of the patients are left unaddressed. Most medications errors related issues demonstrated in our results were attempted to be resolved by suitable strategies. For instance, after discussing with quality department of the hospital, the practice of using the red pouch to store the discontinued medication was implemented. This approach significantly reduced the incidence of administration error by nurses. Another practice inculcated in hospital as a result of our study is to place the allergic bands on the patient wrist and sticker on patient's chart stating the name of the allergic drugs. These were important and clear indication that clinical pharmacist are essential for the principles of rational pharmacotherapy.

CONCLUSION

Our study revealed, there is still huge scope for improvement in prescribing pattern in NABH accredited hospital. The concepts of pharmacoeconomics, complying to prescribing practice recommended by WHO, standard treatment guidelines and strict compliance with the antibiotic policy are essential measures to promote the rational therapy. Polymyxin B may be used instead of colistin as formers are less nephrotoxic. Pharmacists can equally assist and advice to patients in all aspects of their medicine to raise the quality of pharmaceutical care. The clinical pharmacist can revolutionize the face of Indian healthcare setup by working closely with medical and nursing staff assuring the most optimized treatment for patients.

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CONFLICT OF INTEREST

The authors declare that the conflict of interest.

ABBREVIATIONS

NABH: National Accreditation Board for Hospitals and Healthcare Providers; **USA:** United States of America; **WHO:** World Health Organizations; **ISQua:** International Society for Quality in Healthcare; **CPs:** Clinical Pharmacists; **SOAP:** Subjective evidence, Objective evidence, Assessment and Plan; **ADRs:** Adverse Drug Reactions; **CDSCO:** Central Drug Standard Control Organization; **PvPI:** Pharmacovigilance Programme of India; **HODs:** Head of Departments; **NSAIDs:** Non-Steroidal Anti-Inflammatory Drugs; **FDCs:** Fixed-Dose Combinations; **DDIs:** Drug-Drug Interaction; **UMC:** Uppsala Monitoring Centre; **PT:** Prothrombin Time; **INR:** International Normalization Ratio; **APTT:** Activated Partial Thromboplastin Time; **CPK:** Creatine Phosphokinase; **PPIs:** Proton Pump Inhibitors; **ECG:** Electrocardiogram; **CVD:** Cardiovascular Disease; **ICP:** Intracranial Pressure; **RIFLE:** Risk, Injury, Failure, Loss, End stage renal disease; **CKD:** Chronic Kidney Disease; **ACE:** Angiotensin Converting Enzymes; **DRESS:** Drug Rash with Eosinophilia and Systemic Syndrome; **GI:** Gastro-Intestine; **PCV:** Packed Cell Volume; **QID:** Four times a day; **IV:** Intravenous; **ISMP:** Institute of Safe Medicine and Practices.

SUMMARY

Major health problem is the irrational use of drugs in medical practice today. In spite of several attempts to bring rationality in the prescribing pattern, no effective impacts of any attempts have brought potential minimization in the medication errors and still, there is the need for vigorous surveillance. Therefore, the objective of this study was to audit the prescriptions, categorize the types of errors, improve the prescription practice along with generation of information on the core prescribing pattern and demonstrate the common therapeutic interventions done by a clinical pharmacist in NABH accredited hospital.

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The 40 interventional findings noted in our study were about antimicrobial stewardship, Drug-Drug Interaction (DDIs), therapeutic duplication, pharmacovigilance survey, recommendation to select alternate drugs, monitoring parameters, dosage adjustment, medication errors and contraindication. Out of 40 interventions, 15% of interventions were about non-compliance to the antibiotic sensitivity pattern. Few patients were receiving the antibiotics to which they were already resistant. Most of the DDIs also were found to be clinically significant. Most common DDIs were associated with the anticoagulants and least were with antacids.

Our study revealed, there is still huge scope for improvement in prescribing pattern in an NABH accredited hospital. The concepts of pharmacoeconomics, complying to prescribing practice recommended by WHO and standard treatment guideline, strict compliance with the antibiotic policy are essential measures to promote the rational therapy. Pharmacists can equally assist and advice to patients in all aspects of their medicine to raise the quality of pharmaceutical care.

REFERENCES

- Salman MT, Akram MF, Rahman S, Khan FA, Haseen MA, Khan SW. Drug prescribing pattern in surgical wards of a teaching hospital in North India. *Indian J Pract Dr*. 2008;5(2):6-9.
- Hogerzeil HV. Promoting rational prescribing. *British J Clin Pharmacology*. 1995;39(1):1-6.
- Abidi A, Gupta S, Kansal S, Ramgopal R. Prescription auditing and drug utilization pattern in a tertiary care teaching hospital of western UP. *Int J Basic Clin Pharmacol*. 2012;1(3):184-90.
- Deshpande PR, Vantipalli R, Lakshmi CH, Rao E, Regmi B, Ahad A, et al. Clinical pharmacists: The major support to Indian healthcare system in near future. *J Pharm Bioallied Sci*. 2015;33:279-83.
- Zaki SA. Adverse drug reaction and causality assessment scales. *Lung India*. 2011;28(2):152-3.
- Srinivasan R, Ramya G. Adverse Drug Reaction-Causality Assessment. *Int J Res Pharm Chem*. 2011;1(3):606-12.
- Balbir K, Rani W. Prescription audit for evaluation of prescribing pattern of the doctors for rational drug therapy in tertiary care hospital. *J Drug Deliv Ther*. 2013;3(5):77-80.
- Karande S, Sankhe P, Kulkarni M. Patterns of prescription and drug dispensing. *Indian J Pediatr*. 2005;72(2):117-21.
- Gupta R, Guptha S, Sharma KK, Gupta A, Deedwania P. Regional variations in cardiovascular risk factors in India: India heart watch. *World J Cardiol*. 2012;4(4):112-20.
- Kastury N, Singh S, Ansari K. An audit of prescription for rational use of fixed-dose drug combinations. *Indian J Pharmacol*. 1999;31(5):367-9.
- Chakrabarti A. Prescription of fixed-dose combination drugs for diarrhoea. *Indian J Med Ethics*. 2007;4(4):165-7.
- Pillay A, Keche Y, Yegnanarayan R, Patil V, Patil G, Dangare R. Evaluation of prescribing patterns of teaching and nonteaching hospitals by undergraduate medical students in Pune, India. *Int J Basic Clin Pharmacol*. 2013;2(1):61-7.
- Gupta Y, Ramachandran S. Fixed dose drug combinations: Issues and challenges in India. *Indian J Pharmacol*. 2016;48(4):347-9.
- World Health Organization. How to investigate drug use in health facilities: Selected drug use indicators. 1993;1-92. *Who/Dap/93.1*.
- Patel V, Vaidya R, Naik D, Borker P. Irrational drug use in India: a prescription survey from Goa. *J Postgrad Med*. 2005;51(1):9-12.
- Abhijit K, Jain P, Upadhyaya P, Jain S. A study monitoring prescription pattern of antibiotics in a tertiary care hospital in North India. *Int J Basic Clin Pharmacol*. 2014;3(6):1006-11.
- Lavan AH, Gallagher PF, O'Mahony D. Methods to reduce prescribing errors in elderly patients with multimorbidity. *Clin Interv Aging*. 2016;11:857-66.
- Rathod S, Motghare V, Padwal S, Deshmukh V, Pore R, Deshpande R, et al. Study of prescribing practices of injections in outpatients of a rural tertiary care teaching hospital. *Int J Basic Clin Pharmacol*. 2013;2(6):747-50.
- Gupta N, Sharma D, Garg SK, Bhargava VK. Auditing of prescriptions to study utilization of antimicrobials in a tertiary hospital. *Indian J Pharmacol*. 1997;29(6):411-5.
- Hashemi S, Nasrollah A, Rajabi M. Irrational antibiotic prescribing: A local issue or global concern?. *EXCLI Journal*. 2013;12:384-95.
- Mahatme N, Narasimharao R. A study of clinical patterns and causative agents of adverse cutaneous drug reactions. *Indian J Drugs Dermatology*. 2016;2(1):13-8.
- Owens RC, Nolin TD. Antimicrobial-associated QT interval prolongation: Points of interest. *Clin Infect Dis*. 2006;43(12):1603-11.
- Ayad RF, Assar MD, Simpson L, Garner JB, Schussler JM. Causes and management of drug-induced long QT syndrome. *Proc Bayl Univ Med Cent*. 2010;23(3):250-5.
- Guo Q, Sun S, Yu J, Li Y, Cao L. Synergistic activity of azoles with amiodarone against clinically resistant *Candida albicans* tested by checkerboard and time-kill methods. *J Med Microbiol*. 2008;57(4):457-62.
- Shawkat H, Westwood MM, Mortimer A. Mannitol: A review of its clinical uses. *Contin Educ Anaesthesia, Crit Care Pain*. 2012;12(2):82-5.
- Doi K, Ogawa N, Suzuki E, Noiri E, Fujita T. Mannitol-induced acute renal failure. *Am J Med*. 2003;115(7):593-4.
- Babu KA. Assessment of efficacy of amlodipine with cilnidipine in hypertensive patients: A Comparative Study. *Int J Contemp Med Res*. 2017;4(4):956-8.
- Adake P, Somashekar HS, Mohammed RPK, Umar D, Basheer B, Baroudi K. Comparison of amlodipine with cilnidipine on antihypertensive efficacy and incidence of pedal edema in mild to moderate hypertensive individuals: A prospective study. *J Adv Pharm Technol Res*. 2015;6(2):81-5.
- Gupta S, Govil D, Kakar PN, Prakash O, Arora D, Das S, et al. Colistin and polymyxin B: A re-emergence. *Indian J Crit Care Med*. 2009;13(2):49-53.
- Irving G, Neves AL, Dambha-Miller H, Oishi A, Tagashira H, Verho A, et al. International variations in primary care physician consultation time: A systematic review of 67 countries. *BMJ Open*. 2017;7(10):1-15.