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Research Article

Application of Precordial Lead ECG SafOne to Patients with Cardiovascular Disease: Evidence-based Practice

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Abstract.
Electrocardiography (ECG or EKG) is one of the essential cardiac diagnostic tests to record the heart's electrical activities. However, errors in precordial lead placement causes invalid ECG recordings. The invention of precordial lead ECG SafOne aims to reduce these errors. This study aimed to apply the precordial lead ECG SafOne to patients with cardiovascular diseases and compare it to the standard ECG in relation to the presence of artefacts and placement time duration. This study employed the experimental research design with a post-test-only equivalent control group approach with a sample size of 60 outpatients undergoing an ECG test. Data on artefacts and placement time duration from ECG SafOne and standard ECG were identified and measured. Data were analyzed using descriptive statistics and the Wilcoxon test to examine the difference in all the variables collected. The results showed no substantial difference related to the artefacts emerging from ECG SafOne and standard ECG with a p-value of 0.083 (> 0.005). In addition, placement time duration using ECG SafOne is faster than standard ECG (p=0.000). To conclude, ECG SafOne is more practical and efficient than standard ECG. This tool produces ECG recordings with no significant difference from standard ECG. Therefore, ECG SafOne is applicable for electrocardiography recording for patients with cardiovascular diseases.

Keywords: cardiovascular diseases, electrocardiography, diagnostic test, SafOne, precordial lead

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1. INTRODUCTION

Electrocardiography (ECG) is a test performed on patients with cardiovascular problems. ECG recording is one of the most critical cardiac diagnostic tests because it is used to determine cardiac problems and is noninvasive and inexpensive. (1,2) However, to some extent, the standard method for performing ECG recordings is challenging to healthcare providers because of the need to place the precordial lead at the six thoracic landmarks correctly. ECG SafOne is established as a solution to overcome pre-existing

problems. ECG SafOne is a precordial lead invented to locate six precordial lead fast and precisely.(3)

Efforts to prevent the high mortality rate in heart disease patients are to treat them quickly and accurately. The prompt treatment and diagnosis given depend on the ECG recording results. (1) state that ECG recording is one of the essential cardiac diagnostic tests because it determines cardiac problems and is noninvasive, inexpensive, simple, and repeatable. However, errors in precordial lead placement and interchange of precordial lead will cause invalid ECG recordings.

Performing ECG recording in all situations, including emergency conditions, requires speed and accuracy in the examination to provide support quickly. However, ECG recording may result in errors in installing or placing precordial electrodes. (4) The unstable and restless condition experienced by heart attack patients can make insertion difficult. This condition is fatal because it will affect the interpretation of the ECG measurement and incorrectly provides a picture of the patient's actual condition.

Considering the importance of ECG recording to diagnose heart diseases, an effort is needed to make ECG recording easy but does not affect the recording results. The research conducted by Dewi (5) comparing artefacts in manual ECG recording and using SafOne's ECG precordial lead to nursing students, found no significant artefact difference between the ECG examination results using the SafOne and standard ECG. However, this study was conducted on healthy subjects and never on subjects with heart problems. Therefore, this study aimed to analyse the application of the ECG SafOne precordial lead to record ECG in patients with cardiovascular diseases. This test is essential in order to provide accuracy of ECG SafOne. Moreover, the ECG SafOne will later advantage health professional workers to record ECGs fast and precisely. This tool will assist the speed of process diagnosis decisions which also can impact the promptness of treatment provided.

2. MATERIALS AND METHODS

This study employed quantitative research employed a Quasi-Experimental design with a post-test only equivalent control group approach. Ethical approval for this study was obtained from the Ethical Review Board for Nursing and Health Research Universitas Riau certificate number 137/UN.19.5.1.8/KEPK.FKp/2021. The population of this study was outpatient undergoing ECG tests for the disease diagnosis, disease progression, and treatment therapy decision at one of the public hospitals in Pekanbaru, Indonesia. Sixty people participated in this study using the purposive sampling technique. Twice ECG

recordings using the standard ECG precordial lead and the ECG SafOne precordial lead (Figure 1) were equally performed on all samples. All data collected, including artefacts and placement time duration of installing ECG SafOne and standard ECG, were analysed using descriptive and comparison analysis. The univariate analysis described the demographic data. In comparison, bivariate analysis was used to identify the results of the ECG recording between the variables tested on both ECG recordings using the Wilcoxon test.

Figure 1: Precordial ECG SafOne.

3. RESULTS

3.1. Demography of Respondents

Table 1 shows that the average age of respondents in this study was 58.88 years old, with the oldest being 86 years and the youngest 30 years. Age is one of the factors influencing the occurrence of cardiovascular disease. The respondent's average length of illness was 68.65 months, with the longest being 432 months and the lowest being one month.

TABLE 1: Characteristics of respondents.

Characteristics	Mean	Max	Min
Age	58.88 years old	30	86
Long Suffered	68.65 months	1	432

Table 2 reveals that most respondents are male (60%), did not work (63.3%), had an ideal BMI (50%), and 30 per cent of the respondents in this study were diagnosed with Coronary Artery Disease (CAD).

TABLE 2: Characteristics of respondents by gender, occupation, BMI, and medical diagnosis.

Characteristics	F	%
Gender Male Female	36 24	60.0 40.0
Occupation Work Does not work	22 38	36.7 63.3
BMI Underweight Ideal Overweight Obese	2 30 21 7	3.3 50.0 35.0 11.7
Medical Diagnosis CAD HHD CHF Bells Palsy Mitral Stenosis Bradycardia UAP AP AHD MCI CAA Valve Regurgitation CPC CHD Acute STEMI	18 8 12 1 1 1 4 2 5 3 1 1 1 1 1	30.0 13.3 20.0 1.7 1.7 1.7 6.7 3.3 8.3 5.0 1.7 1.7 1.7 1.7 1.7

3.2. Artefacts on the ECG recording using precordial lead ECG SafOne and standard ECG

Analysing the number of artefacts on the ECG recording results will evaluate all ECG lead. Each lead is assessed for the P wave and QRS complex. Then, an analysis is carried out to examine whether there are artefacts. Suppose there are artefacts, the following examination analyses whether these artefacts affect the interpretation results. The analysis of the artefact description in this study can be seen in Table 3. It shows that most artefacts contained in the standard ECG recordings are present (53.3%) but do not affect the interpretation results

TABLE 3: Overview of SafOne standard and ECG ECG artefacts.

Characteristics	F	%
Standard ECG None Yes, but it does not affect the interpretation results Yes, it affects the interpretation results	7 32 21	11.7 53.3 35
SafOne EKG None Yes, but it does not affect the interpretation results Yes, it affects the interpretation results	7 35 18	11.7 58.3 30

3.3. ECG recording placement time duration using precordial lead ECG SafOne and standard ECG

The ECG recording time length was measured by measuring the time locating the precordial lead position. Timing begins with determining the location of V1 in the precordial lead and ends when the precordial lead is attached. The results can be seen in Table 4.

TABLE 4: Precordial lead placement time duration.

Characteristics	Mean	Max	Min
Standard ECG placement time duration	139.75	52	336
ECG SafOne placement time duration	48.17	20	237

Table 4 shows that the average length of placement time duration of precordial lead standard ECG is 139.75 seconds, with the shortest of 52 seconds and the longest of 336 seconds. In addition, the average length of placement time duration of precordial lead ECG SafOne is 48.17 seconds, with the shortest of 20 seconds and the longest of 237 seconds.

3.4. Comparison of ECG recording based on artefacts emerge

This study compares the results of the ECG recordings using ECG SafOne and standard ECG by looking at the artefacts that emerge on the recordings. The Wilcoxon test was then carried out to examine the difference in the recording results between the two tools, as shown below in Table 5.

TABLE 5: Comparison of ECG recordings with ECG SafOne and standard ECG based on artefacts.

	N	Median (Min-Max)	*P-value*
Standard ECG Recording	60	2 (1-3)	0.083
ECG SafOne Recording	60	2 (1-3)	

3.5. Comparisaon of ECG recording based on placement time duration

This study also compared the placement time duration of precordial lead ECG SafOne and standard ECG. Then a T-test was conducted to examine the difference in placement time duration on both tools. The T-test results comparing the ECG placement time duration can be seen in Table 6. There is a difference in the placement time duration between the two tools (p=0.000), where the average placement time duration with the ECG SafOne is 48.17 seconds and is faster than the average placement time duration with the standard ECG (139.75 seconds).

TABLE 6: T-test results of placement time duration of precordial lead ECG SafOne and standard ECG.

	N	Mean±SD	*P-value*
Standard ECG placement time duration	60	139.75±64.038	0.000
ECG SafOne placement time duration	60	48.17±31.361	

4. DISCUSSION

This study investigated the application of the precordial lead ECG SafOne and the standard ECG to patients with cardiovascular disease regarding the presence of artefacts and placement time duration. This study found that the artefacts were present in the recordings using the ECG SafOne, but it did not affect the interpretation results. There was no difference in the results of the ECG SafOne recordings and the standard ECG in terms of artefacts. Artefacts often appear during ECG recording and are influenced by external and internal factors. Electrocardiographic artefacts are defined as waveform interference or electrocardiographic alterations in an ECG recording resulting from noise interference or anything that is not caused by the electrical activity generated by the heart (6–8). The internal factors include the patient's condition at the time of recordings, such as hypothermia, improper skin cleansing, excess gel, and improper placement of limb and precordial lead (9,10).

Moreover, several conditions, such as the respondent's BMI and gender, cause the instability of the ECG SafOne position during the ECG recording process (10). Nomsawadi (11) and Shih (12) showed that age, sex and BMI could affect ECG sensitivity; the higher the BMI, the lower the ECG sensitivity. It can be seen from the number of respondents with obese BMI (28 people). This condition may trigger emerging artefacts of the standard ECG and ECG SafOne.

Proper placement of the precordial can prevent the appearance of artefacts that could interfere with the examination results is one of the goals of SafOne (3). The determination of the ECG lead points on the ECG SafOne is based on theory and SOPs for ECG installation. The distance VI-V2 considers the anatomical distance of the human body (13). In addition, the distance between the lead points was measured thoroughly using a measuring instrument to obtain the correct pattern for making ECG SafOne. The pattern obtained is then formed on the leather material by considering the shape of the thorax of each individual. It is different for each respondent, especially the respondents with different BMI. ECG SafOne were measured using a digital multimeter to obtain an accurate position, thereby increasing the tool's effectiveness (3).

ECG test is one of the standard examinations in emergency services for patients with heart problems. A quick, precise, and accurate examination will determine the health workers' decisions in intervening in patients. Moreover, the position of V1 is vital because it will determine the accuracy of the V2-V6 placement during the ECG examination (14,15). The ECG scan using the ECG SafOne is faster because the examiner locates the V1 precordial point; it quickly finds the V2, V3, V4, V5, and V6 points and

attaches them to the patient's body. The ECG SafOne precordial pattern placement has followed the body's anatomy, taking into account the respondent's BMI. In addition, it is also ensured that the cables connected to each electrode will not touch, making it easier for the examiner to complete an ECG examination quicker and more accurately than a standard ECG. Compared to the ECG SafOne, placement time duration with the standard ECG takes longer because it needs to search for the precordial points one by one, starting from V1-V6. Therefore, using the ECG SafOne for ECG tests will allow healthcare professionals to focus on determining only the precise position of V1. Hence, they can find the V2-V6 points easily when it is placed on a person's chest.

This study's finding is related to a previous study revealing that the ECG scan using the ECG SafOne precordial lead was relatively faster than the Standard ECG (5). However, the previous study did not explain how long it would take for the ECG examination or installing the ECG SafOne precordial lead. (16) PERKI (17) stated that an ECG examination using a standard ECG takes about 5 to 10 minutes. This statement is supported by Fong & Chung (18) mentioned that Hence, Dewi (5) found that the ECG SafOne precordial lead could shorten the duration of the electrocardiogram examination. This statement can be proven in this study that the average placement time duration of standard ECG is 152.90 seconds, while the average placement time duration of ECG SafOne is 53.77 seconds. It indicates 99.13 seconds difference between these two tools. Therefore, the precordial lead ECG SafOne developed by Dewi (5) can assist healthcare professionals in indicating precordial lead location quickly and accurately and reduce the time needed to perform an ECG examination.

5. CONCLUSION

This study depicted that artefacts were found both in the standard ECG recordings and the ECG SafOne; however, they did not affect the interpretation of recording results. There was no significant difference in the results of the ECG SafOne recording and the standard ECG in the artefacts. However, there was a difference in time efficiency between the precordial lead ECG SafOne and the standard ECG precordial lead. The average time for installing the standard ECG precordial lead was longer than using the precordial lead ECG SafOne. Therefore, ECG SafOne is applicable to be used to record ECG, and to sure its compatibility, it should be further researched, focusing on healthcare professionals' perspectives as the user. It is essential to sure a new health tool invention condition before applying it to healthcare services.

Acknowledgments

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