In absentia

"A commentary on

Cholera outbreak in India,"

being a Thesis

compiled for the degree of

Doctor of Medicine

in the University of Edinburgh

by

Joshua Chaytor White,

M. B; C. M. Edin.

Surgeon Captain,

Indian Med. Service.

Meywar Bheel Corps
Kherwara
Rajputana India.
Feby 8th 1893

Dear Sir.

I beg to forward you enclosed in a seperate packet my thesis for graduation as M.D. in the University of Edinburgh at the next graduation ceremonial

I graduated M.B, C.M Aug 1st 1887 my age is 28 (born Oct 21st 1864) and I entered the Indian Medical Service in 1889 my Commission bearing date Sept: 30 1889 (vide army list.) I have complied to the best of my knowledge with all the regulations & requirements as set forth

in pages 18 and 19 "Programme of Classes and Regulations" Graduation in Medicine, and I submit appended the necessary certificates and a letter from the Clerk to the Dean of the Faculty of Medicine received last October.

I have instructed my bankers to pay in to the Registrar £16.. 5.. 0 total fees for the degrees, which will come to hand shortly after receipt of this letter.

The title of the thesis is "A Commentary on Cholera outbreak in India".

Kindly address any further Communication to me as above.

I am Sir,

Your obedient Servant

J Chaytor-White M.B.
Surg^n Capt I.M.S.

To the Dean
of the
Faculty of Med.
Univ. of Edinburgh

26th Sept. 1892.

Dear Sir,

In reply to your letter of 29th August, I beg to state that you can take the Degree of M.D. *in absentiâ* after being settled for a period of years in foreign parts, but must wait till August 1893. (See pp. 18, 19 for M.D. regulations and for size of Thesis paper. The fees for M.D. are £16. 5/- = £5. 5/- for Degree, £1 for Matriculation, and £10 for Government Stamp-duty.

I am, Dear Sir,
Yours truly,
J. Sinclair,
Clerk to Senate

J. Chaytor-White, Esq. M.B.

To the

Dean of the Faculty of Medicine

Univ. of Edinburgh.

I hereby certify on my honour that my thesis entitled "A commentary on Cholera outbreak in India" was solely and entirely Composed & written by myself for the purpose of graduation as Doctor of Medicine in the University of Edinburgh. I also certify that I was 28 (twenty eight) years of age last birth day (Oct 21st 1892); that I am an Officer of H. M. Indian Medical Service, my Commission dating the 30th Sept 1889; that I have been over two years resident in India and that I am unable to leave my duties to appear for graduation in August next. Graduated M. B., C. M. Aug. 1st 1887.

Joshua Chaytor-White M.B., C.M.

Surgeon Captain Ind. Med. Serv.

Meywar Bheel Corps.

Kherwara.

Rajputana, India.

Jany 5th 1893.

A commentary on Cholera outbreak in India.

The literature of cholera is so enormous in amount and so comprehensive in character that a paper treating of the disease in any phase form or particular may seem to many an almost superfluous procedure, and although I am aware of the impossibility to adequately touch more than one phase of the disease with the exhaustive detail it deserves, I trust this short commentary written without the advantage of book's of reference or records in a small Indian outstation, will not be altogether void of interest to those whose experience of Asiatic cholera has, perhaps, not been extensive.

What I shall endeavour to treat of in the following pages, will to a certain extent partake of the description of a personal experience with the disease as met with in India in Epidemic form, with a few deductions thereon, the outcome of actual observation of cholera in a tropical climate and in the midst of insanitary surroundings.

I regret I have to confess at the outset that I have nothing very new or very

original communicate, but I am more than hopeful that the time is not far distant when the lines of enquiry that are now being followed by continental and other observers will be productive of a result that will revolutionise our present empirical treatment of cholera, at best but an endeavour to overcome an imperfectly explained series of phenomena.

"Tempora mutantur et nos in illis mutamur", an axiom which many of the old school are loth to accept, but one which I hope we in India will not neglect — in a clime that is not conducive to innovation and far too difficult of conversion to new and correct ideas.

I think that the recent outbreak of cholera on the European continent has in many ways been productive of public good, and the so called "scare" has stirred up the activity many sanitary authorities in the British Empire that would otherwise have allowed insanitation and disease to exist side by side without molestation. The European Continent, as I remember it some ten years ago, was shockingly regardless of all

sanitary reform and Germany was in no
whit better in this respect than Russia,
and Compared with the British Isles the
Comparison was altogether an unfavor-
able one. I am speaking of a decade
ago, and things on the Continent are
unquestionably better now than then.
It is however with some satisfaction
I observe, that when cholera visited
the United Kingdom last year and
attacked the country at various points
with sufficient foci of disease & cause
an epidemic in an insanitary country,
that England escaped. The isolated cases,
tho' important ones, that occurred would
probably have been sufficient to cause
Epidemic cholera in a country less
heedless of sanitary reform — but
England escaped cholera last year, and
we hope that should this unwelcome
visitor re appear next spring our
shores may be equally fortunate.
It is I think a true saying that where
ideal sanitation exists cholera hardly
finds a home; not that ideal sani-
tation exists in Britain, but in England
at all events, things approach nearer
a satisfactory standpoint than I

Not in Scotland?

had seen elsewhere, and after having visited many cities of the eastern and western hemispheres I can affirm without bias, that I have nowhere seen sanitation needed as at home. In many of the larger cities of the Eastern United States, also in Australia and New Zealand, all countries enjoying good climates, sanitation is well looked after and is indeed far better cared for than in our warmer Eastern possessions with their teeming populations of filthy natives, where epidemic disease is endemic and good sanitation imperatively needed.

For we in India have as I speak, the enemy of cholera always present and are constantly waging a war of sanitary reform as the only true prophylaxis of Epidemic disease. Russia declares India invariably supplies it with cholera by one route or another from whence it is distributed over the whole European Continent. The time is probably not far distant when this matter of dissemination of cholera will become an international question requiring earnest attention, and it behoves the Indian government and its sanitary

advisers to consider this contingency with all the severity the case demands. The danger both countries from India is enormous. Take one route alone that cholera travels to make this apparent. The pilgrim traffic from India to Mecca via the Red Sea and Jeddah is yearly over a hundred thousand souls. ⁂ It is an exceptional year that there is no cholera in Jeddah and the cholera brought back invariably comes from India by pilgrims, would-be "hadjis," whose homes are in the endemic area & who look upon cholera as a customary illness they are never free from. Statistics from Eastern Bengal show that the district from Puri to Sylhet on the south to Purneah on the north, as the apex of an imaginary triangle, are never free from cholera and there is no other area in which cholera can be properly called Endemic. Unquestionably the remedy India ought to apply is the prohibition of fairs & pilgrim traffic in years when cholera is rife & this should be imperatively impressed on the Sanitary administration. Epidemiological returns from the civil surgeons of districts supplying pilgrims

⁂ The fourth epidemic in England that of 1866 came from India via Mecca vide Dr. Netten Radcliffe's Suppl.nt to Simon's report to Priy Coun for 1874.

should be furnished throughout the year, and in connection with the civil authorities those districts shewing disease should be rigorously excluded from the supply of pilgrims. The benefit of this would be felt by the pilgrims as well as by the community, as instanced in 1890 when I understand, that of those carried from India to Mecca in that year over 50% never returned - most having died of cholera.

I do not know how it is that the Indian government so supinely allow fairs to be held in years when cholera has early in the Spring shewn itself to be active, for there is no more certain means of disseminating the disease than by these "melas". No doubt the government are loth to interfere with the religious observances of a large class; but where probably the welfare of the world is concerned a wise discrimination in this matter would be of much good and, I take it, of little harm. The people attending these fairs are filthy natives collected in a place that of all others is pre-eminently fitted both in soil and surroundings for the growth of the cholera germs et corporé.

The water that thousands upon

thousands bathe in at Nurdevât, full of human excrement and germs of disease, is fearlessly and of choice drunk by those that attend these fairs, a most favorable locality for the investigations of many forms of sickness.

The recent epidemic in Russia has again shewn, if indeed further proof were wanting, the uselessness of all quarantine regulations & has again demonstrated the immense superiority and safety of good sanitation as opposed to it. [The futile attempts made at Baku last summer to establish quarantine were quite insufficient to keep the disease from travelling along the trans-Caucasian railway to Astracan and Saratov, and it quickly spread along the trade routes to Russia in Europe.] It was with a feeling of some surprise that I read an article lately in the magazine "The Forum" by my friend and late teacher, Dr. Lewis A. Sayre of Bellevue Hospital New York, wherein he advocated stringent quarantine and Sanitary Cordons as an absolute safeguard and sure way of avoiding cholera. I had thought that everyone with any experience had seen for himself and recognised the

impracticability and undesirability of attempting such a thing as stringent quarantine, excellent in theory but useless in practice. Surgeon-General Cunningham in his book "Cholera—what can the State do to prevent it?" has shewn the hardship of strict quarantine in India & how it has altogether failed to affect its purpose. Since the outbreak of 1858, England has not attempted to enforce it, and still there appears to be a lingering hope that quarantine may prevent the introduction of epidemic disease and that Sanitary cordons may be productive of good! Quarantine to be of any value in India must be rigid and any rules demanding such are sure to inflict much suffering on the native, and are withall quite powerless to prevent intercourse. Indian police are not to be depended upon to carry out an order which they cannot understand and which is distasteful to their ideas as interfering with the liberty of the subject. I think that the less stringent measures that have been adopted [by the order of the Local Govt. Board dated July 17th 1873] for quarantine, & with which they must not be confounded, are of much advantage. These rules, I may briefly remark, deal especially with

the detention of such vessels that are reasonably suspected of being infected by cholera, no vessel being under suspicion unless a case of cholera or choleraic diarrhoea has occurred on board, and the detention is only to be so long as is necessary for the detection and isolation of the sick & the disinfection of the ship and cargo. One of the places where it was agreed* as imperative to have a permanent quarantine station, was in the neighbourhood of Suez and the place then chosen was Tor on the W. Coast of the Gulf of Suez, 60 miles below the entrance to the Canal. The reasons for a station here is apparent without explanation, but the place decided upon was one of the most desolate & barren spots it has ever been my lot to see. The water was bad & the supply insufficient, the sanitation altogether neglected, and the burial of the dead most inefficiently provided for. This place has now been abandoned for "Moses' wells," a station on the east coast with a good water supply and a fair situation. As this is but one route by which cholera travels to the European Continent, its advantage is doubtful, except in that all the Mahammedan pilgrims

* by the International sanitary Congress held in Vienna in 1874

from the Mediterranean ports can be detained there on their way back from Mecca. Ships Examined at Suez & pronounced infected, are sent back to the quarantine station until "pratique" is obtained from the Quay officials.

The vexations hinderance to trade in India that would result from strict adherence to quarantine can hardly be realised by those who have not been brought into direct relation with cholera making its appearance in the midst of a large undertaking. During last summer I was employed by the Govt. of India on special duty in Kashmir in connection with the Gilgit Transport, which was a military operation of large proportion, organised with a view of provisioning the far distant frontier outpost of Gilgit for 3 years. As many high mountain passes in the Himalayas, one over 14.000 feet, had to be crossed the difficulties were considerable & the expense proportionate. The passes are as a rule free from snow for 4 months only in the year, & the time for working was therefore limited. When I entered Kashmir to take up the appointment in May, cholera has just made its appearance

one or two cases having occurred in Srinagar the capital of the Kashmir State, the precursor of a large epidemic that eventually carried off over 11,000 souls. The men that had come from the Punjab and India to work in the transport, numbered 3,500 of the worst class of subjects, mostly coolies and mule drivers, filthy men with filthy habits, & certain to contract disease sooner or later. The base of operations was the village of Bandipur, situated on the Wular lake, the largest collection of water in Kashmir, and the filth of the place when I arrived was indescribable. I at once set to work there the village cleaned and to protect the water supplies, which were happily good. All possible sanitary improvements were made; rigid rules were drawn up and guards to enforce them were requisitioned, but no quarantine was imposed. Seventy thousand maunds (2,500 tons) of supplies entered the place and were carried on coolies and mules up to Gilgit and in all only 25 cases of Cholera occurred. Had quarantine been enforced, lacs of rupees would have been hazarded as all the supplies would have been condemned

or gone bad, and Cholera might have broken out even to a greater extent than above recorded. As it was the undertaking, one of the greatest of the kind ever attempted, was in the face of many difficulties successfully achieved.

How the Cholera got to Kashmir in May last and thence through Afghanistan to Persia, Russia in Asia & Russia in Europe, is still a matter for conjecture. Dr Mitra of Kashmir in his report "Cholera Epidemic in Kashmir 1892," states that the Gilgit Transport Coolies brought it with them from the Punjab one of these men died at Domel in Kashmir on April 24th 1892. This may possibly be correct, but though employed on this work I could find no record of any transport coolie having died on that date & the matter will probably never be satisfactorily cleared up.

The endeavours to trace introduction of cholera into Cantonments or districts in India, is fraught with considerable difficulties and the unreliability of the evidence addduced is notorious, so that it is not advisable to place too much confidence on the details.

The government last year prohibited

the Hardwar fair being held on the usual large scale on account of the risk of dissemminating cholera, but I believe in March last, before the fair opened, cholera was present in the Punjab, a recrudescence probably of the cholera of the previous year which is believed to have had its origin in the Hardwar fair of 1891. Surg. Capt. H. Hendley I. M. S. of Peshawar states (B. M. J. Sept 10th 1892) with some reason, that the mild winter of 1891 never really affected the germ in Afghanistan from whence Cholera spreads to Persia, Russia in Asia & Russia in Europe. From Baku on the Caspian the disease appears then spread Eastward to Astra, but its route of extension beyond that city seems doubtful. The route to Europe therefore taken by the last Epidemic differs slightly from that usually followed in that it took mainly:- (1) the Red sea Egyptian route. (2) the Indian, Afghanistan, Bokara, Khiva caravan route (3) Southern India, Persian Gulf, Syria, Caspian Volga route.

I think our progress of civilization by allowing of increased facility of transport by sea, rail & road, has contributed more to the rapid dissemination of cholera than anything else. If sanitary reforms had kept pace & improved pari passu with Commercial enterprise

in India, I do not think the disease would have the chance it now has of asserting itself in this country year after year. In India communicability is engendered of filthy habits, and why any escape being attacked by cholera in a large epidemic is a matter for wonder. Probably insusceptibility and idiosyncrasy assert themselves in this disease, as Pettenkofer has lately declared, to a greater extent than is usually credited.

As was above referred to, Kashmir last year suffered from a severe outbreak of cholera, the last epidemic previous to this having visited the state in 1888. From 1824 to 1880 epidemics were calculated at the rate of one in 15 years, but since the new high road into Kashmir has been opened and greater facility of transport from the Punjab afforded, cholera appears on an average now every third year, & the probability is, that unless the sanitation is improved this beautiful country will have cholera shortly as an annual visitor. For a similar reason cholera now annually visits the Punjab where as previously intervals of several years intervened between one outbreak and another, & undoubtedly the convenience of railways & quick transport is the direct cause of this. In the Russian outbreak last year, cholera spread with remarkable rapidity from Central Asia to the Caspian & to Moscow

the time in transit taking but a few weeks there previously it had taken months.

The small station in the heart of Rajputana where I write this is an illustration of the converse of the above. This place was visited by Cholera in July last. One hundred and twenty cases with but 41 deaths occurred in the village and bazaar but only 7 cases with two deaths occurred in the regiment and, I believe, on account of good sanitation, excellent water supply, and careful precautions taken by the medical officer in charge of the regiment at the time, the disease was checked before it had assumed any proportions. The station is nearly a hundred miles away from the railway, the roads are bad, the place difficult of access and its trade small and unimportant. The inhabitants of the place are Bheels, an offshoot from the Hindoo race and there are few or no contributors to the great fairs.

The last outbreak here was 17 years ago and it was mild in character, and I can only ascribe the remarkable immunity of the place to its isolated position & the absence of pilgrim traffic. The Bheels are a dirty people and their own houses & villages are insanitary to a degree. Similarly, I believe, distance from India & possibly limited vitality without suitable soil & pabulum sufficiently accounts for the

remarkable immunity of Australia & the islands of the Southern Seas from cholera scourge.

The germ or germs of cholera in all their relations has not been yet satisfactorily disposed of and those that maintain the germ theory will not cover the ground of nor completely account for all cases & outbreaks, have still at all events a right of appeal. I think there is yet an unexplained something, a peculiarity of form or a degree of virulence, assumed at certain times and under certain conditions by the vibrio cholerae asiaticae, that has not yet been brought to light. Why a germ known to be present cannot under certain climatic or telluric conditions, produce a disease it is known to be the progenitor of, is still unexplained. I do not believe that at the present moment the cholera germ is any more dead in Russia or Hamburg than it is in India, and yet at the time I write there is no cholera in these places, though I should say the probability of a fresh outbreak in Spring is considerable.

What determines & what are the actual conditions favorable & the change of cholera from an Endemic to an epidemic form, is still as much a matter for conjecture as what really determines the formation and cessation of an epidemic.

I think that a more extended enquiry into the relation of soil & endemic cholera would be of value & would possibly tend to elucidate facts that would shew the relation between endemic and epidemic disease & might to some extent account for communicative immunity. Pettenkofer of Munich has done more in this direction than anyone & his "soil water", "materials substratum" & "predisposing germ" theories, wherein the germ acting on a suitable soil generates a cholera poison, are too well known to require more than mention. In this relation I would refer to the admirable instructions drawn up and set forth by a Sanitary Commission so far back as 1864 & embodied in the Appendix to the Army Med. Depart. Reports for that year in which clear and definite lines for obtaining the fullest advantage from such an Enquiry are to be found. Since that year when an enquiry was set on foot & two special Experts were sent to India to enquire into into this disease, much has been done and in spite of all we are still uncertain as to the exact nature of cholera & what laws govern its origin and extension.

The influence of climate in nurturing and harboring the disease is worth referring to. Tropical countries are unquestionably favorable cold climates inimical to the origin & spread

of cholera. The influence of cold, not in killing but in keeping the disease dormant from autumn to the following spring, has been so frequently observed as to lead one to expect a rejuvenescence in spring after an autumnal outbreak.

Height, on account of temperature, soil and drainage, is as a rule unfavorable to the origin of cholera; but in India hill stations frequently suffer through importation from the plains as was the case last year in Murree (8000 ft.) and also in Kashmir where an outbreak occurred in a camp 10,000 feet above sea level.

I doubt very much if aërial influences as understood by local and temporary climatic disturbances, has anything to do with determining an outbreak of cholera. In Kashmir the elements were said to be abnormally disturbed at the height of the epidemic & the hills had a "blue" appearance: but I was in Kashmir throughout & observed nothing unusual to attribute to more than fanciful imagination.

The exact effect of rainfall on epidemic cholera is doubtful. Personal experience on this point has induced nothing but conflicting results & I am inclined to disregard the effects of rainfall altogether. It is by many admitted that a copious rainfall of four inches in the 24 hours, such as occurs in the "rains", will as a rule

check an epidemic in progress, while a small rainfall does harm by disseminating the germs, but I think rainfall has no effect on determining an outbreak or in checking one.

I would like to call attention to a point that may seem trivial & this is, that in warm countries dust may be a vehicle of communication. I have frequently had occasion to notice the likelihood of dried particles of excreta being carried long distances into tanks, drinking water and on to food, by the distant dust storms that blow in India. But I do not think there is sufficient tangible evidence adduced to make one alter the opinion as to waters and food being the chief vehicles of communication, and that the disease is distinctly not an air-infectious one, but one that is admitted into the system by way of the mouth only & in food and drink. An interesting epidemic as shewing the part water plays in communicating cholera, was that which broke out in the 1st Battalion 1st Gurkhas at Dharmsala, a Himalayan hill station, on July 12th 1890, which I was specially ordered. There are two battalions in this regiment the first occupying the lower station (5,500 ft.) and the second the upper station (Bhagsu), this latter having an elevation

of 8,500 feet above sea level or situated 3000 feet above the first battalion at the bottom of the hill. Cholera had shewn itself in the tea gardens in the Kangra valley below for some time previous but appeared in epidemic form at Dharmsala, and guards had been placed on all the roads to examine persons entering the military station from outlying districts; but on July 7th a dhobee (washerman) died in the upper station of cholera. Next day a rainstorm occurred & four days after cholera broke out in the lower station, and so severe was it that 280 died in the regiment including 123 fighting men, while some thousands died in the immediate neighbourhood. The outbreak was traced in this instance to the dhobee who was known that was had clothes in water that ran with a fall of 3000 feet directly into the stream used for drinking purposes by the men in the lower station. No other case occurred in the upper station, and on July 22nd the monsoon broke, rain falling continuously for a fortnight, and no more cases of cholera occurred. No European was attacked in this epidemic and it is a fact of frequent observation in India that in some epidemics Europeans seem to have an entire immunity from cholera

while in others the reverse is the case. This gives rise to the (a) question of immunity upon which Pettenkofer so strongly insists (b) possibility of there being special varieties or forms of vibrio which affect particularly one race & from which another is immune. In Kashmir last year again Europeans almost entirely escaped and over 11,000 natives succumbed, while at Murree close by at a later outbreak, 16 Europeans died, mostly officers & no native was known there been attacked.

The pathology and chemistry of the vibrio cholerae asiaticae has been the subject of such extended enquiry of late that to treat of the matter in extenso would be beyond the province of this paper. Since its discovery by Koch in 1883, the comma bacillus may be truly said to have had a checkered existence, to have many times changed its form only to reappear anew to be henceforth known as a "vibrio" and not a "bacillus". It is hardly necessary for me to do more to its well known characteristics as recent occurrences have no doubt made them familiar to all. Its variability of form, degrees of curvature, length and thickness, have been a cause of much confusion & may account for some of the dozen distinct varieties that Cunningham & others declare exist. The most interesting experiments that have been conducted of late are perhaps those of Haffkine,

Doyen & Hueppe. The former ingenious method of procuring a vaccine as a protective against cholera is perhaps still fresh in the memory of many. From an agar cultivation of the vibrio by a series of inoculations into the peritoneum of guinea pigs, a highly concentrated exudation of very virulent character is obtained which has been called a virus exalté. This virus exalté kills with great rapidity when given to guinea pigs by the mouth after the contents of the stomach have been neutralized or when injected into the peritoneum, but if it is injected under the skin it does not kill the guinea pig only producing an extensive oedema, although forming and the wound eventually healing by granulation. If inoculation is now made with concentrated virus into the peritoneum or intestine, the animal is found to be immune and it does not die. The objection to this is the coughing that occurs, & to obviate this Haffkine, by a series of cultivations, produced an attenuated virus that merely produces oedema & no slough and which when injected under the skin is found to confer immunity to the guinea pig from the cholera microbe no matter whether injected into peritoneum or elsewhere. Rabbits and pidgeons had the same immunity when similarly treated, and on inoculating himself Dr. Haffkine found

that practically the same phenomena of swelling and oedema at the point of inoculation with general malais, occurred in himself as had been observed in the rabbit. As was pointed out at the time there is no certainty that laboratory inoculation will give immunity against the natural infection of cholera, however that may come about, and this is one of the points we are still uncertain about. Moreover if Cunningham's suggestion as to there being several varieties of cholera vibrio is correct, is there any certainty that immunity from one variety is necessarily immunity from all? From observation I am inclined to admit the possibility of there being more than one variety of vibrio concerned in the production of cholera, and would suggest the probability that, from the union of two or more, a poison may arise causing cholera intoxication.

Kruppe's suggestion that cholera enters the system while the vibrio is still in the spore stage, thus escaping the action of the gastric juice, is supported by Ferran (Compt. Rend. de l'acad. de Sciences CXV, pp 101), who states that he has observed in the interior of a large comma bacillus, two small granulations analogous to spores which on the protoplasm being digested were set free and readily stained by analine dyes.

This very important statement that there

is a spore stage in the life history of the cholera vibrio is in a manner borne out by the well known experiments of Thiersh & Burdon Sanderson on mice fed with filter papers soaked in cholera dejecta, in which it was shewn that papers soaked in liquid 3 or 4 days old proved considerably more fatal to the mice than that soaked in liquid 1 or 2 days old, and that consequent = ly the maximum virulence of the dejecta was not attained until some time had elapsed after the mice watery evacuations had escaped from the body. The inference is, that active spore formation takes place in the intestine, since few vibrio are found on the first day and many on the third and fourth.

An occurrence that may be perhaps worth recording was observed in Srinagar, Kashmir last year after the outbreak of cholera. The epidemic as may be remembered was of some severity, 17,000 cases of the disease being registered. As the cholera was waning, chicken cholera broke out and the mortality was considerable. The fowl disease ran a short sharp course. The microbe of chicken cholera is supposed to be the vibrio Metschnikovii of Gamaleïa in his work describing this vibrio, remarks as to similarity in appearance

to the vibrio of Koch but does not admit of their actual identity. They resemble one another in character and multitudinous forms. How the disease is spread is not clear, as intra-muscular & intra-peritoneal injections of the growth into fowls did not produce the disease to any extent. Experiment afforded proof that the probable means of infection was by the respiratory passages and so into the blood. The microbe's seat of greatest activity was the alimentary passages, in which it produces a disease identical with chicken cholera, but strangely enough the lungs were found free from disease. It was at the end of the cholera epidemic in Kashmir that the chicken disease occurred; and is it not possible, the vibrio of Koch & that of Metschnikovi being so nearly identical & so variable in forms, that these two vibrios are but forms of one and the same microbe altered in some unknown way? It certainly is peculiar that the chicken epidemic should have appeared after the cholera and admits of an explanation. I believe I am correct in saying Koch failed to produce chicken cholera by injection of vibrio culture into fowls intraperitoneally. Lindsay, Burdon Sanderson & Hafftkine declare dogs, mice & guinea pigs, the susceptable to cholera poisons, and these

is reason for believing that bears and jackals can also become infected. Pettenkofer, on the other hand, affirms that all experiments in cholera conducted on the lower animals are valueless as proving nothing, even if infection were "natural" which it is not.

Our present empirical treatment of cholera is so discouraging that I shall not attempt to do more than refer to it. Our chief anchor where we do not know how to heal, a confession I hesitate to make, is prophylaxis. As has been my endeavour throughout this paper, there is nothing at all comparable to good sanitation, which necessarily includes good & sufficient water supply, efficient removal of excreta and all filth, good food, drainage and healthy surroundings without crowding. Acting on the fact that acid will kill vibrio cultures, I think it is a wise precaution to administer to troops & others as a prophylactic eight or ten drops of dilute acid in water at early morning when the stomach is empty. It is advisable generally to avoid an empty stomach during cholera, and also the drinking of fluids between meals, since Matthew Hay of Aberdeen has shown solid food alone promotes the secretion of hydrochloric acid by the gastric cells.

I strongly advise a ration of tea. Ball troops

passing through an infected district because:-

(1) Water must be boiled & infused tea.

(2) The tannin of tea is a germicide.

(3) Tea acts as a stimulant generally.

All drinking water should be boiled, food supplies should be carefully inspected and dishes and plates washed in boiling water before use. The use of vinegar with food while cholera is prevalent, is an advisable precaution. I am in favor of checking premonitory diarrhoea, the expediency of which is questioned by Johnston and Others.

The ordinary precautions as to general health sanitary observances & the usual methods of treating the disease, I will not mention as it is well trodden ground familiar to all. There is emphatically no specific in cholera and after many trials I cannot point to any one definite drug of more value than another. Each case must be treated on its own merits. 75% will usually die at the beginning and about 25% at the close of an epidemic, and in India a mortality of 50% is satisfactory as showing only the epidemic to have been of ordinary virulence. Salol and the vague treatment have not proved of much value, and neither have transfusion nor the intravenous injection of saline fluids been productive of encouraging results. Neither the tannic enemata cure nor hypodermic injection

of pilocarpin with blisters over the kidney, have been found specific. The symptom of suppression of urine is always to be carefully considered. It is an index of the progression & an almost pathognomonic sign of the disease, and is due chiefly to the paresis of the lining cells and blood vessels of the glomeruli.

Regarding the treatment of cholera by perchloride of mercury, I here had occasion to address the following letter to the Principal Medical Officer H. M. Forces in India through the Chief Medical Officer in the State of Rajputana.

Sir:

"With reference to circular letter No. 5976" "dated Army Head Quarters, Medical Division, Simla" "No. 6. 1891 from the D.M.O. H. M. Forces in India" "to all administrative Medical Officers in India &" "your Endorsement thereon No. 2823, I have the" "honor to submit for your information and favor of" "transmission to Army Head Quarters the following" "modification of the treatment therein recommended."

"2.— The treatment of cholera by perchloride of" "mercury was first brought to my notice in 1888" "when on a visit to China. In both China and" "Japan cholera is constantly treated with mercury" "but administered by hypodermic injection and" "not by the mouth as suggested in the above quoted" "letter. I have usually injected 1/10 gr. of the"

"perchloride with 3 grs. of sodium chloride in 10 min."
"of distilled water, the salt increasing the diffusibility"
"& solubility of the mercury. Have used mercury sub="
"cutaneously in cholera in two Epidemics – in the"
"outbreak in the 1/1st Gurkhas at Dharmsala in "
"July 1890, and again in Kashmir last Summer "
"when doing duty with the Gilgit Transport. On this"
"latter occasion I am inclined to believe the treatment"
"was of value as out of 10 cases treated in the virulent"
"period at the beginning of the Epidemic, there were"
"only 3 deaths."
"3.— I am of opinion that the action of the "
"mercury on the blood in cholera is twofold :- "
" (a) It increases fluidity. "
" (b) It lessens or possibly destroys the activity "
" of the vibrio. "
"I am also of opinion that the administration of "
"this or any other drug by the mouth in the algide stage"
"of cholera is of little value & that all medication except"
"hypodermic ought in this stage of the disease to be "
"discouraged. In cholera the Exhibition of drugs by"
"the mouth is of less value than the hypodermic method"
"on account of the Secretive apparatus of the organism"
"being thrown out of balance. A fortiori, the gastric"
"cells are in an almost inactive state. Moreover"
"absorption by Mucous membranes is retarded in"
"cholera:- (1) Majendie showed that camphor"
"injected per rectum took 5 mins. in cholera"

" before it could be detected in the breath while in "
" health it took 1 min. only. "
" (2) Lebert by experiment found that atropin failed "
" in cholera to dilate the pupil when given by the "
" mouth, but not when hypodermically injected. "
" (3) He observed that morphia given by the mouth in "
" Cholera to relieve spasm did not contract the pupils "
" any appreciable extent. "
" I think the above experiments pretty conclusively "
" demonstrate that the hypodermic is really the "
" only rational medication in cholera, — a disease "
" whose prominent characteristics are purging & "
" vomiting. "
" 4. — I have found also it is preferable to inject the "
" mercurial solution into a selected vein such as "
" the Median basilic or Saphena because :- "
" (a) Mercury unless deeply injected frequently "
" causes abscess at the seat of puncture. "
" (b) When directly injected into the blood "
" rapidity of action is insured. "
" 5- — To sum up I would recommend the "
" medicinal treatment of cholera, excepting perhaps "
" in the premonitory stage, to be by the hypodermic "
" method for the following reasons :- "
" (1) In cholera there is little or no absorption "
" from the gastric mucous membrane. "
" (2) The embarassment of vomiting is avoided. "
" (3) Rapidity & certainty of action is obtained. "

" (4) Medication per rectum is uncertain on "
" account of purging & diminished absorption. "

" I have the honor &c &c. "

As regards the disposal of the dead in epidemic cholera, I am much in favor of cremation as supplying a ready means for killing the infective organisms within the body. If buried, the corpse should be wrapped in a sheet soaked in antiseptic solution and covered with ashes. In large epidemics quicklime pits have been used, quicklime favoring rapid disintegration of the body.

In conclusion I can but reiterate that there is still much to be done and much to elucidate in this mysterious disease, so horrible in its detail & so relentless in its mercy, and if in this incomplete paper I have offered any suggestion of value, this commentary will not have been altogether void of interest.

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