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Original Research Article

Clinical and epidemiological characteristics of a hepatitis E outbreak in an internally displaced persons camp in Kassala, Sudan

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ABSTRACT

Background: Hepatitis E virus (HEV) is a leading cause of acute viral hepatitis in humanitarian settings. In March 2025, a large HEV outbreak occurred in an internally displaced persons (IDP) camp in Kassala, Sudan. The aim of the study was to evaluate the epidemiological and clinical characteristics of the outbreak to inform public health response.
Methods: We conducted a descriptive cross-sectional study using secondary data from the Kassala State Ministry of Health for all reported HEV cases between March and June 2025. Data were analyzed for demographic, clinical, and temporal characteristics.
Results: A total of 1,041 HEV cases were reported. The mean age was 20.3 years, with the highest attack rates in children and young adults (0-19 years). Females were disproportionately affected (60.7% of cases). The most common clinical presentations were dark urine (83.8%), fever (80.1%), and jaundice (74.4%). The epidemic curve peaked in late March, suggesting a common-source exposure. Only 1.6% of cases were laboratory-confirmed, revealing a significant diagnostic gap.
Conclusions: The 2025 Kassala HEV outbreak highlights the vulnerability of IDP populations to waterborne diseases. The findings underscore the urgent need for specific, actionable interventions, including the deployment of rapid diagnostic tests, implementation of point-of-use water treatment, and targeted health education for women and children to prevent future outbreaks.

Keywords: Hepatitis E virus, Outbreak, Internally displaced persons, Kassala, Sudan

INTRODUCTION

Hepatitis E virus (HEV) is a major cause of acute viral hepatitis worldwide, with genotypes 1 and 2 being responsible for large-scale waterborne outbreaks in developing countries.[1,7] These outbreaks are particularly common in humanitarian crises and internally displaced person (IDP) camps, where the disruption of water, sanitation, and hygiene (WASH) infrastructure creates ideal conditions for HEV transmission.[2,8] Sub-Saharan Africa has been a hotspot for such outbreaks, with over 30,000 cases and 600 deaths reported in refugee and IDP camps between 2010 and 2020.[9]

Outbreaks of HEV have been frequently documented in conflict-affected and displacement settings, including Sudan, South Sudan, Chad, and Niger.[3,4,10,11] These populations often face overcrowding, inadequate sanitation, and limited access to safe drinking water, leading to high attack rates.[9] Pregnant women are particularly vulnerable to severe disease, with case fatality rates exceeding 20% in the third trimester.[5]

In March 2025, a large HEV outbreak was reported in the Gharb Al Mattar IDP camp in Kassala, Sudan, a region that has previously hosted refugees and experienced similar outbreaks.[12] The outbreak was characterized by a rapid increase in jaundice cases, primarily affecting children and young adults. However, there was limited laboratory confirmation and a lack of clear data on transmission factors.

Aim

The aim of the study was to describe the clinical and epidemiological characteristics of the HEV outbreak in the Gharb Al Mattar IDP camp to inform future outbreak preparedness and response.

METHODS

Study design and setting

A retrospective descriptive cross-sectional study was conducted using surveillance data from the Gharb Al Mattar IDP camp in Kassala, Sudan.

Data source

The data for this analysis were obtained from an existing health database containing records from HEV surveillance and testing conducted in the IDP camp by the Kassala State Ministry of Health in collaboration with the WHO.

Study population

The study population consisted of all 1,041 reported cases of HEV infection in the Gharb Al Mattar IDP camp between March 3 and June 30, 2025.

Data collection and analysis

Data on demographic characteristics (age, gender), clinical symptoms (fever, jaundice, dark urine, etc.), and date of symptom onset were extracted from the surveillance database. The data were analyzed descriptively using frequencies and percentages.

Inclusion and exclusion criteria

The study included patients identified as reported HEV cases by Kassala State Ministry of Health, who were residents or individuals registered within the specific internally displaced persons (IDP) camp in Kassala, Sudan. Only cases reported during the peak outbreak period, specifically between March and June 2025, were included in the analysis. Cases were excluded if they were reported before March 1, 2025 or after June 30, 2025.Multiple entries for the same patient identified during the data cleaning process were removed. Additionally, records with incomplete data, such as those with critical information missing (e.g., unknown age, sex, or weight), were excluded from the analysis.

Ethical considerations

This study utilized anonymized secondary surveillance data. All personal identifiers were removed prior to analysis to ensure confidentiality. Ethical clearance was obtained from the Kassala State Ministry of Health.

RESULTS

Demographic characteristics

A total of 1,041 HEV cases were reported. The mean age of patients was 20.3 years. Children and adolescents were the most affected populations, with individuals aged birth-19 years constituting 59% of all cases. Females accounted for a majority of cases (60.7%). Detailed demographic characteristics are presented in Table 1.

Table 1: Demographic characteristics of hepatitis E cases (n=1,041).

Characteristics	Category	N	Percentage (%)
Age (years)	Birth 9	272	26.1
	10-19	342	32.9
	20-29	185	17.8
	30-39	125	12.0
	40-49	68	6.5
	50+	49	4.7
Gender	Female	632	60.7
	Male	409	39.3

Clinical presentation

The most frequently reported clinical signs were dark urine (83.8%), fever (80.1%), and jaundice (74.4%). A summary of the clinical presentation is provided in Table 2.

Table 2: Clinical presentation of hepatitis E cases (n=1,041).

Symptom/sign	N	Percentage (%)
Dark urine	872	83.8
Fever	834	80.1
Jaundice (yellow eyes)	775	74.4
Abdominal pain	730	70.1
Vomiting	540	51.9
Yellow discoloration of skin	384	36.9

Temporal distribution

The epidemic curve indicated a point-source outbreak, with a sharp increase in cases in late March and a peak of 163 cases in the week beginning March, 2025.

The number of cases subsequently declined, with only one case reported in June.

Laboratory confirmation

Of the 1,041 suspected cases, only 17 (1.6%) were tested and confirmed by laboratory analysis, highlighting a significant gap in diagnostic capacity during the outbreak.

Statistical associations

A statistically significant association was observed between gender and the presentation of abdominal pain (p=0.027), with females more likely to report this symptom. Age was significantly associated with the presentation of jaundice and abdominal pain, with these symptoms being more prevalent in younger age groups (10-19 years).

DISCUSSION

This study describes the epidemiological and clinical characteristics of a large HEV outbreak in an IDP camp in Kassala, Sudan. The findings highlight the significant burden of HEV in this vulnerable population, with a high attack rate among children and young adults, and a predominance of cases among females. These findings are consistent with other recent HEV outbreaks in the region, such as those among Tigrayan refugees in Sudan and in IDP camps in South Sudan.[12, 13]

The predominance of female cases (60.7%) is a notable finding. While some studies in non-endemic regions report a higher prevalence in males, outbreaks in humanitarian settings have shown a different pattern. For example, an outbreak in Uganda also reported a higher attack rate in women.[14] This may be linked to gender-related exposure risks, such as greater involvement in household water collection, food preparation, and care for sick family members. Further research is needed to explore the sociocultural and behavioral factors that may contribute to this gender disparity in infection risk.

The high attack rate in children and young adults (0-19 years) aligns with the typical epidemiology of HEV in endemic areas, where the disease primarily affects this demographic.[15] The clinical presentation, dominated by dark urine, fever, and jaundice, is consistent with the classic symptoms of acute viral hepatitis.[3,16] It is also important to consider the potential role of malnutrition and co-infections, which are common in IDP camps and can exacerbate disease severity, although this was not assessed in our study.

The epidemic curve, with its sharp peak and subsequent decline, is characteristic of a common-source outbreak, likely due to a contaminated water supply within the camp. This is a recurring theme in HEV outbreaks in humanitarian settings and underscores the critical importance of WASH interventions.[4,6,17] Improving water quality and sanitation is the cornerstone of HEV prevention and control.[18,19]

The extremely low rate of laboratory confirmation (1.6%) is a major limitation of this study and a critical public health issue. This diagnostic gap has significant practical consequences for outbreak management, as it prevents a clear understanding of the true disease burden, hinders the ability to track transmission dynamics, and complicates the evaluation of intervention effectiveness. Reliance on clinical diagnosis alone can lead to misclassification and an inaccurate picture of the outbreak. Strengthening surveillance requires the deployment of rapid diagnostic tests (RDTs) for HEV in field settings.

While the Hecolin® vaccine has shown efficacy and has been used in outbreak settings, its implementation remains complex.[20,21] A multi-pronged approach combining WASH improvements, health education, and potentially vaccination is needed to control HEV in these vulnerable populations.[22]

Limitations

The findings of this study are subject to several limitations. The use of secondary data means that we were reliant on the quality and completeness of the original data collection. The lack of laboratory confirmation for most cases means that some cases may have been misdiagnosed. Finally, the descriptive nature of the study does not allow for a formal analysis of risk factors.

CONCLUSION

The 2025 HEV outbreak in the Gharb Al Mattar IDP camp in Kassala highlights the ongoing threat of waterborne diseases in displaced populations. The outbreak disproportionately affected women and children, and was likely caused by a contaminated water source. These findings underscore the urgent need for specific, actionable interventions to prevent future HEV outbreaks in Sudan and similar settings.

Recommendations

Enhanced surveillance

Deploy rapid diagnostic tests (RDTs) for HEV to improve case detection and surveillance in future outbreaks.

WASH interventions

Implement and sustain point-of-use water treatment options, such as chlorination tablets or ceramic water filters, and ensure adequate sanitation facilities.

Targeted health education

Develop and deliver health education campaigns for women on safe water handling, food preparation, and hygiene practices.

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