Spatial Analysis of Blastocystosis Patients in Lampung Province: Study on Malignancy Patients who Received Chemotherapy at RSUDAM Lampung Province in 2022

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Abstract: Blastocystosis is an intestinal protozoan infection that can cause diarrhea. In the immunocompetent group, it can be asymptomatic. However, in immunosuppressed patients, it can be severe. The disease is transmitted by the oro-faecal route through food that has been contaminated with the faeces of patients. Spatial analysis can be used to map people to determine the risk of the parasite spreading. The aim of this study was to investigate the mapping of blastocystosis patients, studies in patients with malignancies at Lampung Provincial Hospital. We diagnosed Blastocystis infection in 62 fecal samples from study subjects through fecal microscopic examination. To determine the location of the patients' residences, we used Google Maps and Google Art applications based on the addresses listed on the questionnaire. The coordinate data were analyzed, and mapped using the ArcGIS 10.8.2. The results of the microscopic examination showed that 32.26% of the samples were positive for Blastocystis infection. Patients are distributed within the coordinates of 104.6380950 to 109.1035280 East and 3.9533070 to 7.0776440 South. The majority of patients are located in Bandar Lampung City, with the farthest origin of residence being Purbalingga Regency in Central Java Province. The buffering pattern was obtained using a radius of 10 kilometers.

1 INTRODUCTION

Several species of intestinal protozoa have been reported to be one of the causes of intestinal disorders such as diarrhea, which can be persistent and chronic diarrhea or acute diarrhea. Intestinal protozoal infections in immunocompetent groups are usually asymptomatic or mildly symptomatic.

In immunosuppressive groups such as patients with HIV/AIDS, malignancies, patients on immunosuppressive therapy and several other conditions of impaired immunity can be severe and can cause death (Esteghamati et al., 2019; Fletcher et al., 2014). Intestinal protozoa that have been reported as causes of infection are *Giardia lamblia, Cryptosporidium sp, Amoeba, Isospora sp, Cyclospora sp* and *Blastocystis sp* (Boughattas et al., 2017; Esteghamati et al., 2019; Giannakopoulos et al., 2019; Laksemi et al., 2020).

Intestinal protozoal infections are often overlooked and underdiagnosed. This is because the symptoms are mild and even asymptomatic, especially in immunocompetent groups. However, intestinal protozoal infection is one of the infections that can cause increased morbidity and mortality in the community. Impaired nutrient absorption, resulting in impaired growth and development, especially in

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children under five years of age, may lead to cognitive impairment in the future. It is therefore important to overcome this infection (Faria et al., 2017).

Blastocystis sp is a cosmopolitan protozoan parasite. Symptoms are generally atypical and include abdominal pain, constipation, diarrhea, flatulence, and irritable bowel syndrome (IBS). Several species of this parasite are found in the gastrointestinal tract of animals and humans. Several subtypes have also been identified. Not all subtypes infect humans, with only 9 of the 17 reported subtypes found in humans (Asfaram et al., 2019; Dacal et al., 2018; Ramírez et al., 2016; Villamizar et al., 2019; Wawrzyniak et al., 2013) This protozoan is thought to be transmitted by the fecal-oral route. Transmission can occur from person to person, but the possibility of transmission from person to animal and vice versa is unclear (Ramírez et al., 2016).

Geographic Information Systems (GIS) are an important tool for studying the distribution of disease within a location or region. Disease mapping is useful for understanding the distribution of disease incidence and identifying underlying geographic risk factors. In addition, disease mapping facilitates decision making and rapid response for disease management. There are not many studies that discuss the spatial analysis of intestinal protozoan infections, especially blastocystosis in Indonesia. In fact, one of the factors in the spread of diseases, especially orofaecally transmitted diseases, is closely related to geographical, environmental and socio-cultural conditions (Fletcher et al., 2014). The use of spatial analysis on the spread of parasitic diseases has been done in Lampung Province (Dharmamedula et al., 2017; Suwandi et al., 2014; Wardani et al., 2018), but blastocystosis infection has never been done. This paper discusses the spatial analysis of blastocystosis patients in the group of malignancy patients who received chemotherapy in Lampung Province.

2 MATERIALS AND METHODS

The design of this study was cross-sectional analytical observational conducted at RSUDAM Lampung Province. The population of this study were patients with malignancies who received chemotherapy with or without symptoms of diarrhea at RSUDAM Lampung Province in the period October to November 2022. The sample of this study is part of the population determined based on inclusion and exclusion criteria. Inclusion criteria for determining research subjects, namely patients with malignancies who receive chemotherapy with or without diarrhea symptoms; age> 1 year; have received at least 1 chemotherapy with a minimum rarity of at least 1 week since the first chemotherapy; willing to participate in the study by signing an informed consent. Exclusion criteria are suffering from severe complications, not willing to provide feces.

To determine blastocystosis infection, fecal parasitologic examination was performed on all fecal samples of the study subjects. Fecal examination was performed using the formalin ether concentration technique. This technique is used to increase the sensitivity, especially when the number of parasites is low. Approximately 1 ml of fecal suspension in 5% formalin was added to 5 ml of 10% formalin and stirred until homogeneous. After filtering the feces to separate the fiber, 2 ml of diethyl ether was added. The solution was shaken vigorously and centrifuged at 2500 rpm for 2 minutes. The precipitate was removed and the supernatant was collected. The sediment from this concentration test is used for direct testing with 1% Lugol's solvent, which is then read under a microscope at 400X magnification. The result of the test is positive if *Blastocystis sp* is found or negative if not found.

In order to determine the coordinates of the location of the research subject's residence, it was carried out with the help of google map and google earth devices. The home address contained in the questionnaire was entered into google map or google earth to find the location of the research subject's home. The coordinate points that were successfully found were then analyzed to see the mapping of patients and the buffering pattern formed using ArcGIS 10.8.2 software. The patients were mapped based on the results of the microscopic examination. The buffering pattern refers to the gate distance of houseflies as one of the mechanical vectors for the spread of intestinal protozoa. This research has received ethical approval from the Health Ethics Committee of the Faculty of Medicine, University of Lampung No. 2059/UN26.18/PP/05.02.00/2022.

3 RESULTS AND DISCUSSION

Geographically, the residence of the research subjectsis located at the coordinates 104.6380950 east longitude - 109.1035280 east longitude and 3.9533070 south latitude - 7.0776440 south latitude. Administratively, Bandar Lampung City is the place where most of the research subjects live. Thesesubjects generally live in densely populated neighborhoods. Figure 1 shows the distribution of research subjects.

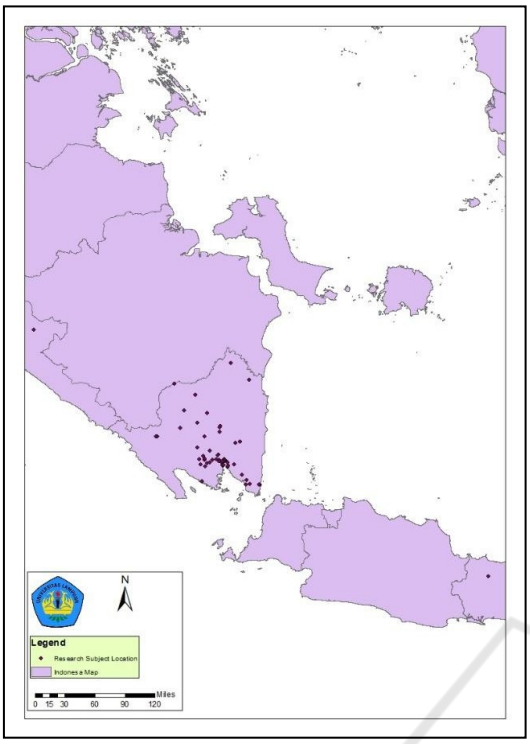

Figure 1: Distribution of All Research Subjects

Based on the results of microscopic examination of fecal parasitology, 20 subjects (32.26%) were positive for Blastocystis sp, 1 subject (1.61%) was positive for Entamoeba histolytica, and 1 subject (1.62%) was positive for hookworm. Almost all subjects found to have parasites resided in Lampung province, only 1 person came from Purbalingga, Central Java. The distribution of patients found positive for parasites by microscopic examination is shown in Figure 2. Administratively, the location of the most positive patients was found in Bandar Lampung City.

Based on satellite imagery, it appears that the research subjects who were positive for blastocystosis in Bandar Lampung were located in densely populated areas. This will certainly have an impact onthe risk area for the spread of this infection. The satellite image is shown in Figure 3.

can result in the parasite entering the human body (CDC, 2019). The presence of mechanical vectors also increases the transmission process by these vectors. Houseflies (*Musca domestica*) are one of the mechanical vectors that are suspected to be one of the factors that facilitate the spread of this parasite. The abilityto fly and move far from the housefly, as well as the resistance of the parasite attached to the fly's body, are important in the transmission process of this parasite (Hastutiek & Fitri, 2013; Szostakowska

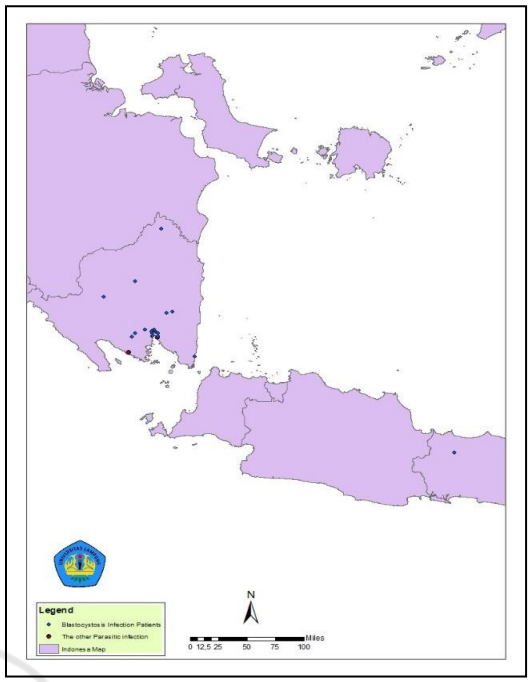

Figure 2: Distribution of Research Subjects Positive for *Blastocystis sp* and Other Intestinal Parasitic Infections

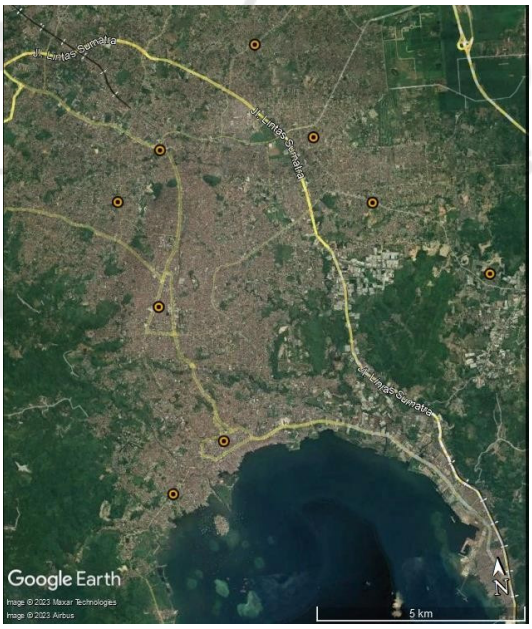

Figure 3: Satellite images of blastocystosis in Bandar Lampung

et al., 2004). In addition to houseflies as potential mechanical vectors, cockroaches have been reported as potential mechanical vectors in the transmission of *Blastocystis sp* (Dokmaikaw & Suntaravitun, 2019; Ma et al., 2020).

The mechanism of transmission of *Blastocystis sp* remains unclear. The infective stage that can be transmitted to humans has not been identified. In general, this transmission is fecal-oral. Parasite contamination from feces on food or eating utensils

Buffer zones are areas of potential or risk for transmission. The radius of this buffer area refers to the areaof contact and transmission of parasites by mechanicalvectors of houseflies, which are abundant in the environment. The flight distance of houseflies can reach 32km (20 miles) (Hastutiek & Fitri, 2013; Puspitarani et al., 2017; Szostakowska et al., 2004; Zurek et al., 2001). In this study, the radius of the buffer area is up to 10 km, and anoverview of the buffer area is shown in Figure 4.

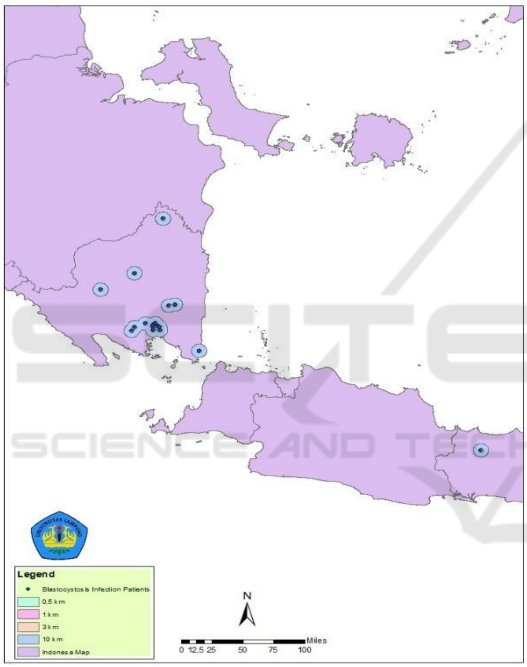

Figure 4: Buffering patterns in patients with blastocystosis

Based on the prevalence obtained, this study has a higher prevalence (32.26%) compared to research in Sydney (5%) (Fletcher et al., 2014); in Rio de Janeiro (12.7%) (Faria et al., 2017); in Iran (5.2%) (Asfaram et al., 2019) and in Padang by 21.3% (Nofita et al., 2015). Other studies in Brazil showed a similar prevalence (31%) (Bertozzo et al., 2022) and in Manado (36,4%) (Muflihatun et al., 2015). This could be due to the different studypopulations. In this study, the population was a high-risk group, namely patients suspected of having a compromised immune system. In the immunocompromised population, the incidence of protozoal infections tends to be high and can cause opportunistic infections, including Blatocystosis (Laksemi et al., 2020; Xu et al., 2021).

The incidence of intestinal protozoan infections such as Blastocystis sp is inextricably linked to favorable environmental conditions such as poor sanitation, population density, availability of mechanical vectors, and community behavior. Open defecation practices may result in environmental contamination by human feces containingprotozoa. This is consistent with the results of other spatial analysis studies, such as those in Rio de Janeiro (Faria et al., 2017) and Iran (Asfaram et al., 2019).

4 CONCLUSIONS

The prevalence of blastocystosis in risk groups such as patients with malignancies was 32.26%. The buffering pattern formed is quite extensive, especially in Bandar Lampung City, although in general the subtype of this parasite is not yet known.

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