

Nurses' Knowledge, Attitude and Safety Interpretation of Waves for Patients Connected with Intra-Aortic Balloon Pump

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Abstract

Background: Safety from harm and injury in receiving health services is a human right. Nurses play a key role in enhancing the quality and safety of care through recognition, management and reporting of issues that have, or could have, a negative impact on patient outcomes. **Aim of the study:** This study aimed to assess nurses' knowledge, attitude and interpretation of waves regarding safety of patient connected with intra-aortic balloon pump. **Research design:** A descriptive exploratory research design was used. **Setting:** This study was conducted at the cardiothoracic intensive care units at Ain-Shams University and Nasser Institute for Research and Treatment. **Subjects:** Convenience sample of 65 nurses. **Tools:** Three tools were used; tool (1) nurses' structured interviewing questionnaire, tool (2) attitude likert scale and tool (3) intra-aortic balloon pump interpretation form. **Results:** 64.6% and 69.2% of the studied nurses had unsatisfactory level of knowledge and waves' interpretation regarding safety of patient connected with intra- aortic balloon pump respectively. While, 56.9% of them had positive attitude regarding safety of patient connected with intra-aortic balloon pump. Furthermore, there was a highly statistically significant positive correlation between nurses' knowledge, safety attitude and intra- aortic balloon pump waves' interpretation. **Conclusion:** More than two thirds of nurses under study had unsatisfactory knowledge level, more than one half of them had positive safety attitude and more than two thirds of them had unsatisfactory level of safety interpretation regarding IABP waves. **Recommendation:** Providing educational training programs for nurses regarding intra- aortic balloon pump and safety interpretation of intra- aortic balloon pump waves.

Keywords: Nurses, Knowledge, Attitude, Intra-aortic balloon pump, Safety waves' interpretation.

Introduction:

Cardiogenic shock is a condition that is characterized by end-organ hypo-perfusion secondary to reduced cardiac output, and is associated with substantial mortality. The mainstay of therapy for cardiogenic shock is reversal of the underlying cause, and concomitant supportive care with vasoactive medications (vasopressors and inotropes). Patients who continue to deteriorate despite these measures may require mechanical circulatory support (Fernando et al., 2022).

Intra-aortic balloon pump counter-pulsation is one of the earliest types of short term MCS. It consists of a flexible 30–50 cc helium-filled balloon catheter (7–8F), connected to a mobile console that times periodic balloon inflation and deflation according to the cardiac cycle. When inflated in diastole (immediately

after the closure of the aortic valve), diastolic and mean arterial pressure rise, thus theoretically improving coronary flow and myocardial oxygenation. On the other hand, when rapidly deflated just prior to blood ejection from the left ventricle, it provides immediate systolic blood pressure attenuation and consequently afterload reduction, leading to an increase in stroke volume. Overall, myocardial oxygen demand is reduced (Brown et al., 2021).

The most common cause of inadequate balloon counter-pulsation is the inaccurate timing of inflation and deflation. Some errors associated with IABP timing will simply result in poor hemodynamic response to IABP, but others are more dangerous for patients with already tenuous cardiovascular situations (Santa-Cruz & Stouffer, 2017).

Nurses who care for patients managed with IABP require knowledge of the mechanism and action of this therapeutic device as well as addressing IABP's indications, contraindications, physiology of functions, potential complications, and safety considerations. Knowledge regarding IABP therapy is vital to safe, efficient patient care in the cardiothoracic intensive care unit (**Rasaria & Sawant, 2019**). Nurses hold attitudes towards safety practices that may influence patient outcomes. These attitudes are referred to as safety attitudes and relate to an individual's beliefs, perceptions, feelings or thinking towards safety practices, procedures and policies. When nurses have positive safety attitudes, a strong safety culture develops. Therefore, nurses' safety attitudes may have a significant impact on patient out-comes and patient safety (**Alanazi, et al., 2022**).

Significance of the study:

Critical care nurses should be skilled in providing effective nursing management to the patient connected with IABP. They are expected to manage the IABP as well as the patient. Nursing staff must continually assess the often subtle changes in patient condition and this requires expert knowledge of the cardiovascular system, therapeutic effects of IABP and the potential adverse events. Maximum benefits from IABP therapy can be derived with highly skilled and knowledgeable critical nursing care (**Schub & Woten, 2018**). The most critical component of IABP- patient management is proper timing of the balloon inflation and deflation (**McSparren et al., 2022**). Analysis of the arterial pressure waveform and the effectiveness of IABP therapy is an important nursing function. Nurses must be able to recognize and correct problems in balloon pump timing to avoid IABP errors and maintain patients' safety (**Snyder et al., 2018**).

Aim of the Study:

This study aimed to assess the nurses' knowledge, attitude and interpretation of waves regarding safety of patient connected with Intra-aortic balloon pump through the following:

1. Assess nurses' knowledge regarding safety of patient connected with intra-aortic balloon pump.
2. Assess nurses' attitude regarding safety of patient connected with intra-aortic balloon pump.
3. Assess nurses' safety interpretation of waves for patient connected with intra-aortic balloon pump.

Research questions:

The current study answered the following questions:

1. What is the nurses' knowledge regarding safety of patient connected with intra-aortic balloon pump?
2. What is the nurses' attitude regarding safety of patient connected with intra-aortic balloon pump?
3. What is the level of nurses' safety interpretation of intra-aortic balloon waves?

Subjects and Methods:

1-Technical design:

The technical design included research design, research setting, research subjects and tools for data collection.

(A) Research design:

A descriptive exploratory research design was used to achieve the aim of this study and answer the research questions. Descriptive research, describe phenomena or examine the relationships between variables. A descriptive research is similar to an exploratory research. However, the two categories can be distinguished by considering the amount of information that is available about the variable(s) under investigation. Exploratory research appropriate when little is known about the area of interest (**Nieswiadomy & Souter, 2018**).

(B) Research Setting:

The study was carried out in two different setting as follow:

1. The cardiothoracic intensive care unit at academic institute for heart surgery which Affilled to Ain-Shams University and consists of one room that contain 10 beds and located on the eighth floor.
2. The cardiothoracic intensive care unit at Nasser Institute for Research & Treatment consists of large room that contains fourteen beds and another room (extension) contains four beds. It is located on the first floor.

(C) Research Subjects:

A convenience sample of all available nurses (65) who were working at the previous two mentioned setting (39 nurses from Nasser Institute for Research and Treatment and 26 nurses from Academic Institute for Heart Surgery) from both gender, within six months starting from the beginning of February 2022 to the end of August 2022 .

(D) Tool of data collection:

Three tools were used to collect the necessary data and fulfill the study aim.

Tool (I): Nurses' structured interviewing questionnaire

It was developed by the researcher in an English language after reviewing the relevant and recent literatures for gathering data and translated to Arabic version. It was composed of two parts:

Part (1): It was concerned with assessment of nurses' demographic data regarding age, gender, education level, workplace, years of experience in cardio thoracic intensive care unit, previous experience in taking care of patients with IABP and training courses about IABP. It was composed of 7 end closed questions.

Part (2): It was concerned with assessment of nurses' level of knowledge regarding safety of patient connected with intra-aortic balloon pump. It was developed by the researcher based on (Rushdy, 2015; Mahgoub & Abd El Hafez, 2017; May-Newman, 2018; Richenbacher, 2019). It included 67 questions

in form of multiple choice questions which categorized as nine parts. The first part was concerned with nurses' knowledge regarding description and function of intra-aortic balloon pump contained (9 MCQ), second part was concerned with nurses' knowledge regarding alarms of IABP contained (6 MCQ), third part was concerned with nurses' knowledge regarding indications and contraindications of IABP contained (2MCQ), fourth part was concerned with nurses' knowledge regarding complications of IABP contained (5 MCQ), fifth part was concerned with nurses' knowledge regarding risk factors associated with using of IABP contained (3 MCQ), sixth part was concerned with nurses' knowledge regarding nursing care of a patient while connected to the aortic balloon pump contained (8 MCQ), Seventh part was concerned with nurses' knowledge regarding interpretation of waves contained (13 MCQ), Part eight was concerned with nurses' knowledge regarding nursing care during weaning stage and removal of the aortic balloon pump contained (8MCQ) and finally; part nine was concerned with nurses' knowledge regarding safety measures for the patient connected to the aortic balloon pump contained (13 MCQ).

❖ Scoring system:

The total score of the second part which was concerned with nurses' knowledge were 67 degrees, if nurses' answer was correct it was given one degree, and given zero if the answer was incorrect. The total degree for every nurse was summed up then categorized as follow:

- More than or equal to 85% (57 degree or more) was considered satisfactory level of knowledge.
- Less than 85% (< 57 degree) was considered unsatisfactory level of knowledge.

Tool (II): Nurses' attitude likert scale: it was adapted from (Sexton et al., 2006) and used to assess of nurses' attitude regarding safety of patient connected with intra-aortic balloon pump. It was consisted of (17) items on a three point likert scale ranged from 1 to 3 point (1=disagree, 2=sometimes, 3= agree).

❖ Scoring system:

The items in nurses' attitude were scored on a three point likert scale, the total score were 51 degrees. The scores of the items were summed-up and the total divided by the number of the items, giving a mean score and accordingly the nurses' attitude was categorized into two categories as the following:

- More than or equal to 70% (36 degree or more) was considered positive attitude.
- Less than 70% (< 36 degree) was considered negative attitude.

Tool (III): Intra-aortic balloon pump interpretation form: it was developed by the researcher in an English language based on reviewing of relevant recent literatures (Arya, 2016; Richards, 2016; Kanchi & Chandran, 2018) and translated to simple Arabic version. It was used to assess nurses' safety interpretation of intra-aortic balloon waves. It included (17) multiple choice questions which categorized as three parts. The first part was concerned with nurses' awareness regarding IABP assist frequency ratio contained (2 MCQ) ; second part was concerned with nurses' awareness regarding timing errors contained (5 MCQ), and finally the third part was concerned with nurses' awareness regarding normal and variation in balloon pressure waveforms contained (10 MCQ).

❖ Scoring system:

The total score for the nurses' safety interpretation of IABP waves was 17 degrees, given one degree if nurses' answer was correct and given zero if the answer was incorrect. The total degree for every nurse was summed up; then categorized as follow:

- More than or equal to 85% (15 degree or more) was considered satisfactory level of awareness.
- Less than 85% (< 15 degree) was considered unsatisfactory level of awareness.

II. Operational design:

The operational design included; preparatory phase, ethical consideration, testing validity and reliability of the developed tools, pilot study and field work.

A. Preparatory phase:

It was conducted through reviewing of recent related literatures and theoretical knowledge of various aspects of the study using articles, periodicals, magazines, books, and internet search to develop tools for data collection.

B. Ethical consideration:

The ethical research consideration in the study included the following: A written research approval to conduct the study was obtained from the scientific research ethical committee at Faculty of Nursing Ain Shams University and the ethical committee at Secretariat of Specialized Medical Centers before initiating the study work. Moreover, the researcher clarified the objectives and aim of the study to the nurses included in the study. Also, the researcher assured maintaining anonymity and confidentiality of nurses' data included in the study. Furthermore, Nurses were informed that they are allowed to withdraw from the study at any time without giving any reasons and without penalties. Also, Oral approval was obtained from all the study participants.

C. Tools validity and reliability:

Tools were translated into Arabic language to facilitate communication with study sample.

Content validity; the validity of the developed tools was reviewed by a panel of five experts from medical surgical nursing department, faculty of nursing, Ain Shams University. The panel of experts was from different academic categories (three professors and two assistant professors). The experts reviewed the content of the tools for clarity, relevance, comprehensiveness, applicability, wording, length format and overall appearance& appropriateness. Modifications of tools were done based on the panels' comments and recommendations.

Testing reliability:

Testing reliability of the developed tools was assessed through measuring internal consistency by cronbach alpha coefficient test.

C. Pilot study:

A pilot study was carried out on 10% of the nurses under study (7) to test the applicability, clarity, efficiency of the tools. The pilot study had also served to estimate the time needed for each subject to fill in the questionnaire. According to the result of the pilot study no correction and omissions of items were performed so the nurses who included in the pilot study were sharing in the study sample.

D. Field work:

Data of the current study were collected in 6 months started from the beginning of February 2022 to the end of August 2022. The researcher firstly met with the nurses working at the previously mentioned setting, explaining the purpose of the study after introducing herself to them. The researcher was visiting the study setting 3 days/week (Sunday, Monday and Thursday) at morning shifts and afternoon shifts. IABP waves' interpretation form was filled by nurses first then the questionnaire for knowledge and the attitude likert scale. Filling in the questionnaire was done by the study sample in the presence of the researcher according to their suitable time. The IABP waves' interpretation form was filled by nurses (first) within 20 minutes. Then, the questionnaire for knowledge that take 45-50 minutes and finally the attitude likert scale that take 15 minutes.

III- Administrative design:

Before starting data collection an official letter requesting permission to conduct the study was directed from the dean of the Faculty of Nursing Ain Shams University to director of Academic Institute for Heart Surgery (Ain-shams University) & Nasser Institute for Research and Treatment to obtain their approval to carry out this study. This letter included the aim of the study and photocopy from data collection tools & protocol in order to get their permission and cooperation in data collection.

IV- Statistical design:

After completion of data collection, data were tabulated and subjected to statistical analysis. Analysis of data was performed by using SPSS program (version 22). While, Microsoft office Exel was used for data handling and graphical presentation. Relevant statistical analysis was used to test the obtained data.

Descriptive statistics: such as frequency, percentage, means, standard deviation.

Analytical statistics:

- Chi- square test: was used to test relationships between variables.
- Linear correlation coefficient: was used to measure the strength and direction of the linear relationship between two variables.
- Alpha cronbach test: was used to assess reliability of the questionnaire.
- Statistical significance was depended on probability (P- value) as the following:
 - Statistically significance at $P\text{-value} \leq 0.05$
 - Highly significance at $P\text{-value} < 0.001$
 - Non significance at $P\text{-value} > 0.05$

Results:

Table (1): Revealed that there was homogeneity between the studied nurses in the two setting as regard to age, level of education, years of experience in cardiothoracic intensive care unit and previous experience in caring of patients connected with IABP at p-value 0.702, 0.639, 0.258, 0.156 respectively. While, there was no homogeneity between the studied nurses regarding their gender. Furthermore, 78.5% of the studied nurses their age ranged from $20 < 30$ years old. Also 53.8% of the nurses were male and had nursing technical institute as regard to level of education. Furthermore, 55.4% & 60% of the studied nurses had less than two years of experience in cardiothoracic intensive care unit & caring of patients connected with IABP respectively.

Table (2): Revealed that, the highest unsatisfactory nurses' knowledge' domain was

description and function of intra-aortic balloon pump in percentage of 72.3%, with mean score of 2.51 ± 1.42 . While, the highest satisfactory nurses' knowledge domain' was nursing care of the patient while connected with the intra- aortic balloon pump in percentage of 50.8%, with mean score of 4.35 ± 1.87 .

Figure (1): illustrated that 64.6% of the studied nurses had unsatisfactory total knowledge level regarding safety of patient connected with intra-aortic balloon pump.

Figure (2): illustrated that 56.9% of the studied nurses had positive attitude regarding safety of patient connected with intra-aortic balloon pump.

Table (3): revealed that the highest unsatisfactory nurses' waves' interpretation domain was IABP assist frequency ratio in percentage of 83.1%, with mean score of

Table (1): Frequency and percentage distribution of the studied nurses regarding their demographic data (n=65).

0.45 ± 0.32 . While, the highest satisfactory nurses' waves' interpretation domain was normal IAB pressure waveform in percentage of 38.5%, with mean score of 0.38 ± 0.29 .

Figure (3): Illustrated that 69.2% of the studied nurses had unsatisfactory total level of safety IABP waves' interpretation. While, 30.8% of them had satisfactory total level of safety IABP waves interpretation.

Table (4): showed that, there is a highly statistically significant positive correlation between total knowledge score and total attitude ($r = 0.747$) at P-value < 0.001 . And there is also a highly statistically significant positive correlation between total knowledge score and total interpretation ($r = 0.711$) at P-value < 0.001 . And a highly statistically significant positive correlation between total attitude score and total interpretation ($r = 0.581$) at p-value < 0.001 .

Demographic Characteristics	Nasser Institute for Research and Treatment		Workplace Academic Institute for Heart Surgery		Total		X ²	P-value
	N	%	N	%	N	%		
1-Age								
- 20 < 30 years	30	46.2	21	32.3	51	78.5	0.709	0.70
- 30 < 40 years	8	12.3	5	7.7	13	20		2
- 40 years or more	1	1.5	0	0	1	1.5		
2- Gender								
-Male	26	40	9	13.8	35	53.8	6.448	0.01
-Female	13	20	17	26.2	30	46.2		1
3- Level of education								
-Bachelor of nursing	11	16.9	8	12.3	19	29.2	.897	0.63
-Nursing technical institute	20	30.8	15	23.1	35	53.8		9
-Secondary nursing school diploma	8	12.3	3	4.6	11	16.9		
4- Years of experience in cardiothoracic intensive care unit								
-Less than two year	25	38.5	11	16.9	36	55.4	4.035	0.25
-2 < 5 years	7	10.8	10	15.4	17	26.2		8
-5 < 10 years	5	7.7	3	4.6	8	12.3		
-10 years or more	2	3.1	2	3.1	4	6.2		
5- Previous experience in taking care of patients with IABP								
-Less than two year	25	38.5	14	21.5	39	60	5.232	0.15
-2 < 4 years	3	4.6	7	10.8	10	15.4		6
-4 < 6 years	7	10.8	2	3.1	9	13.8		
-6 years or more	4	6.2	3	4.6	7	10.8		

Table (2): Frequency and percentage distribution of the studied nurses level of knowledge regarding total knowledge domains (n= 65).

Knowledge domains	Knowledge level				Mean± SD
	Satisfactory ≥ 85%		Unsatisfactory < 85%		
	N	%	N	%	
I-Description and function of intra-aortic balloon pump	18	27.7	47	72.3	2.51±1.42
II-Alarms, indications and contraindications of IABP	21	32.3	44	67.7	2.02±1.04
III- Complications and risk factors associated with using of IABP	23	35.4	42	64.6	2.15±1.16
IV- Nursing care of the patient while connected with the intra- aortic balloon pump	33	50.8	32	49.2	4.35±1.87
V- Interpretation of IABP waves	19	29.2	46	70.8	3.77±1.77
VI- Nursing care during weaning stage and removal of the aortic balloon pump	31	47.7	34	52.3	3.86±1.71
VII- Safety of the patient connected with the aortic balloon pump	24	36.9	41	63.1	4.72±1.85

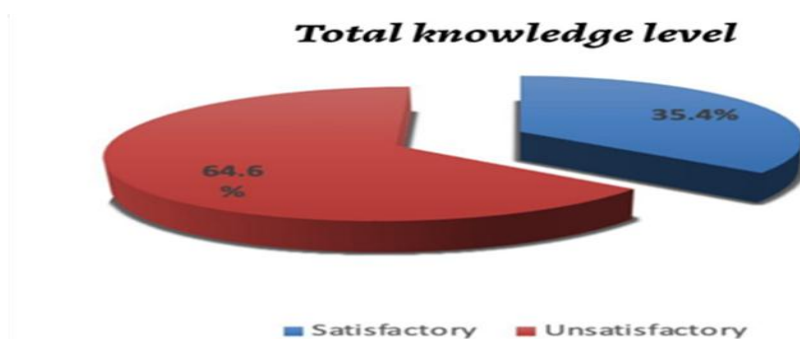


Figure (1): Percentage distribution of the studied nurses regarding their total level of knowledge (n=65).

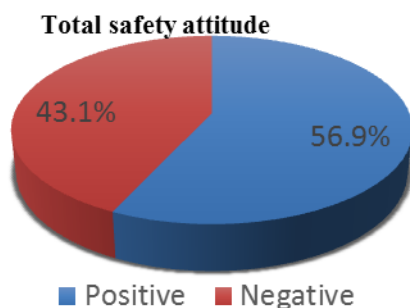


Figure (2): Percentage distribution of the studied nurses according to their total level of attitude (n=65).

Table (3): Frequency and percentage distribution of the studied nurses' level of safety IABP waves interpretation regarding total interpretation domains (n= 65).

IABP waves interpretation domains	Interpretation level				Mean \pm SD
	Satisfactory		Unsatisfactory		
	N	%	N	%	
IABP assist frequency ratio	11	16.9	54	83.1	0.45 \pm 0.32
Timing errors	19	29.2	46	70.8	2.39 \pm 0.37
Normal IAB pressure waveform	25	38.5	40	61.5	0.38 \pm 0.29
Variation in balloon pressure waveforms	23	35.4	42	64.6	3.52 \pm 1.95

Total level of safety interpretation of IABP waves

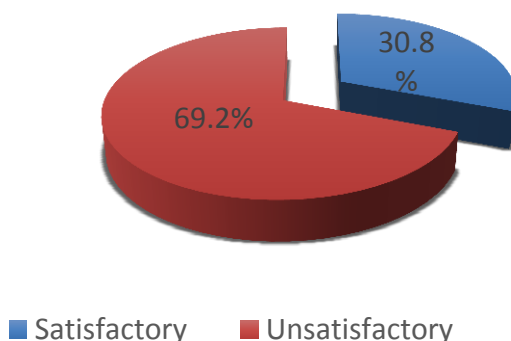


Figure (3): Percentage distributions of the studied nurses' total level of intra-aortic balloon waves' safety interpretation (n=65).

Table (4): Correlation between total 'unsatisfactory knowledge, positive attitude and unsatisfactory IABP waves' interpretation scores.

	Total knowledge score		Total attitude score	
	r	P-value	r	P-value
Total attitude score	0.74	7 <0.001*		
Total IABP waves interpretation score	0.71	1 <0.001*	0.58	1 <0.001*

Discussion:

Regarding nurses level of total knowledge, the current study revealed that more than two thirds of the studied nurses had unsatisfactory level of total knowledge regarding safety of patient connected with intra-aortic balloon pump. Moreover, the highest unsatisfactory domain of knowledge was description and function of intra-aortic balloon pump with mean score of 2.51 \pm 1.42. While, the highest satisfactory knowledge domain' was nursing care of the patient while connected with

the intra- aortic balloon pump with mean score of 4.35 \pm 1.87.

This finding answered the first research question (What is the nurses' knowledge regarding safety of patient connected with intra-aortic balloon pump?). From the researcher point of view, this finding might be due to that more than half of nurses education was technical nursing institute, little years of experience (less than two year), and lack of training courses.

This finding is similar to result study conducted by **Ghafoor et al., (2022)**, in their study entitled "The Effect of Teaching Programme on Knowledge and Caring Practice of Intra-Aortic Balloon Pump Patient Among ICU Staff Nurses", who displayed that, most nurses had poor knowledge related to intra-aortic balloon pump before the educational program.

However, this result is contradicted with **Neelavathi et al., (2020)**, who displayed that, most of the nurses had moderately adequate knowledge regarding IABP care in the pretest in their study in Apollo entitled "Effectiveness of a capacity building program regarding care of patient with intra-aortic balloon pump (IABP) among nurses".

Concerning nurses safety attitude, the current study revealed that, more than half of the studied nurses had positive attitude regarding safety of patient connected with intra-aortic balloon pump. Although the current study showed that more than half of the studied sample had positive attitude toward patient safety, this is less than what is supposed to be for this category of patients. From the researcher point of view, this might be due to lack of nurses' experience and information regarding the importance of patient safety. This finding answered the second research question (What is the nurses' attitude regarding safety of patient connected with intra-aortic balloon pump?).

This finding supported by **Khaliel et al., (2022)**, who illustrated that, more than three-quarters of the studied nurses have positive attitude towards safety measures in cardiac catheterization unit in their study in Benha entitled "Evaluate Nurses' Performance regarding Safety Measures in Cardiac Catheterization Unit at Benha University Hospital and Suggested Guidelines". On the other hand this result is contradicted with **Hasballah et al., (2019)**, who clarified that, more than three quarters of nurses have negative attitude for patient safety in Cardiac Catheterization Unit in their study in Assiut entitled "Assess nurses' knowledge and attitude for patient safety in cardiac catheterization unit".

Regarding nurses' total level of safety interpretation of intra-aortic balloon waves, the current study revealed that more than two thirds of nurses had unsatisfactory level of total safety interpretation of IABP waves. Moreover, the highest unsatisfactory interpretation domain

was IABP assist frequency ratio with mean score of 0.45 ± 0.32 . While, the highest satisfactory interpretation domain was normal IAB pressure waveform with mean score of 0.38 ± 0.29 .

. This finding answered the third research question (What is the level of nurses' safety interpretation of intra-aortic balloon waves?). From the researcher point of view the reason for lack of nurses' safety interpretation of IABP waves was that this topic is not incorporated in the nursing curriculum, which negatively affected their knowledge and practices. Also, might be due to decrease nurses years of experience.

This result matching with **Ameen et al., (2021)**, who stated that, the majority of nurses have unsatisfactory level of cardiac dysrhythmias interpretation pre knowledge enhancement nursing protocol implementation in their study in Egypt entitled "Cardiac Dysrhythmia Interpretation Knowledge Enhancement Nursing Protocol". On the other hand this result is contradicted with **Coll-Badell et al., (2017)**, who reported that, the competence of electrocardiographic interpretation of emergency nurses is high in their study in Spain entitled "Emergency Nurse Competence in Electrocardiographic Interpretation in Spain: A Cross-Sectional Study".

Concerning correlation between nurses' total knowledge, safety attitude, waves interpretation scores, the present study displayed that, there is statistically significant positive correlation between total nurses' knowledge, safety attitude and interpretation of waves' scores. From the researcher point of view nurses with poor knowledge about patient safety and waves' interpretation were less likely to have satisfactory level of waves' interpretation. Nurses displayed positive safety attitudes, despite the fact that they had not received sufficient education or training related to safety culture, showing great potential for further improvement with the delivery of adequate training.

These findings is supported by **Alghamdi et al., (2021)**, who mentioned that, there a significant relationship between nurses'

knowledge and attitudes in their study in kingdom of Saudi Arabia entitled "Assessment of Saudi Arabian Nurses' Knowledge and Attitudes Toward Magnetic Resonance Imaging Safety". Also, this result agreed with **Ali et al., (2022)**, who stated that, there is a positive correlation between studied nurses' level of knowledge and their level of practice regarding ECG application and its interpretation. However, this result is contradicted with **Khaliel et al (2022)**, who found that, there is negative correlation between nurses' knowledge and their attitude regarding safety measures in cardiac catheterization unit.

Conclusion:

Based on findings of the current study, it was concluded that:

More than two thirds of nurses under study had unsatisfactory knowledge level, more than one half of nurses under study had positive attitude regarding safety of patient connected with intra-aortic balloon pump, and more than two third of nurses under study had unsatisfactory level of safety interpretation regarding IABP waves. Also, there was statistically significant positive correlation between total nurses' knowledge, total safety attitude scores and total safety interpretation of IABP waves.

Recommendations:

Based on findings of the present study, the following recommendations were suggested:

- Providing educational training programs for nurses regarding IABP and safety interpretation of IABP waves.
- Including safety interpretation of IABP waves in nursing curriculum
- Replication of the study on a larger probability sample from different geographical locations in Egypt.

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