Communicable Diseases

Investigation of outbreaks of salmonella in hospitals

S R PALMER, B ROWE

Abstract

In a two year prospective survey of outbreaks of salmonella infection in hospitals in England and Wales 55 outbreaks were identified. Reports of investigation of these outbreaks were reviewed for evidence of food borne infection and cross infection. Food borne infection probably accounted for only six outbreaks, but these made up 40% of the 15 outbreaks in which there were more than five patients and staff with symptoms. Person to person transmission was the probable mode of spread in most outbreaks.

It is recommended that in addition to bacteriological investigations clinical and epidemiological data should be collected to implicate food or other possible common vehicles of infection. Bacteriological screening of patients and staff who do not have symptoms may be unrewarding in the absence of epidemiological data to define groups at risk of infection.

Introduction

Outbreaks of salmonella infection in hospitals are of major public health importance for several reasons: they are relatively common, accounting for about one third of all reported salmonella outbreaks occurring outside the home[1]; hospital services may be seriously disrupted or halted[2]; patients, especially the elderly[1] and infants,[3] are at considerable risk of serious morbidity if infected; and hospitals may become the focus of infection with strains possessing multiple antibiotic resistance.[4]

Such outbreaks attract considerable interest by the media—especially when deaths have occurred—and are usually dramatised as food poisoning. In only 24 out of 197 outbreaks reported through the Public Health Laboratory Service (PHLS) between 1974 and 1977, however, was infection considered to be mainly food borne,[1] although information was not available for 121 of the outbreaks. Person to person spread is considered to account for most hospital outbreaks, but this has been disputed.[5] In order to assess the relative importance of food borne and person to person spread we carried out a prospective survey of outbreaks of salmonella in hospitals in England and Wales over a two year period.

PHLS Communicable Disease Surveillance Centre, London NW9 5EQ

S R PALMER, MB, MFCM, specialist in community medicine (epidemiology)

PHLS Division of Enteric Pathogens, Central Public Health Laboratory, Colindale, London

B ROWE, MB, FRCPATH, DTM&H, director

Correspondence to: Dr S R Palmer.

Method

Outbreaks of salmonella infection are routinely reported to the PHLS Communicable Disease Surveillance Centre by PHLS and hospital microbiologists, but to ensure that coverage was as complete as possible during the study period letters were sent to all microbiologists in England and Wales informing them of the study and asking them to ensure early reporting. The definition of an outbreak was: "The occurrence within a hospital of two or more cases of the same serotype or phage type where there was evidence that the cases were associated within the hospital."

Some outbreaks not reported to the Communicable Disease Surveillance Centre came to the notice of the Division of Enteric Pathogens at the PHLS Central Public Health Laboratory, Colindale, and these were added to the study. Data from each outbreak were sought using a standard form, which was completed by a member of the study team after visiting the hospital or by the hospital microbiologist or control of infection nurse when a visit was not possible. When such reports could not be obtained data were collated from laboratory reports, telephone interviews, and letters.

Results

Between July 1980 and July 1982, 55 outbreaks were ascertained. In 26 outbreaks forms were completed, and details of other outbreaks were available only from telephone reports, letters, and routine laboratory reports to the Communicable Disease Surveillance Centre. Sixteen of the outbreaks (29%) were in geriatric units, 11 (20%) in maternity and baby units, eight (15%) in paediatric units, seven (13%) in psychiatric units and hospitals for the mentally subnormal, and 13 (24%) in acute medical, surgical, or mixed units and operating theatre suites. On average, eight patients and staff were affected per outbreak. In 37 outbreaks (67%) there were fewer than five patients and staff with symptoms, and in seven (13%) there were more than 10. The numbers of patients and staff with illnesses were 160 and 29, a ratio of 5·5:1.

In all the outbreaks the onset of illness was spread over several days. In none of the outbreaks were salmonellas isolated from food, nor were there data on food preferences of cases to compare with control patients.

Information was sought about culture of stools or rectal swabs from patients and staff without symptoms during the investigation of outbreaks. In 14 outbreaks no information was obtained. In 22 of the remaining 41 outbreaks screening of both patients and staff was undertaken. In eight outbreaks (20%) screening was restricted to patients without symptoms, and in three outbreaks (7%) symptomless staff but not symptomless patients were screened. In eight outbreaks screening of people who did not have symptoms was not undertaken.

The number of asymptomatic patients screened was available from 15 outbreaks, in which 89 patients and seven staff developed symptoms: 1146 patients were screened and 36 (3%) had positive cultures. The number of ward staff screened was reported in nine outbreaks in which there were 24 patients and seven ward staff who had symptoms: 559 ward staff were screened, 26 (5%) with a positive result.

In six outbreaks hospital investigators thought that food borne infection had played some part.

Outbreak 1—In an acute general hospital a member of the catering staff

was ill with diarrhoea on 10 June and was subsequently shown to be excreting *Salmonella enteritidis* phage type 8. On 24 June a patient developed diarrhoea, and a further 11 cases due to the same organism appeared over the next eight days. Cases included children and adult patients and staff.

Outbreak 2—An outbreak of *S albany* infection in three hospitals in one city affecting 16 patients occurred over four weeks. Of 102 catering staff screened, seven were excreting *S albany*. Foods and environmental swabs from the kitchens did not grow the pathogen.

Outbreak 3—A second outbreak of *S albany* infection in an acute general hospital affected at least 30 patients and six staff over eight weeks. Screening of catering staff showed that 11 of 161 were excreting *S albany*.

Outbreak 4—In an outbreak of *S typhimurium* infection in a geriatric hospital six patients in three wards developed symptoms over three days. All patients and staff were screened, and two of the staff were found to be infected. These staff were excluded from work but a second wave of infection occurred one month later when 12 patients in one ward became ill within 12 hours. The explosive nature of the second wave suggested a point source infection.

Outbreak 5—Four maternity patients and the husband of one patient became ill with *S typhimurium* phage type 10 infection over three days. A sixth patient became ill seven days after the first case. All five mothers delivered over a two day period. A food handler who had prepared food two days before the first case was subsequently shown to be excreting the same phage type.

Outbreak 6—An outbreak of *S thompson* phage type 7 in an acute general hospital affected three patients and one ward cleaner. Screening of faeces of the kitchen staff showed the head chef to be excreting the organism. The three ward cases occurred over 28 days.

In five of these six outbreaks and in 25 other outbreaks person to person spread was believed to have contributed to the continuation of the outbreak.

The features suggesting person to person spread in the outbreaks in which food was not thought to have played a part are summarised below.

Paediatric units—In five of the eight hospitals data on the route of transmission were available. Spread of infection occurred from patients known to have symptoms and to be excreting salmonellas on admission; one was aged 13 years, one 9 years, two 6-11 months, and one under 6 months. Four were barrier nursed from admission. In the fifth outbreak a 13 year old boy incontinent of faeces was not barrier nursed, and a nurse who looked after the patient and took her uniform home to launder became ill four days after his admission. In three of the five outbreaks secondary cases shared the same ward or cubicle as the index case; in one outbreak the admission of an infected patient led to a further nine patients and one member of staff on five different wards developing symptomatic infection over 35 days; the outbreak coincided with a loss of nurses and a consequent increase in staff movements between wards. In the fifth outbreak further details of secondary spread were not available.

Mother and baby units—In nine outbreaks the spread of infection was from mother to baby, baby to nurse, or baby to baby in the same ward. In six of these nine only one secondary case was found. In one unit infection may have been transmitted from an infected infant via the thermometer holder to the next infant admitted to the same cubicle. The thermometer holder was found to be contaminated, despite special cleaning of the cubicle between admissions. In a 10th outbreak two wards were affected; the admission of a mother one week after she had had diarrhoea led to her baby and a second baby becoming infected. Bacteriological screening of faeces of staff over the next four weeks showed that four staff on a neighbouring paediatric ward were excreting the same salmonella serotype as the mother and infants.

Psychiatric units and hospitals for mentally subnormal—In none of the seven outbreaks was the route of transmission found. Two affected one ward and four several wards, with the range of onset of symptoms varying from four to 15 days.

Geriatric units—In eight outbreaks the mode of infection was unknown. In five incidents the admission of an infected patient was probably the source, and in two incidents domestic workers were thought to have introduced infection into the wards. In one of these a domestic worker was ill at work and a patient developed symptoms three days later. Screening of patients showed two to be excreting the same serotype. In another outbreak five patients became ill five to seven days after a domestic worker with salmonella enteritis had worked on the same ward. In one outbreak affecting 17 patients in a large acute general hospital, 16 patients were in the geriatric unit and one was a geriatric patient admitted to the cardiac ward because of bed shortage. No other infected patients were discovered in the cardiac ward, and the only known common factor between this patient and the remainder was medical examination by geriatric unit medical staff.

Acute medical, surgical, and mixed wards and operating theatre suites—Two outbreaks affecting operating theatre staff who did not share food were thought to have resulted from cross infection from members of staff returning from overseas holidays with salmonella enteritis. In one outbreak in an acute surgical ward a bedpan was washed by a nurse using a water hose. She splashed her face and became unwell next day. In the remaining six outbreaks which were not thought to be food borne the source and mode of transmission of infection were not known.

Discussion

In this study we have collected the results of investigations of outbreaks of salmonella in hospitals carried out by microbiologists and control of infection nurses. The most common pattern was of small outbreaks extending over several days or weeks and suggesting person to person spread or a continuing common source of infection, rather than point source food borne episodes. There was some evidence of food borne infection in six outbreaks, but even in these the long duration and the fact that ward staff were affected suggested that person to person spread had caused secondary cases. Secondary spread is known to occur especially in maternity, paediatric, psychiatric, mental subnormality, and geriatric units where faecal soiling of the environment is likely,[6] and this was borne out by our survey. Salmonella infection, however, may also be transmitted in hospitals by common vehicles other than food, and outbreaks caused by contaminated pancreatin,[7] carmine dye,[8] and endoscopes have been described.[9] The epidemic curve in such outbreaks usually mimics that of person to person spread.

Evidence of food borne infection will include onset of symptoms in most patients over a short period of time in wards supplied by the same kitchen. Screening of catering staff may detect symptomless excreters, who are likely to be victims of food borne infection rather than the source of the outbreak. Microbiological examination of food and the kitchen is often unsuccessful in isolating the epidemic agent, and epidemiological evidence of food borne infection should be sought as early as possible by comparing food histories from infected and non-infected patients. Evidence to suggest common vehicles of infection other than food should be sought, and this may be done, for instance, by comparing histories of underlying conditions—for example, cystic fibrosis—special investigations—for example endoscopy or use of carmine dye markers—and treatments—for example, pancreatin—received by infected patients. A hypothesised association between salmonella infection and a particular vehicle should be tested by a case-control study.

In most outbreaks of salmonella in hospital spread of infection will not be food borne, and emphasis by control of infection staff on the hospital kitchens may divert attention from the real cause, which is often poor ward hygiene. Transmission from an infected mother to her baby at delivery is probably unavoidable, but transmission between babies and staff and spread to other wards suggest a breakdown in hygiene. In four outbreaks in paediatric units the source of infection was thought to be a patient who was already barrier nursed, and in other reported outbreaks patients who were barrier nursed became secondary cases. Staff shortage and the consequent increased workload—particularly in paediatric, geriatric, and psychiatric wards—may be the predisposing factor to cross infection. Similarly reduced levels of staffing at night may be important.

The value of bacteriological screening of faeces of patients and staff who do not develop symptoms during an outbreak is not agreed by all microbiologists. It may be thought that the information obtained does not warrant the extra work, since a general improvement in hygiene, strict attention to handwashing by all staff, and safe disposal of faeces should contain the outbreak. The yield from screening symptomless patients and staff in our survey was only 3% for patients and 5% for staff, but there were some unexpected findings. For example, in one outbreak in a geriatric unit screening of patients after the

identification of cases led to the discovery of 33 symptomless excreters. In another outbreak in a maternity unit screening identified eight symptomless mothers and infants in one ward. In the outbreaks where numbers screened were recorded about a third of all infected patients and three quarters of the infected staff identified did not have symptoms: unless screening is carried out the full extent of the outbreak will not be known. If the asymptomatic excretion rate is high case-control studies of possible vehicles of infection are unlikely to be successful unless symptomless excreters are excluded from the control group. Moreover, the bacteriological screening of staff may be useful in drawing their attention to the possibility of person to person spread of infection and to the need for careful personal hygiene. To avoid unnecessary and unprofitable laboratory work, however, we suggest that at least preliminary epidemiological data should be collected before screening is begun. Groups of patients and staff epidemiologically related to the outbreak should be defined so that bacteriological screening can be carried out systematically and results related to hypotheses of the cause of the outbreak.

This survey suggests that food poisoning is not the usual explanation of outbreaks of salmonella in hospitals in England and Wales. Person to person spread is the most important factor, but the possibility of vehicles of infection other than food should be considered. In investigations of outbreaks clinical and epidemiological data are needed in addition to, and in advance of, bacteriological studies for the final elucidation of the cause of the outbreak. Thorough investigation of outbreaks is essential of the transmission of infection is to be interrupted and future incidents prevented.

We are indebted to the Public Health Laboratory Service and hospital microbiologists and control of infection nurses for supporting this study. We thank Dr Sue Hall, Dr Noel Gill, Dr Richard Mayon-White, Dr David Robinson, and Mrs Mary Hall for help during the survey.

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(*Accepted 14 July 1983*)

MATERIA NON MEDICA

Music on the move

Imagine a brilliant day in high summer. It is early morning and under the branches of the eucalyptus the scented air is quiet and cool. Through the blue skied morning the four cylinder car speeds smoothly along. Behind the closed windows can be seen a man moving his head with rhythm and purpose, as if while driving his car he is moving to music.

This scenario in fact describes a general practitioner on his morning rounds, listening to, and conducting, the Sibelius *Karelia Suite*. He is deliberately playing his elation music to celebrate the news that his latest essay has been accepted for publication as Materia non Medica in the *BMJ*.

Despite news to the contrary, general practitioners do, to this very day, a fairly large number of house visits. At least we do in our practice. Thus has evolved in my car a library of music so that I can indulge myself in "listening for pleasure" much akin to the libraries I have read about in the *BMJ*'s occasional series "Reading for Pleasure." Now I can listen at my convenience to cassette or radio through an elaborate loudspeaker system in air conditioned comfort. However, long ago, in the golden olden days, it was considered lucky and opulent to own a car radio. House visits then were timed to fit in with favourite radio programmes. Lunch time rounds would be timed to coincide with, for instance, "Steve Race's Record Choice." Morning rounds went along with the ubiquitous "Housewives' Choice." I'm sure patients wonder why I take so long to come out of the car. (It's the finale of a favourite piece.) I still enjoy the spontaneous pot luck of music on radio. The pleasant surprise on hearing a familiar piece, or the discovery of a new one is always stimulating.

The introduction of cassette recorders for cars means that I can now select music to suit all moods. As described before, elation requires works such as the *Karelia Suite*. The necessity of speed to an urgent call requires the "Farandole" from Bizet's *L'Arlesienne* or Mendelssohn's *Midsummer Night's Dream* overture. Calm relaxation after a long hard day can mean a Vivaldi mandolin concerto or a Beethoven piano. The Vaughan Williams *Fantasia on a Theme of Thomas Tallis* is the one to make the hairs on the back of the neck stand out—suitable for times of deep thought or sadness. Unkind critics have labelled this "A hundred and one ways to play a chord." I find it deeply moving. And so it goes on.

Being an expatriate, nostalgia is an emotion which frequently rises to the surface. For this we can have Elgar's *Nimrod*, some of the Delius shorter suites, and around December I always return to Hamilton Harty's *Carol Symphony*—the middle section still locked in my memory as the introduction to a favourite childhood radio play on the once renowned "Children's Hour."

Being an expatriate *Scot* to boot, nostalgia means vocal music—traditional and historical ballad, the beautiful Burns songs, and occasionally the psalms and paraphrases from the Scottish Psalter (a strict Presbyterian upbringing meant Sundays were for church going and Sunday school only). Listening over the years to the stirring words and music has meant that in one memory corner every word of every verse remains intact.

Listening for pleasure on wheels has enabled me to build a library of music and musical memories which have so far carried me pleasantly through 23 years of medical practice.—J P COLQUHOUN, Cleveland, Australia.

Do as I say, not as I do?

One of the perks of my job in editing is to go to conferences and listen to colleagues talk about what I do, what I should be doing, or how I could do what I do better. You see, we're in the business of communicating. Some of us do it with pencil and paper, some with machines that are very complex, and some verbally. The extraordinary thing is how ponderous we get when we switch the medium. Which brings me back to editors' meetings, where, to my astonishment, many of us violate all the principles that we hold dear in our dealings with our "suppliers": verbosity overtakes conciseness; disorganised presentation overtakes clear thinking and careful preparation; mumbles overtake articulateness; and, worst of all, you can't read the slides beyond the third row. Now there's a gap in the market that needs filling—preparing speakers for delivery to the platform.—SUE BURKHART, London.