

5.2 Markers of endothelial injury and vascular permeability

Severe dengue fever is mainly based on impaired vascular endothelial function. Relevant biomarkers have been widely used in clinical risk assessment. Among them, the applications of sICAM-1 and Ang-2 are relatively mature. Elevated levels of sICAM-1 indicate an increased risk of plasma extravasation or shock (McBride et al., 2024). In patients with dengue shock, Ang-2 has a closer relationship with pulmonary leakage and the risk of death, and has a higher predictive effect on disease progression. Elevated sICAM-1 and VCAM-1 mainly reflect that endothelial cells are in an activated state and are also related to the aggravation of the disease (Sivasubramanian et al., 2022; Yang et al., 2025).

5.3 New multi-group student physical markers

The development of multi-omics technology has provided more ideas for finding new markers and understanding the mechanism of immune storm. Transcriptomic studies have identified some gene expression characteristics related to severe illness, such as elevated MX2 in B cells and elevated CD163 in monocytes. These changes may occur before severe illness and can be used for early prediction (Zhang et al., 2023). Proteomics and metabolomics have also identified many candidate molecules that can reflect the host response intensity and immune activation level (Vairaperumal et al., 2025).

Indicators such as thrombin and sFIt-1 are often used to evaluate the degree of endothelial injury and abnormal coagulation function in critically ill patients. Standardized testing helps to identify high-risk groups at an early stage and guide targeted treatment and intervention. However, the current detection standards are not uniform. Personal factors such as age and underlying diseases may affect the stability and credibility of the results (McBride et al., 2024; Yang et al., 2025; Paul et al., 2025).

Molecules such as miRNAs and lncRNAs have great potential in regulating immune responses. For example, miR-584-5p in the blood can distinguish severe and non-severe dengue fever patients quite well. Some studies have shown that its discriminative ability (AUC) can exceed 0.8 (Katz et al., 2025). This type of new biomarker is expected to be used in clinical practice in the future, but it still needs to be further verified in different populations and the detection methods and determination criteria should be unified (Limothai et al., 2022; Paul et al., 2025).

6 Application Prospect of Biomarkers in Severe Dengue Fever

6.1 Early identification of high-risk patients and disease classification

Early detection of dengue fever patients who may develop into severe cases is very important for improving the treatment effect. In the early stage of fever, the changes of indicators such as CRP, AST, VCAM-1, IL-8, and TNF- α are closely related to the subsequent aggravation of the disease (Moallemi et al., 2025). Among them, elevated CRP and AST can be regarded as early risk signals. The increased expression of VCAM-1 and syndecan-1 indicates a greater possibility of blood leakage or bleeding (Moallemi et al., 2023). The combined use of multiple biological indicators with molecular markers such as lncRNA and miRNA can further improve the accuracy of risk assessment (Limothai et al., 2022).

A comprehensive assessment model based on biomarkers can identify high-risk groups in the early stage of diseases and also support enhanced monitoring and intervention measures. This method has high practical value in areas with dengue fever epidemic and environments with insufficient medical resources. It helps to rationally allocate intensive care resources and improve the overall diagnosis and treatment efficiency (Moallemi et al., 2023; Katz et al., 2025; Vairaperumal et al., 2025).

6.2 Dynamic monitoring of biomarkers and disease assessment

Continuous monitoring of biomarker changes during the disease process is helpful for judging the progression of the disease and treatment response. For instance, elevated levels of cfDNA and CRP during the acute phase of infection usually indicate an increased risk of shock and plasma leakage. Elevated liver enzymes or a continuous decline in platelets may indicate organ damage or a tendency to bleed. Doctors can adjust the treatment strategies in a timely manner based on the changes of these indicators, such as strengthening monitoring or performing fluid resuscitation in advance, to reduce the risk of further deterioration of the condition (Vairaperumal et al., 2025).