

Effectiveness of Structured Electrocardiography Training Programme among Registered Nurses

Ankita Sharma¹, Devanshi Choudhary², Dainy Thomas³,
S Vatchala Dhinakaran⁴, L Gopichandran⁵

Abstract

Cardiovascular disorders make up a large burden on existing health care system. Besides history and physical examination, the electrocardiography (ECG) remains the first and foremost diagnostic investigation to assess the electrical and muscular activity of the heart. Basic understanding of life-threatening cardiac rhythms and their management is an essential skill to salvage the suffering patients. This study aimed to assess the baseline ECG knowledge and also the effectiveness of a structured ECG programme on the knowledge score among registered nurses working at various health care levels. It also aimed to find out the association between knowledge on ECG monitoring, interpretation and other variables. One group pre-test post design was used. In total 101 registered nurses (RNs) were recruited using convenient sampling technique. Demographic and educational profile was assessed. The baseline knowledge scores were assessed using self-designed reliable and valid ECG monitoring and interpretation questionnaire following which structured ECG teaching programme was implemented, and post-test was taken for the knowledge score. Teaching content on ECG monitoring and interpretation was prepared on the basis of review of literature and in consultation with experts. Content validity of teaching content was established by giving it to five experts in different fields and modifications were made according to experts' suggestions. The tools were pre-tested before use among five nursing officers. Reliability coefficient of structured knowledge questionnaire was found out by using Split half technique and the tool was found reliable ($r=0.90$). Descriptive and inferential statistics were used to analyse the data. Majority i.e. 39 (38.61%) of the RNs had educational qualification upto BSc Nursing and majority i.e. 68 (67.33%) had attended ECG learning programme within last three months, majority i.e. 84 (82%) were female, mean age was 33.3 years (mini-22, max-52), majority i.e. 48 (47.5%) had clinical experience of 5-10 years. About half (49.5%) of them had average pre-test knowledge score, 49 (48.5%) had poor pre-test knowledge score. There was a significant improvement ($p=0.0001$) in the mean knowledge score from 4.99 ± 2.16 to 8.96 ± 1.76 . There was a significant association ($p=0.02$) between knowledge gain and recent attendance in ECG workshop during past three months.

People with cardiovascular disease make up majority of patients treated in most acute care hospitals. Cardiovascular diseases constitute most common co-morbid condition in hospitalised patients. Many of these patients have, or are at high risk for arrhythmias and ischaemia, and require continuous electrocardiographic (ECG) monitoring (Hui, 2012). ECG is one of the first and foremost non-invasive diagnostic investigation advised after history taking and physical examination among cardiac patients. ECG is based on the principle of galvanometer and was invented by Einthoven in 1902. It aids in recognition of heart's abnormal electrical

and muscular activity that further helps in diagnosing the underlying pathology. Continuous ECG monitoring is one of the most common technologies used in acute care today. ECG monitoring guides patient care, particularly for patients with risk for arrhythmias and myocardial ischaemia. Although continuous ECG monitoring is ubiquitous in hospitals, monitoring practices are inconsistent. Accurate and timely ECG assessment is an important tool in managing a variety of patients with cardiac problems.

Analysing the electrocardiogram remains one of the most important measures for various life saving measures like PCI and defibrillation. It has been reported that with every min of delay of defibrillation from a witnessed cardiac arrest there is a drop in survival rate to about 7-10 percent (Herlitz et

Authors are: 1-3. Nursing Officer, Department of Cardiology, AIIMS, New Delhi; 4. Assistant Secretary General, Trained Nurses Association of India Headquarters, New Delhi; 5. Associate Professor, College of Nursing, AIIMS, New Delhi.

al, 2015) Studies have indicated that the time taken for defibrillating and PCI in patients with cardiac arrest is directly related to the survival, presence of neurological deficits, and the quality of life after the cardiac arrest. Early measures taken by the first respondent, usually being the nurses have proved to be life saving (Tai et al, 2018).

India being a developing nation is having poor doctor-patient ratio as well as poor nurse-patient ratio. Further, there is narrowing of cardiologist patient ratio that leads to poor cardiac care and less attention to cardiac health. Nurses working at various levels of health sector can aid in early recognition of any threatening change in ECG and can report the findings further for appropriate health care. Usually nurses are the first respondents to any physiological change in the vital parameters of the patient in the hospital. So, appropriate knowledge and skill among nursing professionals regarding the abnormalities in the electrocardiogram would aid in early intervention in lethal arrhythmias. ECG interpretation is regarded as basic and essential skill for nurse in the acute care settings as in emergency unit or in critical areas as ICUs etc. ECG monitoring, identifying life threatening ECG abnormalities and managing them in collaboration enhances the nurse's autonomy, as also their roles and accountability. Various studies have shown effectiveness of various teaching interventions regarding ECG on the knowledge of nurses and nursing students (Rui et al, 2017; Obaydah et al, 2019). Various educational media have been used for ECG teaching among nursing students, nurses as flipped classroom, web-based ECG programme, lecture method etc. This study was aimed to assess the baseline ECG knowledge and to assess the effectiveness of a structured ECG programme on the knowledge score among registered nurses working at various health care levels.

Objectives

The objective of this study was to find out the association between knowledge on ECG monitoring and interpretation of various variables.

Methodology

Quantitative approach, with one group pre-test post-test design was used. This study was done among nursing professionals voluntarily attending the one-day ECG learning programme from different institutes across Delhi. This programme was held on two Saturdays in the month of November, 2019. The study was approved by Trained Nurses Association of India, Delhi branch. Informed consent was obtained before enrollment and confidentiality of the participants was maintained. The nurses taking part in the study were a mixed group of nurses (primary health care nurses, secondary health care nurses, tertiary health care nurses). All the nurses consenting for the

study were included in the study. Calculated sample size was 101, based upon the pilot study statistical analysis at α - 5% and power- 80%.

The data collection tools were: structured demographic performa and structured knowledge assessment questionnaire. Structured demographic performa contains questions on demographic and educational profile. Knowledge questionnaire in total contains 15 questions, 6 on ECG monitoring and 9 skill-based questions on ECG rhythm analysis. The scores are arbitrarily classified as 0-5 (poor knowledge), 6-10 (average knowledge) and 11-15 (good knowledge). Maximum score of questionnaire is 15. For each correct answer, score of one was given. For wrong answer, score of zero was given. The items were based on placement of ECG electrodes, lead representation, steps of ECG reading, axis deviation, normal duration of ECG complexes, ECG strip analysis of sinus pause, atrial flutter, ventricular tachycardia, ventricular fibrillation, torsades de pointes, accelerated junctional rhythm, idioventricular rhythm, accelerated junctional rhythm and second-degree heart block type II. The tools were pre-tested before use. Reliability of structured knowledge questionnaire was found out by using Split half technique and the tool was found reliable ($r=0.90$). Test retest method was used to find out the reliability of skill tool and it was found reliable ($r=0.80$). Written informed consent was obtained from the participants before collecting the data. The teaching was done on the same day of pre-test. The tools were self-administered. The post-test was conducted on the same after the intervention.

The intervention consists of teaching for six hours using various educational media as power point presentation, lecture, hands on session on ECG rhythm interpretation. Firstly four classes were taken each of one hour, topics such as introduction to ECG basic to anatomy and physiology of heart, concepts in ECG interpretation, introduction to arrhythmias - I (sinus tachycardia, sinus bradycardia, sinus arrhythmias, sinus arrest, sinus pause, sinus exit block, heart block, sick sinus syndrome) and introduction to arrhythmias - II (rhythms originating in atria and ventricles, junctional rhythms, features of myocardial ischaemia, electrolyte imbalances on ECG, management of adult bradycardia, tachycardia, cardiac arrest, atrial fibrillation algorithms). One-hour break was given for participants after which three sessions were undertaken where ECGs were specifically displayed with their features. First one was hands-on session on ECG - sinus tachycardia, paroxysmal supraventricular tachycardia, junctional tachycardia, ventricular tachycardia, fibrillation. Second was hands on session on ECG as sinus bradycardia, pacemaker spikes, heart blocks, hyperkalaemia, hypokalaemia, hypercalcaemia, hypocalcaemia.

Third was hands-on ECG – atrial fibrillation, atrial flutter, myocardial infarction, torsades de pointes. After this one-hour hands-on session was conducted wherein the participants were grouped into three to four sub-groups. Each of them was given ECG Practice paper that had 22 ECG-based questions containing various ECG abnormalities covered in the class and participants were asked to interpret the rhythms individually. Each group had one instructor, in case any clarification was needed, they were assisted. Following this session, post-test was administered to the participants and feedback was taken.

The intervention was provided by four mentors, one was associate professor in college of nursing, second was nursing educator, another two were nursing professionals working at coronary care unit. All of them had competence in basics of ECG and its interpretation.

Data analysis: Data were analysed using SPSS version 20. Both descriptive (frequencies, percentages, mean, standard deviation, median and range) and inferential statistics (Student t test, pearson correlation) were used.

Results

Demographic profile of participants (Table 1): Significant number of them i.e. 39 (38.61%) of the RN had educational qualification upto BSc Nursing and majority i.e. 68 (66.7%) had recently attended ECG learning programme within last three months, majority i.e. 84 (83.17%) were female, mean age was 33.3 years (mini-22, max-52), 48 (47.5%) had clinical experience of 5-10 years.

Effectiveness of structured ECG programme: Baseline ECG knowledge (Table 2) – About half the participants i.e. 50 (49.5%) of them had average pre-test knowledge score, 49 (48.5%) had poor pretest knowledge score. Only 2 (1.98%) had good knowledge score.

Knowledge gain (Table 3): There was a statistically significant improvement ($p=0.0001$) in the mean knowledge score from pre-test to post test that is 4.99 ± 2.16 to 8.96 ± 1.76 .

Association of ECG knowledge with educational profile (Table 4): There was a statistically significant association ($p=0.02$) between knowledge gain and recent attendance in ECG workshop in past three months. There was no association between knowledge gain and educational status ($p=0.78$) as well as the year of clinical experience ($p=0.15$).

Additional finding: Feedback from subjects has few statements as the intervention should be carried out in two to three sessions and also that the participants should be provided learning material for future clinical ECG reference.

Table 1: Demographic profile of participants (n=101)

Variables		f (%), Mean $\pm$ SD
Age (in years)		33.3+ 7.50 (Mn-22, Mx-52)
Gender	Male	17 (16.83%)
	Female	84 (83.17%)
Education	GNM	10 (9.90%)
	Post-Basic nursing	26 (25.74%)
	BSc Nursing	39 (38.61%)
	MSc Nursing	26 (25.74%)
	PhD Nursing	0
Years of experience	0-5 years	11 (10.89)
	5-10 years	48 (47.53%)
	10-15 years	24 (23.76%)
	Above 15 years	18 (17.82%)
Recent ECG attendance	Yes	68 (67.33%)
	No	33 (32.67%)

Table 2: Baseline ECG knowledge of the subjects (N= 101)

Pre-test knowledge score	f (%)
0-5 (poor)	49 (48.5%)
5-10 (average)	50 (49.5%)
10-15 (good)	2 (1.98%)

Discussion

Present study revealed significant knowledge gain after structured ECG training programme. This finding is in congruence with study conducted among undergraduate medical students that revealed significant knowledge gain after ECG interpretation programme through web-based instructional media (Nilsson & Bolinder, 2008). Another study conducted in Turkey for assessing knowledge and practices of ECG interpretation among nurses revealed that majority of their subjects had educational qualification upto BSc Nursing and had attended ECG training programme in the past. These findings are in congruence with the findings of the present study. It also revealed high level of ECG knowledge and practice among nurses, while in the present study majority of the nurses had poor to average knowledge although a very small proportion had good knowledge. This can be explained as in the present study subjects were working in the diverse clinical settings while in the Turkish study, subjects were from cardiology ward or ICU settings. A study conducted by Rui et al in 2017 reported a significant gain in ECG knowledge in the group provided with the ECG instructions using a flipped class room and lecture-based learning, this is in congruence with the findings of the present study

Table 3: Pre-test and post-test knowledge score, (N= 101) Student t test

Pre-test score, Mean $\pm$ SD	Post test score, Mean $\pm$ SD	t value, p value
4.99 $\pm$ 2.16	8.96 $\pm$ 1.76	-18.08, <0.001*

*Statistically significant

Table 4: Association between educational profile and knowledge gain

Variable		Knowledge gain Mean $\pm$ SD	F value, p value
Educational status	GNM	4.72 $\pm$ 2.68	0.43, 0.78
	Post Basic	3.96 $\pm$ 1.99	
	BSc	3.72 $\pm$ 2.14	
	MSc	3.88 $\pm$ 3.88	
	PhD	3.00	
Years of experience	0-5	4.7 $\pm$ 2.2	1.81, 0.15
	5-10	3.3 $\pm$ 1.64	
	10-15	4.4 $\pm$ 2.74	
	15 and above	3.71 $\pm$ 1.68	
Previous ECG training	Yes	4.68 $\pm$ 2.45	2.32, 0.02*
	No	3.61 $\pm$ 2.01	

*Statistically significant

where lecture, demonstration and hands-on session for ECG training has been used (Rui et al, 2017). The result of present study about significant gain in knowledge after intervention is in congruence with some other studies (Herlitz et al, 2015; Pickham, 2010). There is a relatively new finding that there was no significant association between knowledge gain and work experience as well their educational status.

Strengths, limitations and recommendations

The strength of the present study lies in its intervention that consists of using various kind of instruction media as lecture method, hands-on experience, group discussion. It had a large sample size of 101, from different hospitals of North India. The presented study has various limitations as post-test was taken on the same day of intervention, this can have pretest bias; the targeted population was registered nurses working at any clinical area. There was no comparison group. Research method used was experimental but weaker design (pre-test post-test one group design) was adapted for this study.

Recommendations

More studies can be undertaken on this area with different research techniques as randomised controlled trial etc. Study can be replicated and post-test can be done at various intervals as one month, one week for knowledge gain assessment. Instructional media can be diversified as use of simulation, group discussion, brainstorming, web-

based learning, participants can be provided with ECG learning material for their clinical reference, targeted population can be changed to registered nurses working in critical areas etc.

Conclusion

ECG monitoring is a pivotal skill for nurses working in critical area for prevention of sudden cardiac deaths in hospital care setting. Therefore, ECG training becomes the most indispensable part while preparing the critical care nurses. Further a deeper understanding in the abnormal and normal ECG rhythms can render nurses to take prompt decisions in case of any emergency situation when encountered with such patients having life threatening ECG rhythms. The present study endorses that nurses can efficiently be taught to interpret an electrocardiogram so as to take life saving interventions as and when necessary.

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