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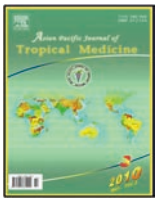

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Clinico-epidemiological features of dengue fever in Saudi Arabia

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ABSTRACT

Objective: To highlight some clinical and epidemiological features of dengue fever. **Methods:** All patients who were admitted to hospitals in Holly Mecca City, Saudi Arabia and were confirmed as dengue fever (DF) or dengue hemorrhagic fever (DHF) were included in this study. The data were collected from patient files and through direct interview with patients or their relatives. Cases were followed through their hospital stay. Routine laboratory investigations were done and diagnosis was confirmed by PCR. **Results:** Most of cases admitted in stable condition (94.37%) and only one case (1.41%) died. Dengue-1 and 3 types were the prevalent dengue viruses and cases in age group 16-44 were the most frequent (70.40%). The most common symptoms was fever reported from all cases followed by headache (74.60%), myalgia and anorexia (67.60%), back pain (59.20%) and chills (54.90%). DF represented (60.57%) of the cases while DHF represented (39.43%). About half of cases had underground water tanks for human use, 5.60% had over house roof water tanks and 43.70% had both types, 16.90% of these tanks were uncovered. Approximately 70.00% of cases reported presence of small collection of water nearby houses and 46.80% reported the presence of mosquitoes within their houses. **Conclusions:** Most dengue fever cases might be endogenous in origin due to prevalence of mosquitoes and their breeding places within the houses and in nearby localities. Control of mosquitoes and their breeding places will contribute to prevention of dengue fever.

1. Introduction

Dengue fever has emerged as a serious international public health threat with almost half of the world population at risk. Dengue viruses cause a wide range of illness including dengue fever (DF), Dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS). Four Dengue serotypes (DENV-1 to-4) can cause severe and fatal disease. The disease is prevalent in tropical and subtropical areas in the world and aedes egypti is the principal transmitter vector [1-3].

Epidemics of a dengue-like disease appeared in the Arabian Peninsula in the late 18th century. The disease was described in Zanzibar, Dar es Salam, the East African coast and Saudi Arabia (Aden, Mecca, Madena and Jeddah [1]. In 1994, the dengue virus was isolated in Jeddah, Saudi Arabia, from a fatal case of DHF. Active surveillance was established in 1994, based on clinical, and laboratory methods to evaluate the prevalence and incidence of dengue, the serotypes detected, and the efficacy of the laboratory diagnosis. Later on the circulation of 3 dengue serotypes was confirmed in Jeddah[4].

The Haj season provides a fertile opportunity for the introduction and exchange of infectious agents among pilgrims, including dengue viruses. Pilgrims come from many countries in South-East Asia, India, Indonesia, Malaysia, Pakistan and Africa. Some of these persons may be in the incubation period of dengue infection and may actually be viraemic during the time of Haj, infecting mosquitoes and subsequently infecting other pilgrims and residents. Fortunately, the little (less than 60 mm/year) rain and dry weather most of the year does not favor efficient spread of dengue [5].

This study was undertaken to analyze the epidemiological, clinical and laboratory features of DF and DHF admitted to hospitals in Mecca within a three months period, during the Haj season.

2. Material and methods

All patients who were admitted to hospitals in Holly Mecca City, Saudi Arabia during mid September to mid December in 2006, (during the Haj season) and confirmed as dengue fever (DF) or Dengue hemorrhagic fever (DHF) and Dengue shock syndrome (DSS) were included in this study. The diagnostic criteria for dengue was defined by Ministry of Health (Infectious Disease Department) in Saudi Arabia which is compatible to great extent with WHO case

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definition[6,7].

2.1 Criteria for dengue

Symptoms for suspected case include acute febrile illness for 2–7 days with two or more of the following: headache, arthralgia, retro-orbital pain, myalgia, rash, hemorrhagic manifestations, leucopenia.

Confirmed case is a suspected case that is confirmed through one of the following laboratory tests: Isolation of virus from serum, plasma, leucocytes or autopsy; Demonstration of four folds or greater change in reciprocal IgG or IgM antibody titer to one or more dengue virus antigen in paired samples; Detection of viral genomic sequence in serum, CSF or autopsy tissue sample by polymerase chain reaction (PCR).

2.2 Criteria for dengue hemorrhagic fever

Confirmed case of dengue plus hemorrhagic tendencies evidenced by one or more of the following: Petechiae, echymoses or purpura; bleeding from mucosa, gastrointestinal tract, injection sites or other sites; thrombocytopenia (100 000 cells per mm^3 or less); Positive tourniquet test.

2.3 Criteria for dengue shock syndrome

Criteria for dengue haemorrhagic fever plus evidence of circulatory failure manifested by hypotension for age, cold, calmy skin and restlessness.

In order not to lose cases, health authority contacted all health facilities to request any patient with dengue like illness to be tested for dengue disease during the study period. A predesigned questionnaire sheet was designed to collect data from patient files and through direct interview with the patients or their relatives. Cases were followed during their hospital stay. Paired sera samples for disease confirmation and other confirmatory tests were done in reference laboratory in Jeddah Saudi Arabia. A detailed history taking, disease manifestations, state at admission and fate of cases, laboratory investigations (total leucocytic count, total platelets count, Hb, liver functions) were obtained.

Data were presented as number and percentage using SPSS statistical software package.

3. Results

Dengue-1 and Dengue-3 types were the prevalent dengue viruses. DF represented 60.57% while DHF represented 39.43% of cases. Most of cases admitted in stable condition (94.37%), four cases were admitted in critical state (5.63%). Only one case died (1.41%) and others discharged after improvement (99.59%).

Demographic information was shown in Table 1. Cases in age group of 16–44 years old were the most frequent (70.40%) while those in age group 10–15 years were the least (12.70%). There were no cases under age of ten years. The majority of cases were students (33.80%), of Saudi nationality (63.40%) and of low educational level (39.40%).

Table 2 showed distribution of disease manifestations. Fever was the most common symptoms reported from all cases followed by headache (74.60%), myalgia (67.60%) and anorexia (67.60%), back pain (59.20%) and chills (54.90%). Arthralgia and nausea were both presented in nearly 43.00% cases, other symptoms including confusion, hallucination, shock and coma were presented in less than 10.00% cases.

Table 1
Personal characteristics of studied patients with dengue fever (n=71).

Items		Number (%)
Age (years)	10–15	9 (12.70)
	16–44	50 (70.40)
	>44	12 (16.90)
Sex	Male	45 (63.40)
	Female	26 (36.60)
Occupation	Professional	10 (14.10)
	Skilled	7 (9.90)
	Unskilled	12 (16.90)
	Employee	4 (5.60)
	House wife	14 (19.70)
	Student	24 (33.80)
Educational level	High	13 (18.30)
	Secondary	23 (32.40)
	Less than secondary	28 (39.40)
	Illiterate	7 (9.90)
Nationality	Saudi	45 (63.40)
	Non-Saudi	26 (36.60)

Table 2
Clinical manifestations of patients with dengue fever (n=71).

Symptoms/signs	Number (%)
Fever	71 (100.00)
Headache	53 (74.60)
Myalgia	48 (67.60)
Anorexia	48 (67.60)
Backache	42 (59.20)
Chills	39 (54.90)
Arthralgia	31 (43.70)
Nausea	30 (42.30)
Vomiting	28 (39.40)
Abdominal pain	28 (39.40)
Retro-orbital pain	21 (29.60)
Diarrhea	21 (29.60)
Skin Rash	16 (22.50)
Haemorrhagic manifestations	12 (16.90)
Others*	7(9.70)

Categories are not mutually exclusive, *e.g. confusion, hallucination, shock and coma.

Laboratory test results were presented in Table 3. More than two thirds of cases (64.80%) had leucopenia, 39.30% showed low platelet count, but only 2.80% had leucocytosis. More than 50.00% showed elevated liver enzymes (SGOT and SGPT) while less than 10% suffered from anaemia.

Table 4 showed distribution of elements favoring occurrence of the disease. About half cases had underground water tanks for daily use (36, 50.70%); 16.90% (12) of these tanks were uncovered. Approximately 70.00% cases reported presence of small collection of water near by houses and 26.76% (19) of these patients lived around buildings under construction with presence of uncovered water collection. Travel/movement to risk area or at risk time and history of presence of dengue case within house was reported by about one fourth cases (20, 28.16%). Mosquitoes within houses were reported by 46.47% cases, and history of dengue cases in the same house was presented in 17 cases (23.94%).

Table 3
Laboratory profile of patients with dengue fever (n=71).

Investigation	Number (%)
Leucocytic count	
Normal	32 (32.40)
Decreased (leucopenia)	46 (64.80)
Increased	2 (2.80)
Platelets count:	
Less than 100,000	28 (39.30)
100,000–150,000	31 (43.70)
>150,000	12 (16.90)
Liver functions (transaminases)	
Normal	29 (40.80)
Elevated	41 (57.70)
Haemoglobin	
Normal	65 (91.50)
Lower (anaemia)	6 (8.50)

Table 4
Some factors predisposing to infection with dengue fever as reported by 71 patients.

Factors		Number (%)
Position of Water tanks in houses	Underground	36 (50.70)
	On house roof	4 (5.63)
	Both	31 (43.66)
Uncovered water tanks in houses		12 (16.90)
Presence of water collection beside houses		22 (30.98)
Presence of mosquitoes in houses		33 (46.48)
Building under construction		19 (26.76)
History of dengue case in same house		17 (23.94)
History of Travel to risk areas		20 (28.16)

4. Discussion

Recently dengue has emerged as a substantial global health problem with increased incidence in new countries and tropical areas [8,9]. Most of the cases (70.40%) occurred in age group of 16–44 years while there was no case below 10 years old. This may be attributed to different exposure to mosquitos' bites. The lower case number in age group of 45 or more agrees with Fakeeh and Zaki [4], who commented that the lower number with virus isolates in this age group could be explained by higher immunity to dengue in this group.

A previous study in Jeddah, Saudi Arabia reported that age of dengue patients ranged from 2 to 60 years with the majority of cases (79.50%) in age group of 20–40 years[6]. However a study in Bangladesh[9] showed that 18% of cases were in children (<18 years) and the highest proportion of cases occurred in persons 18–33 years of age. Another study in India[10] mentioned that more than half of cases were among adults (53.30%) followed by older children (18.30%) and school age children (16.30%) and 11.70% in young children.

In the present study about two thirds of cases were males (63.40%) which agrees with the male to female ratio of 3.3: 1 reported by a previous study[8].

Nearly two thirds of dengue cases occurred among Saudi people. In the Jeddah study about 31% of patients were Saudis and the rest were non-Saudis[6]. The disease was more frequent among those with secondary or low educational level. One third of cases were among students (33.80%) followed by housewives (19.70%). This may be attributed to more risk to mosquitos' bites in their environment. Fakeeh and Zaki reported that a good number of patients were adult construction workers who slept outdoors near water reservoirs, which harbored large numbers of mosquitoes[4]. Rajendan *et al*[10] mentioned that 16.3% of dengue cases were among school going children.

Fever, headache, myalgia, back pain and chills were the most frequent symptoms in our study. This is consistent to a large extent with other studies in Saudi Arabia[6], India[10–12] and Hawaii[13]. Dengue fever represented 60.57% cases, dengue hemorrhagic fever 39.43% and there was no dengue shock syndrome reported during the study period. Rahman *et al*[7] also reported that dengue fever occurred most commonly (60.20%), followed by dengue hemorrhagic fever (39.20%) and dengue shock syndrome (0.60%).

In this study, the frequency of thrombocytopenia was 39.43%, leucopenia was 64.80%, while anemia was less than 10.00%. Similar findings were reported from previous studies in Saudi Arabia[8] and non-Middle Eastern countries[10,14,15]. Thrombocytopenia and leucopenia are thought to be due to depression of bone marrow observed in acute stage of dengue virus infection. Other explanations are direct infection of the megakaryocytes by the virus leading to increased destruction of platelets or the presence of antibodies directed against the platelets [8,16]. The other important laboratory finding was the raised liver transaminases seen in 57.7% of our patients compared to 67% in the Jeddah study [8]. It was reported that dengue fever is associated with liver dysfunction [17].

In this study most houses keep or store water for daily use in tanks; about 17.00% of it was uncovered, in addition

water collection beside houses was reported in one third cases. A case-control study indicated that water storage container facilities in or near construction sites were the focal points of dengue virus transmission in Jeddah, in spite of the low rainfall, water storage containers served as the breeding sites for *Aedes aegypt*, the vector specie[18]. The presence of mosquitoes within and outside houses, deficient distribution piping system for water and sewerage system in affected community increased risk of the diseases as it is suitable environment for mosquitoes breeding. Resurgence of dengue are mostly likely associated with demographic and social changes in the past fifty years [1,19]. Crowded human populations living in urban centers in substandard housing with inadequate water, sewer and waste management systems creating ideal conditions for increased transmission of mosquito- rodent- and water-borne infectious diseases [20,21]. Histories of travels to risk areas and of dengue case in same house were present in approximately one fourth cases in this study. Travels to endemic areas increase the risk of catching disease, while presence of diseased case within house in the presence of the transmitting vector increases disease risk. Air travels by humans, who are incubating the virus provide the ideal mechanism for transporting dengue viruses between population and exchange of dengue viruses and other pathogens [13].

People who are preparing to participate in the Haj should take extra precautions to prevent dengue. They should protect themselves from mosquito bites e.g. stay in well screened or air conditioned hotels or sleep under bed nets and use insect repellent when outdoors. Health education of the public and health care personnel should be an integral part of any prevention and control program. It is important to maintain dengue surveillance at high levels in order to detect early dengue activity and to take effective steps for the control of the vector.

A large scale study is recommended to get more information about disease epidemiology to evaluate disease manifestations with different serotypes.

Conflict of interest statement

We declare that we have no conflict of interest.

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