

Unfortunately in both these cases such proof is not available as both of them presented at the beginning of the disease such atypical features that a diagnosis of botulism did not seem likely, and, thus, much valuable material for the laboratory which 'is the final court of appeal in suspected botulism' was lost or not taken advantage of. Clinical diagnosis has had therefore to be relied upon in these two suspected cases, and there are many factors which point to such a finding being the correct one.

Both affected persons were attacked simultaneously, and were in the same group of people who shared the same food. Other members of the party were also obviously attacked, though admittedly to a much milder degree. Those who were so mildly affected happened to be people who consumed alcohol at the supper party, whereas the two who were severely affected were teetotallers. This is important and interesting as alcohol, it has been established, denatures the botulinum toxin, and prevents intoxication taking place.

A tin of peas, which was not heated prior to consumption, it is known, was used and had been incorporated in the cold salad eaten by all the members of the party, and there is strong presumptive evidence of it being the vehicle which carried the toxin.

The obstinate constipation, a characteristic feature observed in all cases of botulism, was present in both these cases, and was a marked feature of their disease.

The early symptoms, dimness of vision, diplopia, ptosis, photophobia, and lachrymation followed later by dysphagia, abdominal cramps, and still later by marked dyspnoea, and then, finally, with possession of all the mental faculties unimpaired, by death in the case of 'A', constitute a typical clinical picture of botulism.

'B', a less severe case, presents a much more modified and atypical clinical picture, and in her case, the paralysis of the muscles of the lower extremities is a most unusual feature of botulism, and if taken alone would lead one to make a diagnosis of poliomyelitis, except for the fact that the characteristic tenderness and stiffness of the neck seen so persistently in that disease was conspicuous by its absence in this case. In addition, it is not common to get two cases simultaneously infected with poliomyelitis in the same family, though in case 'B' it must be admitted that the fact of some permanent paralysis remaining on recovery, points to an acute poliomyelitis but this again is rendered the unlikely cause as there was even in case 'B' early involvement of the muscles supplied by the cranial nerves, which are seldom or never involved in poliomyelitis.

In concluding, I take this opportunity of thanking Major J. C. Drummond, i.m.s., the then Officiating Surgeon Superintendent, Presidency General Hospital, Calcutta, for his permission to publish these notes, and to Dr. F. E.

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A CHOLERA EPIDEMIC IN SWAT STATE, N. W. F., 1937

By C. J. HASSETT

CAPTAIN, I.M.S.

Malakand

IN August this year an epidemic of cholera occurred in Swat State, Malakand Agency. This account may be of interest as cholera is not endemic in this province and no permanent foci of the disease are known to exist.

It is always imported from outside, generally by *Powindah* families when they are returning to Afghanistan through the province from India proper. Generally, these families are the first to suffer but in this instance the disease was solely confined to the population of Swat State. No cases occurred in the migratory population. At the same time cholera was not prevalent in the Punjab; only a few cases had occurred which were obviously importations from outside that province.

Epidemiology of the epidemic

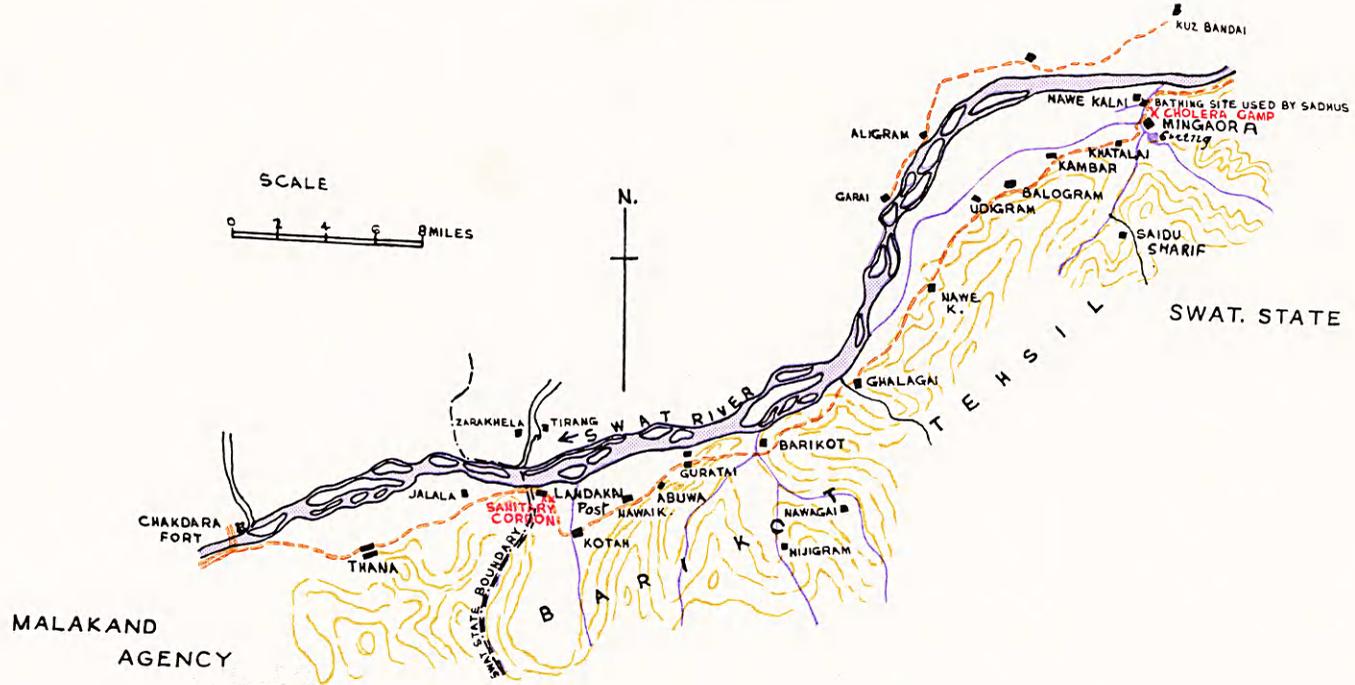
The N. W. F. Province remained free from cholera until 6th August this year when the present epidemic began with explosive suddenness. The outbreak was first reported from Mingora town which is the principal trading centre in Swat State. On 6th August four cases occurred in one family in this town, all of which died. Next day it was reported that 25 more cases had occurred with 15 deaths.

The affected area was visited and the family in which the first cases occurred was interviewed. The sudden manner of the outbreak pointed to its being water-borne. The father of the family stated that he was obtaining his water from a *nullah* running north-west of the town, which takes off from the Swat river about one and a half miles away. Subsequently 20 more cases were seen and all reported that their water had been taken from this *nullah*. Secondly, all the cases seen were to the north-west and east of the town and were scattered about in various places in this area. Most of the families attacked had no contact with each other, thus eliminating house-to-house infection. Thirdly, there were no cases then or on the following three days in the south or south-west of the town. Most of the population in this area obtained their water from a large spring which was due

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Laborda, Chief Medical Officer, the East Indian Railway, Calcutta, for supplying me with the detailed information regarding the history of case 'A' without which a diagnosis of botulism in case 'B' would have been extremely difficult, if not impossible.

MAP



south of the affected area. All evidence pointed to the above-mentioned *nullah* as being the source of infection. Later, a greater concentration of attacks subsequently occurred the nearer one got to this stream. The reason given for using the *nullah* water was that it was cold, as snow water is coming down from Swat Kohistan at this time of the year, and, secondly, the household wells had become brackish at the onset of the hot weather. The problem then was how had the stream become infected, as cholera is not endemic in this province? It is generally imported from outside, namely, the Punjab and the United Provinces. We then endeavoured to find out if any other cases had occurred in villages above this stream. There was only one village, Nawe Kalai, on the stream. It may be seen in the sketch map appended. In this village there were no cases of cholera although when visited several 'cholera' cases were shown which were mostly malignant malaria and dysentery. During the whole of the epidemic no cases occurred there.

It then transpired during the course of a conversation with a local *tehsildar* that a large number of Hindu *sadhus* had been visiting Swat State from the end of May onwards. They had come from down country. Their objective was Ilm, a mountain 9,000 feet high near Mingora town. A number of them had stayed in June and July in Mingora *dharamsala* and with the only three or four Hindu families in the place. This *dharamsala* was visited and the people there questioned as to whether there was any illness among them. We were informed that there was none. Then we endeavoured to find where these *sadhus* took their baths, and the keeper of the *dharamsala* accompanied us to the stream first suspected. It was above Mingora town and below Nawe Kalai village where up to now no cases had occurred. The site on the stream was opposite a divarication which led to the rice-fields. Here the *sadhus* took their baths. The question may be asked how did cholera only occur in Swat if it was brought up from the Punjab or the United Provinces, and no cases occurred in the Peshawar valley on the way up? Evidently a carrier or carriers were the cause of this outbreak and the *sadhus* were the innocent cause, as cholera seldom starts in the Mussulman population at the outset of an epidemic. Tomb and Maitra (1927) after researches in the Asansol mining settlement in Bengal state that the endemicity of cholera in any locality depends primarily upon the existence in the community of numbers of healthy carriers of non-agglutinating vibrios and upon the contamination of drinking-water supplies in a widespread and continuous manner with these non-agglutinating vibrios, which become in time converted into the agglutinating form owing to climatic conditions. No permanent carrier of agglutinating vibrios was ever found but 80 per cent of cholera convalescents were found to be carriers of the non-agglutinating form. They

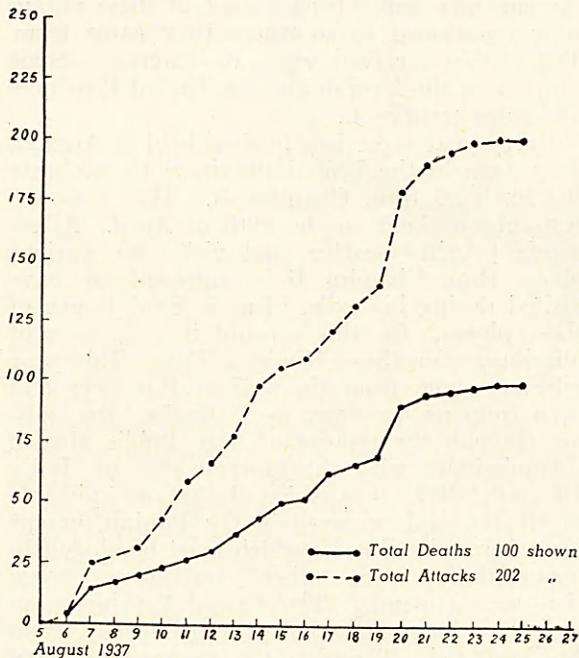
concluded that non-agglutinating vibrios are the reservoir of cholera, both epidemic and endemic, and that mutation of these occur under certain bio-chemico-physical conditions in the human intestine. Thus these non-agglutinating vibrios seem to have been introduced into the drinking-water supplies of the people of Mingora by the pilgrims from the South bathing in these water-supplies some time previous to the outbreak of the epidemic. All evidence adduced seems to show this surmise to have been the correct one. No bacteriological examinations of the water could be carried out for the presence of these vibrios as we were more concerned with preventive measures to control the epidemic, and laboratory facilities were not available. After the epidemic had subsided some of these *sadhus* were questioned as to where they came from. The replies received were of interest. Some came from the Punjab and the United Provinces and some from Sind.

Every year there is a festival held in Ajudiya near Agra in the United Provinces to celebrate the birth of Ram Chandra Ji. This year the festival was held on the 19th of April. Afterwards pilgrims scatter and visit the various places Ram Chandra Ji is supposed to have visited during his exile. Ilm in Swat is one of these places. On this account it is a place of pilgrimage for these Hindu *sadhus*. This year pilgrims came from the United Provinces and even from as far away as Calcutta. On looking through the reports of the Public Health Commissioner with the Government of India (Russell, 1937) it was found that no epidemic of cholera had occurred in the Punjab, except for a few isolated cases which must be obviously importations from other provinces where cholera is endemic. The United Provinces are shown to have had cholera continuously from April onward. Therefore the disease must have been an importation by a chronic carrier or carriers of non-agglutinating vibrios, perhaps from the United Provinces. The pilgrims stayed sufficiently long for the water-supply to have been widely contaminated. No outbreaks seem to have occurred anywhere else on the way up as perhaps their stay was not sufficiently long for wholesale pollution to have occurred and also because conditions were perhaps unfavourable to the persistence or multiplication of vibrios in the Punjab and Frontier provinces. In the Malakand Agency and in Swat thunder showers are common in the hot weather and this increases the percentage of salts and organic matter in the surface water, making it a favourable medium for the rapid multiplication of vibrios in an infected water. Such conditions occur in Bengal, where it is noticed that existing cholera epidemics are increased. Tomb similarly found this to occur in the Asansol mining area when bacteriological examination of surface waters was carried out. The epidemiology of the present epidemic seems to have depended upon the above facts.

Preventive measures

The measures taken to combat the epidemic were as follows :—

1. The disinfection of the water-supplies. This at first proved difficult. The affected *nullah* to the north of the town was obviously the first line of attack. The Ruler was asked to close its entrance from the Swat river by means of a *bund* for ten days. But he refused to agree as the people of the town were dependent on it for the working of their grain mills and this would lead to a food shortage. Ultimately a compromise was made when it was closed for 24 hours and the whole bed of the *nullah* was limed for three-quarters of a mile



Graph showing daily total attacks and deaths.

from the village Nawe Kalai, well above the bathing site, to Mingora. The *bund* was then removed and the whole *nullah* flushed down. The effect of this was at once apparent. There were no further cases of cholera in Mingora five days after this was done. It was a very important factor in the control of the epidemic, as preventive inoculation with cholera vaccine could not have had time to be completely effective.

All wells were sterilized with potassium permanganate or bleaching powder so that by the end of three days every source of water-supply was sterilized. The stream to the south of the town was also disinfected and the people encouraged to draw their water from this source. It had its origin in a spring. It alone was sufficient to supply the whole town with drinking water, but we were at times opposed by the Pathans who thought they should take water from where they liked. After the first three or four days, co-operation was easier to secure in

this matter as they had become frightened and were only too anxious to give every help.

2. The civil and military authorities in the Malakand Agency and in the Peshawar District were warned. Headmen, *tehsildars*, and the *jirgas* throughout the State and Agency were also warned as to what measures they were to adopt. In the State itself all villages contiguous to the affected area had written instructions issued in the vernacular, explaining the nature, mode of spread and control of the disease. These were read out to the people who were collected by beat of drum. Recruitment of coolies was stopped for work on the Malakand hydro-electric scheme and for road making in Waziristan while the epidemic was on.

3. Disinfection of houses and isolation of the affected area was carried out by making arrangements with the State authorities and the *tehsildar* of Mingora to have lime issued to the families in the affected houses. They were also instructed to burn all clothes and *charpoys* belonging to people who had died of the disease. This was in most cases done but it was difficult at times to ensure that the affected households would carry it out. Isolation of the houses and the affected area was carried out as follows :—

All houses where the disease had occurred were noted and the inhabitants of nearby houses warned that exchange of food or eating with families in the affected houses was dangerous. The isolation of the affected area was a difficult matter as it may be seen that the disease spread down the valley to other towns. Most of these cases were found to have been brought originally from Mingora and these small sporadic outbreaks did not show any evidence of it being water-borne. If it was one would have expected a more explosive outbreak in these latter places. The nearest it ever got to the Malakand Agency was a place called Abua, two miles from the State and Agency boundary. Here two cases occurred. These were definitely importations from Mingora as a woman had come from there to visit her sister in Abua and whilst there she developed and died of the disease. Subsequently the sister also developed the disease. There were no more cases after this. The people of this village were by then alive to the danger of house-to-house contact.

When the spread downward occurred anxiety was felt as to whether the Malakand Agency would be affected. A posse of Lavy Sepoys with a sub-assistant surgeon was then stationed at Landaki post, the boundary between Swat State and the Malakand Agency.

Here this sanitary cordon functioned throughout the epidemic and all motor traffic and travellers were stopped and examined. The lorry drivers gave good co-operation, reporting at once any cases of illness which had occurred on the downward journey. A dispensary nearby at Thana was cleared and opened to receive any suspicious cases. One or two people were detained with vomiting, diarrhoea, etc. They

were subsequently proved to be malaria and dysentery. All fruit and vegetables were also prevented from being brought into the Agency at this point. The position of this sanitary cordon was luckily at a good place. If the sketch map is consulted it may be seen that the river is on one side and a range of hills on the other. Thus it guarded the entrance to the Agency and the first big town in the Agency is Thana. Of course it was difficult to guard against a stray carrier who might have wandered across the hills to Thana, but this was thought to be unlikely as all traffic moves through the Landaki post, as the only direct road from Mingora through Swat State passes through here.

4. An inoculation centre and a cholera camp was opened in Mingora. In all 29,590 inoculations were performed throughout the epidemic. The demand for inoculation was surprising on the first day. The centre in Mingora was rushed by the population and the crowd had to be regulated by the State troops. The inoculations proceeded throughout the epidemic and it was subsequently also carried out in the other villages down the valley. A cholera camp, one part for females and the other for the reception of male cases, was opened. This was near the inoculation centre situated to the north of the town, where most of the cases were occurring. It was thought best to localize it here as it was the best situation and away from the south part of the town where the water-supply had been sterilized.

Essential oil mixture was distributed freely to early cases and to all contacts. Collapsed cases were removed to the cholera camp and there given Rogers' alkaline and hypertonic saline solution intravenously. Difficulty was experienced with females who were keeping purdah. They were collected into one large compound of an empty house and there received treatment and inoculation as required.

Final course of the epidemic

Later during the epidemic the disease spread down the valley, as mentioned before, principally to the Barikot *tehsil* half-way between Mingora and Thana. These cases were at once investigated and were proved to have been contact cases from Mingora. Every subsequent case was investigated at once all over the State, as by this time every disease was being called cholera by the frightened population. An assistant surgeon was deputed to this duty. The epidemic continued in a sporadic manner after the disease had ceased in Mingora and eventually it died out. Inoculations and preventive methods were here also carried out vigorously. As mentioned before, the furthest down the disease spread was to within two miles of the Agency boundary.

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PRAWNS AS A POSSIBLE VECTOR OF *V. CHOLERÆ*

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and

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IN the year 1936, an experiment was carried out at the Harcourt Butler Institute of Public Health, Rangoon, in connection with the viability of *B. schafferi* in natural water collections (*vide* Annual Report of the Institute for the year 1936, pages 12 and 13). During the course of these experiments, a fresh-water prawn came under observation and a vibrio, which gave the

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From the 26th August no further cases occurred and the area was declared free from cholera at midnight of 2nd September, 1937.

Summary and conclusions

This epidemic presents several interesting points in that this province was free from cholera this year until the present outbreak. The *sadhus* who made a pilgrimage to Swat State in June and July appear to have been responsible. The latter is a very important matter from the public health point of view, as under present-day conditions the disease can be disseminated rapidly in a widespread manner on account of the rapidity of road and rail transport. The people who go on pilgrimage generally visit towns and villages, where they are given food and shelter by their co-religionists, to their detriment as happened in this epidemic. In this province the *Powindah* families, who are nomadic, generally introduce the disease while they are on their way back to Afghanistan. On this occasion this was not so. That the vagrant pilgrim population who may visit this province are of considerable danger is shown and that their presence may make itself felt long after they have left is well exemplified in this epidemic. Finally, the disease appears to have been carried a long distance before it became apparent and culminated in an explosive outbreak.

In conclusion I should like to thank Lieut.-Colonel W. E. R. Dimond, I.M.S., Assistant Director of Health, N. W. F. P., for his help during the epidemic and to Colonel R. S. Townsend, M.C., I.M.S., Inspector-General, Civil Hospitals, N. W. F. P., for permission to publish this article.

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