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Epidemiology of Dengue Infections in Kassala, Eastern Sudan

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Eighty-one (71.7%) out of 113 patients had confirmed dengue infection (using ELISA IgM serology) at Kassala, Eastern Sudan during the period of August through November 2010. According to the WHO criteria, dengue fever (DF), dengue hemorrhagic fever (DHF), and dengue shock syndrome (DSS) were observed in 30.9, 58, and 11.1% of these patients, respectively. The mean age of these 81 patients was 25.5 years. Male:female ratio was 1.8:1. Various symptoms including fever (100%), headache (75.3%), vomiting (55.6%), nausea (53.1%), and backache (30.9%) were observed among these patients. Thrombocytopenia ($<100/10^9$ platelets/L), and leucopenia (WBC count $<4{,}000 \times 10^9$ cells/L) and hemoconcentration (hematocrit >45) were reported in 86.4, 69.1, and 67.9% of the patients, respectively. High alanine aminotransferase (ALT, >65 U/L) and aspartate aminotransferase (AST >37 U/L) were seen in 9.9 and 14.8% of the patients, respectively. There were five (6.1%) deaths, three of them had DHF and the other two patients had DSS. ***J. Med. Virol. 84:500–503, 2012.*** © 2012 Wiley Periodicals, Inc.

KEY WORDS: dengue; fever; epidemiology; sudan

INTRODUCTION

Dengue is the most common mosquito-borne infection. About 2.5 billion people are estimated to be at risk of infection. Out of 50 million infections occurring each year: 500,000 are hospitalized [Guzman et al., 2002; Gubler, 2004; WHO, 2007; TDR/WHO, 2009]. Due to many factors such as urbanization and air travel, dengue infection has become a major public health problem in the tropics [Gibbons and Vaughn, 2002].

Dengue fever (DF) is classified into two groups: Uncomplicated and severe [World Health Organization, 2009]. This has replaced the older classification where classic DF is defined by the World Health Organization as an acute febrile illness with two more of the following signs or symptoms: Intense headache, retro-orbital pain, myalgia, arthralgia, rash, leucopenia, and hemorrhagic manifestations [World Health Organization, 1997]. Dengue hemorrhagic fever (DHF) is characterized by thrombocytopenia, hemorrhagic manifestations, and increased vascular permeability with plasma leakage primarily into the pleural cavity and peritoneum [CDC, 2008]. The main clinical feature differentiating DF from DHF and dengue shock syndrome (DSS) is the increased vascular permeability [Rigau-Pérez et al., 1998].

Although, the vast majority of the data on dengue infection are from South East Asia [Malavige et al., 2006], recent dengue epidemics have been reported in different regions of the Sudan including the Eastern part [Adam et al., 2010; Malik et al., 2011]. The current study was conducted to investigate the epidemiology and outcomes of dengue infection in Kassala, Eastern Sudan.

MATERIALS AND METHODS

As the part of the collaboration between the Sudanese Ministry of Higher Education and Research and the National Ministry of Health in the different epidemics in Sudan [Adam et al., 2010; Hassanain et al., 2010], all patients with dengue infection presented at Kassala Hospital during 3 months from August through November 2010 were reviewed retrospectively. Although, the old World Health Organization [1997] classification of dengue has been replaced recently [World Health Organization, 2009], the former one has been adopted in this work to facilitate comparison with the results of the previous studies.

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According to WHO classification, dengue is divided into undifferentiated fever, DF, and DHF [World Health Organization, 1997; Ranjit and Kissoon, 2010]. DHF was subdivided further into grades I–IV. Grade I is the presence only of easy bruising or a positive tourniquet test in someone with fever, grade II is the presence of spontaneous bleeding into the skin and elsewhere, grade III is the clinical evidence of shock, and grade IV the shock is so severe that blood pressure and pulse cannot be detected. Grades III and IV are referred to as "dengue shock syndrome (DSS) [World Health Organization, 1997; 2009].

During the epidemic, a specialized ward was created for the care of dengue infection at Kassala Hospital which is a tertiary care hospital, Figure 1. All suspected cases were referred to this ward regardless to their gender or age. The medical files of all patients with dengue infection were reviewed; patients' records retrieved and socio-demographic characteristics (age, gender), various clinical symptoms and signs (fever, headache, vomiting, nausea, backache, abdominal pain, dizziness, diarrhea, and jaundice), hematological and biochemical characteristics [complete blood count, alanine aminotransferase (ALT), and aspartate aminotransferase (AST)] were recorded. The diagnosis or exclusion of dengue infection was conducted using ELISA IgM serology.

Statistics

Data were entered into a computer database and SPSS software (SPSS Inc., Chicago, IL, version 16.0) and double checked before analysis. Means and

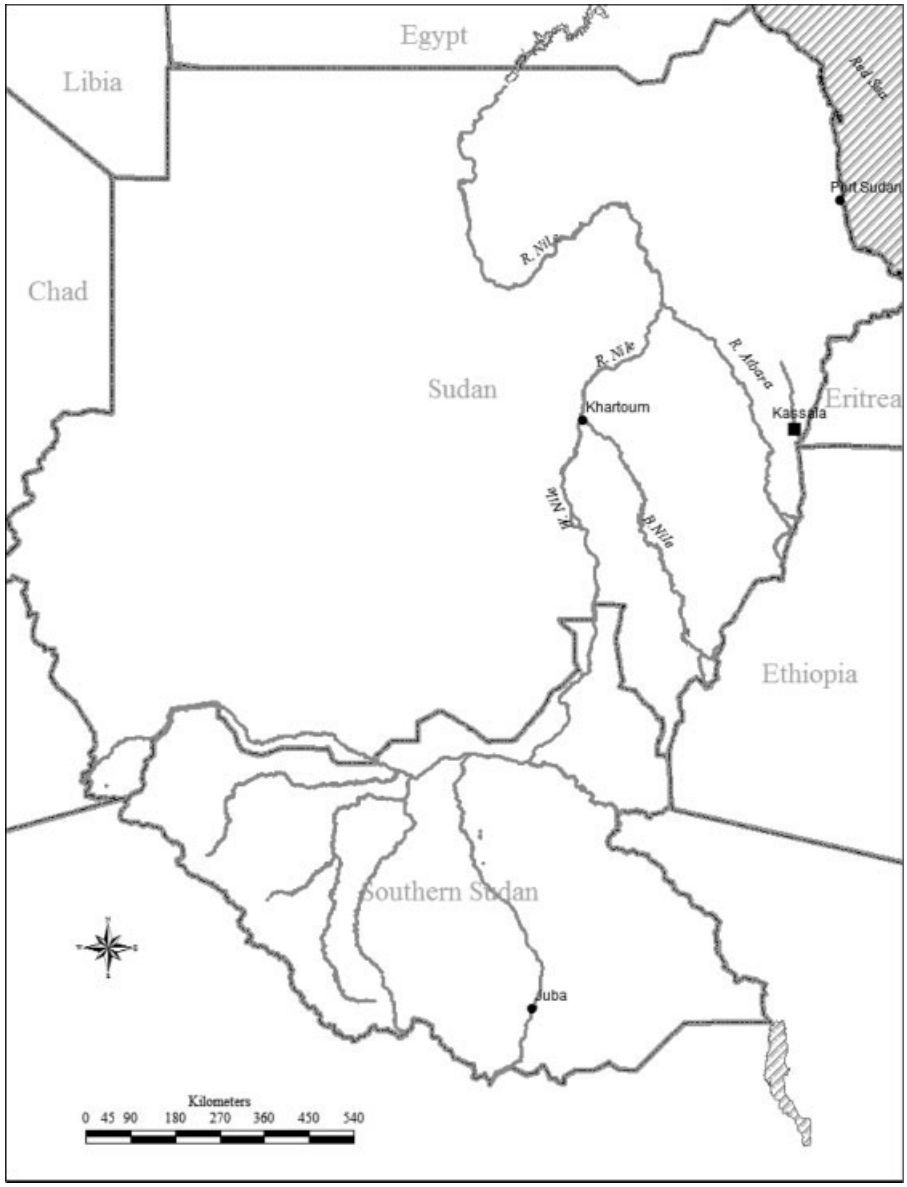

Fig. 1. Map of Sudan.

proportions for the socio-demographic characteristics, biochemical features were compared between the groups of the study using x^2 test and $P < 0.05$ was considered significant.

Ethics

The study received ethical clearance from the Health Research Board at Ministry of Health, Kassala, Sudan.

RESULTS

One hundred and thirteen patients with clinical features suggestive of dengue infection were referred to Kassala hospital. Out of these, 81 (71.7%) patients had a positive IgM dengue infection serology. The majority [61 (75.3%)] of these 81 patients were adults; while the rest [20 (24.7%)] were children <15 year of age. The mean age of the patients was 25.5 years. Male gender constituted 64.2%, with male:female ratio = 1.8:1. DF, DHF, and DSS were observed in 30.9, 58, and 11.1%, respectively.

All the severe cases (DSS) were adult (age ranged between 17 and 50 years. DHF affected 47 patients; out of these 36(76.6%) were adults.

Various clinical manifestations such as fever, headache, vomiting, nausea, backache, abdominal pain, dizziness, diarrhea, and jaundice were reported among these patients, Figure 2.

Thrombocytopenia ($<100/10^9$ platelets/L), and leucopenia (WBC count $<4{,}000 \times 10^9$ cells/L) and hemoconcentration (hematocrit >45) were reported in 86.4, 69.1, and 67.9% respectively. Epistaxis was the most common bleeding manifestation. Abnormal liver function tests with raised ALT (>65 U/L) and AST (>37 U/L) were seen in 9.9 and 14.8% patients, respectively, Table I.

Five of the patients died due to the disease; three of them had DHF and the other two had DSS.

DISCUSSION

The current study showed that the majority of the dengue patients were adult, with the male gender preponderance. DHF and DSS were observed in 58 and 11.1%, respectively. The mortality rate was 6.1%. Recently, dengue infections were reported among children and pregnant women in the nearby setting in Port Sudan in Eastern Sudan [Adam et al., 2010; Hassanain et al., 2010]. Dengue infection is usually mild, non-specific, or even asymptomatic one with very few cases manifest as severe disease [Gibbons and Vaughn, 2002; Wilder-Smith and Schwartz, 2005; Deen et al., 2006]. In this study as well as in the recent report from Port Sudan different symptoms and complications were observed [Malik et al., 2011]. In contrast to South East Asian countries, dengue is not endemic in Sudan and epidemics occur from time to time. However, the current study was hospital-based which might not reflect the real situation at the community level where some mild or asymptomatic infection might occur.

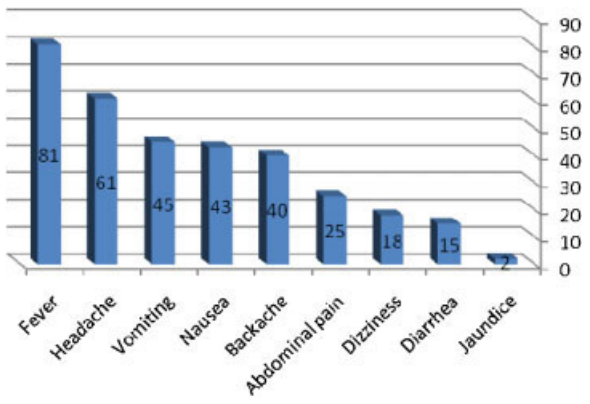

Fig. 2. Presenting symptoms among patients with Dengue in Kassala Hospital, Sudan

The majority of patients in this study were adult males. This might explain the difference in the endemicity of the dengue disease where in endemic countries in South East Asia, children are the main infected group [Anders et al., 2011]. Perhaps some children might have been misdiagnosed and admitted to the pediatric hospital in Kassala in spite of the specialized dengue ward with all the facility of diagnosis and management. However, in the neighboring Saudi Arabia the mean age of patients reported during the recent dengue epidemic was 27.6 years [Ayyub et al., 2006].

The male:female ratio in the current study was 1.8:1 while it was 3.3:1 and 1.5:1 during the two recent dengue epidemics in Saudi Arabia [Ayyub et al., 2006; Khan et al., 2008]. Interestingly, a male preponderance was documented in another hemorrhagic fever (Rift Valley Fever) in the nearby area and the factor of male predominance in the Rift Valley Fever was attributed to the zoonotic nature of the disease [Hassanain et al., 2010]. The gender exposure difference between males and females beside healthcare-seeking behavior might account for this gender difference observed in this setting. However, there was no any study investigating a gender behavior bias in healthcare-seeking behavior in Sudan to support this explanation.

In the current study the DSS constituted 11.1% of the cases and the mortality rate was 6.1%. DSS was observed in 37 (11.9%) of 312 children in Post Sudan, while the death rate among these all children with dengue was 3.8% (12/312) [Malik et al., 2011]. Surprisingly there were no deaths during the two dengue epidemic in neighboring Saudi Arabia [Ayyub et al., 2006; Khan et al., 2008]. Yet, recently, Parkash et al. [2010] reported a 2.6% mortality rate among patients with dengue in Karachi, Pakistan (Pakistan; 2.6%).

One of the limitations of the current report is the absence of direct tests: For the non-structural protein 1 antigen or tests by the polymerase chain reaction. Detection of IgM in symptomatic patients is

TABLE I. Clinical and Laboratory Findings in Dengue Infection Patients, Kassala, Sudan

Variables	DF (N = 25)	DHF(N = 47)	DSS (N = 9)	*P*-value
Number (%) of patients with				
Neutropenia	23 (92)	3 (6.3)	2 (22.2)	0.05
Raised AST	5 (20)	27 (57.4)	6 (66.6)	0.01
Raised ALT	3 (12)	6 (12.7)	1 (11.1)	0.7
Hemoconcentration	5 (20)	4 (8.5)	1 (11.1)	0.9
Platelets count				
>100.000	8 (32)	3 (6.3)	0(0)	0.01
50.000–100.000	11 (44)	25 (53.1)	4 (44.4)	0.6
≤50.000	6 (24)	19 (40.4)	5 (33.3)	0.04

DF, Dengue fever, DHF, Dengue hemorrhagic fever, DSS, Dengue shock syndrome, AST, Aspartate aminotransferase, ALT, Alanine aminotransferase.

considered diagnostic [Gubler, 2010]. Nevertheless, IgM antibodies can cross-react with other flaviviruses, which can make the interpretation of the serology difficult [Chen and Wilson, 2010; Gubler, 2010; Guzman et al., 2010]. On the other hand, negative results will not exclude the disease, as there is about 1 week window period before the appearance of IgM. The other limitation is that the dengue serotype was not investigated which might have been serotype 3 as reported in Portsudan during the recent epidemic [Malik et al., 2011].

REFERENCES

Adam I, Jumaa AM, Elbashir HM, Kasany MS. 2010. Maternal and perinatal outcomes of dengue in PortSudan, eastern Sudan. Virol J 7:153.

Amarasinghe A. Kuritsk JN, Letson GW, Margolis HS. 2011. Dengue virus infection in Africa. Emerg Infect Dis 17:1349–1354.

Anders KL, Nguyet NM, Chau NV, Hung NT, Thuy TT, Lien le B, Farrar J, Wills B, Hien TT, Simmons CP. 2011. Epidemiological factors associated with dengue shock syndrome and mortality in hospitalized dengue patients in Ho Chi Minh City, Vietnam. Am J Trop Med Hyg 84:127–134.

Ayyub M, Khazindar AM, Lubbad EH, Barlas S, Alfi AY, Al-Ukayli S. 2006. Characteristics of dengue fever in a large public hospital, Jeddah, Saudi Arabia. J Ayub Med Coll Abbottabad 18:9–13.

Center for Disease Control and Prevention. 2008. In: Dengue fever. Yellow book traveler's health. Chapter 4. c2008 [updated 2008 Jul 29]. Available at: http://www.xmarks.com/site/wwwn.cdc.gov/travel/yellowBookCh4-DengueFever.aspx. Accessed October 28, 2008.

Chen LH, Wilson ME. 2010. Dengue and chikungunya infections in travelers. Curr Opin Infect Dis 23:438–444.

Deen JL, Harris E, Wills B, Balmaseda A, Hammond SN, Rocha C, Dung NM, Hung NT, Hien TT, Farrar JJ. 2006. The WHO dengue classification and case definitions: Time for a reassessment. Lancet 368:170–173.

Gibbons RV, Vaughn DW. 2002. Dengue an escalating problem. BMJ 324:1563–1566.

Gubler DJ. 2004. The changing pidemiology of yellow fever and dengue, 1900 to 2003: Full circle? Comp Immunol Microbiol Infect Dis 27:319–330.

Gubler DJ. 2010. In: "Dengue viruses", Mahy BWJ, Van Regenmortel MHV, Desk encyclopedia of human and medical virology. Boston: Academic Press. pp. 372–382.

Guzman MG, Kouri G. 2002. Dengue: An update. Lancet Infect Dis 2:33–42.

Guzman MG, Halstead SB, Artsob H, Buchy P, Farrar J, Gubler DJ, Hunsperger E, Kroeger A, Margolis HS, Martínez E, Nathan MB, Pelegrino JL, Simmons C, Yoksan S, Peeling RW. 2010. Dengue: A continuing global threat. Nat Rev Microbiol 8:S7–S16.

Hassanain AM, Noureldien W, Karsany MS, Saeed el NS, Aradaib IE, Adam I. 2010. Rift Valley Fever among febrile patients at New Halfa hospital, eastern Sudan. Virol J 7:97.

Khan NA, Azhar EI, El-Fiky S, Madani HH, Abuljadial MA, Ashshi AM, Turkistani AM, Hamouh EA. 2008. Clinical profile and outcome of hospitalized patients during first outbreak of dengue in Makkah, Saudi Arabia. Acta Trop 105:39–44.

Malavige GN, Ranatunga PK, Velanthanthiri VGNS, Fernando S, Karunatilaka DH, Aaskov J, Seneviratne SL. 2006. Patterns of disease in Sri Lankan dengue patients. Arch Dis Child 91:396–400.

Malik A, Earhart K, Mohareb E, Saad M, Saeed M, Ageep A, Soliman A. 2011. Dengue hemorrhagic fever outbreak in children in Port Sudan. J Infect Public Health 4:1–6.

Parkash O, Almas A, Jafri SMW, Hamid S, Akhtar J, Alishah H. 2010. Severity of acute hepatitis and its outcomes in patients with dengue fever in a tertiary care hospital Karachi, Pakistan. BMC Gastroenterol 10:43.

Ranjit S, Kissoon N. 2010. Dengue hemorrhagic fever and shock syndromes. Pediatr Crit Care Med 12:90–100.

Rigau-Pérez JG, Clark GG, Gubler DJ, Reiter P, Sanders EJ, Vorndam AV. 1998. Dengue and dengue hemorrhagic fever. Lancet 352:971–977.

TDR/WHO. 2009. Dengue: Guidelines for diagnosis, treatment, prevention and control. TDR/WHO. Geneva, Switzerland.

World Health Organization. 1997. Dengue haemorrhagic fever: Diagnosis,treatment,prevention,control. 2nd edition. Geneva, Switzerland: World Health Organization.

World Health Organization. 2007. Scientific working group report on dengue. Geneva, Switzerland: WHO. http://apps.who.int/tdr/publications/tdr-research-publications/swg-report-dengue/pdf/swg_dengue_2.pdf

World Health Organization. 2009. Dengue guidelines for diagnosis, treatment, prevention and control. Geneva: World Health Organization. ISBN 9241547871. http://whqlibdoc.who.int/publications/2009/9789241547871_eng.pdf.

Wilder-Smith A, Schwartz E. 2005. Dengue in travelers. N Engl J Med 353:924–932.