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Diagnostic value of Peguero-Lo Presti electrocardiographic criteria for diagnosing concentric left ventricular hypertrophy in hypertensive patients at Dr. M. Djamil General Hospital Padang

Yanuar Surya Saputra Poedjijo,[1] Akmal M. Hanif,[2] Wahyudi,*[2] Arina Widya Murni,[3] Armen Ahmad,[4] Eifel Faheri,[5] Dwitya Elvira,[6] Eka Kurniawan,[7]

[1]Department of Internal Medicine, Faculty of Medicine, University of Andalas/M. Djamil General Hospital Padang, West Sumatera, Indonesia
[2]Department of Internal Medicine, Division of Cardiovascular, Faculty of Medicine, University of Andalas/M. Djamil General Hospital Padang, West Sumatera, Indonesia
[3]Department of Internal Medicine, Division of Psychosomatic and Palliative Medic, Faculty of Medicine, University of Andalas/M. Djamil General Hospital Padang, West Sumatera, Indonesia
[4]Department of Internal Medicine, Division of Tropical Infectious Diseases, Faculty of Medicine, University of Andalas/M. Djamil General Hospital Padang, West Sumatera, Indonesia
[5]Department of Internal Medicine, Division of Hematology and Medical Oncology, Faculty of Medicine, University of Andalas/M. Djamil General Hospital Padang, West Sumatera, Indonesia
[6]Department of Internal Medicine, Division of Allergy Immunology, Faculty of Medicine, University of Andalas/M. Djamil General Hospital Padang, West Sumatera, Indonesia
[7]Department of Internal Medicine, Division of Rheumatology, Faculty of Medicine, University of Andalas/M. Djamil General Hospital Padang, West Sumatera, Indonesia

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***Corresponding author:**
wahyudi@med.unand.ac.id

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Original Article

ABSTRACT

Background: Hypertension is a risk factor for morbidity and mortality from cardiovascular disease. Left ventricular hypertrophy (LVH) is the main target organ due to hypertension, which is a predictor of the development of cardiovascular diseases such as heart failure. Echocardiography is the gold standard examination for determining heart geometry, and concentric LVH is often found in hypertensive patients. Electrocardiography (ECG) is a widely available, low-cost, and rapid modality for diagnosing LVH in healthcare facilities. The Peguero–Lo Presti (PLP) criteria in ECG examination have better sensitivity and specificity compared to other criteria.
Objectives: This study aims to determine the diagnostic value of PLP ECG to diagnose concentric LVH.
Methods: This research is an analytical observational study with a cross-sectional approach carried out at the inpatient installation of Dr. M. Djamil General Hospital Padang for 6 months, starting from April to September 2024. The study subjects who met the inclusion and exclusion criteria were 90 samples selected by consecutive sampling. An ECG examination was conducted using PLP criteria and echocardiography with the M-mode method to assess left ventricle (LV) geometry. Data were analysed using a 2x2 table to obtain sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy.
Results: From 90 samples, LVH geometry was found concentric in 65.50%, eccentric 4.40%, concentric remodelling 11.10%, and normal 18.90%. In the diagnostic test, PLP criteria had 79.66% sensitivity, 90.32% specificity, 94.00% PPV, 70.00% NPV, and 83.33% accuracy to diagnose concentric LVH in hypertensive patients.
Conclusion: Peguero Lo-Presti criteria on ECG can be used for screening and early diagnosis of concentric LVH in hypertensive patients.

INTRODUCTION

According to data from the World Health Organization (WHO) in 2015, hypertension predominantly impacted individuals in the middle to lower socioeconomic strata, with 1.13 billion affected globally and 17.7 million fatalities resulting from cardiovascular diseases.[1] In 2016, the WHO noted that the death rate of patients with cardiovascular disease associated with hypertension increased to around 17.9 million or as much as 31% of the death rate in the world.[1] Prolonged high blood pressure can affect the increase in heart muscle mass, and leads to an increase in the size of the heart cavity and or abnormal thickening of the heart wall, which causes the condition of left ventricular hypertrophy.[2] Increased blood pressure over a long period of time affects the incidence of left ventricular hypertrophy of the heart around 23-48% as the main target organ to be damaged, and is closely related to the severity of hypertension which reaches 60% of the incidence, with the most common complication of heart failure by 40-60%.[2]

Electrocardiographic examination has been used in various studies for more than 40 years. The American Heart Association (AHA) explains that there are 36 criteria on the ECG to diagnose left ventricular hypertrophy. The majority of criteria use voltage criteria, namely Cornell and Sokolow-Lyon, with the prevalence of these criteria found to be 50% and 29%, respectively. The sensitivity of the Cornell and Sokolow-Lyon criteria was 35% and 17%, respectively.[3]

Peguero et al. conducted a study on 97 patients with left ventricular hypertrophy aimed at establishing the diagnosis of left ventricular hypertrophy with a new method based on the sum of the amplitude of the S wave (deepest S wave (SD)) in any lead and the S wave in the V4 lead (SV4), diagnosed left ventricular hypertrophy if SD + SV4 ≥ 2.8 mV in men and ≥ 2.3 mV in women.[4,5] In diagnosing left ventricular hypertrophy, the Peguero-Lo Presti criteria are best used with a sensitivity of 62% and specificity of 90%, while the sensitivity and specificity of the Cornell criteria are 35% and 90%, and the Sokolow-Lyon criteria have a sensitivity and specificity of 17% and 89%.[4,5]

Research by Laksono in Cirebon, including hypertensive patients with left ventricular hypertrophy, detected via echocardiography, revealed concentric hypertrophy in 93%, remodelling concentric hypertrophy in 4%, and eccentric hypertrophy in 3%.[6] Concentric left ventricular hypertrophy can be accurately assessed by echocardiographic examination as a gold standard, but not all health facilities have echocardiographic equipment.[7]

Electrocardiographic examination can assess left ventricular hypertrophy quickly, easily, at low cost, and is widely available in health facilities, but cannot assess the geometry of left ventricular hypertrophy. Peguero-Lo Presti criteria on electrocardiographic examination have better sensitivity and specificity than other criteria for assessing left ventricular hypertrophy because they show more activation of the myocardium and epicardium.[4,5] Given the foregoing context, the authors would want to investigate the diagnostic value of Peguero-Lo Presti electrocardiograms in identifying concentric left ventricular hypertrophy in hypertensive patients.

METHODS

Study design

This study is a diagnostic test study with a cross-sectional approach. The study was conducted at the Inpatient Installation of Dr. M. Djamil Padang Hospital for 6 months from April to September 2024.

Population and sample

The study sample consisted of patients who met the inclusion criteria namely patients aged >18 years, patients with systolic blood pressure ≥140 and or diastolic ≥90 mmHg, cardiomegaly patients with left ventricular ejection fraction (LVEF) ≥ 50%, and willing to participate in the study by signing informed consent and the exclusion criteria, namely patients with barrel chest, total atrioventricular block, bundle branch block, atrial fibrillation, atrial flutter, pacemaker use, congenital heart disease or heart valve abnormalities, endocarditis, pericarditis, pyocarditis, pericardial effusion, pleural effusion, obesity, and patients who do not allow ECG and

echocardiography examinations such as patients with burns in the examination location area. Sampling was done with a consecutive sampling technique.

Data collection

All populations had baseline data recorded by the researchers: age of the subject from birth until the time of study conducted, sex that refers to the biological characteristics that define humans as female or male, weight that measured by a calibrated weighing scale, height of the subject that measure from the top of the head to the sole of the foot while standing barefoot, blood pressure which are the force of blood that is measured in millimeters of mercury (mmHg), duration of hypertension that defined as duration of the patients starting from the 1st time blood pressure examination results according to the joint national committee 8 (JNC 8) Stage 1 hypertension is diagnosed when the systolic blood pressure ranges from 140–159 mmHg or the diastolic pressure ranges from 90–99 mmHg and Stage 2 hypertension is defined by a systolic pressure of 160 mmHg or higher or a diastolic pressure of 100 mmHg or higher, body mass index that measure individual's weight in kilograms by the square of their height in meters, a BMI of less than 18.5 kg/m^2 is categorised as underweight, a BMI between 18.5 and 22.9 kg/m^2 is considered the normal range, Individuals with a BMI between 23.0 and 24.9 kg/m^2 are classified as overweight, a BMI between 25.0 and 29.9 kg/m^2 is categorised as obese class, and a BMI of 30.0 kg/m^2 or higher indicates obese class II, risk factors such as smoking, comorbid diseases (diabetes mellitus, dyslipidemia, chronic kidney disease, coronary heart disease), and medication history that written on medical record such as ACEI, ARB, CCB, Diuretics, Beta blocker, and categorised into single, double, or triple combination.

The patients were subjected to a calibrated ECG examination with a device speed of 25mm/sec and a voltage of 10 mm/mV using the Peguero-Lo Presti criteria to establish the diagnosis of left ventricular hypertrophy. Interpretation of ECG recording results was said to be left ventricular hypertrophy based on Peguero-Lo Presti criteria when SD + SV4 ≥ 2.8 mV for men and ≥ 2.3 mV for women.

An echocardiographic examination is carried out by a cardiovascular consultant internal medicine specialist to determine concentric left ventricular hypertrophy based on cardiac geometry values in hypertensive patients using a 2-dimensional ®ge Logiq echocardiography device with the M-Mode method. Measurement of intraventricular septal (IVS), left ventricular internal diameter (LVID) and posterior wall thickness (PWT) to obtain left ventricular mass (LVM) data with the formula LVM (grams) = 0.8 x (1.04((IVS + LVID + PWT)^3 - LVID3) + 0.6g. Measurement of body surface area (BSA) with the formula BSA = (((height in cm) x (weight in kg))/3600)^{½}. Measurement of left ventricular mass index (LVMI) with the formula LVM/BSA. Measurement of left ventricular end diastolic dimension (LVEDD) to obtain the relative wall thickness (RWT) value with the formula RWT = 2 x PWT / LVEDD. In left ventricular concentric hypertrophy, LVMI value > 115 g/m^2 in men, > 95 g/m^2 in women and RWT value > 0.42.

Data analysis

Descriptive analysis of basic data including patient characteristics such as name, age, gender, weight, height, body mass index, blood pressure, duration of hypertension, risk factors, comorbid diseases, and medication history were carried out. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy of the Peguero-Lo Presti criteria ECG examination were tested with gold standard echocardiography examination in diagnosing concentric left ventricular hypertrophy in hypertensive patients using a 2x2 table. The variables measured were the number of true positives (TP), false positives (FP), false negatives (FN), and true negatives (TN).

Sensitivity is the ability of the diagnostic test to detect concentric left ventricular hypertrophy in hypertensive patients with Peguero-Lo Presti ECG examination calculated with the formula 1:

$$\frac{TP}{TP+FN} \quad (1)$$

Specificity is the ability of the diagnostic test not to detect concentric left ventricular hypertrophy in hypertensive patients, calculated with the formula 2:

$$\frac{TN}{TN+FP} \quad (2)$$

Positive predictive value is the probability of detecting concentric left ventricular hypertrophy in hypertensive patients with Peguero-Lo Presti ECG examination if the test result is positive, calculated with the formula 3:

$$\frac{TP}{TP+FP} \quad (3)$$

Negative predictive value is the probability of not detecting concentric left ventricular hypertrophy in hypertension with Peguero-Lo Presti ECG examination if the test result is negative, calculated with the formula 4:

$$\frac{TN}{TN+FN} \quad (4)$$

Diagnostic accuracy is the proportion of correct test results (true value) among all those examined, calculated by the formula 5:

$$\frac{TP}{NP+Number\ of\ Samples} \quad (5)$$

Ethical statement

This study was conducted after obtaining ethical clearance from the research ethics committee of Dr. M. Djamil Padang hospital with the number DP.04.03/D.XVI.XI/273/2024. Subjects who met the inclusion criteria of the study were given an explanation and were asked to fill out and sign an informed consent.

RESULTS

Basic characteristics of the study

This study was conducted on 90 hypertensive patients at the inpatient unit of Dr. M. Djamil Padang hospital who met the inclusion and exclusion criteria. The individual characteristics of hypertensive patients suspected of having concentric left ventricular hypertrophy can be seen in Table 1. Basic characteristics of the study, which include gender, age, BMI, systolic blood pressure, diastolic blood pressure, duration of hypertension, risk factors, comorbidities, and medication history.

Table 1. Basic Characteristics of the Study

Characteristics	n = 90 (%)	Mean ± SD
Gender		
Male	34 (37.80)	
Female	56 (62.20)	
Age (years)		53.87 ± 13.33
26 - 35 years	9 (10.00)	
36 - 45 years	12 (13.30)	
46 - 55 years	14 (15.60)	
56 - 65 years	26 (28.90)	
> 65 years	29 (32.20)	
Body mass index (kg/m^2)		23.71 ± 0.98
Normal (18.5 – 22.9)	20 (22.20)	
Overweight (23 – 24.99)	70 (77.80)	
Systolic blood pressure (mmHg)		157.16 ± 11.35
Diastolic blood pressure (mmHg)		71.58 ± 5.79

Characteristics	n = 90 (%)	Mean ± SD
Hypertension stage		
Stage 1 hypertension	56 (62.22)	
Stage 2 hypertension	34 (37.78)	
Hypertension duration (years)		4.93 ± 2.37
Diabetes mellitus		
Present	24 (26.70)	
Absent	66 (73.30)	
Dyslipidemia	21 (23.30)	
Present	69 (76.70)	
Absent		
Chronic kidney disease		
Present	35 (38.90)	
Absent	55 (61.10)	
Coronary heart disease		
Present	9 (10.00)	
Absent	81 (90.00)	
Smoking history		
Present	16 (17.80)	
Absent	74 (82.20)	
Medication history		
ACEI	57 (63.30)	
ARB	23 (25.60)	
CCB	59 (65.60)	
Diuretics	10 (11.10)	
Beta blocker	14 (15.60)	
Anti-hypertensive combination		
Single	27 (30.00)	
Double	39 (43.33)	
Triple	24 (26.67)	

Based on Table 1, hypertensive patients suspected of having concentric left ventricular hypertrophy in this study were mostly found in females, with a percentage of 62.20% and 37.80% in men. Individuals in this study were almost half in the age category >65 years at 32.20% with a mean of 53.87 ± 13.33 years. In this study, weight and height checks were carried out and then calculated body mass index (BMI), with most of the BMI in the overweight category as many as 70 (77.80%) with a mean of 23.71 ± 0.98 kg/m^2. Then the average systolic blood pressure of the subjects was 157.16 ± 11.35 mmHg and diastolic blood pressure 71.58 ± 5.79 mmHg, stage 1 hypertension as many as 56 (62.22%), with an average duration of hypertension of 4.93 ± 2.37 years.

Individuals with a history of diabetes mellitus were 24 (26.70%), dyslipidemia 21 (23.30%), chronic kidney disease 35 (38.90%), and coronary heart disease 9 (10%). Most individuals did not have a history of smoking as many as 74 (82.20%). In medication history, most individuals had a history of ACEI drug consumption of 57 (63.30%) and CCB 59 (65.60%). The use of antihypertensive drug combinations showed that almost half of the individuals, 39 (43.34%), used two-drug combinations.

Echocardiography and electrocardiography examination results

Echocardiographic examination was performed on all study samples. It was found that the results of echocardiographic examination in hypertensive patients showed a mean RWT of 0.51 ± 0.12, and a mean LVMI of 129.03 ± 40.94 g/m^2. The results of echocardiographic examination also showed that most individuals with concentric left ventricular geometry were 59 (65.60%), followed by normal categories 17 (18.90%), concentric remodelling 10 (11.10%), and eccentric 4 (4.40%).

Electrocardiographic examination was performed on all study samples. It was found that

the frequency of left ventricular hypertrophy in hypertensive patients based on Peguero-Lo Presti criteria from ECG examination was 50 (55.56%) individuals, more than those who did not experience left ventricular hypertrophy as many as 40 (44.44%) individuals.

Diagnostic value of electrocardiographic examination of Peguero-Lo Presti criteria for diagnosing concentric left ventricular hypertrophy in hypertensive patients.

Hypertensive patients suspected of having concentric left ventricular hypertrophy were examined in a total of 90 samples. All samples were examined using echocardiography. From the echocardiographic examination, it was found that there were 59 patients with concentric left ventricular hypertrophy. The value of electrocardiographic diagnosis of Peguero-Lo Presti criteria for diagnosing concentric left ventricular hypertrophy in hypertensive patients was assessed by testing the results of echocardiographic examination as a gold standard. The diagnosis test was carried out with a 2x2 table, resulting in a sensitivity of 79.66%, specificity of 90.32%, positive predictive value of 94.00%, negative predictive value of 70%, and diagnostic accuracy of 83.33%.

DISCUSSION

In this study, left ventricular geometry was mostly in the concentric category (65.60%), followed by the normal category (18.90%), concentric remodelling (11.10%), and eccentric only in (4.40%) subjects. Research by Ginting et al. showed that the heart geometry of hypertensive patients with LVH was 90.40% of subjects with concentric LVH, only 9.60% eccentric LVH, and no examination results were obtained with normal or concentric remodelling heart geometry.[8] Then, in hypertensive patients without LVH, the results of cardiac geometry showed 64.30% LVH concentric remodelling and 35.70% were normal; no concentric and eccentric LVH examination results were obtained. Other study found 61.50% concentric LVH, 18.80% of subjects had eccentric LVH and 19.7% were normal.[9]

The population of this study found that most hypertensive patients were female, with a percentage of 62.20% compared to men, 37.80%. Previous study where the incidence of hypertension occurred more in the female sex, with a percentage of 61.60% compared to men of 38.40%.[8] Another study conducted on civil servants of the federal ministry in Addis Ababa, as many as 28.30% of women and 26.20% of men experienced hypertension. Research by Lv et al. showed that more than half of the subjects were female suffering from hypertension with a percentage of 53%.[11] Also a research found that female subjects suffering from hypertension were 57%.[9]

Two studies explained that the prevalence of hypertension in women increases especially after the fifth decade.[10,11] Until puberty, blood pressure is fairly consistent between the two sexes. However, with age, women's hormonal regulation in preventing hypertension decreases and the development of hypertension is faster when compared to men. In women, RAAS components, such as plasma renin, fluctuate during the menstrual cycle in response to changes in estradiol levels. It has recently been shown that activation of estrogen receptor α (ERα) and binding to the nuclear estrogen response element of renin-expressing juxtaglomerular cells are required for basal renin expression. Therefore, in women, RAAS is significantly affected by estrogen status.[10,11]

The subjects in this study were almost half in the age category >65 years (32.20%), with a mean of 53.87 ± 13.13 years. Research by Huang et al. and Letmi et al. found that more than half of the subjects with hypertension were in the age category of >65 years.[12,13] Findings in another study show that hypertensive patients had an average age of 36 years, and Alfaqeeh et al., who found that out of a total of 32,670 respondents, more than a quarter had hypertension, which was highest in the 45-54 age group.[14,15]

Age has been recognised as an unmodifiable risk factor for hypertension. Studies by Legese et al. and Letmi et al. explained that, with increasing age, the structure of blood vessels will undergo changes. There is an increase in the thickness of the blood vessel wall and narrowing of the lumen of the blood vessel due to the accumulation of collagen in the tunica media layer of the vascular.[13,16] In addition, age will also cause the blood vessel wall to harden and become stiff due

to a decrease in the elasticity of the vascular wall. Lack of physical activity, such as cardiorespiratory fitness, also contributes to the increased risk of hypertension in the elderly.[13,16]

The body mass index in this study was mostly in the overweight category as many as 70 (77.80%) subjects, with a mean body mass index of 23.71 ± 0.98 kg/m2. Research by Yu et al. in their study found hypertensive subjects with BMI between 24.80 to 31.0 kg/m2, and Legese et al. explained that being overweight is related to the possibility of hypertension.[16,17] Subjects with overweight/obesity/IMT greater than or equal to 25 kg/m2 have a seven times greater risk of developing hypertension. Research also showed that the subjects had an average BMI of 24.1 kg/m2, and Letmi et al. distributed the largest percentage of hypertensive patients with BMI between 18.5-25 kg/m2 (50%).[12,13]

The mean systolic blood pressure of the subjects was 157.16 ± 11.35 mmHg and diastolic blood pressure 71.58 ± 5.57 mmHg, with most of the stage 1 hypertension as much as 62.22%. Research by Wang et al. in subjects who did not experience LVH had a SBP of 154 ± 14 mmHg and DBP 90 ± 12 mmHg, while LVH subjects had a SBP of 166 ± 13 mmHg and DBP 92 ± 17 mmHg.[18] Guerreiro et al. showed that in non-LVH subjects, SBP was 146 ± 26 mmHg and DBP 81 ± 11 mmHg while LVH subjects had SBP 148 ± 21 mmHg and DBP 81 ± 13 mmHg.[19] Research with an average subject SBP of 130.9 mmHg and DBP 81.2 mmHg.[12] Ginting et al. in their study where the systolic/diastolic blood pressure of non-LVH patients was 138/78.6 mmHg and LVH was 141.9/81.3 mmHg.[8]

In this study, the subjects had a mean duration of hypertension of 4.94 ± 2.37 years. The duration of hypertension in the study of Ginting et al. also had an average of 6 years in subjects without LVH and 7 years in LVH.[8] In the study of Kim et al. also had the majority of hypertensive subjects with a duration of ≥ 5 years who experienced LVH.[20] Slightly different in the study of Zhou et al., which had the majority of patients with hypertension duration of 1-5 years and Peng et al., with the majority of subjects with hypertension duration of 10 years.[21,22]

The European Association of Cardiovascular Imaging (EACVI) and the American Society of Echocardiography (ASE) have mentioned that the occurrence of LVH in hypertensive patients is related to the duration of hypertension and uncontrolled hypertension. Uncontrolled and prolonged hypertension can cause LVH, decreased diastolic function and increased left atrial (LA) pressure, which will eventually lead to LA dilation and fibrosis.[8] Research by Peng et al. also found that there was an association between stage 1 hypertension and a significant increase in 10-year CVD risk.[21]

As many as 38.90% of the subjects in this study had a history of chronic kidney disease. Previous study found 8.2% of hypertensive subjects with chronic kidney disease.[23] In general, salt and volume expansion, sympathetic nervous system (SNS) hyperactivity, regulated renin-angiotensin-aldosterone system (RAAS), oxidative stress, vascular remodelling, endothelial dysfunction, various mediators, and signalling molecules are thought to play a role as factors in the occurrence of renal impairment in hypertensive patients. Chen et al. found that hypertensive subjects with coronary heart disease were 5.3%. It was explained in their study that hypertension is a common risk factor for coronary heart disease (CHD) because it can increase coronary atherosclerosis and cause coronary lumen stenosis.[24] In addition, high systolic blood pressure (SBP) is a risk factor for myocardial fibrosis, myocardial ischemia, and cardiac hypertrophy. Moreover, hypertension and CHD often occur simultaneously, due to shared risk factors and pathophysiological mechanisms, as well as complex interactions. Patients with comorbidity of CHD and hypertension have worse outcomes and prognosis than those with a single disease.[23]

A small proportion of subjects (17.80%) had a history of smoking. Another study found 20.3% of hypertensive subjects who were smokers,25.44% of subjects who smoked, and another research with 47.6% subjects without LVH and 35.6% with LVH who were smokers. Described in the study of Gaya et al., impaired endothelial function, arterial stiffness, increased inflammation, lipid changes, and prothrombotic factors are associated with smoking and appear to initiate and accelerate the atherothrombotic process, ultimately leading to cardiovascular events.[8,25]

Subjects mostly had a history of ACEI (63.30%) and CCB (65.60%) treatment, with almost half getting double anti-hypertensive drugs at 43.33%. Previous study found that most subjects

used CCBs.[26] Ginting et al., which shows subjects with and without LVH have a history of ACEI treatment as much as 92.9% and 97.3% respectively.[8] There are also a studythatfound that the majority of subjects used ACEI/ARB regimens and ARBs were the most commonly used treatment by hypertensive subjects (29.9%).[27,28]

The results of echocardiographic examination in hypertensive patients in this study, based on Table 2 show a mean RWT of 0.51 ± 0.12. Research by Zhou et al. found that 54.2% of patients with concentric LVH had RWT values > 0.42, and Wang et al. with concentric LVH subjects had a mean RWT of 0.46 ± 0.03; subjects who did not have LVH had a mean RWT of 0.38 ± 0.04; and eccentric LVH with a mean of 0.37 ± 0.03.[22,26] Marcato et al. showed that the mean RWT in their subjects was 0.44 ± 0.99 in the concentric LVH group and 0.41 ± 0.08 in the control group.[9]

The mean LVMI in this study was 129.03 ± 40.94. The geometry of LVH in hypertensive patients is more concentric in form, this is due to a mechanism of sustained pressure overload resulting in an increase in left ventricular mass index (LVMI) and RWT with a consequent decrease in left ventricular compliance and increased filling pressure. Ginting et al. showed subjects with concentric LVH had an LVMI of 140.2 g/m2.[8] Likewise, Wang et al. in patients with concentric LVH had an LVMI of 137 ± 19 g/m2.[26]

Table 3 regarding the frequency distribution of left ventricular hypertrophy in hypertensive patients based on ECG examination of Peguero-Lo Presti criteria in this study showed that most subjects with LVH were 55.56% and subjects without LVH were 44.44%. Ginting et al. in their study found 63.50% of subjects with LVH and 36.50% of subjects without LVH.[8] Different in othe study that showed that hypertensive patients with LVH had lower by 35.70% compared to those without LVH, 64.30% and another one with 37.30% LVH and 62.70% no LVH.[13 25] Marcato et al. in their study found that hypertensive patients with LVH were 41.50% of subjects, and not LVH 58.50%.[9] ECG examination of Peguero-Lo Presti criteria in this study was tested using echocardiography as a gold standard. This study found a sensitivity of 79.66%, specificity of 90.32%, positive predictive value of 94.00%, negative predictive value of 70.00%, and accuracy of 83.33%. The sensitivity value of 79.66% means that the ability of the Peguero-Lo Presti criteria ECG examination can detect the occurrence of concentric LVH in hypertensive patients by 79.66% or in other words, that 79.66% of subjects with hypertension can be detected as having concentric LVH through the Peguero-Lo Presti ECG examination. Research by Lv et al. the Peguero-Lo Presti criteria have a higher sensitivity value than other criteria, with a sensitivity of 39.00%.[25] Letmi et al. in their study showed a sensitivity of 38.0% and Ginting et al. in their study obtained a sensitivity of 54.8%. In the study conducted by Ginting et al., the criteria were modified with a new cut-off value, resulting in a sensitivity of 67.1%.[8,13] Marcato et al. obtained a sensitivity of the Peguero-Lo Presti criteria of 51.22%.[9]

The specificity value of 90.32% means that the ability of the Peguero-Lo Presti criteria ECG examination to detect the absence of concentric LVH is 90.32%. This shows that the absence of concentric LVH can be ruled out by 90.32% in the Peguero-Lo Presti criteria ECG examination. Research by Lv et al. showed that the Peguero-Lo Presti ECG had a specificity of 73.00%.[25] Letmi et al. in their study obtained a specificity of 73.00% for the Perguero-Lo Presti ECG examination.[8] Ginting et al.showed a higher specificity value of 90.50% by using the optimal cut-off value for Peguero-Lo Presti criteria for males is ≥ 26 mm, and for females is ≥ 22 mm to diagnose LVH.[8] Marcato et al. in their study found a specificity of 92.86% in the analysis of LVH.[9]

The positive predictive value of 94.00% means that the possibility of concentric LVH with Peguero-Lo Pesti criteria ECG examination is 94.00% if the examination is positive. Research by Lv et al. had a positive predictive value of 24.00% for LVH.[25] Ginting et al. in their study obtained a positive predictive value of 92.50% for LVH.[8] Lower in other study with positive predictive value for Peguero-Lo Presti criteria occurred in LVH of 86.96%.[9]

The negative predictive value of 70% means that the possibility of the absence of concentric LVH with Peguero-Lo Pesti category ECG examination is 70.00% if the examination result is negative. Higher in a study with a negative predictive value of 89.00% for LVH.[25] While, another study showed a lower negative predictive value for LVH of 50.00% and 61,30%.[929]

The 83.33% diagnostic accuracy means that the ability of the Peguero-Lo Presti criteria ECG

examination to get a positive result in subjects with concentric LVH and a negative result in subjects without concentric LVH is 83.33%. Research by Lv et al. obtained an accuracy of 68.00% for the Peguero-Lo Presti ECG related to LVH.[25] Marcato et al. in their study obtained an accuracy value of 69.88% for Peguero-Lo Presti ECG related to LVH.[9]

There are differences in the results of diagnostic values in this study with several other related studies. This happened because other studies used the LVH output variable, so that the results used were the Peguero-Lo Presti ECG diagnostic value for diagnosing LVH and were not specific to concentric LVH as in this study, thus making differences in basic characteristics, inclusion and exclusion criteria. There are currently no studies that test the diagnostic value of the Peguero-Lo Presti ECG for diagnosing concentric LVH in hypertensive patients.[8,9,13,25] Tests for screening purposes must have a high sensitivity, as the sensitivity of an examination empirically indicates the ability of the examination to detect even small changes in abnormalities that lead to a disease. Thus, high sensitivity (≥75% or ≥80%) is good for screening. The specificity of a test procedure indicates that the test detects only the disease. Thus, high specificity is very good for diagnosis.[30,31] This study was conducted in one health centre with a limited sample size, thus these results may limit generalisation to larger demographic and ethnic groups.

CONCLUSION

This study found that the Peguero-Lo Pesti ECG criteria have good sensitivity with high specificity. This suggests that the Peguero-Lo Pesti ECG criteria for diagnosing concentric LVH in hypertensive patients can be used for screening and early diagnostic purposes.

CONFLICT OF INTEREST

All authors declare that they have no conflicts of interest.

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DATA AVAILABILITY

The data will be available on the study's primary site. Please contact the corresponding author for future access.

SUPPLEMENTAL DATA

The supplemental data associated with this article provide additional materials that support and expand upon the main findings presented in the manuscript.

AUTHOR CONTRIBUTIONS

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

DECLARATION OF USING AI IN THE WRITING PROCESS

No AI or AI-assisted technologies were used in the preparation of this manuscript.

LIST OF ABBREVIATIONS

LVH: Left ventricular hypertrophy; ECG: Electrocardiography; PLP: Peguero – Lo Presti; LV: Left ventricle; PPV: Positive predictive value; NPV: Negative predictive value; WHO: World Health Organization; AHA: American Heart Association; SD: Deepest S wave; SV4: S wave in the V4 lead; IVS: intraventricular septal; LVID: Left ventricular internal diameter; PWT : Posterior wall thickness; LVM: Left ventricular mass;

BSA: Body surface area; LVMI: Left ventricular mass index; LVEDD: Left ventricular end diastolic dimension; RWT: Relative wall thickness; TP: True positives; FP: False positives; FN: False negatives; and TN: True negatives; ACEI: Angiotensin Converting Enzyme Inhibitors; ARB: Angiotensin Receptor Blockers; CCB: Calcium Channel Blockers; SBP: Systolic blood pressure; DBP: Diastolic blood pressure.

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