It was decided to explore the swelling as it was rapidly increasing and was causing the disappearance of the zygomatic process, but there was no oedema of the eyelids. The patient was given a general anaesthetic (chloroform and ether), and an incision was made parallel to and just above the left zygomatic process; deep down in the temporal fossa pus was reached, and about two teaspoonfuls were evacuated and a drainage tube introduced.

For a few days the abscess drained and there was slight improvement in the patient's condition generally, but it was not maintained, and as the headache (now referred to the back of the head) became more intense and the speech defect more marked, it was decided to trephine over the left temporo-sphenoidal lobe; this was done on January 10th, 1924. Chloroform was administered by the open method, and just as consciousness was lost he ceased breathing and artificial respiration was resorted to. This was kept up for about three hours, and various efforts made to stimulate the respiratory centre, but without success, for though the heart and circulation continued to function there was absolutely no respiratory response. Suspecting that intracranial pressure was the cause of the respiratory failure, trephining was proceeded with and about 5 oz. of pus evacuated from an abscess in the temporo-sphenoidal lobe, but without the slightest return of the respiratory function, even though artificial respiration was maintained for an hour and a half longer.

TWO CASES OF ANKYLOSIS OF THE LEFT TEMPORO-MANDIBULAR JOINT.

BY

P. T. CRYMBLE, M.B., B.Ch.R.U.I.,

F.R.C.S.Eng.,

SURGEON TO OUT-PATIENTS, HOSPITAL FOR SICK CHILDREN; ASSISTANT SURGEON, ROYAL VICTORIA HOSPITAL, BELFAST.

THESE cases were encountered in the out-patient department of the Queen Street Hospital for Sick Children. In both the condition was of long duration (seven years and twelve years), had followed a serious illness, had produced a most inconvenient deformity, and was completely relieved by removal of the head and neck of the mandible.

The first problem in dealing with a case of long-standing ankylosis of the jaw is to determine whether the obstruction is articular or extra-articular, and on which side it lies. In both these cases it was only after many weeks of insertion of wedges that sufficient movement was obtained to enable one to palpate movement in the right joint and complete absence of movement in the left joint.

The second problem is one of anaesthesia. The jaw being fixed in the closed position one would be unable to control the tongue or to remove secretions or stomach contents from the pharynx, so that it was decided to expose the joint under local anaesthesia and to remove the bone under general anaesthesia.

Thirdly, one had to decide the nature of the operation, and as the obstruction appeared to be due to an ankylosis at the left temporo-mandibular joint, it was decided to try the effect of removing the head and neck of the mandible on the left side.

The result in both cases is very satisfactory, and the patients can eat in a normal manner. The movement obtained at operation has been maintained up to the present—

Necropsy.

A limited *post-mortem* examination disclosed a connexion between the abscess cavity in the left temporo-sphenoidal lobe and the temporal fossa, as the great wing of the sphenoid was found to be perforated by a small hole admitting the point of a probe. This was independent of any of the normal anatomical foramina and was apparently at a point where the bone is usually very thin. The mastoid cells contained pus.

Professor Howden has since called my attention to a skull (macrated) in which the great wing of the sphenoid is actually perforated in the centre of a very thin area. Another point of interest found at the *post-mortem* examination was the inclusion within the large abscess cavity of two small globular abscesses—pus contained within firm walls—which were practically floating free in the larger cavity. It was concluded that there had been several septic foci with abscess formation and that the more rapidly advancing softening process had surrounded and isolated the earlier small collections.

in the one case for two and a half years, in the other for two and a half months.

CASE I.

A girl who at the age of 2 was ill with consumption of the bowels for fourteen weeks. Subsequently an inability to open the mouth was discovered, which persisted up to the age of 9, when she was brought to the out-patient department.

When first examined the mandible was immobile and the upper and lower teeth were in contact. A gap between two upper teeth permitted small portions of solid food to be pushed into the mouth with the finger. Speech was not affected, and the child was intelligent and fairly well nourished. After some weeks of daily insertion of a wooden wedge a slight amount of mandibular movement was obtained, and it was then discovered that the right head of the mandible moved whereas the left was immobile.

Operation.—Under local anaesthesia a skin incision was made along the left zygoma and then downwards in front of the ear; the zygoma was detached and turned downwards with the masseter, and the coronoid process was removed. Under general anaesthesia the head and neck of the mandible were exposed and removed.

After-Treatment.—After operation five-eighths of an inch of movement was possible. For some months the daily insertion of a gag by the father prevented this movement being lost.

Result.—The patient was examined two and a half years after operation and no diminution in the amount of movement had taken place. The child has a better colour than previously, can eat and drink normally, and her parents are well satisfied with the result. The teeth are growing in a very irregular manner.

CASE II.

A girl who had had scarlet fever at the age of 2½ and measles three months later. Inability to open the mouth was noticed after the scarlet fever, and since then the mandible had remained immobile and only liquid food could be taken.

At the age of 12 the patient was brought to the out-patient department, and one found immobility of the mandible with the upper and lower teeth in contact. The upper incisors lay anterior to the lower incisors, leaving a cleft through which fluids could be sucked.

After many weeks' treatment with wooden wedges and screws slight movement was obtained, and palpation revealed movement at the right temporo-mandibular joint and complete immobility at the left temporo-mandibular joint.

Operation.—This patient was not so docile as the first, and after the skin incision general anaesthesia had to be adopted. The skin was incised along the left zygoma and downwards in front of the

FIG. 1.—Case I. A, Before operation: patient attempting to open the mouth; note the teeth in contact. B, Some months after operation; the mouth can now be freely opened.

FIG. 2.—Case II. A, Before operation: patient attempting to open the mouth. B, after operation; the mouth can now be freely opened.

ear. The left temporo-mandibular joint was exposed; bony ankylosis was found between the mandible and the temporal, and the head and neck of the mandible were removed by chisel and gouge. Free movement was immediately obtained, amounting to one inch between the incisor teeth. Subsequently this movement was maintained by the daily insertion of a gag.

At the present date, two and a half months after the operation, there is still a full inch of movement and the child can eat in a normal manner.

The Milroy Lectures, 1924,

ON

THE PLAGUE.*

BY

LIEUT.-COLONEL W. GLEN LISTON, C.I.E., M.D.,
D.P.H., I.M.S.

III.—THE EPIDEMIOLOGY OF PLAGUE.

EACH species of flea generally selects its own species of host, hence the designations human flea, dog, cat, or rat flea. But this method of naming fleas is not strictly accurate, though often convenient. There are, for example, some thirty to forty different species of fleas found on rats in different parts of the world, but our knowledge of them is still very incomplete. With the warning, then, that my remarks on fleas may apply to a number of closely related species, I can proceed to explain that the same species of flea may be found on a number of hosts. *Xenopsylla cheopis*, for example, has been taken on cats, rabbits, guinea-pigs, kangaroos, an Indian antelope, men, and on a number of species of rats. Other species are more restricted in their choice. Different species of fleas also differ in respect to the length of time they live upon their host. Some species fix themselves more or less permanently to one particular host, other species for short periods only. Some feed at frequent intervals, while others drink deeply but less often. All these traits influence the power of any particular species of flea to convey plague from one animal to another. We may conclude that although the transmission of plague by fleas is a purely mechanical process, and for this reason quite different from the transmission of malaria by mosquitos, yet the successful transmission of plague depends to some extent on the species of flea which serves as the transmitting agent.

It is remarkable how speedily fleas can reach a host which comes within a short distance of the spot where they lie in wait. A few examples will suffice to illustrate this peculiar trait, which is of much significance in the spread of plague.

I remember well visiting a commercial office in Bombay where two dead rats had been found in a corner of a very large room. One of these rats was examined and proved to be infected with plague. On the evening of the day on which the rats were found two guinea-pigs were allowed to run free in the corner of the room where the rats were said to have been picked up. The movements of the guinea-pigs were restricted by a barrier which confined them to a portion of the room only. Early next morning a dead rat was found on the floor outside the barrier which confined the guinea-pigs; it lay beneath the desk of one of the clerks employed in the office. The rat was examined for fleas as soon as it was found; six were caught on it. Nothing could be seen on the spot where the rat had died, but a guinea-pig, which was known to be free from fleas, was allowed to run backwards and forwards over this area for about one minute. It was then chloroformed and searched for fleas; eighty-two were picked off it. A second clean guinea-pig was allowed to run over the same spot while the first was being examined; thirty-two fleas were taken on this second animal. Twenty-nine of the 114 fleas caught in this way were dissected; seventeen of them showed abundant plague bacilli in their stomachs. The remaining fleas were transferred to a fresh guinea-pig in the laboratory, and it died of plague in four days. Neither of the guinea-pigs which had been used to trap the fleas developed plague.

We can form some idea of what might have happened to these rat fleas if the clerk had taken his place at his desk, and if the guinea-pig flea traps had not been used, from the following experience in another part of the town. Here a long building, divided into a number of small rooms by partitions, had been evacuated recently by the inhabitants because of the outbreak of plague among them. We visited this house on April 17th with an Indian coolie assistant. This man had bare legs; he entered one of the empty rooms for a few seconds, and when he came out his legs were examined. Forty fleas were captured on his legs; all were human fleas. Next day, April 18th, the place was again visited, and the

same thing happened. On this occasion 113 fleas were caught on the man's legs; fifty-five of them were human fleas, fifty-one were rat fleas, and seven were cat fleas. On the third day the experiment was repeated, when forty human, thirty-four rat, and two cat fleas were taken. On the fourth day the yield was eighty fleas (eighteen human, sixty rat, and two cat fleas). Observe that, at first, only human fleas were caught, but later, when the rat fleas had cause to seek another host in the absence of living rats, rat fleas were captured together with human fleas on the coolie's legs. By the fourth day more rat fleas than human fleas were taken on the man. It is quite possible that, had we not examined this man's legs and removed the fleas from them, he might have carried some of these fleas to his home, and there they might have transferred their attention to their natural hosts the rats.

These observations show that infected rat fleas do not travel far from the spot where they left their host; they generally lie in wait for the passing of another host. If this new host is a rat, the fleas are readily attracted to it and may then be carried to a distance limited by the extent of the rat's wanderings. If the new host is a man, then the distance over which the fleas can be carried may be considerably greater, and will be limited by the distance and by the speed at which the man travels.

Plague thus progresses in two very distinct ways: first, to contiguous areas—here infection is carried chiefly by rats; secondly, to more distant centres *per saltum*—in this case infection is transported by men. Men may carry rat fleas either on their person or in their clothing, or they may transport rats and their fleas with merchandise, in which case railways and ships materially assist the dissemination of the disease.

The Plague Commission was able to shed some light on the probable course of an epizootic of plague among rats when men did not take part in the dissemination of the disease. The progress of epizootics which were induced in groups of rats confined in godowns infested with rat fleas was studied, and the progress of an epizootic in a village which had been abandoned by its inhabitants and in which guinea-pigs were substituted for the human population was observed.

The godown experiments were carried out in Bombay in succession throughout a whole year. They showed that the severity of the epizootic depended on the number of fleas present in the godowns, and on the degree of septicaemia developed in the infected rats. A certain number of rats survived the epizootics in all the experiments, and it was impossible to rekindle the epizootics among the survivors, in spite of repeated attempts to do so, by introducing fresh infection among them. The survivors of the epizootics were proved to be immune to plague by subjecting them to the subcutaneous injection of virulent plague bacilli. The dose administered varied in different experiments from twelve to twenty-six thousand plague bacilli. This dose sufficed to kill a number of wild Bombay rats which were always used as controls. When the dose was small the immunity of the rats which survived the epizootics was complete—that is to say, none died, while many of the control rats developed plague. When the dose was larger some of the survivors of the epizootics died, but a relatively greater number of the control rats succumbed. It appeared, however, that the percentage of survivors in the two groups was not very different when allowance was made for the number of rats which had died of plague during the course of the epizootics. The immunity of the survivors of the epizootics did not therefore seem to have been acquired by exposure to sublethal doses. The rats which survived appeared rather to be individuals naturally immune to the disease; they had been picked out or selected by the epizootic.

This suggested further experiments in which the immunity of rats obtained from places which had not suffered from plague was compared with the immunity of rats caught in places where plague prevailed. The first experiments of this nature were carried out in flea-infested godowns. Rats obtained from Madras, where there had been little or no plague, and rats from Bombay and Poona, where there had been much plague, were subjected in groups to infection communicated by rat fleas. The epizootics thus induced resulted in the death of thirty-six Madras rats, three Bombay rats, and one Poona rat, out of fifty in each group. But the conditions required for the transmission of infection by fleas were difficult to regulate, so that additional experiments were designed in which subcutaneous injections

* This course of Lectures has been slightly abbreviated for publication.