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Effect of nursing educational program regarding defibrillation and cardioversion on patients' outcomes

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Abstract: **Defibrillators are life-saving and their early use improves survival of patients presenting with sudden cardiac arrest due to shockable rhythms if they are used safely and correctly. The Aim of the present study was to evaluate the effect of educational program of nurses' on patients' outcomes. Method A quasi-experimental research design Setting, the present study conducted in coronary care unit at Assiut University Heart Hospital. The sample the study included 30 Patients' before implementation of the education program and 30 Patients' after implementation of the education program. Tools: Three tools were utilized to collect data pertinent to the study, Tool l: Assessment of patients undergoing defibrillation and cardiovertion. Tool II: Characteristics of direct current (DC) electric shock for patients. Tool III: Assessment of expected complication for critically ill patients' undergoing defibrillation and cardiovertion . Result, Finding of the present study revealed that a significant statistical difference was existed between both groups after educational program in relation to types of rhythm, joule used restoring sinus rhythm, number of electric shock. There were insignificant difference observed between two group regarding skin burn after direct current DC electric shock reached to the maximum improvement before discharge .Conclusion: improvement with significant differences in patient study group in overall main domains related to improve nurses' practice after educational program. The study recommended nursing care standard for management of patient undergoing defibrillation and cardiovertion should be revised, updated and available in cardiac care unite in both Arabic and English language.**

Keywords: **Defibrillation, Cardioversion, Life threatening dysrhythmia, Cardiac arrest.**

1. INTRODUCTION

Electrical cardioversion and defibrillation are procedures in the management of patients with cardiac arrhythmias. Cardioversion terminates arrhythmias such as, atrial fibrillation, atrial flutter, atrio-ventricular nodal re-entrant tachycardia, or haemodynamically stable ventricular tachycardia, by delivering a synchronized shock . Cardioversion is usually a scheduled procedure. But sometimes healthcare providers need to do it as an emergency. This is done if symptoms are severe. Cardioversion is not the same as defibrillation. Both use shocks to reset the heart. But defibrillation uses a stronger shock to stop very severe rhythms that can cause sudden death. **(Kaufmann et al., 2018)**

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Nurses are usually the first responsible health care staff and beginners of CPR until resuscitation team arrival. Identifying the initial rhythm is very important because time is important for survival in cardiac arrest due to ventricular fibrillation or tachycardia without pulse. Initial defibrillation shock is the main key for increasing the survival rate. All the nurses should be qualified for diagnosing pulseless fibrillation and ventricular tachycardia; they should be able to do the defibrillation shock during few seconds before resuscitation team arrival. Preventing cardiac arrest in hospital requires training in CPR, monitoring patients, identifying signs of worsening patient's symptoms, benefiting the resuscitation team and effective actions . **(Nafei et al .,2016)**

Nursing care for patient undergoing cardioversion and defibrillation; focuses on symptomatic relief, promotion of comfort and taking emergency actions in fatal dysrhythmias including assessment of disturbed rhythm, obtaining 12- lead ECG to identify the type of arrhythmia, and delivering adequate oxygen to reduce heart workload. As well, while administering medication as prescribed, the nurse should monitor the possible adverse drug reactions and be performing aimed nursing interventions. In cases such as ventricular fibrillation and cardiac arrest, the nurse should perform rapid and safe defibrillation and other cardiac life support protocols to preserve oxygen supply to vital organs .**(Khalil et al ., 2018)**

After the shock, nursing intervention including reassess the patient's rhythm. If the patient has not converted and a second shock is indicated, you will again need to push the synchronized button, as the machine will default to defibrillation mode. Continue to monitor the patient's level of consciousness and vital signs. **(Kirchhof et al., 2018)** Critical care nurses should be document the time you discovered the patient unresponsive and started Cardiopulmonary resuscitation (CPR). Document the procedure, including the patient's electrocardiogram (ECG) rhythms both before and after defibrillation; the number of times defibrillation was performed; the voltage used during each attempt; whether a pulse returned; the dosage, route, and time of drug administration; whether CPR was used; how the airway was maintained; and the patient's outcome. Provide a summary of these events in the patient's medical record**. (Laxman , 2014)**

Significance of the Study

From clinical observation in the cardiac care and critical care units, it was observed that the number of patients with life threatening dysrhythmia has increased over the last years and these patients require intensive collaborative care to save their lives and they are at risk for several consequences. These consequences in turn may have negative impact on the patient's condition, and will prolong patient's hospital stay, That is why there is an interest to conduct such type of research which might safeguard this category of patients against these serious consequences. The study as well could support the important role of the nurse in the patients' care through assessing the patient's and providing the required care regarding life threatening dysrhythmia , Also it is hoped that findings of this study might help in improving quality of patient care and establish evidence based data that can promote nursing practice and research .

Aim of the study: Aim of the study was to evaluate the effect of nursing educational program regarding defibrillation and cardioversion on patients' outcomes.

Research Hypothesis.

Patients' undergoing defibrillation and cardioversion outcomes after implementation of the educational program was better than- Patients' outcomes before implementation of the educational program.

2. PATIENTS AND METHOD

Research design:

A Quasi experimental research design was utilized in this study .

Setting of the study:

The study was conducted in coronary care unit (CCU) at Assiut University heart Hospital.

Sample:

A convenience sample of 60 adult male and female ill patients' admitted to coronary care units undergoing of defibrillation and cardioversion constituted the study sample. 30 patients' were monitoring before implementation of the education program and 30 patients' after implementation of the education program.

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Study Tools

Tools of the study:

Three tools were developed by the researcher for the data collection. It was based on review of relevant literatures this as follow:

Tool I: Assessment of patients undergoing defibrillation and cardiovertion . This tool consisted: Socio- demographic data about the patients ' code, age, sex, education level, marital status, occupation, duration of hospital (CCU) stay. In additional to medical data including diagnosis, past medical history.

Tool II : Types and characterized of direct current (DC) electric shock for critically ill patients' of defibrillation and cardiovertion which include (types of electric shock , types of rhythm before electric shock , joule , types of rhythm after (DC) , number of electric shock from admission for discharge , patient outcome).

Tool III: Assessment of expected complication for critically ill patients' undergoing defibrillation and cardiovertion: It consists of the following:

- **Defibrillation complications (**ventricular fibrillation (VF) after pulseless ventricular tachycardia (VT) , non-sustained ventricular tachycardia (VT), bradycardia , thromboembolism, cardiac arrest).
- **Skin burns after electric shock:** reported after DC electric shocks during stay in (CCU) were also defined in to three categories (No redness, Mild redness, sever redness).

The study was conducted on three phases:

1- Preparatory phase and administrative design:

- An official approval was obtained from the Dean of the Faculty of Nursing; Assiut University to the head of the Heart Hospital at Assiut University, to carry out the study explained the purpose of the study, and asking for permission to conduct the study.

- Development tool by reviewing of medical records was done to fill in the socio-demographic and medical data. Direct observation and examination were utilized to fill in the patient complication sheet and variance analysis was done.

- Content validity: The tools were tested for content related validity by jury of 5 specialists it's in the field of critical care nursing and coronary medicine from Assiut University and the necessary modifications were done.

- A pilot study was done to test the feasibility of the study, and applicability of the tool and the necessary modification were done the pilot study was done on 6 patients who were included in the study if no major modification was necessary.

- The reliability was tested using cronbach,s coaefficient alpha r = 0.805

- Ethical consideration: Research proposal was approved from Ethical committee in the Faculty of Nursing at Assiut University. There is no risk for study subject during application of the research. The study will follow common ethical principles in clinical research. Confidentiality and anonymity will assured. Study subject have the right to refuse to participate and or withdraw from the study without rational any time. Study subject privacy was considered during collection of data. Agree to participant in this study.

2- Implementation phase

- The studied sample fulfilling the reach criteria was assigned into two groups, before and after implementation of the nursing education program.

- The researcher assessed the patients undergoing cardioversion and defibrillation to the designed assessment tool using tool I , from first day of admission as a base line data

- Record of socio- demographic data which include (code, age, sex, education level, marital status, occupation, duration of hospital (ICU) stay). by using (tool 1).

- Record of medical data which include (diagnosis, past medical history). By using (tool 1).

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- Record of types and characterized of direct current (DC) electric shock which include (types of electric shock , types of rhythm before electric shock , Joule , types of rhythm after DC , number of electric shock from admission for discharge , patient outcome). by using (tool 2).

- Record of expected complication for critically ill patients' undergoing defibrillation and cardiovertion which include (VF after pulseless VT, Non-sustained VT, bradycardia , thromboembolism, cardiac arrest) and skin burns after electric shock by using (tool 3) from admission to discharge on each direct current electric shock .

Data collection:

- Data were collected by the researcher during approximately nine months starting from May 2017 to January 2018.

3- Evaluation phase: Evaluation was applied before and after educational program on patients' outcome by using study tool, in order to identify differences, similarities and areas of improvement, as well as defects.

Statistical design

Statistical analysis: Date entry and data analysis were done using SPSS version 19 (Statistical Package for Social Science). Data were presented as number, percentage, mean+-standard deviation. Chi-square test and Fisher Exact test were used to compare qualitative variables. P-value considered statistically significant when $P < 0.05$.

3. RESULT

Table (1): Frequency distribution of socio –demographic and clinical data of patients before and after implementation of an educational program (NO =60)

Variable	Before educational program (NO= 30)		After educational program (NO= 30)		P-value
	No.	%	No.	%	
Age: (years)					
< 40	4	13.3	5	16.7	0.213
40 - < 50	5	16.7	11	36.7	
50 - < 60	6	20.0	6	20.0	
≥ 60	15	50.0	8	26.7	
Mean ± SD	55.90 ± 12.83		49.33 ± 11.82		0.026*
Sex:					
Male	18	60.0	27	90.0	0.007*
Female	12	40.0	3	10.0	
Education:					
Illiterate	13	43.3	6	20.0	0.052
Read and write	4	13.3	8	26.7	0.197
Basic education	7	23.3	5	16.7	0.519
Secondary school	6	20.0	11	36.7	0.152
Marital status:					
Single	1	3.3	2	6.7	1.000
Married	29	96.7	28	93.3	
Duration of hospital stay: (days)					
< 5	14	46.7	7	23.3	0.099
5 - < 10	14	46.7	17	56.7	
≥ 10	2	6.7	6	20.0	
Occupation:					
Employee	9	30.0	11	36.7	0.584

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Unemployed	21	70.0	19	63.3	
Diagnosis:					
Ischemic heart disease (IHD)	27	90.0	26	86.7	1.000
Myocardial infarction (MI)	10	33.3	17	56.7	0.069
Atrial fibrillation (AF)	13	43.3	6	20.0	0.052
Heart failure(HF)	4	13.3	4	13.3	1.000
Past-history:					
Hypertension	21	70.0	18	60.0	0.417
Diabetes mellitus	5	16.7	16	53.3	0.003*
Ischemic heart disease	19	63.3	20	66.7	0.787
Dilated cardiomyopathy	2	6.7	5	16.7	0.424
Previous electrical shock	3	10.0	5	16.7	0.706
Previous primary percutaneous coronary intervention (PCI)	9	30.0	12	40.0	0.417

Chi-square test, Fisher Exact test * Statistical significant difference (P < 0.05).

Table (2) Comparison between before & after educational program as regard types and characteristics of direct current (DC) electric shock for patients.

Items	Before educational program (N= 30)		After educational program (N= 30)		P-value
	No.	%	No.	%	
Types of electric shock:					
Cardioversion	17	56.7	8	26.7	0.018*
Defibrillation	13	43.3	22	73.3	
Types of rhythm before electric shock:					
Atrial fibrillation (AF)	16	53.3	4	13.3	0.001*
Ventricular tachycardia (VT)	11	36.7	22	73.3	0.004*
Atrial flutter	0	0.0	0	0.0	--
Supraventricular tachycardia (SVT)	3	10.0	4	13.3	1.000
Ventricular fibrillation (VF)	0	0.0	0	0.0	--
Asystole	0	0.0	0	0.0	--
Joule:					
100 J	1	3.3	1	3.3	1.000
150 J	14	46.7	8	26.7	0.108
200 J	15	50.0	10	33.3	0.190
270 J	12	40.0	22	73.3	0.009*
Types of rhythm after (DC):					
Return sinus normal	19	63.3	19	63.3	1.000
Atrial fibrillation (AF)	5	16.7	5	16.7	1.000
Ventricular tachycardia (VT)	5	16.7	5	16.7	1.000
Atrial flutter (AFL)	0	0.0	0	0.0	--
Supraventricular tachycardia (SVT)	1	3.3	0	0.0	1.000
Ventricular fibrillation (VF)	0	0.0	1	3.3	1.000

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Number of electric (DC) shock from admission for discharge:					
1 - 3	18	60.0	4	13.3	0.000*
4 - 6	10	33.3	15	50.0	
> 6	2	6.7	11	36.7	
Patient outcome:					
Discharge	10	33.3	9	30.0	0.460
Transferred	14	46.7	18	60.0	
Died	6	20.0	3	10.0	

Chi-square test and Fisher Exact test * Statistical significant difference marked as (P < 0.05).

Table (3): Comparison between before & after educational program as regard complications after dirrct current (DC) electric shock. (NO =60)

Complications	Before program (No= 30)		After program (No= 30)		P-value
	No.	%	No.	%	
No complications	14	46.7	18	60.0	0.301
VF after pulseless VT	2	6.7	5	16.7	0.424
Non-sustained VT	3	10.0	1	3.3	0.612
Bradycardia	6	20.0	9	30.0	0.371
Thromboembolism	0	0.0	0	0.0	--
Cardiac arrest	10	33.3	14	46.7	0.292
Skin burn after DC shock	**Before program (No= 30)**		**After program (No= 30)**		**P-value**
	No.	**%**	**No**	**%**	
DC shock after 2 hours:					
No redness	8	26.7	18	60.0	0.009*
Mild redness	10	33.3	8	26.7	0.573
Severe redness	12	40.0	4	13.3	0.020*
DC shock after 24 hours:					
No redness	17	56.7	22	73.3	0.176
Mild redness	10	33.3	6	20.0	0.243
Severe redness	3	10.0	2	6.7	1.000
DC shock after 48 hours:					
No redness	6	20.7	26	86.7	0.000*
Mild redness	18	62.1	3	10.0	0.000*
Severe redness	5	17.2	1	3.3	0.195
DC shock after 3 days:					
No redness	12	42.9	26	86.7	0.000*
Mild redness	13	46.4	4	13.3	0.010*
Severe redness	3	10.7	0	0.0	0.237
At discharge:					
No redness	13	52.0	28	93.3	0.000*
Mild redness	11	44.0	2	6.7	0.005*
Severe redness	1	4.0	0	0.0	1.000

Chi-square test, Fisher Exact test * Statistical significant difference marked as (P < 0.05).

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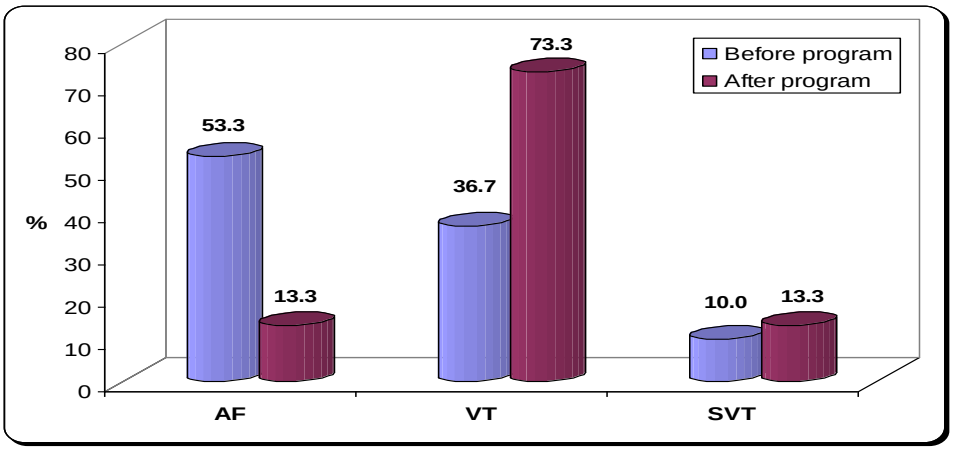

Figure (1): Distribution of study sample according to type of rhythm before direct current (DC) electric shock.

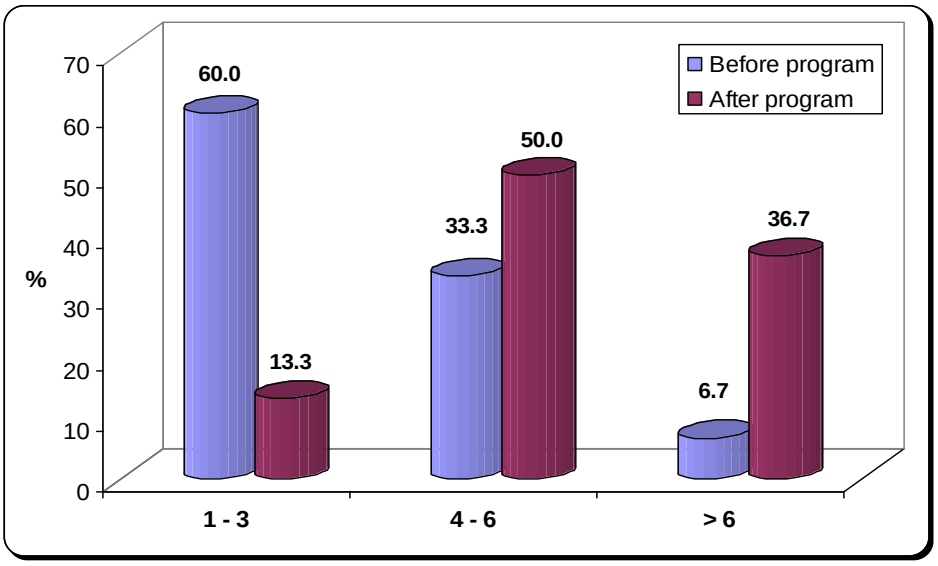

Figure (2): Distribution of study sample according to number of direct current (DC) electric shock from admission for discharge.

Table (1): Show that the mean age of patient before & after program with (55.90 ± 12.83) & (49.33 ± 11.82) respectively there was statistically significant difference between the two groups (p= 0.026). Regarding to patient's **sex**, results revealed a relatively high percent of patients were male patients before & after program (60.0%) & (90%) respectively. **Regarding educational level**, there was no significant difference between the two groups in relation to illiterate, read & write, basic education , secondary school (P = 0.052, 0.197& 0.519, 0.152) respectively.

Regarding to Marital sate the majority of studied patients were married before & after program (96.7%) & (93.3%) respectively. **Regarding** duration of hospital stay, there was no significant difference between the before & after program (P > 0.05). Regarding to occupation results revealed a relatively high percent of the patients were unmployed before & after program (70 %) & (63.2%) respectively. while unemployed (30 %) & (36.7 %) respectively there was no significant difference between the two groups (P > 0.05).

Regarding diagnoses (Ischemic heart disease, myocardial infarction , atrial fibrillation and heart failure) before & after program there was no statistically significant differences (P>0.05).

Regarding past medical history include **(**Hypertension, ischemic heart disease, dilated cardiomyopathy, previous electric shock, previous percutaneous coronary intervention) There was no statistically significant difference between before & after program (P>0.05). But regard past medical history for diabetes statistically significant difference before & after program.

Table (2) and fig (1, 2) :Regarding types of direct current (DC) electric shock it was found between before and after educational program was significant statistically difference between both groups (P<0.05). **Regarding Types of rhythm before (DC) electric shock** it was noticed (AF and VT) before and after educational program with (53.3% & 13.3%) and (36.7 % & 73.3%) of cases respectively there was statistically significant difference (P < 0.05) about (16) patients had atrial fibrillation before program while (22) patients had VT after program .Regarding (AFL , SVT, VF, and asystole) there was no statistically significant difference between before and after educational program (P > 0.05). **Regarding** The average voltages and energies restoring sinus rhythm were noticed (100 J, 150 J and 200 J) was no statistically significant difference between before and after educational program (P < 0.05) while joule (270 J) before and after educational program with (40.0 %) & (73.3%) of cases respectively there was statistically significant difference (P < 0.05) these results show that the energy required to restore sinus rhythm is significantly greater after educational program. Regarding types of rhythm (sinus rhythm, AF, VT, AFL, SVT and VF) before and after educational program was no statistically significant difference (P > 0.05). Regarding number of electric shock from admission to discharge show statistical significant difference between before and after educational program (P < 0.05). It was noticed the number of (DC) electric shock increased after program. Regarding patient outcome show no statistical significant difference before and after educational program (P > 0.05).

Table (3): Regarding complications include (VF after pulseless VT, non-sustained VT, bradycardia, thromboembolism, cardiac arrest) There were no statistically significant difference between before and after educational program (P> 0.05). Regarding skin redness it was noticed more than half number of patient after educational program have no redness after DC electric shock than before educational program .This result revealed that improvement in skin redness reached to the maximum improvement before discharge and show significant statistical differences was found after educational program (p-value < 0.05).

4. DISCUSSION

Time to first defibrillation is widely accepted to correlate closely with survival and recovery of neurological function after cardiac arrest due to ventricular fibrillation or ventricular tachycardia. Focused training of a cadre of nurses to defibrillate on their own initiative may significantly decrease time to first defibrillation in cases of in- critical care units. So studies support that education to staff nurses on defibrillation would be helpful in reducing complications and facilitate early recovery.

This part will be devoted to demographic of the patient under the study:

Based on the results of the present study, the majority of both groups undergoing defibrillation and cardiovertion were in age group > 50 to 65 years old and most patients were males. This finding supported by **(Benjamin et al.,2017)** that mention sex hormones cause differences in cardiac electrophysiological parameters between men and women that may affect the risk for arrhythmias. This agree with **(Angerud et al., 2013**) who found that two third of the studied subjects were male with mean age of 61.8 years.

In the same line (**Hawboldt et al., 2010)** found that majority myocardial infarction patients, their mean age were more than half of them were male. Moreover (**Ahrens et al., 2010) & (Abdelhameed et al., 2013)** mention that acute coronary syndrome is more prevalent in older persons than in younger persons, the condition develops earlier in men than in women.

In relation to the patients' marital status, the present study revealed that the majority of the studied were married. This may be due to the fact that the married persons were more liable to the sources of stress, such as the physical, psychological, or social conditions which is a risk factor for coronary artery disease. This comes in the same line with a study done in Brazil by **(Figueiredo Neto et al., 2015)** & **(Shahine et al., 2017**) whose revealed that married elderly patients with coronary artery disease were more prevalent than single, divorced and widow. Also **(Elgazzar et al., 2018)** found that the majority of the studied patients was married. This may be attributed to the high level of daily life stress on married patients than single one and that stress is considered one of the most aggravating factors for coronary artery disease.

Regarding Types of rhythm before DC electric shock it was noticed that common arrhythmia which detected by the nurse were (AF and VT) before and after program statistically significant between patients' groups. The results showed that the most common arrhythmia among patient after program is ventricular arrhythmias, especially VT. Ventricular arrhythmias are considered as life threatening complications and it is recommended that all health team, especially nurses have enough knowledge about predisposing factors and have enough education to be qualified to manage these arrhythmias.

These present results may attributed to implementation of educational program regarding cardiovertion and defibrillation and provide the nurses with knowledge and high quality practices, which reflect on minimizing complications and improved patients' outcomes. Critical care nurse must able to select time to first defibrillation that are the most serious or most important to the patients which reflect on patients condition.

The results of the present study agree with (**Meaney et al., 2010)** who stated that the proportion of successful defibrillations should increase, and the number of shockable rhythms should also increase due to earlier monitoring-before deterioration to asystole. This is in line with **(Stewart et al., 2014)** who found that effective training programs should be preceded by a period for gathering baseline data on times to first monitoring and first defibrillation.

In the same line **(Tai et al., 2012)** who stated that, nurses are vitally important in patient care. They are usually the first responder to any physiological changes in hospital patients. In VF and pulseless VT, time is the most crucial factor for survival. The shorter the time from arrest to defibrillation, the better the survival rate will be. A delay in defibrillation time of 1 min can greatly decrease the chances of survival.

Regarding The average voltages and energies restoring sinus rhythm were (100 J, 150 J and 200 J) was not statistically significant between patients' groups before and after program implementation ($P < 0.05$), while 270 J which used before and after program was statistically significant ($P < 0.05$) .These results show that the energy required to restore sinus rhythm is significantly greater after program. This concept is supported by **Podrid and Ganz (2015)** who's found that the amount of early shock in adults of biphasic type should be 120 to 200 joules and in monophasic type should be 360 joules. In the same line **(Slater et al., 2013)** found that patients received a biphasic external shock ranging from 50 to 200 J.

Regarding number of electric shock from admission to discharge show statistical significant difference before and after program ($P < 0.05$). It noticed that the number of electric shock increased after program implementation, this result confirm that , the effect of educational program on nurses and the ability of them early and rapidly to detect VT dysrhythmia lead to apply the defibrillator quickly and effectively which may give the significant result. This finding is in the same line with **(Funk et al., 2017)** who stated that, improvement in nurses' knowledge and the quality of care that they provide has little value unless it results in better outcomes for patients. Of the outcomes assessed, continuous ECG monitors and rapid detection of arrhythmias by the nurse after implementation of practice standards for electrocardiographic monitoring.

In the same **(Chan et al ., 2008)** found that delayed in-hospital defibrillation was a relatively frequent problem and that it lowered survival in the present majority of the patients discharged alive from the coronary care unit after educational program. This concept is supported by **Daniele (2012)** found that 36 patients (30.8%) were discharged alive from the emergency department and transferred to hospital wards.

The present study showed that, there was statistically significant difference between before program and after program patients' groups regarding skin burn assessment. These present results may attributed to implementation of educational program regarding defibrillation and cardiovertion equipped and provide the nurses with knowledge and high quality practices, which reflect on minimizing complications and improved patients' outcomes. Critical care nurse must able to select patients problems that are the most serious or most important to the patients which reflect on patients condition.

The results of the present study agree with **(Draeger et al., 2016)** who stated that, skin irritation or burns resulting from poor conduction of electricity between the skin and defibrillator pads or paddles is another complication which may occur during DC cardioversion. This complication is mitigated by ensuring proper use of conductive gel and proper contact of defibrillation pads to the skin minimizes the occurrence of burns and irritation related to the electrical shock**.**

In the same line **(Kirchhof et al., 2013)** reported that the improved skin-to-electrode contact also leads to reduction of transthoracic impedance and an increase in the success rate.

This in line with **Ghule (2014)** who revealed that education of staff nurses on defibrillation would be helpful in reducing complications and facilitate early recovery. Also (**Boodhoo et al., 2004)** found that appropriate training of the nurse led to cardioversion service with sedation be safe, effective, well tolerated, and cost effective.

5. CONCLUSION

Considering the results of the present study and the available evidence, it can be concluded that the educational program had good effectiveness in early detection of lethal dysrhythmia and reduces complications during defibrillation and cardiovertion.

6. RECOMMENDATIONS

- Development and application of training program for all nurses to update their knowledge and improve their skills and attitude to care of patients undergoing defibrillation and cardiovertion.
- Counseling sessions should be offered to cardiac patients, families and their caregivers about life threatening dythrytnmia , its treatment, and side effects.
- Repeat this research on large sample size and in different graphical area for generalized.

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