

## Spread of *Salmonella typhi* in a maternity hospital

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### SUMMARY

An Asian patient with undiagnosed typhoid fever was admitted to a maternity hospital and delivered within 10 min. *Salmonella typhi* (phage type D5) was isolated from her blood and from the faeces of her baby. Another woman in a different room of the labour suite at the same time acquired the same organism in her faeces; her brother was admitted to the Infectious Diseases Unit 5 weeks later with typhoid fever. Two babies, born over 60 h after the index case was delivered, became faecal excretors of the same strain and one of them also developed *S. typhi* osteitis of the hip. These two babies and their mothers were in the same ward as each other, but not that occupied by the infected mother and her baby. Nine other excretors in two of the families involved were identified. The index case and her baby were isolated immediately after delivery, and the relevant rooms in the labour suite were adequately disinfected. No evidence of undisinfected equipment used by the index case and the other infected patients was found, and no spread to staff was detected. The mode of spread remains unknown.

### INTRODUCTION

Outbreaks of salmonella infection occasionally occur in maternity hospitals and spread is mainly in the nursery from baby to baby (Rowe, Giles & Laing Brown 1969). Infection is usually introduced in food or by an infected mother with diarrhoea. Person to person spread of *Salmonella typhi* is rare and there have been no recent reports of cross-infection with this organism in medical, surgical, paediatric or obstetric wards in this country.

In this paper, an unusual episode of spread of *S. typhi* is described in a maternity hospital of 96 beds. Infection was introduced by a woman suffering from typhoid

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fever. The strain was acquired by another woman and two babies, with no evidence of contact between them and the infected patient.

#### DESCRIPTION OF OUTBREAK OF INFECTION

##### *Sequence of events*

(1) An Asian patient (case 1) was admitted in advanced labour and delivered within 10 min in the admission room of a maternity hospital on 7.iv.76 (Table 1). She was then transferred to a delivery room for perineal suturing. Whilst in the delivery room she had a rigor and her temperature rose to 40.8 °C. Samples of blood and urine were taken for culture and treatment commenced with ampicillin. She was then transferred to a side-room of ward G. The baby was taken to the nursery in the labour suite and 10 min later was transferred to the Special Care Baby Unit. *S. typhi* was grown from the patient's blood after 3 days and from the baby's faeces after 4 days. Both were transferred to an Infectious Diseases Department in another hospital on 10.iv.76.

(2) About 5 weeks later, a female Caucasian baby (Case 2), born in the same maternity hospital, was admitted to a paediatric ward of another hospital with osteitis of the femur. *S. typhi* of the same phage type (D5) as the strain isolated from Case 1 was cultured from pus drained from the femur and from the faeces. The baby was transferred to the Infectious Diseases Department on 21.v.76. She was born over 60 h after the delivery of Case 1. Mother and baby were transferred to ward F after delivery and had no contact with Case 1 or her baby (Table 1).

(3) A boy of 16 years (Case 3), brother of a patient who was in the labour ward at the same time as Case 1, was admitted to the Infectious Diseases Department at the same time as Case 2.

(4) After the isolation of *S. typhi* from Case 2 (i.e. about 6 weeks after the isolation of *S. typhi* from Case 1), faeces of possible contacts were examined. Screening included all mothers and babies who were in F and J wards at the relevant time or were delivered between 7 April and 11 April. Four hundred and ninety-three members of staff, including visiting anaesthetists and community nurses, were also screened. *S. typhi* phage type D was isolated from the following: excreter 4, the sister of Case 3, who was in the labour ward at the same time as Case 1 and was subsequently transferred to J ward. A baby (excreter 5) who was in ward F at the same time as Case 2. Family contacts of Case 1 and 2, i.e. three siblings of Case 2, the sister-in-law of Case 1 and her baby and 3 other members of the family.

*S. senftenberg* was isolated from a visiting anaesthetist and a community nurse, but no *S. typhi* was isolated from any members of staff.

#### PROCEDURES

The four mothers involved (i.e. Case 1, excreter 4, mother of Case 2 and mother of excreter 5) had normal deliveries and perineal suturing was required in three of them. None of the labour room staff attended the delivery of more than one of the mothers concerned, but the babies were looked after by the same paediatric

Table 1. *Salmonella typhi* in a maternity hospital

		Date and time of delivery	Post-natal ward	Date and place of discharge from maternity hospital
Case 1* (adult)	Admitted to maternity hospital with typhoid fever 7.iv.76	7.iv.76-10.30	G (baby in S.C.U.)	10.iv.76, to I.D. Dept
Case 2† (infant)	Admitted to I.D. Dept. with <i>S. typhi</i> osteitis of femur 21.v.76	9.iv.76-23.20	F	14.iv.76, to home
Case 3	Brother of excreter 4 admitted to I.D. Dept with typhoid fever 21.v.76	—	—	—
Excreter 4 (adult)	In labour suite at same time as Case 1 but in different room	7.iv.76-14.50	J	9.vii.76, to home
Excreter 5 (infant)	Same ward as Case 2	9.iv.76-16.48	F	14.iv.76, to home

Outside symptomless excreters

\* Sister-in-law and baby and three other members of family.

† Three sibs

staff in their respective wards. All four babies spent some time in the labour suite but were not present in any one room at the same time, apart from Case 2 and excreter 5 in the nursery of ward F for 5 days.

No mothers or babies were transferred from G to F ward and no babies were transferred from the Special Care Unit to F ward during the relevant period. Case 1 and baby were both barrier nursed in single rooms until transferred to the Infectious Diseases Department.

The admission and delivery rooms occupied by the infected patient were 'fogged' with a soluble phenolic disinfectant (1% 'Stericol') and then washed with the same compound 20-30 min later. Equipment and instruments were also disinfected with 1% 'Stericol' or incinerated if disposable. Linen was sent to the laundry in a clearly marked bag and was not sorted before washing in the foul-washing machine at the laundry in another hospital. Disposable catheters were used for mucus extraction in all four babies. All babies had rectal temperatures taken in the labour room nursery. Thermometers were disinfected for 20 min in 1% 'Stericol'. Placentas were examined and weighed in a sluice room and disposed of in a plastic bag. The placenta from Case 1 was sent to the pathology department. Babies were fed with presterilized commercial feeds apart from those in the Special Care Unit.

After the diagnosis of typhoid fever had been made no further patients were admitted to ward G, which was gradually emptied over a few days. The ward was then thoroughly cleaned. Letters were sent to the general practitioners of patients in G ward and the Special Care Unit after the diagnosis was confirmed, notifying them of the occurrence of the disease.

*Bacteriology of the environment of labour room*

Samples were taken from Cheatle's forceps, airways in chlorhexidine, bar soap, nail-brushes, chlorhexidine solutions, other creams and ointments, thermometers, baby scales and other environmental sites, in two separate investigations. As these studies were made several weeks after the original outbreak, no isolations of *S. typhi* would be expected. However, no significant growth of Gram-negative bacilli was found in any of the items sampled and similar investigations in another hospital showed no environmental contamination immediately after a typhoid carrier had been delivered.

## DISCUSSION

The routes of spread of typhoid bacilli in this outbreak are not known. Although Case 1 and excreter 4 were in the labour suite in different rooms at the same time, there was no evidence of contact between them. It is also very unlikely that excreter 4 was admitted carrying the same strain of *S. typhi* as Case 1. Staff attending the two patients were different and it seems unlikely that any untreated equipment was used by both of them. A possible route of spread was on the hands or clothing of staff, particularly after handling the placenta of Case 1 or other items in the sluice room which may have been heavily contaminated. A washing-up cloth may have been contaminated and typhoid bacilli might have survived on such an item, but Case 1 did not eat or drink in the labour suite and there was no obvious route to the kitchen. Bed-pans were boiled. The babies of the two patients were in the same labour room nursery within a few hours of each other. Thermometers and baby scales were apparently adequately disinfected after use. The infected baby was not bathed and was transferred directly from the labour room to the Special Care Baby Unit.

The connexion between Case 1 and the two babies (Case 2 and excreter 5) is much more tenuous. In the 2½-day interval, a number of other babies were delivered but none of these were infected or found to be excreting *S. typhi*. However, it is possible that some of the babies had originally acquired the strain and lost it during the 6-week interval before screening. Transfer on equipment is unlikely as typhoid bacilli survive poorly in the dry environment. No fluids likely to remain in the labour ward for 2 days were found apart from antiseptics, and bacteriological tests indicated that these were unlikely to support the growth of typhoid bacilli. A breast pump was shared between F and G wards, and although it was used by the mother of Case 2, Case 1 did not use it. No staff carriers of *S. typhi* were found and the only staff common to all babies were paediatric medical staff. The likelihood of transferring infection from the baby of Case 1 to the others by this route is small as the infected baby was being barrier nursed in the Special Care Unit. Case 1 and the mother of excreter 5 attended the same antenatal clinic on the day before Case 1 was admitted, but the possibility of transfer of infection in this area was remote, since 110 mothers attended the clinic. Case 1 had attended the antenatal clinic on seven previous occasions and on the day before admission

she complained of back pain. This was thought to be a renal infection but her temperature was not raised and a mid-stream urine specimen was sterile. There was no evidence of spread from Case 1 to other patients in her ward or from her baby to others in the Special Care Unit.

A survey made in June 1976 by the Regional Health Service Infection Research Laboratory detected no important deficiencies in aseptic or hygienic techniques in labour rooms, wards, nurseries or kitchens. The labour suite appeared to be well-organized and efficient in spite of problems of design, which entailed the movement of patients two or three times. However, the large number of attendants in the labour suite at one time without the provision of rest rooms was obviously undesirable. The prompt isolation of mother and baby and terminal disinfection of the labour room and its contents appeared to be satisfactory. The practices in the hospital were considered to be if anything over-cautious and some of the procedures seemed to be unnecessary, e.g. fogging of rooms, pouring disinfectants into sinks, and 'topping and tailing' of babies with a solution of benzalkonium chloride.

As already stated, typhoid fever rarely spreads in hospitals even from initially unrecognized cases who are not barrier-nursed. Carriers are also presumably often admitted to hospital wards without being recognized. In another local maternity hospital, a known carrier was delivered on three occasions and no spread of infection occurred. In the epidemic at the Oswestry Orthopaedic Hospital in 1948, 135 staff and patients were infected but only 9% were secondary infections in patients (Bradley, Wilson Evans & Taylor, 1951). Of 64 cases of typhoid fever reported in Scotland between 1967 and 1974, spread occurred only twice in hospital. A nurse was infected by a child and four persons were infected in a mother and baby unit. (Sharp & Heymann, 1976). Many cases of typhoid fever are also admitted to English hospitals every year and hospital cross-infection is rarely reported.

Infection with *S. typhi* is commonly associated with clinical disease, although symptoms in children or infants are often atypical and mild. In this outbreak no early warning of cross-infection was obtained from the emergence of an actual clinical case of typhoid fever within one to two weeks of exposure. The absence of symptoms in the other infected babies raises the possibility of a complicating factor in Case 2; possibly a small focus of haemorrhage caused by minor trauma of the hip could have provided a nucleus for organisms to multiply. *Salmonella* sp. (Martyn Jones & Pantin, 1956) and gram-negative bacilli other than *S. typhi* frequently spread in nurseries with few or absent symptoms (Noy, Ayliffe & Linton, 1974).

Spread of salmonella from contaminated hospital equipment has occasionally been reported. An outbreak of *S. worthington* occurred amongst neonates in Hong Kong due to contaminated suction equipment (Ip *et al.* 1976). Possible transfer of infection from contaminated duodenal intubation tubing (Communicable Disease Report, 1977) and from an endoscope has recently been reported (Dean, 1977). No evidence of common use of untreated equipment was obtained in the present outbreak.

Another unusual feature was the delivery of a woman in the septicaemic stage of the disease. Contaminated blood may have increased the infectivity of the

patient or baby. The possibility of *in utero* infection of the baby is also of interest as is the reason for the patient presenting with septicaemia in the later stages of pregnancy. Since she could have acquired the infection at an earlier date, it is possible she was more susceptible at that stage. Her sister-in-law living in the same house was probably the immediate source and could have been a carrier when she was delivered in the same hospital in January 1976.

An important aspect of this outbreak is the importation from Pakistan where the disease is endemic. It is likely that there are many unknown carriers amongst the Asian population. Carriers are often intermittent excreters and may not be detected unless several samples of faeces are examined. Routine screening of antenatal patients is of doubtful value and probably would not have identified Case 1 in this outbreak.

Since typhoid rarely spreads in hospital, it is not usually considered necessary to screen contacts especially as typhoid bacilli are not often isolated during the incubation period. Routine screening of contacts in this outbreak would almost certainly not have included Case 2 and excreter 5 who were delivered over 2 days later and were not in the same ward as Case 1 or her baby. However, more information is obviously required on the spread of *S. typhi* in maternity units, although similar conditions to those reported here are likely to be rare. Examination of faeces of mothers and babies in the same ward, or delivered within 2–3 days of the delivery of a known or suspected case of typhoid fever, or a carrier not nursed in isolation in a maternity unit might be worthwhile.

The most important measure to prevent spread is the isolation and barrier nursing of any patient with diarrhoea or other symptoms suggestive of an infection. The names of staff contacts of a known case of typhoid fever should be given to the Occupational Health Department or their own general practitioners. The names of patient contacts should be sent to the Environmental Health Medical Officers, and general practitioners should be informed. A problem raised by this outbreak was the definition of a contact. A patient admitted to the delivery room after an infected patient had been transferred elsewhere and after disinfection of the room would not normally be considered a contact. In view of the unusual features of the present outbreak, general practitioners of patients being delivered within 3 days of the delivery of a known case of typhoid fever should also be notified.

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