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Original Article

Profiles of diphtheria cases in children in Hasan Sadikin Hospital, West Java

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Abstract

Background Diphtheria cases continue to be reported in Indonesia, which has long been one of the countries with the highest number of diphtheria cases worldwide. One of Indonesia's province with the highest annual diphtheria cases is West Java. Dr. Hasan Sadikin General Hospital (RSHS) is one of the tertiary referral hospitals in Bandung, West Java, that treats several diphtheria cases annually. No study focused on the clinical characteristics of diphtheria cases in children admitted to RSHS between 2017 and 2021 yet. Therefore, this study sought to analyze that.

Objective To find out the profiles of children ≤18-year-old with diphtheria admitted in RSHS between 2017-2021.

Methods This descriptive, cross-sectional study reviewed the medical records of diphtheria patients 0 to 18-year-old who were admitted to RSHS between year 2017 and 2021.

Results Out of 45 subjects, 76% were males. The median of age was eight years old, ranging from 2 to 17 years. Most patients lived in urban areas and had normal anthropometry status, although some showed abnormal findings. The data showed that 44% had more than 3 days of onset until admission to the hospital, and the median length of stay was 9 days. The clinical characteristics showed that 91% of patients had pseudomembrane, also present with cough, common cold, hoarseness, stridor, and bull's neck. As many as 44% of patients did not have complete basic immunization status. Complications found were airway obstructions, myocarditis, and sepsis, and 2 deaths were reported.

Conclusion Pseudomembrane was found in the majority of patients. Most patients were over five years of age, and almost half number of the patients did not have complete basic immunization status, indicating the need for improved immunization and booster coverage. **[Paediatr Indones. 2024;64:305-10; DOI: https://doi.org/10.14238/pi64.4.2024.305-10**].

Keywords: *diphtheria; children; clinical profile; immunization status*

Diphtheria is a contagious infection caused by Gram-positive *Corynebacterium diphtheriae*, transmitted through the patient's droplets, coughs, sharing cutlery, and direct contact with an active skin lesion.[1] The disease is marked by a low-grade fever (<38.5°C), cough, sore throat, the presence of a greyish-white membrane that bleeds if removed (pseudomembrane), hoarseness, bull's neck, and stridor.[1] In worst cases, the pseudomembrane formed can cause edema and bull's neck, which then cause a potentially life-threatening airway obstruction.[2] It is a vaccine-preventable disease and human is the only host for these bacteria.[1] The distinct characteristic of this disease is the presence of a pseudomembrane, which is usually located on the larynx, pharynx, and tonsils upon examination.[1,3] Diphtheria often occurs in children above the age of 5 and is more often found in boys than girls.[2]

Diphtheria was one of the leading causes of death in the pre-vaccination era, which, after the introduction of the *Immunization Expansion Program* by the *World Health Organization* in 1974, had a decrease

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in the number of cases, especially in developing countries, although not completely eradicated.[4] The *Global Health Observatory* data repository *World Health Organization* reported, based on the WHO regions, that in 2020, Southeast Asia had as many as 4002 diphtheria cases.[5] Since the 2000s, Indonesia has been one of the countries with the most diphtheria cases. In 2017 and 2018, diphtheria cases in Indonesia experienced a peak of 954 and 1026 cases, respectively.[5] The latest WHO data from 2021 reported 235 cases of diphtheria in Indonesia, and 33 were from West Java, which indicates the still-existing relevance of the disease in this country.[5,6] Diphtheria generally infects children aged 1-10 years but can also infect adults.[7] The major risk factor of this disease is incomplete basic immunization and low coverage of booster doses of the diphtheria vaccines.[2]

Hasan Sadikin General Hospital Bandung (RSHS) is one of the tertiary referral hospitals in West Java that has recorded more diphtheria patients with more severe conditions. There has yet to be a study focusing on the profiles of diphtheria cases in Hasan Sadikin Hospital Bandung from 2017 through 2021. This study aimed to analyze that data, hoping it can be a new source of knowledge for further studies and the medical fields, especially in West Java, Indonesia.

Methods

This descriptive, cross-sectional study analyzed medical records of diphtheria patients in children hospitalized at Hasan Sadikin General Hospital. The medical records were gathered in October-November 2022 after obtaining an ethical exemption letter from Universitas Padjadjaran's Research Ethics Committee, and research permit letter from Hasan Sadikin General Hospital Bandung.

The population studied was medical records of children aged 0 to 18 years who had been diagnosed with diphtheria and were hospitalized in RSHS in the period of the year 2017-2021. The inclusion criteria in this study were medical records of children who were diagnosed with diphtheria and were hospitalized in RSHS from 2017 to 2021 with complete data of age, gender, immunization status, clinical manifestations, complications, duration of onset of symptoms until admission to hospital, length of stay, and outcomes. The sampling method used in this study was total sampling, in which all available medical records suitable with the inclusion criteria were obtained and analyzed.

The data taken from the medical record included demographic data of sex, age, weight in kilograms, height in centimeters, address (city or district), and childbirth order. The characteristic of diphtheria cases in children, consisting of age group, immunization status, clinical manifestations, complications, duration of onset of symptoms until admission to hospital, length of stay in the hospital, and outcomes of disease (alive or dead, and if dead, what was the cause).

The data analysis was carried out using *Microsoft® Excel 365* and *IBM® SPSS® version 25*, presented in tables and described in a narrative form. The weight for age, height for age, and BMI for age data were analyzed and interpreted using the WHO *z*-scores charts. Categorical data were presented in numbers and percentages. In contrast, the numerical data all showed a non-normal distribution based on the Shapiro-Wilk normality test (sample <50), which was presented in the median (range of minimum to maximum value).

Results

The medical record department in RSHS registered 51 medical records of hospitalized diphtheria patients aged 0-18 years registered in the medical record department in RSHS. Only 45 out of 51 met the requirements for this study.

Table 1 reveales 45 total instances during the five years between 2017 and 2021. There were 7 cases in 2017 (making up 16% of the total cases in 5 years), 22 cases in 2018 (49%), 10 cases in 2019 (22%), 4 cases in 2019 (9%), and 2 cases in 2021 (4%). There was a peak of diphtheria cases in children in 2018, possibly due to the reported outbreak at the end of 2017. The cases gradually decreased after 2018, which could be explained by the effect of the government's *Outbreak Response Immunization* for diphtheria conducted in mid-December 2017.

According to the demographic information (**Table 2**), males comprised most of the diphtheria patients (76%), with females comprising the remaining 24%. The median age of diphtheria patients was

8 (range 2-7) years. The median weight was 22.5 kilograms with a range of 11 to 53 kilograms, and the median height is 121 (range 87.5 to 168) centimeters . The height for age data, showed that 67% of patients had normal height for age, 20% were stunted, 9% were severely stunted, and 4% were very tall. The weight for age data showed that 51% of patients had normal weight for age, 7% were underweight, 4% had possible growth problems, and 38% were over the age of 10 years, which can no longer be plotted in the WHO z-score chart. The BMI for age data was also analyzed, and results showed that 67% of patients had normal BMI, 13% had a possible risk of being overweight, 11% were overweight, 4% were wasted, and 4% were severely wasted. The patients' median birth order was second born, with a range of first to seventh born.

All 45 collected data were used to produce the characteristics data in **Table 3**. The age group 0-5 years contributes the most, with 40%, followed by the age group 12-18 years (36%) and the age group 6-11 years (24%).

The medical records' immunization status was obtained by anamnesis with the parents. The answers were complete basic immunization, incomplete basic immunization, not immunized, unknown immunization status, and a few additionally mentioned that their children received diphtheria outbreak response immunization. Most patients (56%) had a history of complete basic immunization, 20% had a history of incomplete basic immunization, 5% were not immunized, 13% had an unknown immunization history, and 11% had received the diphtheria vaccine from the *Outbreak Response Immunization*. There were 60% of patients with ≤3 days duration of onset of symptoms until admission to the hospital, and the rest had more than 3 days. With a range of 2 to 40 days, patients' median length of stay was nine days.

According to the data, 91% of patients presented with pseudomembrane, whereas the remaining individuals had none upon examination but had positive lab results. The body temperature of patients was taken upon admission to the hospital, 80% were in the range of 36.5-37.5°C, 13% were in the range of 37.6-38.0°C, and 7% were >38°C. There were 80% of patients reported having a sore throat, 33% reported having a cough, 18% reported having a common cold, 13% reported having hoarseness, 36% reported having stridor, and 31% reported having a bull's neck upon physical examination.

Ten individuals encountered complications: 7/10 had airway obstruction, 2/10 had myocarditis, and 1/10 had sepsis. Two deaths resulted from these complications, each from myocarditis and sepsis.

Discussion

The data of pediatric patients admitted to RSHS revealed that over 62% of the patients presented with complications from diphtheria (airway obstruction, myocarditis, sepsis, stridor, bull's neck). This data

Table 1. Number of diphtheria cases in children hospitalized in RSHS per year during the 2017-2021 period

Total cases, n(%)	(N=45)
2017	7 (16)
2018	22 (49)
2019	10 (22)
2020	4 (9)
2021	2 (4)

Table 2. Demographic data of children with diphteria

Characteristics	(N=45)
Gender, n(%)	
Male	34 (76)
Female	11 (24)
Median age (range), years	8 (2-17)
Median weight (range), kg	22.5 (11-53)
Median height (range), cm	121 (87.5-168)
Height for age, n(%)	
Normal	30 (67)
Very tall	2 (4)
Stunted	9 (20)
Severely stunted	4 (9)
Weight for age, n(%)	
Normal	23 (51)
Underweight	3 (7)
Possible growth problem	2 (4)
>10 years	7 (38)
BMI for age, n(%)	
Normal	30 (67)
Possible risk of overweight	6 (13)
Overweight	5 (11)
Wasted	2 (4)
Severely Wasted	2 (4)
Residence, n (%)	
Urban	33 (73)
Rural	12 (27)
Median order of childbirth (range)	2 (1-7)

Table 3. Characteristics of diphtheria cases in children hospitalized in RSHS 2017-2021 period

Characteristics	(N=45)
Age group, n (%)	
0-5 years	18 (40)
6-11 years	11 (24)
12-18 years	16 (36)
Immunization status, n (%)	
Complete basic immunization	25 (56)
Incomplete basic immunization	9 (20)
Unimmunized	5 (11)
Unknown immunization status	6 (13)
Received ORI	5 (11)
Duration of onset of symptoms until admission to hospital, n(%)	
≤3 days	27 (60)
>3 days	18 (40)
Median (range), days	3 (1-14)
Median length of stay (range), days	9 (2–40)
Clinical manifestations, n (%)	
Pseudomembrane	41 (91)
Body temperature	
36.5-37.5°C	36 (80)
37.6-38.0°C	6 (13)
>38°C	3 (7)
Sore throat	36 (80)
Cough	15 (33)
Common cold	8 (18)
Hoarseness	6 (13)
Stridor	16 (36)
Bull's neck	14 (31)
Complications, n (%)	
Airway obstruction	7 (16)
Myocarditis	2 (4)
Sepsis 1	1 (2)
Outcomes, n (%)	
Alive (recovery)	43 (96)
Dead	2 (4)
Myocarditis	1 (2)
Sepsis	1 (2)

ORI=Outbreak Response Immunization

indicated that more severe cases of diphtheria in children were more prevalent in this tertiary hospital in West Java. The clinical profiles of diphtheria cases in pediatric patients admitted to RSHS revealed that, although four patients did not initially exhibit pseudomembrane, the disease was present in 91% (41) of the patients. This finding revealed a lower percentage of patients with pseudomembrane than those from comparable studies carried out in Makassar, South Sulawesi,[2] Jakarta,[8] and India,[9] which all showed 100% of patients with pseudomembrane. The findings of this investigation demonstrated that the four cases without pseudomembrane were lab-confirmed instances of diphtheria in which throat swabs revealed the presence of C. diphtheriae. Most patients in comparable studies were older than 5 years old, which was supported by the data from our study, which indicated that 60% of the patients were over the age of 5, with a median age of 8 (range 2-17) years.

Our study shows that most patients lived in urban areas. This result differs with a previous study in North India that showed 66% of patients lived in rural areas.[10] More cases were found in males than in females (76%), which is in line with some similar studies.[2,8,10,11]

Two previous studies also showed the nutritional status of pediatric diphtheria patients. From the height-for-age data, it was found that 29% of patients were

stunted and severely stunted. From the BMI for age data, it was found that 8% of patients were wasted and severely wasted. One of the risk factors for children contracting infections, in this case, diphtheria, is nutritional status.[12,13] Alongside nutritional status, the immunization status of children also contributes to the risk factors of children contracting diphtheria, which might cause patients with a good nutritional status to contract the infection.[12,13] According to our study, 44% of the patients did not receive complete basic immunization. Some comparable studies are in line with the data obtained in ours , which states more findings in patients who had been immunized than those who were unimmunized (85.71% vaccinated),[2] 47% total of fully and partially immunized, 35.3% unimmunized,[8] and 13.04% fully vaccinated, 73.91% not fully vaccinated.[14] Although the data gathered from the medical records did not enclose specific immunization the patients had received, it is assumed that this outcome may be brought about by the diphtheria vaccine's decreasing level of protection following primary vaccinations and the absence of booster doses.[1,2] These findings indicate that age-appropriate immunization coverage still needs much improvement. There were 40% of patients with a duration of onset of symptoms until admission to the hospital of more than three days, which increases the risk of having more severe manifestations of diphtheria.

This study found 2 (4%) deaths in 5 years caused by diphtheria complications, myocarditis, and sepsis. Other similar studies in Jakarta showed 6 (17.7%) deaths in 12 years caused by airway obstruction and myocarditis,[2] and in South Sulawesi reported 4 (14.3%) deaths in 7 years.[8] Early detection of diphtheria cases should be done to prevent more severe conditions and potential deaths.

Conflict of interest

None stated.

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