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Diagnosis of Dengue: Comprehensive review in Current Approaches and Future Perspectives

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Abstract

Dengue, an arthropod-borne viral illness caused by four serotypes of dengue virus (DENV-1 to DENV-4), is a major public health issue in the tropics and subtropics. Accurate and timely diagnosis is essential for efficient disease control and management. This review highlights the existing diagnostic modalities for dengue, ranging from clinical, serological, molecular, to point-of-care (POC) methods. The review discusses recent developments, challenges, and future directions in dengue diagnostics.

Introduction

Dengue fever affects approximately 390 million individuals each year, with almost 100 million showing clinical manifestations [1]. The illness has a wide range of presentations, from mild febrile disease to dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS). Because of the similarity in symptoms with other febrile diseases, diagnosis by laboratory tests plays a critical role in clinical management as well as in surveillance for epidemics.

Clinical Diagnosis

Clinical diagnosis, in most cases, relies on WHO criteria, which involve the sudden onset of fever, headache, myalgia, arthralgia, rash, retro-orbital pain, and hemorrhagic presentation [2]. Clinical manifestations are non-specific, particularly in the initial stage, and need laboratory diagnosis.

Laboratory Diagnosis

Serological Tests

NS1 Antigen Detection: The NS1 protein is detectable from Day 1 to Day 5 of illness. It is an early diagnostic marker that is reliable [3].

IgM and IgG ELISA: IgM antibodies become detectable from Day 5 following infection and show recent infection, and IgG signifies previous exposure. Other flaviviruses may cause cross-reactivity with impact on specificity [4].

Molecular Techniques

RT-PCR: The gold standard for early and specific diagnosis of DENV RNA is reverse transcriptase-polymerase chain reaction, generally in the first five days of illness [5]. It also allows serotyping.

Isothermal amplification techniques (e.g., LAMP): These are becoming new, low-cost, rapid, and good alternatives to PCR, especially for resource-poor areas [6].

Hematological Parameters The common presentation is leukopenia, thrombocytopenia, and increased hematocrit. These are utilized as supporting criteria and markers of disease progression [7].

Point-of-Care (POC) Diagnostics

Lateral flow immunoassays (LFIA) for detecting NS1 antigen or IgM/IgG antibodies are commonly used because of their simplicity and rapidity.

Sensitivity between kits differs, and results depend on timing of sample collection [8].

Diagnosis Challenges

Difficulty in serological diagnosis due to cross-reactivity with Zika, Chikungunya, and other flaviviruses.

Viral loads and antigenemia variability between serotypes and host immune status.
Restricted access to molecular diagnostics in low-resource settings.

Future Perspectives

Multiplex assays: Concurrent detection of multiple arboviruses will enhance differential diagnosis [9].

CRISPR-based diagnostics: SHERLOCK and DETECTR platforms can provide ultra-sensitive and specific detection, with field-deployable potential [10].
Digital health integration: Smartphone-connected biosensors and AI-based diagnostics are being developed to automate dengue surveillance and management.

Conclusion

A blend of molecular, serological, and clinical approaches is the best approach for total dengue diagnosis. Further innovation, particularly in cost-effective and rapid diagnostics, is necessary to end the global dengue burden effectively.

References

1. Bhatt, S., et al. (2013). The global distribution and burden of dengue. Nature, 496(7446), 504–507.
2. WHO. (2009). Dengue: Guidelines for Diagnosis, Treatment, Prevention and Control. Geneva: World Health Organization.
3. Alcon, S., et al. (2002). Enzyme-linked immunosorbent assay specific to dengue virus type 1 nonstructural protein NS1. Journal of Clinical Microbiology, 40(9), 3765–3769.
4. Guzman, M.G., et al. (2010). Dengue: a continuing global threat. Nature Reviews Microbiology, 8(12), S7–S16.
5. Chien, L.J., et al. (2006). Development of real-time reverse transcriptase PCR assays to detect and serotype dengue viruses. Journal of Clinical Microbiology, 44(4), 1295–1304.
6. Teoh, B.T., et al. (2015). Development and evaluation of a reverse transcription loop-mediated isothermal amplification assay for rapid detection of dengue virus serotypes 1–4. Journal of Virological Methods, 222, 154–160.
7. Kalayanarooj, S., & Nimmannitya, S. (2000). Clinical and laboratory presentations of dengue patients with different serotypes. The Southeast Asian Journal of Tropical Medicine and Public Health, 31(4), 787–790.
8. Blacksell, S.D., et al. (2006). Evaluation of a commercial dengue NS1 antigen capture assay for early diagnosis. BMC Infectious Diseases, 6, 9.
9. Shu, P.Y., & Huang, J.H. (2004). Current advances in dengue diagnosis. Clinical and Diagnostic Laboratory Immunology, 11(4), 642–650.
10. Myhrvold, C., et al. (2018). Field-deployable viral diagnostics using CRISPR-Cas13. Science, 360(6387), 444–448.