

Effect of Post Resuscitation Educational Program on Critical Care Nurses' Performance among Patients with Cardiac Arrest Complications

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Abstract

Background: Post resuscitation educational Program developing put a guideline to the patient to be safe as possible from post arrest complication. **The study aimed** to evaluate the effect of post resuscitation educational program on critical care nurses' performance among patients with cardiac arrest complications. **Design:** A Quasi experimental design was used in carrying out this study. **Settings:** the study conducted at critical units at Benha University Hospital. **Subjects:** Nurses: Convenient sample of nurses (105) who are working in the above-mentioned setting; and a purposive sample of 60 adult patients were including in study. **Tools:** **Tool I.** Nurses' Self administration questionnaire sheet aimed to assess nurses' knowledge, **Tool II.** Observational checklists amid to assess nurses' practice regarding care of patient post cardiac arrest **Tool (III)** Patients outcomes to assess patients' outcome post cardiac arrest. **Results:** 45% of nurses had good knowledge before the implementation for them and 79% post-implementation. Also, nurse's practice improved from zero% pre-implementation to 91.4% post-implementation, all patient's had sever impairment preprogram implementation and 62.6of them improved to mild impairment post program **Conclusion:** The study revealed that the all nurses had poor total level of knowledge before the intervention which most of them their practice was improved to more than three quarters of them post implementation. Regarding nurses' practice, the results of the current study illustrated that none of nurses had satisfactory practice pre-program implementation which most of them their practice was improved post-program implementation, patient outcome improved post program. **Recommendations:** Researchers should continuously create educational programs for nurses regarding caring for post cardiac arrest patients, including preventive measures and management of complications.

Keywords: Cardiac Arrest, Complications, Nurse's performance, Educational Program, Post Resuscitation.

Introduction:

Cardiac arrest is the abrupt loss of heart function in a person who may or may not have been diagnosed with heart disease; cardiac arrest can come on suddenly or gradually. Cardiac arrest is often fatal if appropriate steps aren't taken immediately (Egerod et al., 2021).

Successful return of spontaneous circulation (ROSC) is the first step toward the goal of complete recovery from cardiac arrest. The post-resuscitation phase starts at the location where ROSC is achieved but, once stabilized; the patient is transferred to the

most appropriate high-care area as ICU (Adcock et al., 2020).

Management of the post-cardiac arrest syndrome involves management of ventilation aims for normal carbon dioxide values and prevent hyperoxia. Management of circulation the attention should be given to evidence of cardiac ischemia and referral for percutaneous coronary intervention. Optimizing neurological recovery will involve seizure control, management of hyperglycemia and therapeutic hypothermia (Adcock et al., 2020).

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Cardiac patient should have continuous cardiac monitoring along with regular pulse, 12 lead ECG and blood pressure checks. Neurological function should be rapidly assessed by using a Glasgow Coma Scale and recording the score in the patient's clinical notes (**Rajeswaran et al., 2018**).

Nurse plays a very significant role after return of spontaneous circulation, nurse should frequently assess blood glucose, monitoring and treat hyper-glycaemia (>10mmol/l) with insulin but should also avoid hypo-glycaemia and maintain moderate glycemic control (144–180 mg/dL). Nurse should consider induced hypothermia as adult patients with persistent coma after return of spontaneous circulation (ROSC) should be cooled to 32–34°C for 12–24 h provided but avoid hypothermia in patients with coagulopathy /bleeding or refractory arrhythmias because hypothermia exaggerates these conditions. Cooling can be done using cold IV fluid bolus of 30 mL/Kg, surface cooling (ice packs, mattresses), endovascular cooling, etc. Sedation/muscle relaxants may be used to control shivering, agitation, or ventilator as needed. After 24 h, start slow rewarming at 0.25°C (**Coult et al., 2019**).

Significance of study:

Following successful resuscitation from cardiac arrest, neurological impairment as well as other types of organ dysfunction still causes significant morbidity and mortality. The whole-body ischemia reperfusion response that occurs during cardiac arrest and subsequent restoration of systemic circulation results in a series of pathophysiological processes that have been termed the post-cardiac arrest syndrome. The components of the post-cardiac arrest syndrome comprise post-cardiac arrest brain injury, post-cardiac arrest myocardial dysfunction, the systemic ischemia-reperfusion response and persistent precipitating pathology (**Nayeri., 2020**).

Aim of the study:

This study aimed to evaluate the effect of post resuscitation educational program on critical care nurses' performance among patients with cardiac arrest complications.

Hypothesis

- 1- The mean score of nurses' performance level regarding post cardiac arrest will be higher than post program implementation.
- 2- There will be a significant and correlation between nurses' knowledge & practice pre and post implementation of resuscitation nursing management program.
- 3- The mean score of patient's survival from post cardiac arrest complication will be higher post program than before.

Subjects and methods

Research design:

Quasi experimental design was used in carrying out this study to achieve the study aim.

Study Setting:

This study was conducted at critical units (CCU, ICU, & Emergency department) at Benha University Hospital.

Subjects:

A. Nurses:

Convenient sample of all available nurses (105) who are working in the above-mentioned setting.

B. Patients:

A purposive sample of 60 adult patients who participate effectively during 6 months were included in this study.

Patient had inclusion criteria as:

- Adult female or male patient.
- Post cardiac arrest.
- Stay in selected setting at least 72 hours after ROSC.

Data Collection Tools:

Three tools were used to collect data for this study as following:

Tool (I): Nurses' Self administration questionnaire:

The tool aimed to assess nurse's knowledge regarding post cardiac arrest care it was developed by researcher after reviewing recent relevant literature and scientific references and written in simple Arabic language. It contains three parts.

Part (1): Demographic characteristics of nurses: that include (age, gender, job title, educational qualification, years of experience, years of experience at ICU, participation in CPR, participation in code blue team, participation in Rapid Response Team, training courses and validity of BLS\ACLS and PCAC)

Part two: hospital barriers assessment: it aimed to identify hospital police and procedure that can affect the nurses' performance it consist of (16) questions.

Part three: Nurses' knowledge questionnaire: aimed to assess nurses' knowledge regarding post arrest care, it was adapted by researcher after reviewing of related literature as **Abass, &Soliman, (2020)** including (94) questions divided into the following items:

- I- Nurses' knowledge about BLS &ACLS (12questions).
- II- Nurses' knowledge about returns of spontaneous circulation & post cardiac arrest care (9 questions).
- III- Nurses' knowledge about nursing management post cardiac arrest care consist of 6 parts divided as following:
 - Nurses' knowledge regarding respiratory management (6 questions).
 - Nurses' knowledge regarding Cardio-vascular management (10questions).
 - Nurses' knowledge regarding Neuro-logical management (14questions).
 - Nurses' knowledge regarding medications used post return of spontaneous circulation (3 questions)

- Nurses' knowledge regarding targeted temperature management (3questions).
- Nurses' knowledge regarding complications post ROSC (4 questions).

Scoring system:

Knowledge obtained from nurses' were scored and calculated according to answer, their responses were evaluated using model key answer sheet prepared by researcher, they were scored as the following;

- Each correct answer was given one score.
- Each incorrect answer was given zero.

The total score for knowledge was (68). Theses scoring were summed-up and converted into a percent and categorized as follows:

- Good level of knowledge -<75 % of total score (51-68 score).
- Average 60% -75% of total scoring (51 score)
- Poor> 50 % of total scoring (34 score)

Tool 2: Observational checklist:

That aimed to assess nurses' practice regarding post cardiac arrest care, it was adapted by the researcher after reviewing of related literatures as **Nolan, P., (2021)** and including parts as a follow:

- Nurses' practices regarding patients' oxygenation (8 items).
- Nurses' practices regarding patients' ventilation (5 items).
- Nurses' practices regarding optimizing cardiac function (circulation) (11 items).
- Nurses' practices regarding optimizing hemodynamic stability (10 items).
- Nurses' practices regarding metabolic assessment (8 items).
- Nurses' practices regarding optimizing Neurological recovery (11 items).
- Nurses' practices regarding management of patients' Hypothermia (34 items).

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Scoring system:

One score was given for each step that done correctly and zero for the step that done incorrectly or not done. The total level of practice scoring was 88; total practice scores were converted into a percent and categorized as the following:

≥75 was considered satisfactory (≥ 66-88score).

<75was considered unsatisfactory less than (≤66 score).

Tool (3) Patient's outcome assessment:

It was developed by the researcher after reviewing relevant literature, which was used to assess the complication of cardiac arrest patient in critical care environment, it divided to three parts:

Part (1): Demographic data of patients including age, sex, occupation, place of residence, marital status, level of education.

Part (2): Medical data of patients including past hospitalization, past surgery, past medical history, cause of arrest, diagnosis, arrest location, arrest witnessed, time between patients' collapse and ROSC, CPR protocol, duration of CPR, ROSC, use of AED or manual defibrillator, ventilation, methods to confirm airway placement, patients' transference, time between ROSC and reaching investment unit.

Part (3): Patients' complications including:

- Neurological complications which including the following parameters Glasco coma scale, -Pupillary reaction to light and Gag \ cough reflex.
- Cardiac complications including the following parameters Heart Rate 60-120 b\m and Blood pressure BP >90 mmHg and a MAP of >6mmHg and Urine output <25-30 ml \hour.
- Respiratory complications, including the following parameters Apnea, O₂sat95%,

Capillary-refill 0.5 second, MV Weaning and ET Extubating.

- Metabolic complication. including the following parameter CBS 80-120 mg.

Post resuscitation program:

It was designed by researcher and adapted from American Heart Association and cardiac arrest counseling (2020) this guideline were planned to cover knowledge and practice related to updated guidelines of cardiac arrest and it is containing theoretical and practical part.

Theoretical part: it consists of 8 sessions including knowledge about:

1. Introduction to educational program & information about heart anatomy.
2. Basic knowledge about cardiac arrest.
3. Post cardiac arrest care.
4. Post cardiac arrest care (Ventilation axes).
5. Post cardiac arrest care (Hemodynamic & cardiovascular axes).
6. Post cardiac arrest care (Metabolic axes).
7. Post cardiac arrest care (Neurological assessment axes).
8. Post cardiac arrest care (Hypothermia management).

Tools validity and reliability:

Once prepared in its preliminary from the face and content validity were ascertained for comprehensive, accuracy, relevance, simplicity, clarity and ambiguity a jury of five experts from Medical Surgical Nursing department, Faculty of Nursing, Benha University (two professors and three assistant professors). Also, a prepared developed post cardiac arrest care guidelines which covered all items related to nurses' caring patient post cardiac arrest, based on newest current literature was revised by the same expert and all re-coordinated modification were done according to their comments and opinions.

Tool's reliability:

Reliability was testing statistically to assure that the tool was reliable before data

collection. Internal consistence reliability of the tools was tested using & quote; Alpha Cronbach test & for structured questionnaire for nurses' 0.71%, for observational checklist was 0.92% and for patient complication was 0.83%.

Ethical consideration:

All ethical issues were taken into consideration during all phases of the study, the ethical research consideration in this study including the following:

The ethical approval was obtained from the ethical committee of faculty of nursing before initiation the study work.

- The researcher approval was obtained before program implantation the objective and aim of the study were explained to all participants, and the researcher maintains on anonymity and confidentiality of data, it will be used for the research purpose only.
- Additionally oral consent was taken from nurses' who participate in the study after explanation of nature, aim and expected outcomes of the study.
- The participant was informed that they allowed to choose participate or not in the study and they have right to withdrawal from the study at any time.
- Patients or caregivers in case of participation, patients were informed about the study and were given the chance to withdraw from the study at any time.

Pilot study:

A pilot study was carried out 10 % of studied subject (11 nurses) that was excluded from the total subject. The pilot study was done in order to test the clarity and applicability of the study tools and the guidelines, to estimate the time required for each tool to be filled in as well as to identify any possible obstacles that may hinder data collection, based on the results of the pilot study few modifications were done two weeks before testing study.

Field work (data collection):

Data collection of the current study was carried out through 6 months from beginning of April 2019 to the end of September 2021.

The researcher visited the critical care units in Benha University daily (morning and afternoon) time to collect the data by using pervious tools. The study was conducting through the following three phases.

Phase I: assessment phase:

The researcher interviewed with available nurses' in critical units and explain the aim of the study and take their approval to participate in the study prior to data collection, then the researcher assessed the nurse's performance level (knowledge and practice) regarding caring of patients with cardiac arrest and post cardiac arrest care using questionnaire sheet and observational checklist sheet as following:

First, the researcher observes nurses' practice (**tool, 2**) during care of patient with cardiac arrest Return of spontaneous circulation (ROSC)and post arrest time using observational checklist (tool II).

Based on updated guidelines of American heart association and different cardiac resuscitation associations, each skill was evaluated 3 times and the mean was calculated. The time required to fill each chick list was between 35-45 minutes.

Secondary, the questionnaire sheets (tool I) were administered by the researcher to all nurses individually to assess their knowledge about care for post cardiac arrest patient and explanation of the questionnaire sheet was done by the researcher. the average time needed for completion of each interview (by nurses) was between 25-35minuts. This period of pretest (knowledge and practice). Based on the finding of the assessment phase, goals priorities and expecting outcome were formulated. The researcher planned to provide

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the nurses with updated guidelines in simple Arabic language.

Phase II: implementation phase: included the following steps:

- 1- The guidelines implementation was conducting in 12 sessions, it divided to eight sessions for knowledge, and four sessions for the practice. The time of knowledge session time between 45 minutes to 60 minutes. The nurses' divided into groups; each group contained (5nurses) to acquire the related information.
- 2- Different teaching and learning methods were used during the session which including; group discussion, demonstration and re-demonstration.
- 3- The institutional colored booklet was given to each unit head nurse in order to help for reviewing and support teaching it was written in a simple Arabic language and supplemented by colored photo and illustration to help the nurses understanding of the content.
- 4- Each session was started by a summary about what has been discussed in the previous session and the objective of the new session, using simple Arabic language, also, the session ended by a summary of its contents and feedback from the nurses was obtained to ensure that he\she got the maximum benefit.

Phase III: Evaluation phase:

It aimed to evaluation the effect of implementation on educational program on nurses' performance level by comparing the result pre and post implementation and patient outcome by measuring complication level pre and post program using the same data collection tools.

Administrative Design:

An official permission to carry out the study was obtained by submission an official letter from the dean of facility of nursing, Benha University to hospital director and head of department of critical units.

These letters explain and clarified the aim of the study to obtain the approval for data collection. The objectives and nature of study were explained and then it was possible to carry out the study with minimum resistance.

Statistical Analysis:

The collection data were organized, coded, computerized, tabulated and analyzed by using the statistical package for social science (SPSS), version (28).

Chi-square: for independence compares two variables in a contingency table to see if they are related.

The Pearson correlation coefficient is used to measure the strength of a linear association between two variables, where the value $r = 1$ means a perfect positive correlation and the value $r = -1$ means a perfect negative correlation. **Paired T test** is a statistical technique that is used to compare two population means in the case of two samples that are correlated.

Multiple linear regression (MLR), also known simply as multiple regression, is a statistical technique that uses several explanatory variables to predict the outcome of a response.

Data analysis was accomplished by the using of number, percentage, distribution, mean, stander division, and correlation, coefficient; paired t-test was used to test significance of some variances. A significant level value was considered when $p \leq 0.05$, $p \leq 0.001$.

Limitation of the study:

- The data collection was very difficult for researcher to be completed in same time, then the researcher starts data collection before high peak of covid 19 then we stopped for while than starting in applying the educational program and collecting patient data.

Results:

Table (1): Reveals that 74.3%) of the studied nurses were between 20-30 years old with mean and standard deviation 26.25 ± 5.08 . Adding to that 52.4% were females and 72.4%) were nurses. Lastly, 52.4% had >1-5 years of experience in nursing and critical unit. Also clarifies that, all studied nurses (100%) participate in CPR. Conversely all the studied nurses (100%) was not member of code blue or member of Rapid Response Team. Only 11.4% has BLS and ACLS training course certified for two years. Also, (72.4%) followed BLS and ACLS as doctor order.

Table (2): Reveles that there was highly statistically significant difference regarding information of all items of nurse's knowledge regarding patient care.

Figure (1): Demonstrates to an improvement in nurses' knowledge from zero% before the intervention to 79% post-intervention.

Table (3): Describes that there was highly statistically significant difference regarding

all items of practice pre and post implementation of the program.

Figure (2): Illustrates to an improvement in nurses' practice from zero% before the intervention to 91.4% post-intervention.

Table (4): Reveals that, there was highly statistically significant relation between patients' occupation at pre and post implementation of the program. Also, there was statistically significant relation between marital status at pre and post implementation of the program.

Table (5): Reveals that was highly significant difference in patients neurological and cardiac respiratory complications post intervention compared with pre-program.

Table (6): Clarifies that there was statistically significant relation between past hospitalization at pre and post implementation of the program. On the other hand, there was not statistically significant relation between studied sample at pre and post regarding "past surgery, past medical history, causes of arrest and diagnosis.

Table (7): Reveals that, there was positive correlation knowledge and practice at pre implementation of the program. Similarly, there was positive correlation knowledge and practice at post implementation of the program.

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Table (1): Frequency and percentage distribution of socio-demographic characteristics among Nurses. N= 105

Items	N	%
Age		
20 - 30years	78	74.3
31 - 40years	25	23.8
41 - 50 years	2	1.9
51 – 60years	0	0
Means ± SD	26.25 ± 5.08	
Gender		
Female	55	52.4
Male	50	47.6
Job title		
Nurse	76	72.4
Nursing specialist	0	0
Nursing supervisor	29	27.6
Charge nurse	0	0
Qualification		
3 years school	0	0
5 years school	65	61.9
Bachelor degree	40	38.1
High study	0	0
Experience in nursing		
≤1	37	35.2
>1-5 years	55	52.4
>5-10 years	13	12.4
Means ± SD	2.79 ± 2.02	
Experience in critical unit		
≤1	37	35.2
>1-5 years	55	52.4
>5-10 years	13	12.4
Means ± SD	2.79 ± 2.02	

Table (2): Comparison between total nurse's knowledge regarding care for patients with cardiac arrest at pre and post implementation of program.

Items	Pre program	Post program	T test	P value
	Mean ± SD	Mean ± SD		
Information regarding applying BLS&ACLS	7.67 ± 2.20	10.35 ± 1.49	10.28	0.000**
Information about return of spontaneously circulation and post cardiac arrest care ROSC&PCAC	3.31 ± 2.03	8.95 ± 2.08	19.82	0.000**
Information regarding to post resuscitation respiratory system nursing management	3.30 ± 0.93	5.53 ± 0.98	16.87	0.000**
Information regarding to post resuscitation circulatory system nursing management	4.33 ± 1.66	9.05 ± 1.91	19.08	0.000**
Information regarding to post resuscitation neurological assessment and nursing management	7.77 ± 2.18	13.0 ± 2.09	17.66	0.000**
Information regarding post resuscitation medications	1.45 ± 0.088	2.77 ± 0.57	12.72	0.000**
Information regarding to therapeutic hypothermia or target temperature management	1.20 ± 0.71	7.57 ± 5.52	11.69	0.000**
Information regarding to complication nursing management post cardiac arrest care	1.64 ± 1.20	2.93 ± 1.42	7.03	0.000**
Total knowledge	5.25 ± 1.82	16.0 ± 0.0	60.17	0.000**
Total knowledge	35.85 ± 8.36	72.41 ± 16.18	20.56	0.000**

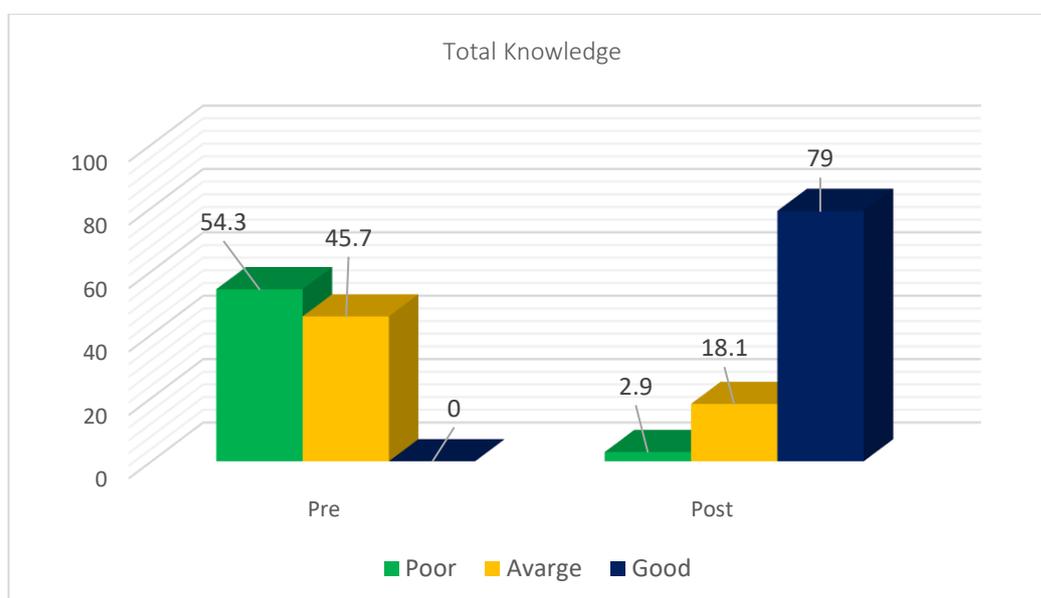


Figure (1): Distribution of nurse's knowledge regarding care for patients with cardiac arrest complications at pre and post implementation of the program.

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Table (3): Compression of total nurses practice for patients with post cardiac arrest complications.

Items of practice	Pre program	Post program	T test	P value
	Mean ± SD	Mean ± SD		
Oxygenation	2.81 ± 0.94	7.42 ± 0.49	35.34	0.000**
Ventilation	0.66 ± 1.7	3.17 ± 0.98	10.79	0.001**
Optimize Cardiac Function (Circulation)	2.79 ± 1.45	10.01 ± 0.13	95.28	0.000**
Optimize Hemodynamic	2.11 ± 0.82	10.0 ± 0.0	108.97	0.000**
Metabolic Assessment	4.71 ± 1.14	8.00 ± 0.0	29.5	0.000**
Optimize Neurologic Recovery	2.95 ± 1.20	10.53 ± 0.55	58.57	0.000**
Cooling stage	0.87 ± 0.66	8.00 ± 0.0	110.49	0.000**
Phase (I) Induction stage	0.98 ± 1.35	4.00 ± 0.0	22.77	0.000**
Phase (II) Maintenance	2.4 ± 0.49	3.00 ± 0.0	12.49	0.000**
Phase (III) Rewarming period	1.00 ± 0.0	1.00 ± 0.0	----	----
Total Therapeutic Hypothermia	5.25 ± 1.82	16.00 ± 0.0	60.17	0.000**
Fever Prevention	0.27 ± 0.44	1.00 ± 0.0	16.5	0.000**
Total practice	21.59 ± 4.24	66.15 ± 1.41	102.03	0.000**

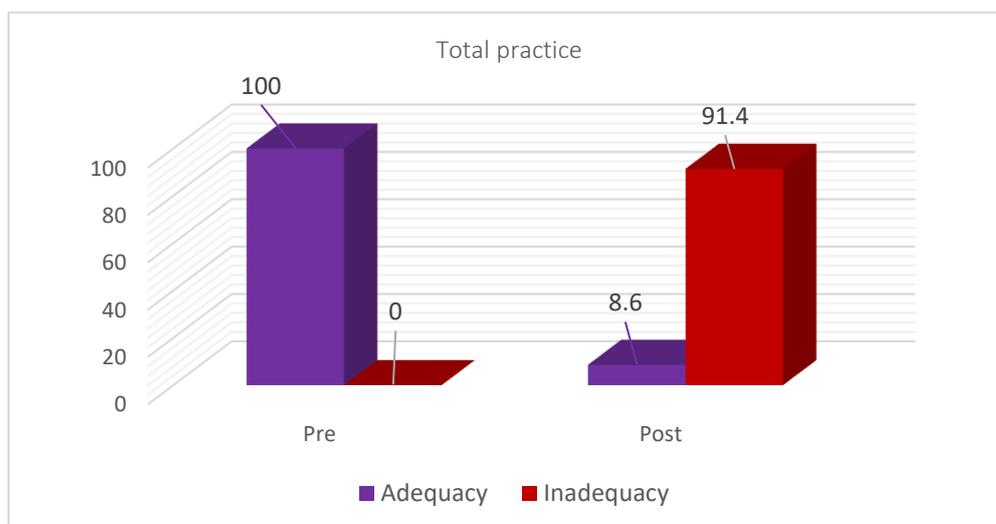


Figure (2): Distribution of nurses' practice regarding care for patients with cardiac arrest complications at pre and post implementation of the program.

Table (4) Frequency and percentage distribution of Socio-Demographic characteristics of studied patients at pre and post program. N=60

Items	Pre program		Post program		X ² P VALUE
	N	%	N	%	
Age					
20-29years.	7	11.7	10	16.7	X ² =7.43 P= 0.06
30-39 years.	11	18.3	9	15	
40-49years.	23	38.3	11	18.3	
50- more	19	31.7	30	50	
SEX					
Female.	27	45	22	40.8	X ² =0.86 P= 0.35
Male	33	55	38	59.2	
Occupation					
Has work.	18	30	44	73.3	X ² =22.55 P= 0.000**
Has not a work	42	70	16	26.7	
Place of usual residence					
Rural.	23	38.3	24	40	X ² =0.03 P= 0.85
Urban.	37	61.7	36	60	
Marital status					
Single.	22	36.7	10	16.7	X ² =9.45 P= 0.02*
Married.	15	25	26	43.3	
Widower.	17	28.3	13	21.7	
Divorced	6	10	12	14.2	
Level of Education					
Educated.	33	55	38	63.3	X ² =0.85 P= 0.35
Non-educated	27	45	22	36.7	

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**Table (5): Frequency and percentage distribution of medical data among studied patients.
N=60.**

Items	Pre program		Post program		X ² P
	N	%	N	%	
Past Hospitalization					
Yes	13	21.7	34	56.7	X ² =15.42 P= 0.000**
No	47	78.3	26	43.3	
Past Surgery					
Yes	12	20	18	30	X ² =1.60 P= 0.20
No	48	80	42	70	
Past medical History					
Unknown.	6	10	2	3.3	X ² =6.32 P= 0.23
Cardiac disorders.	13	21.7	25	41.7	
Metabolic disorder.	41	68.3	12	20	
Respiratory disorders.	·	0	17	28.3	
Neurological disorder	·	0	4	6.7	
Causes of arrest					
Cardiac \ respiratory.	28	46.7	33	55	X ² =4.43 P= 0.67
Neurological.	5	8.3	17	28.3	
Metabolic.	19	31.7	4	6.7	
Unknown.	8	13.3	6	10	
Diagnosis					
Cardiac.	32	53.3	43	71.7	X ² =5.59 P= 0.45
Neurological.	6	10	12	20	
Respiratory.	12	20	3	5	
Metabolic.	10	16.7	2	3.3	
Arrest location					
Out-hospital cardiac arrest.	37	61.7	35	58.3	X ² =0.13 P= 0.70
In-hospital cardiac arrest .	23	38.3	25	41.7	
Arrest Witnessed					
Yes.	20	33.3	27	45	X ² =1.71 P= 0.19
No.	40	66.7	33	55	
Time between patient collapse & ROSC documented					
Documented.	0	0	34	56.7	X ² =4.56 P= 0.12
Not documented.	60	100	26	43.3	
CPR protocol					
BLS\ ACLS.	34	56.7	53	88.3	X ² =15.08 P= 0.000**
Unknown.	26	43.3	7	11.7	

Table (6) Frequency and percentage distribution of patient outcome assessment at pre and post implementation of the program.

Assessment tool and Criteria		Pre program						Post program						X ² P value
		24 hours		72 hours		Week 1		24 hours		72 hours		Week 1		
		N=60	%	N=43	%	N=33	%	N=60	%	N=46	%	N=40	%	
Neurological assessment														
1-GCS A total score	3 to 8 sever impairment.	39	65	38	88.4	33	100	16	26.7	11	23.9	7	17.5	X ² =167.95 P=0.000***
	9 to 12 moderate impairments.	18	30	5	11.6	0	0	33	55	35	54.3	8	20	
	13 to 15 mild impairments.	3	5	0	0	0	0	11	18.3	10	21.7	25	62.5	
2-Pupillary reaction to light	Reacted.	25	41.7	31	72.1	13	39.4	58	96.7	46	100	40	100	X ² =142.38 P=0.000**
	Not reacted.	35	58.3	12	27.9	20	60.6	2	3.3	0	0	0	0	
Gag\Cough reflex	Present	20	33.3	10	23.3	4	12.1	58	96.7	46	100	40	100	X ² =130.51 P=0.000**
	Absent	40	66.7	33	76.7	29	87.9	2	3.4	0	0	0	0	
Cardiac assessment														
1-HR60-120 b\m	Yes	42	70	31	72.1	14	42.4	55	91.7	46	100	40	100	X ² =138.56 P=0.000**
	No	18	30	12	27.9	19	57.6	5	8.3	0	0	0	0	
2-Blood pressure BP >90 mmHg and a MAP of >65 mmHg.	Yes	60	100	28	65.1	16	48.5	56	93.3	46	100	40	100	X ² =131.34 P=0.000**
	No	0	0	15	34.9	17	51.5	4	6.7	0	0	0	0	
3-Urine output <25-30 ml \hour	Yes	60	100	13	30.2	18	54.5	58	96.7	46	100	40	100	X ² =1.004 P=0.31
	No	0	0	30	69.8	15	45.5	2	2	0	0	0	0	
Respiratory assessment														
1- Apnea	Yes	48	80	43	100	33	100	48	80	46	100	9	22.5	X ² =36.55 P=0.000**
	No	12	20	0	0	0	0	12	20	0	0	31	77.5	
2-O ₂ sat95%	Yes	36	60	43	100	20	60.6	58	96.7	46	100	40	100	X ² =5.43 P=0.02
	No	24	40	0	0	13	39.4	2	3.3	0	0	0	0	
3-Capillary-refill 0.5 second	Yes	60	100	26	60.5	15	45.5	58	96.7	46	100	40	100	X ² =0.70 P=0.40
	No	0	0	17	39.5	18	54.5	2	3.3	0	0	0	0	
4-MV weaning.	Yes	0	0	0	0	0	0	12	20	0	0	29	72.5	X ² =0.83 P=0.51
	No	60	100	43	100	33	100	48	80	46	100	11	27.5	
5- ET Extubation	Yes	0	0	0	0	0	0	12	20	0	0	14	35	X ² =0.75 P=0.49
	No	60	100	43	100	33	100	48	80	46	100	26	65	
Metabolic Assessment														
1 -CBS 80-120 mg	Yes	48	80	13	30.2	20	60.6	60	100	46	100	40	100	X ² =0.89 P=0.62

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Table (7): Correlation between total knowledge and practice at pre and post implementation of the program.

Items		Total knowledge	
		Pre	Post
Total knowledge (pre)	R		0.11
	P		0.23
Total practice (pre)	R	0.30*	0.007
	P	0.01	0.75
Total practice (post)	R	0.55	0.88**
	P	0.99	0.001

Discussion:

Nurses play a vital role in reduction of post arrest complications among hospitals caring for patients after resuscitation from cardiac arrest through assisting in monitoring and maintenance of hemodynamic stability, providing targeted temperature management, maintaining of induced hypothermia and frequent monitoring of blood glucose level. Nurse can also assist in neurological assessment, neuro-electro-physiological monitoring, electroencephalography (EEG) and investigations is also essential for early detection and prevention of post ROSC complications **Baldi et al., (2021)**.

The discussion of the current study was carried into four parts including the first part: demographic characteristics of nurses and their barriers during CPR application, **second part:** nurses' knowledge about CR and ROSC, **third part:** nurses' practices regarding ROSC and **Part IV:** patients' outcomes.

Regarding demographic characteristics of studied nurses, the results of the current study showed that less than three quarters of the studied nurses were between 20-30 years old with mean and standard deviation 26.25 ± 5.08 also, more than half of them were females. From the researcher point of view this could be interpreted that young and new graduated nurse were assigned to work at the

critical units such as emergency department and intensive care units because they had fresh and updated knowledge and skills also, the majority of them were females due to the old perception that nursing profession is more suitable job for females more than males. The study was agreed with **Abass& Soliman, (2020)** who studied "Effect of Implementing Advanced Cardio-vascular Life Support (ACLS) Guidelines 2016 on Nurse's Knowledge and Performance" and revealed that more than two thirds of their participants had age less than 30 years old. Conversely, the study was disagreed with **Nasri, & Bulushi., (2020)** who studied "Examining nurses' theoretical knowledge, attitude, and practice of cardio-pulmonary resuscitation in hospitals and primary health care settings in South Sharqiyah" who illustrated that two thirds of them aged from 31-40 years old.

The result of the current study also revealed that more than half had >1-5 years of experience in nursing and critical unit. The study was also supported by **Pettersen et al., (2018)** who studied "European cardiovascular nurses' and allied professionals' knowledge and practical skills regarding cardiopulmonary resuscitation." and showed that more than two thirds had less than five years of experience. Conversely these results were disagreed with **Al-Ahdal, & Makki, (2020)** who studied "Nurses' Performance

Regarding Emergency Management of Arrhythmias Post-Cardiac Surgery at Cardiac Centers, Khartoum” and revealed that most of them had less than one year of experience.

The results of the current study revealed that there was highly statistically significant difference regarding information of all items of nurse’s knowledge regarding patient care in addition, there was significant improvement in nurses’ total knowledge from non of them had good knowledge that improved to more than three quarters of them post-intervention (**table, 11 & fig. 1**), from the researcher point of view, this could be due to the effect of educational program and the researcher ability to motivate nurses to acquire more knowledge in order to improve their practices.

The study was supported by **Pfeiffer et al, (2021)** who illustrated significant modifications in all domains of nurses’ knowledge and nurses’ total knowledge post return of spontaneous circulation post program application in addition, the study was agreed with **Abass& Soliman, (2020)** who revealed significant improvement in nurses’ knowledge regarding post return of spontaneous circulation.

The results of the current study revealed that that there was highly statistically significant difference regarding all items of practice pre and post implementation of the program, from the researcher point of view, this could be due to the effect of clear, illustrative, comprehensive and focused educational program that results in increasing nurses’ awareness about cardiac arrest complications. The study was supported by **Ahmed et al., (2019)** who studied “Effect of nursing educational program regarding defibrillation and cardioversion on patients’ outcomes” and revealed that there was significant improvement in nurses’ total

practice items such as MV, ABG, drug administration and targeted temperature.

Concerning nurses' total practice regarding care for patients with cardiac arrest complications, the results of the present study illustrated that there was significant improvement in nurses' performance from zero% before the intervention to most of them had satisfactory practice at post implementation of the program. From the researcher point of view, this could be due to the effect of clear demonstration and re-demonstration and colored booklet. The study was agreed with **Marler, et al., (2020)** who studied “ Implementing Cardiac Surgical Unit—Advanced Life Support Through Simulation-Based Learning: A Quality Improvement Project” and revealed that there was significant improvement in nurses performance post educational program, nearly one quarter of them had unsatisfactory practices re-intervention that improved to nearly two thirds of them post intervention.

Concerning socio-demographic characteristics of studied patients, the results of the current study revealed that there was highly statistically significant relation between patients’ at pre and post implementation of the program. From the researcher point of view, this could be due to employee patients had high level of education so that they had ability to maintain healthy life style and decrease bad habits so that they decreased post-cardiac complications, the study was agreed with **Soleimanpour et al., (2014)** who studied “ Main complications of mild induced hypothermia after cardiac arrest:” and revealed that there was significant relation between studied employees’ occupation and their associated post cardiac complications.

Regarding patient outcome assessment at pre and post implementation of the program,

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the current study revealed that was highly significant difference in patients neurological and cardiac respiratory complications post intervention compared with pre-program, from the researcher point of view that could be due to the effect of program on modification of nurses' actives that reflected on patients' health outcomes. The study was congruent with **Cheng et al., (2018)** who revealed that there was significant improvement in patients circulatory, neurological outcomes post intervention.

Conclusion:

Post cardiac arrest complications are sophisticated health problem with poor prognosis so that requires preventive methods as well as adequate therapeutic intervention, the study revealed all nurses had poor total level of knowledge before the intervention which improved to more than three quarters of them had good knowledge post-intervention. Regarding nurses' practice, the results of the current study illustrated that none of nurses had competent practice pre-program implementation which improved to most of them had competent practice post-intervention.

Recommendations:

- Additional researches should be done to monitor, evaluate and rehabilitate patients post-cardiac arrest.
- Researches should be continuously conducted for monitoring and evaluating critical care nurses' performance among patients with cardiac arrest complications.
- Researchers should continuously create educational programs for nurses regarding caring for post cardiac arrest patients, management of complications and preventive measures.
- in improving their knowledge and practice.

- Encouraging social agencies to support patients after ROSC.

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تأثير برنامج تعليمي في فترة ما بعد الإنعاش القلبي على أداء ممرضات الرعاية الحرجة و مضاعفات مرضى السكتة القلبية

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من منطلق حمايه المرضى من مضاعفات فترة ما بعد الإنعاش بعد السكتة القلبية, تم تطوير برنامج تعليمي لرفع مستوى التمريض التوعوي للمعلومات و المهارات) المعرفى و المهارى) لتقليل معانات المرضى بعدالسكتة القلبيه وتقليل التعرض الى المضاعفات والعمل على ورفع مستوى الرعاية التمريضية للمريض من خلال تطوير المهارات العملية للتمريض.لذا هدفت هذه الدراسة إلى تقييم تأثير البرنامج التعليمي في فترة ما بعد إنعاش القلب على أداء ممرضات الرعاية الحرجة و مضاعفات مريض السكتة القلبية. وقد اجريت هذه الدراسة في العناية المركزة , عناية القلب و الطوارئ بمستشفى بنها الجامعي على عينة متاحه من ١٠٥ ممرضة و ٦٠ مريض. وقد اشارت النتائج الدراسة الى تحسن للمستوى المعرفى من ٤٩% قبل تطبيق البرنامج الى ٧٩% بعد تطبيق البرنامج , ايضا ظهر مؤشر تحسن ملحوظ فى الاداء المهارى حيث كان صفر% قبل تنفيذ البرنامج الى ٩١,٤% بعد تنفيذ البرنامج , اظهر جميع المرضى انخفاضاً ملحوظاً فى نسبة المضاعفات من شديد الاصابة بالمضاعفات الى قليل المضاعفات. وقد اوصت الدراسة بالاستمرار على تطوير الرعاية التمريضية المكثفة للمرضى فى فترة رجوع النبض التلقائى بعد السكتة القلبية