



Pediatric Viral and Bacterial Skin Infection Profile

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ABSTRACT

Background: Viral and bacterial skin infection is a common condition amongst children. In developing countries, it is a complex major health problem. However, epidemiological study on viral and bacterial skin infection in the pediatric population is still lacking, especially in Indonesia. **Purpose:** This study aimed to evaluate bacterial and viral skin infection amongst children and its association with age and sex. **Methods:** This study used a cross-sectional design with a retrospective approach. We retrieved medical records of pediatric patients admitted to Dr. Harjono S Ponorogo General Public Hospital between 2016 and 2020. **Result:** Of the 1,427 collected medical records, we found that the viral infection prevalence was 4.9% (n=70) and 7.5% (n= 107) for bacterial skin infection. Viral infection was most observed amongst subjects in the >12-year age group and 2–12-year for bacterial infection. Infection was more commonly observed amongst boys. **Conclusion:** The skin infection prevalence in Dr. Harjono S. Ponorogo General Hospital is lower compared to other studies. Skin infection of viral origin was most reported in children aged >12 years and bacterial infection in children aged 2–12. Both skin infections were more commonly observed in boys than girls.

Keywords: skin infection, pediatric, profile, viral infection, bacterial infection.

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BACKGROUND

Skin infection is a common condition amongst children. It is influenced by geography, season and climate, socioeconomic factors, and personal hygiene.¹⁻³ In developed countries, skin infection is still a cause of morbidity. Its incidence is more common than pneumonia and urinary tract infection.⁴ However, in a developing country, such as Indonesia, it is a complex major health problem. Temperature, humidity, low hygiene, lack of access to clean water, and low education attainment render the disease to spread among children throughout the community.⁵

The most common skin infection in the pediatric population is bacterial in origin, followed by fungal and viral infections.^{3,6} In a low-resource setting, this condition could be challenging for clinicians to diagnose and treat, especially in an area where microbiology testing is not widely available.⁷

The prevalence of certain skin diseases in children could reflect a community's hygiene. Hence,

evaluating pediatric skin diseases is an essential public health issue. However, epidemiological study on skin infection in the pediatric population in Indonesia is still lacking. Given its scarcity of evidence, this study aimed to evaluate bacterial and viral skin infection amongst children and its association with age and sex.

METHODS

We conducted a cross-sectional study with a retrospective approach. The study data were medical records of patients admitted to Dr. Harjono S General Public Hospital, a secondary hospital located in Ponorogo, East Java, Indonesia, serving 949,320 residents.⁸ Ponorogo regency has a tropical climate and is 92–2.563 meters above sea level.⁹ The temperature range in Ponorogo is 22°C to 35°C, with an average of >32°C during the dry season, and the humidity range is between 70-95%.^{10,11}

We extracted the diagnosis, age, and sex information from the collected study data. The

inclusion criterion of the study was pediatric patients < 18-year-old with a diagnosis of skin disorder. Also, we excluded medical records with unclear and incomplete information.

We followed the Center for Drug Evaluation and Research to classify the age group.¹² The collected data were then processed into a spreadsheet. We analyzed the data descriptively and presented them in tables. The study protocol has been approved by the Health Research Ethics Committee of Dr. Harjono S.

Ponorogo General Hospital (Ref: 352021K11146 2021110600001/ XI/ KEPK/ 2021).

RESULT

Of the 1,427 medical records, the prevalence of viral infection was 4.9% (n= 70) and 7.5% (n= 107) for bacterial skin infection. The most common viral skin infection was varicella (n= 29), and for bacterial origin, the most common presentation was crusted impetigo (n= 32) (Table 1).

Table 1. The Prevalence of Viral and Bacterial Skin Infection

Disease	Year					Total (%) (N= 1,427)
	2016 (%) (N= 315)	2017 (%) (N= 433)	2018 (%) (N= 332)	2019 (%) (N= 242)	2020 (%) (N= 105)	
Viral Infection	15 (1.1)	17 (1.2)	18 (1.3)	15 (1.1)	5 (0.4)	70 (4.9)
Herpes simplex	-	-	-	-	-	-
Herpes zoster	-	3 (0.2)	3 (0.2)	3 (0.2)	1 (0.1)	10 (0.7)
Varicella	4 (0.3)	6 (0.4)	12 (0.8)	5 (0.4)	2 (0.1)	29 (2.0)
Hand, foot, mouth disease	3 (0.2)	-	-	-	-	3 (0.2)
Molluscum Contagiosum	4 (0.3)	4 (0.3)	1 (0.1)	2 (0.1)	-	11 (0.8)
Verruca Vulgaris (HPV)	4 (0.3)	4 (0.3)	2 (0.1)	5 (0.4)	2 (0.1)	17 (1.2)
Bacterial Infection	11 (0.8)	32 (2.2)	27 (1.9)	25 (1.8)	12 (0.8)	107 (7.5)
Crusted Impetigo	2 (0.1)	14 (0.3)	7 (0.5)	4 (0.3)	5 (0.4)	32 (2.2)
Bullous Impetigo	-	3 (0.2)	3 (0.2)	2 (0.1)	5 (0.4)	13 (0.9)
Ecthyma	-	3 (0.2)	4 (0.3)	5 (0.4)	-	12 (0.8)
Folliculitis	2 (0.1)	1 (0.1)	2 (0.1)	2 (0.1)	-	7 (0.5)
Furuncle	6 (0.4)	10 (0.7)	6 (0.4)	6 (0.4)	-	28 (2.0)
Carbuncle	-	1 (0.1)	2 (0.1)	2 (0.1)	-	5 (0.4)
Erysipelas	-	-	-	4 (0.3)	-	4 (0.3)
Cellulitis	-	-	1 (0.1)	-	2 (0.1)	3 (0.2)
Leprosy	1 (0.1)	-	2 (0.1)	-	-	3 (0.2)

Table 2. Viral Skin Infection According to Age

Age group	Year					Total (%)
	2016 (%)	2017 (%)	2018 (%)	2019 (%)	2020 (%)	
0–1 month	-	-	-	-	-	-
1–24 months	-	-	-	-	-	-
2–12 years	11 (15.7)	8 (11.4)	10 (14.3)	6 (8.6)	1 (1.4)	36 (51.4)
>12 years	4 (5.7)	9 (12.9)	8 (11.4)	9 (12.9)	4 (5.7)	34 (48.6)

Table 3. Bacterial Skin Infection based on Age

Age group	Year					Total (%)
	2016 (%)	2017 (%)	2018 (%)	2019 (%)	2020 (%)	
0–1 month	1 (0.9)	-	-	-	-	1 (0.9)
1–24 months	2 (1.9)	1 (0.9)	4 (3.7)	3 (2.8)	4 (3.7)	14 (13.1)
2–12 years	6 (5.6)	27 (25.3)	17 (16.8)	11 (10.2)	5 (4.7)	66 (61.7)
>12 years	2 (1.9)	4 (3.7)	6 (5.6)	11 (10.3)	3 (2.8)	26 (24.3)

Table 4. Viral and Bacterial Skin Infection based on Sex

Sex	Year					Total (%)
	2016 (%)	2017 (%)	2018 (%)	2019 (%)	2020 (%)	
Viral						
Male	7 (10.0)	10 (14.3)	12 (17.1)	11 (15.7)	2 (2.9)	42 (60.0)
Female	8 (11.4)	7 (10.0)	6 (8.6)	4 (5.7)	3 (4.3)	28 (40.0)
Bacterial						
Male	9 (8.4)	17 (15.9)	14 (13.1)	18 (16.8)	6 (5.6)	64 (59.8)
Female	2 (1.9)	15 (14.0)	13 (12.1)	7 (6.5)	6 (5.6)	43 (40.2)

From 2016–2020, we observed that viral skin infection was more common amongst children in the \geq 13-year age group. Its occurrence tended to increase with age (Table 2). Most bacterial skin infection cases were observed in the 6–12 years age group (Table 3). In contrast to those of viral origin, the incidence of bacterial infection did not increase with age. In general, more viral and bacterial skin infections were observed in boys than in girls (Table 4).

DISCUSSION

In this study, we found that viral and bacterial infections were 4.9% and 7.9%, respectively. Our finding showed a different result compared to previous studies. Those studies reported that skin infection was the most common skin disease in the pediatric population.^{13,14} Based on previous evidence, misdiagnosis is a common phenomenon in pediatric skin disease. Multiple skin conditions can make the diagnosis more complex; hence, several conditions tend to be missed in diagnosis.^{15,16}

Skin infections, be they viral or bacterial in origin, were more commonly found in boys than girls. A previous epidemiological study implied that no viral nor bacterial skin infection was associated with the patient's sex.¹⁷ However, evidence from other studies stated that sex influences immune response against infection, including viruses and bacteria.^{18–20} A study done in pediatric atopic dermatitis patients with secondary infection also reported that the disease affect males more commonly than their female counterparts.²¹

Testosterone, estradiol, and progesterone play a role in immune modulation. They affect many cells, including dendritics, macrophages, and lymphocytes.¹⁸ Testosterone is known for its immunosuppressive effect that could decrease interferon- γ level (IFN- γ). On the contrary, estradiol can boost T-helper 1 (Th1) immunity.²⁰

The TH1 cells reinforce and promote inflammatory responses against infection by several means. First, they express IFN- γ , a cytokine that activates macrophages, cluster differentiation 8+ (CD8+) T cells, and natural killer (NK) cells. Once

activated, these cells act as an immune effectors.²² Th1 cells also express interleukin-2 (IL-2) to promote B cells into producing antibodies.^{23,24}

Th1 also express chemokine molecule such as C-C chemokine receptor type 5 (CCR5) and C-X-C Motif Chemokine Receptor 3 (CXCR3).²⁵ Chemokine receptors are essential in immune response as they play a role in leukocyte migration into the inflammation or infection site.²⁶ Thus, the difference in the level of testosterone and estradiol between males and females could result in the predilection of infection among male subjects. Furthermore, gender and sex in the pediatric population also play a role in personal hygiene, a factor that plays a role in skin infection. Male is reported to have a low level of personal hygiene compared to female.²⁷

In our study, viral infection was most observed amongst subjects in the >12-year age group. For bacterial infection, the most common occurrence was amongst subjects in 2–12 years group. It is in accordance with a previous study that reported pediatric skin infections were most common amongst the 6–11-year and 12–16-year age groups.^{13,28} A prospective cohort study by Ahmadu et al. in children aged 5–13 years stated that 5–7-year age group is the age group with the worst personal hygiene, followed by children aged 8–10 years.²⁹ Personal hygiene is one of the factors of infectious disease and skin infection.^{30,31} Other than age, demographic and socioeconomic factors affect both personal hygiene behavior and skin infection occurrence.^{2,32}

In conclusion, the prevalence of skin infection in Dr. Harjono S. Ponorogo General Hospital is lower compared to other studies. Varicella was the most common viral infection, and crusted impetigo was the most common presentation of bacterial infection. Skin infection of viral origin was most reported in children aged >12 years, and bacterial infection in children aged 2–12. Both viral and bacterial skin infections were more commonly observed in boys than girls. This study has limitations in terms of data collection and study design. A larger scale study is needed to confirm our findings.

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