

Development of MENARI plus (Self Pulse Assessment and Clinical Scoring) for Detecting Atrial Fibrillation in High-risk Population

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Abstract: This study was intended to examine the accuracy of MENARI Plus in atrial fibrillation detection. We collected data from a total of 476 subjects who were considered to be high-risk patients at Saiful Anwar General Hospital, a member of Yayasan Jantung Indonesia in Banyuwangi and Batu, East Java, Indonesia. We identified independent risk factors for detecting atrial fibrillation (AF) with multiple regressions. Every participant underwent a self-pulse radial check and electrocardiography examination. AF was diagnosed by a cardiologist. In this study, the mean age of these patients was 58,9, ± 10,9 years. We found 25% of patients had AF, and 74,4% of our subjects were female. This tools had an area under the receiver operating curve (AUC) of 0.83 (95% CI 0.84 to 0.92) with a sensitivity of 0.84 (95% CI 0.82 to 0.94) and a specificity of 0.80 (95% CI 0.79 to 0.84) at a cut-off score of 7 on the scale. In this study, the sensitivity of MENARI Plus was high; however, it had low specificity for atrial fibrillation. Therefore, it is applicable for ruling out atrial fibrillation, and it may also become an effective screening tool in earlier detection of atrial fibrillation. In addition, MENARI Plus can be opportunistically used by the doctors to analyse patients with previously undetected atrial fibrillation.

1 INTRODUCTION

The prevalence of AF was 1–2% in the general Indonesian population; it is therefore important to understand the risk factors associated with AF. Early diagnoses are needed for stroke prevention in 40–60% of asymptomatic AF patients. Oral anticoagulant is the most important medical measure that can be taken to avoid unnecessary strokes in AF patients (Rizal and Yuniadi, 2019). AF can be identified by pulse irregularity, which means that pulse palpation is a prospective approach in identifying undiagnosed AF patients.

The 2016 European Society of Cardiology guidelines explained that opportunistic pulse palpation and ECG record are applied when the patients with a minimum age of 65 years experienced pulse irregularity (Kirchhof et al., 2016). A worldwide AF-awareness campaign is held annually. The purpose is to increase public awareness of this condition.

Indonesia started a national campaign to increase awareness of atrial fibrillation in 2016 by celebrating AF Campaign Day every September. Indonesia promotes national screening program using the theme of 'AYO MENARI,' which translates into English as, 'Let's Go Dancing'. MENARI stands for *MERaba NAdi sendiRI* (translated into English as a self-pulse check). Self-pulse checks are commonly used to measure heart rate, and the measure is being increasingly advocated as a means self-checking for atrial fibrillation, of which an 'irregularly irregular' pulse is a characteristic feature. From a recent meta-analysis, the self-pulse check has quite high sensitivity and specificity compared to 12-lead ECG recordings (0.98 and 0.92, respectively) (Taggar et al., 2016).

In Indonesia, it is surprising that the effectiveness of self-pulse checking for detecting atrial fibrillation in the general population is unknown. This study was intended to assess the effectiveness of our national screening program 'MENARI' (self-pulse check) and to try to increase the diagnosis yield by adding some

clinical conditions to MENARI. We ultimately attempted to build a simple scoring system that can be used by the general population to detect AF.

2 MATERIAL AND METHODS

This was an observational analytic study with a cross-sectional design. This research was conducted at the Cardiology Outpatient Centre of Saiful Anwar General Hospital Malang, with assistance from Lavalette Hospital Malang, Indonesian Heart Association and the geriatric association in Malang, Indonesia. Our study samples included subjects between the ages of 50–75 years old, since the registry in Yayasan Jantung Indonesia, Malang Raya, mostly found AF in patients within this age range. After seeking and obtaining informed consent from each participant, subjects of this study completed a structured questionnaire and provided information on gender, age, smoking status, medical history, physical exercise, profession and level of education. We used the patients' medical records to collect medical history, medication history and lifestyle factors. We used standard methods for measuring blood pressure, weight, height and waist circumference.

Patients were able to assess their self-pulse. The patients implemented the Mini-Mental State Examination (MMSE). They receive an explanation of the benefit of pulse palpation. The patients also obtained knowledge of self-assessment of heart regularity, especially the technique of radial artery pulse palpation. Every participant performed self-pulse palpation and electrocardiography.

2.1 Statistical Analyses

The mean with SD are presented for continuous variables and several patients (%) for the categorical variables. We used a multivariate regression to develop clinical risk factors. The stepwise model selection procedure was performed to develop clinical scoring. The pool of variables was also confirmed by a removal approach with a *P*-value threshold of 0.25. Testing for interactions was applied for risk factors in the final model; however, no potential advance progression could be accomplished by involving these interactions. The area under the curve (AUC) was used to evaluate the performance of this score.

2.2 Ethics

This study received approval from the Medical Ethics Committee at Saiful Anwar General Hospital Malang

(Ethical Clearance No. 400/122/K3/302/2019). All subjects of this study signed and were given informed consents.

3 RESULT

3.1 Clinical Characteristics

A total of 476 subjects participated in the study; 321 (65.6%) of the subjects were female. The mean age of the population was 53,6, $\pm 11,06$ Years old. Mean SBP and DBP were 125, $\pm 17,5$; and 79,7, $\pm 11,5$ mmHg; and the prevalence of subjects with atrial fibrillation was found to be 23,5%. The baseline characteristics of the subject are described in Table 1.

Table 1: Baseline Characteristic.

Characteristics	Total n=476
Age	53,6 \pm 11,06
Female	65,6%
SBP	125 \pm 17,5
DBP	79,7 \pm 11,5
AF	23,5%
Heart rate	83,5 \pm 12,5
Weight	61,57 \pm 9,7
BMI	26,27 \pm 6,6
MMSE score	28,6 \pm 0,5
Diabetes	9,8%
Hypertension	41%
History of TIA/Stroke	5,5%

3.2 Clinical Characteristics of Participants by ECG

Derivation of patients' characteristics are provided in Table 2. A total of 461 subjects were analysed. As many as 43 subjects with developed AF were compared with other patients without AF. The patients with developed AF were older ($P < .03$),

Table 2: Univariate Analysis.

Variables	AF	Non-AF	P
Age >65	43.4%	26.8%	0.03
BMI > 26	9.3%	8.8%	0.45
MENARI (irregular)	66,6%	30,9%	0.000
Hypertension	66.1%	32.2%	0.000
Diabetes Mellitus	5.2%	9.8%	0.26
Stroke/TIA	11.1%	4.3%	0.138
Hyperthyroid	5.7%	0%	0.00
Dyspnoea	8.5%	6.5%	0.54
Palpitation	66%	32.5%	0.000
Chest pain	1.9%	5.3%	0.43
Syncope	2.2%	5.7	0.46
Dizziness	22.6%	11.4%	0.089
Fatigue	34%	17.9%	0.02

more frequently men ($P < .001$), and experienced higher rates of hypertension ($P < .000$), hyperthyroid ($P < .000$) and stroke ($P < .138$). Clinical manifestation in AF patients were palpitations ($p < .000$), fatigue ($P < .02$) dizziness ($P < .089$).

Risk Factors for incidences of AF and Score Development Univariate Cox regression analysis is shown in Table 3. On multivariable analyses, age was >65 years, Irregular Self Pulse palpation (MENARI), Hypertension, Palpitation, and fatigue were independent risk factors for incident AF (Table 3). Given the significant association with diagnosed AF, a combination of independent risk factors was identified as the new simple MENARI Plus score (Table 3): Irregular self-pulse palpation (MENARI) (4 point each); P: palpitation (2 points); L: oLd (age > 65 years, 1 point); U: fatigUe (2 points); and H: hypertenSion (2 points). The total score ranged from 0 to 11 points.

The score presented a good discrimination with an area under the receiver operating curve (AUC) of 0.83 (95% CI 0.84 to 0.92) with a sensitivity of 0.84 (95% CI 0.82 to 0.94) and a specificity of 0.80 (95% CI 0.79 to 0.84). A bootstrap sampling procedure was used

internally to validate the score results, which gave an AUC of the validation (AUC 0.87 [95% CI 0.80 to 0.95]).

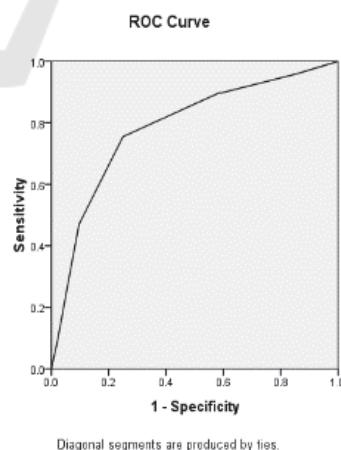


Figure 1: AUC of Derivation Set.

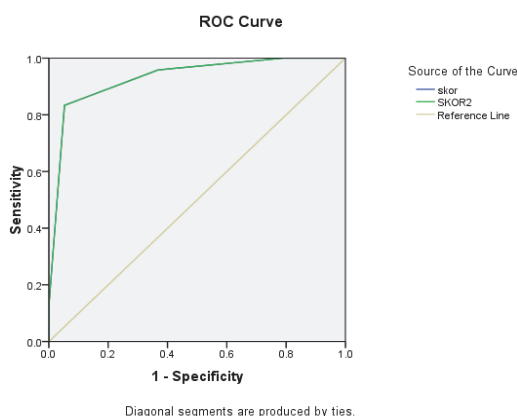


Figure 2: AUC of Validation Set.

Table 3: MENARI Plus Score.

Predictors	Multiplying Factor	Value
Irregular MENARI	+4	0.000
Palpitation	+2	0.000
Age >65	+1	0.046
Hypertension	+2	0.006
Fatigue	+2	0.02
TOTAL POSSIBLE SCORE	11	

4 DISCUSSION

4.1 Baseline Data

The prevalence of AF in our sample was high (23.5% of the sample), compared to another study that ranged between 6–9% of the population. This is likely due to the fact that the sample was taken from a high-risk population group. This study was performed with patients between the ages 50–75 years old because according to the registry from Yayasan Jantung Indonesia, Malang Raya, incidences of atrial fibrillation were mostly found in their age. It is often associated with a higher prevalence of another cardiovascular comorbidity, such as hypertension (41%), the history of stroke or TIA (5.5%) and/or diabetes mellitus (9.8%). Therefore, this number cannot be generalised to the overall prevalence of AF in Indonesia. AF is found more frequently in older patients (43.4% vs. 26.8%, $p = 0.03$) and hypertensive

patients (66.1% vs. 32.2%, $p = 0.00$), compared to younger and non-hypertensive patients. European data revealed that incidences of AF are discovered in 3.7–4.2% of those aged 60–70 years of age; these numbers increase to 10–17% in older ages. Hypertension and diabetes mellitus were already known to be risk factors for AF.

Although Self-Pulse Check / MENARI has been widely used for screening purposes, its effectiveness in Indonesia had never been evaluated. According to a systematic review by Harris et al. conducted in 2012, the self-pulse check showed a high rate of accuracy for detecting AF. The sensitivity and specificity range were 87–97% and 70–81%, respectively. This rate is high, but there still room for improvement. A European Heart Rhythm Association (EHRA) Consensus document from 2017 started to divine another screening tool and technique with higher diagnosis yield, such as a handheld device and smartphone.

Adding some clinical characteristics to increase the accuracy of diagnosis has been widely used in another diagnostic method, such as well-known SYNTAX and Clinical Syntax for predicting clinical outcome in patients who underwent percutaneous coronary intervention. By adding these clinical predictors, it can increase its accuracy; borrowing the idea of adding simple clinical characteristics, MENARI PLUS was built.

Several clinical conditions that were previously known as symptoms and risk factors were analysed. Statistically, some characteristics have proven to be correlated to AF. MENARI Plus consists of self-pulse check (MENARI / MEraba Nadi sendiRI in Indonesian words); palpitation is the most common symptom found in AF patients. More than half of all patients with AF had an episode of palpitation as the primary symptom; another symptom that has proven to be significant is fatigue; and loss of atrial kick during diastole, short diastolic filling time (in AF with rapid ventricular response) and increased mitral and tricuspid regurgitation are believed to be responsible for the decrease in cardiac output.

The number of the patients admitted to the hospital due to heart failure related to AF has increased in the last decade. Current guidelines also showed a strong correlation between heart failure and atrial fibrillation. Catheter ablation of AF was shown to reduce the morbidity and morbidity patient with heart failure. Thus, indicated that fatigue and another sign of heart failure are correlated with AF. As previously mentioned, hypertension and older age are strongly correlated with AF.

Table 4: Predictor for Atrial Fibrillation.

MENARI	Self-pulse check (MEraba NAdi sendiRI in Indonesian word)
P	Palpitation
L	OLder Age (> 65 years old)
U	FatigUe
S	HypertenSion

5 CONCLUSION

We found that the specificity of MENARI Plus is low, while its sensitivity is high for atrial fibrillation identification in high-risk patients. This scoring system can also rule out undetected atrial fibrillation.

REFERENCES

- Kirchhof, P., Benussi, S., Kotecha, D., Ahlsson, A., Atar, D., Casadei, B., ... Vardas, P. (2016). 2016 ESC Guidelines for the management of atrial fibrillation developed in collaboration with EACTS. *European Heart Journal*, 37(38), 2893–2962. <http://doi.org/10.1093/eurheartj/ehw210>
- Rizal, A., & Yuniadi, Y. (2019). Epigenetic implication in atrial fibrillation: A potential biomarker? *Journal of Laboratory and Precision Medicine (JLPM)*, 4, 1–8. <http://doi.org/10.21037/jlpm.2019.09.02>
- Taggar, J. S., Coleman, T., Lewis, S., Heneghan, C., & Jones, M. (2016). Accuracy of methods for detecting an irregular pulse and suspected atrial fibrillation: A systematic review and meta-analysis. *European Journal of Preventive Cardiology*, 23(12), 1330–1338. <http://doi.org/10.1177/2047487315611347>.