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Factors of Severity Dengue Hemorrhagic Fever during the Covid-19 Pandemic; A Case Control Study in Buleleng Bali

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ABSTRACT

Background: The incidence of severe Dengue Hemorrhagic Fever (DHF) in Buleleng District during the COVID-19 pandemic was very high. Our study aimed to analyze the relationship between age, sex, area of residence, type of hospital, season of occurrence and time period with the incidence of severe DHF.
Methods: We conducted a case-control study. Our study sample was 135 with a ratio of cases to controls of 1:2. We collected secondary data obtained from the DHF register data of the Buleleng District Health Office in 2019 to 2020. We performed data processing and analysis using the SPSS version 22. Descriptive analysis using a cross-table distribution and inferential analysis using Chi-Square or Fisher-Exact tests with p values <0.05 or Confident Interval (CI) is 95%.
Result: We found more severe cases of DHF in the group aged 1-12 years, male, living in rural areas, undergoing hospitalization in private hospitals, during the rainy season and during the COVID-19 pandemic period. Age group 1-12 years (OR: 4.3 95%CI: 1.9-9.4, p value=0,000) and rainy season (OR: 2.4 95%CI: 1.1-5.2, p value=0,025) were significantly associated with the severity of DHF.
Conclusion: The age group of 1-12 years and the rainy season are risk factors for the severity of DHF during the COVID-19 pandemic. It is necessary to disseminate early awareness of DHF at the elementary school level and empower parents in maintaining the health condition of their children.

Keywords: age; season; dengue hemorrhagic fever; COVID-19 pandemic

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Introduction

Dengue Hemorrhagic Fever (DHF) is a vector borne disease caused by the Dengue Virus (DENV) and is widespread throughout the tropics and subtropics [1]. Some cases of DHF have mild symptoms, but some cases have severe manifestations which can lead to shock and even death [2].

The incidence of severe DHF in several countries before the COVID-19 pandemic was quite high. The prevalence of severe DHF in the pediatric age group in Vietnam was reported to be 6% [3]. The prevalence of severe DHF in the adult and elderly age group in Taiwan was reported to be 4% [4]. The prevalence of death in Taiwan under 7 days after disease onset was reported to be 43% and under 3 days after clinical symptoms was 35% [5].

The incidence of severe DHF and deaths in Indonesia before the COVID-19 pandemic was also reported to be quite high. The prevalence of severe DHF in the child age group in Jakarta was reported at 15.32% with a mortality rate of 0.41% [6]. The prevalence of severe DHF in all age groups in Bali was reported at 2.59% [7]. The prevalence of death in the child age group in Yogyakarta was reported to be 27% [8].

The incidence of severe DHF before the COVID-19 pandemic in Buleleng District was lower than when the pandemic occurred. The prevalence of severe DHF in 2019 was reported at 1.1% with a mortality rate of 0.63% [9].

The incidence of DHF in Buleleng District during the COVID-19 pandemic experienced a significant increase and became the area with the highest DHF incidence in Indonesia on 2020 [10]. The high incidence is accompanied by an increasing trend in the incidence of severe DHF. The prevalence of severe DHF in 2020 was reported at 2.5% with a mortality rate of 0.38% [9].

This problem occurs because it is influenced by multiple factors. World Health Organization (WHO) states that there are a set of factors that affect a persons health status such as behavior, social, economic, cultural, food security, environmental conditions and sanitation, access to health services, policy support, regional stability to climate and seasonal changes [11].

Individual factors such as age and sex, environmental factors such as area of residence, health service factors such as type of hospital and changes in season and period of occurrence are some of the factors that have the potential to cause DHF severity and even death [12].

An increase in the incidence of severe DHF is a serious health problem in vector borne disease control programs, so it is necessary to know the causative factors. These findings can be used as planning material in overcoming these problems so as to prevent aggravating the burden on the public health system [13].

Our study aims to analyze the risk factors for the incidence of severe DHF which include age, sex, area of residence, type of hospital, change of season and period of disease incidence.

Methods

We conducted a case-control study in Buleleng District through tracking DHF cases reported in 2019 and 2020. We analyzed the relationship between age, sex, area of residence, type of hospital, season and time period of occurrence as independent variables and the degree of DHF as dependent variable. We did age categorization by finding the median value and then categorized it into two using the median cut point because the age data were not normally distributed. Our study sample was all DHF patients who met the limits as cases and controls. Cases were DHF patients who experienced shock or died who lived in Buleleng District and controls were DHF patients who did not develop into severe DHF and were declared cured.

We carried out data processing and analysis using a computer assisted by the IBM Statistical Package for the Social Sciences (SPSS) version 22 application. Descriptive analysis was carried out using a cross table distribution to compare the proportion of case and control subjects whose analysis results were in the form of frequency (n) and percentage (%). Inferential analysis was performed using Chi-Square or Fisher-Exact statistical tests to prove the hypothesis with a significance value of p value <0.05 or Confident Interval (CI) of 95%. The strength of

the risk factor relationship is interpreted using the value of the crude odds ratio (OR).

Result

Table 1. Distribution of subjects and risk factors for the incidence of severe DHF in Buleleng District

Variable	Severe DHF n (%)	Mild DHF n (%)	Total n (%)	crude OR	95%CI	p value
Age group						
1-12 years	33 (73,3)	35 (38,9)	68 (50,4)	4,3	1,9-9,4	0,000
13-72 years	12 (26,7)	55 (61,1)	67 (49,6)			
Sex						
Male	23 (51,1)	57 (63,3)	80 (59,3)	0,6	0,2-1,2	0,173
Female	22 (48,9)	33 (36,7)	55 (40,7)			
Residential Area						
Rural area	26 (57,8)	58 (64,4)	84 (62,2)	1,3	0,6-2,7	0,451
Urban area	19 (42,2)	32 (35,6)	51 (37,8)			
Type of Hospital						
Private	26 (57,8)	51 (56,7)	77 (57,0)	0,9	0,4-1,9	0,902
Government	19 (42,2)	39 (43,3)	58 (43,0)			
Seasonal Change						
Rain	33 (73,3)	48 (53,3)	81 (60,0)	2,4	1,1-5,2	0,025
Dry	12 (26,7)	42 (46,7)	54 (40,0)			
Occurrence Period						
During the COVID-19 Pandemic	39 (86,7)	78 (86,7)	117 (86,7)	1,0	0,3-2,8	1,000
Before the COVID-19 Pandemic	6 (13,3)	12 (13,3)	18 (13,3)			

We found that the age group of 1-12 years experienced more severe DHF which was 73.3%. The age group of 1-12 years has a 4,3 times higher risk of experiencing severe DHF. Age was significantly related to the severity of DHF (p value=0.000). Male was found to experience more severe dengue by 51.1%. Sex was not found to have a significant relationship with the severity of DHF (p value=0.173).

Residents of rural areas were found to experience more severe dengue which was 57.8%. The area of residence was not found to be significantly associated with the severity of DHF (p value=0.451). More severe dengue patients were found in private hospitals, which amounted to 57.8%. The type of hospital was not found to be associated with the severity of DHF (p value=0.902).

Patients with severe DHF were more commonly found in the rainy season, which was 73.3%. The rainy season has a 2,4 times higher risk of causing severe DHF. Seasonal changes were significantly related to the severity of DHF (p value=0.025). Patients with severe DHF were more commonly found during the COVID-19 pandemic which was 86.7%, but there was no relationship between the period of occurrence and the severity of DHF.

Discussion

Age can indirectly affect the function and performance of body organs. Children age group is more susceptible to severe DHF and even death due to an unstable immune system and more permeable blood vessels [14]. We found that the age group 1-12 years had a 4.3 times higher risk of severe DHF.

The findings of our study are in line with the study conducted by Pradipta, who found that ages 5-18 years and under 5 years old had a higher risk of developing DSS with respectively aOR=4.140; p=0.007 and aOR=4.022; p=0.018[15]. Studies conducted by Pangaribuan also found that age under 5 years was a prognostic factor for death from DSS (HR=1.430; p=0.005)[8].

Research studies conducted Thanachartwet and Mallhi instead found different results that those aged over 40 years

were at higher risk of severe DHF infection with respectively aOR: 5,219, 95% CI: 1,538-17,689 and aOR= 4.1, p < 0.001[16,17]. Studies by Pang, found that age 60 years had a higher risk of organ damage due to DENV infection (aOR=2.75; 95% CI: 1.3-5.8)[18].

Study conducted by Moraes found that those aged 50 years and under 4 years had a higher risk of dying from severe DHF (OR= 2.29, 95% CI= 1.59–3.29); (OR = 1.83, 95% CI = 1, 47-2.28)[19]. Studies by Karunakaran found slightly different results that DHF patients aged over 40 years had a higher risk of death than patients aged under 40 years (aOR=9.3; 95% CI: 1.9-44.4)[20]. Older age groups are at high risk for complications of DHF and even death due to decreased ability of body organ performance and endurance [14].

Sero prevalence of DENV infection in the male population was found to be 81.89% and female population was 78.19%[21]. The male population tends to be more susceptible to DHF infection because genetic and hormonal antibodies are less optimal in producing immunoglobulins than female population. We found that the male population experienced more severe DHF but did not find an association with DHF severity.

Our findings are not in line with studies conducted by Lestari and Sahly, who found that male population was at higher risk of severe DHF with (OR=1.86, p=0.174); (OR=1.91)[22,23]. The prevalence of death on arrival and during hospitalization was also found to be higher in male population (64.1%)[5].

In contrast to our findings and the results of the studies previously described, the study conducted by Huy, Podung and Pang J, instead found that female population was at higher risk for severe DHF with each (OR: 1.37, 95% CI; 1.17-1.60, p=<0.001); (OR=3.25); (aOR=1.57; 95%CI:1.28–1.94)[24,25,26]. Female population who are at high risk include those who are pregnant and who have a history of abnormal menstruation so that they have the potential to experience vaginal bleeding [14].

The area of residence is suspected to be one of the risk factors for the incidence of DHF. We found that the population of rural areas experienced more severe DHF, but there was no relationship between the area of residence and the severity of DHF. Studies conducted by Yuliawati found similar results that the larval density index based on House Index (HI) = 44.1%, Container Index (CI) = 31.7%, Breteau Index (BI) = 74.9% and Ovitrap Index (OI) = 64.1 % higher in rural areas[27]. Studies conducted by Moraes also found that rural areas had a higher risk of DHF mortality with severe symptoms (OR = 2.84, 95% CI = 2.19-3.69)[19].

Other findings report that urban areas have a higher potential for DHF than rural areas due to urbanization, population density and human mobility[2]. Human mobility will facilitate the spread of DENV infection by following the pattern and traffic flow of population movements [28].

Another factor that triggers urban areas to be more prone to DHF is the diversity of community characteristics and disease prevention behavior so that it will have an impact on the density of vectors that are agents of DENV transmission. Urban residents tend to have limited time to keep the environment clean due to the demands of social and economic status [29].

The type of hospital is one of the factors that influence people tastes in spending on health services [30]. We found that there were more severe DHF patients in private hospitals but there was no relationship between the type of hospital and the severity of DHF. Based on the results of the literature review, there have not been many studies related to the different types of hospitals that can exacerbate the incidence of DHF.

Seasonal changes are the main factors that affect the incidence of DHF. High rainfall can increase the availability of water so that it invites the arrival of Aedes aegypti and albopictus mosquitoes to breed [31].

We found that more severe DHF cases were found in the rainy season. The rainy season has a 2,4 times higher risk of causing severe DHF than the dry season. This is influenced by a decrease in temperature, an increase in air humidity and rainfall. This condition causes the population density of Aedes aegypti larvae in the rainy season [32].

The COVID-19 pandemic has caused an unprecedented decline in human mobility but has actually caused the opposite to actually

have an impact on the increase in DHF cases. We found that severe DHF cases were more common during the COVID-19 pandemic, but there was no relationship between the period of occurrence and the severity of DHF.

Our findings are corroborated by a study conducted by Cavany, who found that 70% of the population stayed at home during the COVID-19 pandemic and led to a 10% increase in the average total DENV infection[33]. The prevalence of infected residents in their own homes rose from 54% in normal conditions to 66% in social distancing conditions, and the household secondary attack rate rose from 0.109 to 0.128 or an increase of 17%.

Conclusion

The age group of 1-12 years and the rainy season are risk factors for the severity of DHF during the COVID-19 pandemic. It is necessary to disseminate early warning of DHF at the elementary school level and to encourage and strengthen the role of parents to check their children to health care facilities if they have a fever for no apparent reason.

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