

## Role of Nurse Regarding Administration of Intravenous Magnesium for Patients with Cardiac Arrhythmia

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### Abstract

**Background:** Arrhythmias are a typical presentation to critical care units following ischemia or electrolytes imbalance ; an arrhythmia is any rhythm other than sinus rhythm. Timely interpretation of arrhythmia saves lives, particularly those of the nursing staff who are the first responders to medicine administrations in a CCU or ICU setting. **Aim of the study:** This study was conducted to assess nurses' level of knowledge regarding the administration of intravenous magnesium for patients with cardiac arrhythmia, **Design:** A descriptive exploratory design was utilized to achieve the aim. **Setting:** This study conducted at critical care units of two hospitals Cardiovascular and thoracic academy hospital and National Cardiac Institute Hospital. Affiliated with Ain Shams University Hospital. **Sample:** A convenient sample (50) of all available nurses were included from previously mentioned setting. **Tools :** Data was collected using the following two tools 1) nurse self-administration questionnaire, Nurses' 2) Nurses' observational checklist **Results:** 86% majority of the studied nurses' have an unsatisfactory level of knowledge while only 14% of them had satisfactory level, regarding the total nurses' levels of total practical knowledge about guidelines on the safe use of intravenous magnesium. 90% of the studied nurses' had an unsatisfactory regarding total level of practice. **Conclusion :** the majority of nurses had an unsatisfactory level regarding of knowledge and practical knowledge of the administration of intravenous magnesium sulfate for patients with cardiac arrhythmia. **Recommendations :** Provide educational and training programs to improve nurses' awareness regarding administration of intravenous magnesium in critical care units supported with evidence-based practices, protocols, and guidelines.

**Keywords :** Role of nurse, administration of intervenons magnisum, carrdiac arrhythmia

### Introduction

Cardiac arrhythmia is a condition in which the heart rate is changed by abnormal electrical conduction or automaticity, Arrhythmias range in severity from mild and asymptomatic (such as sinus arrhythmia, in which the heart rate increases and decreases with breathing such as ventricular fibrillation, which necessitates immediate medical intervention. Arrhythmias are often categorized according to their origin (atrial or ventricular, their impact on cardiac output and blood weight, which are affected in part by the

origin site, determines their clinical relevance (*Salaminia et al., 2019*).

Magnesium has a wide range of physiological and pharmacological impact on many body's organ systems. It has been used in the prevention and treatment of many different forms of cardiac arrhythmia although Intravenous magnesium (*Kotecha, 2019*).

There is evidence to suggest that magnesium levels are linked to the occurrence of ventricular arrhythmias following cardiac surgery. In addition, there are several

hypotheses on the relationship between magnesium levels and arrhythmia in patients with severe coronary artery disease. Magnesium intervention prior to cardiac surgery has been shown to minimize the incidence of atrial and ventricular arrhythmic events in recent studies (*Trappe, 2020*).

The American Association for Thoracic Surgery and the European Society of Cardiology have recently included magnesium in their guidelines for preventing and managing certain arrhythmias, Magnesium has also been shown to prevent new-onset and treatment-refractory supraventricular tachycardia (SVT), refractory ventricular fibrillation, and a variety of drug-induced arrhythmias (*Santos, 2021*).

All nursing staff participating in the administration of intravenous medications and fluids must maintain accountability for their acts or omissions in practice, critical care nurses must follow the policy for the safe and secure handling of medicines and complete a term of training and demonstrate intravenous drug administration competency also report occurrences and all details of medication administration involving intravenous drug prescribing, dispensing, preparation, administration, and monitoring, when a clinical requirement exceeds existing knowledge and skills, seek advice from senior colleagues or a pharmacist (*Connor & Coopersmith, 2021*).

#### Significance of the study

According to the most recent world health organization (WHO) statistics published in 2023, the number of cardiac arrhythmias in Egypt reached 173,871, accounting for 32.40% of all deaths. Egypt ranks 15th in the world with an age-adjusted death rate of 268.11 per 100,000 inhabitants, Arrhythmias are predicted to affect 1.5% to 5% of the general population, with atrial fibrillation being the most frequent. Arrhythmias may or may not cause symptoms and might be paroxysmal, making calculating real incidence challenging. The occurrence of arrhythmia in general is related with increased morbidity and death (*Sengupta et al., 2023*).

#### Aim of the study:

##### This study aims to:

- 1- Assess nurses' level of knowledge regarding Administration of Intravenous Magnesium for patients with Cardiac Arrhythmia.
- 2- Assess nurses' level of practical knowledge regarding guidelines on safe use of intravenous magnesium.
- 3- Assess nurses' level of practice pre/during /post the administration of intravenous magnesium.

#### Research Questions:

1. What is the nurses' level of knowledge regarding Administration of Intravenous Magnesium for Patient Cardiac Arrhythmia?
2. What is the nurses' level of practical knowledge regarding guidelines on the safe use of intravenous magnesium?
3. What is the nurses' level of practice pre/during /post administration of intravenous magnesium?

#### Subject and Methods

##### Research Design:

A descriptive exploratory design was used in this study to achieve the aim of this study as a framework for carrying out research activities in different fields of study. Descriptive is an attempt to achieve the study's goal of observing, describing, and exploring features of a scenario, person, organization, place, or phenomenon (*Mamboleo, 2023*).

**Research setting:** The study was conducted in the critical care unit of the Cardiovascular and thoracic academy hospital and National Cardiac Institute Hospital, affiliated to Cairo University.

**Subject:** A convenient sample of all available nurses around 50 nurses, from the above-mentioned setting who already dealing with cardiac arrhythmia Patients, receiving intravenous magnesium, 30 nurses from the Cardiovascular and Thoracic Academy Hospital, and 20 nurses National Cardiac Institute Hospital.

##### Tools of data collection

Data was collected using the following tools:

##### I. Tool 1: Nurse Self-administration questionnaire:

This tool was developed and modified by the researcher.

**The first Part:** was concerned with nurses' demographic data; it includes six-item nurses' age, gender, level of qualification, marital status, years of experience in the ICU, and attendance for training courses about magnesium intravenous.

**The second Part:** Nurses' general knowledge this part was adapted from *Mahmud & Abdullah (2021)* and modified by the researcher according to the study aim and it was used to assess the level of nurses' knowledge regarding the administration of intravenous magnesium

**Scoring system:**

The total score regarding nurses know general knowledge If the answer is correct, was given one mark and an incorrect answer was give zero marks. The evaluation of the nurses' level of knowledge level was calculated according to

- $\leq 85\%$  is considered unsatisfactory (less than 32 scores).
- $\geq 85\%$  is considered satisfactory (32 scores).

**Third part: Nurses' practical knowledge regarding guidelines on the safe use of intravenous magnesium.**

This section was adapted from, (*Farouk Abd El Hafez et al., 2023*). And it was used to assess the level of nurses' practical knowledge about guidelines on the safe use of intravenous magnesium. This guideline includes two subtitles the first subtitle Safe Handling of Medication includes (twelve MCQs) and the second subtitle includes (four MCQs) Error prevention strategies to Improve the Safety of Medication

**Scoring system:**

The total score of the assessment of nurses' level of practical knowledge regarding guidelines on the safe use of intravenous magnesium was calculated and categorized to the following satisfactory level:

- $\leq 85\%$  is considered unsatisfactory (less than 14 scores).
- $\geq 85\%$  is considered satisfactory (14 scores).

**Tool II: Nurses' observational checklist:**

This tool will be designed by the researcher after reviewing the related literature to assess Nurses 'level of practice before, during, and after the administration of intravenous magnesium for cardiac arrhythmia patients it was adapted from (*Weheida et al., 2019*).

**Scoring system:**

The total score of studied nurses' practice ranged from 1 to 37 degree each item was evaluated as "done "was taken "one" degree and not done "was taken "zero" degree. The score was summed up and converted into a percentage score

- $\leq 90\%$  is considered incompetent practice. (Less than 33 degrees).
- $\geq 90\%$  is considered competent practice (33 degrees).

**Operational design**

The operational design includes the

preparatory phase, ethical consideration, content validity and reliability, and fieldwork.

**Preparatory phase:**

This phase included reviewing current and past, local and international related literature and theoretical knowledge of various aspects of the study using textbooks, articles, journals, periodicals, magazines, and the internet to modify tools for data collection. During this phase, the researcher also visited the selected places to get acquainted with the personal and the study settings.

**Ethical Consideration:** The research approval will be obtained from the ethical committee in the faculty of nursing before starting the study. The researcher clarified the objectives and aim of the study to nurses included in the study before starting. Oral consent was obtained from the studied nurses before including in the study; a clear and simple explanation was given to the studied nurses. Secured that all gathered data as confidential and used for research purposes only, the researcher was assuring maintain anonymity and confidentiality of the subject data included in the study. The studied nurses are informed that they have the right to withdraw from the study at any time.

**Pilot study:** A pilot study was conducted on 10% of the total sample equal five nurses to test the applicability of the constructed tools and the clarity of the questions. The pilot has also served to estimate the time needed for each subject to fill out the questionnaire. According to the result of the pilot, no modification was performed, so the nurses were included in the study sample.

**Field work:**

- The study was approved by the hospital director and the nursing directors of the critical care units, in the previously mentioned study setting after getting permission and collaboration to conduct the study, the Faculty of Nursing Ain Shams University sent them a letter describing the purpose of the study.
- Data collection start from the beginning of January 2023 until the end of April 2023 and accomplished throughout the following phases:
- **Preparatory assessment phase:** The investigator was available at each study setting 3 days per week by rotation (Tuesday, Wednesday, and Thursday) through the morning and afternoon shifts. Each nurse was interviewed and assessed individually by the investigator using the previously mentioned tools
- **Second phase:** the investigator introduced herself to the nurses and then informed them of the aim of the study. The investigator observes the actual practice of each nurse by observational checklist and filled by the investigator between 20-30 minutes.

- **Third phase:** after that and in presence of the investigator the questionnaire sheet was distributed to all nurse's researcher to ensure that the questions was answered completely by the nurse. The investigator assessed nurses' knowledge regarding care of patient during administration of intravenous magnesium by using self-administration questioner which took 20to30 mints to be filled by the nurses.

**Administrative design:** Official permission was obtained by submission of a formal letter from the dean of the faculty of nursing at Ain Shams University to the director of each previously mentioned setting of cardiovascular and thoracic academy hospital and National Cardiac Institute hospitals. Collect the necessary data for the current study after a brief explanation of the purpose of the study and expected outcomes, using proper channels of communication from authorized personnel.

**Statistical analysis:** Data entry and statistical analysis were done by using (SPSS) version 26 computer software package. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables. Means and standard deviations for quantitative variables, Shapiro- Wilk Test and Kolmogorov-Smirnov Test were used to determine whether a variable follows a normal distribution.

#### Significance of the results:

- Non-significant with p-value  $\geq 0.05$
- Statistical significance with p-value  $< 0.05$ .
- High significant with p-value  $< 0.01$ .

## Results

**Table (1):** showed that the age of studied nurses ranged from 20 - < 30 years' old with mean age  $28.94 \pm 4.31$ , 66% were female, 35.2% of them had technical health nursing institute certificate, 60% were single, The Years of experience for nurses under the study was 52% and 66% didn't attended any training courses about administration of intravenous magnesium for patient with cardiac arrhythmia.

**Figure (1):** displays the total satisfactory and unsatisfactory of the studied nurses' level of knowledge regarding the administration of intravenous magnesium, 86% of the studied nurses have unsatisfactory level while only 14

% have satisfactory level.

**Table (2):** showed that 74%, 68% and 62% of studied nurses' had correct answers about Magnesium as a mineral that to general health, normal range of magnesium in the blood, and natural magnesium element stores in the body respectively, while 78.0% and 68.0% of them had incorrect answer regarding symptoms of magnesium deficiency in the body and symptoms of high levels of magnesium in the body.

**Figure (2):** displays the nurses' levels of total practical knowledge regarding guidelines on safe use of intravenous magnesium. 90 % of the studied nurses' have unsatisfactory level while only 10 % have satisfactory level.

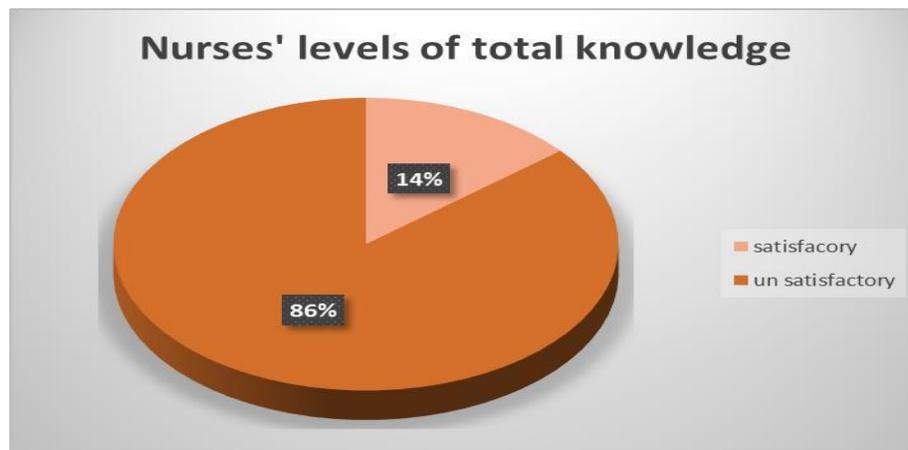
**Table (3):** shows that there was a statically significant relation between all items of studied nurses' demographic data and their total level regarding practical knowledge with P value  $< 0.05$ , while there was insignificant relation between their age and their level of practical knowledge with P value .405

**Table (4):** describes the Relation between demographic data and studied nurses' total levels of knowledge. Result showed that there was a statistically significant relation between all studied nurses' demographic data with P value  $< 0.05$  except in nurses had a pervious training course about administration of intravenous magnesium as P value.090.

**Table (1): Frequency distribution of the studied nurses according to their demographic data (n=50).**

	Total (n = 50)	
	No.	%
<b>Age (years)</b>		
20 - ≤ 30	37	74
30 - < 40	13	26
<b>Mean± SD</b>	<b>28.94 ± 4.31</b>	
<b>Gender</b>		
Male	17	34
Female	33	66
<b>Educational Qualifications</b>		
Nursing diploma	3	4.2
Technical health nursing institute	25	35.2
Bachelor's degree	16	22.5
Postgraduate	6	8.5
<b>Years of experience in ICU</b>		
< 5	26	52
5- 10	21	42
> 10	3	6
<b>Previous training courses</b>		
Yes	17	34
No	33	66

\*Significant at p <0.05. \*\*Highly significant at p <0.01. Not significant at p>0.05.

**Figure (1): Nurses' levels of total knowledge about the administration of intravenous magnesium.****Table (2): Nurses' Practical Observational Checklist Regarding Administration of Intravenous Magnesium sulfate for Cardiac Arrhythmia Patients (N=50).**

Nurses' practical observation items		Competent		Incompetent		$\chi^2$	P-value
		N	%	N	%		
1	Before Administration of magnesium sulfate intravenous (preparation):	5	10	45	90	32.00	.000**
2	During administration	6	12	44	88	28.880	.000**
3	After administration	30	60	20	40	2.00	.157

Figure (2): Total studied Nurses' level of practice before, during and after administration of intravenous magnesium.

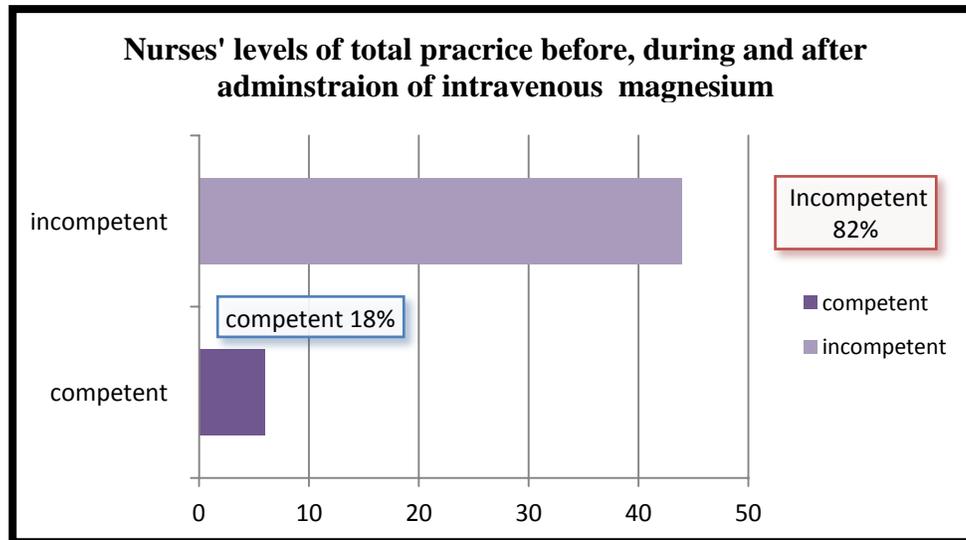


Table (3): Relation between demographic data and nurses' level of total practical knowledge(n=50).

Demographic data	Satisfactory		Unsatisfactory		X <sup>2</sup>	P
	No.	%	No.	%		
<b>Age (years)</b>						
20 - ≥30	0	0	37	100.0	-	-
31 - < 40	5	38.5	8	61.5	.692	.405
<b>Gender</b>						
Male	2	11.1	16	88.9	10.88	.001**
Female	3	9.4	29	90.6	21.12	.000**
<b>Educational Qualifications</b>						
Nursing diploma	0	0	3	100.0	-	-
Technical institute	0	0	25	100.0	-	-
Bachelor's degree	1	6.3	15	93.8	12.25	.000**
Postgraduate	4	66.7	2	33.3	.667	.414
<b>Years of experience in ICU</b>						
< 5	0	0	26	100.0	-	-
5 - 10	5	20.8	19	79.2	8.16	.004**
> 10	0	0	0	0	-	-
<b>Previous training courses</b>						
Yes	4	23.5	13	76.5	4.76	.029*
No	1	3.0	32	97.0	29.12	.000**

Table (4): Correlation between studied nurses' knowledge and their total level of practice(n=50).

Items	R-test	P-Value
Correlation between Knowledge and Practical knowledge	.431	0.000**
Knowledge and level of practice	.603	0.000**
Practical knowledge and Level of practice	.284	.045*

## Discussion

Intravenous magnesium therapy has gained significant attention in medical practice due to its diverse therapeutic benefits. Magnesium plays a crucial role in various physiological processes, including neuromuscular transmission, cardiac function, and electrolyte balance. The administration of intravenous magnesium has been employed in the treatment of conditions such as cardiac arrhythmias, preeclampsia, and acute asthma exacerbations (*Salah Abdelgalil et al., 2019*).

However, the optimal guidelines for the use of intravenous magnesium therapy continue to evolve. This introduction aims to provide an overview of the current knowledge and guidelines regarding the appropriate use of intravenous magnesium. Despite its widespread use, clear guidelines for the optimal utilization of intravenous magnesium therapy are essential to ensure safe and effective outcomes (*Razak et al., 2020*).

### Part I: Demographic data of studied nurses:

Regarding to nurses' demographic data, the present study result revealed that near to three quarters of nurses their aged between twenty to thirty years, near to two thirds of them were females, and about one third of nurses had technical health nursing institute.

These results are consistent with *Smith et al. (2019)*, in the study entitled "An integrative review of the side effects related to the use of magnesium sulfate for pre-eclampsia and eclampsia" whose study mentioned in relation to demographic characteristics that more than two thirds of nurses were less than thirty years this reflect the young average of age of nurses. This may be due to increased number of nurses in few last years in Egypt. In the same line *Willems et al. (2022)*, in study entitled "Medical, Interventional, and Surgical Treatment Strategies for Atrial Fibrillation" found that more than two thirds of nurses were less than thirty years.

### Part II concerning with studied nurses' knowledge regarding magnesium for patients with cardiac arrhythmia:

The current study results showed that more than a half of studied nurses had answered correctly for questions about magnesium as a mineral that is beneficial to general health, what is the normal range of magnesium in the blood, and where is the natural magnesium element in the body respectively. From the researcher's point of view, this result may be interpreted by the fact that those questions cover very basic knowledge that is easy to gain.

On the other hand, two thirds of the studied nurses had answer incorrectly to questions about

Symptoms of magnesium deficiency in the body and Symptoms of high levels of magnesium in the body. These results may be due to lack of interest of nurses to search about pathophysiology and mechanisms of actions of different diseases and also due to hard or nature work in CCU.

### Part III: studied nurses' level of practical knowledge regarding guidelines for the use of intravenous magnesium.

As regards nurses' practical knowledge regarding policy of safe dealing with high-alert drugs the majority of subjects demonstrated satisfactory knowledge in various aspects of safe magnesium sulfate usage, such as patient identity verification, expiration date checks, and proper storage practices. However, there were areas of relatively lower knowledge, particularly in the recommended storage procedure for high-alert medications in the cardiac care unit.

On the same line *Elnaem et al. (2018)* reported that more than half of his study subjects had a high level of knowledge in safe magnesium sulfate usage and proper storage practices. While on the other hand *Fadlala et al. (2019)* found that healthcare providers had lacked awareness of proper storage conditions for medications, emphasizing the need for education and training that address specific storage considerations.

### Part IV: Nurses' level practical knowledge regarding administration of intravenous magnesium for cardiac arrhythmia patient

Regarding nurses' level of practice before, during and after administration of intravenous magnesium sulfate for cardiac arrhythmia patients the majority of nurses demonstrated incompetent level before and during administration, while more than a half of them demonstrated a competent level after administration.

The current results are consistent with *Jedwab et al. (2019)* in a study entitled "Magnesium sulphate replacement therapy in cardiac surgery patients", healthcare workers had an average level of practice during different phases of administration of intravenous magnesium sulfate.

### Part V: Relation between demographic data and the studied variables.

Regarding the relation between demographic data and studied nurses' total levels of knowledge, the current studies presented that there was a statistically significant relation between all studied nurses' demographic data except in nurses had a previous training course about administration of intravenous magnesium.

On the same line Study *Smith et al. (2019)*, who examined the relationship between nurses' demographic data and their knowledge and attitudes regarding intravenous magnesium, the findings revealed that certain demographic factors such as age, years of experience, and level of

education were associated with variations in nurses' knowledge and attitudes. While on the other side, *Abdullah et al. (2020)* explored the relationship between nurses' demographic characteristics and their medication management abilities, including knowledge and skills related to intravenous magnesium, the findings indicated that variables such as age, years of experience, and social status and previous training were associated with variations in nurses' medication management abilities.

## Conclusion

On the light of the current study findings, it can be concluded that the majority of nurses had an unsatisfactory level regarding knowledge and practical knowledge of administration of intravenous magnesium sulfate for patients with cardiac arrhythmia. As regards nurses' practical level more than three quarters of the studied nurses had incompetent regarding administration of intravenous magnesium sulfate for patients with cardiac arrhythmia.

## Recommendation

**Based on the current study finding the following recommendations were proposed:**

- Developing and implementing standardized protocols and guidelines for the administration of intravenous magnesium sulfate for patients with cardiac arrhythmia.
- Designing education programs for nurses to enhance their knowledge and practical skills related to the administration of intravenous magnesium sulfate.
- Establish a periodic evaluation, skills assessments, and observation of practice and system for ongoing monitoring and assessment of nurses' competency in administering intravenous magnesium sulfate.
- Incorporate comprehensive content on the administration of intravenous magnesium sulfate into nursing curricula.

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