
Clinical Characteristics And Inflammatory Biomarkers Of Hospitalized Children With Hand, Foot, And Mouth Disease: A Case Series

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Abstract

Hand, foot, and mouth disease (HFMD) is an acute viral infection that commonly affects young children. Although the disease is usually self-limiting, some patients require hospitalization due to decreased oral intake and dehydration. Data on the clinical and laboratory characteristics of hospitalized HFMD patients remain limited. This retrospective case series analyzed medical records of pediatric HFMD patients hospitalized at RSU An Ni'mah Wangon Banyumas from January 2024 to November 2025. Demographic characteristics, clinical manifestations, length of stay, and laboratory findings were collected. Inflammatory biomarkers including neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR) were calculated. Data were analyzed descriptively. A total of 11 patients were included with a median age of 33 months (range 16–121 months). Most patients were younger than 36 months (63.6%), and 72.7% were female. The median length of hospital stay was 4 days (range 2–8 days). All patients presented with fever and oral lesions, while hand and foot lesions were observed in 81.8% and 90.9% of cases. Gastrointestinal symptoms were present in several patients. Laboratory findings were generally within normal ranges, with a median NLR of 2.76 and PLR of 160. One patient had dengue coinfection. Hospitalized HFMD patients commonly present with typical clinical features and favorable outcomes with supportive treatment. Inflammatory biomarkers such as NLR and PLR may reflect the inflammatory response in HFMD.

Keywords: Hand, Foot, And Mouth Disease, Children, Inflammatory Biomarkers, NLR, PLR.

INTRODUCTION

Hand, foot, and mouth disease (HFMD) is an acute viral infection that primarily affects young children and is caused by enteroviruses from the Picornaviridae family, most commonly Enterovirus A71 and Coxsackievirus A16. The disease is characterized by fever followed by vesicular or maculopapular lesions on the oral mucosa, palms, and soles. Although most cases are mild and self-limiting, HFMD remains an important public health concern due to its potential to cause outbreaks among children (Guerra et al., 2023; Zhu et al., 2023)

Epidemiologically, HFMD occurs most frequently in children under five years of age. This susceptibility is associated with an immature immune system and frequent close contact among children in this age group. Epidemiological studies have shown that toddlers have the highest risk of enterovirus infection leading to HFMD (Yuan et al., 2024). In addition to the typical mucocutaneous manifestations, some patients may develop gastrointestinal symptoms and reduced oral intake due to pain from oral lesions, which in certain cases may lead to dehydration and require hospitalization (Zhu et al., 2023).

Laboratory findings in HFMD are generally nonspecific. However, several studies have suggested that simple inflammatory biomarkers such as the neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR) may reflect the inflammatory response in viral infections and may be associated with disease severity (Li et al., 2020). Nevertheless, data describing the clinical characteristics and laboratory parameters of hospitalized HFMD patients remain limited. Therefore, this study aimed to describe the clinical characteristics, laboratory findings, and inflammatory biomarkers in pediatric patients with HFMD who required hospitalization.

RESEARCH METHODS

This study was a retrospective descriptive case series conducted at RSU An Ni'mah Wangon Banyumas using medical records of patients hospitalized between January 2024 and November 2025. The study population included all pediatric patients diagnosed with Hand, Foot, and Mouth Disease who were admitted during the study period. Total sampling was applied. The inclusion criteria were pediatric patients with a clinical diagnosis of Hand, Foot, and Mouth Disease who were hospitalized and had complete medical records. Patients with incomplete medical records were excluded from the study.

Data collected included demographic characteristics, clinical manifestations, length of hospital stay, and laboratory findings. Demographic characteristics included age and sex. Clinical manifestations included fever, oral lesions, lesions on the hands and feet, gastrointestinal symptoms, and history of contact with similar cases. Length of hospital stay was calculated based on the number of days from admission to discharge.

Laboratory parameters analyzed included hemoglobin, leukocyte count, platelet count, lymphocyte percentage, absolute lymphocyte count, and absolute granulocyte count. Inflammatory biomarkers were calculated using the neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR). NLR was calculated by dividing the absolute granulocyte count by the absolute lymphocyte count, while PLR was calculated by dividing the platelet count by the absolute lymphocyte count. Data were analyzed descriptively. Categorical variables were presented as frequencies and percentages, while numerical variables were presented as median and range.

RESULTS AND DISCUSSION

Results

A total of 11 pediatric patients diagnosed with Hand, Foot, and Mouth Disease were hospitalized during the study period. The median age of the patients was 33 months, with a range of 16 to 121 months. Most patients were younger than 36 months (7 patients, 63.6%). Based on sex, the majority of patients were female (8 patients, 72.7%), while 3 patients were male (27.3%). The length of hospital stay ranged from 2 to 8 days, with a median of 4 days. The demographic and baseline clinical characteristics of the patients are presented in Table 1.

Table 1. Baseline characteristics of patients

Characteristic	n (%)
Sex	Male 3 (27.3%)
	Female 8 (72.7%)
Age group 33 (16–121)	<36 months 7 (63.6%)
	≥36 months 4 (36.4%)
Condition at admission to the hospital	Emergency 7 (63.6%)
	Non-emergency 4 (36.4%)
Length of Stay, day	4 (2–8)
Day of fever at admission	1 (1–8)

All patients presented with fever and oral lesions. Hand lesions were observed in 9 patients (81.8%), while foot lesions were found in 10 patients (90.9%). Gastrointestinal symptoms were also reported in several patients, including nausea in 6 patients (54.5%), vomiting in 3 patients (27.3%), abdominal pain in 2 patients (18.2%), and diarrhea in 3 patients (27.3%). All patients (11 patients, 100%) experienced decreased oral intake and weakness at admission. A history of contact with similar cases was identified in 1 patient (9.1%). The median day of fever at hospital presentation was day 1, with a range of 1 to 8 days. The distribution of clinical manifestations is presented in Table 2.

Representative clinical manifestations, including oral ulcers and palmoplantar lesions, are shown in Figure 1.

Table 2. Clinical manifestations of HFMD patients

Clinical Manifestations	n (%)
Fever	11 (100)
Oral ulcers	11 (100)
Hand lesions	9 (81.8)
Foot lesions	10 (90.9)
Nausea	6 (54.5)
Vomiting	3 (27.3)
Abdominal pain	2 (18.2)
Diarrhea	3 (27.3)
Cough	1 (9.1)
Low intake	11 (100)
Weakness	11 (100)
History of contact	1 (9.1)



Figure 1. Clinical manifestations of hand, foot, and mouth disease. (a) Vesicular lesion on the tongue. (b) Maculopapular lesions on the palm. (c) Papulovesicular lesions on the plantar surface of the foot.

Laboratory examination showed that hemoglobin levels ranged from 10.3 to 14.3 g/dL, with a median of 12.2 g/dL. Leukocyte counts ranged from 5.8 to 12.1 $\times 10^3/\mu\text{L}$, with a median of 10.0 $\times 10^3/\mu\text{L}$. Platelet counts ranged from 184 to 340 $\times 10^3/\mu\text{L}$, with a median of 284 $\times 10^3/\mu\text{L}$. Lymphocyte percentages ranged from 11.7% to 59.6%, with a median of 24.5%. Analysis of inflammatory biomarkers showed that the neutrophil-to-lymphocyte ratio (NLR) ranged from 0.51 to 6.55, with a median of 2.76, while the platelet-to-lymphocyte ratio (PLR) ranged from 36 to 219, with a median of 160. The hematological characteristics of the patients are presented in Table 3.

Table 3. Laboratory findings and inflammatory biomarkers

Parameter	Median (Range)
Hemoglobin (g/dL)	12.2 (10.3–14.3)
Leukocyte ($\times 10^3/\mu\text{L}$)	10.0 (5.8–12.1)
Platelet ($\times 10^3/\mu\text{L}$)	284 (184–340)
Lymphocyte (%)	24.5 (11.7–59.6)
Neutrophil (%)	72.54 \pm 8.99

NLR	2.76 (0.51–6.55)
PLR	160 (36–219)

Several patients had additional diagnoses during hospitalization, most commonly mild to moderate dehydration associated with decreased oral intake. In addition, one patient was identified with dengue fever coinfection without warning signs during hospitalization. The patient experienced persistent fever accompanied by a progressive decline in platelet and leukocyte counts, with a reactive NS1 antigen test on the third day of hospitalization. The patient was managed with intravenous hydration and supportive therapy. Changes in the patient’s hematological parameters during hospitalization are presented in Table 4.

Table 4. Hematological changes in the patient with HFMD and dengue coinfection

Day	Hb	Hct	Leukocyte	Platelet
Day 1	13.2	39	10.000	232.000
Day 3	13.0	38.9	3.000	148.000
Day 4	12.6	38.2	2.600	121.000
Day 5	12.8	38.4	4.300	108.000
Day 6	10.5	31.8	4.200	61.000
Recovery	13.0	37.5	6.300	167.000

Discussion

Hand, foot, and mouth disease (HFMD) is an acute viral infection caused by enteroviruses from the Picornaviridae family, most commonly Enterovirus A71 and Coxsackievirus A16. In recent years, Coxsackievirus A6 has also been increasingly reported as a cause of HFMD outbreaks in several Asian countries (Zhu et al., 2023). The disease mainly affects young children and can occur as sporadic cases or community outbreaks, particularly in the Asia–Pacific region where the disease burden is highest (Yuan et al., 2024).

In this study, most patients were younger than 36 months, with the youngest patient aged 16 months. This finding is consistent with previous studies conducted in several regions, including Shanghai, China (mean age <4.1 years with a median of 3 years during 2011–2021), Taiwan (mean age 2.1 years during 2013–2018), Hangzhou, and Singapore (children aged 3–3.9 years during 2016–2018) (Kua & Pang, 2020; J. Wang & Zhang, 2023; Y. Wang et al., 2020). The high incidence in this age group may be related to the immature immune system, limited hygiene awareness and practices, and increased exposure to enteroviruses in social environments such as daycare centers and preschool settings (J. Zhou et al., 2022). In contrast, the incidence of HFMD in infants younger than six months is relatively lower, possibly due to the protective effect of maternal antibodies during early life. Serological studies have shown that infants in the first year of life may still possess protective antibodies, including IgA, which provide partial protection against HFMD infection. As maternal antibodies gradually decline and the child’s immune system is not yet fully developed, susceptibility to HFMD increases in toddlers (Wu et al., 2025).

In this study, the proportion of HFMD cases was higher among females than males. This finding differs from several previous studies reporting that males have a higher risk of HFMD. Some studies suggest that boys tend to participate more frequently in outdoor activities, increasing their opportunities for exposure to viral sources (Guo et al., 2026; Zhao et al., 2025). However, Salsabila et al., (2024) reported no statistically significant association between sex and HFMD incidence. Similar findings were also reported by Kua & Pang, (2020) and Ang et al., (2011), indicating that HFMD occurrence may not significantly differ between males and females. These differences may be influenced by variations in behavioral patterns and environmental exposure among children in different settings.

Length of hospital stay is another important indicator in describing the clinical course of HFMD. In this case series, the length of hospitalization ranged from 2 to 8 days, with a median of 4 days. This finding is comparable with previous studies reporting relatively short hospitalization periods for

HFMD patients. Nhan et al., (2020) reported a median hospital stay of approximately 3 days, while Abdi et al., (2024) also found an average hospitalization duration of about 3 days. Another study by Zhou et al., (2024) reported a mean hospital stay of 5.2 days among hospitalized HFMD patients. Differences in hospitalization duration may be influenced by disease severity, clinical condition at admission, and management policies across healthcare facilities. In most cases, HFMD follows a mild and self-limiting course, and patients usually show clinical improvement within a few days.

In this study, all patients presented with fever and oral lesions, and most also had lesions on the hands and feet. These findings are consistent with the typical clinical presentation of HFMD, characterized by fever accompanied by vesicular or papulovesicular lesions on the oral mucosa and a rash on the hands and feet (Guerra et al., 2023; Herrera Ortiz et al., 2024). Oral lesions usually appear as vesicles that rupture and form shallow ulcers on the oral mucosa, particularly on the tongue, buccal mucosa, and soft palate (Guerra et al., 2023). In addition to mucocutaneous manifestations, several patients in this study also experienced gastrointestinal symptoms such as nausea, vomiting, abdominal pain, and diarrhea. Gastrointestinal manifestations in HFMD have also been reported in previous studies. (Cheng et al., 2022) reported that approximately 11.8% of HFMD patients experienced gastrointestinal symptoms such as vomiting and diarrhea during the acute phase of the disease. These symptoms may be associated with enterovirus replication in the gastrointestinal tract and the systemic inflammatory response during infection.

All patients in this study also experienced decreased oral intake and weakness at hospital admission. This condition may be associated with pain caused by oral lesions, which can lead to difficulty in eating and drinking in children (Niels, 2016). Stomatitis in HFMD can cause odynophagia, which limits oral intake and may result in dehydration, thereby requiring supportive management including fluid therapy (Guerra et al., 2023; Herrera Ortiz et al., 2024).

In this study, most hematological parameters were within relatively normal ranges with limited variation among patients. This finding is consistent with the nature of HFMD, which generally does not produce specific laboratory abnormalities, especially in mild to moderate cases. The analysis of inflammatory biomarkers showed a median NLR value of 2.76 and a median PLR value of 160. NLR is a marker of systemic inflammation derived from the ratio of neutrophils to lymphocytes and reflects the balance between inflammatory responses and immune regulation during infection (Li et al., 2020). Several studies have reported that elevated NLR values are associated with disease severity and mortality risk in severe HFMD cases. Platelets also play an important role in inflammatory processes through the release of inflammatory mediators and interactions with leukocytes at sites of inflammation. Miao et al., (2020) reported that platelet counts were associated with HFMD progression and may serve as a simple biomarker for monitoring disease progression. Other studies have also shown that platelet-related indices such as platelet count (PLT), platelet distribution width (PDW), and platelet-to-lymphocyte ratio (PLR) are associated with HFMD severity, particularly in cases with neurological complications (Cheng et al., 2026). However, in this study, NLR and PLR values were relatively low, which may reflect the predominantly mild to moderate disease severity without significant systemic complications.

An interesting finding in this study was the presence of one patient with coinfection of HFMD and dengue fever. Viral coinfections may occur in tropical regions where multiple viral infections are endemic. Dengue and HFMD share several early clinical manifestations, such as fever and malaise, which may create diagnostic challenges during the early phase of illness. Therefore, careful clinical evaluation and serial laboratory monitoring are important, particularly in patients with fever patterns that are inconsistent with the typical clinical course of HFMD, especially in areas with high dengue prevalence (Jagadishkumar et al., 2020; Mai Hong et al., 2017).

This study has several limitations. First, the sample size was relatively small because the study was conducted in a single healthcare center and included only hospitalized patients. Second, virological identification of enterovirus serotypes was not performed, so the specific etiological agents

of HFMD could not be determined. Nevertheless, this study provides an overview of the clinical characteristics, laboratory findings, and potential coinfections among hospitalized HFMD patients.

CONCLUSION

This study shows that most hospitalized pediatric patients with Hand, Foot, and Mouth Disease were younger than three years and presented with typical clinical manifestations, including fever, oral lesions, and lesions on the hands and feet. Most patients also experienced decreased oral intake due to painful oral lesions, which may lead to dehydration and require hospitalization. Laboratory findings were generally within normal ranges with limited variation among patients. Inflammatory biomarkers such as the Neutrophil-to-Lymphocyte Ratio (NLR) and Platelet-to-Lymphocyte Ratio (PLR) indicated mild to moderate inflammatory responses, consistent with the typically self-limiting clinical course of HFMD. One case of HFMD with dengue fever coinfection was also identified, highlighting the importance of careful clinical evaluation and laboratory monitoring in patients with atypical fever patterns. Overall, this study provides an overview of the clinical characteristics, laboratory findings, and inflammatory biomarkers in hospitalized HFMD patients, which may assist clinicians in improving the recognition and clinical assessment of this disease.

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