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# Risk factors of mortality among dengue patients admitted to a tertiary care setting in Kerala, India

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## KEYWORDS

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**Abstract** Dengue is one of the most serious and rapidly emerging tropical mosquito-borne diseases. The state of Kerala in India is hyperendemic for the disease and is one of the leading states in the reporting of deaths due to dengue. As primary prevention of dengue has had limited success, the prevention of mortality through the identification of risk factors and efficient patient management is of utmost importance. Hence, a record-based case control study was conducted in the Medical College Hospital in Thiruvananthapuram to identify the risk factors of mortality in patients admitted with dengue. Dengue patients over 40 years of age were 9.3 times (95% CI; 1.9–44.4) more likely to die compared with younger patients. The clinical features associated with mortality from dengue were altered sensorium (odds ratio (OR) – 156, 95% CI; 12.575–1935.197), abnormal reflexes (OR – 8.5, 95% CI; 1.833–39.421) and edema (OR – 13.22, 95% CI; 2.651–65.951). Mortality was also higher in those patients with co-morbidities such as diabetes mellitus (OR – 26, 95% CI; 2.47–273.674) and hypertension (OR – 44, 95% CI; 6.23–315.499). The independent predictors of mortality were altered sensorium and hypertension. Dengue fever patients with these clinical features and those who are elderly should be more rigorously monitored and promptly referred from lower settings when required to reduce mortality.

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## Introduction

Dengue is one of the most serious and rapidly emerging tropical mosquito-borne diseases. The global disease burden is 465,000 Disability adjusted

life years DALYs, which is only paralleled by that of malaria among mosquito-borne diseases [1]. Worldwide, approximately 2.5–3 billion people (40% of the global population) live in constant risk of contracting this infection. It is estimated that 50 million cases and 24,000 deaths occur annually in 100 endemic countries worldwide. Nearly 500,000 cases are hospitalized annually, of which 90% are

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children. The south-east Asia region contributes 52% of the cases annually. India is one of the seven identified countries in this region that regularly reports dengue fever/dengue hemorrhagic fever (DF/DHF) outbreaks. India appears to be transforming into a major hyperendemic niche for dengue infection. Increasingly, previously unaffected areas are being struck by the dengue epidemic. The first confirmed report of dengue infection in India dates back to the 1940s. Thereafter, several states began to report the disease, which mostly struck in epidemic proportion, often inflicting heavy morbidity and mortality, both in urban and rural environments [2,3].

In Kerala, cases of dengue, including some deaths, were reported for the first time in 1997; nevertheless, DEN-1, DEN-2 and DEN-4 viruses had been previously detected in human sera. Dengue antibodies had been detected in human sera from Kozhikode, Kannur, Palakkad, Thrissur, Kottayam and Thiruvananthapuram districts as early as 1979 [4]. In recent years, DEN-2 and DEN-3 have been isolated from vector mosquitoes and human blood sera, respectively [5]. In 2003, Kerala reported the highest number of deaths due to dengue among Indian states, and over the years, the reported cases of dengue in this region have been increasing [6]. The proportion of deaths contributed by Kerala has also increased from 8% in 2006 to 15% in 2010. Kerala is now hyper-endemic for dengue, with the presence of all four serotypes, high rates of co-infection and local genomic evolution of viral strains [7]. The district of Thiruvananthapuram has reported the greatest number of cases in the state; 40–50% of the cases reported in Thiruvananthapuram are from the urban areas of the district [6].

Death due to dengue is an avoidable cause of mortality [8]. The primary prevention of dengue through vector control activities has had limited success worldwide [9]. Currently, there is neither a vaccine to prevent the disease nor an antiviral treatment. However, secondary prevention to reduce mortality through improved clinical case management has substantially lowered the mortality rate for severe dengue over the past two decades from 10–20% to <1% [10,11]. The first objective of the WHO global strategy 2012–2020 is to reduce the mortality due to dengue by 50% from 2010 levels [12]. The number of deaths is determined not only by the factors that facilitate transmission but also by those that influence the severity of the disease and the ease of health care access [13]. Dengue mortality can be reduced by the implementation of early case detection and appropriate management of severe cases. Research to provide better diagnostics and

biomarkers that can predict disease severity is urgently needed [12]. Organ involvement, shock, bacteremia, co-morbidities, hemorrhage and certain biochemical parameters have been identified as useful predictors of mortality in studies conducted in dengue-endemic countries, but there may be regional differences. The objective of this study was to identify the risk factors of mortality in dengue patients admitted to the Medical College Hospital, Thiruvananthapuram during the period 2005–2008.

## Materials and methods

### Study design

A case control study was conducted using the hospital records of dengue patients admitted to the Medical College of Thiruvananthapuram during the period 2005–2008.

### Setting

Medical College Hospital, located in Thiruvananthapuram, Kerala, India, is a premier institution for the provision of comprehensive tertiary health care irrespective of economic or social status and disabilities. It is the largest multi-specialty hospital in South Kerala and serves the major portion of the Thiruvananthapuram and Kollam districts and the adjacent districts of Tamil Nadu.

### Study population

A case was defined as a patient who was admitted with a diagnosis of probable dengue confirmed by either reverse transcriptase polymerase chain reaction (RT-PCR) or IgM antibody and who died during the hospital stay. The controls were dengue-confirmed patients who recovered from the illness during their stay in the hospital and were subsequently discharged.

### Sample size and sampling technique

There were only 10 confirmed dengue deaths during 2005–2008 that met the eligibility criteria; these were selected as the cases. The patients who met the criteria for controls were enlisted, and then 40 individuals were randomly selected from this list.

### Data collection

A semi-structured questionnaire was used to collect the study variables. The study variables included

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