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Correlation of P Wave Dispersion and Quality of Life of Heart Failure Due to Coronary Heart Disease Patient in Haji Adam Malik General Hospital

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ABSTRACT

Introduction: P wave dispersion is a more sensitive cardiovascular marker which obtained by the ECG to elaborate structural and electrophysiological abnormalities in patients. This study aims to elucidate P wave dispersion prevalence in heart failure due to coronary heart disease patients and the correlation with their quality of life.

Method: This analytical cross-sectional study is done in RSUP Haji Adam Malik in 133 patients with heart failure from May to June 2023. Patients had undergone clinical evaluation, physical examination, 12-lead electrocardiography (ECG), and then were given the MLFHQ to assess the quality of their lives. Data were analyzed using fischer-exact test, with p value less than 0.05 considered to be significant.

Results: From the total of 133 sample of patients, there were 55 (43.2%) patients with positive p wave dispersion, among them 2 had low quality of life, 25 had moderate quality of life, and 28 had good quality of life. With mean of PWD is 27.9±15.1 ms. The group of patient with negative p wave dispersion 78 had moderate and good quality of life. P value is less than 0.01. It's concluded that there was a positive correlation between p wave dispersion and quality of life of heart failure patients in Haji Adam Malik general hospital

Conclusion: There is positive correlation between p wave dispersion and quality of life of heart failure due to coronary heart disease patients in Haji Adam Malik general hospital.

Keywords

P wave dispersion, ECG, Heart failure, Quality of life

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INTRODUCTION

There are several clinical and bedside parameters that can be predictors of heart failure mortality and morbidity, including PR interval and P wave.[1] In a study by Solimen et al., it was found that PR interval prolongation was associated with short-term mortality in heart failure patients.[2] In the Framingham Heart Study, PR interval prolongation was associated with a 40% increase in all-cause mortality.[3] The study by Soliman et al. examined mortality risk in patients in the NHANES-III study.4 He found that P wave duration, not PR interval prolongation, was associated with increased mortality risk.[2]

P-wave dispersion, defined as the variation in duration of the longest and shortest P-waves in 12 ECG leads, is a cardiovascular marker that more sensitively describes structural (such as atrial hypertrophy and dilatation) and electrophysiological (slowed or fragmented atrial conduction) abnormalities.[4,5] Senen et al. found that there was higher P-wave dispersion in patients with dilated cardiomyopathy compared to the control group.[6] This may be explained because P wave duration and P wave dispersion are influenced by autonomic tone which induces changes in impulse propagation velocity. Sympathetic activity has been shown to be

increased in heart failure patients and associated with P wave dispersion in patients with paroxysmal atrial fibrillation (AF). [1]

P-wave dispersion is a predictor of AF, a condition associated with reduced quality of life in heart failure patients. The study by Joby et al. examined predictors of paroxysmal AF in patients post Coronary Artery Bypass Graft (CABG) surgery and reported on multivariate analysis that increased P-wave dispersion was an independent predictor (OR = 1.03, 95% CI: 1.01-1.05, P = 0.01) of AF.[7] In another study by Tsioufis et al. in hypertensive patients, they reported that P-wave dispersion in AF patients was 22 ms higher than in patients without AF ($p < 0.0005$).[8] The study by Comin-Colet et al. reported that heart failure patients with AF had a lower quality of life ($p=0.002$), based on the Kansas City Cardiomyopathy Questionnaire (KCCQ) ($p<0.001$), EuroQoL-5D (EQ-5D) quality of life questionnaire ($p<0.001$), and visual analogue scale assessment ($p<0.001$), than heart failure patients without AF.[9] However, different results were obtained by Sepehrvand et al. where AF was not associated with a decrease in KCCQ scores over 12 months in heart failure patients ($p=0.43$).[10]

Although there are several studies examining P wave dispersion and AF and the relationship between AF and quality of life in heart failure patients, the relationship between P wave dispersion to thromboembolic risk and quality of life in heart failure patients has not been widely studied, especially in populations with sinus rhythm. This study aims to examine the relationship between P wave dispersion and quality of life of heart failure patients with coronary causes and their thromboembolic risk profile at Haji Adam malik Hospital.

METHOD

This was a single centre observational study with a cross-sectional design. This study was approved by the Ethics Committee of Hajj Adam Malik Hospital, North Sumatra. Additional medical record data were collected at each visit through the E-MR system. This study was conducted at Haji Adam Malik Hospital, North Sumatra. The research time was from May to June 2023. The target population of this study were patients with heart failure with coronary causes in Indonesia.

The inclusion criteria in this study were adult patients aged 18 years and over, patients with a diagnosis of chronic heart failure with coronary causes, patients with sinus rhythm, patients with any left ventricular ejection fraction (LVEF), patients with NYHA functional class I, II, or III, patients who visited the heart and vascular polyclinic of Adam Malik Hospital from May 2023 to June 2023. Patients with renal failure, patients with acute heart failure, patients with cancer, patients unwilling or unable to give consent, and patients unable to have an ECG examination were included in the exclusion criteria.

Outpatients who meet the inclusion and exclusion criteria will be explained about the study and willingness to be a research subject. Patients who provide written informed consent will be evaluated regarding demographic status (name, gender, age), medical history in the form of comorbidities (ischaemic heart disease, hypertension, diabetes mellitus, valvular heart disease, dilated cardiomyopathy, history of Coronary Artery Bypass Graft surgery) and cardiovascular medications (diuretics, beta blockers, ACEi or ARBs, aldosterone antagonists, digoxin, amiodarone, ivabradine), physical examination (systolic and diastolic blood pressure), functional class of heart failure, 12-lead ECG, and left ventricular ejection fraction and atrial diameter on echocardiography.

The scoring of thromboembolic risk in patients with atrial fibrillation is according to the CHA2DS2-VASc score. This scoring contains questions related to risk factors that patients have and then summed up to determine the level of thromboembolic risk. Some of the components are chronic heart failure, hypertension, age above 75 years, diabetes mellitus, history of stroke or transient ischemic attack or thromboembolism, vascular disease, age 65-74 years, and gender. As per the stratification by the European Society of Cardiology for atrial fibrillation: score 0 low risk, score 1 medium risk, and score ≥ 2 high risk.

Questions will be asked about the quality of life of patients with heart failure according to the MLHFQ (Minnesota Living with Heart Failure Questionnaire) questionnaire. This questionnaire contains questions that aim to find out how much the patient's heart failure (heart condition) has affected the patient's life so far. After

reading each question, patients are asked to circle 0,1,2,3,4, or 5 to rate how much their life is affected by heart failure. The questionnaire has a maximum score of up to 65. The scores for each question are totalled and then interpreted as follows: scores < 20 were interpreted as good quality of life, scores 20-40 were interpreted as moderate quality of life, and scores > 40 were interpreted as poor quality of life. Thromboembolic risk factors in patients were measured by the CHA2DS2-VASc score. Quality of life was measured with the Minnesota Living with Heart Failure Questionnaire (MLHFQ)-Indonesia questionnaire.

The primary outcomes were prevalence of P-wave dispersion (categorical), quality of life from MLHFQ questionnaire (categorical) and risk stratification from CHA2DS2-VASc score (categorical). Differences in qualitative variables were analysed by Chi-square when eligible and Fisher's test otherwise. Multivariate analyses with multiple logistic regression and Spearman correlation were used for estimation of correlation between different variables and P wave index. The cut-off for significance was p value <0.05.

RESULTS

Table 1. Basic Characteristics of Research Results

Demographics	Quality Results Alive (n=133)			*p value*
	Good (N: 102)	Medium (N: 29)	Bad (N: 2)	
Characteristics Patient				
Age (years)	56.02 (±9.02)	55.68 (29 – 75)	46.5 (44 – 49)	0.012b
Type Sex				0.766c
Man	83 (76.9)	23 (21.3)	2 (1.9)	
Woman	19 (76)	6 (24)	0 (0)	
Smoke	55(73.3)	19 (25.3)	1 (1.3)	0.53c
Hypertension	31 (77.5)	9 (22.5)	0 (0)	0.64c
Diabetes mellitus	39 (75)	13 (25)	0 (0)	0.42c
Strokes	3 (75)	1 (25)	0 (0)	0.95c
Class Functional				<0.05c*
NYHA I	50 (84.7)	9 (15.3)	0 (0)	
NYHA II	46 (76.7)	13 (21.7)	1 (1.7)	
NYHA III	6 (42.9)	7 (50)	1 (7.1)	
Echocardiography Data				
LVEF				<0.05c*
≥50	56 (90.3)	6 (9.7)	0 (0)	
31 – 49	34 (63.0)	19 (35.2)	1 (1.9)	
≤30	12 (70.6)	4 (23.5)	1 (5.9)	
Left atrial dilatation	3 (27.3)	8 (72.7)	0 (0)	<0.01c*
Consumption therapy fail heart				0.691c
Optimal	3 (100)	0	0	
Sub-Optimal	95 (75.4)	29 (23)	2 (1.6)	
Not optimal	4 (100)	0	0	
CHA2DSC-Vasc Score	3.14 (3.00 -5.00)	3.38 (3.00 -6.00)	5.00 (4.00 – 6.00)	0.445c

Analysis between P wave dispersion and quality of life was conducted using fisher exact with significant results, p<0.05. The results showed (X2 = 51.7, p < 0.01), there was an association between quality of life and P wave dispersion (table 4.2). Quality of life using MLHFQ questionnaire with scoring <20 good, 20 - 40 moderate, and >40 poor. In 133 subjects, 103 patients or 76.9% had good MLHFQ questionnaire results. All study subjects had similar CHA2DSC-Vasc score categories, namely high risk with a score ≥ 2 as many as 133 subjects or 100%.

We then analysed the Chads2-Vasc2 scoring profile in the population based on PWD, to see how the possible thromboembolic risk of patients with PWD in the heart failure population (table 4.3). The insignificant p value was due to the uneven distribution of samples in both groups. Based on table 4.4, it can be concluded that through multivariate tests it was found that PWD independently influenced quality of life very strongly and significantly (95% KI: 13.01-16).

Table 2. Connection dispersion P waves with Quality Life

	Quality Life				*p value*
	Good	Currently	Bad	Total	
PWD Positive	28	25	2	55	
PWD Negative	74	4	0	78	<0.01
Total	102	29	2	133	

Thicker lines indicate strong significance, while thinner lines indicate weak significance. The multivariate analysis in figure 4.2 shows the strongest association of PWD with quality of life (Exp. (B): 13). The result of an independent relationship was also found in left atrial dilatation with PWD (Exp. (B): 0.539). While the relationship between LVEF and quality of life has moderate strength (Exp. (B): 0.456).

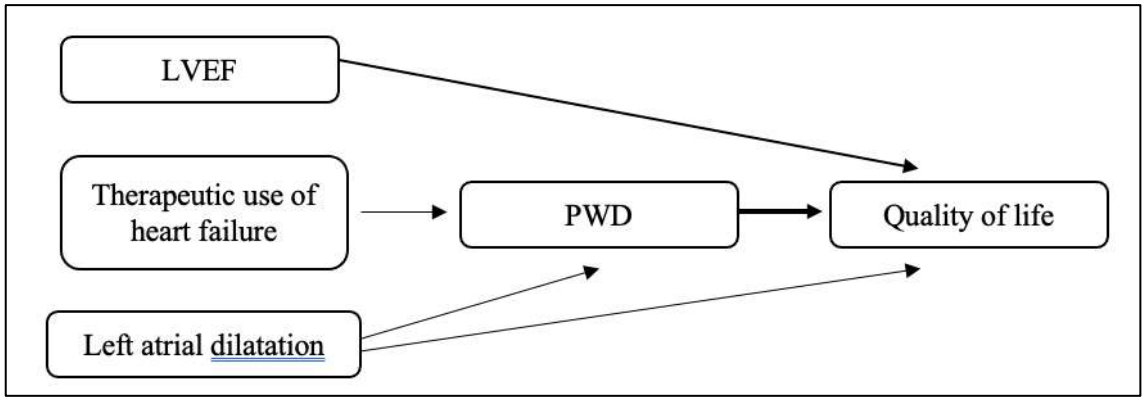

Figure 1. Diagram of multivariate logistic regression analysis between factors affecting PWD and quality of life

Table 3. Profile CHA2DSC-Vasc score based on PWD

		Dispersion P waves			*p value*
		Positive	Negative	Total	
Cha2dscVasc Score	3	14	24	38	
	4	24	28	52	0.647
	>4	17	26	43	
	Total	55	78	133	

Table 4. Multivariate analysis regression logistics between variables to Quality Life

		P	Exp (B)	95%CI
Quality life	LVEF	0.028	0.456	0.321-0.766
	Left atrial dilatation	0.092	0.278	0.153-0.768
	PWD	<0.000	13.55	13.01-16

Intra- and interobserver reliability analyses of P wave dispersion measurements were performed by 3 people, with 2 cardiologists and the researcher himself, using the Bland Altman measurement method. B coefficient results were obtained: 0.28 with a p value of 0.428, which is not significant. It is evident that there is no proportional bias in the analysis.

Table 5. Multivariate analysis regression logistics between variables against PWD

		P	Exp (B)	95%CI
PWD	Left atrial dilatation	0.025	0.539	0.314-0.924
	Use therapy fail heart	0.033	0.094	0.011-0.825

Analysis of the odds ratio of comorbidities with the quality of life of heart failure patients was carried out using chi-square. In table 4.7 there is data on the results of the odds ratio analysis on comorbid patients, no significant results were found. The highest odds ratio result was stroke, with OR 2.1 [CI 95% 0.219 - 21.3]. The lowest result was hypertension with OR 0.69 [CI 95% 0.33 - 1.47].

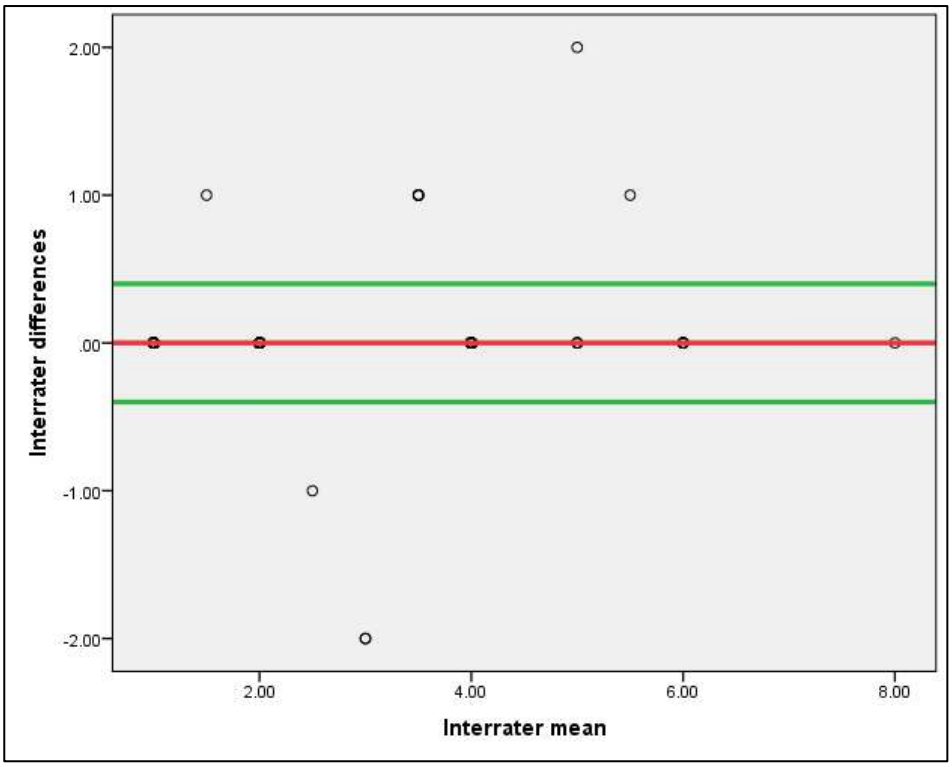

Figure 2. Scatter plot Bland-Altman analysis

Table 6. Comorbid Odds Ratio Analysis with quality life

Comorbid	Odds Ratio	Confidence Interval (95%)		*p value*
		Lower	Upper	
Hypertension	1.43	0.67	3.02	0.645
Strokes	2.1	0.219	21.3	0.959
Diabetes	1.21	0.59	2.47	0.424

DISCUSSION

Heart failure is a complex condition where there is a decrease in the ability of the heart to pump blood. Heart failure is one of the causes of mortality and morbidity in the world. On ECG, P wave is a marker of right and left atrial depolarisation, P wave dispersion in heart failure can be a sign of increased mortality, due to the correlation between P wave dispersion and the occurrence of atrial fibrillation.[1-3]

On chi-square analysis, it was shown that quality of life was associated with P wave dispersion. The higher the P wave dispersion, the lower the quality of life. This finding is similar to a study conducted by Tuluce et al in a population of cardiomyopathy patients, who found that P-wave dispersion increases the risk of atrial fibrillation, which can cause symptoms of palpitations, chest pain, and syncope. This condition can interfere with the patient's daily life, thus reducing the morbidity of heart failure patients who have P-wave dispersion.[11]

Based on research by ARIC, Gutierrez et al106 recently reported that abnormal P wave parameters are associated with greater cognitive decline and a higher risk of dementia. A total of 13,714 middle-aged participants (mean age, 57 years; 56% female; 23% black participants) were followed for dementia and changes in cognitive function during a mean follow-up of 18 years. Abnormal P wave axis, prolonged P wave duration, and interatrial block were found in the study. All P wave parameters were found to be abnormal except IAB was associated with an increased risk of dementia even after adjustment for incident AF and stroke: Multivariable HR of abnormal PTFV1=1.60 (95% CI, 1.41-2.83); abnormal P wave axis, HR, 1.36 (95% CI, 1.17-2.57); prolonged P wave duration, HR, 1.60 (95% CI, 1.42-1.80). In addition, abnormal P waves were also associated with greater decline in global cognitive function.

In the chi-square analysis, there was a significant result between left ventricular ejection fraction and quality of life of heart failure patients. This is similar to a cross-sectional study conducted by Francisca et al in Nigeria, which found a negative correlation in PWD and ejection fraction of patients, but a unidirectional relationship with their quality of life.[12] This could be because in heart failure patients there is remodelling that causes changes in electrical conduction. In the future, P wave dispersion can be developed to be a diagnostic and prognostic component for heart failure patients and ejection fraction.[13]

No relationship was found between P wave dispersion (PWD) and thromboembolic risk assessed by CHA2DSC-Vasc2 scoring. The same thing was also found in a study by Deveci et al in Turkey, which showed no correlation between P wave dispersion, P min, P max, and CHA2DSC-Vasc2 score.[14]

In this study there were several patients with left atrial dilatation on echocardiographic examination. Left atrial dilatation is one of the markers of heart failure. There is a relationship between left atrial dilatation and quality of life of heart failure patients. The same thing was found in a cross sectional study by Masood et al.[15] The study was conducted on 28 people and found that the quality of life of patients with heart failure decreased with an increase in left atrial volume greater than the control group. This can be caused because in atrial hypertrophy, cardiac electrophysiological disorders can be found which cause clinical symptoms that interfere with the daily life of heart failure patients. Another study conducted by Senen et al also showed similar results. The study compared two groups, a group with atrial dilatation and a control group.

P-wave dispersion can be found positive in several comorbidities such as (diabetes, stroke, and hypertension) but in our study the results obtained were no association between PWD and these comorbidities. This is in contrast to the study of Yazici et al, where PWD was found to increase in diabetic patients despite no evidence of ischaemia, ventricular hypertrophy and hypertension. The mechanism of increased PWD and diabetes is still not understood, but it is concluded that there are structural and electrophysiological disorders of the heart in diabetic patients that cause increased PWD.[16]

CONCLUSION

There is positive correlation between p wave dispersion and quality of life of heart failure due to coronary heart disease patients in Haji Adam Malik general hospital.

DECLARATIONS

None

CONSENT FOR PUBLICATION

The Authors agree to publication in Journal of Society Medicine.

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COMPETING INTERESTS

The authors declare that there is no conflict of interest.

AUTHORS' CONTRIBUTIONS

All authors significantly contribute to the work reported, whether in acquisition of data, analysis, and interpretation, or in all these areas. Contribute to drafting and revising. Approved the final version to be published, agreed on the journal to be submitted, and agreed to be accountable for all aspects of the work.

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