

Research Article

Identification and Evaluation of Medication Errors in Pre- and Post-Operative Setting

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ABSTRACT

Objectives: Inappropriate drug omission and drug re-initiation all through surgery may lead to numerous adverse events that may have a excessive effect on the patient's health and postoperative outcome. Hence we aim to identify the incidence of medication error due to pre-operative drug omission and postoperative drug re-initiation.

Methods and materials: It is a single-centred, observational study conducted prospectively in a Tertiary care hospital for a study period of six months. Case sheets of patients undergoing various surgeries were collected via a organized interview with the patient or the patient's care taker. The evidence attained from health care professionals and patients were construed and the results were produced.

Results: There was a highly prevalent medication error due to pre-operative drug omission and postoperative drug re-initiation (59.7%). A total of about 172 medication errors were identified in 288 patients. The acceptance of these medication errors by physicians were high (73.83%) and few medication errors were rejected with proper justification (15.69%). Most of the medications errors were observed in the use of anti-platelet and anti-diabetic drugs.

Conclusion: The study concludes that the incidence of medication error due to pre-operative drug omission and postoperative drug re-initiation were high in the study population and proactive identification these errors may prevent various adverse events and improve patient's postoperative outcome .

Keywords: Medication error, Surgery unit, Drug omission, Drug re-initiation, Patient safety, Postoperative outcome

INTRODUCTION

Surgery being one of the essential component in health care setting, any complication during and after surgery may have a clinical impact on the patient's condition causing morbidity and mortality ¹. The recent advances in surgery has made it as an easier option nowadays. Patients admitted in the surgery ward tend to receive poly-pharmacy which may be the important risk factor for drug therapy problems which may lead to increased health care cost, prolonged stay in the hospital, post-operative complications and reduced patient's quality of life ^{1,2}. In surgical unit the most common medication errors identified were prescription errors followed by administration errors. The most common type of administration error in surgery ward was found to be drug omission³.

It has been estimated that more than 50% of the patients undergoing surgery takes various

medications on regular basis⁴. During surgery some chronic medications taken by the patients has to be temporarily stopped on the day of surgery and restarted immediately to avoid further complications⁵. In surgery unit patients who were on poly-pharmacy showed 7 times increased incidence of medication errors when compared with patients who were not on poly-pharmacy⁶. Hence early detection and resolution of these medication errors may prevent various adverse events and also improve the patient's quality of life after surgery.

Pharmaceutical care contributed by the Pharmacist to optimise drug therapy is the foundation of clinical pharmacy⁷. Pharmacist's intervention is a valuable input in health care setting which help in reducing medication errors and in rationalizing the drug therapy which significantly contribute to the patient safety⁸. Medication errors identified by the clinical

pharmacists enhances the patient's safety and also improve the patient's therapeutic outcome by preventing various unwanted adverse events due to these errors⁹. The proactive approach of the pharmacist seems to have more impact on the patient safety profile.

Many studies have shown that importance of pharmacist intervention in identifying medication errors in various health care departments like emergency department¹⁰, Cardiology^{11,12}, Neurology¹³, Oncology^{14,15}, Pulmonology¹⁶ and various other departments^{17,18}. With high prevalence of medication errors in surgical ward, there are very scarce literature information about the medication error due to omission and re-initiation in surgery ward, hence we have made an approach to identify the incidence of medication error due to preoperative drug omission and postoperative drug re-initiation in surgical ward in a tertiary care hospital.

METHODOLOGY AND MATERIALS

Sample population and Study design

It is a single-centred, observational study that was conducted prospectively in a Tertiary care hospital. The study period was for about of 6 months. The study included all patients with chronic diseases scheduled for all general, Cardiology, Neurology and Orthopaedic surgeries and above 18 years. All the emergency surgeries which were done on immediate basis within 120mins after admission and Non-invasive surgeries and paediatric population were Excluded.

Data collection

Records of all the patients undergoing various surgeries were collected via a organized interview with the patient's care taker and patient. Patient's medication history was also collected from the hospital records, previous medical records (if any) and also from previous prescriptions (if any). The

information about any OTC drug intake and co-morbid conditions were also obtained. Cross checking was done extensively to ensure that all the information regarding the patient's drug therapy was obtained. All the collected information was imputed in a structured medication reconciliation form by the Pharmacist. The data about the continuation and discontinuation of drugs during the period of surgery along with proper explanation were attained from the health care professionals.

Peri operative management standard guidelines

All the information obtained were pooled and compared with the Standard Perioperative guidelines of the particular hospital along with other drug specific perioperative guidelines Anti Diabetic drugs¹⁹, Diuretics²⁰ and Anti platelet drugs²¹. These guidelines were selected based on the acceptance by the Physicians. Any non-compliance with these guidelines were noted and informed to the particular Physician during the ward rounds. These medication errors were categorised based on the different class of drug along with the patient's identification code.

RESULTS

A total of about 297 patients were selected based on the inclusion criteria, out of which 9 patients were removed from the study due to various reasons. Among these 288 cases, 120 cases were females (41.67%) and 168 cases were males (58.33%). Majority belonged to the Patients age group between 56 and 65 years (76.39%). Out of 288 records collected, it was found that 256 records were reconciled and 32 records were not reconciled. The detailed information regarding the patient inclusion is explained in the figure 1

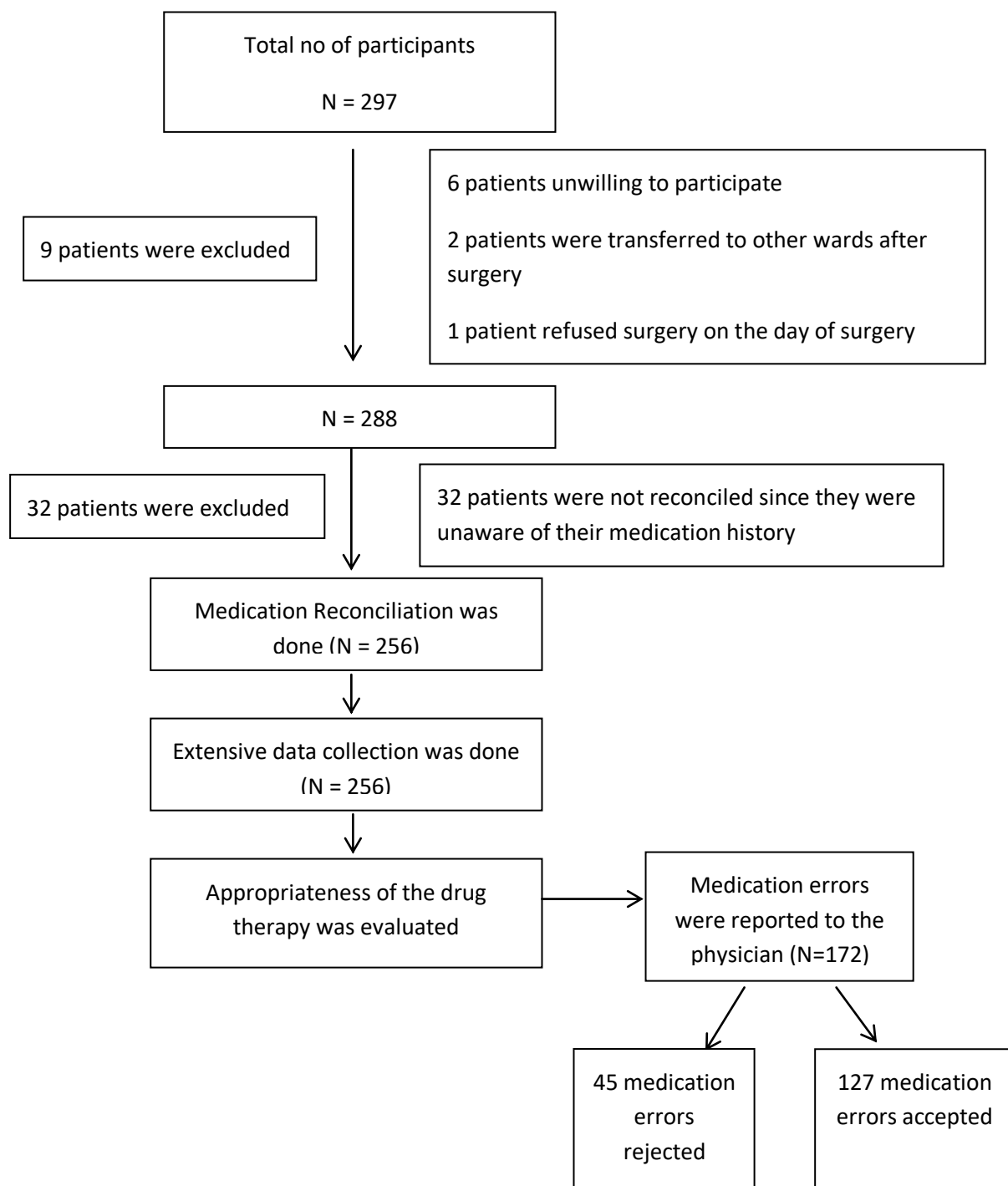


Fig.1: Flow chart for study participant recruitment

The demographic features, Patients Percentage that were scheduled for numerous surgeries are given in below in Table 1. The related

comorbidities that were found in numerous patients based on the diverse type of surgery is given in Table 2.

Table 1: Demographic characteristics

Variable	N(%)
Gender	
Male	168(58.33%)
Female	120(41.67%)

Age	
>18-35	0
36-55	38(13.19%)
56-65	220(76.39%)
>65	30(10.42%)
Surgery Department	
General	124(43.05%)
Ortho	78(27.08%)
Cardiac	54(18.75%)
Neuro	32(12.15%)

Table 2: Comorbidity information

Comorbidities	General	Cardiac	Neuro	Orthopedic	Total
Hypertension	69	36	13	65	183
Diabetes Mellitus	55	28	18	42	143
Hypothyroidism	17	4	10	13	44
Dyslipidaemia	5	-	-	1	6
CAD	14	21	4	12	51
Seizures	-	-	3	1	4
Respiratory disorder	-	-	-	3	3
Chronic gastritis	-	-	-	3	3
Allergic bronchitis	-	-	1	-	1
Retroviral +ve	-	-	1	-	1
RHD	-	1	-	-	1

The majority of the medication errors were observed in the discontinuation and re-initiation of the antiplatelet therapy and in the use of anti-diabetic drugs. Among the 172 medication errors observed, 108 were observed in the use of Anti-platelet therapy. And out of 143 Diabetic cases, 49 cases showed deviation from standards in

which, 21 deviations were rejected with proper justification and 28 were accepted. The combined information concerning the medication errors were detected relying on the different class of drugs and on the type of medication errors are given in the table 3

Table 3: Medication errors observed based on the different class of drugs and based on the type of medication errors

Variable	Frequency (percentage)	
	Preoperative (N = 112)	Postoperative (N = 60)
Total no of medication errors		
1. Not Accepted	31 (27.67)	14 (23.3%)
2. Accepted	81 (72.32)	46 (76.67%)
Unintended medication errors by drug class		
1. Oral Hypoglycaemic Agents		
a. Pioglitazone and Metformin	19 (16.96)	5 (8.3%)
(combination)	1	0
b. Glimepride and Metformin	3	1
(combination)		
c. Glimepride		
d. Metformin	1	0
e. Glycomet	6	2
f. Glycomet and Glimepride	2	0
(combination)	1	1
g. Vildagliptin		
h. Gliclazide and Metformin	2	1
(combination)	1	0

i.	Gliclazide	1	0
j.	Others	1	0
2.	Insulin therapy	1	0
3.	Thyroid Supplements	21 (18.75)	4 (6.67%)
4.	Diuretics	3 (2.67)	1 (1.67%)
a.	Hydrochlorothiazide	7 (6.25)	3 (5%)
b.	Torsemide	3	2
c.	Spironolactone	2	0
d.	Spironolactone and Furosemide combination	1	1
		1	0
5.	Anti - Platelet therapy		
a.	Aspirin	61(54.46)	47 (78.3%)
b.	Clopidogrel	32	24
c.	Aspirin and Clopidogrel combination	20	17
6.	Anti-ulcer drugs	9	6
a.	Pantoprazole		
	Medication errors based on type	1(0.89)	0
	Drug continuation on the day of surgery	1	0
1.	Omission		
2.	Duplication	47 (41.96)	0
3.	Inappropriate discontinuation and re-initiation	3 (2.68)	0
		1 (0.89)	0
		61 (54.46)	60(100%)

DISCUSSION

Based on the above study reports it was understood that there was varied drug use pattern during the pre and post operative settings from the standard guidelines which altered the patient's blood sugar levels, blood pressure levels and patient's response after the surgery which may be contributed to non-compliance with the standard treatment guidelines. Most of the medication errors obtained were due to improper withdrawal and re-initiation of certain drugs during and after surgery respectively.

Better pre-operative glycaemic control in diabetic patients have been shown to produce positive postoperative outcomes²². In our study the anti-diabetic drug usage was proper in most of cases but in some instance they were discontinued on day of surgery and started after surgery or replaced them by insulin. In some cases, they were continued on day of surgery which deviated from standard guidelines representing inappropriate drug usage. According to the American Diabetic Association (ADA) standards of medical care 2019 recommendations, all the oral hypoglycaemic agents should be withheld on the day of surgery and reinitiated on the next day¹⁹.

An event report submitted by the Pennsylvania healthcare facilities, shows that in medical or surgical units the prevalence of insulin related medication errors were around 22.3%(n=599)²³. In this study, commonly the insulin dose was discontinued on day of surgery. In our study

based on patient specific target blood glucose levels set by physician insulin dose was adjusted. If blood glucose levels were within in the set target range insulin dose was omitted if not STAT dose with short acting insulin was given based by intravenous route. Switching Insulin to Oral hypoglycaemic agents (OHA) and OHA to insulin was seen in some cases which were based on physician empirical therapy of interest.

Anti-hypertensive like diuretics were continued on the day of the surgery in some instance which indicated variation from standard guidelines. Improper diuretic use may lead to hypovolemia and may interact with anaesthesia which may lead to various other complications. In a cohort study which evaluated the pre and intra operative use of diuretics have concluded that pre and intra operative use of diuretics in non-cardiac surgery, showed significant correlation with the development of Acute Kidney Injury²⁰. Another study result has shown that the preoperative use of diuretics in patients undergoing cardiac surgery is associated with major adverse events like death, postoperative kidney dysfunction and cardiovascular complications like myocardial infarction, stroke etc²⁴. In very few cases the re-initiation of diuretics after surgery was not done promptly. Blood pressure (BP) of patient in some cases was altered after surgery and particularly in such cases, either dosage adjustment or new combinations were started based on physician empirical therapy of interest.

Antiplatelet drug use varied from patient to patient. Majority of cases are with deviation from standard treatment guideline. The omission and re-initiation of antiplatelet was based on assessment of risk-benefit criteria by physician. A systematic review has concluded that it's best to discontinue clopidogrel at least five days before a cardiac surgery²¹. In our patients cardiac surgery, aspirin and clopidogrel was stopped on an average of 3 and 4 days respectively prior to surgery and started immediately after surgery but in orthopaedic surgeries they were stopped on an average 2 days before surgery and started 4 days after surgery. In cardiac surgeries, cardiac risk overshadowed bleeding risk and in orthopaedic surgeries postoperative bleeding risk overshadowed cardiac risk. The discontinuation and re-initiation of Antiplatelet drugs were justified in some cases but in most cases there were no proper justification which may lead to undesired effects in the patient. Thyroid supplements were continued on day of surgery. Supplementation of thyroid drugs were done to some patients when they are on nil by mouth (NBM) which indicate disparity from standard guidelines and improper drug usage.

CONCLUSION

Our study has shown that there were highly prevalent medication errors in surgery department. Inappropriate drug use throughout surgery may lead to several drug related problems that may have a great influence on the patient's health condition. These drug related problems can be proactively identified and prohibited with the help of a professionally trained Clinical/Hospital pharmacist since good perioperative medication management improves postoperative outcome. This study is an add on study that explains the importance of Pharmacist Intervention in hospital settings.

Ethics approval

Ethical approval obtained for the study

Source of Funding

Nil

Conflict of interest

Author declares that there was no conflicting interest

REFERENCES

1. Tefera, G. M., Zeleke, A. Z., Iima, Y. M., & Kebede, T. M. (2020). Drug Therapy Problems and the Role of Clinical Pharmacist in Surgery Ward: Prospective Observational and

- Interventional Study. *Drug, Healthcare and Patient Safety*, 12, 71.
2. Kennedy, I. M., Van Rij, A. M., Spears, G. F., Pettigrew, R. A., & Tucker, I. G. (2000). Polypharmacy in a general surgical unit and consequences of drug withdrawal. *British journal of clinical pharmacology*, 49(4), 353-362.
3. Patel, S., Patel, A., Patel, V., & Solanki, M. (2018). Study of medication error in hospitalised patients in tertiary care hospital. *Indian Journal of Pharmacy Practice*, 11(1), 32-36.
4. Perioperative Medication Management: Overview. Cardiovascular System, Respiratory System. Emedicine.medscape.com. (2021). Retrieved 10 December 2020, from <https://emedicine.medscape.com/article/284801-overview>.
5. Ngige, G., Carton, E., Zaborowski, A., Brown, A., Conyard, E., & Gaskin, J. (2018). 4CPS-239 Evaluation of clinical pharmacist interventions in surgical patients.
6. Tefera, G. M., Zeleke, A. Z., Iima, Y. M., & Kebede, T. M. (2020). Drug Therapy Problems and the Role of Clinical Pharmacist in Surgery Ward: Prospective Observational and Interventional Study. *Drug, Healthcare and Patient Safety*, 12, 71.
7. Hepler, C. D. (2004). Clinical pharmacy, pharmaceutical care, and the quality of drug therapy. *Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy*, 24(11), 1491-1498.
8. Al Rahbi, H. A. M., Al-Sabri, R. M., & Chitme, H. R. (2014). Interventions by pharmacists in out-patient pharmaceutical care. *Saudi Pharmaceutical Journal*, 22(2), 101-106.
9. The Pharmacist's Role in Medication Safety. Psnet.ahrq.gov. (2021). Retrieved 10 December 2020, from <https://psnet.ahrq.gov/primer/pharmacists-role-medication-safety>.
10. Kaboli PJ, Hoth AB, McClimon BJ, Schnipper JL. Clinical pharmacists and inpatient medical care: a systematic review. *Archives of internal medicine*. 2006 May 8;166(9):955-64.
11. Omboni, S., & Caserini, M. (2018). Effectiveness of pharmacist's intervention in the management of cardiovascular diseases. *Open Heart*. 5(1).
12. Khazan, E., Hough, A., Parra, D., & Groppi, J. (2019). Evaluation of Interventions by Clinical Pharmacy Specialists in Cardiology at a VA Ambulatory Cardiology Clinic. *Federal Practitioner*. 36(2). 56.
13. Ali, M. A. S., Khedr, E. M. H., Ahmed, F. A. H., & Mohamed, N. N. E. (2018). Clinical pharmacist interventions in managing drug-related problems in hospitalized patients with neurological diseases. *International journal of clinical pharmacy*, 40(5), 1257-1264.

14. Duarte, N. C., Barbosa, C. R., Tavares, M. G., Dias, L. P., Souza, R. N., & Moriel, P. (2019). Clinical oncology pharmacist: Effective contribution to patient safety. *Journal of oncology pharmacy practice*, 25(7), 1665-1674.
15. Colombo, L. R. P., Aguiar, P. M., Lima, T. M., & Storpirtis, S. (2017). The effects of pharmacist interventions on adult outpatients with cancer: A systematic review. *Journal of Clinical Pharmacy and Therapeutics*, 42(4), 414-424.
16. Apikoglu-Rabus, S., Yesilyaprak, G., & Izzettin, F. V. (2016). Drug-related problems and pharmacist interventions in a cohort of patients with asthma and chronic obstructive pulmonary disease. *Respiratory medicine*, 120, 109-115.
17. Ashok, K., Mathew, A. A., Thomas, A., Mohan, D., Gopalakrishna, R., & Reghu, R. (2017). Clinical Pharmacist's Interventions on Medication Adherence and Knowledge of Inflammatory Bowel Disease Patients. *Journal of Young Pharmacists*, 9(3), 381.
18. Salgado, T. M., Moles, R., Benrimoi, S. I., & Fernandez-Llimos, F. (2012). Pharmacists' interventions in the management of patients with chronic kidney disease: a systematic review. *Nephrology Dialysis Transplantation*, 27(1), 276-292.
19. American Diabetes Association. (2020). 15. Diabetes Care in the Hospital: Standards of Medical Care in Diabetes—2020. *Diabetes Care*, 43(Supplement 1), S193-S202.
20. Tagawa, M., Ogata, A., & Hamano, T. (2015). Pre-and/or intra-operative prescription of diuretics, but not renin-angiotensin-system inhibitors, is significantly associated with acute kidney injury after non-cardiac surgery: a retrospective cohort study. *PLoS One*, 10(7), e0132507.
21. Ferrandis, R., Llau, J. V., & Mugarra, A. (2009). Perioperative management of antiplatelet-drugs in cardiac surgery. *Current Cardiology Reviews*, 5(2), 125-132.
22. Kuzulugil, D., Papeix, G., Luu, J., & Kerridge, R. K. (2019). Recent advances in diabetes treatments and their perioperative implications. *Current Opinion in Anaesthesiology*, 32(3), 398.
23. Authority. Pennsylvania Patient Safety. "Medication errors with the dosing of insulin: problems across the continuum." *Pa Patient Saf Advis* 7 (2010): 9-17.
24. Bandeali, S. J., Kayani, W. T., Lee, V. V., Elayda, M., Alam, M., Huang, H. D., ... & Virani, S. S. (2013). Association Between Preoperative Diuretic Use and In-hospital Outcomes After Cardiac Surgery. *Cardiovascular therapeutics*, 31(5), 291-297.