An outbreak of Typhoid Fever in Malacca: Epidemiology and Aetiology

by Soong Foong San

MBBS, MPH
Department of Social and Preventive Medicine,
Faculty of Medicine,
University of Malaya,
Kuala Lumpur,
Malaysia.

Introduction

TYPHOID FEVER is endemic in Malacca. For several years past, an average of one notification per week has been received at the Health Office, Malacca (Health Officer, Malacca, 1965). The true incidence must be considerably higher, as doubtless many cases do not come to the notice of qualified practitioners.

This paper describes and discusses a small but explosive outbreak in a single village, affecting 31 persons – two of them fatally – in a population of 62.

General description of Solok Kampong Baru

Solok Kampong Baru is a small Malay settlement, eight miles from Malacca town (figure 1). At the time of the outbreak, there were 12 houses situated fairly close together on both sides of a cart-track. The population of the village was 32 males and 30 females. Most of the working adults were rubber tappers employed by neighbouring rubber estates. A few were smallholders with 2 – 4 acres of rubber land which they worked themselves. The income of the villagers was generally low. There was no electricity or piped water supply.

Fig 1
Location of Solok Kampong Baru.

Observations (i) Epidemiological aspects

There was a total of 31 cases (see Appendix I for details in support of the diagnosis and Appendix II for a discussion of other cases of typhoid fever occurring near Solok Kampong Baru at the time of the outbreak).

Date of onset of the cases: The date of onset of each case was obtained and checked wherever possible with other members of the household. Inspite of the care taken to ensure that the dates were as accurate as possible, there may well have been errors ranging from a few days to a week in view of the generally insidious onset of this disease.

The earliest date of onset recorded was 6 April with two cases and the last date, 28th April, with one case (figure 2). Bearing in mind the long incubation period of typhoid fever, this grouping of cases within about three weeks suggested a common source of infection.

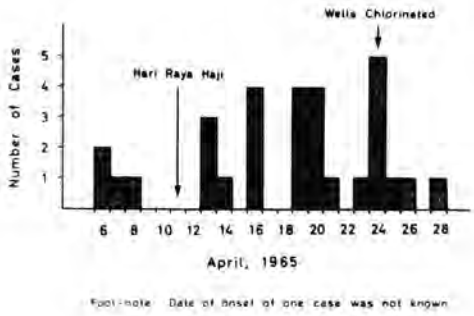

Fig 2
Number of cases of typhoid fever in Solok Kampong Baru by dates of onset.

Persons affected: The attack rate based on the village population was 50%. The proportion of males attacked was 17 out of 32, and females, 14 out of 30 (table I). There were cases in all age groups, except children below one year. In men over the age of 50 years, the proportion attacked – 2 out of 8 – was less than that of the other age groups. A similar decrease in attack rate was not observed among women above the age of 50. Since we are dealing with small numbers, the differences observed could have arisen by chance alone. The occupations of the cases include rubber tappers, students, a teacher, a gardener and a corporal (table II).

AGE (YEARS	MALE		FEMALE		TOTAL	
	PERSONS AT RISK	CASES	PERSONS AT RISK	CASES	PERSONS AT RISK	CASES
0 –	1	0	2	0	3	0
1 –	4	2	1	0	5	2
5 –	2	2	2	1	4	3
10 –	8	5	4	2	12	7
20 –	5	2	6	3	11	5
30 –	3	3	4	2	7	5
40 –	1	1	5	3	6	4
50 and over	8	2	6	3	14	5
TOTAL	32	17	30	14	62	31

TABLE I: Number of persons at risk and the number of typhoid cases by age and sex.

OCCUPATIONS	PERSONS AT RISK	CASES
RUBBER TAPPERS	26	13
STUDENTS	8	7
TEACHERS	1	1
GARDENERS	2	1
CORPORAL (T.A.)	1	1
TAXI-DRIVER	1	0
UNEMPLOYED AND CHILDREN	23	8
TOTAL	62	31

TABLE II: Number of persons at risk and the number of typhoid cases by occupation.

Households affected: Of the 12 households in Solok Kampong Baru, ten had one or more cases (figure 3). The early cases (6 – 8 April) occurred in Households 8 and 10, three in Household 8, and one in Household 10.

(ii) Environmental and Personal Factors

Water supply: 8 out of the 12 households had shallow earth wells close to their homes (figure 3). The villagers used the water from these wells mainly for washing and bathing purposes.

There was one "cement" well in the middle of the village. This well (figure 4) was lined with a prefabricated concrete ring of diameter 3½ feet and height 4 feet, the upper end of which projected 2½ feet above

ground level and served as the parapet for the well. Below the ring, there was no lining of any sort. The depth of the well was eight feet and the water level was usually six feet below ground level. There was no protective cover for the well, but there was a circular, concrete drainage apron 3½ feet wide in which there were large cracks. The exit drain leading from the apron was four feet long and usually water-logged.

Fig 3
Occurrence of cases by households, dates of onset and location of wells and latrines in Solok Kampong Baru in April 1965.

The rainfall for the two months preceding the outbreak was relatively low. However, the villagers stated that there was always water in the "cement" well. Each householder used his own rope and bucket to draw water from it. The women in the village often washed their clothes on the apron.

After an extensive inquiry, it was established that all the households in the village, except Households 11 and 12, drew water from the "cement" well for drinking and cooking purposes, before and during the outbreak. (Households 11 and 12 used water from their earth wells for drinking and cooking). It was reliably learnt that boiling of well water before drinking was not usually practised by the villagers except for making coffee and other hot drinks. It is significant that neither Household 11 nor 12 was affected during the outbreak.

Bacteriological examinations of the water from the "cement" and other wells of the village were not carried out. They were all chlorinated as soon as the outbreak was recognised on 24th April.

Disposal of excreta: The village had no sanitary latrines at the time of the outbreak. The methods of excreta disposal used were:

shallow pit	—	8 households
bush	—	3 households
stream	—	1 household

The sites for defaecation were situated more than 50 yards from the "cement" well (figure 3) and were so situated that it is unlikely that the well was polluted by surface or ground water from any of them. Some householders stated that the same bucket that was used for taking water to the site of defaecation for the performance of the anal toilet was sometimes used for drawing water from the "cement" well.

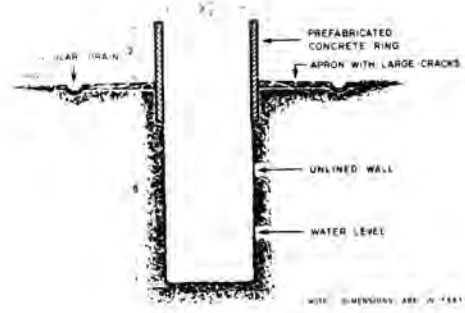

Fig 4
Cross-section of the "cement" wall.

Refuse disposal and flies: Household refuse was usually collected and burnt. Fly-breeding was observed in several of the pits and in the open ground (bush disposal area). However, flies were not numerous either inside or outside the houses. In view of the other evidence, it is unlikely that flies played any part in the transmission of typhoid fever in this outbreak.

Sources of food and sharing of food: Most of the households obtained their provisions from the shops in Bukit Katil Village or occasionally in Malacca town. Rice, sweetened condensed milk and fish were regularly taken. Uncooked food, such as salad and cut fruits, and bread were rarely taken. No fresh milk had been consumed recently.

An ice-cream hawker came irregularly to the village. Most of the villagers interviewed denied having bought ice-cream from him within six weeks prior to the outbreak. The ice-cream hawker was licensed by the Health Department and received T.A.B. vaccination yearly. No laboratory tests were done to exclude him as a typhoid carrier.

Inquiries were also directed towards the practice of sharing of food by a large number of villagers from indifferent households prior to the outbreak. The feast days in the village were Hari Raya Puasa

(2.2.1965) and Hari Raya Haji (11.4.1965). The earliest cases occurred too long after the first of these to be related to it, but those that occurred after 24 April could have been related to the second. The question arises whether the later cases were secondary to those occurring between 6 – 8 April. The latter would begin to excrete typhoid organisms from about the 10th day of their illness, i.e. from the 16 April onwards. Secondary cases would appear after an interval of about two weeks after this, i.e. around 30 April, or a few days earlier if the incubation period was shorter than usual. According to the foregoing reasoning, the only cases which could have been secondary to the primary cases in this outbreak were those with dates of onset 25, 26 and 28 April – one on each date.

Discussion of the aetiology

The outstanding features of this outbreak were:

(a) All the cases occurred within a period of 22 days.

(b) The attack rate was generally high among all groups.

This pattern indicates a common source of infection to which a large number of susceptible persons were exposed at the same time or within a short period of each other. Water and food supplies are the obvious suspects. There was no restaurant in the village, but it has already been noted that there was a communal sharing of food on the occasion of a festival (Hari Raya Haji), five days after the outbreak commenced, which might account for some of the later cases, but could not account for the earlier ones.

Unfortunately, no direct bacteriological evidence was obtained, but there is very strong circumstantial evidence that the water from the "cement" well was the source of infection:

(1) The use of water from the "cement" well for drinking and cooking purposes was a common factor among the affected households. No case occurred among the two households that did not use the water from the "cement" well.

(2) The well was unprotected against pollution.

(3) There were certain practices favourable both to the contamination of the well water and to the spread of infection.

(a) Water was drawn from the well by buckets that were used for other household purposes.

(b) The water was drunk unboiled.

(c) Soiled clothing was washed on the apro of the well.

If the conclusion that the well water was the common source of infection is correct, how was the well water contaminated in the first instance? We have to consider two possible sources:

(a) A case or carrier of typhoid fever among the permanent residents, or

(b) A case or carrier of typhoid fever who visited the village just prior to the outbreak.

Apparently, neither a case of typhoid fever nor a person with symptoms suggestive of typhoid fever occurred in the village within a month before the outbreak. Soon after it occurred, a stool survey was carried out on the unaffected population of the village. Three consecutive cultures at daily intervals of stool specimens from each villager were made. All were negative for salmonella organisms. However, this could not rule out the possibility of an intermittent carrier. Unfortunately, it was not feasible to carry out a survey of Vi agglutinin which has considerable value in detecting carriers of S. Typhi (Cruickshank, 1965). There is the possibility, although this is rather remote, that one of the cases was a carrier prior to the outbreak, but had since suffered a relapse of the disease.

On further inquiry, the villagers could not recall any visitor with symptoms suggestive of typhoid fever present in the village prior to the outbreak. However, the well could have been contaminated by a visitor who was a carrier, through a bucket used by him when cleaning after defaecation, or taken by a second party to a site in the bush where the carrier had recently defaecated, and used soon after for drawing water from the "cement" well. This is the most likely explanation compatible with the evidence available.

Summary

The epidemiological aspects of an outbreak of typhoid fever in Solok Kampong Baru, Malacca, are described. The outbreak was characterised by an attack rate of 50% among a susceptible village population within a period of 22 days. The only common aetiological factor found was the use of water, unboiled, from a "cement" well for drinking and cooking purposes by all the affected households, whereas two households which did not use this water escaped. It is concluded that this was a water-borne outbreak from a single source – a contaminated well. The source of contamination was not ascertained, but is considered most likely to have been an unidentified carrier temporarily resident in the village.

Acknowledgement

I would like to thank Professor W. Danaraj for her encouragement, Dr. Tow Siang Yeow and his staff in the Malacca State Health Office for their assistance and Professor G.W. Gale for his help in drafting this paper.

References

(1) Cruickshank, R. (1965) Medical Microbiology, 11th Edition, E. & S. Livingstone, Edinburgh and London, p. 229.

(2) Health Officer, Malacca (1965) Personal Communication.

Appendix I

Blood and/or stool cultures for Salmonella organisms as well as the Widal agglutination test were done at the General Hospital, Malacca, on every fever case from the village. Unfortunately, in some cases, the Widal agglutination test was not repeated after treatment with chloramphanicol, and the patients' condition improved. The breakdown of the cases was:

14 had positive cultures for S. Typhi.
4 others showed a rising titre for the Widal agglutination test.
13 were clinical typhoid cases.
TOTAL 31 cases

Appendix II

Cases of Typhoid Fever occurring near Solok Kampong Baru at the time of the outbreak:

(a) Four members of a family of seven in Pengkalan Badak village, about 1½ miles from Solok Kampong Baru, were diagnosed as typhoid cases at the time of the outbreak. The date of onset of one of the cases was 8.4.65 and of the three other cases was 14.4.65. They were all related to the members of Household No. 10 (an affected household) in Solok Kampong Baru and used to take cold drinks and food there two to three times a week before and during the outbreak.

(b) In Kampong Bukit Duyong, about two miles from Solok Kampong Baru, two households were affected, with a total of six typhoid cases (dates of onset from 8.4.65 to 14.4.65). The members of these two households had visited Household No. 6 (an affected household) in Solok Kampong Baru on four occasions before the outbreak.

On further inquiry, it appeared that the affected persons did not take any ice-cream within a month prior to their onset of symptoms. The common factor found was the partaking of drinks and food in the affected households in Solok Kampong Baru. Therefore, the source of infection for these cases was very likely to be the same as those in Solok Kampong Baru.