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ON AN

EPIDEMIC OF TYPHUS

IN THE

North-West Provinces of India.

BY

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ON AN

EPIDEMIC OF TYPHUS, &c.

The subject of the following remarks, although of peculiar interest and importance to the profession in India, is not altogether unworthy of the attention of every student of disease. Till within a very few years, the idea of typhus fever occurring in India was ignored by most physicians, and passed over in silence by systematic writers on the disease of the country. Annesely, in his work, does not allude to it ; Dr. Morehead, in his *Researches on Disease in India*, states positively that typhus, typhoid, and relapsing fevers are unknown ; and Johnston and Martin, while they allow that typhus may, and occasionally does, occur in India, yet deem "the climate extremely unfavourable to the existence and perpetuation of typhus contagion." Since 1856, however, not a few isolated cases of pure typhoid, or, more properly, enteric fever, have been recorded in the *Indian Annals of Medical Science*. Dr. Ewart of Ajmere, Dr. Scriven of the Presidency General Hospital, Drs. Goodeve and Payne, have all contributed cases, proving incontestably that this disease does occur within the tropics,—more frequently, perhaps, in the climates of the hills, but often enough in the plains to give it claim to a place among the diseases of India.

The writers above referred to have described cases of pure enteric fever. The epidemic regarding which I wish to place on record a few observations, appeared to me one of pure typhus, with peculiarities incident to the constitutions of the natives and the circumstances under which most of the observed cases occurred.

It is much to be regretted that the general population of the towns and villages of the East are reached with so much difficulty in matters pertaining to their inner and social life. No vital statistics derived from the native officials are even approximately correct ; consequently, when disease is rife amongst the community, we are compelled to fall back for reliable information on the registered and isolated groups of men inhabiting our jails and regimental lines. The obvious result of this is, that, in the case of the jails, our observations are based on constitutions the least able to bear up against epidemic influences ; while in a regiment we see the effects on men

placed in the most favourable circumstances to resist such attacks. As for the pathology of any particular affection, we are indebted almost entirely to observations made on the bodies of prisoners, as it is next to impossible to overcome the prejudices of the free natives against allowing the bodies of their relatives to be opened.

Had the epidemic we are now considering been localized, or had it been confined exclusively to the prisons of the North-West Provinces, we might have been justified in attributing its origin to some local or special conditions. Into this question I am not disposed to enter at length. I shall point out presently the apparent starting-point of the epidemic, from whence it developed and spread itself slowly. I shall show that, during the cold months of January and February of this year, it was kept in check, until, with the returning heats of spring, it burst forth with great virulence, and at once, in districts hundreds of miles apart, amongst the free population, amongst the prisoners in our jails, and amongst our native troops. Its history, equally with its peculiar symptoms, will be seen to separate it from the ordinary malarious fevers of the tropics.

My own experience of the epidemic was confined to the inmates of the Central Prison at Agra; and from the cases coming under my own eye I have drawn the details of this paper. I shall not hesitate, however, to quote from the statistics furnished by other medical officers, and to draw from their descriptions of the disease such supplementary remarks as may serve to illustrate its character.

It appears that, so far back as June, 1859, typhus fever made its appearance in an epidemic form in and around Saugor, in Central India. In an able communication from Dr. Rice, the Civil Surgeon of Saugor, I find the following:—"In June, 1859, I noticed that typhoid fever was very common among the military police. I recognised the disease, and returned every case as 'continued fever.' It was not until August that I had an opportuuity of seeing it in the city and cantonment Bazaar, where for that month it had been killing every third man. The villages of the district, all remarkable for their filth and swampy condition, had been depopulated; and there are the most reasonable grounds, short of an actual census, for believing that the greater proportion of them lost half their population."

Here, then, we seem to have the starting-point and focus of the epidemic; at all events, Saugor is the first point at which I have been able to trace fever of a type, as I shall subsequently show, identical with that which reached Agra in the following year. It is to be regretted that Dr. Rice's observations did not include any dissections of fatal cases. The epidemic did not attack the prisoners in the jail; and, as I have noted above, the insuperable objections of the general population preclude any examination being made in a case of death from ordinary disease, where no judicial object is to be served.

Keeping the main road from Central India towards the Ganges, we find the disease next showed itself at Marzapore. Here, also, the jail was exempt from an attack; but the fever raged in the surrounding district with considerable violence. The Civil Surgeon, Dr. Loch, did not have any cases under his immediate observation. He writes :—"As far as I could ascertain, it was a very severe type of quartan fever, accompanied by great determination of blood to the head." The civil officer then in charge of the district states that the natives died in from five to seven days; and I think I am justified in believing that, had any cases of the fever been throughout under Dr. Loch's observation, he would have seen reason to recognise a type of fever quite distinct from any form of malarious origin with which we are acquainted.

Passing eastward, it next appeared at Ghazeepore, and is thus noticed by the Civil Surgeon, Dr. Garden, in a Special Report on the jail of that station :—"The fever that occurred in the jail during October, November, and December 1859, and January 1860, would hardly claim attention for itself on any ground, excepting, perhaps, the greatly increased number of admissions, were it not for its evident connection with that which consentaneously raged throughout the whole of this and neighbouring districts, and which, assuming a typhoid form, proved fatal to a most fearful extent." Farther on in Dr. Garden's Report I find it stated, that out of 171 admissions under the head of Fever, 9 deaths only are noted as occurring from the fever, while 43 are mentioned as dying from other causes consecutive to the fever, chiefly "pneumonia and other affections of the lung." Now, there can be no doubt that these consecutive diseases were the sequelæ of the fever, assuming its congestive features so gravely as to lead the physician to regard the case as a special inflammation of whatever viscus was most seriously implicated. Still, whether those cases be regarded as having terminated fatally from an intercurrent inflammation or not, there is no room to question that the very prevalence of these fatal complications gives a peculiar character to the fever, and is a strong connecting link between the disease as it came under Dr. Garden's observation, and as it subsequently showed itself in other parts of the country.

Proceeding onwards in its destructive course, the epidemic swept over the provinces of Behar and Benares, causing so fearful a mortality, that, according to the Civil Surgeon of Benares, "few families altogether escaped, and for the time the population generally seemed prostrated by the extent of its inroads." The large jail in the station of Benares seems fortunately to have escaped the prevailing type of disease; hence the Civil Surgeon, Dr. Naismith, although recognising the epidemic intensity of the fever amongst the free population, and its destructive character, "either by assuming typhoid and congestive features, or by including splenic cachexia and visceral disease," is inclined to give a local origin to the affection

itself. I find him writing :—"This outbreak of fever was the sequel and, in my opinion, the effect of a late and heavy fall of rain, which lasted for several days, during the month of October 1859." While giving all due weight to Dr. Naismith's opinion on this point, I hesitate to regard this late fall of rain as sufficient in itself to produce a type of fever so distinct in its features, so widespread and fatal in its results ; while, at the same time, it must be remembered that the Benares epidemic does not stand alone, and cannot be regarded as isolated from the epidemic that preceded it in Saugor, and followed in its steps in other portions of the North-West Provinces, as soon as the heat of the season supplied the conditions requisite for its rapid development.

While the fever was raging in the provinces to the south and east, the cold weather supervened in the North-Western Districts ; and the disease, although by no means extinguished, had its spread and development temporarily arrested. In almost every station situated in the tract of country lying between the Ganges and the Jumna, isolated cases were reported during the early months of the year ; but it was only gathering strength for its final ravages in the warm months of spring. The Civil Surgeons of Mynpoory, Allyghur, and Futtyghur, all had occasion to remark the occurrence of one or two cases amongst the military police under their care during February and March ; and each independently came to the conclusion that it was true typhus with which they had to deal.

Having thus far traced the history of the affection, and its progress from Central India eastwards to the banks of the Ganges, and northwards through the country lying between the Ganges and the Jumna, I shall now, from my own experience, detail its symptoms and characteristic features when fully developed during the months of March, April, and May.

Towards the end of February several cases of fever in my hospital assumed what I considered to be a congestive remittent type, with the remissions so slightly marked as to pass unnoticed. Several of these cases terminated fatally. So unusual is it to meet with continued fevers amongst the natives of India, that it was only after some time that I was constrained to recognise, from its many peculiar features, an unwonted form of fever, and began to enter the cases in my Hospital Register under the head of Typhoid Continued Fever.

So early as the beginning of March the effects on my hospital establishment and attendants proved to me that the affection was contagious, and caused me to institute measures accordingly. Into the details of these measures I need not enter : in the main, they were directed towards relieving the prison of its inmates by encamping them out or by transference to neighbouring small jails, and this chiefly with the object of converting the convict sleeping bar-

racks into hospital wards; thus scattering the affected over a large space, and diluting the fever poison.

To avoid repetition, and to show clearly the distinctive features of the fever, I shall give a short sketch of the most usual course it took, adding any supplementary remarks that may be necessary on exceptional symptoms and complications. I do not mean it to be understood that every symptom detailed in this general outline occurred in every case, but they were all to be found in every small group of cases.

Two-thirds of the men coming under treatment asserted that their illness commenced with a shivering fit. While acknowledging the truth of this statement as regards the apparent initiatory symptom, I have good reason to believe that in most cases a previous period of malaise was passed through, either unobserved by the men themselves, or, when the disease became so fatal, concealed by them to avoid being sent to hospital. Besides the evidence on this head gathered from the gangsmen, the rapidity with which great bodily weakness supervened points to a period during which the fever poison had been lurking in the system and depressing the vital energies. When the shivering attack came on during the night, the men were hardly able in the morning to walk to hospital, and never able to carry their own bedding. The expression of their faces rapidly altered; they looked wearied, listless, and unconcerned, and were already possessed with the idea that they would never recover from the disease. In strong men, the countenance was at first full and flushed, the veins protruding from the forehead, and the eyes suffused, or even bloodshot. Headache was by no means a constant symptom, but, when present, was complained of across the forehead. Pains in the back and limbs were constant and severe. The skin was hot, dry, and pungent; the pulse at first full and bounding, and varying from 110 to 130 in frequency. The tongue, after a few hours, became covered in the centre with a dry, white fur, the edges and tip becoming bright red; in a few cases it remained dry and glazed, but without fur, throughout the attack; acquiring a dark brown line down the centre as the disease advanced, and becoming a little furred on the approach of convalescence. Vomiting occurred in many cases in the early stages; very often the belly was or became tense and swollen, with considerable tenderness in the epigastrium. The bowels were for the most part constipated; but a slight purgative was often sufficient to set up uncontrollable diarrhœa. The urine was scanty and high-coloured, passed with considerable difficulty, and often completely retained. Throughout the epidemic the respiratory organs were much affected; mostly so, however, at its commencement in the month of March. At that time scarcely a case came into hospital without showing this complication most violently.

The nervous centres rarely became affected for the first three or

four days, but the muscular depression increased hourly. The men lay on their backs with outstretched limbs, unwilling or unable to move; the hand, when raised, shook, and could with difficulty be directed to the wished-for position; the tongue was protruded tremulously and with apparent effort. By-and-bye the functions of the brain began to be impaired. The patient lies dozing uneasily; his eyelids are closed, but he does not sleep; if you forcibly open them, he complains, and turns his head away from the light, and you can see that his pupils are fixed, sometimes contracted, sometimes dilated. At a still later period you require to shake him and speak sharply to attract his attention; but even then he would answer rationally, only he is unwilling to be disturbed, and lapses again into the same dozing state. About the fifth day he gets rapidly worse; he is incapable of the slightest muscular exertion, and slips down off his bedding on to the centre pathway of the hospital; his pulse becomes hourly smaller, weaker, and more rapid; sordes collect about his teeth and gums; his tongue becomes dry and baked, the fur browns and cracks, but does not thicken much; his throat is so parched that he is made to swallow with the greatest difficulty; he looses his voice and speaks only in a whisper; he complains of no pain. Gradually low muttering delirium supervenes; he becomes insensible to all surrounding objects, and cannot be roused; passes his stools involuntarily, and dies comatose.

The above is a rough sketch of the course which a majority of the fatal cases ran. With the few exceptions of men who died within 48 hours after their admission into hospital, the crisis of the disease occurred on the fifth, seventh, or ninth day. At those periods, either the patient's system was overpowered by the disease, and he died comatose; or the fever left him, and he became convalescent. Usually there was no marked crisis; sometimes an increased flow of urine, less frequently a profuse perspiration, but very often an increased discharge from the bowels. Neither the patient nor his attendants could tell exactly at what time the fever left him. Within a couple of hours his skin became soft and slightly moist, from being hard, dry, and pungent; his pulse lowered in rapidity, and became soft; his tongue and mouth moistened; he complained less of thirst and dryness of throat. His countenance in a few hours became quite altered. Instead of the restless, twitching irritability of his roused condition, and the dull, listless quiet in which he lay when undisturbed, his face became quiet, relaxed, and placid; his eyes were opened, and tolerant of light; he lay on his back equally helpless as before, but, beyond weakness and a feeling of being bruised all over, he declared himself well.

Often the cases now went on well, and the men acquired strength day by day; but in a large number, after the third or fourth day of convalescence, a change occurred. This arose sometimes, no doubt, from indiscretion on the part of the patient, but more frequently

from the imperfect elimination of the morbific matter from the system. All the former symptoms return with increased violence ; the tongue, which had been moist and gradually cleaning, becomes again dry and fissured, fur collects and thickens, and a brown crust forms rapidly. All the typhoid symptoms are intensified : the dry, pungent heat of the skin ; the small, quick, thready pulse ; the restless, semi-delirious wakefulness ; and, finally, the cold, clammy sweat that ushers in the quiet of coma.

If the patient lived over 48 hours of the relapse, nature seemed to make an effort to throw off the poison by a profuse discharge from the bowels. At first he passed large quantities of dark gravelly-looking fæces, with a most offensive odour ; this rapidly changed to shreds of mucus, floating in slime and streaked with blood, and often to pure blood. Although several cases rallied on the occurrence of this discharge, they generally perished subsequently from chronic dysentery.

Four or five cases exhibited features so distinct from any detailed above, that they demand separate notice. With them, after the fever had lasted from 24 to 48 hours, all the symptoms seemed to subside ; the patient's skin became quite cool ; his pulse quiet and soft ; his breathing easy and natural. He lay on his back, and complained of nothing ; only his unnaturally quiet condition attracted attention. His eyelids remained closed, but the eye had no intolerance of light ; the pupils were either contracted, or dilated and fixed. He could answer questions when roused, but did so very unwillingly. The patient usually lay in this state during three or four days without taking food, and at last passed quietly from sleep into death. The *post-mortem* examination in these cases revealed serous effusion to a great extent in the ventricles and under the pia mater of the brain.

In a few cases the disease was so rapidly fatal that the men died in a few hours ; the blood-poison seemed instantaneously to overpower the nervous system. These extreme cases were met with mostly amongst the hospital attendants—strong, vigorous men, but who were of necessity much exposed to the contagion. The attack in this form was often ushered in by intense nausea and reaching ; but none of the men complained of tenderness on pressure over the epigastrium, indicating that the cause of the vomiting and nausea lay in the cerebrum. Nine men died within 24 hours, and 14 men within 48 hours, of their coming under observation.

Before passing on to consider the sequelæ of the disease, I may advert here to an observation having reference to the sequence in which the prime characteristic of the epidemic—namely, congestions of the internal organs—occurred. In the end of February and the early part of March my attention was attracted chiefly to the respiratory organs. All the symptoms pointed to the lungs as deeply involved in mischief : wheezing and hissing sounds were to

be heard all over the chest ; and the *post-mortem* examinations, as will be seen, sustained the diagnosis. Taking into consideration that at the time the mean daily range of temperature was 36·4, the prominence of the lung affection was scarcely to be wondered at. After the second week in March the lung complication lessened, or, at all events, became shrouded in the more imminent danger arising from brain congestion. This vascular congestion, with the serous and even apoplectic effusions in the head, were combated with the utmost difficulty. This marked pre-eminence of head disturbance, in its turn, yielded to another group of symptoms originating in congestions of the abdominal organs, more especially of the liver and mucous membrane of the bowels. This additional complication occurred after the first week in April, and continued, with greater or less prominence, until the fever began to abate in the end of May. Pain was complained of on pressure over the right hypochondrium and epigastrium ; a jaundice tinge of the conjunctive and of the various secretions was oftener visible ; abdominal tenderness and tympanitis were more common ; and hiccup, sometimes uncontrollable, accompanied or succeeded to sharp attacks of diarrhœa or dysentery.

By far the most common sequela of the fever was dysentry or dysenteric diarrhœa. In a few cases this showed itself very early, and rapidly carried off the patient ; but most commonly it did not arise until after some days of convalescence, and seemed to have its origin in that flux from the bowels that occurred frequently at the crisis of the case. The *post-mortem* appearances varied with the stage at which the patient died ; but in no respect did the state of the mucous membrane differ from what is ordinarily observed in cases of idiopathic dysentery. I need only mention that, out of 299 deaths resulting from the epidemic, 76 were occasioned by the subsequent diarrhœa, to show how very prevalent and fatal this complication proved. In the general congestion of the internal viscera which accompanied the fever, the respiratory organs suffered severely, and had in many cases laid in them the foundation of disease that could not but terminate unfavourably. Sometimes low pneumonia supervened, and the patients lingered on for a long time, and appeared to perish of debility and general malaise. In six of these cases which I examined after death, grey hepatization was found in a portion or the whole of one lung. Confirmed phthisis has resulted in five cases ; and I have no doubt that in many others tubercular deposits have taken place, which will, sooner or later, carry them to their graves. Swelling of the parotid gland occurred very frequently at the crisis of the fever. Twenty-six marked cases came under my observation ; and many other patients complained of pains and stiffness in the parotid region, of whom I took no note. Of the 26 cases, 10 resulted in suppuration ; in the rest the swelling gradually resolved itself under remedial measures. Erysipelas

of the head followed the parotideal swellings in 4 cases, 2 of which proved fatal ; while 2 of the cases in which suppuration occurred died from exhaustion. Permanent weakness of mind resulted from the fever in 1 case. Chronic rheumatic pains of the limbs and œdema of the lower extremities have been of frequent occurrence, and very intractable.

On the treatment pursued I have very few remarks to make. Most usually the patient's bowels had to be opened by 4 or 5 grains of calomel, succeeded by a senna draught ; subsequently they were regulated by castor-oil or warm water enemata. Quinine I found to be positively injurious until convalescence had commenced, when it became invaluable as a powerful tonic. Small doses of mercurials, with James's or Dover's powder ; tartar emetic with laudanum ; diaphoretics and diuretics, were all employed. Early in the attack I had often to resort to leeching and cupping, directed to whatever organ was most involved in congestion ; but the stage suited to antiphlogistic treatment never lasted long,—a strong tendency to depression, with dry, brown tongue and feeble pulse, rapidly supervened. Then it was that the want of vital power in the convict constitution manifested itself : strong soup by the mouth or by injection, with the most powerful stimulants, were necessary to keep the vital spark alive through the struggle that followed.

Subsequent complications had to be treated by specific means, but it is unnecessary to enter into all the details.

I found convalescence tedious in almost every case, even where no relapse had occurred. Great weakness of the digestive powers, constant vomiting after meals, irregularity of the bowels and the passage of indigested food, indicated, by their persistence, the great shock which the men's constitutions had sustained. Many months elapsed before they were fit to be removed from the convalescent gangs.

The *post-mortem* appearances in all the fatal cases which I examined had one common characteristic, that of great congestion of almost all the internal viscera. To appreciate this, it is only necessary to glance at the analysis of the examination of 104 bodies, all made within six hours after death (see Appendix A). I examined the head in 58 of those cases, and found the brain healthy in 12, much congested in 32, having serious effusion in considerable quantity in 6, and apoplectic effusions in 12. In the last the blood was in every case effused under the pia mater, and spread over the cerebral convolutions in a thin layer. In 5 cases I found the lungs healthy ; in 61 they were congested ; in 32, much engorged ; and in 6, one, or a portion of one lung, was hepatized. The liver was healthy in only 3 cases ; in 63 it was dark in colour, and gorged with blood ; in 37 it was softened, and of some shade of yellow in colour ; in 1 case it was small, hard, and contracted. The gall-bladder was empty in 32 cases, full in 70, and engorged in only 2. The spleen was healthy

in 66 cases, enlarged and engorged in 28, small and hard in 10. The kidneys were normal in 53 cases, highly congested in 31, and otherwise diseased and degenerated in 20. The mucous membrane of the colon was congested generally in 37 cases, and showed ulceration in some part of its course in 28 ; in the others it was healthy. In 23 out of those 104 cases a general jaundice tinge was observable after death, although in only 8 of them the conjunctivæ were affected during treatment.

In about 20 cases I examined the whole extent of the intestine, but could detect no disease in the small gut further than sometimes a slight general congestion of the mucous membrane. The solitary glands and Payer's patches were in a natural condition ; so, also, were the glands of the mesentery. It would have been more satisfactory to have carried out this investigation in all the bodies opened ; but the difficulties that had to be contended against in the heat of an Indian May, with an hospital establishment disorganized by the prevailing disease, led me to rest satisfied with noting the condition of the principal organs, the more especially as, in the cases I did examine, no lesions of particular glands were observed.

In addition to these 104 cases, I have collected notes, in some respects imperfect, of the appearances remarked in 278 bodies examined by the medical officers in charge of the Meerut, Allahabad, and Ghazeepore jails. The pathological appearances are almost identical with those I have already mentioned, and I shall content myself with giving a short analysis of them. In 120 out of the 278 the scalp and brain were much congested. Serious effusion had taken place in 125 cases. The lungs were reported healthy in 32 cases, congested in 160, engorged in 83, and hepatized in 14. The liver was found dark and engorged in 156 cases ; soft and of some shade of yellow, in 42 ; small and contracted in 12. The spleen was remarked as healthy in 12, enlarged and congested in 262, and small and contracted in 3 cases. The kidneys were healthy in 48 cases, congested in 35, and otherwise diseased in 28. The stomach and duodenum were found congested in 28 cases. The large bowel was congested in 19 cases, and contained ulcers in 24. A general jaundice tinge of the surface was observed in 59 cases.

I need scarcely remark on the evidence to be drawn from these observations as to the identity of the epidemic all over the country. Taking this in connection with the symptoms of the affection, the character of its sequelæ, and its marked contagious power, we have a type of fever such as has never been met with in an epidemic form in this country, and, as I believe, identical with true typhus in the temperate zone. Its epidemic prevalence, the character of the initiatory symptoms, the intense pungent heat of the skin, the great muscular depression, the state of the tongue and bowels, the acute brain symptoms, the absence of any peculiar morbid condition of the intestinal glands, and the almost universal presence of congestion in

the viscera, are conditions common to both affections. I examined every case with intense interest, to discover any appearance of the cutaneous rash peculiar to true typhus; and, although I failed to detect it, I do not think myself justified in denying its presence. Such an eruption would be observed with the most difficulty on the swarthy skin of an East Indian; and its apparent absence is of less importance when all the other symptoms point so distinctly to the peculiar type of fever.

A few words will dispose of the question of the contagious power of the fever—a characteristic which of itself removes this epidemic from being classed with ordinary malarious fevers. At the commencement of the outburst I had four native doctors attached to my hospital; they were all, within three weeks, lying in the jaws of death. Of seven others sent to do duty, only three escaped. In the case of the convicts attending on the sick in hospital the result was still more marked. During the epidemic, 326 men were entered on the books as attendants on the sick. Of these, 221 caught the fever, and 56 died; that is, they were attacked in the proportion of 68·2 per cent., and 25·3 per cent. died. At one time I thought to mend matters by changing the whole gang of attendants after seven days' duty; but my first experiment proved that, even during that short period, the fever-poison had permeated their systems, and only waited for sufficient time to develope itself. On the 23rd March, I relieved, experimentally, 57 men from hospital duty, and sent them out into a standing camp some miles distant. They were, at the time of their removal, all apparently healthy, and they were placed at once in the most favourable circumstances for retaining their health. No one fell sick up to the 29th; but, from that date up to the 9th April, no fewer than 28 out of the 57 men were sent into the main hospital with bad attacks of the fever. To give one instance more: out of 12 turnkeys employed in the hospital wards, no fewer than 7 suffered from the fever, and 1 died.

Before concluding, I have one or two remarks to offer on the general rate of mortality amongst the men under my care. 88·6 per cent. of them had attacks of the fever, and the ratio of deaths so treated was 14·7 per cent. The rate, as might have been expected, was not uniform amongst the different castes. For example, the sickness was greatest amongst the Hindoos; whilst the mortality was highest amongst the Mohammedans—the former dying in the ratio of 12·5 per cent. of those attacked, while the death-rate of the latter ran up as high as 17 per cent. For further details on this point I would refer to the analysis to be found in Appendix D.

Besides the tabular statements I have referred to, I thought it might be useful to add one or two others, which find a place in the Appendices. Appendix B is an analysis of the fatal cases, with respect to the age and duration of imprisonment of the men. Appendix C gives the result of my observations as to the period at

which death took place in 229 cases, not including those men who died of the sequelæ of the fever. And, in Appendix E, I have added an abstract of the Meteorological Register kept up in connection with the prison.

APPENDIX A.

Analysis of Post-mortem Examinations in 104 *Fever Cases.*

Total Number.	Scalp and brain congested	Serous effusions in brain	Apoplectic effusions in brain	Lungs healthy	Lungs congested	Lungs engorged	Lungs hepatized	Liver healthy	Liver dark and engorged	Liver yellow and soft	Liver small and contracted	Gall-bladder empty
104	32	6	8	5	61	32	6	3	63	37	1	32
	Gall-bladder full	Gall-bladder engorged	Spleen healthy	Spleen engorged and enlarged	Spleen small and contracted	Kidneys healthy	Kidneys congested	Kidneys otherwise diseased	Stomach & duodenum congested	Large bowel congested	Large bowel ulcerated	General jaundice tint
	70	2	66	28	10	53	31	20	2	37	28	23

APPENDIX B.

Analysis of Age and Duration of Imprisonment in 229 *Fatal Cases of Fever.*

Period of Life.						Duration of Imprisonment.							Total.
Under 20	Under 30	Under 40	Under 50	Under 60	Under 70	Under One Year	Under 2	Under 3	Under 4	Under 5	Under 6	Under 7	
4	84	60	37	25	19	103	79	36	4	4	1	2	229

APPENDIX C.

Period at which death took place in 229 *Fatal Cases of Fever.*

Died.											Total
Within 24 hours	Within 48 hours	Within 3 days	Within 4 days	Within 5 days	Within 6 days	Within 7 days	Within 8 days	Within 9 days	Within 10 days	Over 10 and within 15 days	
9	14	32	22	28	28	16	16	6	5	53	229

APPENDIX D.

Per-centage of Sickness and Death-rate compared in Different Classes.

Hindoos of Castes not usually Flesh-eaters.		Hindoos of Castes usually Flesh-eaters.		Mohammedans.		Night-soil Men by Caste and Occupation.		Total.	
Sick.	Died.	Sick.	Died.	Sick.	Died.	Sick.	Died.	Sick.	Died.
89·2 per cent.	18·6 per cent.	90·2 per cent.	12·5 per cent.	81·3 per cent.	17 per cent.	91·1 per cent.	30·5 per cent.	88·6 per cent.	14·7 per cent.

APPENDIX E.

Abstract of Meteorological Observations taken at Agra during the Fever Epidemic of 1860.

Month.	Mean Temperature of Air	Mean Daily Range of Temperature	Mean Temperature of Dew-point	Mean Temperature of Evaporation	Mean Amount of Cloud	Mean Amount of Ozone	Prevalent Winds.	Electrical Discharges not Thunder-storms	Amount of Rain.
February,	68·9	31·	52·5	51·8	3·5	2·3	N. & N.W.	5	2 slight showers.
March, ...	81·0	36·4	40·5	56·9	0·7	0·7	N.W.	1	Do. do.
April, ...	91·4	39·1	50·2	61·6	1·1	0·02	N.W.	1	None.
May, ...	95·1	32·8	48·9	66·	1·6	0·4	N.W.	4	None.
June,.....	97·1	29·4	56·2	71·9	3·05	1·3	N.W. & E.	3	1 inch.

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