

Clinical Role of Pharmacists, To Overcome Medication Errors Related to High Alert Medication, Which Needs High Care from Prescribing to Doses Administration to The Patients

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ABSTRACT

This study gives brief scientific findings on high alert medications, that these types of medicines are very sensitive in sense of usage because of their low therapeutic windows (Zyoud et al., 2019), (Geeson et al., 2020), (Salman et al., 2020). Whether it is scientifically proved that if these medications are used in a little lower dose than their recommended doses, they can't produce therapeutic effects. This scientific study has pursued the 'Descriptive Study' method and carried out at a tertiary care hospital in Karachi, through reviewing patient's medication profiles of those patients which were admitted in different wards including general Pediatric ward, High Dependency Unit (HDU), ICU, total duration for this study was five months.

The study has proved, if the high medication medicine's doses will increase even some instant from the recommended therapeutic doses, it will cause toxic effects, and they will have more chances to produce adverse drug events, and it will definitely be life-threatening to target patients. Also, it has been found that in Pakistani hospitals, these medications are being used in very critical areas of the hospital, like, ICUs, HDUs, CCUs, NICUs. So, it needs to each organization, especially all categories of hospitals either they contain primary, secondary, or tertiary care set-up, essentially, they take initiatives to aware their health care professionals including Physicians, Consultants, Pharmacists, Nursing staff, whoever are involved in prescribing, dispensing, and administering these drugs respectively to the patients to keep control for the harmful events.

Secondly, this study recognizing the clinical role of pharmacists inside the hospitals, it has studied many interventions harmful medications errors which are frequently prescribed on different events in studied hospitals. In this study, 200 patient profiles are evaluated in which 28 high alert medications being find prescribed.

Though the study severely has found that in most cases of using the potassium chloride has also found, that was about 13.5%, which is ultimately a life-threatening event to patients under care.

Thirdly, the study has evaluated, other 15 types of medication errors in the prescribed area, which has seen in the Wrong drug prescriptions as 6%, low dose 9%, high dose 11%. Though 18% of patient's profiles have been observed in which therapeutic drug level was even not monitored, and 6% of wrong units has prescribed! For 10% route of administration hasn't been mentioned, 5% of the profiles in which the route of administration has to find wrongly prescribed. 7% of unnecessary medications, and 10% of those profiles in which high alert medications have to find prescribed with the wrong dilution!

Further, evaluations have found out that improper quantity of Diluent in 5% of profiles prescribed and Duplication of drugs has to find in 3%, Wrong frequency, 5%, and the Wrong Rate of Administration 3%. But no evidence has reported at which level drugs have reached at the patient's end. With all these findings the study strongly emphasizes that these errors can be controlled only with the effective role of pharmacists, who always intervene with these types of medication errors. So, this study proves the role of pharmacists for better usage of High Alert Medications. The study recommends this role of Pharmacists in hospitals especially in Pakistan where mostly High Alert Medication Care Centers are running without proper pharmacy set-up. This study is helpful for medical practitioners, hospital organizations in developing countries to know the importance of clinical pharmacists in the management of High Alert Medications.

Keywords: HIGH ALERT MEDICATION, CLINICAL PHARMACY, ROLE OF PHARMACISTS, MEDICATION ERRORS, DEVELOPING COUNTRIES

Introduction

The high alert medications are the medications that have a lower margin between minimum effective concentration (MEC) and minimum toxic concentration (MTC). Due to a small margin either these drugs may be lost their therapeutic effects when these are prescribed/given at lower doses from the recommended doses or they produce toxic effects / life-threatening events at a little bit high dose from recommended range and may cause the death of the patients.

The High Alert Medications (HAMs) are those medications that may cause significant patient harm when used incorrectly (Zyoud et al., 2019), The drugs may cause life-threatening events even when used intended because high alert medications are the medications that have a lower margin between minimum effective concentration (MEC) and minimum toxic concentration (MTC), these are also known as RED Alert Drugs(Salman et al., 2020),(McGinley, 2009). These may cause either serious toxic effects or life-threatening adverse drug reactions when these will handle improperly (Lo et al., 2013). To handle these medicines physician will be responsible that they have to properly prescribed, the pharmacist has to dispense with double-checking and Nurses are responsible for administration to patients very carefully. (Perini &

Neiva, 2009), (Otero et al., 2014). Due to the small margin between MEC to MTC either these drugs may be lost their therapeutic effect when these are prescribed/given at lower dose from the recommended doses or they produce toxic effects / life-threatening events at a little bit high dose from recommended range and may cause the death of a patient due to toxicity of medication (Grissinger, 2017), (Manias et al., 2014), Or we can say that those medications causing serious injury if they misused. These type of medications are also used in the pediatric set- up also, so its needs to aware all health care professionals to handle high alert medications with highly caring because these can be life-threatening if these will be handled improperly (Bataille et al., 2015), For properly handling these types of medications there is a needs to by developing a list of high alert medication inside the organization and give awareness regarding their prescribing, dispensing, and administering to health professionals i.e. physicians, pharmacist, and staff nurses respectively that is the only best tool to overcome the possible harmful event (Nydert et al., 2020), (Khoo et al., 2013), The awareness should be given to health professionals related to high alert medications through publishing different types of brushes, newsletters, organizing different seminars or continuous medication education presentations, instead of this properly validate the usage of these types of medication through different policies and procedures against hospitals protocols(Tang et al., 2015), (Bataille et al., 2015). High alert medicines may affect all types of patients but it needs to high care especially when given to geriatric and pediatric patients because they can't bear little consequence which relates to a medication error (Tang et al., 2015), (Geeson et al., 2020).

It is observed that most medications produce harmful effects when used improperly but high alert medications cause life-threatening events even when used common and produce serious harmful effects on patient's health (Geeson et al., 2020), (Zyoud et al., 2019). So, the known practice can be help full to reduce the potential harms related to High Alert Medications. The goals of prescribing are to eliminate harm to the patients from the use of high alert medications, to develop standardized medications practices to handle high alert medications, and to monitor and continually improve the delivery process of high alert medications (Arvais et al., 2015). The principles to manage the high alert medication are to remove the possibility of errors, to make Errors Visible, and to Decrease the consequences of errors (Chanakit et al., 2013), (Karaoui et al., 2019).

Categories of high alert medications

The high alert medications are categorized in different ways is dependent on internal organizational policies followed by international protocols, the list is mentioned in Table. 1 that is approved in that hospital (where this study has been conducted).

Table 1: Categories Of high alert medications

| Adrenergic agonists IV (Inotropic) | Adrenergic Antagonist IV | Anesthetic Agents / Pain Management |
|---|--|---|
| 1. Epinephrine 2. Phenylephrine 3. Digoxin 4. Norepinephrine 5. Dopamine 6. Dobutamine 7. Isoproterenol | 1. Propranolol 2. Metoprolol 3. Labetalol 4. Esmolol | 1. Ketamine 2. Propofol 3. Bupivacaine |
| Antiarrhythmics IV | Antithrombotic Agents | Concentrated Electrolytes |
| 1. Lidocaine 2. Amiodarone 3. Adenosine 4. Procainamide | 1. Warfarin 2. Enoxaparin(clexane) 3. Actilyse 4. Heparin 5. Tenecteplase 6. Fondaparinux | 1. Sodium Chloride Infusion >0.9% 2. Potassium Chloride (equal to or greater than 2 meq/ml) 3. Calcium Gluconate 4. Sodium Bicarbonate 5. Calcium Chloride 10% |
| Neuromuscular Blocking Agents | Controlled Medications | Narcotics Medications |
| 1. Succinylcholine 2. Atracurium 3. Pancronium 4. Cisatracurium 5. Rocuronium | 1. Midazolam 2. Diazepam 3. Zolpigen 4. Clonazepam 5. Alprazolam 6. Bromazepam | 1. Morphine 2. Fentanyl 3. Pethidine 4. Tramadol |
| Miscellaneous | | |
| 1. Dextrose, Hypertonic,20% or greater 2. Nitroprusside sodium 3. Insulin 4. Promethazine 5. Ephedrine 6. Methotrexate | | |

Materials and methods

Method

This descriptive study that was carried out at a tertiary care hospital in Karachi, through reviewing patient’s medication profiles of those patients which were admitted in different wards like general Pediatric ward, High Dependency Unit (HDU), ICU, during 5 months and matched with organizational as well as international protocols.

Measuring tools

In this study, three tools are used to measuring the data, A. Patients' medication charts evaluated B. verifications of correct doses, indications, and other parameters of given medications against standard recommended books like British national formulary, laxi-comp handbook of education and pharma-guide.

Data collection and analysis

The data collection strategy was notified, intervene patients' profiles from the desk of the pharmacist, and verified recommended books like British national formulary, Lexicomp handbook of medication (latest edition), and also, verification of prescription of the 200 patients who were hospitalized in The Hospital The framework of the study was used to identify the problems related to the study and we performed a secondary analysis of the available information.

Duration of study

This evaluation-based study whose data carried out at different wards like general Pediatric ward, High Dependency Unit (HDU), ICU 50 beds, during 5 months (June 2020 – Oct. 2020)

Results

Through this study total of 200 patient profiles were evaluated in which following high alert medications prescribed, and it is observed that mostly potassium chloride was prescribed which is 27 from a total of (n) 200 patient's profiles.

Table 2: High Alert Medications Prescribed

| S. No. | Drug Prescribed | N | % | % cumulative |
|--------|--------------------|----|------|--------------|
| 1 | Epinephrine | 13 | 6.5 | 6.5 |
| 2 | Phenyepinephrine | 3 | 1.5 | 1.5 |
| 3 | Digoxin | 17 | 8.5 | 8.5 |
| 4 | Norepinephrine | 9 | 5.5 | 5.5 |
| 5 | Dopamine | 8 | 4.0 | 4.0 |
| 6 | Dobutamine | 7 | 3.5 | 3.5 |
| 7 | Labetalol | 6 | 3.0 | 3.0 |
| 8 | Warfarin | 7 | 3.5 | 3.5 |
| 9 | Enoxaparin | 3 | 1.5 | 1.5 |
| 10 | Heparin | 7 | 3.5 | 3.5 |
| 11 | Sodium Chloride | 9 | 4.5 | 4.5 |
| 12 | Potassium Chloride | 27 | 13.5 | 13.5 |
| 13 | Calcium Gluconate | 7 | 3.5 | 3.5 |
| 14 | Sodium Bicarbonate | 5 | 2.5 | 2.5 |
| 15 | Calcium Chloride | 5 | 2.5 | 2.5 |
| 16 | Ketamine | 7 | 3.5 | 3.5 |
| 17 | Propofol | 3 | 1.5 | 1.5 |
| 18 | Bupivacaine | 5 | 2.5 | 2.5 |
| 19 | Lidocaine | 7 | 3.5 | 3.5 |
| 20 | Amiodarone | 3 | 1.5 | 1.5 |

| | | | | |
|----|-----------------|-----|-----|-----|
| 21 | Adenosine | 2 | 1.0 | 1.0 |
| 22 | Procainamide | 1 | 0.5 | 0.5 |
| 23 | Succinylcholine | 5 | 2.5 | 2.5 |
| 24 | Atracuram | 7 | 3.5 | 3.5 |
| 25 | Nitroprusside | 11 | 5.5 | 5.5 |
| 26 | Insulin | 9 | 4.5 | 4.5 |
| 27 | Ephedrine | 4 | 2.0 | 2.0 |
| 28 | Methriaxate | 3 | 1.5 | 1.5 |
| | Total | 200 | | |

Through this study, it is evaluated that there are multiple medication errors observed in the following areas as shown in table 3 below.

Table 3: Percentage Of medication Errors Observed

| Medication Errors | From the total of 200 patient' medication charts/Profiles |
|-------------------------------------|---|
| Wrong drug to inappropriate patient | 6 % |
| Lower Dose | 9 % |
| High Dose | 11 % |
| Therapeutic Drug Not monitored | 18 % |
| Wrong Unit Prescribed | 6 % |
| No Unit mentioned | 2 % |
| Without route of administration | 9 % |
| Wrong route of administration | 5 % |
| Unnecessary medication prescribed | 7 % |
| The wrong Dilution prescribed | 10 % |
| Improper quantity of diluents | 5 % |
| Duplication of Drugs prescribed | 3 % |
| Wrong frequency of drugs prescribed | 5 % |
| Wrong rate of administration | 3 % |

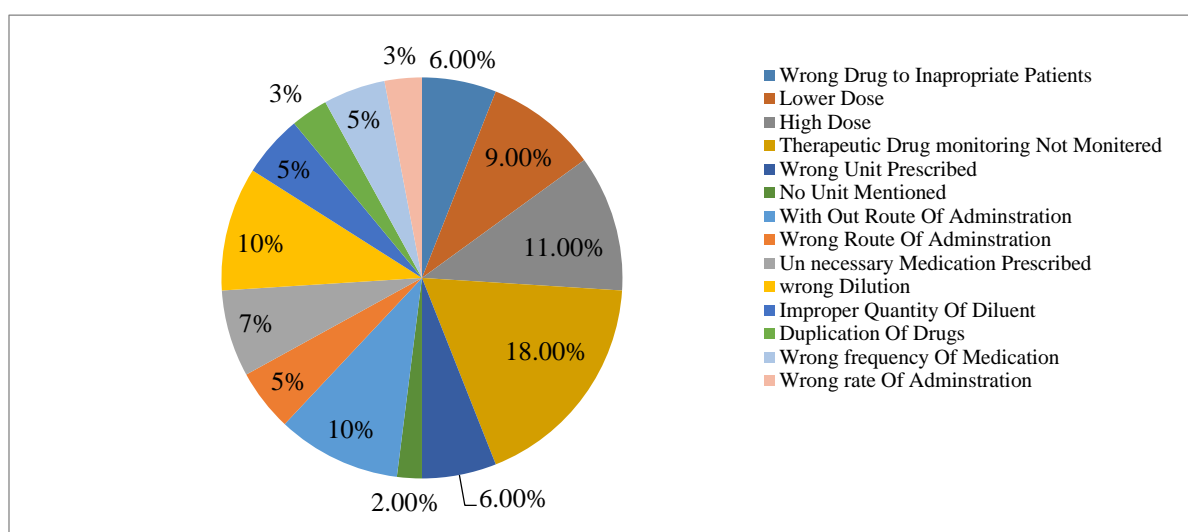


Figure 1: High Alert Medications Which Frequently Involve in Harmful Medication Errors

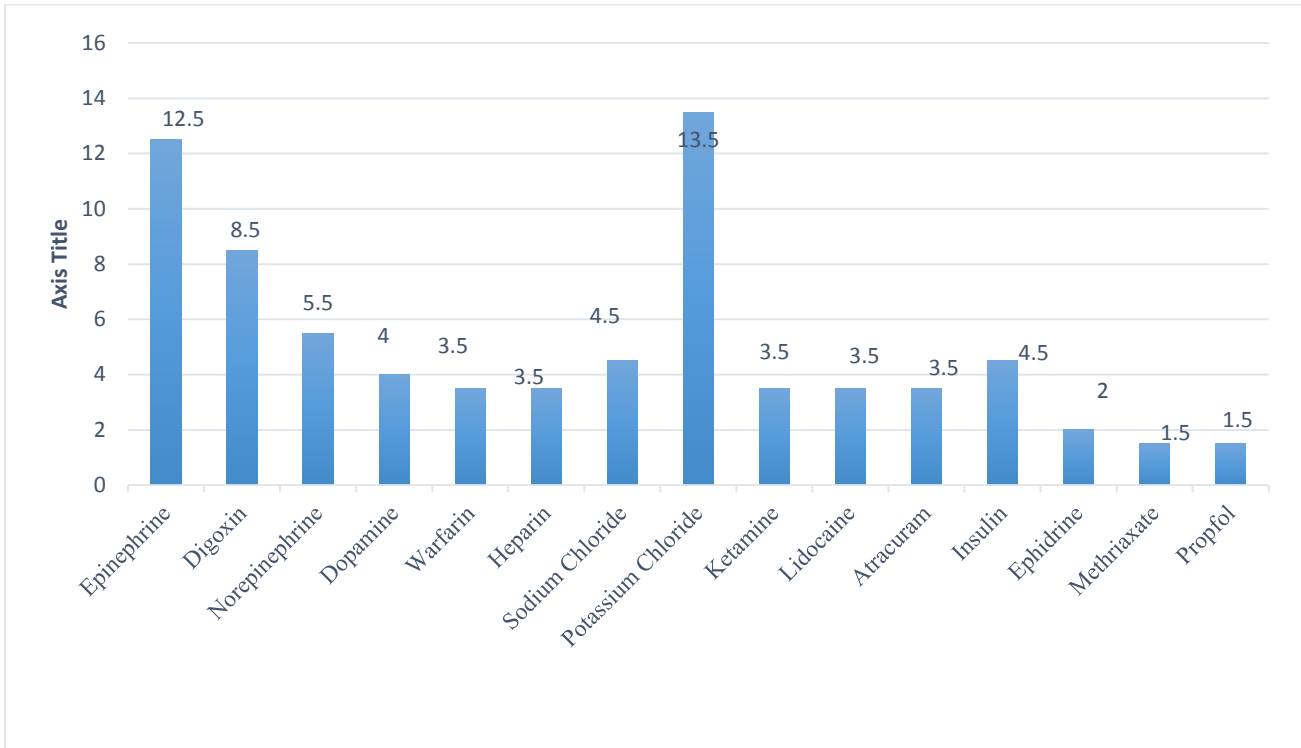


Figure 2: High Alert Medications Which Frequently Involve in Harmful Medication Errors

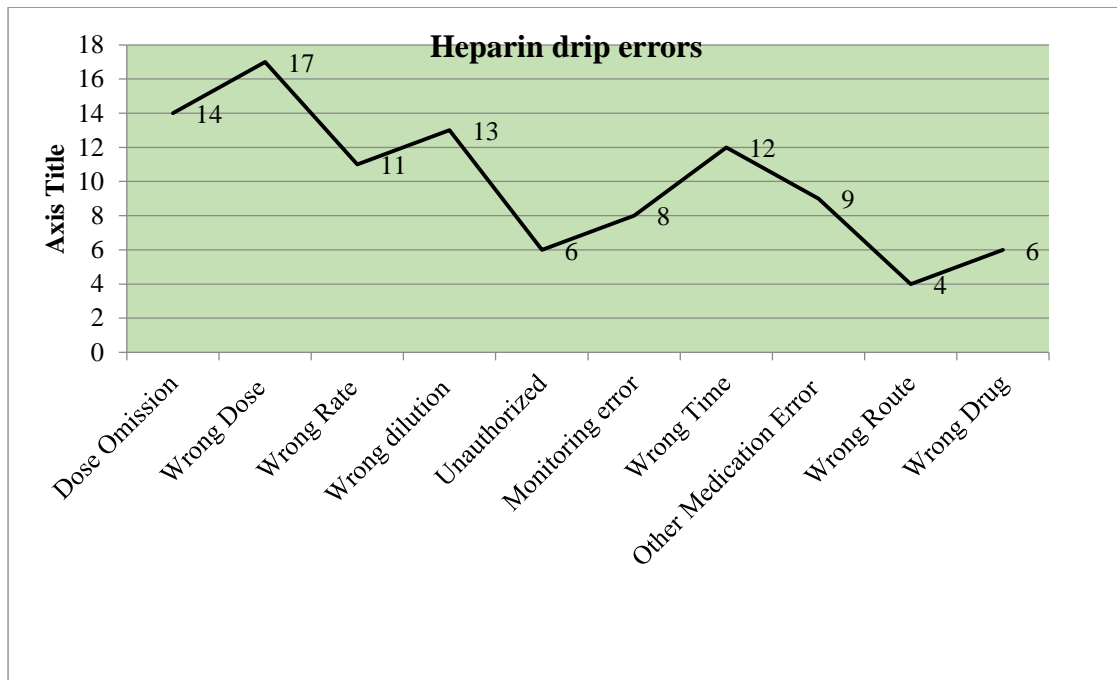


Figure 3: HEPARIN DRIP ERRORS This figure is showing a graph of medications involved in harmful events

Results

Overall, 200 Patients profiles were overviewed in which 28 different drugs were involved from 10 classes of drugs which considered as HIGH ALERT DRUGS according to hospital pharmacy, from which potassium chloride mostly involved i.e. 13.5%, through this study it is evaluated that, 15 types of medication errors were involved like Wrong drug prescribed 6%, low dose 9%, high dose 11%, 18% of patients profiles were observed in which therapeutic drug level not monitored, and 6% of wrong units prescribed, 10% in which route of administration not mentioned, 5% of profiles in which route of administration wrongly prescribed, 7% of unnecessary medications, and 10% of that profiles in which high alert medications prescribed with the wrong dilution. Further, it was evaluated that profiles in which improper quantity of diluent prescribed that was 5% and duplication of drugs 3%, wrong freq. 5%, and the wrong rate of administration 3%. Through this study, it is also evaluated that mostly harmful events occurred which were captured before administration of drugs in which mostly potassium chloride, ephedrine, and epinephrine digoxin were wrongly prescribed i.e. 13.5%, 2%, 12.5%, 8.5% (out of 200 patients profiles). And related to ephedrine it is evaluated that it was prescribed at the wrong dose i.e., 17 times out of total no of prescriptions.

Conclusion

It is concluded from this study all HIGH ALERT MEDICATIONS must be controlled under qualified health care professional (i.e., pharmacist, trained Nurse), and must be dispatched with double-check as well as monitored only by trained pharmacists because these types of drugs are frequently used at intensive care units like, HDU, ICU which may cause life-threatening events to patients. These should use properly and monitored accurately, as they must not cause further damage by incorrectly using them. This also noted that all the high alert drugs are under control by the on-duty pharmacist at the study site so that's why no any harmful event occurs at the study site, so this is quite clear evidence that this is only the way by which patients can be saved from life-threatening events.

Through this study, it is also found that the pharmacist can play important role in the management of medication therapy especially in high alert medication which has seen very effective, it is most protective about wrong prescribing errors for the patients from any possible life-threatening events.

Discussion

The study is conducted to evaluate the wrong prescribing trends of medication which belong to a narrow therapeutic window. i.e. high alert medications and aims to identify medication errors which might be possible in different areas where the medications are used, and this study emphasized the role of the pharmacist to ensure that every medication has to be safely given to patients especially these kinds of medications i.e. high alert medications which are very sensitive in this sense that if these medications will be given in low therapeutic dose these will not produce their effects or in case of little variation (above the therapeutic dose) that will produce toxic effects, because of the narrow therapeutic window.

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