EPIDEMIOLOGY—AN INTERESTING QUEST.

By Major Cathcart Garner.
Royal Army Medical Corps.

On September 8th, 1904, the Department was notified of the appearance of plague, probably pneumonic, in the village of Seyaffa, in Qualioobia Province, Egypt. The notification was made by the Native District Sanitary Inspector, who reported that the normal monthly mortality had already been exceeded. The report was received at headquarters with some disappointment, because the experience of the last six years had led us to look for a diminution if not a disappearance of plague in the districts, between the months of September and March; the reason probably being that rats usually litter in Egypt in the early part of the month of March, and the new litters presenting no immunity, readily become infected with plague in places inaccessible to, or which may have escaped the vigilance of, our disinfecting gangs. By October these litters have either died or become immune. In this case, however, there was a probability that the infection had been spread directly in the pneumonic form from man to man, because the last cases of plague which had occurred prior to the receipt of the report had been a series of seven in a village only five kilometres' distance from Seyaffa, three of which cases had occurred in one family, and had been of pneumonic type, so it was not unreasonable to suppose that a friend or relative of this family infected with pneumonic plague had fled to Seyaffa, and had infected the community there.

On receipt of the report the usual precautions were taken; a special native doctor was sent to reside in the village, also a trained disinfector in charge of a disinfecting gang; a hospital was pitched, a house to house inspection for sick and contacts was made, and a regular disinfection of the infected houses and their contents was carried out; cultures from lungs and spleens of deceased cases were to be taken by sterilised syringe, sowed on agar-agar tubes, and forwarded to the Hygienic Institute for bacteriological examination. An English sub-inspector was ordered to visit the place several times weekly and report.

The result of all this was that seven cases were found and removed to hospital, all of whom with one exception died within twenty-four hours. Dr. Ekins, the English sub-inspector in charge, reported certain peculiarities of symptoms which did not tally with
our experience of plague, and, moreover, drew attention to the curious fact that all the cases which had been seen, and all the deaths which had occurred in the village up to September 12th, had been those of women over thirty years of age, that no two cases had occurred in any one house, nor had any two contiguous houses furnished cases.

The first cultures arriving at the laboratory were negative as regards plague bacillus. The diagnosis of plague was therefore more than doubtful; on visiting the village I found fifteen people segregated, six cases in hospital, nine in isolation tents. The cases in hospital were all women of over middle age, the contacts were in good health, and after five days' supervision were allowed to return to their houses. No co-relation could be found among the cases, they had come from houses dotted all over the village, as before noted by Dr. Ekins; the majority of the deaths had ensued within thirty hours of the first attack; further, it was found that the village which we suspected as having infected Seyaffa, was separated therefrom by one of the largest water-ways in Egypt, the Rayah Tewfiquia, and that there was no relationship by marriage or otherwise between the two villages, and little or no communication in the ordinary way. The orders with regard to isolation, disinfection, &c., had been carefully complied with and carried out.

The Omdeh, or head-man of the village, was a reliable man, who had already been promoted for good work done in connection with Public Health Administration, and I had every reason to believe that his reports and statements concerning the families, houses and relationships in Seyaffa and the neighbouring villages were correct. No trace of any infectious disease or unusual mortality was found in any of the villages within a radius of fifteen miles, and all deaths occurring in such villages were inspected by qualified medical men, instead of by the village barber-surgeons, as is usually done in places where no qualified sanitary medical officer resides.

On examining the cases in hospital carefully I was convinced that we were not dealing with plague: symptoms, history of cases, ages, were all against such diagnosis. The symptoms briefly were as follows: Sudden attack with intense feeling of chilliness and rigor, splitting headache, increased rapidity of breathing, cyanosis of face and extremities, thready rapid pulse; physical signs in lungs, although apical, suggested bronchitis rather than pneumonia, dullness at base due to pleural fluid in some cases, no diarrhea, vomiting not a marked symptom and absent in most of the cases, no buboes. All the cases were women over thirty-five years of age. Nearly all
the deaths had occurred within thirty-six hours of attack, and in one case, which had been under observation from the very first feeling of malaise, the woman had died in seven hours. One symptom present in all the cases was a feeling of intense pain and oppression as of a crushing weight over the sternum, so agonising as to cause patients to scream. The patients, instead of presenting the stupid "abbatu" appearance of plague patients, were observant, asking if they had a chance of recovery, &c., and in some cases remained conscious up to the moment of death.

Reports from the Hygienic Institute still showed that the cultures gave negative results as regards plague bacillus. Excluding the diagnosis of plague, the outbreak became an exceedingly interesting one, and every effort was made to fix the diagnosis. The closest supervision was now established over the village, one of our English staff visited daily; and another native doctor, specially chosen on account of his ability and intelligence, Dr. Aly Eff. Ibrahim, was sent down to co-operate with his Egyptian colleague, and to trace carefully any clue that might be found. Owing to the horror and dislike of autopsies amongst natives, and to the attendant dangers thereof in dealing with pneumonic plague, no post-mortem examinations had been allowed. Now, however, Dr. Aly Ibrahim was instructed to make one or two autopsies, in the event of any further deaths occurring.

On September 15th, up to which date ten deaths had occurred (always amongst women of middle age) since September 9th, a woman aged 40 was found suffering from a malignant pustule on the left cheek.

On September 17th a man who had probably fled from the village to escape the previous house to house inspections, returned to his house by night and died there; he had a large anthrax (Charbon) on the back of his neck; while the doctor was examining the corpse he became aware that there was more than the usual excitement afoot amongst the women of the house, and on examining them he found one of them at the point of death, so ill indeed that he could not remove her to hospital. She died almost immediately, and the culture which was taken from her lungs was sent to Cairo for examination; it was found to contain over a hundred colonies of pure anthrax bacilli, and guinea-pigs inoculated with it died forty hours afterwards from true anthrax.

It is very unusual to find the phlegmatic fellaheen giving expression to any pain.
An autopsy was made by Dr. Aly Ibrahim, who reported a normal condition of the viscera with the exception of the heart and lungs. Under the heading "Heart" he reported: "Pericardium normal, its cavity contained about five tablespoonfuls of clear serum, the heart muscle was covered with a large amount of fat but the muscle itself was apparently normal but soft, the cavities contained a moderate amount of dark bluish blood. The valves were normal." Lungs: "Both lungs had the same appearance. The pleural cavity contained about 300 cc. of yellowish clear serum. The surface of the lung was edematous and covered with a gelatinous clear substance not unlike coagulated serum. The lung itself was normal in colour and consistency except for a few scattered patches which felt solid, and of the size of a millieme (sixpence); the lung was not congested and its cut surface was apparently normal, except where one of these little solid patches had been cut into, when it looked dark red in colour or resembling liver. When squeezed it oozed frothy mucus and serum in abundance, but was unstained with blood. Larynx and trachea inflamed in places. Bronchial glands enlarged." Professor Eppinger, in his paper "Die Hadernkrankheit," published at Jena, 1894, describes the pleural and pulmonary post-mortem conditions in almost identical terms.

Cultures taken from cases which died on September 17th, 18th, 20th, 22nd and 23rd, all contained anthrax bacilli unmistakable in their macroscopic and microscopic appearances, their mode of growth, and their morphological action and effect upon guinea pigs. There was consequently no longer any doubt whatever as to the diagnosis. We were dealing with a serious outbreak of anthrax (wool-sorters' disease) in the pulmonary form. Having arrived at the diagnosis it remained to determine the cause and mode of infection. One fact stood out clearly, that (with the exception of the man who had died of the Charbon) all the cases had occurred and were occurring among women aged 35 to 40, and upwards.

Restrictions had been generally imposed throughout Egypt, on account of rinderpest, on the skin and hide trade, consequently no hides, bones, &c., were found in the village, and as the result of the disinfection, which had been carried out on the assumption that we had been dealing with plague, all shreds of wool, rags and other rubbish had been burned. Owing to the shortage of meat in the country due to the severe visitation of cattle plague in 1903, the embargo which had hitherto being placed on the importation of cattle and sheep from Syria had been conditionally
removed, i.e., they were allowed to come into Egypt after undergoing a short period of quarantine and observation. Anthrax is not uncommon amongst the sheep in Syria, so it was considered possible that in spite of the quarantine and observation imposed, some infected sheep might have reached the village. After a most careful search, however, no trace of disease was found amongst the cattle or sheep either in the village or within a radius of twenty miles of it. Still, the fact of not finding a case of anthrax amongst the cattle or sheep existing did not negative the possibility of such cases having occurred some time before.

We proceeded to follow the clue that only women of a certain age had suffered. With the exception of the professional water drawers (Saqqaeen), only women fetch the water for home consumption; it was possible that a back water or well might have become contaminated by an anthrax infected carcass; watchmen were accordingly posted to prevent women drawing water from other than known pure sources. It was soon seen that this theory was untenable, because: (1) Cases continued to crop up after the water supply had been guarded; (2) the cases continued to take the pulmonary and not the intestinal form; (3) if the water brought to the houses were infected, not only the old women but also the men and children would have contracted the disease.

Rags, shreds of wool, and wool-spinning had been constantly kept in view as possible means of infection; but the village had been disinfected and re-disinfected by our gangs under a highly trained superintendent, I had personally assured myself of the removal and destruction of all rags, bones, hides and rubbish; and as regards the wool, little or no spinning is done by women in Egypt, such work is almost invariably performed by the men, among whom not a single case had occurred. Consequently we were forced to discard the supposition that rags, wool, &c., were a source of infection in this case.

On September 30th, while returning to Seyaffa from a tour of inspection of the neighbourhood in company with an English Sub-Inspector and a Sheikh of the village, we happened upon a dead donkey which was remarkable only in that it had been a valuable beast, worth £20 at least, and that it had evidently died suddenly, because it was in magnificent condition and could not have been ill for more than a day or two prior to death. On remarking to the Sheikh on the loss such a fine beast must have been to its owner, he replied that there seemed to be some bad luck on the village, as not only were the women dying, but within the last
fortnight eight or nine donkeys also had perished. This was interesting, and naturally arrested one's attention.

It must be remembered that in spite of our enquiries concerning disease amongst sheep and cattle no one in the village had breathed a word about any mortality amongst the donkeys. I confess that I had never entertained the possibility of donkeys becoming infected with anthrax; now, however, that this information with regard to a donkey mortality had been volunteered it appeared worth while to enquire into it. Dr. Aly Ibrahim was accordingly told to ferret out all he could concerning the statement, and was instructed, in the event of any further deaths occurring amongst the donkeys of the village, to send up cultures to Cairo and to make a post-mortem examination.

On October 2nd another donkey died at Seyaffa, and the culture taken from the lungs and sent to Cairo disclosed many colonies of anthrax bacilli; moreover, not only the lungs but also the trachea displayed similar pathological lesions to those found in human cases and described by Dr. Aly Ibrahim and Professor Eppinger. The statement that several donkeys had died within the last month was also corroborated by the Omdeh and Sheikhs in the course of conversation with Aly Ibrahim. Attention was next turned to the number of donkeys that had died; it was found that up to October 4th fifteen donkeys had certainly succumbed, probably more, but no clear history could be elicited beyond these fifteen; it was then demonstrated that in most of the houses where donkeys had died, human cases had also occurred, and any cases which had not actually come from the same houses as dead donkeys had been found in houses close by.

Endeavouring to find the manner by which a donkey could become infected with anthrax in the pulmonary form, we could safely exclude food; it seemed impossible that any corn, beans or chopped straw could convey the infection, and as regards grass (Barseem), if it had been contaminated by anthrax-infected cattle or sheep we should have found donkeys attacked by the intestinal rather than by the pulmonary form of the disease. A donkey in comparison with a horse, mule, horned cattle or sheep is a clean feeder, but it may be noticed that he usually muzzles or sniffs at any droppings, dung, or urine which he encounters. If sheep or cattle infected with anthrax in the usual form had been in the village it was certain that their dung would contain anthrax spores; as I have mentioned, we had already made close enquiry as to any mortality amongst the village sheep and cattle, with a negative
Epidemiology—An Interesting Quest

result; but on thinking the matter over it was remembered that although cattle plague (rinderpest) had broken out among the cattle of Seyaffa in the autumn of 1903 and had been successfully stamped out, a second invasion occurred in January, 1904, which, though of mild type, had lasted for some months, and had accounted for thirty-five deaths amongst the village cattle. Was it not possible that, the attention of our veterinary staff having been concentrated on rinderpest, some cases of anthrax might have occurred and escaped recognition. Enquiries were accordingly set on foot again, and it was found that many of the deaths amongst the cattle which have been returned as rinderpest during the outbreak in spring, did actually come from the very houses which had furnished us with either human or donkey cases of anthrax, or both. The Omdeh and Sheikhs of Seyaffa also admitted that sheep belonging to the village had died, but as they did not suppose they had died from cattle plague no report had been made. Although it is true that sheep may be attacked by cattle plague, still the disease takes such a mild course in these animals that recovery is the rule, and I can find no authenticated cases in Egypt or elsewhere of sheep dying of rinderpest. Professor Koch's experiments in South Africa also tally with our Egyptian experience in this respect. Consequently the suspicion that cases of anthrax had existed amongst the cattle and sheep at Seyaffa so early as the months of January, February, March, and April became almost a certainty, but required proof.

The fellah as a rule stables his sheep, cow, camel, goat or any live stock which he may possess in his house, or at best in a small covered zariba or byre immediately off the living rooms of the house. The dung from these animals, supposing one or more were infected by anthrax, would naturally contain bacilli and spores. It is collected by the children and is used for two purposes: (a) For manure; (b) for the making of "gilla," a mixture of dung and chopped straw formed into round flat cakes or hollow oblong bricks and allowed to dry, when, as occasion requires, it is used for firing.

The dung of the cattle deceased during the outbreak in the spring had of course long since been removed, but the gilla remained, and owing to the known resisting power of anthrax spores we still expected to find spores in the gilla, if the dung from which it had originally been made had been infected. Professor Bitter, the Director of the Hygienic Institute, kindly undertook the task of finding anthrax spores if such existed in the gilla, remarking at the same time that the gilla might prove after all to be the real source
of the anthrax outbreak in the village. On reflection, it seemed that the proof of the existence of anthrax spores in the gilla would clear up any doubt and dissipate all the difficulties which had met us in tracing the source of the outbreak. The one household duty

![Fig. 1.—Examples of round and long brick Gilla.](image1)

![Fig. 2.—Method of stacking Gilla bricks on house tops at Seyaffa.](image2)

almost invariably performed by middle-aged or old women amongst the fellaheen is baking (very exceptionally infirm old men confined to the house help in this work). The baking is done either in a mud oven or on a large round flat iron over an open fire, but in
either case the fire is made of dried gilla; so that a woman in
breaking gilla cakes before placing them on the fire or in the oven
would almost certainly inspire some of the resulting dust. Per­
sonally I felt so convinced that this was the real mode of infection,
that on October 4th I went down to the village and asked the
Omdeh and Sheikhs to apprise the whole village by crier of the
danger from the gilla, advising the employment of other firing where
available, and if none other were available, that the women should
cover their mouth and nose with their veils when handling or break­
ing gilla, or when baking.

Specimens of the dung from donkeys from the village had
already been examined, but as was expected no trace of anthrax
was found, the donkeys being infected only by the pulmonary form
of the disease. Samples of gilla from the different houses where
either human or donkey cases, or both, had occurred were now
collected and sent up to Professor Bitter, who on October 10th
proceeded to inoculate a series of guinea-pigs directly with it.

It was found that the inhabitants of Seyaffa only used the round
gilla made in the spring time for fuel during the summer months;
the oblong brick-shaped variety which is made in the winter months
is stored on the roof tops and is kept for long periods, sometimes
three or four years, being used as required during the late autumn,
winter, and early spring; consequently the search for anthrax was
confined chiefly to the round-shaped gilla as being that most likely
to have become infected during the months of February, March,
and April.

Professor Bitter's experiments were naturally followed with
great interest, because if the guinea-pigs succumbed to anthrax
the chain of evidence as to the source of infection of both old
women and donkeys would be complete. Nevertheless we were
convinced that even if the experiments proved negative the gilla
was the true source of infection, because from the day following
the exhortation of the Omdeh and Sheikhs that the women should
veil themselves while baking, or desist altogether from using gilla
as firing (i.e., October 5th), no further case had occurred in the
village, whereas prior to this one or two cases had been occurring
daily.¹

On October 13th Professor Bitter reported that one of the

¹ This cessation of cases continued until July 12th, when, probably the effect
of the Sheikhs' warning having passed off, some of the women failed to take the
precautions advised.
guinea-pigs inoculated with gilla taken from houses at Seyaffa which had furnished a case of anthrax in a woman, and in which a donkey had previously died, had succumbed to true anthrax; this was good news and confirmed our belief. Orders were at once sent to Seyaffa to destroy by fire all the round gilla which existed in the village. This was done under the supervision of an English inspector, and the people were compensated in money. Professor Bitter, to make assurance doubly sure, made some further inocula-

Fig. 3.

tions from gilla taken from other houses suspected of harbouring anthrax infection, again with a positive result. The accompanying microphotograph of typical anthrax was taken from a preparation from a guinea-pig which was inoculated on October 20th, and died four days afterwards. From the date of the destruction of the round gilla in the village no further case of anthrax occurred; the epidemic was completely stamped out.

Remarks.—To summarise, a small outbreak of anthrax had occurred amongst cattle and sheep at the time when attention was centred on rinderpest, and the cases of anthrax having escaped notice had been returned as cattle plague. The droppings of these
animals infected with anthrax had been collected and made into gilla, which consequently infected both women and donkeys. The mode of infection in both had been similar, by inhalation: the donkey snuffing at the gilla heap, the woman by inspiring gilla dust when baking.

Thirty-eight human cases occurred altogether, two of which had taken the form of malignant pustule and one had been of the intestinal form. Only two men were infected: one was the man who died of Charbon on the back of the neck, the other an old man, a Fikki, who never left the house and assisted his wife to do the baking. All the cases with one exception had been amongst people of middle age or more; the exception was the intestinal case which occurred in the person of a young girl, i.e., a child who had been employed in the stacking of gilla in heaps, and who had therefore probably infected herself directly from her hands. The period of incubation appears to be without doubt a very short one, probably within twenty-four hours, as shown by the fact that after the order was issued on the afternoon of October 4th that women should veil themselves before baking, no cases occurred between the 5th and the 12th, when two men were attacked, probably because they neglected to take the precaution advised. After October 15th, by which time all the round gilla had been incinerated, there was a complete cessation of the epidemic.

A point of interest to be noted is that one may easily miss finding anthrax in the lung by aspiration if the point of the needle does not happen to enter one of the foci of infection. Consequently several aspirations should be made and several tubes of agar-agar should be sowed. I am unable at present to state whether the pleuritic exudation invariably contains anthrax bacilli or not, probably it does. I trust Professor Bitter will publish some remarks on this point and others in connection with this rare disease; my best thanks are due to him and to Dr. Aly Ibrahim for the valuable aid they afforded in tracing the infection step by step.

---

1 A reciter of verses of the Koran.