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Clinical Symptoms Validity on Malaria Slide Examination in Identifying Malaria Sufferers

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Abstract
Kepil Village is one of the villages in Kepil sub-district categorized as HCI village (High Case Incidence). In finding the suspect malaria sufferers based on the type of clinical examination, there are two possibilities of mistake arise that is the discovery of false positives or false negatives. Therefore, it is necessary committed a clinical diagnosis study that has high validity and easy to be done by every health officers. This study aimed to calculate the sensitivity, specificity, positive predictive value and negative predictive value of each clinical symptoms of malaria examination, calculate the prevalence of malaria and to know the type of malaria parasite in Kepil village, Kepil sub-district, Wonosobo regency. This study was observational research which only observes the natural course of events, and making notes of sufferers and not sufferers under study. The type of this research was cross-sectional by screening. Subjects taken were 96 people and there were 35 people with positive results. It was known by the symptoms combination of fever and headache which had the highest sensitivity for 97.1%, but the specificity is only 9.8%, while the symptoms combination of fever, chills, aches, weakness, diarrhea, and the lack of appetite had 100% as the highest specificity but the sensitivity is only 2.9%. The prevalence of malaria in Kepil was 36.5%. Type of malaria parasite in Kepil village found 80% was vivax plasmodium. Clinical symptoms that have high validity (sensitivity and specificity) with a positive slide of malaria were symptoms of fever chills, vomiting, pain, therefore the combination of symptoms could be used as a tool to identify the malaria in Kepil Village. This is going to increase the Slide Positivity Rate (SPR), saving the cost and time of blood preparation therefore the treatment can be given to the right person and malaria sufferers.

Keywords: *validity, clinical symptoms of malaria, cases finding*

I. INTRODUCTION

Malaria is a disease that widely spreads in the world between 60 degrees and 40 degrees in the south longitude including more than 100 tropical and sub-tropical countries. The population risked of malaria is about 2.3 billion or 40% of the world's population. Each year, the number of malaria cases is 300-500 million and cause of 1.5-2.7 million deaths, especially in sub-Saharan Africa. Nowadays, Europe, North America, Middle East, some Caribbean Australia and China are free areas of malaria in the world. Malaria decreases the health status and ability to work and becomes an obstacle for economic development.

The operational policy of malaria eradication refers to the global strategy of malaria eradication becoming result of an agreement between health ministers and WHO (Word Health Organization). The strategy contains four basic technical elements include 1) Rapid diagnosis and early treatment, 2) Selective and continuous vector eradication, and 3) assessing the malaria situation periodically, especially from ecological and socioeconomic aspects.

Central Java province has 7 malaria endemic areas, they are Jepara, Banjarnegara, Purworejo, Wonosobo, Pekalongan, Magelang, and Kebumen district with their *Annual Parasite Incidence rate* is 0.32 per mil.

Based on territory allocation of administrative government, Wonosobo district is divided into 13 sub-district and 264 villages. The width of Wonosobo district is 984,680 kilometers which consists of 18. 767 hectares of rice field wherein 79,701 hectares are semi-technical irrigation lands, 11,081 hectares are simple irrigations and 4,284 hectares are rain feds. The pattern of plants is not simultaneous with the number of harvests is 3 times per year.

From 13 sub-districts in Wonosobo, there are 4 sub-districts which are malaria endemic areas that are Kaliworo, Wadaslintang, Kepil and Sapuran sub-district. In Kaliworo sub-district, there are 369 people with clinical malaria cases wherein the *Annual Parasite Incidence* (API) is 7.15%. In Wadaslintang sub-district, there are 52% or 986 malaria cases with 17.52% API. In Kepil, malaria cases are 613 with 25,17% API and in Sapuran sub-district, there are 329 malaria cases with 14.9% API. From the 4 endemic to malaria sub-district, Kepil is on the highest incidence status.

The exact diagnosis of malaria is confirmed by the discovery of malaria's plasmodium in the sufferers' blood. Nevertheless, diagnosis is difficult to do routinely for every health officers in the field due to the limitation of cost and time. For this reason, it is necessary to conduct a clinical diagnosis study which has high validity and is easy to be done by health officers and malaria specialist in malaria areas. By finding the plasmodium malaria rapidly and accurately by clinical symptoms, the accuracy of malaria diagnosis can be increased. Besides saving the testing time, the using of tools and materials and the irrational treatment reduction can be achieved.

II. METHODS

The method of this research is observational research wherein researchers only observe the natural course of events, making notes of suffering and not suffering the diseases studied. Whereas the type of this research is a cross-sectional study by screening wherein the measurements of exposure and the effect inflicted are made in a long time besides this study is going to know prevalence of disease.

The population of this study was all village residents who had 2 to 4 hours fever symptom settled in Kepil village, Kepil sub-district of Wonosobo district. The sample size according to Widodo formula (2014) is 96 samples. The sampling technique in this study was undertaken by checking all residents indicated fever symptom through home and Public Health Center visit and mass fever survey activity. From the activities, researcher then took for 96 samples.

III. RESULTS

A. General Description of Research Location

Kepil village is a part of Kepil sub-district with 647,000 hectare areas consisted of 173,000 hectare of paddy field, 59,000 hectare of yard, 349,000 hectare of garden and 4,000 hectare for fishery.
The borders of Kepil are to the north, bordered with Beran Village, to east bordered with Gading Rejo Village, to south, it is bordered with Bener Village, and to west, it is bordered with Gondowulon Village. The total population of Kepil village in 2015 was 5,537 inhabitants, wherein consisted of 2,748 or 50,4% men and 2,789 or 50,4% women.

The number of family heads in Kepil is 1,386 and the number of houses is 1,288 consisted of 13 Community Association (Rukun Warga), 32 Neighborhood Association (Rukun Tetangga). The largest population is in Sumpet hamlet for 1820 or 32.9% people and the smallest number of people is 726 or 13.1% in Siwiyu hamlet.

B. Respondents Characteristic

1.Age Category

The samples of this research aged 40 years old as the most respondents for 32 (33.3%) respondents and the fewest respondents were 2 respondents between 13 to 15 years old. It can be seen by the following table.

Table 1. Distribution of age

Age	Frequency	Proportion
0- 6 years	10	10.4
7-12 years	7	7.3
13-15 years	2	2.1
16-19 years	9	9.4
20-26 years	8	8.3
27-40 years	28	29.2
41 years above	32	33.3
Total	96	100

2. Gender

The respondents based on gender consist of 39 (40,6%) men respondents and 57 (59,4%) women respondents.

3. Hamlet

Table 2. Distribution of Hamlets

Hamlets	Frequency	Proportion
Sibungkang	57	59.4%
Bojong	14	14.6%
Sumpet	13	13.5%
Siwiyu	12	12.5%
Total	96	100%

4. Occupation

Occupation of selected respondents in this study consist of farmers as the most respondents for 61,5% and 1% for trader.

Table 3. Distribution of Jobs

Jobs	Frequency	Proportion
Non Job	36	37.5%
Farmer	59	61.5%
Trader	1	1%
Total	96	100%

C. Prevalence and the Type of Malaria Parasite

1. **Prevalence**

Prevalence rate of malaria in Kepil village, Kepil sub-district can be calculated by using the following formula

$$P = \frac{\text{A number of people with particular diseases or Particular condition in time}}{\text{A number of people in risked population in particular time}} \text{ X } 100\%$$

$$= \frac{35}{96} \text{ X } 100\%$$

$$= 36.5\%$$

So the prevalence of malaria in Kepil was 36.5%

2. Type of Malaria Parasites

Based on the result of study, there were 28 (80%) plasmodium *vivax* and only 7 (20%) plasmodium falciparum was found in Kepil.

Table 4. Distribution of Plasmodium

Parasite types	Frequency	%
P.Falcifarum	7	20
P.Vivax	28	80
Mixedinfection	0	0
Total	35	100%

D. Clinical Symptoms Validity

To determine the validity of clinical symptoms, the calculation of the sensitivity and specificity of the clinical symptoms of malaria was compared with the result of microscopic examination of malaria blood supply. Highest sensitivity on the combination of fever clinical symptoms and headache was 97.1%. Highest specificity in combination of fever, aching, diarrhea, and the lack of appetite was 100%. Highest PPV (Positive Predicative Value) on symptoms of fever, aches, diarrhea, and the lack of appetite was 100% and the highest NPV (Negative Predicative Value) on the symptoms combination of fever, headache, sweat,

and lack of appetite was 89.95%. The validity of each combination of clinical symptoms can be seen as follows.

$$Se = \frac{30}{35} \times 100 = 85{,}6\%$$

$$Sp = \frac{35}{61} \times 100 = 57{,}4\%$$

$$Ppv = \frac{30}{56} \times 100 = 53{,}6\%$$

$$Npv = \frac{35}{40} \times 100 = 87{,}5\%$$

IV. DISCUSSION

A. Age Category

The 96 subjects of this research were taken from mass fever survey, home and Public Health center visiting. By those activities, expected all malaria sufferers can take part as the subject of research. The proportion of blood taken from subjects aged 0-6 years old was 10.4%, 7-12 years old was 7.3%, 13-15 years old was 2.1%, 16-19 years old was 9.4%, 20-26 years old was 8.3%, 27- 40 years old was 29.2%, and aged 41 years and above was 33.3%. Blood sampling was committed in all age groups because all age groups have the risk to be infected. By discovering sufferer under 6 years, it indicated that the disease was happening in Kepil.

B. Gender Category

Most of the respondents in this research were women (59,4%). This must become full of attention considering if it happens on pregnant women, it will be more dangerous due to inflict a severe anemia, although this malaria infection does not distinguish the gender (Health Department, 2009).

C. Hamlets Category

The respondents of this research were taken from all hamlets in Kepil on July 2014. From 96 subjects, taken 59.4% respondents from Sibungkang, 14.6% came from Bojong, 13,5% came from Sumpet and 12.5% came from Siwiyu hamlet. Most of the respondents were taken from Sibungkang hamlet because it had larger population consisted of 1520 people besides many of them had suffered fever. According to Health Public Center report, Sibungkang is the hamlet with the most malaria sufferers for the last 3 years. The smallest respondents were taken from the Siwiyu hamlet because fewer populations that only consist of 726 people and the hamlet with only a few malaria sufferers during the last 3 years.

D. Occupation Category

Based on the result of the research, most respondents were the farmers consisted of 61.5%. This is due to farmers in Kepil generally works in the fields until afternoon, the possibility of mosquito bitten is bigger and supposed to be the host of diseases.

E. Prevalence and the Types of Parasite

The respondents of this research consist of 96 people. From all respondents, found 35 people were positive in suffering malaria while 61 were negative. Based on the results of the test, it can be stated that the prevalence of malaria in Kepil were 36.5%. This is classified as high prevalence, because WHO stated that the high prevalence is prevalence which is more than 20%.

F. Types of Parasite

From the result of the research, there were 35 positives suffering malaria. From 35 respondents, there 7 respondents were positive suffering malaria falcifarum and 28 positives suffering malaria vivax. So it can be concluded that there are more plasmodium vivax found in Kepil. This is possible due to the treatment was not so good and early transmission was high.

G. Clinical Symptoms Validity

Validity was measured from clinical symptoms then compared with standard wherein blood testing counted by *sensitivity*, *specificity*, *positive predictive value* and *negative predictive value* of each clinical symptom towards the discovery of malaria positive slide. Clinical symptoms used were fever combined with one or more other clinical symptoms of malaria therefore overall clinical symptoms used were 145 symptoms.

Sensitivity is the proportion of suffer subjects with the positive diagnostic test results or in another words, the possibility of the diagnostic test results will be positive when performed on a group of suffer subjects or, the ability of diagnostic tests to indicate the person having disease is correct. Higher sensitivity values indicates that the more sensitive and vice versa. From the 145 clinical symptoms used and compared to the results of blood testing, researcher obtained the highest sensitivity value in clinical symptoms was 97.1% of fever and headache. The value of low sensitivity was 0% with 67 kinds of symptoms combination. One of combination was fever, chills, headache, multiple sweats, aches and lack of appetite.

The specificity is the proportion of healthy subjects who indicate the negative diagnostic test results, or the possibility that the diagnostic test results will be negative if it is committed on a group of healthy subjects or in other words a diagnostic test will show the people who do not have the disease is correct. It can be concluded that the greater the value, the bigger specificity of the measure. From 145 clinical symptoms used and compared with the results of blood testing, researcher obtained high specificity value in the combination of fever, chills, multiple sweats, aches, and the combination of clinical symptoms of fever, aches, weak, diarrhea, and lack of appetite was 100% and the lowest specificity on the combination fever and fatigue symptoms was 8.2%.

In addition to the size of the sensitivity and specificity of the diagnostic test, there is also a measure to provide the prediction value of a diagnostic test. The measure is a *Positive Predictive Value* (PPV). PPV is the probability of sufferers if the diagnostic test is positive or in other words, the high possibility of suffering based on a positive diagnostic test result.

Aside PPV, there is also *Negative Predictive Value* (NPV) measure. NPV is the probability of person does not suffer from a disease if the test result is negative, or the high possibility of people does not suffer from all negative test results. This predictive value is also called the posterior probability because it is set after the diagnostic test results are known. This value is fluctuated, depending on the prevalence of the disease, so it is called an unstable part of the diagnostic test. The highest PPV value came from the combination of fever, chills, headache, multiple sweats, aches and combination of fever, aching, weakness, diarrhea, and lack of appetite symptoms with 100% PPV while the highest NPV value came from the symptoms combination of fever, headache, multiple sweats, and lack of appetite with 89, 8% NPV.

V. CONCLUSIONS

1. From the 145 symptoms used then compared with blood testing, researcher obtained the highest sensitivity (97,1%) which was taken from fever and headache. The highest specificity (100%) was taken from 2 types of symptoms combination. One of the symptom combinations was fever, chills, aches, weakness, and lack of appetite. The highest PPV is 100% consisted of 2 types of symptom combination. One of them was fever, chills, headache, multiple sweats, and aches. The highest NPV is 89,9% consisted of symptom combination of fever, headache, sweat a lot, and lack of appetite. The highest validity is 80,2% which is symptom combination of fever, chill, vomit, and aches.
2. The prevalence of malaria respondents in Kepil village, Wonosobo regency is 36.5% and it is the high prevalence rate.
3. The most malaria parasite found in Kepil Village is Plamodium vivax with 80%.

VI. SUGGESTIONS

1. Kepil is a malaria endemic area, therefore, it needs a continuous monitoring in order to avoid an increase cases through fever surveys.
2. Symptom combination of fever, chills, vomits, pain can be used as a tool to identify early malaria disease in Kepil Village, because it has good validity (sensitivity 68,6%, specificity 86,9%, PPV 75%, NPV 82,8 %)

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