An outbreak of multi-resistant *Shigella sonnei* in a long-stay geriatric nursing centre

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Abstract

An outbreak of *Shigella sonnei* infection in a long-stay nursing centre was detected during routine surveillance of notifications in July 1999. Subsequent investigations identified 13 cases of multi-resistant *S. sonnei* infection affecting nine staff, three community members associated with the centre and one resident of the centre. Each isolate of *S. sonnei* was genetically indistinguishable. The outbreak investigation identified contact with residents with vomiting and diarrhoea as a significant risk factor for infection amongst staff providing nursing care. This association, and the duration of the outbreak over several months, suggests that transmission was most likely person-to-person. This outbreak demonstrates the importance of infection control policies and hygiene measures in long-stay nursing facilities. *Commun Dis Intell* 2000;24:272-275.

Keywords: shigellosis, infection control, nursing home, multi-resistant, gastroenteritis, enteric precautions

Introduction

Shigella spp. are a leading cause of bacillary dysentery worldwide and a major cause of diarrhoeal disease in developing countries.[1] In Australia, most *Shigella boydii* and *Shigella dysenteriae* infections are acquired overseas, while *Shigella flexneri* infection occurs predominantly in indigenous populations. *Shigella sonnei* infection is usually locally acquired (John Bates, Queensland Health Scientific Services, personal communication).

In July 1999 routine surveillance of disease notifications by the Brisbane Southside Public Health Unit (BSPHU) detected a cluster of multi-resistant *Shigella sonnei* infections involving six adult females in the Brisbane South/ South Coast area. All six isolates demonstrated the same antibiotic resistance pattern. Preliminary investigations identified these cases as part of an outbreak of diarrhoeal disease associated with a long-stay nursing centre. This paper describes the epidemiological, microbiological and environmental features of the outbreak investigation.

Methods

Preliminary investigation

All six female cases were administered a standard questionnaire regarding their demographic details, occupations, symptoms, food history, travel and other potential exposures. These preliminary interviews found five of the six cases to be nursing staff from the same long-stay nursing centre. The sixth case acquired her infection whilst travelling overseas. An outbreak investigation was commenced to determine the source of infection and the vehicle of transmission, and to introduce control measures to prevent further spread of the disease.

Epidemiology

The epidemiological study involved a descriptive study of residents of the nursing centre, and an analytical study (retrospective cohort) of the staff. A retrospective review was also conducted of all cases of *S. sonnei* notified to the BSPHU in 1999.

(i) Descriptive

Epidemiological investigations were commenced on 26 July 1999. The nursing centre had two wings and the nurse managers of each provided information about nursing home residents. Demographic and clinical data for the 4-week study period (28 June to 26 July 1999) were abstracted from the medical records of each resident. Information on food history was collected from the nurse managers because of the residents' age and potential for poor recall. Faecal specimens were requested from any resident who had a history of gastrointestinal illness during the 4-week study period.

(ii) Cohort Study

To collect information from all staff members covering the study period, a retrospective cohort study was conducted using a specific self-administered questionnaire. This included demographic information, occupational duties, movements and workplace location, symptoms, pathology requested and other clinical details among ill staff. A case was defined as any staff member who had an illness characterised by diarrhoea, vomiting or abdominal pain and had laboratory confirmed *S. sonnei* in their stool since 28 June 1999.

Univariate and stratified analyses of the data were conducted using Epi Info v6.04b.[2] Relative risks with 95 per

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cent confidence intervals were calculated. Significance of associations between exposure and illness were determined using Chi-square and Fischer's exact tests.

Microbiology

All staff were asked to provide a faecal specimen for microscopy, culture and sensitivity testing. Staff of the Public Health Microbiology Laboratory, Queensland Health Scientific Services, examined clinical isolates. *S. sonnei* strains were biochemically identified using the API 20E strip (bioMerieux Australia Pty Ltd) and biotyped using the Pasteur Institute methods.[3]

All *Shigella* isolates from this outbreak were tested for antibiotic sensitivity using the Vitek Gram-negative sensitivity card (bioMerieux Australia Pty Ltd). The isolates were compared for susceptibility to ampicillin, cephalothin, cefotaxime, ciprofloxacin, trimethoprim-sulfamethoxazole, amoxicillin-clavulanate, chloramphenicol and gentamicin. The isolates were also compared with other community-derived isolates using Pulsed Field Gel Electrophoresis (PFGE).

Environmental

Staff from the BSPHU and South Coast Public Health Unit inspected food preparation and handling, and laundry and toilet facilities at the nursing centre. Environmental swabs taken of the kitchen preparation surfaces and communal handtowels were examined for *Shigella*. Standard enteric precautions, including hand washing, disposal of contaminated materials and disinfection methods were reviewed with staff.

Results

Epidemiology

The retrospective review of notified cases identified two cases with onset in April 1999 with a similar sensitivity pattern to those cases involved in the nursing centre outbreak in July. These cases occurred in siblings aged 3 and 8 years. The mother of these two children was a staff member of the nursing centre. She had symptoms of abdominal pain and diarrhoea 1 week before her children, but no specimens were requested at the time.

During the outbreak investigation a subsequent case of *S. sonnei* was notified to the BSPHU. This case occurred in a 9 year old male who was a family member of a friend of a staff member.

Descriptive

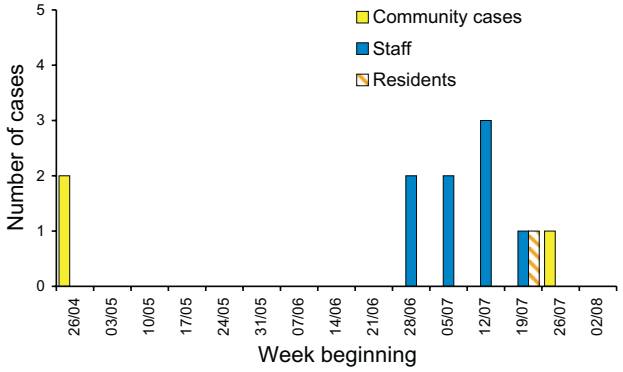
The nursing centre contained 81 residents (age range 50 to 100 years) living in two wings, 43 in Wing A and 38 in Wing B. During the study period 13 residents had developed symptoms of gastrointestinal illness, seven from wing A and six from wing B. Following the commencement of the investigation, faecal specimens were collected from these 13 residents, only one of whom was symptomatic. *S. sonnei* infection was detected in one resident from Wing B.

Cohort Study

Questionnaires were completed by 71/75 staff (95% response rate). Three non-responders were on recreational leave and one was on unrelated sick leave during the study period. Median age of staff was 45 years, with a range from 19 to 60 years. There were 68 female and three male staff - 39 Assistants In Nursing (AIN) (55%), 12 Registered Nurses (RN) (17%), nine domestic kitchen staff (13%), three cleaners (4%), two laundry staff, two diversional therapists, one physiotherapist, one cook, one handyman and one secretary. Fifty-four staff (76%) handled food in the course of their duties. Of these, 44 were involved in the feeding of residents and 10 were involved in preparation of food. One of the nine domestic kitchen staff was symptomatic towards the end of the outbreak, but stool culture was negative. Thirteen staff, including the five cases originally identified, gave a history of gastrointestinal illness during the study period. Eight of these and one asymptomatic staff member were confirmed with *S. sonnei* infection. All nine positive staff were female, eight AIN and one RN. The median age of those infected was 38.5 years (range 19 to 56 years).

Symptoms among the eight symptomatic staff with confirmed *S. sonnei* infection included diarrhoea (100%), fever (87.5%), abdominal cramps (87.5%), vomiting (75%), nausea (62.5%) and blood in stools (37.5%). Their dates of onset are shown in the Figure. The median duration of illness was 7 days (range 2 to 16 days). Seven of the eight consulted a medical practitioner and three required hospitalisation for 1 to 4 days. Four were treated with antibiotics, two with ciprofloxacin and two with norfloxacin. In the 3 days before their illness only two of the nine staff with confirmed *Shigella* infection had consumed food prepared in the nursing home kitchen.

Figure. Laboratory-confirmed *Shigella sonnei* cases of illness, 1999, by date of onset



Staff employed as AIN were almost seven times more likely to be infected with *S. sonnei* than all other staff in the nursing centre (Relative Risk 6.6, 95% Confidence Interval 0.9-49.8, P = 0.04). RN were 40 per cent less likely to be infected than other staff members but this was not significant (RR 0.61, 95% CI 0.08-4.47, P=1.0). No other staff were associated with infection. Furthermore, there was no association between occupational duties requiring food handling and *S. sonnei* infection.

Staff who worked in wing B only during the first 3 weeks of this outbreak were at a significantly higher risk of infection than other staff (RR 3.4, 95% CI 1.0-11.4, P = 0.05). During this study period, staff who had person-to-person contact (providing nursing care) with any nursing home residents who had been ill with diarrhoea and vomiting were at significantly higher risk of *S. sonnei* infection than other staff

(RR undefined, 95% CI undefined, P = 0.02). Similarly staff whose duties involved cleaning faeces and vomitus from ill residents were also at significantly higher risk (RR undefined, 95% CI undefined, P = 0.008).

Microbiology

S. sonnei was detected in nine staff members (attack rate 13%), one resident and three community members associated with the centre. All *S. sonnei* isolates associated with this outbreak had the API profile number 1104112, and were biotype 'a'. Antibiotic sensitivity testing revealed that all were uniformly resistant to ampicillin, amoxycillin-clavulanate and trimethoprim-sulfamethoxazole, and were uniformly sensitive to ciprofloxacin, cefotaxime and gentamicin. Pulsed Field Gel Electrophoresis using 11 outbreak isolates, including one of the initial community cases and the most recent community case, confirmed that the isolates were genetically indistinguishable. Comparison of two outbreak isolates with six unrelated community isolates showed that the outbreak isolates were different from other circulating strains of *S. sonnei*.

Environmental

No *Shigella* isolates were obtained from any of the environmental swabs or the communal handtowels. Advice was provided concerning several minor aspects relating to food handling and hygiene.

Discussion

Few outbreaks of shigellosis in long-stay nursing centres have been reported. In one, nine patients and three staff had positive stool cultures for *S. sonnei*.[4] The source of infection in the index case, a long-stay patient with few outside contacts, was not found. In another outbreak, six patients and one staff member had confirmed *S. sonnei* infection.[5] A factor in that outbreak was gastrointestinal illness in two staff members 5 and 8 days respectively before the first patients showed symptoms. These staff had continued to work despite their illnesses.

This is the first outbreak of multi-resistant *S. sonnei* in a long-stay nursing centre described in Australia. The index case of this outbreak could not be reliably determined. However, the detection of identical isolates several months apart in community members associated with the centre, but different from other community isolates, suggests that the outbreak was sustained over a period of months (Figure). Factors playing a role in this might include staff continuing to work despite illness and the use of communal handtowels throughout the centre. Both aspects were addressed during the outbreak investigation.

In this outbreak no source or vehicle of transmission was identified, and food did not appear to be involved. Evidence suggested that the mode of transmission was person-to-person, facilitated by lack of attention to basic infection control practices and enteric precautions while cleaning patients who were symptomatic. The significant association between *S. sonnei* infection and AIN but not other occupations supports this hypothesis because the AIN are the principal carers involved in showering and cleaning residents and clearing up vomitus and faeces. Use of gloves was part of the centre's infection control policy. Although available, their use was not evident during the first inspection of the centre. Public health advice included instruction in infection control procedures such as hand washing, disinfection, use of gloves, soap dispensers, paper towels and enteric precautions. Exclusion of ill staff (until recovered) and food handlers (for 48 hours after their first normal stool), and restriction of staff movement between wards, was recommended.[6] No further cases were reported after these interventions.

This outbreak differs from others described in the literature because of the high proportion of staff involved. However, we cannot exclude the possibility of more widespread infection in residents because only 1/13 symptomatic residents had stool specimens collected while symptomatic. The increased risk among staff (especially in Wing B) of *S. sonnei* infection through person-to-person contact with ill residents also suggests that there may have been more cases among residents than were identified during the investigation. According to the nurse managers, diarrhoea (frequent loose stools) was common among the patients because of laxative use. It is possible that the outbreak was propagated by a combination of residents with diarrhoea and inadequate hygiene measures, resulting in staff becoming infected.

Antibiotic sensitivity, plasmid profile and PFGE are useful methods to characterise and compare *S. sonnei* isolates from sporadic and outbreak situations.[7,8] One advantage of PFGE is the relative stability of the patterns over time, allowing identification of outbreak strains despite loss (or acquisition) of plasmids. Consequently, PFGE is being used more often for subtyping of *S. sonnei* from clusters or outbreaks.[1,9,10] In this investigation the biochemical profile, antibiograms, biotype and PFGE were identical for all isolates. PFGE also demonstrated that the outbreak subtype was distinct from sporadic community *S. sonnei* isolates detected elsewhere in Queensland independent of this outbreak.

Long-stay nursing centres present an environment in which outbreaks of enteric disease can have significant health consequences for staff and residents. The occurrence of this outbreak demonstrates the important role of public health interventions and regular attention to infection control policy and practice including fundamental matters such as hygiene and exclusion of ill staff. It is to be hoped that the long-stay nursing care industry heeds the messages learned from this outbreak.

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