

An overview dengue fever epidemiology laboratory testing and approaching to management, role of nursing

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Abstract

Dengue fever, a mosquito-borne viral illness caused by the dengue virus (DENV), is a significant public health challenge, particularly in tropical and subtropical regions. With an estimated 390 million annual infections worldwide, dengue fever ranges from mild febrile illness to severe life-threatening conditions such as dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS). Effective management depends on timely diagnosis, supportive care, and public health interventions. Laboratory testing plays a vital role in confirming cases, while the role of nurses is pivotal in patient care, education, and community-level interventions. This review explores the epidemiology, laboratory diagnostics, management strategies, and the critical contributions of nursing in dengue fever control and patient care.

Introduction

Dengue fever, a mosquito-borne viral disease, is one of the most significant global public health challenges today. Caused by the dengue virus (DENV), which belongs to the *Flaviviridae* family, the disease is transmitted predominantly by *Aedes aegypti* and *Aedes albopictus* mosquitoes. The global burden of dengue fever has increased dramatically over the past few decades, driven by rapid urbanization, climate change, increased international travel, and population growth in tropical and subtropical regions. According to the World Health Organization (WHO), an

estimated 3.9 billion people in over 100 countries are at risk of dengue infection, with approximately 390 million cases annually, of which 96 million are symptomatic [1, 2].

Dengue presents as a spectrum of clinical manifestations, ranging from mild febrile illness to severe life-threatening complications, including dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS). The disease imposes a heavy economic burden on endemic countries due to healthcare costs, loss of productivity, and strain on healthcare systems during outbreaks. Efforts to control dengue fever are complicated by the lack of specific antiviral treatments and vaccines with universal efficacy, necessitating reliance on vector control, supportive care, and early diagnosis [3].

The role of healthcare professionals, including nurses, is pivotal in managing dengue patients and preventing its spread. Nurses are central to recognizing early warning signs, implementing fluid management protocols, and educating patients and communities about preventive measures. This review delves into the epidemiology, diagnostic approaches, management strategies, and the critical role of nursing in combating dengue fever.

Epidemiology of Dengue Fever

1.1 Global Distribution and Burden

Dengue fever has transitioned from a sporadic tropical disease to a global health crisis. Over the past 50 years, the incidence of dengue has increased 30-fold, with large-scale epidemics occurring frequently in densely populated urban areas [3]. The Americas, Southeast Asia, and the Western Pacific regions bear the highest disease burden, accounting for over 70% of global cases [4]. In Africa, dengue remains underdiagnosed and underreported due to limited laboratory facilities and surveillance systems.

1.2 Climate and Environmental Factors

Rising global temperatures and irregular rainfall patterns create favorable breeding conditions for *Aedes* mosquitoes. Urbanization, with its associated water storage practices and waste mismanagement, contributes to the proliferation of mosquito habitats [5].

1.3 Risk Factors

Socioeconomic Factors: Poverty and inadequate sanitation increase exposure to *Aedes* vectors.

Globalization: Increased international travel and trade facilitate the rapid spread of dengue across borders.

Immunity and Serotype Dynamics: Sequential infections with different serotypes (DENV-1 to DENV-4) heighten the risk of severe disease due to antibody-dependent enhancement (ADE), where preexisting antibodies from a prior infection worsen the severity of a subsequent infection [6].

2. Expanded Laboratory Testing for Dengue Fever

Timely and accurate diagnosis of dengue fever is crucial for effective management, reducing complications, and implementing public health interventions during outbreaks.

2.1 Direct Diagnostic Methods

- **Reverse Transcriptase Polymerase Chain Reaction (RT-PCR):**

RT-PCR detects viral RNA in blood and provides information on the circulating serotype. It is most effective during the early viremic phase (0–5 days after symptom onset) [7]. Advantages: High sensitivity and specificity; allows for serotype differentiation. Disadvantages: Requires sophisticated laboratory infrastructure and trained personnel.

- **NS1 Antigen Testing:**

NS1 (non-structural protein 1) antigen tests are rapid and effective in the early stages of infection. Available as enzyme-linked immunosorbent assay (ELISA) or rapid diagnostic test (RDT) formats, they are widely used in low-resource settings [8]. Limitation: Reduced sensitivity in secondary dengue infections.

2.2 Indirect Serological Methods

- **IgM and IgG Antibody Testing:**

IgM antibodies are detectable 4–5 days post-infection and confirm acute dengue. IgG levels rise later and are indicative of past exposure or secondary infections. Cross-reactivity with other flaviviruses (e.g., Zika, yellow fever) limits specificity in endemic regions [9].

2.3 Hematological and Biochemical Markers

- **Complete Blood Count (CBC):**

Thrombocytopenia (platelet count $<100,000/\mu\text{L}$), leukopenia, and hemoconcentration (elevated hematocrit) are hallmark findings in severe cases.

- **Liver Function Tests (LFTs):**

Elevated transaminases signal hepatic involvement, often observed in DHF and DSS.

- **Biomarkers:**

Emerging markers, such as interleukin-6 (IL-6) and vascular endothelial growth factor (VEGF), are being investigated for predicting disease severity.

3. Expanded Approaches to Management

Management of dengue fever is primarily supportive, focusing on symptom relief, prevention of complications, and monitoring for severe disease progression.

3.1 Mild Dengue Fever

- **Symptomatic Treatment:**

Paracetamol is the preferred analgesic and antipyretic. Aspirin and NSAIDs are contraindicated due to bleeding risk.

- **Hydration:**

Oral rehydration therapy (ORT) is essential to prevent dehydration and maintain electrolyte balance.

3.2 Severe Dengue (DHF and DSS)

- **Fluid Management:**

Intravenous fluid therapy with crystalloids or colloids is tailored to the patient's clinical condition and monitored through urine output, blood pressure, and hematocrit levels [10].

- **Monitoring for Shock:**

Close observation for signs of shock, including cold extremities, rapid weak pulse, and narrowing pulse pressure (<20 mmHg), is critical.

3.3 Critical Care Interventions

Patients with DSS may require intensive care support, including vasopressors for refractory shock and platelet transfusions for severe bleeding.

3.4 Dengue Vaccination

CYD-TDV (Dengvaxia) is the only licensed dengue vaccine, recommended for seropositive individuals aged 9–45 years in endemic areas. Concerns about vaccine-associated severe dengue in seronegative individuals have limited its widespread use [11].

Expanded Role of Nursing in Dengue Fever Management

Nurses are vital in the multidisciplinary approach to dengue fever management, providing direct patient care, education, and community engagement to prevent transmission and ensure effective treatment. Their roles encompass a wide range of activities, from early detection and triage to the implementation of fluid management protocols and infection control measures [12,13].

1. Early Recognition and Triage

Nurses are often the first point of contact in healthcare settings and play a crucial role in identifying potential dengue cases and prioritizing care.

1.1 Identifying Symptoms

Recognizing classic symptoms of dengue fever, such as high fever, headache, myalgia, retro-orbital pain, and rash, especially in endemic areas. Identifying early warning signs of severe dengue, such as:

- Persistent vomiting.
- Severe abdominal pain.
- Mucosal bleeding.
- Lethargy or restlessness.
- Signs of shock, including cold extremities, rapid weak pulse, and narrowing pulse pressure.

1.2 Effective Triage

- **Stratifying patients based on severity:**

- Category A: Mild dengue fever requiring outpatient management.
- Category B: Patients with warning signs requiring closer monitoring in a hospital setting.
- Category C: Severe dengue cases requiring intensive care.

1.3 Accurate Documentation

- Recording vital signs, symptoms, and warning signs systematically for effective communication with the healthcare team.
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2. Fluid Management

Proper fluid management is the cornerstone of dengue treatment, particularly in patients with dengue hemorrhagic fever (DHF) or dengue shock syndrome (DSS).

2.1 Monitoring Hydration Status

Assessing clinical signs of dehydration or fluid overload, including:

- Capillary refill time.
- Skin turgor.
- Blood pressure trends.
- Urine output (target: ≥ 0.5 mL/kg/hour).

Regularly monitoring hematocrit levels to detect hemoconcentration, which indicates plasma leakage.

2.2 Administering Intravenous (IV) Fluids

Calculating and delivering the appropriate amount of IV fluids based on the patient's weight, clinical condition, and stage of illness:

- Crystalloids (e.g., Ringer's lactate, normal saline) for mild-to-moderate plasma leakage.
- Colloids for severe plasma leakage or shock.

Adjusting fluid rates based on hematocrit, blood pressure, and urine output.

2.3 Preventing Overhydration

Recognizing signs of fluid overload, such as pulmonary edema and pleural effusion, and adjusting fluid therapy accordingly.

3. Patient Education and Advocacy

Educating patients and caregivers is a central role for nurses, especially in outpatient and community settings.

3.1 Promoting Symptomatic Relief

Educating patients on the safe use of medications:

- Encouraging the use of paracetamol for fever and pain relief.
- Advising against the use of NSAIDs (e.g., aspirin, ibuprofen) due to the risk of bleeding.

Reinforcing the importance of adequate hydration and the use of oral rehydration solutions (ORS).

3.2 Recognizing Warning Signs

Teaching patients and families to monitor for severe symptoms, such as persistent vomiting, difficulty breathing, or sudden changes in behavior, and to seek medical care promptly.

3.3 Post-Recovery Education

Explaining the risk of subsequent dengue infections leading to more severe disease (due to antibody-dependent enhancement) and the importance of preventive measures.

3.4 Advocacy for Preventive Care

Encouraging vaccination with CYD-TDV (Dengvaxia) for eligible individuals in endemic areas. Promoting the elimination of mosquito breeding sites around homes and communities.

4. Infection Prevention and Control

Nurses play a critical role in preventing dengue transmission, both within healthcare facilities and in the broader community.

4.1 In-Hospital Vector Control

Ensuring that patient rooms are mosquito-proof by using bed nets, window screens, or insecticide sprays. Monitoring for stagnant water or potential mosquito breeding sites within healthcare premises.

4.2 Community-Level Engagement

Collaborating with public health officials to conduct community cleanup drives to eliminate breeding sites, such as water containers, discarded tires, and clogged drains. Promoting the use of personal protective measures, including:

- Wearing long-sleeved clothing.
- Using insect repellents containing DEET or picaridin.
- Installing mosquito screens on windows and doors.

5. Psychological Support

Dengue fever can cause significant anxiety for patients and families, particularly in severe cases. Nurses provide reassurance and emotional support to alleviate these concerns.

5.1 Patient Communication

Maintaining open and empathetic communication to address patient fears about complications or hospitalization. Explaining procedures, treatment goals, and recovery expectations in a clear and comforting manner.

5.2 Family Engagement

Involving families in the care process, providing regular updates on the patient's condition, and teaching them how to assist with care at home.

6. Role in Community Health Education

Nurses are at the forefront of public health initiatives aimed at preventing dengue outbreaks.

6.1 Awareness Campaigns

Leading educational sessions in schools, workplaces, and community centers to raise awareness about dengue prevention. Demonstrating practical methods for reducing mosquito breeding, such as covering water storage containers and proper waste disposal.

6.2 Supporting Vaccination Programs

Coordinating with public health authorities to implement dengue vaccination campaigns in endemic areas. Educating communities about the safety and efficacy of vaccines to overcome vaccine hesitancy.

Conclusion

Dengue fever represents a growing global health challenge, requiring a multidisciplinary approach to reduce its burden. Timely and accurate laboratory diagnosis, effective management of symptoms, and robust public health interventions are essential components of dengue control. Nurses, as frontline healthcare providers, play a pivotal role in managing dengue patients and preventing disease transmission through their expertise in triage, supportive care, and community engagement. Addressing the challenges posed by dengue will require strengthening healthcare systems, enhancing surveillance, and fostering collaboration among healthcare professionals, policymakers, and communities. Continued research into innovative diagnostic tools, treatments, and vaccines holds promise for mitigating the impact of this widespread disease. The role of nurses in managing dengue fever is multifaceted, encompassing clinical care, education, and public health interventions. Nurses are instrumental in recognizing early warning signs, implementing effective fluid management, and educating patients and communities about preventive measures. Their contributions extend beyond bedside care to include advocacy, infection control, and participation in public health campaigns. By integrating their expertise into multidisciplinary approaches, nurses play a pivotal role in reducing the burden of dengue fever and improving outcomes for affected populations. Strengthening nursing education, providing adequate resources, and fostering community engagement are essential steps toward more effective dengue prevention and management.

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