STUDYING OF SERIAL CASES OF MELIOIDOSIS AFTER THE HISTORIC FLOODS IN CENTRAL VIETNAM 2020

Binh Nguyen Duy[1], Hoai Thu Dang Thi[2], Chuong Tran Xuan[1]

Summary

Introduction: Melioidosis (Whitmore) is a severe acute bacterial infection caused by *Burkholderia pseudomallei.* Melioidosis is transmitted to humans from soil and water environments; especially when exposed to flood water, which can cause epidemics because flood currents carry bacteria to a large area. After the historical floods in the Central region an outbreak of melioidosis occurred.

Objectives:

1. To investigate the relationship between the outbreak of melioidosis and the 2020 floods.

2. Describe some characteristics of melioidosis patients in the North Central provinces after the floods in 2020.

Subjects and research methods: Patients in the central provinces where the flood has just occurred, were diagnosed with melioidosis, treated at Hue Central Hospital from January 1, 2020 to December 31, 2020.

Results and discussion: In 2020, there was 43 patients with melioidosis, but only during the 3-month period of floods from October 1 to December 31, 2020 there were 33 patients (76.74%). The rate of diseases appearing in 3 months with floods was 3.1 times higher than the rate of 25% diseases appearing every 3 months, $p < 0.0001$. The majority of patients (81.4%) are farmers and live in rural areas (76.7%). The mean age was 56.14 ± 14.85. Most of the patients had chronic diseases: diabetes (34.9%), chronic kidney disease (9.3%), chronic lung disease (34.9%), 18.6% alcoholism. 72.1% of patients had sepsis, the most commonly damaged organs were the lungs (69.8%) and abscesses of the liver, spleen, and kidney (27.9%). There were 13 patients died (30.2%).

Conclusions: The rate of melioidosis patients in 3 months with floods was 3.1 times higher than the average rate of disease appearing every 3 months ($p < 0.0001$). Most patients had risk factors such as diabetes, chronic kidney disease, chronic lung disease, alcoholism. The most commonly injured organs are the lungs and abscesses of the liver, spleen, and kidneys. The mortality rate was 30.2%.

Key words: *Melioidosis, historical floods, North Central Vietnam.*

INTRODUCTION

Melioidosis, also known as Whitmore's disease, is a severe acute infectious disease that can infect humans or animals from contaminated soil or water. Melioidosis is caused by the bacterium *Burkholderia pseudomallei*, belonging to the species *Pseudomonas*[5].

Melioidosis is predominately a disease of tropical climates, especially in southeast Asia and northern Australia. The bacteria that cause melioidosis is found in contaminated water and soil, especially in tropical and subtropical areas[8]. Melioidosis can be transmitted to people through direct contact with contaminated dust or droplets, ingestion of contaminated water, contact with soil, particularly through skin abrasions.

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Manifestations of melioidosis include sepsis, pneumonia, abscess, or other local and disseminated infections (musculoskeletal, urinary tract infections, etc.). Many cases of melioidosis have been reported in Vietnam, especially in recent years[10]. In central Vietnam, there are only a few cases per month. However, in 2020, within only 3 months from October to December, dozens of cases were recorded after the historic floods occurred in the area. In view of the sudden increase of these rare cases, we conducted a study and introduced melioidosis patients after the floods in Central Vietnam with two purposes:

1. To investigate the relationship between the outbreak of melioidosis and the floods in 2020

2. Describe some characteristics of melioidosis patients in the North Central provinces after the floods in 2020

MATERIALS AND METHODS

Patients were admitted to Hue Central Hospital with a diagnosis of melioidosis from January 1, 2020 to December 31, 2020. All patients were from the central provinces of Vietnam (Ha Tinh, Quang Binh, Quang Tri and Thua Thien Hue), which experienced a series of floods from early October to late December 2020.

Information on epidemiology, residence, time of exposure to flood water, and risk factors of all patients were collected. Cultures from different specimens (blood, urine, pus, sputum, bronchial fluid, abscess fluid, ect.) were positive with *Burkholderia pseudomallei*.

B. pseudomallei was identified by Gram stain, culture, biochemical assays (API - Biomerieux) and automated identification on VITEK 2. Antibiogram MIC was performed according to the guidelines of CLSI (Clinical and Laboratory Standards Institute - American Institute of Clinical and Laboratory Standards) (CLSI M45 - A2).

RESULTS

The relationship between outbreak of melioidosis and the floods in 2020

In 2020, a total of 43 patients diagnosed with melioidosis were admitted to Hue Central Hospital. Especially only in the 3 - month period from October 1 to December 31, 2020 (the period of major floods) there were 33 hospitalized patients (76.74%).

The majority of patients (81.4%) are farmers and live in rural areas (76.7%). All patients were from the provinces of Central Vietnam: Hatinh 3 (6.9%), Quangbinh 8 (18.6%), Quangtri 13 (30.2%), Thuathien Hue 19 (44.2%).

Some characteristics of melioidosis patients in the North Central provinces

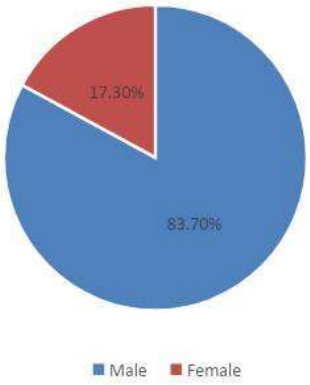

Chart 1. Gender

There were 36 males (83.7%) and 7 females (16.3%). The mean age was 56.14 ± 14.85 years old (the lowest was 27 years old, the highest was 85 years old).

Table 1. Comorbidities

Comorbidities	Number	%
Diabetes	15	34.9
Chronic lung disease	15	34.9
Chronic kidney disease	4	9.3
Alcoholism	8	18.6

Most of the patients had chronic diseases such as diabetes (34.9%), chronic kidney disease (9.3%), chronic lung disease (34.9%), alcoholism (18.6%).

Table 2. Organ damages

Organ damage	Number	%
Sepsis	31	72.09
Pneumonia	30	69.77
Abscess of liver, spleen, kidney	12	27.9
Osteoarthritis	8	18.6
Skin and soft tissue abscesses	3	6.97

72.1% of patients had sepsis, the most commonly injured organs were the lungs (69.8%) and abscesses of the liver, spleen and kidney (27.9%).

Table 3. Laboratory results

	Number	Minimum	Maximum	Average	Unit
WBC	43	2.96	26.32	11.19 ± 5.26	k/µL
CRP	29	5.0	488.9	162.1 ± 129.1	mg/L
PCT	28	0.062	100.000	32.464 ± 37.080	ng/mL
Lactate	25	0.7	21.1	3.4 ± 4.0	mmol/L
Creatinine	43	43.00	1214.00	118.39 ± 189.80	mmol/L
AST	40	10.00	340.69	79.13 ± 67.32	U/l
ALT	40	5.39	313.78	76.14 ± 69.24	U/l

The parameters reflecting the infection status such as white blood cells, CRP, and PCT were all elevated. Tests to assess liver and kidney damage (creatinine, transaminase) were elevated.

Table 4. Treatment results

Treatment results	Number	%
Cure	30	69.8
Death	13	30.2

There were 13 deaths, accounting for 30.2% of the total number of patients.

DISCUSSION

The outbreak of melioidosis and the floods in 2020

In 2020, a total of 43 patients diagnosed with melioidosis were hospitalized at Hue Central Hospital. There were 33 hospitalized patients (76.74%) during just the 3-month period from October 1 to December 31, 2020. The rate of diseases appearing in 3 months with floods was 3.1 times higher than the rate of 25% diseases appearing every 3 months. This difference was statistically significant ($p < 0.0001$). It is estimated that there was an average of 0.338 patients per 100,000 population/year when there was no flood and 3.35 patients per 100,000 population/year during the floods[1].

According to a report by Hue Central Hospital, within 5 years from 2014 to 2019, there were 83 melioidosis patients hospitalized and treated; an average of 16.6 cases/year and 1.38 cases/month. In particular, in 2020 there were 43 cases/year. The number of hospitalizations with melioidosis in the flood season was 9.9 times higher than when there was no flood.

In 2020, according to the National Center for Hydro - Meteorological Forecasting, the reality of natural disasters has many unusual factors. The weather pattern was influenced by the El Nino phenomenon at the beginning of the year, while at the end of the year it was influenced by the La Nina phenomenon. This situation was complicated throughout the country by intense heat at the beginning of the year, strong storms, and heavy rain at the end of the year. During the period from October 5 to October 20 in Central Vietnam, there was heavy rain almost every day. The amount of rain in the first 20 days of October was 100% to 200% higher than normal days. In many places, it even exceeds 300% to 400% of the average rainfall, such as Quang Binh, Quang Tri, and Thua Thien Hue. The total rainfall for the whole period was 1,000 - 2,000mm. In some places, it reached 2,000 - 3,000mm, which was 3 to 5 times higher than the average of many years in the same period. Several places had exceeded historical values, such as Khe Sanh (Quang Tri) with 2,451 mm (the average was 329mm), Hue with 2,370 mm (the average was 494mm).

In Darwin report (Australia), there were 118 cases (22%) who had occupations involving soil and water contact; 436 cases (81%) occurred during the rainy season[3].

According to Limmathurotsakul (Thailand), the rate of melioidosis patients increased in a certain area after natural disasters, such as the tsunami in 2004 and Typhoon Haitang (increased from 0.7 to 70 per 100,000 people/year) in southern and western Taiwan[6].

The majority of patients (81.4%) are farmers and live in rural areas (76.7%). All patients were from central provinces: Ha Tinh 3 (6.9%), Quang Binh 8 (18.6%), Quang Tri 13 (30.2%), Thua

Thien Hue 19 (44.2%). These areas experienced several major floods from October to December 2020.

Soawapak Hinjoy (Northeastern Thailand) indicated that a greater incidence of melioidosis was linked to a higher prevalence of diabetes mellitus; the increasing age of farmers in rural areas, as well as the increased use of land for agricultural and rice cultivation, were risk factors for melioidosis[7].

Some characteristics of melioidosis patients in the North Central provinces

There were 36 males (83.7%) and 7 females (16.3%). The mean age was 56.14 ± 14.85 years old (the lowest age was 27 years old, the highest age was 85 years old). Most of the patients had chronic diseases such as diabetes (34.9%), chronic kidney disease (9.3%), lung disease (34.9%), alcoholism (18.6%).

Natesan (Malaysia) concluded that melioidosis was closely related to age, occupation, precipitation and predisposed chronic diseases, especially diabetes[9].

In a study by Limmathurotsakul on 2,217 patients in Thailand, 662 patients (29.9%) had known diabetes, and 370 patients (16.7%) were diagnosed with diabetes over the course of their melioidosis treatment (these patients had not previously been diagnosed and treated for diabetes). In the previously undiagnosed diabetes group, 222 patients (60%) survived and 148 patients (40%) died[4]. Limmathurotsakul concluded that male, age over 45, diabetes (diagnosed and undiagnosed) were independent risk factors for melioidosis. Diagnosed and undiagnosed diabetes were associated with adjusted RRs of 12.4 and 7.8, respectively, compared with no diabetes ($p < 0.001$)[4].

B. Currie also came to the same conclusion: the mean age was 46.8 years, 264 (72.5%) males, 178 patients were Aboriginal Australians and 59 patients (16.2%) died from melioidosis. The mean annual incidence was 19.6 cases per 100,000 people, with 260 cases per 100,000 diabetic individuals[2].

Melioidosis damages multiple organs; in our study, 72.1% of patients had sepsis, the most commonly affected organs were the lungs (69.8%) and abscesses of internal organs (liver, spleen, kidney) (27.9%).

In Darwin report (Australia), there were 278 cases with pneumonia (51%), genital infections, 76 cases (14%), skin infections, 68 cases (13%), septic arthritis/osteomyelitis, 20 cases (4%) and neuromuscular melioidosis, 14 cases (3%). There were 298 cases (55%) with sepsis and 116 cases (21%) with septic shock (58 deaths). A prostate abscess occurred in 76 cases (20% of 372 men)[3].

The parameters in table 3 showed white blood cells, CRP, and PCT all high elevated. Tests to assess liver and kidney damage (creatinine, transaminase) were also elevated. The same results were reported in many researches before[3,5,10].

CONCLUSIONS

The rate of melioidosis patients in 3 months with floods was 3.1 times higher than the average rate of disease appearing every 3 months ($p < 0.0001$).

Most of the patients had risk factors such as diabetes (34.9%), chronic kidney disease (9.3%), lung disease (34.9%), and alcoholism (18.6%). The most commonly injured organs are the lungs (69.8%) and abscesses of the liver, spleen, and kidney (27.9%). The mortality rate was 30.2%.

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