



KNOWLEDGE, ATTITUDE AND PRACTICE OF NURSES IN THE PREPARATION AND ADMINISTRATION OF INTRAVENOUS MEDICATION IN ICU OF A MULTISPECIALTY TERTIARY CARE PRIVATE CORPORATE HOSPITAL AT COIMBATORE

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ABSTRACT

Medical treatment is intended to save life and improve health, and all health workers, especially nurses as the most populated healthcare workers who spend the most time with the patients, have a greater responsibility to prevent transmission of health-care associated infections. Adherence to safe injection practices and related infection control is part of that responsibility as it protects patients and health workers. The objective of the study is to assess the knowledge, attitude and practices of nurses working in intensive care units regarding the parenteral preparations and its administration. A total of 96 nurses were working in the study site (ICU). Respondents were asked to complete the questionnaire which has 45 questions regarding the practice, attitude and knowledge related to the preparation and administration of the medications. Out of the 96 respondents, only 85 of the questionnaires were included in the study (n= 85). All the respondents (n=85) attempted all the questions. Regarding the practices of the nurses and it was found that respondents managed to obtain high level of correct responses (>50% of respondents) for most of the questions. The results obtained were categorized as practice, attitude and knowledge.

KEYWORDS: Injectables, practice, attitude, knowledge, ICU.

INTRODUCTION

According to the US National Coordinating Council for Medication Error Reporting and Prevention (NCCMERP 2001) medication error is “any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health-care professional, patient or consumer”. The characteristics of medication process (complexity of the procedures, multiplicity of professionals and services involved, rapid introduction of new drugs, diagnostic and therapeutic technologies, etc.) frequently evolves errors that jeopardize care security and quality, generating an increase in costs as well. Medication error is a potentially life-threatening problem that is relatively common in all hospitals around the world.^[6]

A study reported that many medication errors were found to be due to lack of pharmacological knowledge, improper attitude and lack of skills in medication administration and had shown that 5.41% of the medication errors that occurred were due to failure in following the prescription and poor skills in

administering drugs. Quality of this process is vital in providing safe patient care and attempts at quality improvement should be continually evaluated. In relation to safe IV medication use, health care providers are required to have adequate knowledge and skill.

A multidisciplinary team is necessary for medication management and the prevention of medication errors. The administration of medication is a fundamental role of a nurse and is the last step in the medication process preceded by the initiation and processing of the order.

Nurses should adhere to the eight rights of medication administration (Right patient, Right medication, Right dose, Right route, Right time, Right documentation, Right reason, and Right response) to prevent medication errors. Since nurses are ultimately responsible during the medication administration phase, it is important for them to understand causes of medication administration errors.

Nurses who are able to plan and carry out nursing care with knowledge, skill and confidence are better

ambassadors for their speciality. Nurses practice within a changing and progressing health care environment and therefore they are required to develop their knowledge, skill and attitude.

MATERIALS AND METHODS

A prospective – direct observational study was conducted for a duration of 8 months in a 750 bedded multi-specialty hospital located at South India. Regular ward rounds were carried out in the study department. The report on the study results was prepared and the same was submitted to the study department for necessary modification on future therapy for a safe and effective treatment. A total of 96 nurses were working in the study site. Respondents were asked to complete the questionnaire which has 45 questions regarding the practice, attitude and knowledge related to the preparation and administration of the medications.

RESULTS AND DISCUSSION

Sample characteristics and findings

A total of 96 nurses were working in the study site. Respondents were asked to complete the questionnaire which has 45 questions regarding the practice, attitude and knowledge related to the preparation and

administration of the medications. Out of the 96 respondents, only 85 of the questionnaires were included in the study ($n=85$). Gender profiles of the respondents were found to be 88.23% females and 11.76% males. The mean age of the respondents was 23.46 ± 6.89 years. The majority of the respondents (64.70%) were B.Sc Nursing degree holders and 29.4% were Diploma holders. From the 85 respondents, 8.23% were head nurses while 91.76% were staff nurses. 50.58% of respondents had less than 2 years of experience while 8.23% had 10 years or more working experience.

PRACTICE

All the respondents ($n=85$) attempted all the questions. Regarding the practices of the nurses and it was found that respondents managed to obtain high level of correct responses (>50% of respondents) for most of the questions. The results obtained were categorized as practice, attitude and knowledge and the details were given in the **table number 1 – 8**.

In the practice part of the questionnaire the respondents answered correctly where 69% accepted that they failed in reporting any medication error and also 79% admitted that they will administer the solution even if it is turbid.

Table 1: Assessment of practice of nurses in ICU's ($n=85$) and the % of correct responses.

Q ns.	Statements	Correct answers to the statements	Correct response % (n)	Wrong response % (n)
1.	Will you check the appropriateness of the dose/route using the current drug references?	Yes	98.82(84)	1.17(1)
2.	Is it necessary to check the site of injection or lab value or vital signs before administering the ordered drug?	Yes	98.82(84)	1.17(1)
3.	Are you involved in preparing IV admixtures?	No	3.52(3)	96.47(82)
4.	If yes, Then where will you prepare the IV admixtures?	No	0(0)	100(85)
5.	Do you check the expiry date for any medication that is being administered to a patient?	Yes	95.29(81)	4.70(4)
6.	Will you administer the IV solution if it is turbid?	No	78.82(67)	21.17(18)
7.	Do you use personal protective equipments (gloves, mask etc.,) during the preparation and administration of injectables?	Yes	96.47(82)	3.52(3)
8.	Have you ever reported a drug error or any error because you did not think the error was serious to warrant reporting?	No	44.70(38)	55.29(47)
9.	Have you ever failed to report a medication error because you were afraid that you might be subject to disciplinary action or even lose your job?	No	69.41(59)	30.58(26)
10.	Will you check the details of the patients including the medication on the chart and use other technology (bar code system)?	Yes	95.29(81)	4.70(4)
11.	Will you document the administration of drug after giving the ordered medication?	Yes	96.47(82)	3.52(3)
12.	Normal Saline is used to flush any infusion system.	Yes	77.64(66)	22.35(19)
13.	Do you follow any protocol/guidelines if published by the authority in administering the IV medications?	Yes	95.29(81)	4.70(4)
14.	Do you think that attending CNE programs/ workshops/ conferences which you feel that had improved your skill about IV administration of drugs.	Yes	81.17(69)	18.82(16)
15.	Do you always check the medication chart for any high alert medications?	Yes	100(85)	0(0)
MEAN			75.45	24.54
SD			33.44	33.44

Variables like age, position, years of experience and educational status of the nurses were compared in respect with the practice and the statistical analysis were done using ONE WAY ANOVA and T TEST in which the

statistical significance was defined at $p < 0.05$. The results had revealed that none of the variables studied were found to be significant with their practice.

Table 2: Comparison of descriptive characteristics of nurses with the practice.

Sr. No.	Variables	Number	Percentage	Practice scores Mean $\pm$ sd
Age				
1.	≤ 25	55	64.70%	75.7 $\pm$ 33.6
2.	26-35	24	28.23%	75.5 $\pm$ 33.4
3.	36-50	6	7.05%	72.2 $\pm$ 37.0
				P= 0.95 (not significant)
Position				
1.	HEAD NURSE	7	8.23%	73.3 $\pm$ 34.9
2.	STAFF NURSE	78	91.76%	76.1 $\pm$ 33.8
				P= 0.82 (not significant)
Years of Experience				
1.	≤ 2	44	51.76%	75.6 $\pm$ 33.3
2.	>2-5	21	24.70%	75.5 $\pm$ 34.8
3.	>5-10	13	15.29%	75.8 $\pm$ 33.0
4.	>10	7	8.23%	73.3 $\pm$ 35.7
				P= 0.99 (not significant)
Education				
1.	DIPLOMA IN GNM	15	17.64%	77.3 $\pm$ 33.0
2.	B.Sc. NURSING	57	67.05%	66.4 $\pm$ 37.1
3.	GNM	10	11.76%	70.0 $\pm$ 37.2
4.	Diploma with post basic nursing	3	3.52%	73.3 $\pm$ 38.2
				P= 0.86 (not significant)

Attitude

Respondent answers in the attitude section were encouraging. According to the results, about 80% of the respondent, in order to reduce errors it is necessary to take preventive measures, such as frequent trainings, authoritative guidelines which should be drawn up taking into consideration the available scientific evidences, continuous evaluation of clinical skills, as well as the error report and awareness about the medication errors in order to improve care.

Regarding the attitude of the respondents, about 78.27% respondents gave positive attitude and they agree with the fact that awareness about the medication errors (96.46% of respondents) can reduce clinical risk during the administration of IV drugs.

Training/CNE programs on safe management of IV drugs (95% of respondents gave positive attitude) can reduce the risk of medication errors to the maximum possible.

While analyzing the negative attitude dimensions from the questions, about 61.1% of respondents told documenting the time, route and site of injection and checking the laboratory values and vital signs before administration are not necessary.

And about 69.1% of respondents do not know that they are not always clear about whether they view a minor

drug discrepancy should be reported as the medication errors.

Eight hundred and twenty five of the respondents attitude was that the solution to be administered need not to be clear and sometimes it can be turbid also. This report is in continuation with the practice questions.

Table 3: Assessment of attitude of nurses in ICU's (n=85) and the % of correct responses.

Qns.	Statements	Correct answers to the statements	Correct response % (n)	Wrong response % (n)
1.	Documenting the time, route, and any other specific information including the site of injection or any laboratory value or vital sign that needed to be checked before giving the drugs are not necessary.	No	38.82(33)	61.17(52)
2.	Separate facility for preparing the IV preparation or well prepared IV preparations for patients are good for better patient care.	Yes	92.94(79)	7.05(6)
3.	Checking of Expiry date for the medication on labels is the responsibility of a Pharmacist or Pharmacy department.	Yes	94.11(80)	5.88(5)
4.	The IV solutions that are being administered need not be to a clear solution and sometime turbid solutions can also be administered.	No	82.35(70)	17.64(15)
5.	Medication errors should be reported in order to provide opportunity for improving patient care.	Yes	95.29(81)	4.70(4)
6.	Systematic reporting program for reporting the administration errors can create awareness among the nurses.	Yes	94.11(80)	5.88(5)
7.	Training/CNE on safe management of IV drugs can reduce the risk of errors.	Yes	95.29(81)	4.70(4)
8.	Awareness about medication error, its prevention can reduce clinical risk during administration of drugs.	Yes	96.47(82)	3.52(3)
9.	Protocol/ guidelines/ procedures can affect professional behavior, ensuring proper management of therapeutic process.	Yes	60(51)	40(34)
10.	Clinical skills about safe management of drug therapy need to be regularly evaluated.	Yes	92.94(79)	7.05(6)
11.	Do you think that supervision by senior nurses while their juniors administer IV Injectables will be useful?	Yes	95.29(81)	4.70(4)
12.	Will there be any positive impact in using infusion control devices?	Yes	72.94(62)	27.05(23)
13.	Do you think that nurses play a crucial role in reducing the harm caused by IV injectable errors?	Yes	83.52(71)	16.47(14)
14.	It is not always clear to nurses whether what they view as a minor drug discrepancy should be reported as a medication error.	No	30.58(26)	69.41(59)
15.	Prescription for a high alert medication is the same as that of the prescription for any other medication.	No	49.41(42)	50.58(43)
MEAN			78.27	21.72
SD			22.68	22.68

Variables like age, position, years of experience and educational status of the nurses was compared in respect with the attitude and the statistical analysis were done using ONE WAY ANOVA and T TEST in which the

statistical significance was defined at $p < 0.05$. The statistical analysis of the results revealed that none of the variable were found to be significant.

Table 4: Comparison of descriptive characteristics of nurses with the attitude.

Sr. No.	Variables	Number	Percentage	Attitude scores Mean $\pm$ sd
AGE				
1.	≤ 25	55	64.70%	78.0 $\pm$ 22.8
2.	26-35	24	28.23%	78.61 $\pm$ 23.0
3.	36-50	6	7.05%	78.8 $\pm$ 26.3
				P= 0.99 (not significant)
POSITION				
1.	HEAD NURSE	7	8.23%	80.9 $\pm$ 25.1
2.	STAFF NURSE	78	91.76%	78.0 $\pm$ 22.6
				P= 0.74 (not significant)
YEARS OF EXPERIENCE				
1.	≤ 2	44	51.76%	77.2 $\pm$ 22.0
2.	>2-5	21	24.70%	78.0 $\pm$ 24.5
3.	>5-10	13	15.29%	81.5 $\pm$ 23.2
4.	>10	7	8.23%	79.0 $\pm$ 26.3

EDUCATION					P= 0.96 (not significant)
1.	DIPLOMA IN GNM	15	17.64%	78.1±23.9	P= 0.58 (not significant)
2.	B.Sc. NURSING	57	67.05%	79.1±20.9	
3.	GNM	10	11.76%	76.0±25.8	
4.	Diploma with post basic nursing	3	3.52%	86.6±16.9	

Knowledge

Findings from this study showed that nurses from the study site had an average level of knowledge about the IV medications. The knowledge levels of nurses in this study were not influenced by age, length (years of experience), level of nursing education, and working position.

Over 25% of the nurses did not realize that IV antibiotics were stable when it was diluted with NaCl 0.9%. For instance, only 40% of the nurses realized that stability of IV meropenem after reconstitution with 0.9% NaCl is 24 hours under refrigeration while its duration of stability in dextrose 5% is only 4 hours under refrigeration.

In this study, over 31.76% of the nurses did not understand that the rate of slow IV bolus medication administration should be longer than one minute.

Overall, the respondents have limited knowledge in the administration of concentrated calcium chloride and potassium chloride injections. In response to question concerning the administration of concentrated electrolyte solutions, 50.58% of the nurses did not realize that potassium chloride injection could not be administered as an IV bolus in emergency condition such as ventricular fibrillation. Only 34.1% of nurses understand that calcium chloride 10% 210ml should be administered as bolus in 1-2 when an emergency happens such as hypocalcaemia tetany.

About 50.5% of the nurses did not recognize that IV ceftriaxone cannot be administered simultaneously with solution containing calcium gluconate via Y site.

About 71.76% of respondents knowledge about the importance of checking the expiry date of the medication received was found to be very poor.

Table 5: Assessment of knowledge of nurses in ICU's (n=85) and the % of correct responses.

Qns.	Statements	Correct answers to the statements	Correct response % (n)	Wrong response % (n)
1.	It is not necessary to check expiry date for a medication that is recently received from pharmacy	No	71.76(61)	28.23(24)
2.	Hand washing with anti-septic or alcohol should be performed before preparation/ administration of IV antibiotic solution	Yes	96.47(82)	3.52(3)
3.	Cefaperazone vial top should be swabbed with alcohol prior to reconstitution with NS.	Yes	62.35(53)	37.64(32)
4.	Which one of the below given statement is correct? A. Stability of IV meropenem after reconstitution with NS is 24 hours under refrigeration. B. Stability of IV meropenem after reconstitution with NS is up to 48 hours under refrigeration. C. Stability of IV meropenem after reconstitution with 5% dextrose is 4 hours under refrigeration.	A and C	40(34)	60(51)
5.	IV antibiotics are stable when diluted using?	NaCl 0.9%	76.47(65)	23.52(20)
6.	Patient's armband and IV catheter should be inspected for phlebitis or extravasation during administration of IV cytotoxic drugs.	Yes	80(68)	20(17)
7.	Medications administered intramuscularly acts rapidly than if administered intravenously.	No	55.29(47)	44.70(38)
8.	Slow bolus IV injection means administering the IV medication in _____ minute.	Longer than one minute	68.23(58)	31.76(27)
9.	A relatively large volume of fluid or dose of a drug or test substance given intravenously and rapidly to hasten or magnify a response is called as _____	IV bolus	54.11(46)	45.88(39)
10.	IV Ceftriaxone can be administered simultaneously with solution containing Calcium Gluconate via a Y-site, at a slower rate of 5mg/min.	No	49.41(42)	50.58(43)
11.	Potassium Chloride injection should be administered as slow bolus	No	49.41(42)	50.58(43)

	injection for over 3 minutes during emergency such as ventricular fibrillation.			
12.	IV. medications can be given via the same catheter with blood	No	92.94(79)	7.05(6)
13.	When an emergency happens such as hypocalcaemia tetany, 10% Calcium Chloride 210 ml should be administered in 1– 2 minutes as bolus.	Yes	34.11(29)	65.88(56)
14.	Medications that are classified as High Alert Medication include Noradrenaline and Insulin.	Yes	77.64(66)	22.35(19)
15.	Infusion pumps are used to deliver the which one of the following into a patient's body	Nutrient and medications	40(34)	60(51)
Mean			63.21%	36.78%
SD			19.28%	19.28%

Variables like age, position, years of experience and educational status of the nurses was compared in respect with the practice, attitude and knowledge and the statistical analysis were done using ONE WAY ANOVA

and T TEST in which the statistical significance was defined at $p < 0.05$. Statistical analysis revealed that none of the variables studied were found to be significant.

Table 6: Comparison of descriptive characteristics of nurses with the knowledge.

Sr. No.	Variables	Number	Percentage	Knowledge scores Mean $\pm$ sd
Age				
1.	≤ 25	55	64.70%	62.3 $\pm$ 20.4
2.	26-35	24	28.23%	63.3 $\pm$ 19.1
3.	36-50	6	7.05%	71.2 $\pm$ 23.9
				P= 0.47 (not significant)
Position				
1.	HEAD NURSE	7	8.23%	68.5 $\pm$ 25.4
2.	STAFF NURSE	78	91.76%	62.7 $\pm$ 19.5
				P= 0.48 (not significant)
Years of Experience				
1.	≤ 2	44	51.76%	61.3 $\pm$ 19.6
2.	>2-5	21	24.70%	62.5 $\pm$ 23.1
3.	>5-10	13	15.29%	66.1 $\pm$ 24.4
4.	>10	7	8.23%	71.2 $\pm$ 22.9
				P= 0.61 (not significant)
Education				
1.	DIPLOMA IN GNM	15	17.64%	60.9 $\pm$ 17.2
2.	B.Sc. NURSING	57	67.05%	58.2 $\pm$ 24.6
3.	GNM	10	11.76%	62.0 $\pm$ 26.2
4.	Diploma with post basic nursing	3	3.52%	68.8 $\pm$ 32.0
				P= 0.70 (not significant)

Perception of Nurses on Medication Errors

The probable causes for medication errors are given in the Table No. 28. was included in the questionnaire. Nurses were asked to give the rank for the listed causes from 1 to 10, with 1 indicating most frequent cause and 10 indicating least frequent cause.

Answers of the nurses were categorized based on the number of nurses who ranked each statement and the mean score was calculated for each category and are listed in the table no. 28. The ranking was given as per Henry Garette Ranking Method.

Table 7: Ranking given by the nurses on causes for medication errors.

Sr. No.	Statements	Ranking (n) N=85									
		1	2	3	4	5	6	7	8	9	10
1.	Drug errors occur when the nurse fails to check the patient's name band with the Medication Administration Record (MAR.)	45	5	3	3	8	4	0	2	0	15
2.	Drug errors occur when the physician's writing on the medication order and is difficult to read or illegible.	25	20	8	4	5	6	1	5	2	9
3.	Drug errors occur when the medication labels/packaging are of poor quality or damaged.	22	16	7	6	16	3	1	3	4	7

4.	Drug errors occur when there is confusion between two drugs with similar names.	21	23	2	7	8	5	7	5	1	6
5.	Drug errors occur when the physician prescribes the Wrong dose.	30	17	6	1	11	3	1	7	2	7
6.	Drug errors occur when the nurse miscalculates the dose	21	18	4	7	12	3	4	6	1	9
7.	Drug errors occur when the nurse sets up or adjusts an Infusion device incorrectly.	18	17	1	8	19	2	4	6	3	7
8.	Drug errors occur when nurses are confused by the different types and functions of infusion devices	15	13	10	6	11	3	5	9	5	8
9.	Drug errors occur when nurses are distracted by other patients, coworkers or events on the unit.	15	13	7	5	11	7	4	4	6	13
10.	Drug errors occur when nurses are tired and exhausted.	18	7	6	2	5	3	2	9	9	24

Table 8: Ranking for the medication error statements by Henry Garette Ranking Method.

Sr. No.	Statements	Mean	Henry Garette ranking
1.	Drug errors occur when the nurse fails to check the patient's name band with the Medication Administration Record (MAR.)	62.97647	1
2.	Drug errors occur when the physician's writing on the medication order and is difficult to read or illegible.	60.89412	3
3.	Drug errors occur when the medication labels/packaging are of poor quality or damaged.	59.77647	5
4.	Drug errors occur when there is confusion between two drugs with similar names.	60.36471	4
5.	Drug errors occur when the physician prescribes the Wrong dose.	62.11765	2
6.	Drug errors occur when the nurse miscalculates the dose	58.62353	6
7.	Drug errors occur when the nurse sets up or adjusts an Infusion device incorrectly.	57.34118	7
8.	Drug errors occur when nurses are confused by the different types and functions of infusion devices	54.78824	8
9.	Drug errors occur when nurses are distracted by other patients, coworkers or events on the unit.	52.92941	9
10.	Drug errors occur when nurses are tired and exhausted.	46.64706	10

The above table portrays the ranking regarding the causes for the medication errors and it showed the significant cause for medication error is when the nurses fails to check the Patients name band with the Medication Administration Record (MAR). While the next three means ranked perceived causes of drug errors were the following: "Drug errors occur when the physician prescribes the Wrong dose." "Drug errors occur when the physician's writing on the medication order and it is difficult to read or illegible." "Drug errors occur when there is confusion between two drugs with similar names."

CONCLUSION

The study concludes that majority of the medication errors can be avoided by close monitoring of the prescriptions. The clinical pharmacist shall acts as a conciliator between the physician and the nurses to ensure safe use of injectable medications and the rationale use of other drugs. Adopting bar code system for medication administration, smart infusion pumps, CPOE with medication error software may be helpful in preventing the medication errors and improves patient quality of life. The study proved to be a convincing evidence for the role of clinical pharmacist and in

providing pharmaceutical care program which improves patient outcomes.

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