An epidemic of rotavirus diarrhoea in Jawhar Taluk, Thane district, Maharashtra, India, December 2000–January 2001

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SUMMARY

An epidemic of diarrhoea in Jawhar, a tribal area of Thane district, Maharashtra, India was investigated. Within a period of approximately 2 months 490 cases of acute diarrhoea were reported among children under 5 years of age, with a case fatality rate of 0·40%. Twenty-seven out of 39 (69·23%) rectal swabs/faecal specimens obtained from hospitalized paediatric patients up to 2 years of age from Jawhar were positive by ELISA for rotavirus. Of these, seven were in the age group of ≤6 months. Seven ELISA-positive faecal specimens were positive for serotype G3 by RT–PCR. Out of 15 serum samples collected from these patients, 12 showed the presence of rotavirus-specific IgM. Rotavirus appears to be the aetiological agent of this widespread outbreak in Jawhar, Thane district, Maharashtra state, India.

INTRODUCTION

In India, rotavirus as a cause of acute paediatric diarrhoea requiring hospitalization has been reported from several places [1–10]. In a long-term study from Bangalore, Karnataka state, India [11], rotavirus was detected among 200 out of a total of 1141 cases (17·5%) of diarrhoea. Kelkar et al. [12] have carried out studies of the prevalence of rotavirus diarrhoea from hospitalized cases over a period of 4 years in Pune, Maharashtra. Rotavirus was detected in 266 (28·15%) out of 945 faecal specimens collected between July 1992 and June 1996 from children <5 years of age [12]. Statistical analysis revealed that seasonality had a strong influence on the number of rotavirus diarrhoea cases admitted to the hospital. The peak incidence of cases was in the winter and the minimum in the rainy season [12]. Age was strongly associated with the prevalence of rotavirus diarrhoea.

The results of univariate analysis revealed that the 6–12 months age group was the most vulnerable to the disease followed by the 12–18 months age group. The ≤6 months age group was also susceptible to rotavirus diarrhoea but to a lesser extent compared to age groups 6–12 and 12–18 months [12].

Most of the above reports recorded the detection of rotavirus from stool samples collected from hospitalized cases of diarrhoea in children from endemic cities. A large-scale epidemic of rotavirus diarrhoea (491 cases within 2 months) was reported from Manipur, Assam, India in 1979 [13]. Rotavirus was detected in 53 out of 59 stool samples, and the case fatality rate was 0·8%.

An epidemic of diarrhoea in a tribal population of Jawhar Taluk, Thane district, Maharashtra, occurred in December 2000–January 2001. We present the investigation of this outbreak.

METHODS

The state of Maharashtra has 31 districts, 336 towns and 40 412 villages (source: Government of

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Maharashtra, Census of India, Election Commission of India). The total population (2001) is 96 752 247. The population density is 314 persons/km² and 42·4 % live in urban areas. The life expectancy at birth (1993–1997) is 65·5 years, the infant mortality rate is 48/1000 (1999) and the literacy rate (2001) is 77·27 % (source: Census of India; Economic Survey, 2000–2001; Office of the Registrar General of India, Ministry of Home Affairs, Government of India). In Maharashtra, 36·86 % of the people live below the poverty line.

Epidemic area

Jawhar Taluk is situated in the eastern part of Thane district and 90 % of the population are tribal. The tribal populations are isolated, living in remote forests and hilly areas far from urban centres. These groups are also socioeconomically disadvantaged, with unemployment and poor health being major factors. According to the district health authorities, diarrhoea is endemic in Jawhar. Winter diarrhoea is also known to occur.

The Jawhar area is hilly with an elevation of 566·6 m. It receives heavy rainfall (average 190–200 cm). The water supply is through wells and lakes. Of the total population of Jawhar Development Block, approximately 94 % (122 833/131 346) are tribal, and only 7 % (9325/131 346) live in urban areas [14]. The tribal population of <5 years old is approximately 14 003 (sample registration system, 1996, Government of India), of which approximately 5600 are aged 0–24 months. The group aged 0–24 months is the most susceptible to rotavirus diarrhoea [12].

The clinical and epidemiological data of the epidemic were obtained from the Medical Superintendent, Cottage Hospital, Jawhar, Thane district.

Faecal specimens

A total of 39 rectal swabs/faecal specimens were received from the Medical Superintendent, Cottage Hospital, Jawhar, Thane district, on wet ice. Lot no. 1, consisting of 23 rectal swabs was collected on 14 December 2000, 2 weeks after the diarrhoea cases started appearing. It was noticed that the quantity of the faecal material on rectal swabs of the first lot was minimal. Lot no. 2, consisting of 16 faecal specimens was collected on 19 December 2000, by which time the number of cases admitted to hospital had increased twofold.

Serum samples

Fifteen acute serum samples were received from children hospitalized at Jawhar along with rectal swab specimens of lot no. 1.

Diagnosis of rotavirus in faecal specimens by ELISA

Rectal swabs were squeezed in about 0·5 ml of 10 mmol phosphate-buffered saline (PBS), pH 7·2, containing antibiotics and 0·5 mmol calcium chloride and clarified [Making Science (more) Effective (MSE) Coolspin-2, rotor: 34 115–613 fixed angle] at 1777 *g* for 20 min at 4 °C. Ten per cent (v/v) faecal suspensions were also prepared in PBS. The supernatant fluids were tested for group A rotavirus by ELISA, developed at The National Institute for Virology, Pune [15].

PCR serotyping

Procedure for PCR typing was similar to the method described by Taniguchi et al. [16]. Briefly, amplification was carried out in two stages. A first amplification of the full-length VP7 gene was followed by a second amplification of the DNA fragment using nested primers.

Detection of IgM

The serum samples from patients were tested for the presence of rotavirus-specific IgM by capture enzyme immunoassay, according to the method described by Coulson et al. [17] with some modifications. Rabbit anti-human IgM (Dakopatts, Ely, Cambs, UK catalogue no. AO 425) was used as the coating antibody. Rotavirus-specific rabbit antibody conjugated to horseradish peroxidase (Sigma, St. Louis, MO, USA), prepared in our laboratory, was employed for the detection of IgM. The cut-off optical density (OD) value for IgM was taken as the mean OD of all sera from healthy subjects (excluding five with higher ODs).

RESULTS

Features of the epidemic

In December 2000 to January 2001, an unusually large number of cases of diarrhoea in children occurred in Jawhar. All these cases were hospitalized. A total of 490 diarrhoea cases from Jawhar were reported. The epidemic curve is presented in Figure 1. Figure 2
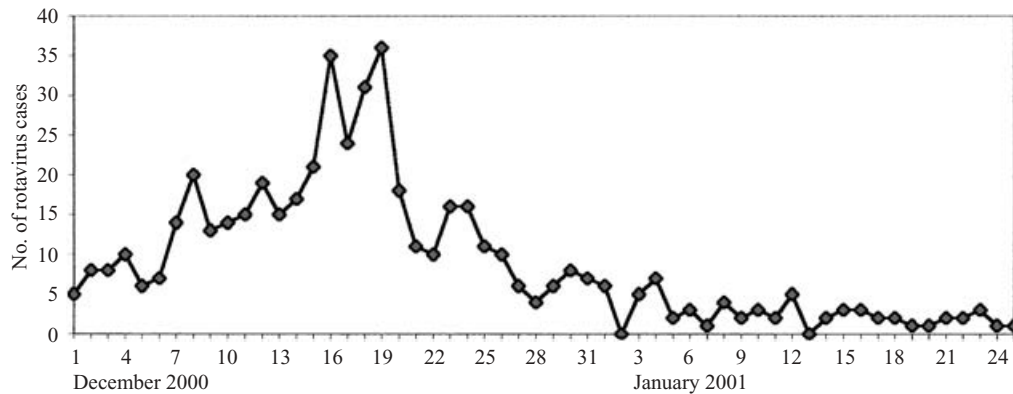
Fig. 1. Hospitalized diarrhoea cases at Jawhar Taluk, Thane district.
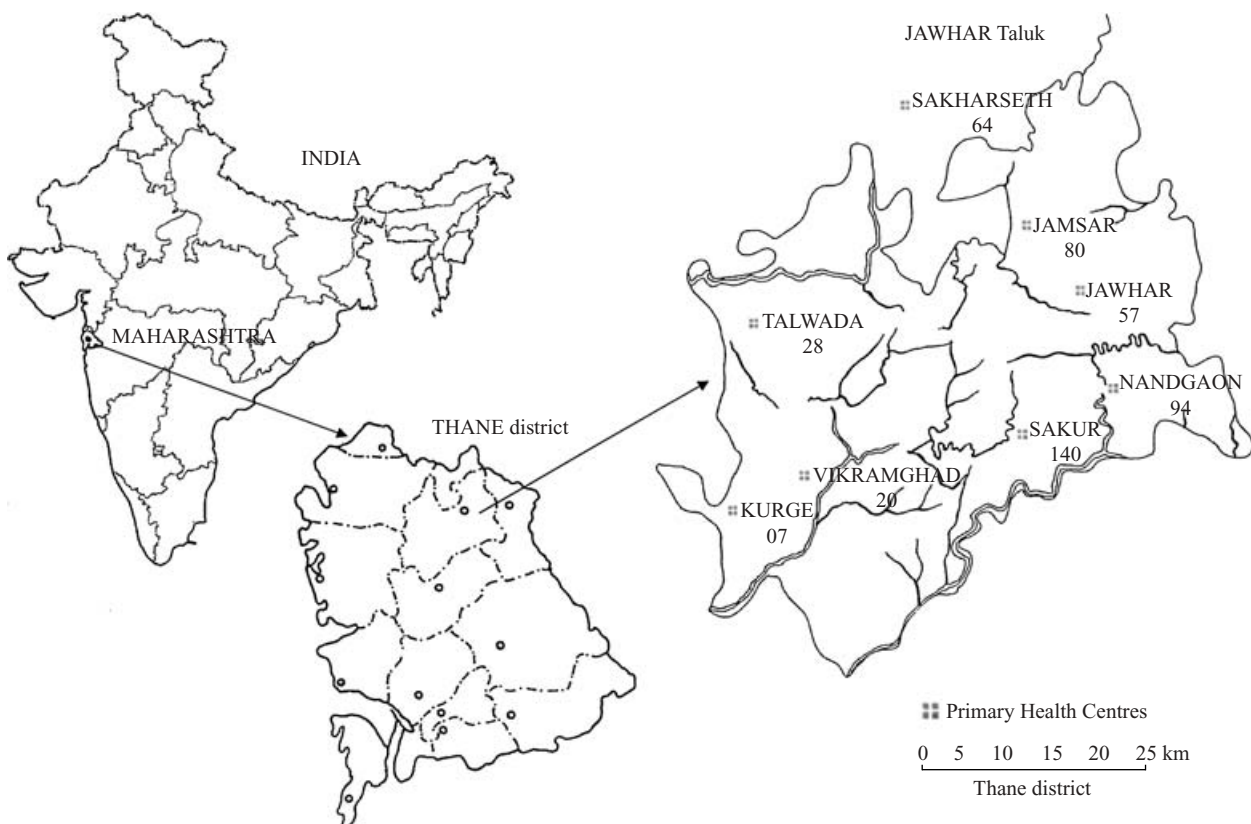

Fig. 2. Map showing the location and number of cases that occurred in Jawhar Taluk, Thane district.

shows the location and number of children having diarrhoea who attended different primary-health centres of Jawhar Taluk. Jawhar has a cottage hospital where all the diarrhoea patients were admitted.

The case fatality was 2/490 (0·40%), which is fewer than expected; more male children (58·97%) were affected. The age distribution of diarrhoea cases is presented in Figure 3. In this outbreak, the maximum number of cases (299/490, 61·02%) were reported from the >6–12 months age group.

Rotavirus was detected by ELISA in 27 (69·2%) out of 39 rectal swabs/faecal specimens from Jawhar. The age distribution of 27 cases in which virus was detected is shown in the Table. Serotyping of rotavirus with monoclonal antibodies could not be performed due to inadequate quantity of stool samples of lot no. 1 obtained from Jawhar. However, seven ELISA-positive faecal specimens from lot no. 2 were tested by PCR. All the seven specimens were found to be positive for the G3 serotype.
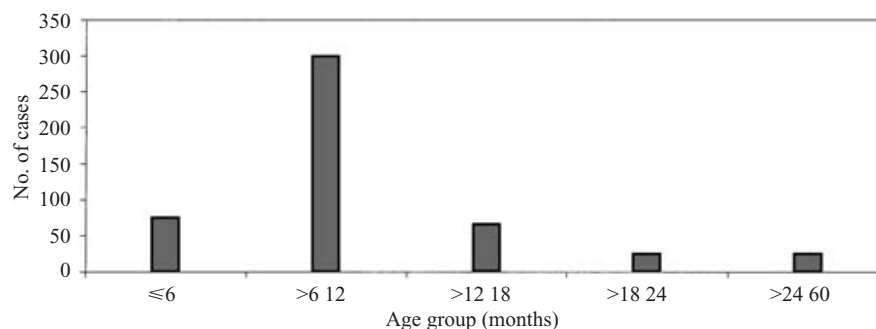
Fig. 3. Age distribution of diarrhoea cases at Jawhar Taluk, Thane district.

Table. *Age distribution of rotavirus positive cases by ELISA at Jawhar Taluk, Thane district, Maharashtra, India*

Age group (months)	No. +ve /total +ve	% positive
⩽6	7/27	25·92
>6–12	15/27	55·55
>12–18	2/27	7·50
>18–24	3/27	11·11

Rotavirus-specific IgM antibodies were detected in 12/15 (80%) of the sera obtained from the hospitalized children at Jawhar, indicating recent infection with rotavirus. Three out of 12 serum samples positive for IgM were from children <2 months old. These results together with the virus detection and epidemiological data reiterated the role of rotavirus causing diarrhoea in children <2 months old.

DISCUSSION

The epidemic at Jawhar affected a large number of children, with a case fatality rate of 0·4%, which was much less than expected. This may be due to prompt treatment of children at the Cottage Hospital, Jawhar. Normally, the 6–12 months age group is most affected in rotavirus diarrhoea [18]. This outbreak was typical in that the maximum number of cases occurred in the >6–12 months age group.

Outbreaks due to rotavirus have been reported in South Israel and in an American Indian community [19–21]. However, an epidemic such as the one in Jawhar, Thane district, has only been reported once previously in India, at Manipur [13]. It is important to note that both epidemics occurred in the months of December and January, and both areas are hilly, with tribal populations.

The present outbreak was due to rotavirus and the serotype involved was G3. The reports from India [9, 12, 22–24] show that G3 is a less common serotype compared to G1, G2 and G4, except for studies at Bangalore, India [11]. However, serotype G3 was detected in the cases that occurred during this epidemic.

Several factors such as winter season; low socioeconomic status (below the poverty line); and poor hygienic conditions may have contributed to the epidemic.

The special feature of this epidemic at Thane was the detection of an unusually large number of cases (75/490, 15·31%) aged ⩽6 months. The diarrhoea cases in the ⩽6 months age group were compared to cases in a previous study from Pune [12]. That study reported 26/266 (9·78%) diarrhoea cases among the ⩽6 months age group. Thus, the proportion of diarrhoea cases in this young age group in Jawhar was significantly higher ($P < 0.05$) than those occurring in Pune. At Jawhar, 7/27 (25·92%) infants with proven rotavirus diarrhoea were ⩽6 months old. Of these, 5 (18·51%) cases occurred among children <2 months old, compared to 11·53% in Pune. Although, the 6–18 months age group is the most susceptible to rotavirus among hospitalized children for diarrhoea [25], it has been reported in some developing countries that the disease is common in children <3 months old [25–27].

Occurrence of rotavirus diarrhoea in children <2 months due to the G3 serotype is probably because of insufficient maternal antibodies. We are currently conducting studies which examine this issue. In summary, we present an unusually large epidemic of rotavirus diarrhoea in a disadvantaged tribal population in India. Predominance of the G3 serotype was a feature of the epidemic.

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