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Original Research

Post-earthquake outbreak of rotavirus gastroenteritis in Kashmir (India): An epidemiological analysis

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Summary *Objective:* An earthquake struck Kashmir on 8 October 2005. A central team of public health specialists was sent to Kashmir to assess the public health measures required following the earthquake, and to assist in institution of public health measures.
Study design: Epidemiological and environmental investigation in Tangdar block (Kupwara district) and Uri *Tehsil* (Baramula district).
Methodology: Visits to villages affected by the earthquake, rehabilitation camps and health care, examination of cases with acute diarrhoeal disease (ADD), environmental observations, collection of clinical samples from ADD cases and environmental samples from drinking water sources, and laboratory methods.
Results: In total, 1783 cases of ADD were reported between 14 October and 17 December 2005 in Tangdar (population 65000). The overall attack rate was 20% in children under 4 years of age. Twelve cases of ADD with loose motions without blood were studied, and 11 rectal swabs and one stool sample were processed. No bacterial enteropathogens could be isolated, but three of the 12 samples yielded rotavirus antigen on enzyme-linked immunosorbent assay. Twelve of 13 (92.3%) water samples, collected from various stream or tap water (source: spring/stream) sources, were unsatisfactory ($P = 0.001$) using the H_2S strip method compared with other sources (well/mineral water). All eight water sources in Tangdar block were unsatisfactory, indicated by blackening of H_2S filter paper strips. Following the earthquake, drinking stream water or tap water without boiling or chlorination may have led to a common

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source water-borne outbreak of rotavirus gastroenteritis. Other contributing factors were: overcrowding; poor sanitation; open-air defaecation; poor hygiene; and living in makeshift camps near streams. Person-to-person transmission may also have contributed to perpetuation of the outbreak. Following the establishment of medical camps and information, education and communication regarding the need to drink boiled water and follow safer hygienic practices, the outbreak was brought under control.

Conclusions: The earthquake in Kashmir in 2005 led to widespread contamination of drinking water sources such as stream and tap water (source: stream or spring). This appears to have led to a common source outbreak of rotavirus between October and December 2005, leading to ADD, amongst infants and small children, transmitted by the faecal-oral route and perpetuated by person-to-person transmission.

Introduction

With its vast geographic terrain of rivers, mountains and seas, India is prone to natural disasters such as floods, earthquakes, cyclones and even tsunami. This leads to devastation, with loss of human lives, properties and economic losses. This is invariably followed by outbreaks of infectious disease. At this stage, the role of the State becomes imperative.

An earthquake struck Kashmir on 8 October 2005 (Fig. 1). This led to large-scale destruction of houses, mainly in Kupwara and Baramula districts, approximately 1400 deaths, thousands of missing people and many injuries. Numerous livestock were also killed. This situation warranted the State to commence relief/rebuilding work immediately, supported by the army and non-government organizations. People were housed in tents and relief materials were distributed. The affected population was surveyed. Medical camps were formed and a disease surveillance system was established.

Figure 1 Post catastrophe in Uri *Tehsil*.

Incidences of acute diarrhoeal disease (ADD), acute respiratory infection (ARI), fever and jaundice were recorded, on a daily basis, in various relief camps and adjoining hospitals. Information, education and communication (IEC) activity regarding safe drinking water, chlorine tablet distribution and measles vaccination to children under 10 years of age was commenced.

To assess the public health measures required following the earthquake, and to assist the State in instituting public health measures, a central team of public health specialists from the National Institute of Communicable Diseases (NICD), Government of India, was sent to Kashmir from 8 to 21 November 2005 to undertake investigations. The team carried out an epidemiological and environmental investigation.

The team visited the affected district of Kupwara. The most affected block was Tangdar in Karnah *Tehsil* (subdistrict or administrative unit consisting of several villages) with an estimated population of 65,000. Tangdar block is located 221 km from Srinagar, 5300 ft above sea level. Karnah *Tehsil* experienced 85% damage to houses. The team visited some of the affected villages such as Gabra and Teetwal, various rehabilitation camps and Tangdar Community Health Centre (CHC) Hospital. The local population had poor levels of literacy and low hygienic standards, and many of them reared cattle.

In another affected district (Baramula), the team visited Buniyar Primary Health Centre (PHC) and Uri Subdistrict Hospital, located 110 km from Srinagar, and carried out investigations.

The normal water supply in the affected district came from natural resources (spring/stream water), and it was stored for distribution without filtration or chlorination. This did not lead to any problems before the earthquake.