EDITORIAL

Medication Prescription Errors in Intensive Care Unit: An Avoidable Menace

Deven Juneja[1], Anjali Mishra[2]

Keywords: Incidence, Intensive care unit, Medication nonadherence.
Indian Journal of Critical Care Medicine (2022): 10.5005/jp-journals-10071-24215

The National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) has defined medication error (ME) as "any preventable event that may cause or lead to inappropriate medication use or patient harm, while the medication is in the control of the healthcare professional, patient, or consumer."[1] These errors are fairly common and as per the estimates from the United States of America, approximately 400,000 people die prematurely, on an annual basis, because of preventable MEs occurring during their hospitalization.[2] Medication prescription errors (MPEs) may occur more frequently in acute care settings including emergency rooms, operation theatres, and intensive care units (ICUs), where high levels of acuity is required.

The process of medication involves prescription; transcription; and preparing, dispensing, and administering a drug.[3] The spectrum of these errors is broad and may be related to an incorrect prescription, spelling errors, illegible handwriting, wrong abbreviations, poor comprehension of the drug orders by the administering staff, lack of daily drug chart review by the doctors, wrong labeling or reconstitution of the drugs, inaccurate dosing, frequency or route of administration, and wrong combination of drugs.[4] Patients in ICU are particularly more vulnerable to prescription errors as they are prescribed twice as many drugs as those in the wards. The other factors that directly cause a higher incidence of errors in ICU include frequent occurrence of organ dysfunctions with deranged kidney and liver functions and altered pharmacokinetics and pharmacodynamics of drugs. The reported prevalence of the errors in the intensive areas has ranged from 1.2 to 947 errors per 1,000 patient days.[5] MEs are particularly hazardous in critically ill patients, and they are two to three times more likely to be harmed and 2.5 times more likely to die, as compared to non-ICU patients.[6,7]

In ICU patients, MEs are second only to catheter- and line-related events. The risk factors associated with increased MEs may be classified as patient related (severity of illness, need for sedation, and mechanical ventilation), provider related (working hours, psychological state, inexperience and sleep deprivation), and ICU organization and environment related (nurse-to-patient ratio, inadequate supervision, premature and nighttime discharge, type of ICU, number of medications, and frequent dose changes).[8] Type of ICUs and medications can both affect the risk of MEs. Medical ICUs have been shown to be associated with higher MEs as compared to surgical ICUs even with similar number of medications being prescribed in both types of ICUs.[9] The commonly implicated medications associated with MEs include antibiotics, analgesics, anticoagulants, and cardiovascular drugs. However, there is variability in the groups of drugs from different parts of the world, which may be attributed to the geographical factors, comorbidities of the patients, type of cases admitted, and the severity quotient of the illnesses.[10,11] Nonetheless, there is a dearth of data from the Indian subcontinent.

In this issue of Indian Journal of Critical Care Medicine (IJCCM), Kumar and colleagues published a prospective study on MPEs in ICU and reported a prescription error rate of 10.7% (95% confidence interval, CI 10.3–11.1).[12] There were 2,624 prescription errors out of a total of 24,572 medication orders. When analyzed for severity, 1,757 (7.15%) were nonsevere MPEs which did not cause any patient harm. However, 867 (3.52%) were severe MPEs requiring interventions and/or resulting in patient harm. Seventy percent of the severe MPEs occurred in the antibiotic group, which accounted for 2.8% of the total errors, whereas, in the category of nonsevere errors, the classes of drugs most commonly implicated in MEs were general care medicines (multivitamins) and nutrition (5.6%) followed by antibiotics (0.4%), cardiovascular (0.3%), and antihypertensives (0.2%).[12] It may be collated that MPEs related to antibiotics are more likely to result in patient harm as compared to MPEs related to other drugs. Interestingly, out of 138 ICU patients included in the study, 129 (92.8%) had one or more MPEs during their ICU stay. This may further emphasize the fact that MEs are exceedingly common among ICU patients. The study also found a direct positive correlation between high creatinine and international normalized ratio (INR) values with high MPEs.[12]

Even though it gives a good insight of prevailing MPEs in the Indian ICUs, this paper has some shortcomings. It is a single-center study, and hence, the results may lack generalizability. In addition, the authors did not include medications given as continuous

[1]Institute of Critical Care Medicine, Max Super Speciality Hospital, New Delhi, India
[2]Department of Critical Care Medicine, Holy Family Hospital, New Delhi, India
Corresponding Author: Deven Juneja, Institute of Critical Care Medicine, Max Super Speciality Hospital, New Delhi, India, Phone: +91 9818290380, e-mail: devenjuneja@gmail.com

How to cite this article: Juneja D, Mishra A. Medication Prescription Errors in Intensive Care Unit: An Avoidable Menace. Indian J Crit Care Med 2022;26(5):541–542.
Source of support: Nil
Conflict of interest: None

infusion, like insulin, and inotropic and vasopressor agents, and hence might have missed the impact of MEs on important cardiovascular drugs.[12]

Intensive care units have a complex and dynamic environment requiring coordination and harmony between several healthcare workers and components. This makes ICU environment prone to failures in healthcare processes which occur frequently but are difficult to detect. Furthermore, these may go unreported because of fear of shame or punishment. However, these failures carry high repeatability and may cause severe harm to patients affecting their clinical outcomes.[13] MEs are not only a threat to the patient safety but also a financial burden on the patient and the institution. Hence, a conscious effort and an integrative approach to prevent and decrease the incidence of these errors is mandatory.

Even though most of the MEs are preventable, they are difficult to reduce. The clinical practice guidelines on safe medication use in ICU recommends educating healthcare workers; implementing computerized physician order entry system (COPE)/clinical decision support systems (CDSS); conducting independent double checks during drug dispensing; and using computerized drug dosing software, ICU protocols, robotic or automated drug dispensing systems, medication labeling practices for "sound alike look alike drugs" (SALAD), barcode medication administration, and safe medication concentration practices to reduce the incidence of MEs.[14] Several other practices may also be helpful in reducing MEs, and these include improving nurse/patient ratio, participation of clinical pharmacist on rounds, use of standardized protocols, and judicious dosage adjustments in patients with renal and liver dysfunction. A recent Cochrane meta-analysis including 65 studies involving 110,875 participants reported that only a few interventions like medication reconciliation, CPOE/CDSS, barcoding, feedback, and dispensing systems in surgical wards were able to significantly reduce MEs, but the role of other interventions remain indeterminate due to lack of evidence.[15]

Like in many other facets of health care, artificial intelligence (AI)-based systems may hold the future of reducing MEs in hospitalized patients. AI-based CDSS may aid in ensuring delivery of correct drug, in correct doses to the correct patient. It may also help in improving the accuracy and reliability of prescription checks and detection of MEs. AI may be effective in not only significantly reducing MEs but also improving patient safety and satisfaction.[16] However, it may be a challenge to implement these strategies and interventions in low resource settings.

Presently, most of the data pertaining to incidence, risk factors, prevention, and impact of MEs have originated from high-resource countries.[15] Extrapolation of these findings to our healthcare settings is difficult as we have our own unique way of prescribing and administering medications. The use of CPOE/CDSS, barcodes, and automated/robotic dispensing system, which are generally recommended, remains a distant dream in many of our centers. Even the present study used the paper-based method of drug prescription, which still remains the method of choice in most of the resource-limited countries.[12] Hence, there remains a continued need for further prospective multicenter randomized controlled trials for addressing the existing evidence gaps and to collate evidence pertinent to our settings to improve our patient outcomes and make our ICUs safer.

Orcid

Deven Juneja https://orcid.org/0000-0002-8841-5678
Anjali Mishra https://orcid.org/0000-0003-1492-3220

References

1. NCCMERP. The national coordinating council for medication error reporting and prevention. Medication errors—definition. Available at: https://www.nccmerp.org/about-medication-errors [Accessed on March 26, 2022].
2. James JT. A new, evidence-based estimate of patient harms associated with hospital care. J Patient Saf 2013;9(3):122–128. DOI: 10.1097/PTS.0b013e3182948a69.
3. Hussain E, Kao E. Medication safety and transfusion errors in the ICU and beyond. Crit Care Clin 2005;21(1):91–110. DOI: 10.1016/j.ccc.2004.08.003.
4. Laher AE, Enyuma CO, Gerber L, Buchanan S, Adam A, Richards GA. Medication errors at a tertiary hospital intensive care unit. Cureus 2021;13(12):e20374. DOI: 10.7759/cureus.20374.
5. Kane-Gill S, Weber RJ. Principles and practices of medication safety in the ICU. Crit Care Clin 2006;22(2):273–290. DOI: 10.1016/j.ccc.2006.02.005.
6. Latif A, Rawat N, Pustavoitau A, Pronovost PJ, Pham JC. National study on the distribution, causes, and consequences of voluntarily reported medication errors between the ICU and non-ICU settings. Crit Care Med 2013;41:389–398. DOI: 10.1097/CCM.0b013e318274156a.
7. Kane-Gill SL, Kowiatek JG, Weber RJ. A comparison of voluntarily reported medication errors in intensive care and general care units. Qual Saf Health Care 2010;19(1):55–59. DOI: 10.1136/qshc.2008.027961.
8. Valentin A, Capuzzo M, Guidet B, Moreno RP, Dolanski L, Bauer P, et al. Patient safety in intensive care: results from the multinational Sentinel Events Evaluation (SEE) study. Intensive Care Med 2006;32(10):1591–1598. DOI: 10.1007/s00134-006-0290-7.
9. Sinopoli DJ, Needham DM, Thompson DA, Holzmueller CG, Dorman T, Lubomski LH, et al. Intensive care unit safety incidents for medical versus surgical patients: a prospective multicenter study. J Crit Care 2007;22(3):177–183. DOI: 10.1016/j.jcrc.2006.11.002.
10. Landrigan CP, Rothschild JM, Cronin JW, Kaushal R, Burdick E, Katz JT, et al. Effect of reducing interns' work hours on serious medical errors in intensive care units. N Engl J Med 2004;351(18):1838–1848. DOI: 10.1056/NEJMoa041406.
11. Agalu A, Ayele Y, Bedada W, Woldie M. Medication prescribing errors in the intensive care unit of Jimma University Specialized Hospital, Southwest Ethiopia. J Multidiscip Healthc 2011;4:377–382. DOI: 10.2147/JMDH.S24671.
12. Kumar M, Sahni N, Shafiq N, Yaddanapudi L. Medication prescription errors in the intensive care unit: prospective observational study. Indian J Crit Care Med 2021. DOI: 10.5005/jp-journals-10071-24148.
13. Homauni A, Zargar Balaye Jame S, Hazrati E, Markazi-Moghaddam N. Intensive care unit risk assessment: a systematic review. Iran J Public Health 2020;49(8):1422–1431. DOI: 10.18502/ijph.v49i8.3865.
14. Kane-Gill SL, Dasta JF, Buckley MS, Devabhakthuni S, Liu M, Cohen H, et al. Clinical practice guideline: safe medication use in the ICU. Crit Care Med 2017;45(9):e877–e915. DOI: 10.1097/CCM.0000000000002533.
15. Ciapponi A, Fernandez Nievas SE, Seijo M, Rodríguez MB, Vietto V, García-Perdomo HA, et al. Reducing medication errors for adults in hospital settings. Cochrane Database Syst Rev 2021;11(11):CD009985. DOI: 10.1002/14651858.CD009985.pub2.
16. Segal G, Segev A, Brom A, Lifshitz Y, Wasserstrum Y, Zimlichman E. Reducing drug prescription errors and adverse drug events by application of a probabilistic, machine-learning based clinical decision support system in an inpatient setting. J Am Med Inform Assoc 2019;26(12):1560–1565. DOI: 10.1093/jamia/ocz135.