An Outbreak of Acute Diarrheal Disease, Presumably of Viral Origin, Among Children of a Local School

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Beginning June 16, 1961, a large number of children attending Ube Konan Primary School came down with an acute diarrheal disease and the outbreak ceased within a week without further spread. The school is situated in the suburbs of the city of Ube. Various pieces of evidence point to a viral origin of the disease, although the causative agent has not yet been identified. In view of the fact that similar incidents frequently occur among groups of people in Japan during summer and most of them have been assumed to be poisoning or of intestinal bacterial infection without solid proof, it seems worthwhile to report our observations.

OBSERVATIONS

1. Epidemic

The first patient who had diarrhea and fever and was arbitrarily included in the series visited a local physician on June 16 which was followed by a few simiar cases on 17th and then by a sudden burst, totaling 186 in number. They were immediately accommodated in the auditorium of the school and in the infectious disease ward of our hospital, while several groups of physicians and technicians dispatched from public health centers of the prefecture and the city took necessary measures for the prevention of the spread. The daily occurrence of the patients during this epidemic is indicated in Fig. 1, and it is clearly seen that the majority of the patients (51%) came down in one day, June 19th. Since diarrheal diseases are common at this time of the year, it is likely that the patients seen on the first and the last day might have had some other diarrheal ailment and the actual number of the days during which the epidemic occurred was 3 to 5 days, instead of 6 days in the figure. Apparently, it was not due to a preformed toxin in a meal because of the spread of the days of occurrence, and equally obvious was that the minimum of the average incubation time was not shorter than 2 days.

Patients were limited among those of ages 5 to 15, the majority being the pupils of this school (Fig. 2). Several junior high school students who were their brothers or sisters and had similar symptoms were included, although no proof of the identity of the disease was provided. The largest number of cases was seen among 11

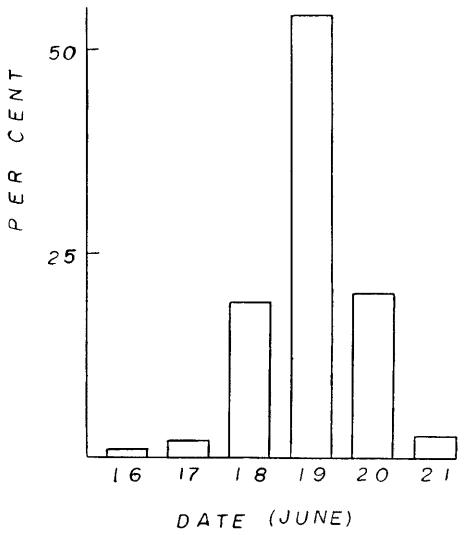

Fig. 1. The occurrence of patients. The ordinate indicates the number of patients who came down.

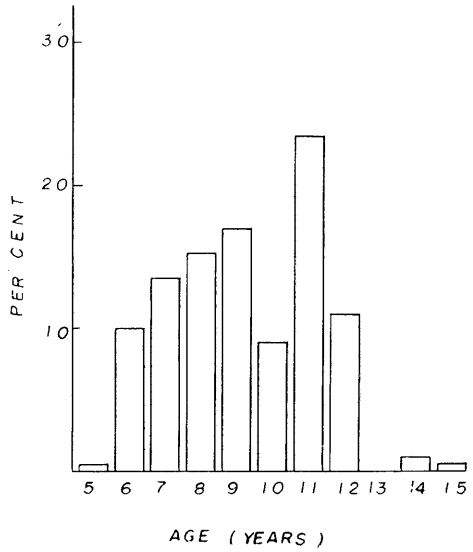

Fig. 2. Age distribution of the patients.

year old children. None of the school employees or teachers became ill during this period. No significant predilection in sex was noted when 99 boys were compared with 87 girls which constituted 12.6 and 13.9% of the total school boy and girl populations, respectively.

2. Clinical picture

Subjective symptoms. The major complaints included diarrhea, abdominal pain, headache, fever and prostration as seen in Table 1. The duration of the diarrhea was relatively short, about 80% of the cases recovering within 3 days (Fig. 3). The

TABLE 1 Subjective Complaints and Frequencies

Complaints	No. of patients	Per cent
Diarrhea	180	96.8
Abdominal pain	124	66.7
Headache	112	60.0
Fever	102	55.0
Prostration	74	45.5
Nausea	43	23.1
Chills	22	11.8
Vertigo	11	5.9
Urinary incontinence	3	1.6
Convulsion	1	0.5

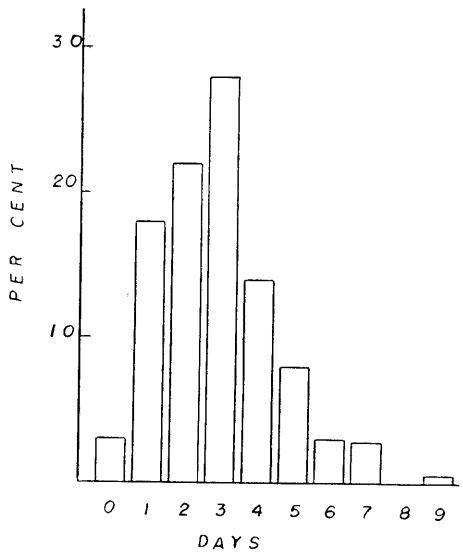

Fig. 3. Duration of diarrhea.

frequency of stools seldom exceeded 10 times a day, and it was between 2 and 5 in the majority of the cases in acute stage. The stool was watery with a somewhat greenish tint and never had gross blood or pus. There were no noticeable prodromal signs. Fever was noted in 55% of the cases but in only 4 patients was it above 38.0°C at one time or other. The fever curve had only one peak and no patients exhibited a two peak pattern. A typical fever pattern is shown in Fig. 4. The

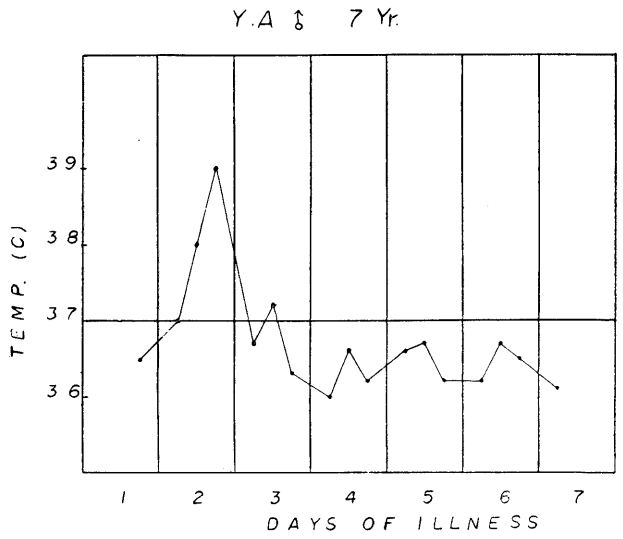

Fig. 4. A typical fever pattern.

fever returned to normal within 24 hours in 71% of the febrile cases and within 48 hours in 96% (Fig. 5).

Fig. 5. Duration of fever.

Objective signs. Tenderness was elicited in the left lower quadrant in 64 cases and in the right lower quadrant in 4. Although some had fur on the tongue, it never was pathologically heavy. There were no vascular injection of the conjunctiva or the pharynx, lymphadenopathy or abnormalities in the chest. Urinalyses carried out on ten specimens were all negative for protein, urobilinogen and sugar. White blood cell counts made on ten patients in acute stage revealed normal counts in 9 and a moderate leukocytosis in one, without any consistent trend in the differential.

Bacteriological study. Blood cultures made on about twenty hospitalized patients were all negative. The effort to isolate dysentery bacilli from fecal materials taken from all the patients and their families which totaled 2,500, yielded only three positives, the isolated strains differing from each other. The dysentery study was carried out by the personnel of the prefectural and city bacteriological laboratories.

Virological study. Ten fecal specimens taken from patients who just passed the acute stage were diluted with 40 volumes of the Hanks' solution, and filtered through the Seitz filter. Such filtrates were mixed and administered, in 4 cc dose, to eight volunteers (medical students) through a duodenal tubing passed into the duodenum while fasting. None of the volunteers developed diarrhea except that a few of them

had some headache two to four days later. Unfortunately, no early fecal materials were secured for this study because of the delay in the preparation for the virological study. The same fecal materials were diluted with 200 volumes of the Hanks' solution containing penicillin and streptomycin and subjected to ultracentrifugation at 30,000 rpm for 30 minutes. The supernatant was added to tissue cultures of HeLa, FL, monkey kidney, and human embryonic cells. Some cytopathogenic effect was observed in the latter two types of cultures. The cytopathogenic effect was demonstrable with human embryonic cells after five passages, but the identity of the agent has as yet to await elucidation.

DISCUSSION

The cause of the diarrheal disease which broke out among the pupils of Konan Primary School in June, 1961, was traceable to one of the lunches provided by the school. Inasmuch as there were no signs of acute poisoning such as sudden onset and violent vomiting, it must have been infectious in nature. Also evident, on this assumption, is that it was mild in infectivity. As long as the percentage of positive dysentery bacilli among the patients and their families was lower than that expected in a random population which is somewhere around 2.7%[1], dysentery can readily be excluded. Ushio,[2] working in the Prefectural Bacteriological Laboratory, isolated a number of nonpathogenic Escherichia, some Proteus morganii and other bacterial strains from the materials during the epidemic but could not incriminate any particular one. Reasoning *a posteriori*, a viral disease seems to be most likely.

Viral diarrhea was first experimentally demonstrated by Light and Hodes[3] in 1942 who instilled a fecal filtrate taken from infants in Baltimore-Washington area into the nose and throat of young calves and produced diarrhea. Many reports have since appeared throughout the world, describing outbreadks of diarrhea in closed institutions or in certain geographical localities in which the causative agent was definitely or indefinitely identified as virus. A large variety of enteroviruses including ECHO, Coxsackie A and B, polioviruses and some adenoviruses have been isolated from various infectious diarrheas[4]. The first epidemic of diarrhea in Japan demonstrated to be of viral origin prevailed in several prefectures in 1948[5,6]. A number of similar epidemics and outbreaks of diarrhea otherwise unidentified have since been reported[7], and extensive investigations were carried out in some of them, notably in the case of Mobara epidemic. These epidemics, taken as a whole, are characterized by acute diarrhea of a few days duration. Systemic symptoms are mild, the fever seldom exceeds 38°C and no sequelae have ever been reported. Although virological evidence is inadequate in our study, the epidemic we observed resembled very closely the previously described[8] in Japan. According to Kojima et al[9]., who produced diarrhea in volunteers with fecal filtrates during an early epidemic, the incubation period was 2 to 8 days, with an average of 4 days. The

estimated incubation time in the present epidemic coincides very well with theirs. The failure to produce the disease in volunteers in this study might have been due either to the inadequacy of the fecal materials used or to the fact that the adult population in Japan has already been exposed to this virus to develop immunity, as suggested by Tateno[10]. He attempted to explain the decrease in epidemics of viral diarrhea in recent years in Japan on the basis of acquisition of immunity on the part of the large population by the past epidemics, mostly subclinically. His theory fits in well with our observation that only children were afflicted with this disease.

SUMMARY

An epidemic of acute diarrheal disease which occurred among a group of school children in June, 1961, is reported. The school lunch was held as responsible, but bacteriolgical studies failed to demonstrate the causative agent. The disease was characterized by a sudden onset of diarrhea with minimal systemic symptoms, and the clinical picture closely resembled the previously described viral diarrhea. The incubation period was estimated to be several days. The course was short without sequelae. The importance of the recognition of this disease among otherwise unidentifiable group poisonings in Japan is discussed.

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