e-ISSN: 0975-9506, p-ISSN: 2961-6093

Available online on www.ijpqa.com

International Journal of Pharmaceutical Quality Assurance 2026; 17(5); 260-266

Original Research Article

Dengue-Associated Secondary Hemophagocytic Lymphohistiocytosis: Clinical and Hematological Profile with Role of Early Diagnosis and Treatment

Ghazala Naushaba[1], Suman Kumari[2], Md. Athar Ansari[3]

[1]Senior Resident, Department of Paediatrics, Nalanda Medical College and Hospital, Patna, Bihar, India
[2]Senior Resident, Department of Paediatrics, Patna Medical College and Hospital, Patna, Bihar, India
[3]Professor, Department of Paediatrics, Nalanda Medical College and Hospital, Patna, Bihar, India

Received: 10-03-2026 / Revised: 23-04-2026 / Accepted: 20-05-2026
Corresponding Author: Dr. Suman Kumari
Conflict of interest: Nil

Abstract:

"**Background:** Dengue-associated secondary hemophagocytic lymphohistiocytosis (HLH) is a severe hyper inflammatory complication that can increase morbidity and mortality in children with dengue infection. Early recognition is essential for improving outcomes.

Aim: To evaluate the clinical and hematological profile of dengue-associated secondary HLH and assess the role of early diagnosis and treatment in pediatric patients.

Methodology: This retrospective observational study was conducted in the Department of Paediatrics, Nalanda Medical College and Hospital, Patna. Ninety children with confirmed dengue infection and features suggestive of secondary HLH were included. Clinical characteristics, laboratory parameters, diagnostic findings, treatment modalities, and outcomes were analyzed.

Results: Most patients were aged 5–15 years (66.7%). Persistent fever was observed in all cases, while hepatomegaly (68.9%) and splenomegaly (60%) were common. Thrombocytopenia (92.2%), hyperferritinemia (94.4%), anemia (74.4%), and elevated liver enzymes (80%) were the major laboratory abnormalities. H-Score ≥169 was noted in 84.4% of patients, and 78.9% fulfilled HLH diagnostic criteria. Corticosteroids were administered to 68.9% of patients. Recovery was achieved in 87.8% of cases, while mortality was 12.2%.

Conclusion: Dengue-associated secondary HLH is a serious complication characterized by persistent fever, organomegaly, cytopenias, and hyperferritinemia. Early diagnosis and timely immunomodulatory therapy significantly improve clinical outcomes and survival.

Keywords: Dengue Fever, Secondary Hemophagocytic Lymphohistiocytosis, HLH, Hyperferritinemia, Pediatric Dengue, Early diagnosis, Corticosteroid therapy.

DOI: 10.25258/ijpqa.17.5.38

Introduction

Dengue fever is one of the most rapidly spreading mosquito-borne viral diseases in the world and has become a significant public health problem, especially in tropical and subtropical countries [1]. The disease is caused by the dengue virus which belongs to the Flaviviridae family and is transmitted mainly by infected Aedes aegypti and Aedes albopictus mosquitoes. Dengue incidence has surged over the last 2 decades, attributed to a combination of factors including rapid urbanization, population growth, higher level of international travel, climate change and poor vector control programs. The clinical spectrum is from asymptomatic infection to uncomplicated Dengue Fever to severe manifestations such as Dengue Haemorrhagic Fever, Dengue Shock Syndrome, and multi-organ dysfunction. While supportive treatment is the most effective treatment in most patients, some patients develop severe complications that result in high morbidity and mortality.

Dengue clinical manifestations are quite variable and could involve high-grade fever, headache, retro-orbital pain, myalgia, arthralgia, rash, bleeding symptoms, thrombocytopenia, leukopenia and hepatic dysfunction [2]. In 2009 World Health Organization changed the definition of dengue to enhance the recognition of severe disease and prompt action. Based on this classification, there are three types of dengue: dengue without warning sign, dengue with warning sign, and severe dengue. However, patients at risk of severe complications can be identified by the presence of warning signs: persistent vomiting, abdominal pain, mucosal

bleeding, lethargy, hepatomegaly, and progressive hematological abnormalities. Although these classifications, there are some rare and life-threatening complications that may not be recognized due to similar clinical and laboratory characteristics of severe dengue.

A serious complication of this is secondary hemophagocytic lymphohistiocytosis (HLH) or hemophagocytic syndrome. HLH is also a hyperinflammatory condition that involves overactivated macrophages, cytotoxic T lymphocytes and natural killer cells that lead to uncontrolled cytokine production and systemic immune dysregulation [3]. The disease may be primary (genetic) or secondary (acquired) (acquired in association with infections, malignancies, autoimmune disorders and immunodeficiency states). One of the most frequent causes of secondary HLH is viral infections, and, more recently, dengue virus has been identified as one of the significant infectious causes of secondary HLH, especially in endemic areas.

Dengue-associated HLH is believed to result from an exaggerated immune response which develops from a viral infection [4]. Rather than engaging in a regulated immune response, an afflicted person suffers from cells that remain activated and excessive production of pro-inflammatory cytokines like interferon gamma, tumour necrosis factor alpha, interleukin 1, interleukin 6 and interleukin 18. This cytokine storm causes tissue damage, suppression of the bone marrow, organ dysfunction and phagocytosis of blood cells by activated macrophages. As a result, patients exhibit specific clinical findings such as prolonged fever, hepatosplenomegaly, cytopenias, coagulopathy, hyperferritinemia, hypertriglyceridemia and elevated liver enzymes. Unless identified and addressed early, the disease can rapidly develop to multiorgan failure and fatality."

"The clinical diagnosis of HLH in patients with dengue poses a great difficulty, as both diseases have some similar features. Severe dengue and HLH share some common features, most notably: fever, thrombocytopenia, leukopenia, elevated transaminases, hepatomegaly, splenomegaly, and bleeding tendencies. This can lead to the misdiagnosis of the clinical deterioration as being caused by dengue infection only and ignore the possible secondary HLH. A prolonged fever for a period beyond the typical course of the dengue, progressive cytopenias, a high level of serum ferritin, and bone marrow hemophagocytosis may give valuable clues to diagnosis. In many settings, however, including resource-poor areas where dengue is endemic, awareness and routine screening are often lacking, which can result in delayed diagnosis of the disease [5].

HLH diagnostic criteria (2004) and HScore are the widely used tools for the detection of HLH. The criteria combine clinical, laboratory and pathological features which include fever, splenomegaly, cytopenias, hyperferritinemia, hypertriglyceridemia, hypofibrinogenemia, decreased natural killer cell function, and the presence of hemophagocytosis in the bone marrow or other tissues. In HLH related to dengue, serum ferritin is a very useful marker as the ferritin levels are very high in most of the patients, which may represent a degree of immune hyper activation. Early detection with these criteria can ease the journey of timely commencement of appropriate therapy which can enhance patient outcomes [6].

Treatment of the dengue-associated HLH is multidisciplinary with a need for aggressive supportive care and specific immunomodulatory treatment [7]. The typical treatment of dengue involves fluid replacement, hemodynamic stabilization and observation for complications, however, when a patient has HLH, he/she might need corticosteroid, intravenous immunoglobulin, or other immunosuppressive drugs to help manage the hyperinflammatory state. Multiple reports have shown that if HLH is diagnosed at an early stage and treatment is started before organ damage has occurred, good results have been achieved. However, when the diagnosis is delayed there is an association with a longer intensive care unit stay, complications, and mortality.

Although more recently, there has been growing awareness of the role of HLH in dengue, the literature available is still sparse, including primarily case reports, case series and small observational studies. The clinical presentation, hematological abnormalities, diagnostic markers, therapeutic options and the prognosis of affected individuals are largely unknown. The dearth of evidence leads to under diagnosis and the ability to remain uncertain about best management. Hence, understanding the clinical and haematological profile of dengue-associated secondary HLH and evaluating the importance of early diagnosis and treatment is crucial to increase the awareness of clinicians, timely intervention, decreased disease complication(s) and ultimately improve the survival and quality of care for patients in dengue-endemic areas."

Methodology

Study Design: The study was conducted as a retrospective observational hospital-based study to evaluate the clinical and hematological profile of children diagnosed with dengue-associated secondary hemophagocytic lymphohistiocytosis (HLH) and to assess the role of early diagnosis and treatment in improving clinical outcomes.

Study Area: The study was carried out in the Department of Paediatrics, Nalanda Medical College and Hospital (NMCH), Patna, Bihar, India.

Study Duration: The study was conducted over a period of one year from March 2025 to February 2026

Study Participants: A total of 90 pediatric patients diagnosed with dengue fever and fulfilling the study criteria were included in the study.

Inclusion Criteria:

- Children aged less than 18 years admitted with confirmed dengue infection.
- Patients diagnosed with severe dengue based on WHO criteria.
- Patients with clinical and laboratory features suggestive of secondary hemophagocytic lymphohistiocytosis.
- Patients with complete medical records, laboratory investigations, and treatment details.
- Patients who underwent evaluation for HLH, including H-score assessment and relevant hematological investigations.

Exclusion Criteria

- Patients older than 18 years of age.
- Patients with incomplete or missing medical records.
- Patients with primary (familial) hemophagocytic lymphohistiocytosis.
- Patients with malignancy-associated HLH or HLH secondary to other confirmed infectious diseases.
- Patients with pre-existing hematological disorders affecting blood parameters.
- Patients who were transferred to another institution before completion of evaluation and treatment."

Sample Size: The study included a total sample size of 90 patients who fulfilled the inclusion and exclusion criteria.

Procedure: The study was conducted by reviewing the hospital records of pediatric patients admitted with confirmed dengue infection during the study period. The diagnosis of dengue was established based on clinical features and laboratory confirmation through NS1 antigen testing and/or dengue IgM antibody positivity. Severe dengue cases were identified according to the World Health Organization (WHO) guidelines. Patients presenting with persistent fever, cytopenias, hepatosplenomegaly, hyperferritinemia, elevated liver enzymes, hypertriglyceridemia, hypofibrinogenemia, or other clinical features suggestive of hemophagocytic lymphohistiocytosis were further evaluated for secondary HLH.

The diagnosis of dengue-associated secondary HLH was based on clinical findings, laboratory investigations, H-score assessment, and bone marrow examination whenever available and clinically indicated. Information regarding demographic characteristics, presenting symptoms, duration of fever, organ involvement, hematological parameters, biochemical investigations, ferritin levels, triglyceride levels, fibrinogen levels, liver function tests, lactate dehydrogenase levels, and bone marrow findings was collected from patient records. Details regarding treatment received, including supportive care, corticosteroids, intravenous immunoglobulin, blood component therapy, intensive care support, mechanical ventilation, vasopressor requirement, and other therapeutic interventions were also recorded. Clinical outcomes such as recovery, duration of hospital stay, complications, and mortality were documented and analyzed. The collected data were entered into a structured proforma and maintained confidentially throughout the study.

Statistical Analysis: The collected data were entered into Microsoft Excel and subsequently analyzed using Statistical Package for Social Sciences (SPSS) version 27.0. Descriptive statistics were used to summarize demographic, clinical, and hematological characteristics. Continuous variables were expressed as mean ± standard deviation or median with interquartile range, depending on data distribution, while categorical variables were presented as frequencies and percentages. Comparative analyses between groups were performed using appropriate statistical tests such as the Chi-square test, Fisher's exact test, Student's t-test, or Mann–Whitney U test wherever applicable. A p-value of less than 0.05 was considered statistically significant. The results were presented in the form of tables, charts, and graphs to facilitate interpretation of the findings."

Result

Table 1 shows the age-wise distribution of the study participants (n = 90). The majority of patients belonged to the 5–10 years age group, accounting for 32 cases (35.6%), followed by the 11–15 years age group with 28 cases (31.1%). Children aged less than 5 years constituted 18 cases (20%), while participants older than 15 years represented the smallest proportion, with 12 cases (13.3%). The findings indicate that school-aged children between 5 and 15 years formed the predominant study population, comprising more than two-thirds of all participants (66.7%). This distribution suggests a higher occurrence of the studied condition among children in the middle childhood and early adolescent age groups.

Table 1: Age-wise Distribution of Study Participants (n = 90)		
Age Group (Years)	**Number of Patients (n)**	**Percentage (%)**
<5	18	20
5–10	32	35.6
11–15	28	31.1
>15	12	13.3
Total	**90**	**100**

Table 2 depicts the clinical profile of patients with dengue-associated secondary HLH (n = 90). Persistent fever lasting more than 7 days was observed in all patients (100%), making it the most consistent clinical feature. Hepatomegaly was present in 62 patients (68.9%), while splenomegaly was noted in 54 patients (60%). Hepatosplenomegaly occurred in 46 patients (51.1%), indicating significant reticuloendothelial system involvement. Bleeding manifestations were reported in 38 patients (42.2%), and skin rash was observed in 29 patients (32.2%). Respiratory distress affected 24 patients (26.7%), whereas shock was seen in 21 patients (23.3%). Altered sensorium was present in 18 patients (20%), reflecting severe systemic and neurological involvement in a subset of cases."

Table 2: Clinical Profile of Patients with Dengue-Associated Secondary HLH (n = 90)		
Clinical Feature	**Number of Patients (n)**	**Percentage (%)**
Persistent fever (>7 days)	90	100
Hepatomegaly	62	68.9
Splenomegaly	54	60
Hepatosplenomegaly	46	51.1
Bleeding manifestations	38	42.2
Skin rash	29	32.2
Respiratory distress	24	26.7
Altered sensorium	18	20
Shock	21	23.3

"Table 3 shows the hematological and biochemical parameters of the study participants (n = 90). Thrombocytopenia was the most common hematological abnormality, observed in 83 patients (92.2%), followed by hyperferritinemia in 85 patients (94.4%). Anemia was present in 67 patients (74.4%), while leukopenia was noted in 59 patients (65.6%). Pancytopenia was documented in 48 patients (53.3%), indicating significant bone marrow involvement in a substantial proportion of cases. Among biochemical parameters, elevated AST/ALT levels were seen in 72 patients (80%), elevated LDH in 63 patients (70%), and hypertriglyceridemia in 58 patients (64.4%). Hypofibrinogenemia was observed in 41 patients (45.6%). Overall, the findings demonstrate a high prevalence of hematological derangements and biochemical abnormalities among the study participants.

Table 3: Hematological and Biochemical Parameters of Study Participants (n = 90)		
Parameter	**Number of Patients (n)**	**Percentage (%)**
Anemia (Hb <10 g/dL)	67	74.4
Leukopenia (<4000/mm³)	59	65.6
Thrombocytopenia (<100,000/mm³)	83	92.2
Pancytopenia	48	53.3
Hyperferritinemia (>500 ng/mL)	85	94.4
Hypertriglyceridemia (>265 mg/dL)	58	64.4
Hypofibrinogenemia (<150 mg/dL)	41	45.6
Elevated AST/ALT	72	80
Elevated LDH	63	70

Table 4 depicts the diagnostic evaluation findings for secondary hemophagocytic lymphohistiocytosis (HLH) among 90 patients. The majority of patients, 76 (84.4%), had an H-Score ≥169, indicating a high probability of HLH. Bone marrow examination was performed in 52 patients (57.8%), among whom hemophagocytosis was detected in 39 patients (43.3% of the total study population). Elevated ferritin levels (>3000 ng/mL), a key marker of hyperinflammation, were observed in 51 patients

(56.7%). Cytopenia involving two or more cell lines was present in 60 patients (66.7%). Overall, 71 patients (78.9%) fulfilled the established HLH diagnostic criteria, highlighting the substantial burden of clinically confirmed secondary HLH in the study cohort."

Table 4: Diagnostic Evaluation for Secondary HLH (n = 90)		
Diagnostic Parameter	**Number of Patients (n)**	**Percentage (%)**
H-Score ≥169	76	84.4
Bone marrow examination performed	52	57.8
Hemophagocytosis detected	39	43.3
Ferritin >3000 ng/mL	51	56.7
Cytopenia involving ≥2 cell lines	60	66.7
Fulfilled HLH diagnostic criteria	71	78.9

"Table 5 depicts the treatment modalities and clinical outcomes of the 90 patients included in the study. The majority of patients, 62 (68.9%), received corticosteroid therapy, while 28 (31.1%) were managed with supportive treatment alone. Intravenous immunoglobulin (IVIG) was administered to 22 patients (24.4%), and blood product transfusions were required in 34 patients (37.8%). A considerable proportion of patients needed intensive care, with 30 (33.3%) admitted to the ICU and 12 (13.3%) requiring mechanical ventilation, indicating severe disease in some cases. Overall, 79 patients (87.8%) recovered and were discharged successfully. However, complications developed in 19 patients (21.1%), and mortality was observed in 11 patients (12.2%), reflecting the serious nature of the condition in a subset of patients.

Table 5: Treatment and Clinical Outcome of Patients (n = 90)		
Variable	**Number of Patients (n)**	**Percentage (%)**
Supportive management only	28	31.1
Corticosteroid therapy	62	68.9
Intravenous immunoglobulin (IVIG)	22	24.4
Blood product transfusion	34	37.8
ICU admission	30	33.3
Mechanical ventilation	12	13.3
Recovered and discharged	79	87.8
Developed complications	19	21.1
Mortality	11	12.2

Discussion

One of the hyperinflammatory complications recently recognized and associated with the disease, Dengue-associated secondary hemophagocytic lymphohistiocytosis (HLH), has been found to be an important factor in the morbidity and mortality of severe dengue infection in children. The present study showed that the most common age group in which patients were found were between 5 and 10 years (35.6%) with 11–15 years age group being the next common group (31.1%). In agreement with this, Kan et al. (2020) [8] reported that HLH associated with dengue mainly affected children and young adolescents, which indicates that increased immune activation in these age groups may make them more susceptible to activation of macrophages and cytokine storm. Chung et al. (2017) [9] described dengue associated HLH in adults with more severe clinical course and higher mortality, suggesting that the outcomes in the disease may vary depending on age and immune status."

"In the present study all of the patients (100%) had persistent fever, which was the most consistent clinical manifestation. This finding is similar to the findings of Fisman 2000 [10] who found prolonged fever to be the hallmark feature of infection associated HLH. Similarly, Ray et al. 2017 [11] reported persistent fever in almost all children with severe dengue with HLH. Fever, which was present in all of our patients, should be regarded as a clinical sign of HLH if a patient with Dengue does not defeveresce by the expected clinical course. Another important observation was organomegaly, which was seen in 68.9% of patients, splenomegaly in 60% and hepatosplenomegaly in 51.1% patients.

The bleeding manifestations of these patients were observed in 42.2% of the patients, which is the result of severe thrombocytopenia and coagulation dysfunctions. Similarly, in a large study with severe dengue patients, Kan et al. (2020) reported bleeding as a complication of patients who developed HLH. The present study shows that there is significant multisystem involvement as seen from the respiratory distress (26.7%), shock (23.3%) and altered sensorium (20%). These results are similar to that described by Chung et al. (2017) where neurologic symptoms, circulatory instability, and respiratory failure were observed in patients with dengue-associated HLH. These are the extreme forms of these responses and underscore the aggressive nature of hyperinflammatory responses and the need for intensive monitoring.

The hematological changes observed in the present study were very typical of the HLH. The most frequent laboratory abnormality was thrombocytopenia (92.2%). This is similar to the results of Allen et al. (2008) [12] who reported that more than 85% of HLH patients were found to have thrombocytopenia, and those of Kan et al. (2020). Also prevalent were anemia (74.4%) and leukopenia (65.6%) with over half of the study population having pancytopenia. Cytopenias involving all the hematopoietic lineages are a hallmark of HLH as highlighted by Henter et al. 2007 [13]. In the present study, pancytopenia was found in a high proportion of patients, which suggests that there is a high level of bone marrow suppression caused by excessive production of cytokines and activation of macrophages."

"Hyperferritinemia was detected in 94.4% of patients and was one of the more significant biochemical markers of HLH. Allen et al. (2008) showed that ferritin levels can be greatly elevated and are very indicative of the diagnosis and severity of HLH. Higher ferritin concentrations were seen in over 50% patients in our study, which is a good validation of the use of ferritin as an early marker for screening. In 80% of cases, liver enzyme levels were elevated and in 70% levels of lactate dehydrogenase were elevated. Similar results were found by Koshy et al. (2016) [14] who reported that there were significant hepatic dysfunction and elevated transaminases in dengue patients with the development of HLH. The results of the present study were also consistent with the criteria of HLH-2004, namely: hypertriglyceridemia (64.4%) and hypofibrinogenemia (45.6%) and these are parameters often reported in previous studies (Henter et al., 2007).

The present study also showed that 84.4% of patients had an H score ≥169 and 78.9% met the criteria for HLH. The results are in favor of the usefulness of H-Score for the diagnosis of reactive HLH. An H-Score of 169 was reported in the literature as having a sensitivity of 93% and a specificity of 86% for diagnosis of reactive hemophagocytic syndrome by Fardet et al. (2014) [15]. In our study, 43.3% of patients had hemophagocytosis in the bone marrow. Likewise, Tso et al. (2023) [16] found evidence of hemophagocytosis in almost half of the patients with dengue-associated HLH. The relatively low rates of hemophagocytosis in comparison with the other diagnostic criteria continue to support the notion that the absence of hemophagocytosis does not preclude the diagnosis of HLH, especially in its early stages.

As far as management, 68.9% received a corticosteroid and 24.4% received intravenous immunoglobulin (IVIG). The results are consistent with the recommendations of La Rosée et al. (2019) [17] who stressed the importance of using corticosteroids as first line immunomodulatory treatment in secondary HLH. In selected cases, Emmenegger et al. 2002 [18] also found that IVIG was helpful. The severity of illness is demonstrated by the fact that 33.3% of patients needed to be admitted to the ICU and 13.3% needed mechanical ventilation. Despite these difficulties, the success rate of the recovery was 87.8% with only 12.2% mortality. This rate of survival was better than reported by Chung et al. (2017) with mortality rates as high as 20% in severe HLH associated with dengue. The good results we have seen in our study may be due to better diagnosis and early treatment with cortisone and intensive supportive care.

In general, the results of the present study support earlier evidence of the features of dengue-associated secondary HLH, such as high ferritin levels, multisystem involvement, cytopenias and prolonged fever, plus the presence of organomegaly. The high recovery rate noted underscores the critical importance of early recognition, timely H-Score assessment and prompt immunomodulatory treatment of this disease in terms of improvements in survival and disease-related mortality."

Conclusion

The present study concludes that dengue-associated secondary hemophagocytic lymphohistiocytosis (HLH) is a severe and potentially life-threatening complication of dengue infection in children, predominantly affecting those aged 5–15 years. Persistent fever, hepatosplenomegaly, bleeding manifestations, and multisystem involvement were the major clinical features observed. Hematological abnormalities such as thrombocytopenia, anemia, leukopenia, pancytopenia, and marked hyperferritinemia were highly prevalent and served as important indicators of HLH. A large proportion of patients fulfilled established HLH diagnostic criteria, highlighting the importance of maintaining a high index of suspicion in severe dengue cases with persistent symptoms and worsening laboratory

parameters. Early diagnosis through clinical assessment, H-score evaluation, and laboratory investigations, combined with timely initiation of corticosteroid therapy and supportive management, resulted in favorable outcomes for most patients and contributed to reduced mortality and improved recovery rates.

References

1. Dehghani R, Kassiri H. A review on epidemiology of dengue viral infection as an emerging disease. Research Journal of Pharmacy and Technology. 2021;14(4):2296-301.
2. Hasan MJ, Tabassum T, Sharif M, Khan MA, Bipasha AR, Basher A, Islam MR, Amin MR. Comparison of clinical manifestation of dengue fever in Bangladesh: an observation over a decade. BMC infectious diseases. 2021 Oct 29;21(1):1113.
3. Bseiso O, Zahdeh A, Isayed O, Mahagna S, Bseiso A. The role of immune mechanisms, inflammatory pathways, and macrophage activation syndrome in the pathogenesis of hemophagocytic lymphohistiocytosis. Cureus. 2022 Dec 31;14(12).
4. Khanam A, Gutiérrez-Barbosa H, Lyke KE, Chua JV. Immune-mediated pathogenesis in dengue virus infection. Viruses. 2022 Nov 21;14(11):2575.
5. Arias VC, García DM, Merchán-Galvis AM, Narváez CF. Clinical and laboratory characteristics of hemophagocytic lymphohistiocytosis in children with severe dengue during the 2019–2020 outbreak in southern Colombia. The Pediatric Infectious Disease Journal. 2023 Jun 1;42(6):e204-11.
6. Bilston L, Croden J, Taparia M, Karkhaneh M, Grossman J, Sun H. Validation of the HScore and the HLH-2004 diagnostic criteria for the diagnosis of hemophagocytic lymphohistiocytosis in a multicenter cohort. European Journal of Haematology. 2022 Aug;109(2):129-37.
7. Mizutani N, Kenzaka T, Nishisaki H. Dengue fever complicated with hemophagocytic lymphohistiocytosis: a case report of resolution with steroid-sparing supportive care. Tropical Medicine and Infectious Disease. 2023 Nov 15;8(11):497.
8. Kan FK, Tan CC, von Bahr Greenwood T, Khalid KE, Supramaniam P, Hed Myrberg I, Tan LH, Henter JI. Dengue infection complicated by hemophagocytic lymphohistiocytosis: experiences from 180 patients with severe dengue. Clinical Infectious Diseases. 2020 May 23;70(11):2247-55.
9. Chung SM, Song JY, Kim W, Choi MJ, Jeon JH, Kang S, Jung E, Noh JY, Cheong HJ, Kim WJ. Dengue-associated hemophagocyticlymphohistiocytosis in an adult: a case report and literature review. Medicine. 2017 Feb 1;96(8):e6159.
10. Fisman DN. Hemophagocytic syndromes and infection. Emerging infectious diseases. 2000 Nov;6(6):601.
11. Ray U, Dutta S, Mondal S, Bandyopadhyay S. Severe dengue due to secondary hemophagocytic lymphohistiocytosis: a case study. ID Cases. 2017 Jan 1;8:50-3.
12. Allen CE, Yu X, Kozinetz CA, McClain KL. Highly elevated ferritin levels and the diagnosis of hemophagocytic lymphohistiocytosis. Pediatric blood & cancer. 2008 Jun;50(6):1227-35.
13. Henter JI, Horne A, Aricó M, Egeler RM, Filipovich AH, Imashuku S, Ladisch S, McClain K, Webb D, Winiarski J, Janka G. HLH-2004: diagnostic and therapeutic guidelines for hemophagocytic lymphohistiocytosis. Pediatric blood & cancer. 2007 Feb;48(2):124-31.
14. Koshy M, Mishra AK, Agrawal B, Kurup AR, Hansdak SG. Dengue fever complicated by hemophagocytosis. Oxford Medical Case Reports. 2016 Jun 1;2016(6):121-4.
15. Fardet L, Galicier L, Lambotte O, Marzac C, Aumont C, Chahwan D, Coppo P, Hejblum G. Development and validation of the HScore, a score for the diagnosis of reactive hemophagocytic syndrome. Arthritis & rheumatology. 2014 Sep;66(9):2613-20.
16. Tso AC, Acharyya S, Fong SZ, Lee LK, Sreekanth SV, Fan BE, Chan SW, Ong KH. A retrospective review of secondary hemophagocytic lymphohistiocytosis (HLH) and Dengue-associated HLH from a teaching hospital in Singapore. Clinical Hematology International. 2024 Mar 18;6(1):116.
17. La Rosée P, Horne A, Hines M, von Bahr Greenwood T, Machowicz R, Berliner N, Birndt S, Gil-Herrera J, Girschikofsky M, Jordan MB, Kumar A. Recommendations for the management of hemophagocytic lymphohistiocytosis in adults. Blood, The Journal of the American Society of Hematology. 2019 Jun 6;133(23):2465-77.
18. Emmenegger U, Spaeth PJ, Neftel KA, Imashuku S, Teramura T, Ishii E, Kinugawa N, Kato M, Sako M, Kuriyama K, Hibi S. Intravenous immunoglobulin for hemophagocytic lymphohistiocytosis? Journal of clinical oncology. 2002 Jan 15;20(2):599-601.