Analysis of Lymphatic Filariasis Transmission Potential in Pekalongan City, Central Java, Indonesia

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Research Article
Analysis of Lymphatic Filariasis Transmission Potential in Pekalongan City, Central Java, Indonesia

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Abstract

Background and Objectives: Pekalongan city was still an endemic area of lymphatic filariasis (LF). It might be related to environmental conditions, the existence of chronic human filariasis and mosquitoes containing filarial worms. Mass drug administration had been implemented, but new LF cases still occurred. The aim of this study was to analyze the potential factors related to the transmission of LF in Pekalongan City, Central Java, Indonesia. **Materials and Methods:** Cross-sectional design was chosen to study 50 filariasis cases. Research variables consisted of the environment, completeness of taking medication and mosquitoes as a suspected vector. Data were analyzed descriptively. **Results:** A large number of subjects (78.0%) didn't consume diethylcarbamazine (DEC) completely. The potential breeding sites were wastewater disposal facilities, small water bodies and batik liquid waste. **Conclusion:** Lack of compliance in LF cases, poor environment and infective mosquito were potential factors of LF transmission.

Key words: Lymphatic filariasis, potential of transmission, non-compliance, environmental condition

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Lymphatic Filariasis (LF) is one of the neglected tropical diseases (NTDs). It is caused by three species of worms, *Wuchereria bancrofti, Brugia malayi* and *B. timori*. They generally have almost the same life cycle. The NTDs have gained global attention and are a major public health problem in 11 Southeast Asian countries[1]. This disease did not have an effect on high morbidity and mortality but affected the productivity of the population and social life[2].

The LF spread in almost all regions of Indonesia. Provinces with the highest number of clinical cases were: Aceh, East Nusa Tenggara, Papua, Riau and East Kalimantan (East Borneo). The endemic level in Indonesia ranges from 0-40%. Central Java was one of the LF endemic areas in Indonesia with microfilaria rate[3] of 0.8%. Pekalongan city was one of the endemic areas of filariasis, with 77 chronic cases[4]. The eradication program of LF only focused on a finger blood survey and mass treatment. Meanwhile, the control of mosquitoes as the vector has never been a concern.

Based on the article published previously[5] that emphasized the entomological aspect, it concluded that there were mosquitoes which contained the filarial worm and confirmed as the vector of LF in Pekalongan City. The existence of the vector is not the only factor contributing to the spread of filariasis transmission. There are other factors which also they involve in filariasis transmission, like local environment, compliance with medication and community participation. These are very important and known by stakeholders as the basics in determining policy and strategy to combat filariasis in an endemic area. This is why this research was conducted, as this research was very important for the basis of in generating local and specific policy. It is because LF control will be successful if it concerns four aspects: the existence of the vector, LF cases as carriers, an environmental condition which support mosquito development and a good policy refering to evidence-based practice. Therefore, the objective of this study was to analyze the potential factors related to the transmission of LF in Pekalongan city, Central Java, Indonesia.

MATERIALS AND METHODS

Study design: This was an observational study conducted in Pekalongan city, Central Java, Indonesia. This study was conducted from September to December, 2014. A cross-sectional design was chosen for data collection approach.

Research subjects and variables: A total of 50 cases of chronic LF had been purposively chosen as research subjects. The variables studied in this research consisted of environmental factors (breeding places and its condition), completeness of taking medication (how they got and compliance in consuming the medicine) and mosquito vector.

Data collection procedure: Data collection were conducted through interviews and observation, using questionnaire and checklist. Interview was performed by health officers who had been trained before. It was conducted to gain information about health service regarding to when the blood test had been conducted, the number and frequency of consuming medicine and its side effects, the assistance of taking medication and whether the finger blood test was conducted or not after finishing the administration of the drug. Observation of environmental factor was conducted to gain the information about the presence of mosquito habitats (breeding and resting places) surround the LF houses, using observation check list.

Before interviewing the subjects, they had been asked for informed consent as the standard ethic for the research. It was based on the ethical clearance issued by Health Research Ethics Committee of the Faculty of Public Health, University of Diponegoro No. 257.A/EC/ FKM/2014.

Data analysis: Data were processed through editing, coding, entry and analysis. Results were analyzed descriptively using tables and figure for interpretation.

RESULTS

Source of transmission: The interview results of 50 respondents with filariasis cases showed 48 respondents (96%) said they were given the drug diethylcarbamazine (DEC) after the finger blood test used to diagnose filariasis. The results of interviews provided information that the administration of the drug ranged from two weeks to one month after the finger blood test. Within the filariasis control programs, treatments were performed intensely for 10 days in a row. The results of this research showed that 11 respondents (22%) took the medication 10 times in a row. The intensity of taking medication for other cases ranged from one to seven times. The LF patients who did not comply by consuming DEC completely could be a carrier (source of transmission).

In order to increase the effectiveness of treatment, assistance in taking medication was carried out for LF patients. The results of this research found that of the 48 respondents that were given the DEC after the finger blood test and took medication on the first day, 28 patients (58.3%) got assistance in taking medication. However, the proportion of LF patients who took medication until the 10th day (completed regimen according to standards) were relatively low (22.0%). This condition needs to get attention for filariasis prevention activities in the future. Thus, if LF patients truly want to heal, they had to take medication until the 10th day.

This study explored the information concerning who should be assisted in taking medication among LF patients. It showed that there were some people providing assistance in taking medication. Most of those providing assistance (50.0%) were relatives of LF patients. Assistance in taking medication from health workers was relatively small (7.1%). This study also found five LF patients who took the medication on their own and did not need any assistance in taking medication. There were 16 LF patients (33.3%) who did not drink the medication given to them once in a while. The various reason was mentioned such as pregnancy, breast feeding, working out of town, forgetting, dizziness, nausea, vomiting, pain and fear of fainting because there was one who fainted after taking the drug. The interviews results found some side effects experienced by the patients after taking the drug. Those side effects were: the body feeling hot, nausea, dizziness and vomiting. However, there were some patients who did not experience any side effects after taking the drug.

The activities of taking medication completely were the goal of the program in order to achieve complete recovery. The success of taking medication could be detected by a blood test after the completion of consuming DEC. This study found 34 patients (70.8%) who did not get any blood test after completing the medication. Only a small proportion (29.2%) said they had a blood test after completing the medication.

Mosquito habitat: Environmental observation around patient houses was performed to find the mosquito habitat of suspected LF transmitters. There were 45 houses (90%) that had breeding places of mosquitoes. The observation found different types of mosquito habitats as seen in Table 1.

Table 1 indicated that there were three types of mosquito habitats most commonly found, they were sewage, gutter and pools of waste water. This study also found that there ware more than one habitat in LF patients' houses, such as the combination of gutter and river/under bridges or the combination of gutter, river and rice fields.

Table 1: Types of mosquito habitats found in Pekalongan city

Type of habitat	Frequency	Percentage
Sewage	11	24.4
Gutter	11	24.4
Pools of wastewater	8	17.8
River/under bridges	1	2.2
Garden pond	1	2.2
Sewage, gutter	2	4.4
Sewage, pools of wastewater	1	2.2
Gutter, river/under bridges	6	13.3
Sewage, gutter, pools of waste water	1	2.2
Gutter, river, rice field	2	4.4
Sewage, gutter, river, rice field	1	2.2
Total	45	100.0

Table 2: Frequency distribution of water type in mosquito habitats

Water type	Frequency	Percentage
Domestic wastewater	25	55.5
Tidal water	7	15.5
Domestic wastewater and tidal water	5	11.2
Domestic wastewater, batik industries, tidal water	5	11.2
Domestic wastewater and batik industries	2	4.4
Pond water	1	2.2
Total	45	100.0

Further observations were conducted on those types of habitats to determine the water types. The observation results about the types of water in mosquito habitats were are seen in Table 2.

The distribution of water types of mosquito habitats showed that most of the habitats were domestic wastewater (55.5%). The second most common water type in mosquito habitats was tidal water (15.5%). Generally, there are three types of main water used as mosquito habitats, domestic wastewater, tidal water and batik industry waste water. These types seem to be relatively suitable types of water for breeding places of mosquitoes. Mosquito habitats were considered potential if there were mosquito larvae in it. The observation result showed that more than half of the habitats in study sites were found to have mosquito larvae (55.5%).

Potential analysis of transmission: The infection source of LF were new cases or possibly old cases who did not complete the medication. This study did not find any new cases of LF because finger blood tests were not conducted to examine microfilaria. The subjects in this study (96%) were old cases who were diagnosed as LF patients from 2005 until 2013. Only two subjects (4%) of LF patients were diagnosed in the year 2014.

This study defined that old patients who did not complete the medication were a carrier or potential source of LF transmission in the community. The failure to complete the medication regimen was a reflection of the waywardness of

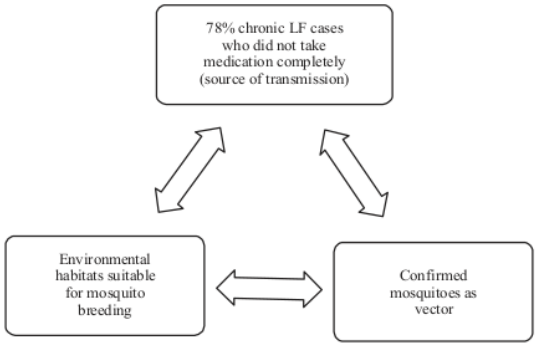

Fig. 1: Three potential aspects of lymphatic filariasis (LF) transmission

cases to achieve recovery. However, it is possible that some cases of lack of medication completion are due to lack of drug availability and medication was not given to patients after finger blood test. Earlier description stated that there were two cases (4%) who did not take the medicine at all after being diagnosed positive for microfilaria, only 11 patients (22%) took the medication completely (consume all 10 doses). The other 37 patients (74%) took the medicine with a variation in frequency from one to seven times after being diagnosed positive for microfilaria. Assuming that patients taking all 10 doses of medication would recover and if they did not take 10 times medication they would not recover, the potential source of transmitting LF in the study site was high enough (78%).

The previous research confirmed that *Culex quinquefasciatus* as the only vector in the study site. This was a serious condition because the mosquitoes that contained positive worms (L3) were infective and might transmit to other people when the mosquitoes suck on a new host. Thus, there was a mosquito potentially being the vector of LF transmission in the study site. Environmental factors were media where the mosquito vector bred. This study found some habitats were breeding places of mosquitoes. Commonly found habitats were sewage, gutters, pools and river/under the bridge. Those three aspects (breeding place, chronic LF who did not complete medication and confirmed mosquitoes as a vector) were potential transmission modes for LF in this study site. Those related factors were are illustrated in Fig. 1.

Those factors should be used as the basis for planning of LF control programs in the future. Mosquito control must be the main focus in preventing LF transmission. Besides that, the routine surveillance of entomology and finger blood surveys must be conducted.

DISCUSSION

In this study, 22.0% of subjects completed the medication. Therefore, there were 78.0% of LF cases who took the medication incompletely (including two cases who did not take any medicine at all). The reasons why they did not complete the medication were because of pain, side effects and pregnancy. They could be a carrier or the source of LF transmission if there were preyed on by mosquitoes. The pattern of incomplete medication in Pekalongan city had a larger proportion (78.0%) than other studies. A study in Bengal, India found that 29.5% of LF cases did not complete their medication in the year 2009. In 2010, there were 33.3% cases who did not complete the medication. This will affect the success of filariasis elimination because it depends on the level of real consumption and medication adherence rather than the coverage of taking the medication[6]. The study results in India also found the side effects that appear after taking the medicine are a headache, fever and vomiting. There was also a previous study in Malaysia, which indicated some reasons for non-compliance of medication taking like fear of side effects, being too young, previous side effects, too many tablets and inadequately given[7].

A study in Ghana also found some reasons patients did not complete the medication. In this study, 31.8% of respondents stated that they did not obtain the drugs, while 18.2% of respondents were not in their house when the officer came to distribute the drugs[8]. The study of Roy *et al.*[9] in Bengal, West India also found some reasons not to consume drugs: 20.15% of respondents were afraid of the side effects, 16.88% did not know that it was a mass treatment and the rest were not in their house when officer distributing the drugs arrived[9]. Another study in Karnata also showed relatively low medication adherence (45.9%), whereas the expected target is 85%[10].

These study results showed that the potential transmission source of LF in Pekalongan city was large enough. This was shown by only 22.0% of respondents adhering to complete all the medication. Therefore, health workers were expected to improve the coverage of drug distribution and provide education to increase LF patients' knowledge and awareness to complete the medication in order to prevent them from being a source of infection in the future. These approaches were important in LF transmission control as. Jontari[11] stated that more health education and awareness raising campaigns could improve drug compliance. The best way to prevent LF was to avoid being bitten by mosquitoes between dusk and dawn and eliminate

mosquitoes in the area[11]. On the other hand, the health officers should increase their knowledge about filariasis control activities, targeted education programs for physicians and health workers and inter-personal communication among community members. A study in Puducherry, India indicated that health workers achieved relatively higher coverage and compliance than non-health staff working as drug distributors. It was noted that health workers had better knowledge, which helped them to pass the correct information to the beneficiaries and improvecompliance[12,13].

Observation of the environmental factor showed many breeding sites got almost 90% of the subjects. The most common breeding sites were wastewater disposal facilities (WWDF) and drainage with the proportions of both at 24.4%. Those breeding sites were suitable for *Culex quinquefasciatus*, which usually lay their eggs in contaminated water containing organic materials such as garbage, human waste and branches of trees[14]. Based on literature review, *Culex* mosquitoes breed in association with human habitats and domestic pets. They prefer to breed in polluted waters, such as sewage and sullage water collections including cesspools, cesspits, drains and septic tanks. They can also breed in comparatively clean water collections if such types of polluted water collections are absent[15]. The previous research found that *Culex quinquefasciatus* was the confirmed vector in Pekalongan city[16]. Other research in Nigeria also showed that *Culex quinquefasciatus* was the type of mosquitoes most identified in the study site[17]. A study in Markudi, Africa showed that the order of vector importance of the identified vectors was *Culex quinquefasciatus*, *Anopheles funestus*, *Anopheles gambiae*[18]. From these research results, *Culex quinquefasciatus* looks like the predominant vector in several endemic areas of filariasis in the world. Based on those factors, it can be stated that chronic LF cases, poor environmental conditions, compliance and community participation contribute to LF transmission.

CONCLUSION AND RECOMMENDATIONS

This study concluded that LF patients that were not compliant in consuming DEC completely, poor environmental habitats that suit as a breeding site for mosquitoes and community participation may strongly contribute to LF transmission in Pekalongan city. It was recommended to increase community awareness of the importance of consuming DEC completely, mosquito surveillance and finger blood survey in order to accelerate the achievement of LF control program.

SIGNIFICANCE STATEMENT

Pekalongan city is one of the areas in Central Java where LF is endemic. A plan to combat LF will be effective if it is conducted comprehensively to consider contributing related factors, especially local environment, compliance and community participation. This research found that the number of LF cases compliant in consuming DEC completely was low (22%). So, they may be a source of transmission or carrier. Observation of the environmental factors found poor environmental conditions that were suitable for breeding places for mosquitoes and their development. These factors were very important to be considered as an integrated part of making policy and programs. It is important for the community to be compliant in consuming DEC. Thus, the results of this research will contribute to accelerate the target achievement of LF control program.

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