Original Article

Effect of invasive hemodynamic monitoring training program on nurses' knowledge and practice in cardiac centers in Sudan

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Abstract

Background:
The critically ill patients often complain of complex medical or surgical conditions need a continuous assessment for their circulatory system using a well-established monitoring system in diagnoses and management. Thus invasive hemodynamic monitoring is quiet necessary and considered one of essential competences for the critical care nurses.

Aim:
This study aimed to assess the effect of invasive hemodynamic monitoring training program on nurses' knowledge and practice in governmental cardiac centers in Sudan during the period 2015 to 2018.

Methods:
quasi; experimental study, the training program was designed and applied in four selected Sudanese governmental cardiac centers through proportional random sampling method of the participants (n = 61), an official permission was obtained from National Ribat University, Federal Ministry of Health, then the data was collected by validated questionnaire and checklist, then managed by SPSS v.20, only values less than 0.05 was considered significant, with a confidence interval of 95%.

Results:
Participants' overall knowledge before the interventional program was 54.3% increased to 92.0% after the interventional program, and 93.4% in the follow up phase. Participant' mean practice before applying of the program was 34.2% increased to 80.9% after the interventional program and 84.0% in the follow up phase. These results indicated significant improvement in nurses' competences before and early after interventional program by one month (P = 0.004), before and late after 3 months in the follow up phase (P = 0.003).

الملخص

خلفية:
المرضى الذين يعانون من حالات طبية وجراحية حرجة يحتاجون إلى تقييم مستمر لنظام القلب والأوعية الدموية للتشخيص والعلاج، لذلك مراقبة الدورة الدموية من داخل الوعاء الدموي لهؤلاء المرضى أمر بالغ الأهمية وتعتبر واحدة من الكفاءات الرئيسية اللازمة لممرضي الرعاية الحرجة.

الهدف :
دراسة أثر البرنامج التدريبي على مدى معرفة ومهارة ممرضي الحالات الحرجة فيما يتعلق بمراقبة قياسات الدورة الدموية من داخل الوعاء الدموي بوحدات الرعاية الحرجة بمراكز القلب السودانية الحكومية للأعوام ٢٠١٥ ـ٢٠١٨.

طريقة البحث:
دراسة تطبيقية, البرنامج التدريبي صمم ونفذ لأربع مراكز قلب سودانية حكومية, عن طريق جمع العينة العشوائي التناسبي (العدد = ٦١), تم أخذ التصريح من جامعة الرباط الوطني, ووزارة الصحة الاتحادية, كما تم أخذ أذن شفاهي من المشاركين في الدراسة. تم جمع البيانات عن طريق الاستبيان وقائمة التحقق, حيث تمت معالجة البيانات باستخدام الحزمة الإحصائية للعلوم الاجتماعية الإصدار ٢٠.فقط القيم الأقل من ٠,٠٥ اعتبرت ذات قيمة إحصائية.

النتائج:
أشارت النتائج أن نسبة المعرفة الشاملة للمشاركين قبل البرنامج التدريبي كانت ٥٤,٣٪ ارتفعت إلى ٩٢,٠٪ بعد تنفيذ البرنامج التدريبي, و ٩٣,٤٪ في فترة المتابعة. كما أشارت أن نسبة التطبيق العملي الصحيحة الشاملة قبل البرنامج التدريبي كانت ٣٤,٢٪, ارتفعت إلى ٨٠,٩٪ بعد التنفيذ و ٨٤,٠٪ في فترة المتابعة. كما أشارت هذه الدراسة إلى وجود تحسن ملحوظ في كفاءة الممرضين قبل وبعد البرنامج التدريبي, مقارنة بقبل وبعد البرنامج التدريبي بمدة واحد شهر(P = ٠,٠٠٤), قبل البرنامج التدريبي وبعده بمدة ٣ أشهر خلال فترة المتابعة (P = ٠,٠٣).

Conclusion:
Baseline level of critical care nurses' competences about invasive hemodynamic monitoring in the Sudanese cardiac centers was not satisfactory. There was a considerable improvement in nurses' competences when they received a structured educational program on invasive hemodynamic monitoring.

Keywords:
invasive hemodynamic monitoring, knowledge, practice, training, nurses

الخلاصة :
المستوى الأساسي لكفاءة ممرضي الحالات الحرجة لقياسات مراقبة الدورة الدموية من داخل الوعاء الدموي بمراكز القلب السودانية الحكومية لم تكن مرضية, كما أوضحت وجود أثر و تحسن في كفاءة الممرضين عند تلقيهم لبرنامج تدريبي معتمد فيما يتعلق بقياسات مراقبة الدورة الدموية من داخل الوعاء الدموي.

كلمات مفتاحيه:
مراقبة قياسات الدورة الدموية من داخل الوعاء الدموي, المعرفة, مهارة, برنامج التدريبي.

Introduction

Hemodynamic monitoring is a practice on monitoring machines to measure cardiovascular parameters of patients. Monitoring definitely affects patient care positively, and the critical care nurses must be eligible to interpret all parameters on the clinical setting parameters from error and keep in mind the all pharmacological, biochemical, or physiological data for the changes observed on the clinical setting as well. Therefore the competent nurses have a tremendous impact on patient outcome as technology in the critical care setting has being used in both diagnostic and therapeutic decision making purposes [1, 2].

Critical ill patients physiologically are unstable, so; they need for a well-secured vascular access for both therapeutic purposes to give fluids and essential medications, or diagnostic hemodynamic monitoring purposes. Furthermore; critically ill patients usually need rapid medical interventions pointed in supporting compromised vital organ, and standardizing their response to that therapy [3, 4].

The access line is the therapeutic cornerstone in the critical care setting. All patients must have a well-secured access line, even without current use as receiving infusion therapy, also the need for that vascular access lines must be frequently weighed against the need, cost, and risk of potential complications [3, 5, 6].

There are different intensity levels of invasive hemodynamic monitoring focusing on the clinical needs; the simplest level includes monitoring heart rhythm, central venous pressure, and arterial blood pressure. Patient who has a low cardiac output after acute myocardial infarction needs more intense level of surveillance, so, it required to use pulmonary artery catheter "Swan Ganz", which provides hemodynamic information that includes intra-cardiac pressures, direct measurement of cardiac output, and if necessary it provides a direct measurement of pulmonary arterial oxygen saturation [7,10]. The study aimed to assess the effect of Invasive Hemodynamic Monitoring Training Program on nurses' knowledge and practice in cardiac centers in Sudan.

Methods

Design: A quasi experimental study that was conducted as pretest and posttest one group design.

Study population: All nurses who work in the governmental cardiac centers' critical care units in the Sudan with at least one year experience and registered at the Sudanese National Medical and Health Professional Council were taken as target population of this study. Sampling and sample size calculation: Probability simple random sampling method was used. The study sample was composed of 61 nurses in four governmental cardiac centers in the Sudan. The sample size required to meet

this objective was calculated using the following formula (curtsey of the Department of Mathematics; College of Science, University of Khartoum):

$$N = \frac{(Z1 - \alpha + Z1 - \beta)\,2}{\Delta 2} + \frac{(Z1 - \alpha)\,2}{2}$$

Distribution of critical care nurses working in the Sudanese governmental cardiac centers (2015 - 2018)

No	Cardiac center name	Frame	Proportionate sample	%
1	Sudan Heart Center	45 nurses	19	31.1
2	Ahmedgasim Specialized Hospital	24 nurses	10	16.4
3	Shaab Teaching Hospital	33 nurses	13	23.0
4	Madani Heart Center	45 nurses	19	29.5
	Total	147 nurses	61	100

Instruments

1. Structured self administered questionnaire was designed by the researchers and utilized for data collection. The Cronbach's alpha was used to assess internal consistency and validity of the designed questionnaire. Based on sample of 10 nurses, the level of Cronbach's alpha was above acceptable level, which indicates the validity and reliability of questionnaire.

First: to find out the general characteristics of the study sample, it contains basic data related to their general characteristics such as nurses' gender, level of education, years of experience, attendance of invasive hemodynamic monitoring courses, availability of written protocols in their unit, (reviewed by expert academics for reliability and modifications were made as well as 10 nurses excluded from the sample for validity test).

Second: to assess nurses' knowledge regarding variables of invasive hemodynamic monitoring that includes questions about knowledge related to phlebostatic axis; central line removal position, etc.

The questionnaire composed of 31 questions using a scoring system of the phrases (correct =1. incorrect = 0), the interval score was used for evaluation of the scores for the level of knowledge items which was evaluated by: poor (less than 50%), fair (50% - 75%), good (more than 75%).

2. Observational checklist was used by researchers. It was composed of main ten observed items, the scale for checklist was scored into (done = 1, not done = 0).

Data analysis:

The collected data was arranged into a master sheet, coded separately and then entered into the software (SPSS) Statistical Package for Social Science version 20.

Ethical consideration:

- Approval from The National Ribat University, Faculty of Graduate Studies and Scientific Research.
- Approval from the Federal Ministry of Health
- Sudan (Scientific Researches Committee) toward the study areas.
- A written consent from the nurses under study.

The training program procedure:

Nursing educational programs in healthcare institutions improve nurses' knowledge and practice that will improve their quality of care which result in better patient outcome; also it improves satisfaction for the nurses, physicians, clients, and their families (11).

Contents of the program:

The researchers prepared a training program to be delivered to the intervention group. The training program contents were:

- Lectures that included: (power point presentation, videos, and photos).
- Group discussion.
- Practical demos.
- Practical supervision.
- Posters and Handouts.

Theoretical framework:

Many theories in health education and health promotion seek answers to the fundamental question of why people behave the way they do. Furthermore; the improvement in health care, education, and lifestyle are amazing achievement in which intended to meet the demand of the future to produce the intelligent, independent people as reported by Combs 1972 cited in Candy 1991 [12] The educational sessions of this study educational program were conducted in order to improve the nurses' knowledge and practice regarding invasive hemodynamic monitoring, by keeping the adult learning theory of Malcolm Knowles (Theory of Andragogy) in mind [13-15].The TRA model (theory of reasoned action behavior) illustrates that human behaviors can be predicted from behavioral intentions, attitude, and influences by subjective social norms [16].

Materials of the program:

- Laptop presentations that included power point presentation, photos, videos, and wall posters for theoretical part.
- Half manikin with full invasive hemodynamic monitoring kit for practical part.

Results:

In the Sudan, most of critical care nurses who work in the governmental cardiac centers are working in four major cardiac centers; three of them are in the capital of the Sudan which is Khartoum state, and one center in the middle of the country which is Gezira state.

The demographic characteristics of participants was shown in Table 1, most of participants were females (67.2%), and less than 30 years old (77%), almost of them have bachelor qualification (90.2%) and their experience was less than 5 years (62.3%). Table 1 also showed that there was no written protocol in the units (82%) and most of nurses (93.4%) did not attend any formal training.

Table 2 and Figure 1 and Figure 4, showed the participants' global mean knowledge before the interventional program which was 54.3% increased to 92.0% after the interventional program, and 93.4% in the follow up phase. Participant' global mean of practice before applying of the program was 34.2% increased to 80.9% after the interventional program and 84.0% in the follow up phase. These results indicated significant improvement in nurses' competence before and early after interventional program by one month ($P = 0.004$), before and late after 3 months in the follow up phase ($P = 0.003$), Table 3 and Figure 2 and Figure 3.

Table (1):Characteristics of nurses working in the Sudanese cardiac centers critical care units (n=61).

Character	N	%
Gender:		
Males	20	32.8
Females	41	67.2
Age in years:		
< 30	47	77.0
≥ 30	14	23.0
Nursing qualifications:		
Diploma	0	0
Bachelor	55	90.2
Master	9.8	9.8
PhD	0	0
Nursing experience:		
Less than 5 years	38	62.3
More than 5 years	23	37.7
Availability of formal written protocol in the unit :	11	18.0
Yes	50	82.0
No		
Attendance of formal training program:		
Yes	4	6.6
No	57	93.4

Table (2): Knowledge of the population regarding preparation, procedure, and complications of the invasive hemodynamic monitoring system in the Sudanese cardiac centers before and after attendance of the training program (n=61).

Item		Pre		Post (early)		CI 95%		P
		Mean	SD	Mean	SD	Lower	Upper	
preparation of the system	Preparation of the invasive system	1.0	0.76	2.0	1.18	0.14	0.85	0.007
	Allen test	2.0	0.10	2.0	0.0	0.87	1.43	0.006
	Preparation for CVC	2.0	0.14	2.0	0.0	-0.05	0.02	0.319
	Invasive homodynamic monitoring	2.0	0.11	2.0	0.4	-0.48	-0.01	0.040
	The best line for CVP connection	2.0	0.1	2.0	0.0	-0.81	-0.27	0.002
	The pressure in the pressure bag	2.0	0.2	2.0	0.1	-0.71	-0.21	0.006
	Standard zeroing intervals	1.0	0.4	2.0	0.8	-0.11	0.27	0.001
	Phlebostatic axis	1.0	0.1	2.0	1.0	0.93	1.46	0.002
	The dicrotic notch	2.0	0.1	2.0	1.2	0.73	1.34	0.004
	Sudden shooting in BP, nursing intervention	2.0	0.2	2.0	0.3	-0.55	-0.14	0.007
	Sudden dropping in BP, nursing intervention	2.0	0.3	2.0	0.0	-0.48	-0.15	0.002
	Total	2.0	0.22	2.0	0.45	0.53	0.56	0.036

procedure	Confirmation of the actual invasive readings	2.0	1.1	2.0	0.3	-0.31	0.14	0.004
	Repeated zeroing of the invasive system	2.0	0.1	2.0	0.5	0.49	0.06	0.005
	The level of the transducer affects the reading	2.0	0.3	2.0	0.4	0.16	0.06	0.008
	Insurance of the function of the pressure bag with flushing solution	2.0	0.6	2.0	0.7	-0.11	0.08	0.005
	CVP is indicated to measure the preload	1.0	0.1	2.0	0.0	0.07	0.29	0.001
	Do you think that the arterial waveform on the monitor is important	2.0	0.1	2.0	0.0	-0.02	0.05	0.319
	Do you think that the CVP waveform on the monitor is important	2.0	0.2	2.0	0.0	-0.01	0.08	0.156
	Total	2.0	0.3	2.0	0.2	0.16	0.10	0.071
Complications	The best position for CVC removal	2.0	0.7	2.0	0.2	-0.82	-0.36	0.003
	The commonest site for CVC related infection	2.0	1.0	2.0	0.8	0.29	0.83	0.008
	Pneumothorax related to CVC insertion	2.0	0.4	2.0	0.5	-0.38	0.12	0.002
	Standard dressing intervals of the CVC	2.0	0.7	2.0	0.3	-0.29	0.09	0.003
	Your duty as a nurse to know the age of the CVC	2.0	0.2	2.0	0.0	-0.01	0.10	0.080
	Total	2.0	0.6	2.0	0.3	0.35	0.30	0.010

Table (3): Study population according to their practice in the Sudanese cardiac centers before and after application of the training program (n=61).

Item	Pre		Post (early)		C/I 95%		P
	Mean	SD	Mean	SD	Lower	Upper	
Checked the pressure bag and the flushing solution	1.0	0.9	2.0	0.0	0.55	0.79	0.004
Leveled the transducer to the phlebostatic axis	1.0	0.8	2.0	0.0	0.16	0.39	0.004
Made zeroing of the invasive system in the beginning of the shift	1.0	0.2	2.0	0.2	0.60	0.84	0.002
Changed the stopper after every use	1.0	0.3	2.0	0.3	0.33	0.62	0.003
Kept the access line always dressed	1.0	0.6	2.0	0.0	0.15	0.37	0.009
Used hand hygiene methods during handling	1.0	0.7	2.0	0.0	0.11	0.32	0.009
Used alcohol swap for the 3 way stopcock pole	1.0	0.5	2.0	0.5	0.52	0.79	0.002
Kept the 3-way stopcock always covered	1.0	0.7	2.0	0.0	0.36	0.62	0.006
Performed the fast flush squire test	1.0	0.8	2.0	0.0	0.95	1.02	0.002
Removed the access line properly	1.0	0.5	2.0	0.5	0.16	0.39	0.004
Total	1.0	0.6	2.0	0.15	0.38	0.57	0.004

Figure (1): Participants' knowledge percentage regarding invasive hemodynamic monitoring in the Sudanese cardiac centers before application of the training program by hospitals (n = 61).

(١):

(= ٦١).

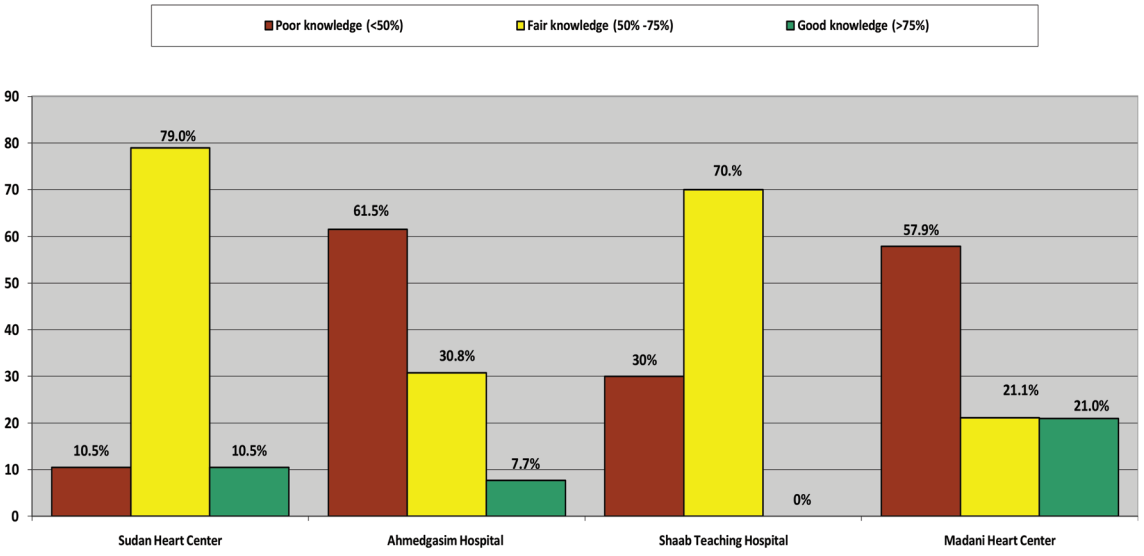


Figure (2): Distribution of participants' total practice percentage regarding invasive hemodynamic monitoring in the Sudanese cardiac centers before application of the training program (n = 61).

(٢):

(= ٦١).

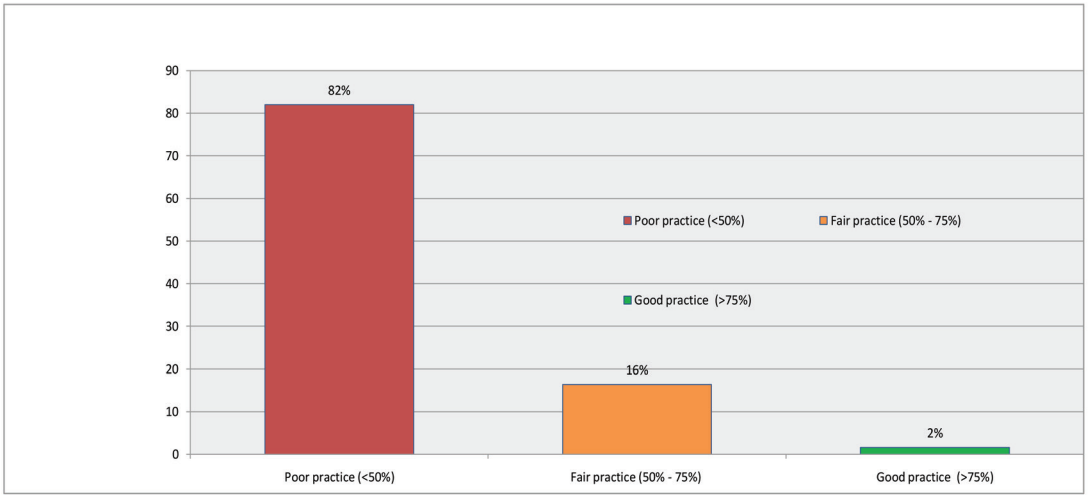


Figure (3): Participants' practice percentage regarding invasive hemodynamic monitoring in the Sudanese cardiac centers before application of the training program by hospital (n = 61).

(٣):

(= ٦١).

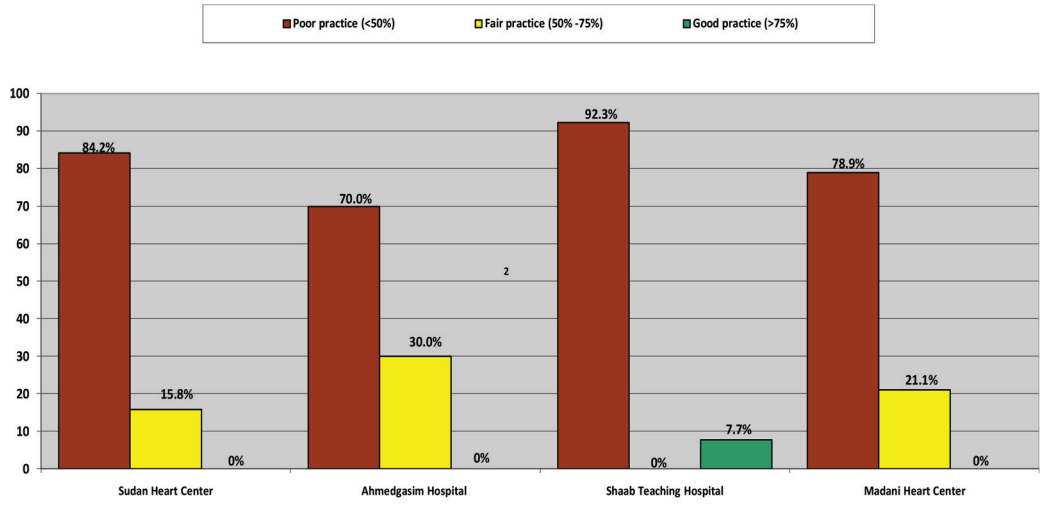
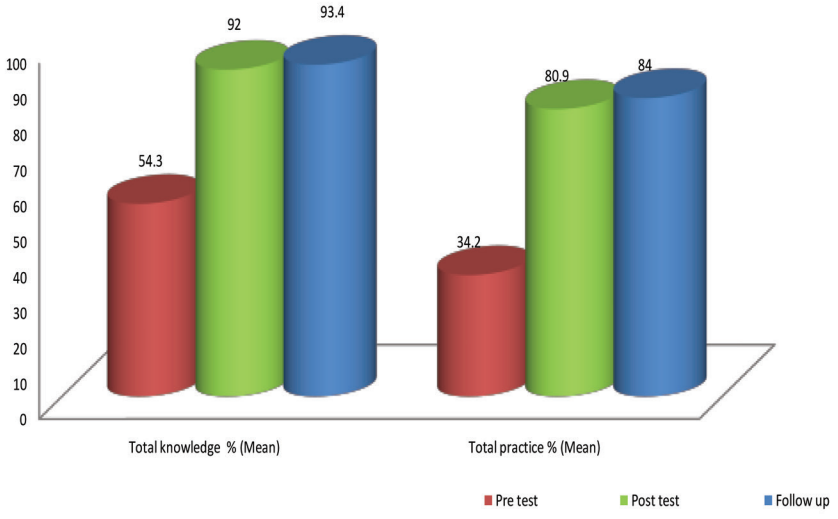


Figure (4): Participants' mean total knowledge and practice before and after the interventional training program (n = 61).

(٤):

(= ٦١).



Discussion:

Education is crucial element for critical care nurses, particularly in countries where there is lack of formal and well organized programs, despite the limited resources in undeveloped countries such as the Sudan, still have to deal with complex issues related to enforcement of standard programs [11, 17]. The present study included 61 nurses, most of them were female nurses (67.2%), and the most were less than 30 years old (77.0%), furthermore; majority (90.2%) had a bachelor degree in nursing besides (62.3%) had clinical nursing experience less than 5 years. These results are similar to a study made in Oman in 2015 to study improving of nurses' knowledge to reduce catheter related bloodstream infection [18] .

Regarding the training program, this study educational program was based on the educational theory of Andragogy by Malcolm Knowles (13). It found that majority of nurses (93.4%) did not get any training program before related to this study, or has a written protocol in their critical care unit (82.0%) related to invasive hemodynamic monitoring. These findings were similar as studies found that training programs were required to target the specific needs of nursing staff working at different care settings [19, 21]. On the same line a study done in England in 2017 stated that quality should begin with education and end with education [34]. For these reasons enhancing nurses' performance as a result of applying an educational program was noticed and supported by lots of researches, these findings also congruent with researchers found that nurses' knowledge is enhanced by professional training and well education [22, 27].

Regarding level of education, this study has found that; there were no statistical significant difference between nurses' total knowledge and practice and their level of education where the p values were more than 0.05, these results may be due to most of the studied nurses were in the same age group, and majority were also in the same educational level. These results are contradicted with studies found a significant relation between nurses' knowledge, and practice, and participants' level of education [24, 26].

Regarding the age of participants, these results clarified that there were no statistical significant difference between nurses' practice and their age groups. These findings are resembled with a research done in Arizona in 2011, concluded that there were no significant statistical differences between practice score and nurses' age, and between nurses' practice and nurses' age [26].

Regarding years of experience the results of the current study showed that most of studied nurses had years of clinical nursing experience less than 5 years (77.0%); these findings were contradicted with a study done in Egypt in 2011, it revealed a positive statistically correlation between years of experience and practice [25]. Lastly these results agreed with a study done in Egypt in 2012 reported that there were no statistically significance relation was found between nurses' practice and their age, and years of experience [24].

Participants' baseline mean practice regarding invasive hemodynamic monitoring before application of the interventional program was 38.4% which was reflected as poor results, these results are similar to a descriptive study done in Sudan in 2014 to study critical care nurses knowledge and practice about invasive hemodynamic monitoring that found nurses' knowledge was fair and nurses' practice was poor [28].There was a noticeable improvement on overall nurses' practice after their receipt of the structured interventional program.

Statistically, this study found that; nurses' practice has improved from 34.2% to 80.9% after the interventional program which was considered as good results, mean p value was 0.0045. These results are similar to a study done in Oman in 2015 to study improving of nurses' knowledge to reduce catheter related

bloodstream infection [18].There were no statistical significant changes in nurses' practice in this study in post interventional period and follow up phase, where the mean p value of nurses' practice mean p value was 0.368. These results are similar to a study take place in Egypt in 2014 to investigate the effect of structured educational program on nurses' practice [23].
The present study is unique in several ways, first; the type of study; that included nurses practice in very critical area, second; the area of the study that was critical care units in un developed country, third; this study identified key determinants of nurses' practices; rather than simply documenting what nurses do and what demographic factors relate to these knowledge and practices [29, 31].
The findings of this study have implications for problem solving interventions to increase nurses' competences on invasive hemodynamic monitoring that will enhance the quality of nursing care, patient safety and outcome, also it has a relevance for the educational programs in healthcare institutions that will improve nurses' practice thus will lead to save lives, result in better patient outcomes, reduces blood stream infection rates, improve satisfaction for nurses, physicians, clients and their families, and is cost efficient to implement. Furthermore this study has implications for social change in practice that will consider as an opportunity to create a quality improvement project for the critically ill patients [9].

The present study has provided evidence and database for conducting studies in invasive hemodynamic monitoring in critical care units in the Sudan. Advantages are that it is a multicentre carried out in four main governmental specialized cardiac centres in the Sudan; also it has been carried out in an undeveloped country that does not have previous or similar interventional studies to compare with to fill the gap.Limitations of this study include lack of generalization, and the small sample size.

Conclusions:

The baseline level of critical care nurses' knowledge and practice regarding invasive hemodynamic monitoring in the Sudanese cardiac centers' was not satisfactory.
There was a considerable improvement in nurses' level of knowledge and practice after the receipt of a structured educational program on invasive hemodynamic monitoring.

Competing on interest:

We declare that this study is one of our own works. We also declare that we have no competing interests related to this study.

Financial support of the study:

The researchers did not receive any financial support from any authority, and the entire expenses towards implementation of this study were provided by the researchers only.

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Annexes:

1- Questionnaire:

SECTION (A)

Basic information about nurses under study

Please make a tick around the appropriate answer (ONLY ONE):-

1.Your hospital is:
1. Sudan Heart center
2. Shaab Teaching Hospital
3. Ahmedgasim Hospital
4. Madani Heart Center

2. Your gender is:
1. Male
2. Female

3.Your age is:

1. Below 29 years
2. 29 to 35 years
3. More than 35 years

4. Your scientific qualification in nursing is:
1.Diploma
2. Bachelor
3. Master
4.Doctorate

5. Your clinical experience in nursing is:
1. Less than one year
2. 1 to 5 years
3. More than 5 years

6. Do you have a written protocol about invasive hemodynamic monitoring in your critical care unit?

1. Yes
2. No

7. If you have a written protocol, is it always applied in practice?

1. Yes
2. No

8. Have you ever attended any training program about invasive hemodynamic monitoring?

1. Yes
2. No

Section B

Invasive Hemodynamic Monitoring Knowledge Assessment:

Please make a tick against the best response for each of the following statements regarding invasive hemodynamic monitoring. (only one response):

1.Preparation of the invasive hemodynamic monitoring needs:
1.Monitor and Transducer
2. Monitor and ECG cable
3. Monitor and peripheral cannula
4. None of the above

2.Allen test is done to:
1.Test central line patency
2. Test arterial collateral perfusion
3. Test the pressure bag pressure
4. Test the actual blood pressure.

3.To prepare for central line insertion you need:
1.Dressing set
2. Alcohol swap
3. Central venous catheter
4. All of the above

4. Invasive hemodynamic monitoring is done for:
1.Heart rate & respiratory rate
2.Noninvasive Blood Pressure
3.ECG rhythm strip
4.CVP, ABP, & PAP

5. When you have a triple central line (three lumens) and you need to measure the central venous pressure, best line of connection:
1. The proximal line
2. The median line
3. The distal line
4. I don't know

6. The pressure in the pressure bag should always be:
1. 100mm/Hg
2. 200mm/Hg
3. 300mm/Hg
4. I don't know

7.Zeroing of the system should be:
1. Every hour
2. Every shift
3. Not important
4. I don't know

8. The phlebostatic axis is:
1. Point marker on the neck
2. point of leveling transducer
3. Point of arterial line puncture
4. I don't know it

9. The dicrotic notch is seen in:

1. Central venous pressure waveform
2. Arterial waveform
3. Electrocardiogram waveform
4. I don't know it

10.Your patient on invasive monitor, he suddenly developed shooting in systemic blood pressure (e.g. 240/180) the first nursing action you should do is to:
1.Notify the physician
2. Start glycerin infusion
3. Check the invasive system first
4. Do nothing

11.Your patient on invasive monitor , he suddenly developed dropping in systemic blood pressure (60/40) the first nursing interventions you will do is:
1. Notify the physician
2. Start Noradrenaline infusion
3. Check the invasive system first
4. Doing nothing

12.Confirmation of the actual monitor readings is best done by the:
1. Resident physician
2 . C a r d i o l o g i s t
3. Nurse in charge
4. Anesthesiologist

13.Repeated zeroing is not necessary in the recognition of the accurate reading:

1. Yes
2. No

14.The level of the transducer affects the actual reading:
1. Yes
2. No

15. To ensure pressure bag with flushing solution is well functioning you test it by:
1.Make zeroing
2.pressing the flushing devise
3. Notify the physician
4. I don't know

16.CVP is indicated to measure the preload:
1.Yes
2. No
3. I don't know.

17.The best position for removing of the central line is:
1. Sitting position
2. Supine position
3. Trendelenburg position
4. I don't know

18. The commonest site for central venous catheter related infection is:
1. External jugular
2. Internal jugular
3. Femoral
4. I don't know

19.Do you know the central line catheter related infection bundle?
1.Yes
2. No

20. Pneumothorax related to central line insertion is more common in the:

1. External jugular site
2. Internal jugular site

3. Subclavian site
4. I don't know

21.Standard dressing of the central line intervals should be:

1. Every shift
2. Every day
3. Every 2 days.
4. I don't know

22.Is it your duty to know the age of the central venous line of your patient?
1.Yes
2. No
3. I don't know

23.Do you think that the arterial waveform on the monitor is important?

1.Yes
2. No
3. I don't know

24.Do you think that CVP waveform on the monitor is also important?

1.Yes
2. No
2-
3-

Annexes:

2. observational check list:

Observation	Done	Not Done
Checked the pressure bag and the flushing solution		
Leveled of the transducer to phlebostatic axis		
Made zeroing of the system in the beginning of the shift		
Changed the stopper after every use		
Kept the access line always dressed		
Used hand hygiene methods during handling		
Used alcohol swab for the three way stopcock		
Kept the three way stopcock always covered		
Performed the fast flush squire test		
Removed the access line properly		