Nurses' Knowledge and Practice Regarding Hemodynamic Monitoring for Patients with Cardiothoracic, Vascular Surgery and Patient Outcome

Hala Abdel Sabour Gad, Nadia Mohamed Taha, Gehan El Sayed Hafez
Medical Surgical Nursing department- Faculty of Nursing- Zagazig University, Egypt.

Abstract

Hemodynamic monitoring of a surgical patient acquires a major relevance in high-risk patients and those suffering from surgical diseases associated with hemodynamic instability. So International and national job duties of ICU nurses obligate them to tackle the hemodynamic monitoring. This study aimed to evaluate nurses' knowledge and practice regarding hemodynamic monitoring for patients with cardiothoracic, vascular surgery and patient outcome in cardiothoracic intensive care units at Zagazig University Hospital and Al Ahrar Hospital. A descriptive cross sectional design was utilized. Data were collected from two setting; the cardiothoracic intensive care units at Zagazig University and Al-Ahrar Hospital. The study was conducted on forty four nurses and forty four patients from the same hospital setting which have been selected to the study**.** Two tools were used for collection of data, first, questionnaire self-administer tool to collect demographic characteristics of study nurses, questions to assess nurses' knowledge regarding hemodynamic monitoring for patients with cardiothoracic, vascular surgery and patient outcome. Second tool was an observational checklist to assess nurses' practice regarding hemodynamic monitoring for patients with cardiothoracic, vascular surgery. Results of this study showed that, more than half of the nurses were less than 30 years and had less than 10 years of experience, half of the nurses graduated from technical institute. Less than a quarter of the studied nurses had satisfactory total knowledge regarding hemodynamic monitoring. Less than one third of the studied nurses had total satisfactory practice regarding hemodynamic monitoring for patients with cardiothoracic, vascular surgery. Relation's analysis showed no significant relation between total nurses' knowledge and practice scores. There was no significant relation between total knowledge score and total practice score and patient outcome. Conclusion nurses had unsatisfactory level of knowledge and practice about hemodynamic monitoring for patients with cardiothoracic, vascular surgery. They did not apply the most recommended nursing practices regarding hemodynamic monitoring for patients with cardiothoracic, vascular surgery. It is recommended to design and apply training programs to improve nurses' knowledge and practice regarding hemodynamic monitoring for patients with cardiothoracic, vascular surgery.

Key words: Hemodynamic Monitoring. Nurses. Cardiothoracic. Vascular. Knowledge. Practice**.** Patient outcome.

Introduction

The 2016 Heart Disease and Stroke Statistics update of the American Heart Association (AHA) has recently reported that 15.5 million persons ≥20 years of age in the USA have CHD (**Mozaffarian et al,2016**) Heart disease is the leading cause of death in Egypt, with ischemic heart disease (IHD) and stroke accounting for 21% and 14% of all deaths respectively. Overall, cardiovascular disease (CVD) mortality accounts for 46% of all mortality. The high prevalence of cardiovascular risk factors (e.g. smoking, hypertension, diabetes, poor life style…etc.) contributes to a burden of cardiovascular morbidity and mortality generally in the Middle East and particularly in Egypt**(WHO, 2016) .**

Cardiac operations, including coronary artery bypass graft (CABG) cardiac valve, and aortic procedures, represent one of the most common categories of surgeries performed in the United States. With an average inpatient cost of $40,000, the yearly direct cost of these procedures alone is more than $20 billion, representing 1–2% of U.S. healthcare costs.

As the population ages and care becomes more sophisticated, cardiac surgery is being performed on older, sicker, and more complicated patients. Simultaneously, the spectrum of cardiac surgery is expanding, with increasing use of both minimally invasive techniques and mechanical circulatory support devices(**Stephens,R.&Whitman,J.2015)**.
The hemodynamic monitoring of a surgical patient acquires a major relevance in high-risk patients and those suffering from surgical diseases associated with hemodynamic instability, such as hemorrhagic or septic shock; however, all surgical patients require the monitoring and evaluation, and sometimes benefit from optimizing their hemodynamic status. hemodynamic monitoring can be invasive or noninvasive, and continuous or intermittent. Monitoring devices can measure physiologic variables directly, or derive these variables through signal processing. Signal processing does not minimize the usefulness of physiologic variable analysis; it just separates the output data from the patient by the use of the data processor. The most common signal processing physiologic variable measured clinically is the electrocardiogram **(Wilkman, 2014).**
Invasive hemodynamic monitoring is one of the major competencies required for critical care nurses. Moreover, monitoring parameters and assurance of accuracy of an invasive system are crucial in providing high - quality nursing care in the ICUs. Also, measurement of hemodynamic monitoring among critically ill patients is essential. Inaccurate measurement may create risks and mistakes in diagnosis as well as nursing and medical interventions **(Rosenberg et al, 2014)** .

Significance of the study

Hemodynamic Monitoring (HM) is an important component of critically ill patient care. Knowledge of the cardiovascular function, monitoring of therapeutic interventions, and the need for differential diagnosis make HM techniques an essential component for the outcomes of these patients **(Dias et al ,2014).** **Thanachartwet et al (2016)** added that Hemodynamic Monitoring is a functional tool used for assessing the pathophysiological process of a disease, and proper monitoring can alert health care teams to an impending cardiovascular crisis before the development of organ injury. Hemodynamic monitoring is also used to facilitate diagnosis, which enables more effective management, and to monitor response to therapy.

Aim of the study

The aim of the current study was to:
to evaluate nurses knowledge and practice regarding hemodynamic monitoring for patients with cardiothoracic , vascular surgery and patient outcome in Cardiothoracic Intensive Care Unit at Zagazig University Hospital and Al Ahrar Hospital.

Methodology

Research questions:

1. What is the level of nurses' knowledge regarding hemodynamic monitoring for patients with cardiothoracic and vascular surgery?
2. What is the level of nurses' practice regarding hemodynamic monitoring for patients with cardiothoracic and vascular surgery?
3. What is the patient outcome regarding hemodynamic monitoring?

Research design:
Cross Sectional descriptive design was utilized in this study.

Study setting*:*
The current study was carried out at Cardiothoracic Intensive Care Unit at Zagazig University Hospital and Al Ahrar Hospital.

Study subjects:
The study sample included All available nurses working in cardiothoracic and vascular intensive care units (44 nurses) and 44 cardiothoracic surgery patients, 30 nurses from cardiothoracic and vascular intensive care units at Zagazig University, 14 nurses from cardiothoracic and vascular

intensive care units of Al-Ahrar Hospital. Total number of the subjects was 44 nurses (42 of them are females and 2 are males) and 44 patients were selected randomly from the above setting , 5 nurses and 5 patients selected randomly to pilot study then excluded from the subjects.

Tools of data collection:

Two tools were used for data collection,

Tool I: Structured Interview Questionnaire for Nurses:

It was designed in Arabic form to avoid misunderstanding. It was developed by the researcher based on literature review **(Anderson, 2012, Dhiren, 2010, Fry, 2011, Hill, 2017)** and opinion of expertise for content validity. It included the following parts:

Part I: Personnel characteristic Data of the Studied Nurses: which were composed of 6 items including (age, sex, , level of education, years of experience in CTICUs, as well as attending any training courses related to hemodynamic monitoring).

Part II: Nurses' Knowledge Recalled Questionnaire: Entails questions to assess nurses' knowledge regarding hemodynamic monitoring. Total items were 38 multiple choice questions

Part III: Patient Outcome Sheet: This tool is constructed and filled by the researcher. It consists of 14 items such as age, sex, diagnosis, length of stay in CTICU, vital signs, arterial blood pressure, central venous pressure, ABG, amount of urine, skin color, color of mucus membrane, color of lips, color of nails, CBC results(RBCs, WBCs, Hb level and platelet count).

The scoring system:

Scoring system was graded according to the items of the interviewing questionnaire. The answers of respondents (nurses) were evaluated using model key answer prepared by the researcher. The total score of the knowledge was 38 grades (100%). Each correct answer scored one grade, and zero for incorrect answer or didn't know. The total knowledge score was classified as follow:

- Satisfactory level of knowledge≥ 80%
- Unsatisfactory level of knowledge<80%

II- Nurses' practice

Tool II: Structured Observational Checklist for Nurses' Practice. A structured observational checklist was developed by the researcher to evaluate nurses' practice provided to patients with cardiothoracic and vascular surgery as guided by(**Lynn& LeBon, 2011,Scales, 2010).**

Scoring system:

Each step in the observational checklist was checked as done or not done. The total score of all practices were (78 grades). Each step done correctly take score one, while the not done take score zero. The total score of all practices was classified as the following:

- Satisfactory≥80%
- Unsatisfactory<80%

Validity and reliability:

It was established for assure of content validity by a panel of 5 expertise's in medicine and nursing at Zagazig University who revised the tools for clarity, relevance, comprehensiveness, understanding, and ease for implementation and according to their opinion minor modification were applied. Reliability statistics of the study, Cronbach's Alpha was 0.87.

Scale	No. of items	Cronbach's alpha coefficient
Observation checklist tool	80	0.87

Pilot study:

A pilot study for tools of data collection was carried out on 10% in order to test whether they are clear, understandable,

and feasible and applicability. For this study, the researcher randomly selected 5 nurses to participate in the pilot testing of the questionnaire sheet and checklist and 5 patients. Simple modify was done based on pilot results and the sample who shared in the pilot study excluded from the study sample.

Field work:

Field work of this study was executed in six months from May 2018 to October 2018 and the following was done.

Interviewing the nurses at the above mentioned setting, the researcher started by introducing herself to the nurses then informing them about the purpose of the study. The nurses met the researcher at the end of the morning shift for nurses working at morning shift and at the afternoon before starting their work. Each nurse individually interviewed to fulfill the questionnaire. Each interview lasted for about 30 minutes to complete the tool. Each nurse was observed for two shifts for three times then she was asked to fulfill the questionnaire. The researcher was available three days weekly. As the researcher was observing nurses' practical skills about studied procedure. The time needed to complete the checklist varies ranged between 30-45 minutes. The time needed to complete the checklist depends upon the time of the procedure and filled by the researcher during nurses' performance. The researcher started examining and observing each patient from the immediate post-operative period until transferring to the department.

In order to assess patients' outcome, the researcher measured vital signs, measured CVP, and calculated the amount of urine, and examined skin, mucus membranes, nails, lips for each patient. The researcher revised the results of CBC and ABG for each patient continuously. The researcher observed the monitor attached to each patient for arterial pressure.

Administrative and ethical considerations:

An official permission for data collection in the Cardiothoracic and vascular intensive care units and Al-Ahrar Hospital was obtained from the hospital administrative personnel by the submission of a formal letter from the Dean of the Faculty of Nursing.

Meeting and discussion were held between the researcher and the nursing administrative personnel to make them aware about the aims and objectives of the research, as well as , to get cooperation during the phases of the research, also nurses consent were obtained before starting data collection.

The reactions of the administrative personnel were very supportive for the research, where some of nurses ask for rewards to complete the questionnaire.

At the interview, each subject was informed about the purpose, benefits of the study, and they were informed that their participation is voluntary and they have right to withdraw from the study at any time without given any reason. In addition, confidentiality, and anonymity of the subjects were assured through coding of all data.

Statistical analysis:

Data collected throughout history, basic clinical examination, laboratory investigations and outcome measures coded, entered and analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 20.0) (Statistical Package for the Social Sciences) software for analysis.

According to the type of data qualitative represent as number and percentage, quantitative continues group represent by mean ± SD, the following tests were used to test differences for significance; Differences between frequencies (qualitative variables) and percentages in groups were compared by Chi-square test. P value was set at <0.05 for significant results & <0.001 for high significant result.

Results

Table (1): Personnel characteristics of the studied nurses (n=44):

▪ **Table (1):** shows that personnel characteristics of the studied nurses showed that 54.5% of the nurses were less than 30 years, 95.5% were female and 52.2% of them had experience in hospital less than 10 years. In relation to educational level 50% of nurses had technical institute and 61.4% of nurses didn't attend training courses.

	No	%
Age		
<30y	24	54.5
>30y	20	45.5
Mean ± SD	31.1±8.5	
Median & Range	28.5 & 46-20	
Sex		
Male	2	4.5
Female	42	95.5
Educational Level		
Diploma	9	20.5
Technical Institute	22	50.0
Bachelor	13	29.5
Experience		
<10y	23	52.2
>10y	21	47.7
Mean ± SD	10.6 ± 9.2	
Median & Range	8 & 28-0.5	
Attending training courses		
No	27	61.4
Yes	17	38.6

Table (2): Personnel characteristics of the studied patients (N=44)

- **Table (2):** This table represents personnel characteristics of the studied patients. The table showed that 63.6% were above 45 years, 68.2% of the studied patients were male. According to the table 70.5% of the studied patients stayed at hospital for more than 3 days.

Patients' data	**N**	**%**
Age		
≤ 45y	16	36.4
> 45y	28	63.6
Sex		
Male	30	68.2
Female	14	31.8
ICU stay		
< 3 day	13	29.5
≥ 3 days	31	70.5

Table (3): Total nurses' knowledge regarding hemodynamic monitoring for patients with cardiothoracic and vascular surgery (n =44):

Total Knowledge	Mean ± SD	Satisfactory		Unsatisfactory	
		No	%	No	%
Anatomy of the circulatory system	5.77 ± 1.31	31	70.4	13	29.6
Blood and circulation	5.95 ± 2.24	15	34.1	29	65.9
Hemodynamics	12.18 ± 3.69	6	13.6	38	86.4
Total Knowledge score	23.91 ± 5.95	4	9.1	40	90.9

- **Table (3):** This table demonstrates total nurses knowledge regarding hemodynamic monitoring for patients with cardiothoracic and vascular surgery .The table clarified that 59.1% of the studied nurses had satisfactory total knowledge regarding anatomy of the circulatory system with mean and standard deviation (5.77 ± 1.31). Total knowledge regarding Blood and circulation 34.1% had satisfactory total knowledge with mean and standard deviation (5.95 ± 2.24). 13.6% of the studied nurses had satisfactory total knowledge regarding hemodynamics with mean and standard deviation(12.18 ± 3.69). 9.1% of the studied nurses had satisfactory total knowledge regarding hemodynamic monitoring for patients with cardiothoracic and vascular surgery.

Table (4): Total nurses' Practice regarding hemodynamic monitoring for patients with cardiothoracic and vascular surgery (n =44*)*:

Total practice	Mean ± SD	Satisfactory		Unsatisfactory	
		No	%	No	%
Temperature	9.01 ± 1.16	0	0	44	100
Pulse	6.73 ± 1.59	13	29.5	31	70.5
Respiration	0.0 ± 0.0	0	0	44	100
Blood pressure	11.07 ± 1.42	12	27.3	32	72.7
CVP	13.41 ± 0.95	43	97.7	1	2.3
ABG	11.84 ± 1.27	34	77.3	10	22.7
Total practice score	52.09 ± 3.90	13	29.5	44	100

- **Table (4):**This table shows distribution of total nurses' Practice regarding hemodynamic monitoring for patients with cardiothoracic and vascular surgery. The table clarified that 29.5% studied nurses had satisfactory practice regarding assessment of pulse with mean and standard deviation(6.73 ± 1.59). 27.3% of the studied nurses had satisfactory practice regarding blood pressure measurement with mean and standard deviation (11.07 ± 1.42). 97.7% of the studied nurses had satisfactory practice regarding CVP measurement with mean and standard deviation(13.41 ± 0.95). 77.3% of the studied nurses had satisfactory practice regarding ABG with mean and standard deviation (11.84 ± 1.27). Non of the studied nurses had satisfactory practice regarding assessment of temperature with mean and standard deviation (9.01 ± 1.16).According to the table 29.5% of the studied nurses

had satisfactory total practice regarding hemodynamic monitoring for patients with cardiothoracic and vascular surgery.

	Practice				$\chi 2$	P
	Satisfactory		Unsatisfactory			
	Knowledge					
	No	%	No	%	$\chi 2$	P
Age	Satisfactory		Unsatisfactory			
	No	%	No	%		
Age						
<30y	1	33.3	23	56.1	1.332	0.281
>30y	2	66.7	18	43.9		
Experience						
<10y	3	75	18	45	1.312	0.252
>10y	1	25	22	55		
Sex						
Male	0	0	2	5	0.210	0.647
Female	4	100	38	95		
Qualification						
Diploma	1	25	8	20	0.075	0.963
Technical Institute	2	50	20	50		
Bachelor	1	25	12	30		
Attending training courses						
No	3	75	24	60	0.345	0.557
Yes	1	25	16	40		

Table (5): Relation between nurses' total knowledge score and Demographic characteristics of the nurses (n=44)

Table(5): This table showed that there was no statistical significant relation between nurses knowledge and demographic characteristics of them

<30y	8	61.5	15	48.4	0.655	0.437
>30y	5	38.5	16	51.6		
Sex						
Male	0*	0	2*	6.5	0.879	0.349
Female	13	100	29	39.5		
Qualification						
Diploma	3*	23	6	19.4		
Technical	7	54	15	48.4	0.378	
Institute						0.828
Bachelor	3*	23	10	32.2		
Experience						
>10y	5	38.4	16	51.6	0.635	0.426
<10y	8	61.6	15	48.4		
Attending training courses						
No	7	53.8	20	64.5	0.440	0.507
Yes	6	46.2	11	35.5		

Table (6): Relation between nurses' total practice score and Demographic characteristics of the nurses (n=44):

- **Table(6)** : This table showed that there was no relation between nurses practice and demographic characteristics of them.

Table (7): Relation between total knowledge score and items of practice (n=44):

	Knowledge				**χ2**	**P**
	Satisfactory		**Unsatisfactory**			
	No	**%**	**No**	**%**		
Temp						
Satisfactory	0	0	0	0	-	-
Unsatisfactory	4	100	40	100		
Pulse						
Satisfactory	2	50	11	27.5	0.884	0.347
Unsatisfactory	2	50	29	72.5		
Resp						
Satisfactory	0	0	0	0	-	-
Unsatisfactory	4	100	40	100		
BP						
Satisfactory	1	25	11	27.5	0.011	0.915
Unsatisfactory	3	75	29	72.5		
CVP						
Satisfactory	4	100	39	97.5	0.102	0.749
Unsatisfactory	0	0	1	2.5		
ABG						
Satisfactory	3	75	31	77.5	0.013	0.909
Unsatisfactory	1	25	9	22.5		

- **Table(7):** This table showed that there was no statistical significant relation between total knowledge score and items of practice.

Table(8): Relation between total practice score and items of knowledge (n=44):

	Practice				χ^2	P
	Satisfactory		Unsatisfactory			
	No	%	No	%		
Anatomy of circulatory system						
Satisfactory	7	53.8	19	61.3	0.210	0.647
Unsatisfactory	6	46.2	12	38.7		
Blood and Circulation						
Satisfactory	5	38.5	10	32.3	0.157	0.692
Unsatisfactory	8	61.5	21	67.7		
Hemodynamic						
Satisfactory	1*	7.7	5	16.1	0.554	0.457
Unsatisfactory	12	92.3	26	83.9		

Table (8): This table showed that there was no significant relation between total practice score and items of knowledge.

Table (9) : Relation between nurses' practice and patient outcome

patient outcome		**Practice**				χ^2	P
		Satisfactory		Unsatisfactory			
	Normal	6	46.2	16	51.6		
	Less than normal	4	30.8	12	38.7		
BP	Higher than normal	3	23	3	9.7	1.419	0.492
Pulse	Normal	8	61.5	14	45.2		
	Less than normal	1	7.7	0	0		
	Higher than normal	4	30.8	17	54.8	3.9	0.136
ABP	Normal	10	76.9	17	54.8		
	Less than normal	2	15.4	6	19.4	0.815	0.615
	Higher than normal	1	7.7	4	12.9		
	Normal	6	46.2	23	74.2		
	Less than normal	6	46.2	8	25.8		
CVP	Higher than normal	1	7.7	0	0	4.66	0.097

- **Table (9):** This table demonstrate relation between nurse practice and hemodynamic state of the patients. The table showed that there was no

relation between nurses practice and patient outcome

Table(10): Relation between nurses' knowledge and patient outcome

		Total Knowledge		**Practice total**			
		r	**P**	**R**	**P**		
Age		-0.121	0.434	-0.068	0.659		
Total Knowledge				0.091	0.559		
patient outcome		**Knowledge**				**χ2**	**P**
		Satisfactory		Unsatisfactory			
		No	%	No	%		
	Normal	3	75	19	47.5		
	Less than normal	1	25	15	37.5		
BP	Higher than normal	0	0	6	15	1.306	0.520
Pulse	Normal	3	75	19	47.5		
	Less than normal	0	0	1	2.5		
	Higher than normal	1	25	20	50	1.126	0.569
ABP	Normal	2	50	25	62.5		
	Less than normal	2	50	10	25	2.757	0.252
	Higher than normal	0	0	5	12.5		
	Normal	2	50	27	67.5		
	Less than normal	2	50	12	30		
CVP	Higher than normal	0	0	1	2.5	0.726	0.696

- **Table(10):** This table demonstrate relation between nurse knowledge and hemodynamic state of the patients. According to the table there was no relation between nurses knowledge and patient outcome.

Table (11): Correlation between total knowledge score and total practice score (n=44):

Table (11): This table showed that there was no statistical significant relation between total knowledge score and total practice score.

Discussion:

Critically ill patients are often hemodynamically unstable (or at risk of becoming unstable) owing to hypovolemia, cardiac dysfunction, or alterations of vasomotor function, leading to organ dysfunction, deterioration into multi-organ failure, and eventually death. With hemodynamic monitoring, we aim to guide our medical management so as to prevent or treat organ failure and improve the outcomes of our patients **(Huygh et al, 2016).**

. As regards to the nurses' characteristics, the present study reveals that the majority of the studied nurses were females, more than half of them were less than 30 years and had less than 10 years of experience in hospital. This result may be due to shortage in the number of the highly qualified nurses who were always busy

with administrative duties that is considered one of the main factors which affect on the quality of care offered to such group of patients.

These findings agree with **Abdullah, Mohammed & Ismail (2014)** conducted a study about "Relationship between Perceived Organizational Climate and Conflict Management Strategies among Nurses in Cairo University Hospitals" who found that the majority of nurses were female. This is in the same line with **Deshmukh & Shinde (2014)** in published study about "Practice Regarding Venous Access Device Care among Nurses" who found that the majority of nurses were less than 30 years of age, four fifth of them were females, the majority of the nurses had diploma degree and the majority of them had experience less than 10 years.

As regard to the educational level of As regard to the educational level of the studied nurses the present study revealed that, half of the nurses graduated from technical institute. This finding agree with **Mahgoub & AbdEl Hafez (2017)** in their study about **"**Effect of Implementing Intra-Aortic Balloon Pump Teaching Program on Critical Care Nurse's knowledge and Practice at Assuit University, Egypt" who revealed that the majority of the nurses held technical institute of nursing. These findings disagree with **Ahmed, Eltayeb & Abd-Elsalam (2016)** in their study about "Assessment of Nurses' Performance Regarding Invasive Hemodynamic Monitoring at Critical Care Units in Sudan" who found that the majority of nurses had a bachelor's degree . As well these findings disagree with **Abd kader & Shaaban (2012)**who studied "Critical Care Nurses Knowledge and Practice of Fever Management at a University Hospital" and revealed that more than two thirds of the studied sample had bachelor degree.

The result of the study revealed that more than half of nurses didn't receive training courses about cardiothoracic surgery this result might be due to that there are no hospital policies that regulate continuous training for nurses who worked at cardiothoracic surgery which lead to lack of nurses' knowledge and complex assessment required for caring with cardiothoracic and vascular surgery patients. Training courses are essential and play a very important role in nurses' development as it assist in updating their knowledge and performance as well as improvement of quality of care given for their patients.

This agree with **Mahmoud et al (2016)** in their study about "Assessment of Knowledge and Practice of Nurses Regarding Oxygen Therapy in El malk Nimir Uuniversity Hospital in Sudan" who found that all of the nursing staff had not training course. This is contraindicated with **Ahmed, Mohammed& Ghanem (2015)** in their study about "Coronary Artery Bypass Grafting, Effect of Developing and Implementing Nursing Care Standards on Patient's Outcome in Assiut University" who revealed that the majority didn't attend training courses related to coronary artery bypass graft surgery. As well, these findings were not in accordance with **Metwaly (2011)** in her study about "Nurses' Performance Regarding Nasogastric Tube Feeding in Intensive Care Units, a study at Zagazig University" who found that more than half of the studied sample had training courses about critically ill patients.

Regarding characteristics of the patients under study it was found that the majority of the studied sample were males, about two thirds of them were more than 45 years of age and stayed at hospital more than 3 days. This result may be due to that the most common age affected between 40-60 years who are exposed to cardiothoracic diseases. This agrees with **Ahmed, Mohammed& Ghanem (2015)** who found that more than half of the patients were male As well, **Giakoumidakis et al (2011) in** their study about "Risk Factors for Increased Hospital Mortality: A cohort Study among Cardiac Surgery Patients" who mentioned that, sixty seven percent of the studied patients were males. **Taha (2017)** study findings demonstrated that the majority of both

group were males within the age group of ≥ 50 years old.

This disagree with **Rusingiza et al (2017)** in their study about "Outcomes for Patients with Rheumatic Heart Disease after Cardiac Surgery Followed at Rural District Hospitals in Rwanda" who found that the majority of patients were women. The findings of the present study disagree with **Nakamura et al (2010)** in their study about "Outcome after Valve Surgery in Octogenarians and Efficacy of Early Mobilization with Early Cardiac Rehabilitation" who found that Patients are mobilized rapidly and often ambulate on the first postoperative day. Many patients are ready to leave the ICU within 24–48 hours after surgery.

The present study reported that more than three quarters of the studied nurses had unsatisfactory total knowledge regarding hemodynamic monitoring for cardiothoracic and vascular surgery patients. This inadequacy of nurses knowledge regarding this critical condition may be a result of their level of education , lack of continuous training courses , lack of updating and refreshment of nurses' knowledge and lack of direction and nurse's appraisal about patient's care . These agree with **Khalel (2017**) in her study about "Nurses' Knowledge and Practice Regarding Hemodynamic Monitoring Patients For Post Coronary Artery Bypass Graft Surgery In Ahmed Gasim Hospital Cardiac Center, Bahri Locality Khartoum state, Sudan" who found that nurses' knowledge regarding definition, indication and consist of hemodynamic monitoring was poor knowledge and Poor knowledge regarding insertion and purpose of arterial and central line.

The findings of our study were also similar to findings reported by **Ahmed, Eltayeb & Abd-Elsalam (2016)** who found that the overall knowledge of critical care nurses (who participated in the study) about invasive hemodynamic monitoring was not acceptable. This is in the same line with a descriptive study conducted by **cardilo (2011)** on "Hemodynamic Monitoring and Practice at North California among Critically Ill Patients" which concluded that nurses had poor knowledge on hemodynamic monitoring. Also, this result supported by **Ahmed, Mohammed& Ghanem (2015)** who stated that nurses had unsatisfactory knowledge related to standard of care for patient after coronary artery bypass graft surgery pre NCSs implementation. This is in the same line with **(lear, 2011)** in published study about "Knowledge of Nursing Personals Regarding Immediate Post-Operative Care of Cardiac Surgery Patients on Ventilator in Cardio thoracic Intensive Care Unit (CTICU) in Selected Hospitals of Hyderabad" who revealed that the nurses had a low knowledge regarding immediate post-operative care of cardiac patients on ventilators.

The present study revealed that the majority of nurses had unsatisfactory practice regarding hemodynamic monitoring for cardiothoracic and vascular surgery patients this inadequacy of nurses' practice may be due to lack of nurses knowledge which reflects on their performance, lack of training courses in this field, lack of qualification as half of nurses had technical institute, insufficient staff, lack of close supervision and increased number of patients. This agree with **Khalel (2017)** found that nurses' practice about hemodynamic monitoring was poor. This also agrees with **El-Metwally (2012)** who stated that most of nurses had inadequate practice at the pre-program phase. As well, these findings agree with **Ahmed, Eltayeb & Abd-Elsalam (2016)**who found that nurses practice regarding hemodynamic monitoring was poor.

Also, **Ahmed, Mohammed, & Ghanem (2015**) showed that all studied nurses weren't properly prepared prior to their working and/or dealing with such coronary artery bypass graft surgery patients and really they got their experience while being there, working and managing the patients in the real life emergency situations.

The present study revealed that there was no statistically significant relation

between total nurses' knowledge and personnel data such as age, years of experience and training courses. Also, no relation was found between total nurses' practice and personnel data as age, years of experience and training courses. This may be a result of that the majority of the studied nurses had technical institute, and gained their information from the practical field or acquired their experience from their colleagues .One of the most important reasons is lack of refreshment of nurses' knowledge and development of nurses' practice through continuous training and educational programs. This finding agree with **Taha (2017)** found that there was no significant statistical difference observed between nurses knowledge before the study intervention and their personnel characteristics. As well, **Endla et al (2017)** in their study about "Effectiveness of Planned Teaching Programme on Knowledge and Practice Regarding Hemodynamic Monitoring among Staff Nurses Selected Hospital in Bareilly" revealed that there was no statistical association between knowledge and practice scores with selected socio-demographic variables. These findings are in the same line with **Hassan (2017)** in his study about "Assessment of Nurses Knowledge about Patient Safety after Cardiac Catheterization for Adult Patients in Ibn Al - Biter Specialist Center Cardiac Surgery" who found that there are no significant relationship between nurses knowledge and sociodemographic variables such as age, sex, level of teaching, years of factor in cardiac catheterization and training Course.

The present study that there was negative correlation between knowledge and practice scores of studied nurses and their age with no statistical significance. These findings disagree with **Endla et al (2017)** who found that there was a positive correlation between knowledge and practice scores. Findings are contraindicated with **Taha (2017)** who showed that knowledge was correlated with practice scores among nurses. Also, age was positively correlated with knowledge before and immediately after implementing a designed teaching protocol. And, age was positively correlated with practice of nurses with a highly statistical significant.

The present study demonstrated that there was no relation between nurses' knowledge and practice and patient outcome. These findings disagree with **Taha (2017)** who found that improvement of nurses' knowledge and practice led to improvement of patient outcomes in form of lowering the occurrence of coronary artery bypass graft surgery complications.

Finally, analysis of data in the current study showed that, the majority of the studied nurses had unsatisfactory level of total knowledge compared to all of them had unsatisfactory level of total practice for patients with cardiothoracic and vascular surgery. As regards to patient outcome the present study showed unsatisfactory outcome for the studied patients.

Conclusion:

According to the results of the present study, it can be concluded that Most of the studied nurses reported that, they didn't receive training courses regarding cardiothoracic and vascular surgery. Regarding the study result, all of the studied nurses had unsatisfactory level of total practice score compared to the majority of them had also unsatisfactory level of their knowledge regarding hemodynamic monitoring for cardiothoracic and vascular surgery patients. As regards to patient outcome, all of the studied patients had unstable outcome. In addition, there was no statistically significant difference between total nurses' knowledge and total practice score and patient outcome.

Recommendations:

- Based on the results of the present study the following recommendations are suggested:
- Periodic evaluation and validation of the training given and training programs should be included both theoretical and practical.

- Written procedures should be drawn up specifying safe working methods to cover each process.
- Complete manual procedures should be in Arabic language, easily used and available to all nurses.
- Knowledge and competence of nursing staff should be periodically evaluated, documented and up to date if necessary.
- Booklet about nurses' knowledge and practice care for cardiothoracic and vascular surgery patients .
- Further studies are necessary to identify effects of educational programs on nurses' performance in the CTICUs.

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