Original Article

An interventional study on intensive care unit drug therapy assessment in a rural district hospital in India

Abstract

Background: Intensive care unit is a potential area for drug-related problems. As many of the patients treated are complex patients, clinical pharmacy intervention could find drug therapy problems.

Materials and Methods: Drug information liaisons daily attended ward rounds with intensivists and screened the patient for drug therapy assessment using the American Society for Health-System Pharmacists clinical skills competition DTA format. This was a prospective study done for 6 months from August 2012 to January 2013. Simple statistics were used to tabulate the drug-related problems assessed.

Results: A total of 72 patients were screened for drug therapy problems, for which 947 drug doses were prescribed in the study period. The total number of prescriptions was 148. The average number of drugs per prescription was 6.39 and the average number of drugs per patient was 13.15. A total of 243 problems were identified; on an average, 1.67 problems were present per prescription. The total number of drug interactions identified was *N* = 192 (78.2%); majority of them (61.4%) were of type C (not serious). So, 55.73% of them were monitored and not stopped or substituted. The second type of problem was a correlation between drug therapy and medical problem (7.4%). Appropriate drug selection and drug regimen was the third problem, and the adverse drug reactions and therapeutic duplications accounted for approximately 2% of the drug-related problems identified.

Conclusion: Drug interactions constituted the major problem of ICUs, but not many were serious or significant. Consensus in assessment of drug-related problems and convincing intensivists with good quality evidences are required for better acceptance of interventions.

Key words:
Clinical pharmacy interventions, drug therapy assessment, intensive care unit, ward round

Introduction

Many of the patients admitted in the intensive care unit (ICU) are complex patients. It is difficult to define a complex patient, yet it is generally understood that the term applies to those who require an extra amount of care and consideration as a consequence of complicated and extensive medicine regimes compounded by physical and mental limitations. International Pharmaceutical Federation World Congress 2013 had adopted the theme, "connecting to complex patients pharmacists take the lead."[1]

The medication therapy review is a systematic process of collecting patient-specific information, assessing medication therapies to identify medication-related problems, developing a prioritized list of medication-related problems, and creating a plan to resolve them.[2] As pharmacy practice continues to evolve with a greater focus on medication therapy management (MTM), it becomes more important for patients in intensive care.[3,4] In this article, we use a complimentary term "drug therapy assessment" (DTA) instead of MTM.

Pharmacists with clinical pharmacy specialization and Pharm. D are well trained, yet often underutilized. It is

Access this article online	
Website: www.jbclinpharm.org	Quick Response Code
DOI: 10.4103/0976-0105.118801	

Priyanka Tejashwani Pichala, Bharani Mukkillapati Kumar, Seeba Zachariah, Dixon Thomas, Laura Saunchez[1], Alvarez-Uria Gerardo[2]

Department of Pharmacy Practice, Raghavendra Institute of Pharmaceutical Education and Research, [1]Intensive Care Unit, Rural Development Trust Hospital, [2]Department of Infectious Diseases, Rural Development Trust Hospital, Bathalapalli, Anantapur, Andhra Pradesh, India

Address for correspondence:
Prof. Dixon Thomas,
HOD, Pharmacy Practice, Raghavendra Institute of Pharmaceutical Education and Research, Anantapuramu, AP, India.
E-mail: dixon.thomas@gmail.com

important for the healthcare providers to work as a team to reach better medication therapy outcomes for patients. In addition, pharmacists can serve as a resource to other healthcare providers and payers to assure safe, appropriate, and cost-effective medication use.[5]

Critically ill patients generally need high usage of antibiotics; it is challenging to use them safely with a control on adverse drug reactions (ADRs) and drug interactions (DIs).[6] In an ICU, physicians perceive clinical pharmacy services as valuable. Fundamental services are viewed more favorably than desirable or optimal services, possibly because they are provided more frequently or are required for safe patient care.[7] Clinical pharmacy interventions could also decrease the cost of treatment in the ICUs.[8] Average number of interventions is also usually high in ICUs.[9] DIs are one of the highest occurring drug-related problems in the ICUs and the intensivists give lesser priority to its significance compared to pharmacists.[10] Medication errors shall be a potential reason for drug related problems.[11]

Materials and Methods

This was a prospective interventional study. The study was carried out for a period of 6 months from August 2012 to January 2013 in a multidisciplinary ICU of RDT hospital, Bathalapalli, Andhra Pradesh, India. All the patients admitted in the ICU were included in the study. During the study period, the drug information liaisons participating in the ward rounds along with medical team reviewed the patients' case sheets and identified the problems in consultation with the staff. A self-designed patient profile form has been used to collect the data. Various aspects were monitored according to American Society for Health-System Pharmacists DTA worksheet (for clinical skills competition),[12] and attention of the intensivists to the interventions was called for the problems identified.

Results

Study population

The study was carried out for a period of 6 months in the ICU. A total of 72 patients were screened for drug therapy problems. Out of these 72 patients, males were 59.7% (n = 43) and females were 40.3% (n = 29).

Based on their age, the total 72 patients were classified into seven different age groups and are presented in Table 1.

Out of the total 72 patients, 43 were referred by the Department of General Medicine, 20 by the Department of Surgery, 5 by the Department of Obstetrics and Gynecology, and 4 were referred by the Department of Pediatrics.

A total of 947 drug doses were prescribed to 72 patients in the study period. The total number of prescriptions was 148. The average number of drugs per prescription was 6.39 and the average number of drugs per patient was 13.15. The drug utilization pattern for the patients in the ICU is presented in Table 2.

Among the total 947 drugs prescribed for the patients in the ICU, antibiotics occupied a major portion. They alone accounted for 20.27% (n = 192) of the total drugs prescribed. The average number of antibiotics per prescription was found to be 1.29 and the average number of antibiotics per patient was found to be 2.66. Various classes of antibiotics have been prescribed for the patients. They are listed in Table 3.

Table 1: Age groups of the study population

Age group (years)	Number of patients
1-10	4
11-20	11
21-30	10
31-40	14
41-50	16
51-60	13
61-70	4

Table 2: Drug utilization pattern

Drug prescribed	Number (n)	Percentage
Antibiotics	192	20.27
Noradrenaline	14	1.47
Midazolam	32	3.37
Ipratropium nebs	13	1.37
Salbutamol nebs	30	3.16
Heparin	12	1.26
Morphine	21	2.21
NSAIDs	76	8.02
Statins	4	0.42
Dopamine and dobutamine	32	3.37
H2 receptor antagonists	65	6.86
PPIs	28	2.95
Miscellaneous	153	16.15
Steroids	32	3.37
Fentanyl	14	1.47
Antiepileptics	44	4.64
Antihypertensives	65	6.83
Levitiracetam	4	0.42
Glycopyrrolate	12	1.26

NSAIDs: Non-steroidal anti-inflammatory drugs

Table 3: Various classes of antibiotics prescribed in the ICU

Antibiotic prescribed	Number (n)	Percentage
Cephalosporins	68	35.41
Aminoglycosides	33	17.18
Metronidazole	27	14.06
Penicillins	19	9.89
Clindamycin	17	8.85
Chloramphenicol	6	3.12
Vancomycin	5	2.6
Doxycycline	5	2.6
Levofloxacin	3	1.56
Azithromycin	3	1.56
Collistin	11	5.72

ICU: Intensive care unit

Drug therapy assessment

DTA was done for all the cases in the ICU. A total number of 243 problems were identified in the 148 prescriptions of 72 patients. On an average, 1.67 problems were present per prescription. Among the 243 problems identified, 56.79% (n = 138 in 43 males; 3.2 times) were present in male patients and 43.20% (n = 105 in 29 females; 3.6 times) in female patients. There were no significant differences between male and female patients in the occurrence of drug therapy problems. Eight different aspects have been analyzed related to medications and the problems are categorized as shown in Table 4.

Out of the total problems identified by DTA, DIs accounted for a major part. Total number of DIs identified was N = 192 (78.2%). Based on their severity level, the DIs have been classified into four different categories and are presented in Table 5.

The effects of the DIs were varied, and they affected various organ systems such as central nervous system, cardiovascular system, excretory system, digestive system, etc., [Table 6].

Interventions in DIs

After identifying the DIs in the prescriptions, various interventions were made such as substituting the drug, stopping or avoiding or adjusting the dose, and monitoring of DI effects. The interventions made for the DIs are shown in Table 7.

A distant second drug therapy problem was the correlation between drug therapy and medical problem (7.4%) wherein there was a medication without indication or an untreated indication. Appropriate drug selection and drug regimen was the third commonest problem, accounting for approximately 5% of all the problems identified. The ADRs and therapeutic duplications accounted for approximately 2% of the drug-related problems identified.

Only 47% of the interventions were accepted by the medical team.

Discussion

Patients in the ICU need high number of medicines and, thus, the drug assessment. This may be due to the fact that most of the patients in the ICU are seriously/terminally ill and/or have multiple concomitant diseases.

From the DTA, it was found that DIs accounted for the lion's share (78.6%) of the drug-related problems identified. This was complimentary to a study from Australia which claims a high number of drug-drug interactions (DDIs). The majority of DDIs were categorized as type C severity level. "Substitution" was recommended in 34 cases of clinically significant DDIs, "dosage adjustment" in 17 (4.2%) cases, and "stop or avoid" in 13 (3.2%) cases.[13] A study from USA claims that a total conservative estimate of cost savings associated with clinical pharmacy interventions in preventing ADRs amounted to $565,664. Future studies are needed in this direction, as ADRs could also happen with DDIs.[14] There was no incidence of failure to receive therapy; this can be attributed to the fact that especially for the ICU patients, the drugs were not charged as it was a charity hospital (which eliminates the

Table 4: Problems identified by drug therapy assessment

Drug therapy assessment	No. of problems	Percentage of problems
Correlation between drug therapy and medical problem	18	7.4
Appropriate drug selection	10	4.11
Drug regimen	12	4.93
Therapeutic duplication	6	2.46
Drug allergy or intolerance	0	0
Drug interactions	192	78.6
Adverse drug reactions	5	2.05
Failure to receive therapy	0	0

Table 5: Classification of drug interactions based on severity level

Severity	Description	Number	Percentage
Type A	The interactions were found to be life threatening	0	0
Type B	Required medical intervention to minimize or prevent serious adverse effect	32	16.6
Type C	Resulted in exacerbation of the patient's condition and/or required an alteration in therapy	118	61.4
Type D	Did not require a major alteration in therapy	42	21.8

Table 6: Effects of drug interactions

Effect of drug interaction	Drugs involved	Percentage
Nephrotoxicity	Cephalosporins and aminoglycosides	13.3
	Cephalosporins and other drugs	6.97
	Aminoglycosides	7.55
	Antihypertensives	5.8
CNS and respiratory depression	Midazolam and morphine	12.2
	Antiepileptics	9.7
Hypotension	Antihypertensives	10.46
CNS and respiratory depression, seizure risk	Opioid analgesics	15.11
Liver toxicity	Others	5.8
Bleeding disorders	Anticoagulants	5.81
GI bleeding disorders	Others	2.78

CNS: Central Nervous System, GI: Gastrointestinal

Table 7: Interventions made for drug interactions

Interventions	Number	Percentage
Substitution	22	11.46
Stop/avoid/dose adjustment	39	20.31
Monitoring	107	55.73
No interventions	24	12.5

financial aspect) and all the medicines are administered by the nurses (which eliminates the patient adherence problems).

Drug–DIs was the most common drug-related problem identified, and this is mainly due to the large number of drugs prescribed per patient. It was not needed to stop a drug to avoid DIs because in most of the cases, that specific drug was absolutely necessary for that particular patient and the benefits of drug therapy outweighed the risk posed by the DI. When evaluating DIs, one primary concern was the clinical significance or level of severity of the interaction. Even though a large number of DIs were identified in this study, only a few were clinically significant (approx. 20%) and most required monitoring the patients (55%). Various interventions were made for DIs, such as substituting the drug, stopping or avoiding or adjusting the dose, and monitoring of DI effects.

Acceptance of interventions was moderate. This can be attributed to the fact that most of the interventions made were already put in practice in the ICU. Most of the interventions were to monitor patient parameters such as renal function, liver function, electrolyte levels, monitoring for CNS and respiratory depression; however, such things were routinely carried out in the ICU even before the commencement of this study. But some of the international studies show higher level of acceptance of interventions (all above 95%).[13,15]

However, this study points out that there is a significant number of drug-related problems occurring in the ICUs and the presence of a pharmacist in the healthcare team in the ICU can make a vital contribution, both in terms of increasing efficacy and decreasing adverse events and other drug-related problems. There are various studies that have demonstrated the significant impact of clinical pharmacist interventions on the cost of the drug therapy. So, presence of a clinical pharmacist in the ICU is beneficial for the patient, healthcare team, and the institution.[16] Future studies and standardization of practice are required to establish delivery of better services by clinical pharmacists in the intensive clinical team work.[17,18]

Conclusion

Patients in the ICU are considered as complex patients, have high number of drug therapy problems, and are in need of clinical pharmacy services. Four-fifths of drug-related problems identified were DIs. However, there was no life-threatening DI; most of them were moderate or minor DIs that required only dosage adjustments and monitoring of patient parameters. Other drug-related problems identified were problems in drug regimen, therapeutic duplication, and ADRs. Adherence was not a problem as patients had no significant role in administration of drugs. It has been proven that the participation of well-trained pharmacists on ward rounds can aid in identifying and preventing drug-related problems. The physician, pharmacists, and nurses should be more vigilant toward potential drug-related problems among patients, especially those admitted to critical care.

References

1. FIP. IPA CPD E-Times. Available from: https://sites.google.com/site/cpdetimes/home/e [Last accessed on 2013 Jul 25].
2. American Pharmacists Association. Medication Therapy Management Services | American Pharmacists Association. Available from: http://www.pharmacist.com/medication-therapy-management-services [Last accessed on 2013 Jul 6].
3. American Society of Health-System Pharmacists. Product Details. Available from: http://store.ashp.org/Default.aspx?TabId=216andProductId=4750 [Last accessed on 2013 Jul 6].
4. Smith M. Pharmacists' role in improving diabetes medication management. J Diabetes Sci Technol Online 2009;3:175-9.
5. Roberts S, Gainsbrugh R. Medication therapy management and collaborative drug therapy management. J Manag Care Pharm 2010;16:67-8.
6. Kollef MH. Antibiotics for the critically ill: More than just selecting appropriate initial therapy. Crit Care 2013;17:146.
7. MacLaren R, Brett McQueen R, Campbell J. Clinical and financial impact of pharmacy services in the intensive care unit: Pharmacist and prescriber perceptions. Pharmacotherapy 2013;33:401-10.
8. Lucca JM, Ramesh M, Narahari GM, Minaz N. Impact of clinical pharmacist interventions on the cost of drug therapy in intensive care units of a tertiary care teaching hospital. J Pharmacol Pharmacother 2012;3:242-7.
9. Larochelle JM, Ghaly M, Creel AM. Clinical pharmacy faculty interventions in a pediatric intensive care unit: An eight-month review. J Pediatr Pharmacol Ther 2012;17:263-9.
10. Askari M, Eslami S, Louws M, Dongelmans D, Wierenga P, Kuiper R, *et al*. Relevance of drug-drug interaction in the ICU-perceptions of intensivists and pharmacists. Stud Health Technol Inform 2012;180:716-20.
11. Cunningham KJ. Analysis of clinical interventions and the impact of pediatric pharmacists on medication error prevention in a teaching hospital. J Pediatr Pharmacol Ther 2012;17:365-73.
12. ASHP. Clinical skills competition. Available from: http://www.ashp.org/menu/AboutUs/Awards/ClinicalSkillsCompetition [Last accessed on 2013 Jul 6].
13. Hasan SS, Lim KN, Anwar M, Sathvik BS, Ahmadi K, Yuan AW, *et al*. Impact of pharmacists' intervention on identification and management of drug-drug interactions in an intensive care setting. Singapore Med J 2012;53:526-31.
14. Hamblin S, Rumbaugh K, Miller R. Prevention of adverse drug events and cost savings associated with PharmD interventions in an academic level I trauma center: An evidence-based approach. J Trauma Acute Care Surg 2012;73:1484-90.
15. Prot-Labarthe S, Di Paolo ER, Lavoie A, Quennery S, Bussières JF, Brion F, *et al*. Pediatric drug-related problems: A multicenter study in four French-speaking countries. Int J Clin Pharm 2013;35:251-9.
16. Berthouzoz S, Berger L, Bonnabry P, Pannatier A. The hospital pharmacist: An important contributor to improved patient safety in the hospital. Chimia (Aarau) 2012;66:300-3.
17. Vazin A, Delfani S. Medication errors in an internal intensive care unit of a large teaching hospital: A direct observation study. Acta Med Iran 2012;50:425-32.
18. Jiang SP, Zheng X, Li X, Lu XY. Effectiveness of pharmaceutical care in an intensive care unit from China. A pre- and post-intervention study. Saudi Med J 2012;33:756-62.

How to cite this article: Pichala PT, Kumar BM, Zachariah S, Thomas D, Saunchez L, Gerardo A. An interventional study on intensive care unit drug therapy assessment in a rural district hospital in India. J Basic Clin Pharma 2013;4:64-7.

Source of Support: Nil, **Conflict of Interest:** None declared.