Diagnostic value of mean platelet volume (MPV) to troponin T inpatients with acute coronary syndrome

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Abstract. Acute Coronary Syndrome (ACS) is used to describe the spectrum of coronary artery disease (CAD). Troponin T is the determinant of the most sensitive marker of ACS, but there aren’t all hospitals have this because of expensiveness. Mean Platelet Volume (MPV) is one of the components of a complete blood routine examination and relatively cheap as a marker in ACS. Determining the sensitivity and specificity of MPV in detecting cases of the acute coronary syndrome, 325 subjects’ medical records were from the period of July 2013 to June 2014; 228 ACS patients met the inclusion criteria. 228 subjects showed a risk factor for age ≥45years of more 195 (85.5%), 122 subjects with hypertension (53.5%) and subjects who smoked 118 (51.8%) that suffered most ACS. Subjects with risk factors for diabetes mellitus, obesity, menopause and dyslipidemia in this study was lower than non-diabetic 161 (70.6%), obese 189 (82.9%), nonmenopause 196 (86%) and normal lipid 210 (92.1%). But there was no relation between risk factor with MPV and troponin T statistically. The results of diagnostic tests MPV for the evaluation of patients with ACS, sensitivity 92%, specificity 71%, positive predictive value 95% and negative predictive value 58%.

1. Introduction
Coronary Heart Disease (CHD) is an abnormal state caused by heart and blood vessel dysfunction. The blockage in these coronary arteries can be partial or total of one or more coronary arteries and or branches. The degree of stenosis in the coronary artery can be seen by coronary angiography and usually measured by a visual evaluation or quantitative coronary angiography (QTC) of the percentage reduction relative to the adjacent normal segment.¹,²

Acute coronary syndrome (ACS) is the most common cause of death. Clinical manifestations of CAD may include unstable angina pectoris (UAP), acute myocardial infarction without ST-elevation (NSTEMI) and IMA with an ST-elevation segment (STEMI). ACS is an emergency case that must be diagnosed immediately, with proper management to avoid morbidity and mortality rate. Due to the high mortality rate of ACS, several different modalities have been used to improve the effectiveness of this disease identification immediately.³-⁶

Platelet activation and aggregation have long been noted in the pathophysiology of coronary heart disease because platelets play an important role in contributing to thrombus formation after coronary plaque rupture. Mean Platelet Volume (MPV) is a simple and reliable thrombocyte size index, which correlates with platelet functional status, as a marker of the risk of atherothrombosis. Also, previous evidence suggests MPV may be an independent risk factor for recurrent myocardial infarction of
existing risk factors such as hypertension, dyslipidemia, increased fibrinogen, white blood cell count, or plasma viscosity.5-8,10

The results of a study in Iran confirmed that MPV at admission not only predicted reperfusion and attack disorders in AMI with STE segment patients also could be considered a practical way of identifying high-risk patients.9,11-13

The study about the MPV diagnostic value in patients with the acute coronary syndrome is still lacking.

2. Methods
The data in this study was secondary data from medical records of inpatient Adam Malik Hospital Medan period July 2013 to June 2014.

Conducted data about the history of the disease, CHD risk factors such as hypertension, diabetes mellitus, menopause, history of smoking, obesity, and dyslipidemia suffering from CHD. The 12-lead EKG analysis is performed, and the supporting laboratory is complete blood, urea, creatinin, lipid profile, blood sugar level, Troponin T, and CK-MB.

From the complete blood test will get the value of MPV. Blood tests performed using automatic cell counting Sysmex XT-4000i made in Japan, COBAS INTEGRA 400 and COBAS 6000 made in Switzerland. Blood examination was in Installation of Clinical Pathology Laboratory.

Statistical Analysis
The risk factors of ACS were in the distribution table, and then a statistical analysis determines to see the association of risk factors with MPV and troponin T.

The collected data of MPV and Troponin T measurements were tabulated and entered into 2 x 2 tables if reached above the specified limits, were included in the positive category and below the limits specified in the negative category. The calculation is done to find the sensitivity, specificity, positive predictive value and negative prediction value.

3. Results
The number of patients in this study was 325 people that are suffering from the acute coronary syndrome. About 228 patients were found to match the inclusion and exclusion criteria for the study sample. There were 183 patients (80.3%) more than female 45 patients (19.7%). Statistically, however, there was no relationship between sexes with MPV (table 1).

Table 1. Distribution data based on sex, age, hypertension, DM, obesity, smoking, menopause and dyslipidemia to MVP in patients with the acute coronary syndrome.

| Risk Factors      | MPV                  | Total | p  |
|-------------------|----------------------|-------|----|
|                   | Negative (≤ 9.0 fL)  | Positive (> 9.0 fL) | n  | %  | n  | %  |
| Sex               |                      |       |    |     |     |     |
| Men               | 31                   | 152    | 80.00 | 183 | 80.30 | 0.823 |
| Women             | 7                    | 38     | 20.00 | 45  | 19.70 |
| Age (years)       |                      |       |     |     |     |     |
| ≤ 45              | 3                    | 30     | 15.80 | 33  | 14.50 | 0.207 |
| > 45              | 35                   | 160    | 84.20 | 195 | 85.0  |
| Hypertension      |                      |       |     |     |     |     |
| Yes               | 18                   | 104    | 54.70 | 122 | 53.50 | 0.406 |
| No                | 20                   | 86     | 45.00 | 106 | 46.50 |
| DM                |                      |       |     |     |     |     |
| Yes               | 8                    | 59     | 31.10 | 67  | 29.40 | 0.217 |
| No                | 30                   | 131    | 68.90 | 161 | 70.60 |
| Obesities         |                      |       |     |     |     |     |
| Yes               | 6                    | 33     | 17.40 | 39  | 17.10 | 0.813 |
| No                | 32                   | 157    | 82.60 | 189 | 82.90 |
Distribution based on age, hypertension, DM, obesity, smoking, menopause and dyslipidemia in ACS based on MPV and Troponin T values are in Table 2.

Table 2. Distribution data based on sex, age, hypertension, DM, obesity, smoking, menopause and dyslipidemia to troponin T in patients with the acute coronary syndrome.

| Risk factors     | Troponin T Group | Total | p     |
|------------------|------------------|-------|-------|
|                  | Negative (≤ 0.1 µg/L) | Positive (> 0.1 µg/L) |       |       |
|                  | n | % | n | % | n | % |       |
| Sex              |       |       |       |       |       |       |
| Men              | 25 | 80.60 | 158 | 80.20 | 183 | 80.30 | 0.954 |
| Women            | 6  | 19.40 | 39  | 19.80 | 45  | 19.70 |       |
| Age (year)       |       |       |       |       |       |       |       |
| ≤ 45             | 3  | 9.70  | 30  | 15.20 | 33  | 14.50 | 0.307 |
| > 45             | 28 | 90.30 | 167 | 84.80 | 195 | 85.50 |       |
| Hypertension     |       |       |       |       |       |       |       |
| Yes              | 15 | 48.40 | 107 | 54.30 | 122 | 53.50 | 0.539 |
| No               | 16 | 51.60 | 90  | 45.70 | 106 | 46.50 |       |
| DM               |       |       |       |       |       |       |       |
| Yes              | 8  | 25.80 | 59  | 29.90 | 67  | 29.40 | 0.638 |
| No               | 23 | 74.20 | 138 | 70.10 | 161 | 70.60 |       |
| Obesities        |       |       |       |       |       |       |       |
| Yes              | 3  | 9.70  | 36  | 18.30 | 39  | 17.10 | 0.237 |
| No               | 28 | 90.30 | 161 | 81.70 | 189 | 82.90 |       |
| Smoking          |       |       |       |       |       |       |       |
| Yes              | 16 | 51.60 | 102 | 51.80 | 118 | 51.80 | 0.986 |
| No               | 15 | 48.40 | 95  | 48.20 | 110 | 48.20 |       |
| Menopause        |       |       |       |       |       |       |       |
| Yes              | 5  | 16.10 | 27  | 13.70 | 32  | 14.00 | 0.447 |
| No               | 26 | 83.90 | 170 | 86.30 | 196 | 86.00 |       |
| Dyslipidemia     |       |       |       |       |       |       |       |
| Yes              | 2  | 6.50  | 16  | 8.10  | 18  | 7.90  | 0.545 |
| No               | 29 | 93.50 | 181 | 91.90 | 210 | 92.10 |       |

The calculation of the sensitivity, specificity, positive predictive value and negative predictive value is in the 2x2 table.

Table 3. Diagnosis value have MPV level and troponin T level in patients with the acute coronary syndrome.

| MPV group | Troponin T group | Total | p     |
|-----------|------------------|-------|-------|
|           | Negative (≤ 0.1 µg/L) | Positive (> 0.1 µg/L) |       |       |
|           | n | % | n | % | n | % |       |
| Negative (≤ 9.0 fL) | 22 | 71.00 | 16 | 8.10 | 38 | 16.70 | 0.000 |
### Table 1

| Positive (> 9.0 fL) | 9  | 29.00 | 181 | 91.90 | 190 | 83.30 |
|---------------------|----|-------|-----|-------|-----|-------|
| Total               | 31 | 100.00| 197 | 100.00| 228 | 100.00|

The result of analysis using ROC curve it’s found that the area under the curve (AUC) ROC was 0.889 (95% CI: 0.824 - 0.954; p = 0.0001).

![ROC Curve](image)

**Figure 1.** ROC curve of MPV.

### 4. Discussion

The frequency of data distribution it can be seen that in patients with the acute coronary syndrome (ACS), the proportion of subjects with a risk factor of age > 45 years was more common (85.5%). These results indicate that the age factor was likely to be a risk to ACS. But statistically analysis there was no correlation between age with MPV value (p = 0.207) and with Troponin T value (p = 0.307).

The proportion of subjects with hypertension risk factors (53.5%) was also greater than those without hypertension (46.5%). The statistical analysis there was no correlation between hypertension with MPV value (p = 0.406) and with Troponin T value (p = 0.539). The proportion of subjects with smoking (51.8%) was greater than without smoking history (48.2%). It was also in line with the previous study that proves that smoking history was a risk factor for the occurrence of ACS. But statistically analysis there was no correlation between smoking risk factor with MPV value (p = 0.635) and with Troponin T value (p = 0.986).414

The proportion of subjects with risk factors for type 2 diabetes mellitus was lower (29.4%) compared with no diabetes mellitus (70.6%). The statistical analysis there was no correlation between risk factor of diabetes mellitus with MPV value (p = 0.217) and with Troponin T value (p = 0.638).

The proportion of subjects with obesity (17.1%) was also lower than with no obesity (82.9%). The statistically there was no relationship between risk factors for obesity with MPV (p = 0.813) and with Troponin T (p = 0.237). The proportion of subjects with menopausal risk factors (14%) was also lower than those not yet menopausal (86%). This is not in line with previous studies that suggest that menopause is a risk factor. Statistically there was no correlation between risk factor of menopause with MPV value (p = 0.865) and with Troponin T value (p = 0.447). The proportion of subjects with a risk factor for dyslipidemia (7.9%) was also lower than with no dyslipidemia (92.1%). That wasn’t in line with the previous study to suggest that dyslipidemia was a risk factor.457

The differences in outcomes seen in the proportion of risk factors for diabetes mellitus, obesity, menopause and dyslipidemia in this study do not deny the results of previous studies that have proven that these variables as a risk factor. This happens because the purpose of this study to see the
frequency distribution of risk factors without seeing at the relationship between the risk factor and the incidence of acute coronary syndrome that requires a more comprehensive research design with a large sample.\(^4\)

The results of diagnostic test obtained from this research data showed that the sensitivity value of MPV examination of 92%. It suggests that MPV may be a marker of the ACS, which the prevalence of adopted sensitivity was \(\geq 85\%\). However, the specificity value obtained from this study was 71%. This specificity value indicates that the MPV's ability to determine that the subjects did not suffer ACS was only 71%. It can be concluded that MPV examination can be used as a marker of screening test on ACS such as standardized marker, i.e. troponin T, in line with the results of the previous study which showed that MPV value increases in the incidence of ACS.\(^7,8\)

The positive predictive value of 95% and a negative predictive value of 58% indicated that a positive diagnostic outcome (MPV value \(\geq 9.0\) fL) with MPV examination could prove that a person was suffering from ACS with 95% confidence. While the negative diagnostic result (the value of MPV \(\leq 9.0\) fL) with MPV examination stated that we can be sure the subject did not suffer from ACS, with the confidence of only 58%. Statistically, there was a significant relationship between MPV and troponin T (\(p = 0.0001\)).

5. Conclusion
The results of diagnostic test obtained from this research data indicate that MPV examination can be used to diagnose acute coronary syndrome with a sensitivity of 92%, but its specificity is 71%.

The value of MPV \(> 9.0\) fL may determine that a person suffers from ACS (positive predictive value 95%). Meanwhile MPV value \(\leq 9.0\) fL cannot determine that a person does not suffer from ACS (negative predictive value 58%).

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