Assessment of Nurses' Knowledge and Practice regarding Dealing with High Alert Medications

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Abstract

Medications classified as High-Alert Medications (HAMs) are those that, even when taken as prescribed, have a high potential of seriously harming the patient. Incorrect drug dosage, incorrect mode of administration, and improper dosage are the three most frequent causes of death. Objective: Assess nurse's knowledge and practice in dealing with high alert medications. Setting: The study was conducted at general medical and surgical units at Makkah Hospita, Saudi Arabial. Subjects: 167 nurses who were involved in direct patient care and responsible for administering medications. Tools: Two tools were used to elicit the necessary data; nurse's practice in dealing with HAMs observational check list, and nurse's knowledge in dealing with HAMs questionnaire. Results: The mean scores and the mean percentage for nurses' knowledge and practice related to medications as general, insulin, opioids, sedatives and anticoagulants were utilized. It was observed that the mean score for practice related to HAMs in general were (23.02±2.50) and (39.70±4.30) as the mean percentage, and level of the nurses' practice was satisfactory ≤75% or unsatisfactory ≥70%. Regarding the 5 main items it was observed that practice in general were unsatisfactory (100.0 %).Nurse's knowledge related to insulin, opioids, sedatives and anticoagulants had a mean score of (10.47±1.57) with a mean percentage of (74.81±11.22). Conclusion: Regarding the administration of high alert drugs, there is a discrepancy between the established guidelines and the knowledge and practice of nurses. The collective level of knowledge among all nurses was inadequate, with many falsehoods in a subtotal area that could result in risky practices and dangerous complication. The practice total score was unsatisfactory. Recommendations: It is highly recommended that a list of high-alert drugs be provided, along with pharmaceutical safety policies and procedures.

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Introduction

The most often used medical intervention is medication, which is also most frequently linked to unfavorable outcomes in hospitalized patients (1). Adverse drug events are more common in older hospitalized patients, partly because of their higher medication consumption and co-morbid diseases including liver and kidney illness[2,3]. An increase in the number of medications increases the likelihood of drug-drug and drug-disease interactions. Not all medications in clinical use are of equal risk to patient's serious adverse events, appearing to be caused by relatively small number of medications[4].

Achieving specific treatment outcomes that enhance a patient's quality of life while lowering risk is the aim of medication therapy (5). Therapeutic drug use (prescription and nonprescription) and drug administration devices carries inherent dangers, both known and unknown (6). Several traits are common to High-Alert Medications (HAMs), including a limited therapeutic index and the potential for serious consequences in the event of a system malfunction or incorrect medication administration. Because minor adjustments to dosage or blood drug levels can result in dose- or blood concentration-dependent critical therapeutic failures, or Adverse Drug Events (ADEs), drugs with a narrow therapeutic index are risky [7]. HAMs are medications that are most likely to cause significant harm to the patient, even when used as intended. The top 5 HAMs included insulin, opiates and narcotics, injectable potassium chloride or phosphate concentrate, intravenous anticoagulants, and concentrated sodium chloride[8].

The Institute for Healthcare Improvement's (IHI) America recommends that focusing on a few groups of high alert medications (insulin, opioids, sedatives and anticoagulants) would have the greatest impact[8]. These 4 groups of HAMs are responsible for the majority of harm, due to their inherent risks and high frequency of use. Due to the diversity of reports and on the rates of medications errors (MEs) in Saudi Arabia, meta-analysis to determine the rate of medications errors in Saudi Arabia using meta-analysis in the hospital settings was done. Sixteen articles were included in this search. The total incidence of MEs in Saudi Arabia hospitals was estimated at 44.4%. Prescribing errors, dispensing errors, and adminstration errors incidents represent 40.2%, 28.2%, and 34.5% out of the total number of reported MEs, respectively [9]. Each of these studies only focused on errors occurring in one hospital department during a certain time period. The lack of data in Saudi Arabia is not only a result of a lack of research in this field, but also due to the absence of voluntary reporting systems, except in very few hospitals. Despite this information gap, there is no doubt that Medication Errors (MEs) still represent a major concern around the globe, even in developed countries[9,10].

Adverse Drug Events (ADEs), which are defined as injuries from drug therapy, are among the most common causes of harm during the delivery of health care[11]. At least a quarter of these events are preventable[11,12]. HAMs carry a major risk of causing serious injuries or death to patients if misused. Errors with these drugs are not necessarily more common, but the consequences are devastating[13].

Lack of drug knowledge, including unaware of prescription interactions, improper dosages, mixing, and too rapid infusions, was the most frequent reason of pharmaceutical errors (22%)(14). Inadequate patient information (14%), such as prescribing the wrong prescription, was the second most common cause. The most frequent reasons include improper or unclear dosage, missing dosage, or unclear or nonexistent usage instructions [15-17]. Environmental factors that can promote medication errors include inadequate lighting, cluttered work environments, increased patient acuity and distractions during drug

preparation or administration and caregiver fatigue. Distractions and interruptions can disrupt the clinician's focus; leading to serious errors[18].

The complicated multi-step process of administering medication includes writing prescriptions, transcribing, preparing prescriptions, giving them to patients, and keeping track of their responses. Errors can occur at any point; however, while prescription errors are common, some are caught by nurses, pharmacists, or other staff members. In the United States of America (USA), nurses give the majority of prescriptions, and administration errors account for 26% to 32% of all medication errors [19].

Medication errors can be caused by a variety of circumstances. medicine errors can result from flaws in these areas, according to the Institute for Safe Medication Practices (ISMP), which has identified ten essential components that have the biggest impact on medicine use. They consist of the following: environmental factors, staff competency and education, patient education, quality processes, risk management, drug information, patient education, drug packaging, labeling and nomenclature, medication storage, stock, standardization and distribution, drug device acquisition, use, and monitoring [19].

Because the nurses care for their patients around the clock in hospitals, they see themselves as primarily responsible for their patients well-being and the main role they play in health care team is to serve as key guardian of patient safety, so before carrying out a medication order: determine that the order is clear, complete, current, legible and appropriate, and verify that the order, pharmacy label and/or Medication Administration Records (MARs) are complete[20]. A complete order includes: client name, date prescribed, medication name, strength, dosage, route, dosefrequency, why the drug is prescribed when it is Pro Re Nata (PRN) medication, quantity to be dispensed if appropriate, prescriber signature, clarify any incomplete order with the prescriber, use the pharmacy dispensing label as an order if there is no alternative, confirm that the label is current, accurate and appropriate[21]. Accurate demographic information the "right patient" is the first of the "five rights" of medication administration. Required patientinformation includes name, age, weight, allergies, diagnosis, current lab results, and vital signs[21].

Barcode scanning of the patient's armband to confirm patient's identity so can reduce medication errors related to patient information. But initially, barcode technology increases medicationadministration times, which may lead nursing staff to use potentially dangerous "workarounds" that bypass this safetysystem[20].

Many medication errors stem from miscommunication among physicians, pharmacists, and nurses. One way to promote effective communication among team members is to use the "SBAR" method (situation, background, assessment, andrecommendations). Poor communication accounts for more than 60% of the root causes of sentinel events reported to the JC[19]. Nowadays there are new challenges in the medical field especially in the part of medications and treatment facing the nursing staff. So they have to continue education and training to make them knowledgeable and help them to reduce any medication errors that may occur by using this knowledge to improve their practice[22]. So nursing staff should be up to date on both internal and external medication errors, as an error that may occur at one facility is likely to occur at another and to make them up to date for medications related policies, procedures, and protocols and if there is new information, should be made readily available to nursing staff[22].

Giving patients their medications is a clinical nursing activity that has a significant risk of error. Nursing staff must therefore become aware in order to protect their practice from errors. This will enable them to handle any issues that arise from their work, reduce errors, and improve their capacity to make the right decision at the right moment (21). In addition to favorably influencing suitable self-care practices and self-care behaviors, nurses have substantial opportunity to maintain, spot growing problems, advise patients of their risk status, and encourage appropriate self-care practices [19].

Aim of the Study

This study aimed to assess nurse's knowledge and practice in dealing with high alert medications.

Research Questions:

- What is the nurse's knowledge in dealing with high hazard medications?

- What are the nurse's practices in dealing with high hazard medications?

Materials and Method

Materials

Design: It is a descriptive research design.

Setting: This study was conducted at Makkah Hospital in the following settings:

1. General medical units including the nephrology, endocrine, chestdiseases, cardiovascular,gastrointestinal and diabetic units.

2. General surgical units includingcardiac and chest surgery, oncology, vascular interventional and diabeticfoot surgery, neurosurgery and uro- reproductive surgery units. These units include a total bed capacity of 246 beds.

Subjects: Subjects of the study consisted of all available staff nurses (167) who were involved in direct patient care and responsible for administering medications at the above mentioned setting with not lessthan two years of experience. Seventy seven nurses were affiliated to the medical units and (90) in surgical units.

- One hundred and one nurses were technical diploma graduates and the remainders 66 were secondarynursing diploma holders.

- Each unit was assigned about (6-7) nurses in the morning shift and about (3-4) nurses for evening andnight shifts.

- One hundred and twenty four of the studded nurses were working 6-8 hours daily, 41 for 8-12 hours and the remaining 2 for more than 12 hours daily.

Tools: Two tools were used to elicit the necessary data:

Tool I: Nurse's practices in dealing with high alert medications observation check list

This tool was developed by the researcher based on review of literature[2,7,11,14,23,24] in order to observe nurses practices during phases of preparation, medication administration and reassessment of such medication. It comprised the following five parts and questions:

- Nurse's practices when dealing withmedications in general; this part included (29 items).

- Nurse's practices in dealing with insulin; this part included (18 items).

- Nurse's practices in dealing with opioids; this part included (15 items).

- Nurse's practices in dealing with sedatives; this part included (7 items).

- Nurse's practices in dealing with anticoagulants; this part included (16 items).

Scoring system: Every practice included sub practices which were translated into items. Nurses' practice related to each task was scored on3 points Likert type scale as follows:

- Incorrect practice = 0

- Correct but incomplete practice = 1

- Correct and complete practice = 2

Total score of nurse's practices wereclassified as follows:

▪ A total score of 75% was considereda satisfactory nurse's practices related to such medications.

▪ A total score of less than 75% wasconsidered unsatisfactory.

Tool II: Nurse's knowledge in dealing with high alert medications questionnaire

This tool was developed by the researcher based on a thorough review of literatures related to HAMs administration[7,5,21,23,25].

This tool consists of two parts.

Part I: Socio-demographics of studied nurses as age, sex, the department, qualifications, years of experience, nurse to patient ratio, number of work hours and courses attended in relation to medications administration.

Part II: This part was used to assess the nurse's knowledge related to HAMs; these questions were grouped under 5 domains as follows:

- Nurse's knowledge in dealing with HAMs in general: This domain consists of (7) questions.

Nurse's knowledge when dealing with insulin: This domain consists of (32) questions (23) questions of which were closed ended questions, and the remaining 9 questions were open ended.

- Nurse's knowledge in dealing with opioids: This domain consists of (14) questions including (2) open ended questions.

- Nurse's knowledge in dealing with sedatives which consists of (14) questions

- Nurse's knowledge in dealing with anti- coagulants: which consists of (28) questions.

Scoring system: Nurse's knowledge answers were scored on a three points Likert scale as follows:

- Incorrect answer or don't know =0

- Correct but incomplete answer =1

- Correct and complete answer = 2

Total scores for nurses 'knowledge wereclassified as follow:

▪ A score of 75% of total related to each medications group was considered "satisfactory" nurses knowledge.

▪ A score less than 75% were considered "unsatisfactory" nurses knowledge.

Method

- Official letters were directed to the director to obtain their approval for conducting the study, after explanation of the purpose of the study.

- The developed tools observational check list and structured questionnaire were adapted according to the recent review of literature [2,7,14,21,23-26].

- The structured questionnaire (tool II) was translated into Arabic language.

Tools of the study were submitted to a Jury of 5 experts in the field to test tool content and construct validity, some modifications were introduced accordingly.

- Reliability of the tools was tested by using Alpha Cronbach's test.

-        A pilot study was carried out on 10% of nurses (12 nurses) to test feasibility and applicability; those were excluded from the study.

-        Data collection was preceded as follows; each nurse was watched individually during medication preparation and administrationthroughout morning and afternoon shifts using tool 1 items.

-        The structured questionnaires were distributed to nurse to fill and completeits items after explaining the aim of the study.

-        Data were collected through out a period of two months from (February 2022 to April 2022).

Ethical considerations:

Informed written consents of nurseparticipant were obtained after explanation of the aim of the study. Privacy and anonymity ware maintained; and confidentiality of the collected data assured. Participation in the study was not obligatory and right to withdraw from the study confirmed.

Statistical Analysis

-        Data were fed to the computer and analyzed using IBM SPSS software package version 22.

-        Frequency tables and cross tabulations were used to illustrate the results of categorical data and tested by the Chi Square Test. Quantitative data were summarized by the arithmetic mean and standard deviation.

-        Qualitative data were described using frequency, number and percent.

-        Quantitative data were described usingmean and standard deviation.

-        Mean score percentage (No and %) were used for describing and ranking the qualitative data.

-        Pearson correlation coefficient test was used to explore the association (or relationship) between the socio demographical, knowledge and the practices of the nurses.

Results

Table (1) represents distribution of the studied nurses according to socio demographic data. The results of table show that (167) of the nurses enrolled in the study, (53.9%) were working in surgical departments, and (46.1%) in medical departments, all of the nurses are females. Seventy eight point four of the observations were carried at morning shifts, while (21.6%) in evening shifts.

It can be noted that (20.4%) of the nurses were less than 30 year, (29.9 were between (30-40 years) old, while (31.7%) the remaining were (41-50 years) old, and (18%) of the nurse's were more than 50 years old, the mean age and standard deviation of study group were (48.75±8.2). The same table represent that (100%) of the nurses are females.

Socio demographic data	No.	%
Age (years)		
<30 years.	34	20.4
30 < 40 years.	50	29.9
41 < 50 years.	53	31.7
>50 years.	30	18.0

Min. – Max.	18.0 – 57.0	
Mean ± SD.	40.09 ± 10.42	
Sex		
Male	0	0.0
Female	167	100.0
Surgical departments	90	53.9
Medical departments	77	46.1
Observation time		
Morning shift	131	78.4
Afternoon shift	36	21.6
Qualification of nurses		
Technical diploma nursing[*]	101	60.5
Secondary nursing diploma[**]	66	39.5
Years of experience in the assigned departments		
<3 years	7	4.2
3 to <8 years	20	12.0
8 to <13 years	16	9.6
13 to <18 years	29	17.4
>18 years	95	56.9
Nurse to patient ratio		
1 :5 patients per shift	12	7.2
5 :10 patients per shift	68	40.7
10 : 15 patients per shift	48	28.7
>15 patients per shift	39	23.4
Number of work hours/day		
6 – 8 hours/day	124	74.3
8 – 12 hours/day	41	24.6
>12 hours/day	2	1.2
Courses attended related to HAMs		
No	167	100.0
1	0	0.0

Table (2) represents percentage of the studied nurses' practices in dealing with insulin. Storing of different types of insulin was carried out by (99.4%) of nurses in a correct but incomplete way, (0.6%) in a correct and complete way. Upon admission assessment of insulin type, time, site used, eating habits, blood glucose pattern, symptoms of hypo or hyperglycemia, and monitoring the blood glucose were all checked as correct but incomplete practices by (100%-100%-96.4%-96, 4%-100%-100%-96.4%) of nurses respectively.

All of the nurses (100%) were not storing insulin at the bedside. The practices of 97.0% of nurses were checked as being correct and complete regarding "administering insulin if the food not available or patient has hypoglycemia". "Assuring of the hypoglycemic rescue availability" was carried out by (85.0%) of nurses in correct but incomplete way. Observing the recommended abbreviation was carried out by the majority of nurses (80.8%) in a correct and incomplete.

Nurse's practices in dealing with insulin	Not done or Incorrect practice		Done correct but incomplete		Done correct and complete	
	No.	%	No.	%	No.	%
Storing different types of insulin vials separately	0	0.0	166	99.4	1	0.6
Upon admission, complete assessing insulin for:						
Type	0	0.0	167	100.0	0	0.0
Time of administration	0	0.0	167	100.0	0	0.0
Sites used	6	3.6	161	96.4	0	0.0
Eating habits	6	3.6	161	96.4	0	0.0
Blood glucose pattern	0	0.0	167	100.0	0	0.0
Symptoms of hypo- or hyperglycemia that the patient has experienced	0	0.0	167	100.0	0	0.0
Monitor blood glucose carefully and respond promptly to results	6	3.6	161	96.4	0	0.0
Insulin Not stored at the patient's bedside	0	0.0	0	0.0	167	100.0
Insulin not administered if the food not available or the patient is hypoglycemic	0	0.0	5	3.0	162	97.0
Hypoglycemic rescue agents such as glucagon and dextrose are available	24	14.4	142	85.0	1	0.6
Observing &recommended abbreviations: international unit	32	19.2	135	80.8	0	0.0
Doing double-check to assure the correct insulin, especially when the patient is receiving more than one type, check patient identifiers, type, product, then measured dose	167	100.0	0	0.0	0	0.0
Document the time and result for blood glucose and any dose	0	0.0	48	28.7	119	71.3

of insulin given						
Using ONLY insulin syringes in administration of insulin	0	0.0	48	28.7	119	71.3
Before administering insulin, inform the patient of the most recent blood glucose result and the type and dosage of insulinto be administered	62	37.1	105	62.9	0	0.0
Teaching the patient the signs and symptoms of hypoglycemiaand hyperglycemia. Instruct the patient to report any symptoms	17	10.2	128	76.6	22	13.2
Teaching the patient how to calculate the insulin dosage and how to make self-injection before patient discharge	167	100.0	0	0.0	0	0.0
Teaching the patient how to use insulin pen if the patient start to use	167	100.0	0	0.0	0	0.0
Teaching the patient who has glucometer check how to be used at home	167	100.0	0	0.0	0	0.0
Blood samples for blood glucose test are NOT taken from IV site through which glucose is running	49	29.3	104	62.3	14	8.4
Assess &document sites of insulin injection for abnormalities in the skin before administration	81	48.5	86	51.5	0	0.0
Observe & record the patient for any circumstances that will cause insulin requirements to vary, such as (nothing per mouth, infection, and change in activity, steroid medications, total parental nutrition, or other circumstances that affect metabolism)	21	12.6	146	87.4	0	0.0
Carry out nutritional assessment and record 24 hrs food consumption	57	34.1	110	65.9	0	0.0

Table (3) it can be observed that the practices of "Assess & record the action of sedation through sedation scale at leastevery 4 hours", "Assess &record the pain level using pain scale every time that patient complains from pain" and " Assess the conscious level by the conscious level scale" were not "done at all" or "done incorrectly" by the majority of the studied nurses i:e 89.2%, 90.4% and 88.6% of the studied sample respectively.

The same table displays that same practices were "done correct but incomplete" such as "Assess & record for evidence of allergic reaction such as nausea and vomiting" and "Monitor carefullyduring the first 24 hours especially at night time the incidence of hypoxia and its frequency", which were carried out by 100% and 98.8% of the studied nurses respectively.

Almost all of the listed practices in dealing with opioids were neither "done correctly nor completely" except for two practices namely " Assure of the opioid order is complete, clear & signed by treating doctor" and " Monitor & record patients taking opioids for

common adverse effects as bradycardia, hypotension and lethargy", which were carried out by only34.7% and 11.4% of the studied nurses, respectively.

Nurse's practices in dealing with opioids	Not done or Incorrect practice		Done correct but incomplete		Done correct and complete	
	No.	%	No.	%	No.	%
Before giving the opioids order, make independent double checks with another licensed nurse	88	52.7	79	47.3	0	0.0
Assess &record any factors that increase risk of respiratory depression: (as obesity, underweight, asthma, sleep apnea)	49	29.3	118	70.7	0	0.0
Monitor carefully during the first 24 hours incidence of hypoxia and its frequency	2	1.2	165	98.8	0	0.0
Assess &record at least every four hours (respiratory rate, heart rate, and blood pressure)after giving opioids.	17	10.2	150	89.8	0	0.0
Check the type& accuracy of the calculated dosage, route, & time before administering medication.	53	31.7	114	68.3	0	0.0
Assess & record for evidence of allergic reactions such as nausea and vomiting.	0	0.0	167	100.0	0	0.0
Assess &record the bowel& bladder function, every shift & charting collection every 24 hours to notify if preset of any abnormalities as constipation.	56	33.5	111	66.5	0	0.0
Assess &record medication dose in mg or mcg, not mL.	70	41.9	97	58.1	0	0.0
Monitor & record patients taking opioids forcommon adverse effects as (bradycardia, hypotension, and lethargy).	0	0.0	148	88.6	19	11.4
Document pain assessment & reassessment.	19	11.4	148	88.6	0	0.0
Assess & record the action of sedation through sedation scale at least every 4 hours especially at night.	149	89.2	18	10.8	0	0.0
Assess &record pain level using pain scales every time the patient complains of pain.	151	90.4	16	9.6	0	0.0
Assess the conscious level of a conscious level scale.	148	88.6	19	11.4	0	0.0
Assess &record the patient medication to avoid any possible drug interactions.	59	35.3	108	64.7	0	0.0
Assure the opioid order is complete, clear & signed by treating doctor.	2	1.2	107	64.1	58	34.7

Table (4) reveals that the practices of "using of sedation scale for assessing sedation level", "assessment factors that increasing the risk of respiratory depression" and "Reassess pain after the intervention has reached peak effect for 30-60 minutes after administering sedatives", were "not done" at all or "done incorrectly" by the majority of the studied nurses i:e 99.4%, 94.6% and 71.3% of the studied sample, respectively.

The same table portrays that same practices were "done correct but incomplete" such as "review the completemedication order and documenting in patient file", "inform the treating doctor after giving first dosage of sedatives to modify the treatment" and "reassess the pain at each new report", were carried out by 92.8%, 74.3% and 70.7% of the studied nurses, respectively.

Nurse's practices related to dealing withsedatives	Not done or Incorrect practice		Done correctbut incomplete		Done correct and complete	
	No.	%	No.	%	No.	%
Check patient's allergies before initiating opioids or sedative therapy	107	64.1	60	35.9	0	0.0
Assess &record factors that increase risk of respiratory depression: obesity, underweight, asthma, sleep apnea	158	94.6	9	5.4	0	0.0
Using sedation scale to assess sedation level at least every 4hours (S)–Sleeping: normal sleep, (respiratory rate more than 8 per minute).	166	99.4	1	0.6	0	0.0
Reassess the pain at each new report of pain, any change in the presentation of pain, and when pain is not relieved by sedatives or other relaxation measures using pain scale	49	29.3	118	70.7	0	0.0
Reassess pain after the intervention has reached peak effect for 30-60 minutes afteradministering sedatives	119	71.3	48	28.7	0	0.0
Review the complete medication order and document name of drug dosage, route date and time	12	7.2	155	92.8	0	0.0
Inform the treating physician after giving first dosage of the sedatives to modify the dose according to the patient response	43	25.7	124	74.3	0	0.0

Table (5) it can be noticed that the majority of the studied nurse's practices related to "Double check the orders for anticoagulants to confirm that is clear, complete & accurate before administration" and "Labeling the distal end of the heparin line" were "not done" at all or "done incorrectly", which were carried out by 100% and 98.2% of the studied nurses respectively, while, 100% of the studied nurses practices related to "assessment and documenting of baseline coagulation before starting the treatment with anticoagulants" "done correctly but incomplete".

Nurse's practices in dealing with anticoagulants	Not done or Incorrect practice		Done correct but incomplete		Done correct and complete	
	No.	%	No.	%	No.	%
Assess &document baseline coagulation time before beginning therapy, including International Normalized Ratio ,Activated Pro- thrombin Time &Pro-Thrombin Time	0	0.0	167	100.0	0	0.0
Assess & record: (height, weight, allergies, diagnosis, and indication for heparin)	14	8.4	153	91.6	0	0.0
Assess &document the food types patient is taking to be sure that not make interaction with warfarin	43	25.7	124	74.3	0	0.0
Store, label &separate types of anticoagulants in different places	13	7.8	154	92.2	0	0.0
Labe& separate different anticoagulants for different patients	0	0.0	118	70.7	49	29.3
Assess &document that warfarin is discontinued before invasive procedures	60	35.9	107	64.1	0	0.0
Assure that protamine sulfate, the antidote for heparin, is available &inform nurse in charge if not available	48	28.7	119	71.3	0	0.0
Assure that the warfarin antidote, vitamin K (phytonadione) is available &inform nurse in charge if not available	49	29.3	118	70.7	0	0.0
provide the patient & family health education related to the prescribed anticoagulant that includes:						
The importance of follow-up monitoring.	71	42.5	96	57.5	0	0.0
Compliance to medication.	60	35.9	107	64.1	0	0.0
Drug-food interactions	89	53.3	78	46.7	0	0.0
The potential for adverse drug reactions and interactions.	61	36.5	106	63.5	0	0.0
Assess &document the results of the coagulation profile & notify the treating physician for the results if any abnormalities present	0	0.0	166	99.4	1	0.6

Review the complete medication order & document name of drugdosage, route date and time	10	6.0	157	94.0	0	0.0
Double check the orders for anticoagulants to confirm that is clear, complete & accurate before administration of medication to patient	167	100.0	0	0.0	0	0.0
Assure that the patient is not receiving medications that affect blood clotting or affect the action of heparin, as low molecular weight heparin by checking patient medication record	44	26.3	123	73.7	0	0.0
Labeling the distal end of the heparin line	164	98.2	3	1.8	0	0.0
Assess & document in the nursing record that blood sample was sent to check Activated Prothrombin Time before starting the initialdose of heparin	1	0.6	166	99.4	0	0.0
Assess , report and record to the treating physician & responsible nurses each shift if any of these signs noticed:						
Signs of bleeding internal bleeding as observed melena or hematuria or external bleeding as epistaxis.	6	3.6	161	96.4	0	0.0
Hematoma formation or extension.	22	13.2	145	86.8	0	0.0
Excessive bleeding or oozing at incision or IV site.	5	3.0	162	97.0	0	0.0
Hemoglobin decrease of > 2 grams or total hemoglobin of < 8 grams.	6	3.6	161	96.4	0	0.0
Platelets less than 100,000/mm3, a decrease of 50,000/mm3, or a decrease of 50% of baseline	0	0.0	167	100.0	0	0.0

Table (6) shows that nurses practices related to sedatives had the lowest mean percent score (22.03±7.03), whereas those related to insulin, were scored as(44.84±4.81). The total mean and mean % score of all practices were found to be (75.63±6.94) and (38.59±3.54) respectively.

Nurses' practices related to the 5 main items ofHAMs	Total score	% score
	Mean ± SD.	Mean ± SD.
1. Practices related to HAMs (58 scores)	23.02 ± 2.50	39.70 ± 4.30
2. Practices related to insulin (36 scores)	21.52 ± 2.31	44.84 ± 4.81
3. Practices related to opioids (30 scores)	10.29 ± 1.96	34.31 ± 6.53
4. Practices related to sedatives (14 scores)	3.08 ± 0.98	22.03 ± 7.03
5. Practices related to anticoagulants (32 scores)	17.71 ± 2.28	38.51 ± 4.95
Total mean scores (170 scores)	75.63 ± 6.94	38.59 ± 3.54

Table (7) shows the percentage of knowledge of the studied nurses related to dealing with insulin. It can be noticed that almost all of the nurses 99.4% answered the question about "popular route to given insulin injection". However, it can be noticed the answers of most nurses. i.e 92.2% pertaining to " the rang of measuring blood sugar in case of hypoglycemia and start to administer insulin via insulin pump" were "incorrect".

Nurse's knowledge related to dealing with insulin	Incorrect answer		Correct answer	
	No.	%	No.	%
What is the source of insulin in the human body?	0	0.0	167	100.0
What are the benefits of insulin in human body?	26	15.6	141	84.4
What is the normal value of fasting blood sugar?	25	15.0	142	85.0
When give short-acting insulin?	62	37.1	105	62.9
When fast acting insulin starts to act?	87	52.1	80	47.9
When the intermediate acting insulin action begins after injection?	144	86.2	23	13.8
Is Lantus insulin short acting insulin?	71	42.5	96	57.5
Is Novorapid insulin is long acting insulin?	120	71.9	47	28.1
What is the color of short acting insulin?	56	33.5	111	66.5
What is the color of the long acting insulin?	134	80.2	33	19.8
What are the most important precautions to be considered before giving the intermediate acting insulin?	115	68.9	52	31.1
What are the precautions taken when giving the rapid acting insulin?	84	50.3	83	49.7
What is the popular route to give insulin injection?	1	0.6	166	99.4
What is the dangerous of insulin if the potassium level decreased in the blood?	54	32.3	113	67.7
What is the used abbreviation to calculate insulin dosage?	60	35.9	107	64.1
What factors that increase insulin actions?	100	59.9	67	40.1
What is the factors delaying insulin absorption?	123	73.7	44	26.3
What are the factors which, if found not use a bottle of insulin and must be disposed immediately?	44	26.3	123	73.7
How much time can keep a bottle of insulin used outside of the refrigerator, and then must be disposed of?	147	88.0	20	12.0
Action to be followed by the nurse in case of hypoglycemia?	130	77.8	37	22.2
What is the action to be taken in the case of	49	29.3	118	70.7

hyperglycemia?					
What is the surprised conditions which, if observed must be reported?	31	18.6	136	81.4	
What is the range of measuring blood sugar in case of hyperglycemia and started to administer insulin via insulin pump?	154	92.2	13	7.8	
What are the different types of insulin? Write 1 example for each type?	1	0.6	123	73.7	43	25.7
What are the basic precautions to be taken before insulin administering?	32	19.2	135	80.8	0	0.0
What are the basic precautions to be taken after insulinadministering?	36	21.6	122	73.1	9	5.4
Mention the sites for insulin injections?	18	10.8	145	86.8	4	2.4
Mention three of signs of hypoglycemia if the decrease is light to moderate?	17	10.2	75	44.9	75	44.9
Mention two signs hypoglycemia if the decrease of blood sugar is severe?	15	9.0	64	38.3	88	52.7
Mention three signs of hyperglycemia if present of ketoacidosis in the blood?	25	15.0	94	56.3	48	28.7
What are the special precautions to be given to patient and he have to take when he notice decrease in blood sugar?	47	28.1	118	70.7	2	1.2
What are the precautions to be given to patient and he have to take when he noticed increase in the blood sugar?	58	34.7	106	63.5	3	1.8

Table (8) displays the percentage of knowledge of the studied nurses related to dealing with opioids. Almost more than half of the nurses participants (53.9%), answered the question of "the indications for opioids" correctly and completely. However, approximately three quarter of the sample meaning 74.9%, replied to the question of "can you combine an opioid with other sedatives", correctly butincompletely.

Nurses knowledge related to dealing with opioids	Incorrect answer		Correct but incomplete		Correct and complete	
	No.	%	No.	%	No.	%
Mention three diseases which have to take opioids drugs?	12	7.2	65	38.9	90	53.9

	Incorrect answer		Correct answer	
Mention three signs that appears on the patient if increasedthe opioids dosage?	18	10.8 76	45.5	73 43.7
	No.	%	No.	%
What are the possible side effects when using a opioids druglike Nalofien?	88	52.7	79	47.3
Can you give the patient any opioid drug if it has a history of drug abuse?	72	43.1	95	56.9
Can you combine opioids drug and other sedatives?	125	74.9	42	25.1
Do you able to give the patient opioids order such as morphine if he has history of previous complications occur during administering him such as loss of consciousness or slow breathing any opioids medication?	123	73.7	44	26.3
What are the most important vital signs, which must be observed and taken into the primary considerations when giving any opioids medicine?	100	59.9	67	40.1
What is the rate of follow-up and measurement of vital signs (such as pressure and respiratory rate and pulse) when givingthe drug an anesthetic?	88	52.7	79	47.3
What is the rate of checking the degree of awareness for patients under the influence of the opioids drug?	99	59.3	68	40.7
What medications which can increase the concentration of morphine in blood?	79	47.3	88	52.7
Which conditions must to take precautions when administered opioids drug?	74	44.3	93	55.7
What are the serious symptoms that can occur during the treatment with tramal?	114	68.3	53	31.7
Is there a specific system determines maximum doses of opioids drug authorized for the patient?	86	51.5	81	48.5
What is an antidote medication to the effect of morphine?	123	73.7	44	26.3

Table (9) shows the percentage of knowledge of the studied nurses related to dealing with sedatives. The tabledemonstrate that the question of" what is your action if the patient complaining of pain and there is no order of sedative" was answered correctly by great percentage of nurses (84.4%). However "withdrawal symptoms of sedatives" was answered incorrectly by a vast majority (77.8%).

Nurse knowledge related to dealing with sedatives	Incorrect answer		Correct answer	
	No.	%	No.	%
What is nursing action if the patient complains pain and there is no order of sedative?	26	15.6	141	84.4
Rate of administering sedatives?	54	32.3	113	67.7
Does any of the following medical conditions require careful attention when give any kind of sedatives such as Valium or Dormicum?	72	43.1	95	56.9
Side effects of frequently giving sedatives?	100	59.9	67	40.1
Withdrawal symptoms of sedatives?	130	77.8	37	22.2
What are the unwanted side effects that occur when you give the patient a sedative?	86	51.5	81	48.5
Nursing action if the patient is suffering from weak pulse and difficulty breathing after giving sedatives?	50	29.9	117	70.1
What is the role of the nurse to assess the patient's condition before administering any sedative?	68	40.7	99	59.3
What are the allergy signs of sedatives?	79	47.3	88	52.7
Scale used to adjust sedative dose?	84	50.3	83	49.7
Subsequent doses modifications after giving sedatives?	53	31.7	114	68.3
Test to determine if patient pain real or not?	76	45.5	91	54.5
Giving patient sedatives if source of pain is unknown?	78	46.7	89	53.3
Time of evaluating patient pain level?	76	45.5	91	54.5

Table (10) represents percentage of knowledge of studied nurses related to dealing with anticoagulants. "Measures to take in case of surgery or tooth extraction", was answered by around 80% of the nurse participants. Nevertheless the question regarding the "schedule of talking vitalsigns in patient on anticoagulant therapies" was surprisingly answered by also a great number (116 nurses) or (69.5%).

Knowledge of the nurses related to dealing with anticoagulants	Incorrect answer		Correct answer	
	No.	%	No.	%
What are the indications for anticoagulants?	88	52.7	79	47.3
What are the initial blood studies required for a newly admitted patient to	87	52.1	80	47.9

determine the proper doses of anticoagulants?				
What are the contraindications for heparin administration?	56	33.5	111	66.5
What are the conditions which warrant attention when administering anticoagulants?	136	81.4	31	18.6
What are the cases where giving warfarin or coumadin preventable?	153	91.6	14	8.4
Factors increasing the effect of warfarin which has to reduce the dose?	84	50.3	83	49.7
Factors that may reduce the effect of warfarin?	143	85.6	24	14.4
Drugs that interact with heparin and affect the efficiency?	100	59.9	67	40.1
Medications that can increase the warfarin effect?	98	58.7	69	41.3
Medications that decreased or increase warfarin effect?	96	57.5	71	42.5
Foods that containing vitamin K, which interact with warfarin?	113	67.7	54	32.3
Possibility of administering heparin intramuscularly?	63	37.7	104	62.3
What is the interval between discontinuing intravenous heparin and the beginning of warfarin?	71	42.5	96	57.5
Frequency of coagulation profile at the start of intravenous heparin?	111	66.5	56	33.5
Tim of discontinuing anticoagulants prior to surgery?	78	46.7	89	53.3
What is the blood investigation should be observed and to follow up carefully when the patient heparin therapy?	96	57.5	71	42.5
Blood investigation required to be followed during warfarin or Coumadin therapy?	121	72.5	46	27.5
Side effects of warfarin?	73	43.7	94	56.3
Complications of warfarin treatment to be reported?	59	35.3	108	64.7
Necessity of vital signs of patients on anticoagulants?	57	34.1	110	65.9
Schedule of checking vital signs in patients on anticoagulants?	116	69.5	51	30.5
Possibility of giving warfarin on an empty stomach?	113	67.7	54	32.3
Measures to have in case of missed dose of anticoagulant?	42	25.1	125	74.9
Antidotes for warfarin in emergency?	61	36.5	106	63.5
Measures to take in case of surgery or tooth extraction?	33	19.8	134	80.2
Diet to avoid for patient on anticoagulant therapy?	73	43.7	94	56.3
Precautions to be followed throughout warfarin therapy?	82	49.1	85	50.9
What have to avoid during treatment by warfarin?	79	47.3	88	52.7

Table (11) represents the mean and mean percentage scores of the nurses' knowledge related to the 5main items of high alert medications. The mean score of nurses knowledge related to HAMs in general was (10.47±1.57) with a mean percentage score of (74.81±11.22). The nurses knowledge mean score related to insulin was (21.30±4.02) with a mean percentage of (51.95±9.82).The mean percentage score related to opioids the result shows the mean was (7.78±2.29) with a mean percentage score of (48.65±14.31). Knowledge mean score related to sedatives was (7.82±3.05) with a mean percentage score of (55.86±21.82). The total mean scores of the 5 items was (60.70±11.65) with a total mean percentage score and slandered deviation of (53.25±10.22).

The nurse's knowledge related to the 5 main items of HAMs	Total score Mean ± SD.	% score Mean ± SD.
1. knowledge related to HAMs as general (14 scores)	10.47 ± 1.57	74.81 ± 11.22
2. knowledge related to insulin (64 scores)	21.30 ± 4.02	51.95 ± 9.82
3. knowledge related to opioids (28 scores)	7.78 ± 2.29	48.65 ± 14.31
4. knowledge related to sedatives (28 scores)	7.82 ± 3.05	55.86 ± 21.82
5. knowledge related to anticoagulants (36 scores)	13.32 ± 4.37	45.94 ± 15.07
Total mean scores (142 scores)	60.70 ± 11.65	53.25 ± 10.22

Discussion

The majority of healthcare workers are nurses, who are also essential to the provision, administration, and teaching of patient safety and error reduction in healthcare facilities. Consequently, nurses are in charge of ensuring their patients' safety. Medication use, specifically medication management procedures and drug administration safety, is one aspect of patient safety to take into account [27].

Errors in drug administration by nurses are most often caused by inadequate knowledge and practices. While most mistakes don't hurt patients, giving HAMs incorrectly can have major repercussions. Having adequate knowledge is essential, as it reinforces the habits. While MEs are common and ongoing, the main cause of adverse effects is the administration of HAMs, which continue to be the most troublesome medicines linked to medication errors [28].

Socio demographic data of the studysubjects:

The present study shows that 31.0% of the studied nurses were from (41<50) years old, while; (20.4%) were <30 years old and the experience years of the majority were

<18 years in the assigned departments. The present study reveals that all of studied nurses were females. The greater fractions of nurses in are females. Studying nursing in universities and schools was exclusive for females till 9 or 10 years ago. This result agreed with the result of a recent study carried out in Egypt at Al- Manial University Hospital on eighty five nurses by Shahin (2012) who found that three quarters of the studied sample were females, the age of more than one third of the sample ranged between 25>34 years and one quarter between 35 > 45 years[29].

Nurses practices in dealing with HAMs:

The findings of the present study demonstrate the nurses practices related to dealing with HAMs unsatisfactory. Thismay be due to a combination of several factors; some were related to the hospital system, and the other may related to the nurses themselves. This unsatisfactory score may be due the absence of hospital written protocol or guidelines in dealing with these types of medications, shortage of the nurses staff, inadequate

supervision by the nurses supervisors, scarce orientation or training in services programs related to these types of medications, high work load.

Elisabeth and George (2010) corroborated this finding by determining that the basic "five rights" taught in nursing school are the appropriate place to start when it comes to nursing implications for preventing adverse drug events in intensive care units. These rights are traditionally viewed as essential to preventing errors and preventing patient harm (30). Additionally, the Yousef and Eman (2016) study suggested creating the National Drug Quality Reporting System, which maintains safety goods, avoids drug-related quality issues such look-alike sound-like errors, and satisfies quality requirements necessary for pharmacy practice [31].

As regards nurse's practices in dealing with insulin, the result revealed that most of the studied nurses have unsatisfactorypractice scores related to insulin. It was observed that, they were neither not carrying out independent double check of insulin, the nurses are not follow any guide procedure. Also they did not attend health education programs regarding calculate insulin dosage, how to use glucometer, and how to use insulin pen. So they were not teaching the patient about these items. Nevertheless practice related to assessment and recording food consumption in 24 hours were found to be correct but incomplete. This finding is supported by a study carried out by Anita and Christiana (2014) which represented lack of training in diabetes especially in the area of insulin and its new advancement. The content of education should be dynamic and needs to reflect current evidence and practice guidelines and expert consensus supports in the need for specialized diabetic nurses and educational training beyond academic preparation for the primary instructors on the diabetes team[32].

According to the study's findings, the majority of nurses' procedures regarding opioid prescriptions were found to be inadequate. The majority of the nurses did not complete a thorough assessment and recording, particularly for high-risk patients, prior to administering opioids. They also did not measure the patients' level of pain or consciousness during the administration of opioids, which could be contributing factors to these nursing malpractices. Policies and procedures may have a greater impact on opioid-related nursing practices.

The present study revealed that, the majority of the studied nurses had unsatisfactory practice scores related to sedatives. These nurses' mal practices might be related to some significant factors; they were not checking allergy before initiating the sedatives, not full filling assessment and recording factors that increase the risk of respiratory depression, were neither assessing pain level, in complete reviewing medication order, and not informing the treating doctor after giving first dose to modifying the treatment. Lack of policies, procedures and protocols could have resulted in practical gaps and overlaps that make the nurses confused about their responsibilities. Ossama and Mahmoud (2011) recommended frequentassessment level of analgesia and sedation is essential to achieve optimal level and prevent both over-sedation and under- sedation. Close monitoring promotes repeated evaluation of response to therapy, thus helping to avoid over-sedation and to eliminate pain and agitation[33].

Also the present study reveals that the majority of the studied nurses have unsatisfactory practice scores related to anticoagulants. These nursing mal practices probably could be related to incomplete assessment (height, weight, allergies, diagnosis, indication of the treatment and the type of food), incomplete review of medication orders, neither carrying out independent double check by other nurses, nor checking other medication that might affect the action of anticoagulants.

According to the Joint Commission (2010) it has been reported that, patients under consideration for receiving anticoagulant drugs must be carefully screened for contraindications and drug interactions. The patient, who received anticoagulants, must be monitored closely to ensure effectiveness of the anticoagulant and to prevent side effects

or overdosing. Heparin and warfarin in particular have narrow therapeutic ranges and a high potential for complications[34]. Also, in this regards Edith et al. (2013) indicated that anticoagulants are high risk medicationsassociated with a significant rate of medication errors among hospitalized patients. Several national organizations have introduced initiatives to reduce the likelihood of patient harm associated with the use of anticoagulants. Health care organizations are under increasing pressure to develop systems to ensure the safe and effective use of anticoagulants in the inpatient setting[35].

Nurses knowledge in dealing with HAMs:

The present study reveals that nearly almost all of the nurse's knowledge related to dealing with insulin medications was unsatisfactory. This may be due to lack of training and educational programs, lack of knowledge regarding pharmacology of insulin, different types of conditions that accelerate or delay the action of the insulin, as well as pre-and post-precautions when dealing with insulin syringe pump. A related study by Surendranath et al. (2011) also showed low practice standards and insufficient knowledge among nurses. Ignorance of these could lead to the development of issues associated to insulin and diabetes. Enhancement of knowledge could take several forms. A patient information booklet with visual illustrations could be provided. It would include details on insulin types and their color codes, insulin administration sites, administration techniques, storage, signs of hypo- and hyperglycemia, and complications related to insulin use and management [36].

Also the present study revealed that the majority of nurses' knowledge related to dealing with opioids was unsatisfactory.The unavailability of written policies and protocols to be followed by nurses for usage of opioids, absence of specific system to determine maximum dosage, deficiency knowledge about opioids pharmacological effectand adverse effects, antidotes as well as limited usage of advanced technology as Smart" Patient Control Analgesia pump, pulse oximetry, and noninvasive capnography modules. All of these important measures to deal effectively with opioids and to avoid errors.

In this regard, a study conducted in 2016 by Deborah et al. for the Centers for Disease Control Prevention revealed that health practitioners and systems have difficulties in the prevention, assessment, and treatment of chronic pain both prior to the initiation of opioid medication and on occasion while it continues. Practitioners and nurses should be able to assess risk factors for opioid-related harms, as well as how to lessen pain, the number of people who acquire an opioid use problem, and the adverse events associated with these medications[37].

The current study demonstrates that nurses' knowledge related to dealing with sedatives was unsatisfactory. Most of the nurses had lack of knowledge aboutpharmacological characteristics of sedatives, side effects of frequently giving sedatives, withdrawal symptoms, and role of the nurse to assess the patient before administering the medications, allergic signs of sedatives, over dose, and unwanted side effects as well as pain scale that must be used to assess pain. This may be related to significant factors as unavailability of written policies and protocols to be followed by nurses for usage of sedatives, limited educational programs or trainingand unawareness of the hospital guidelines or policies, poor communication among health care teams.

The results of this study are in line with a study conducted in 2015 by Bogdanov et al., which revealed that nurses have significant difficulties when assessing pain. Even so, there are a lot of verified instruments available, like numerical pain scores (38). As the members of the healthcare team closest to the patients and as their advocates, studies by Modi (2010) suggested that nurses should possess a very high competency in pain assessment. It is the nurses' responsibility to comfort patients by assessing pain and providing relief. Moreover, Michelle et al. (2011) noted that nurses need to determine what obstacles stand in the way of implementing procedural comfort management [39,40].

Nihad (2015) emphasized that education is recommended to improve knowledge and correct misconceptions, and to ensure that nurses who assess and manage patients' pain are aware of the importance of best practice in pain assessment and pain management to incorporate it into their practice. With respect to policy, there are yet no standardized set of nurse-based pain protocols[41].

The findings of the present study demonstrate that most of nurses have unsatisfactory knowledge related to anticoagulants; unawareness of the nurses about the different types of anticoagulants especially the oral, limited knowledge of the anticoagulants pharmacology, unavailability of written guidelines as well as computer system which aids in the adjusting of the anticoagulant dosage. Less contact nurses with some types of anticoagulants especially in some surgical units, using educational programs related to these types of medication.

Moreover Amany et al. (2017) ascertains bout the nurses should have a unique role in caring for patientsundertaking long-life anticoagulant therapy. In order to guarantee that the medication is used to its fullest potential and to prevent any issues, nurses have a duty to educate their patients on the therapeutic regimen and any side effects. Prior to starting treatment, they must also check their patients for drug allergies. After that, they must keep an eye on the therapy's efficacy, the patient's adherence to it, and any possible adverse effects[42].

As a result, in addition to having a thorough grasp of HAMs and having received specialized training in this area, nurses also need to be aware of the nature of the drugs, how they affect patient health, and how to avoid prescription errors. High standards and specialized expertise are being developed in the nursing profession through research and evidence-based methods. Knowledge modifies perspective and fosters practical confidence.

Conclusion

The current study found that nurses' knowledge and behaviors regarding the administration of HAMs differed from the recommended guidelines. The overall and subtotal knowledge levels of all participating nurses for managing HAMs were inadequate, with a great quantity of incorrect information that may have resulted in risky procedures and dangerous complications.The practices levels were unsatisfactory. Healthcare providers using electronic system to write prescriptions (e-prescribing) were seven times less likely to make errors than those writing their prescriptions by hand.

Recommendations

Lists of HAMs have to be available at all health care facilities. Medication safety policies and procedures are developed that enhance the ability of healthcare workers to use these medications safely, improved the working conditions, benefits and rewards for nurses to motivate them. Usage ofdouble check of medications by two qualified nurses for, patient full name, hospital number, the name of medication, dosage, time, route, expiry date of medication are suggested.

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