Outbreak report

Outbreak Of Acute Gastroenteritis In An Austrian Boarding School, September 2006

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An outbreak of acute gastroenteritis occurred in September 2006 in a boarding school in eastern Austria. Of 113 cases, 101 were hospitalised. In order to identify the outbreak source, a retrospective cohort study on the group at risk was performed, including 222 pupils and 30 staff members. Food exposure in the canteen of the school was identified as the most relevant common link among the cases in the case series investigation. Although the preliminary microbiological investigation made Norovirus infections possible, an in-depth descriptive epidemiological investigation later pointed to food intoxication rather than a viral infection as the cause of the outbreak. The analytical epidemiological investigation implicated boiled rice and chicken wings served in the canteen as the most likely source of the outbreak. Staphylococcus aureus was identified as the causative agent. Further molecular characterisation revealed that the predominant S. aureus type in this outbreak was a new spa type, t2046. The same spa type was isolated from stool specimens of the majority of the cases investigated, from samples of the incriminated boiled rice, and also from a swab of a palmar skin lesion of one of the healthy kitchen workers, who is therefore the most likely source of contamination. This outbreak underlines again the importance of compliance with the basic guidelines for kitchen hygiene.

Background

On 21 September 2006, the Austrian media reported the occurrence of a cluster of gastroenteritis cases in a boarding school in Eisenstadt, capital of the province Burgenland in eastern Austria. Television crews broadcast from the school yard where the affected people received first aid, and announced a "Salmonella poisoning after consumption of fried chicken in a school canteen".

After only a few initial cases earlier in the day, within two hours that afternoon over 70 people developed symptoms. Most of the patients required parenteral fluid replacement. Overwhelmed by the high number of patients suffering from diarrhoea and circulatory collapse, the local emergency services had to be supported by external services. Ambulances and three helicopters transferred patients into nearby hospitals. Some patients fully recovered after fluid replacement while waiting for the hospital transfer. In total, 101 people were hospitalised in four hospitals in the affected province and in four hospitals of a neighbouring province. The boarding school was closed on the same day (21 September), and an environmental inspection of the canteen was performed by local environmental health officers. The school reopened on 26 September.

Independent of the acute crisis management, the responsible local health authorities asked the Austrian agency for health and food safety to investigate the cluster. Stool samples obtained from five cases were tested on the same evening. Norovirus was detected in stool samples from two of the five investigated cases. The stool samples were negative for *Salmonella*, *Campylobacter*, enterohaemorrhagic *E. coli* and *Yersinia*.

Materials and methods

In the case series investigation, food exposure in the canteen of the boarding school was identified as the most relevant common link among the cases. Based on the preliminary investigation of the stool samples that indicated the presence of norovirus, the following case definition was formulated: A case was defined as a person who had eaten food served in the school canteen on 19, 20 or 21 September and then became ill with diarrhoea and/or vomiting on 23 September at the latest. In order to test the hypothesis that the canteen food was the source of the outbreak, a retrospective cohort study was performed. The boarding school houses 222 pupils, who usually eat breakfast, lunch and dinner in the school's canteen. Thirty adults, including house staff and teachers, also eat in this canteen.

Stool samples were obtained from 45 cases. Culture for bacterial pathogens were performed as described elsewhere [1]. RT-PCR for norovirus was performed at the national norovirus reference laboratory as described previously [2]. Stool specimens were investigated for staphylococcal enterotoxin using Tecra Unique (Tecra International Pty Ltd, Frenchs Forest, Australia). This test, although appropriate for the detection of staphylococcal enterotoxin in food and food-related samples, is not licensed for use in human specimens. It was used here for stool samples because a *Staphylococcus aureus* enterotoxin test for stool specimens is currently not available. Test kits were available for testing only 23 cases. Eight of the nine kitchen workers had nasal swabs taken, which were screened for staphylococcal colonisation, while a palmar swab was obtained from a chronic scaling skin lesion of the ninth kitchen worker. Food specimens were tested for staphylococcal enterotoxin and by culture for bacterial pathogens following accredited methods.

S. aureus isolates of human and food origin were subjected to *Spa* typing. *Spa* types are determined by sequencing of the variable repeat region of the *Staphylococcus* protein A gene (*spa*) as described elsewhere [3]. The repeat region may contain one to 23 repeat units. A number (Ridom nomenclature) is assigned to each unique DNA sequence in a repeat unit. To date, 149 different repeat units are stored in the Ridom *spa* database, describing more than 2000 different *spa* types (www.ridom.de). Thus, the repeat structure of a *spa* type is accurately defined by a numerical code.

A standardised questionnaire designed by EpiInfo for Windows version 3.3.2. was delivered to everyone involved (including kitchen

staff) usually consuming meals in the canteen in order to assess the following information: demographic data, presence of symptoms, clinical onset, disease symptoms, hospitalisation, duration of hospitalisation, outcome of treatment, and food consumption on 19, 20, and 21 September. Complete questionnaires were returned from all 249 people interviewed. Nine people who had not eaten in the canteen on one or more of the three days were excluded from the original group of interest. A cohort of 240 people remained in the data base for the analysis.

Results

Among the 240 cohort members were 224 males (93%). The median age was 16 years (minimum 14 years; maximum 61 years). Of these 240, 113 people fulfilled the outbreak case definition, yielding an overall attack rate of 47%. Among those 113 cases, there were 111 males (98%); the median age was 16 years (interquartile range 15 – 17 years; min 14 years, max 55 years). Out of the 113 cases, 111 were pupils, one was a tutor and one case belonged to the kitchen staff. Eighty patients (71%) had diarrhoea, 103 (91%) had vomiting attacks, 28 (25%) had fever, 77 (68%) had abdominal cramps and 60 (53%) had circulatory instability (i.e. vertigo, faintness or collapse). Some 101 patients (89%) were hospitalised, with the median duration of hospitalisation one day (ranging from one to three days). The epidemic curve illustrates the short period of the event; the cases occurred between 1 pm and 7 pm following the lunch served from 12 to 2 pm. (Figure 1). All 113 patients recovered within a period of no more than 48 hours.

In total, stool samples from 45 cases were collected. None of them contained *Salmonella*. The 45 specimens also tested
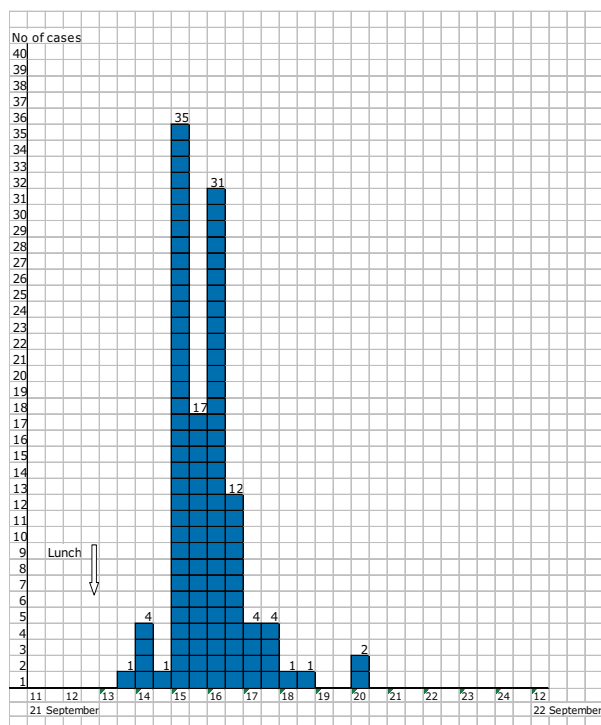
negative for *Campylobacter*, enterohaemorrhagic *Escherichia coli* and *Yersinia*. Of those 45 stool samples, 44 were positive for *S. aureus*, when CNA agar plates (Biomerieux) or Mannit-NaCl agar plates (Oxoid) were used as primary medium. Only 23 stool samples were investigated for staphylococcal enterotoxin; one of them tested positive. Twenty-five stool samples were tested for norovirus, three of which were positive for norovirus genotype II in the RT-PCR.

Food samples collected from the dishes left over from lunch (ketchup, boiled rice and breaded chicken) as well as from raw eggs that had been used for preparing the breaded chicken, tested negative for the pathogens listed above. The rice and the batter of the chicken wings also tested negative for *Bacillus cereus*, *Clostridium perfringens* and staphylococcal enterotoxin. The rice specimens yielded a low number of *S. aureus* (=<10⁴) per gram

S. aureus isolates from 42 of the 44 cases positive for *S. aureus* were typed. *Spa* typing revealed that the isolates from 37 out of the 42 cases, from the palmar swab of the otherwise healthy kitchen worker, and from the samples of boiled rice were identical with respect to their *spa* type. This particular type (repeat structure: 11-19-21-17-34-24-34-22-31-25) was not described among the more than 2,000 different *spa* types that were available in the Ridom *spa*-database (www.ridom.de) at the time of the outbreak. Meanwhile, this *spa* type has been included in the Ridom *spa*-database as t2046.

The kitchen worker whose palmar swab was positive for the particular *S. aureus* strain, had been involved in preparing the dishes at the day of the outbreak. In addition, *S. aureus* of a different *spa* type (t909) was isolated from nasal swabs of two other healthy kitchen workers and from stool specimens of three of the 42 cases for whom the *S. aureus* isolates had been typed. The stool isolate from one further case was of *spa* type t005, and the isolate from the remaining case turned out to be a mixed culture of t909 plus t2046.

Analysis of the day-specific attack rates revealed that food consumption on 21 September was associated with disease risk: of the 210 people that had eaten in the canteen on that day, 113 became a case, whereas none of the 30 people that had not eaten on that day became a case (Table 1). If one of those 30 had been a case, the relative risk would be 16.6 (95% CI 2.4–114.7). The analysis of the food items served on 21 September revealed the highest relative risk for consumption of breaded chicken (RR 7.4; 95% CI 2.5-21.8; Table 2). Consumption of rice was associated with a relative risk of 2 (95% CI 1.35-2.9) and consumption of soup with a RR of 3.7 (95% CI 2.0-6.8). No soup was available for microbiological testing.

FIGURE 1

Cases by time of clinical onset (30-minute intervals)

TABLE 1

Date-specific attack rate (AR)%, relative risk (RR) and risk difference (95% CI)

Date	Day-specific AR %	RR (95%CI)	Risk difference (95%CI)
19-Sep	108/224 (48.2)	1.5 (0.7-3.2)	17.4 (-6.7–40.1)
20-Sep	108/226 (47.8)	1,4 (0.7-2.8)	12.1 (-13.9–38.0)
21-Sep	113/210 (53.8)	Uncalculable	53.8 (47.0 – 60.3)

Food-specific attack rate (AR)%, relative risk (RR) on 21 September

Item of exposure	No. of people exposed*			No of people not exposed*			Univariable
	Ill	Total	AR %	Ill	Total	AR %	RR (95%CI)
Breakfast	84	169	49.3	29	41	70.7	0.7 (0.6-0.9)
Lunch	113	184	61.4	0	26	0	--
Soup	104	159	65.4	9	51	17.6	3.7 (2.0-6.8)
Breaded chicken wings	110	175	62.9	3	35	8.6	7.4 (2.5-21.8)
Boiled rice	92	145	63.4	21	65	32.3	2 (1.4-2.9)
Salad	50	86	58.1	63	124	58.8	1.1 (0.8-1.4)

Discussion

The outbreak presented here underlines the importance of proper epidemiological investigation of clusters of food-borne illness, since interpretation of the microbiological investigations alone was unable to clarify the chain of causality. While it was no problem to exclude *Salmonella* as causative agent, the exclusion of norovirus as a culprit of this outbreak required epidemiological analysis. The shape of the epidemic curve was not compatible with a norovirus outbreak, neither when assuming a point source outbreak with infectious exposure at one of the three days nor when assuming a continuous source that was active during all three days. The frequency distribution of clinical onsets (occurrence of cases within only seven hours) does not reflect the usual distribution of the incubation periods for norovirus infection (16 to 48 hours). Another feature of the event was the absence of secondary cases among the many health care workers involved, which made a norovirus outbreak unlikely.

The abrupt, in some cases violent, clinical onset, with nausea, abdominal cramps, vomiting, diarrhoea, lowered blood pressure and even prostration, the intensity of illness that explained the high frequency of hospitalisation, the very short duration of illness (no more than a maximum of two days) and the short interval between consumption of the most likely causative food and onset of illness all indicate food intoxication.

Although the number of staphylococci recovered from the rice did not exceed the permitted threshold of 105 bacteria/gram food [4], and although enterotoxin could not be detected in any of the epidemiologically implicated food items (the boiled rice and the batter of the chicken wings), the hypothesis of staphylococcal food intoxication is supported by two facts. Firstly, the time interval between consumption of the epidemiologically incriminated food items and the onset of symptoms varied from 30 minutes to seven hours, with a mean of two to four hours. Secondly, *S. aureus* were isolated from 37 cases as well as from the implicated rice, and were identical with respect to *spa* typing. *S. aureus* of the same *spa* type was also isolated from a swab of a palmar chronic scaling skin lesion of an otherwise healthy kitchen worker. Based on the microbiological and analytical epidemiological results, the breaded chicken wings and the rice are the most likely source of the food poisoning. The soup, although only implicated epidemiologically, has to be considered as another possible source of this outbreak.

In addition, *S. aureus* of a different *spa* type was isolated from nasal swabs of two healthy kitchen workers. At least 25% of healthy foodhandlers are carrying *S. aureus* [4].

This food poisoning outbreak underlines the importance of complying with basic guidelines for kitchen hygiene [4]. Foodhandlers should be educated about strict food hygiene, sanitation and cleanliness of kitchens, proper temperature control, hand washing, cleaning of fingernails, the danger of working with exposed skin and of nose or eye infections and uncovered wounds. People with boils, abscesses and other purulent lesions of hands, face or nose should be temporarily excluded from food handling.

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