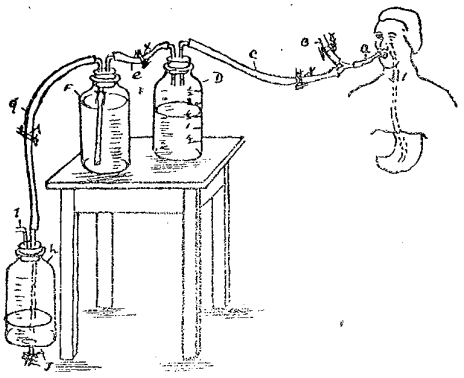
of it. Close the screw on tube (e) before taking the cork out of the bottle (f). After putting the cork in tightly open the screw on the tube (e). To keep up the same syphonage throughout, keep a little water in both of the bottles (f and h) and end of the tube (g) in the water while you transfer water from (h) to (f). If a bottle with the drainage connection (j) is not available, remove corks of both the bottles (f and h) and transfer water. Close screw on tube (e) before opening the bottle (f). Put a screw on tube (g) and close screw when you open the bottle and you will keep up the syphonage. After fixing the corks, open all the screws except on (b). When the trap bottle (d) is full, empty it by closing the screws on tubes (e) and (c). When the nasal tube does not work, wash it with measured clean sodium bicarbonate solution through the tube (b) remembering to close screw on tube (c). After cleaning, close screw on (b) and open screw on (c).



In some cases fluids can be given through the tube (b). These should be measured and recorded. Alkaline mouth wash can be given during suction to avoid dry mouth and to avoid accumulation of thick mucus in the mouth. Chewing gums or fruit lozenges can be given to stimulate salivation to avoid parotitis. Anything given by mouth or through the tube (b) should be measured and recorded.

The nasal catheter or duodenal tube is sterilized and kept in a basin of cracked ice at least for 5 minutes. It can be introduced then through the nose without lubricant by the doctor and the adhesive applied by the nurse to hold the catheter in good position. Connect the catheter or duodenal tube to the Y tube connected to the tube (c) leading to the bottle (d).

It is safe and convenient to fix the apparatus on a table of 3½ feet in height behind the head of the patient's cot.

Cholera And Its Treatment

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At the present time, the subject of cholera and its treatment occupies the front page of topics of medical interest, as the home of cholera is considered to be the delta of the Ganges; and we in Bengal, would indeed be guilty of gross ignorance, if we could not lead the rest of India in the correct methods of the treatment of a disease, which no matter where it breaks out, be it sporadically or in epidemic form, its source can be successfully traced back to lower Bengal.

Like the poor, cholera has been with us right through the ages, and history has it on record that the disease has been accurately described as far back as 400 B.C. by the learned Sanskrits. It was, however, not till the year 1817 that the disease became to be known as cholera when, in this year, a severe epidemic broke out in India. The causative organism up till then remained unknown, and it was not until over another sixty years—thanks to the eminent German bacteriologist, Koch,—that the Cholera vibrio was finally discovered by him in Egypt, and his findings easily corroborated a year later in India. The year 1883 is a red-letter day in the history of cholera, as with the finding of the C. vibrio, prophylactic measures, always more important than the cure itself, were put into force.

The Cholera vibrio is a very actively motile Comma bacillus possessing a terminal flagellum or tail. It is very easily cultured on agar, potato, broth and gelatine media, producing in the last mentioned a typical liquefaction. It grows best at an optimum

temperature of 35° to 37° C, but its growth is easily checked at 40° to 41°C, whereas at 50°C it is inhibited, and at still higher temperatures completely destroyed. On the other hand, the C. vibrio can live for long periods at the freezing point, and even at considerably lower temperatures offers a good deal of resistance. This is most important as it follows that ice made from impure water, and ice cream made from impure milk, constitute two very fruitful sources of infection, both these articles of diet being in such great demand just at the time that cholera is most rife. The mode of infection in cholera is mainly through food and water, and to be brief can be summed up in one sentence 'You can eat cholera, and you can drink cholera, but you cannot catch it, (like the measles or love). In water, Comma bacilli live in the fresh type, from 2 days to 568 days, and up to or more than 20 days in distilled water. The frequent spread of cholera along the course of the large rivers such as the Ganges and the Nile is thus easily explained, for in time of epidemics, both cholera evacuations, and not rarely the corpses of cholera patients, find their way into such streams from whence drinking water is so extensively obtained.

In soil, which remains damp at sufficient depth to be protected from the sun and its disinfecting effects, Comma bacilli may live for a considerable time, even, it is stated, up to several months.

In cholera carriers, who form a very present and dangerous source of conveying infection, the C. vibrio are easily disseminated, particularly when, as they often are, they be those who handle articles of diet.

In milk, which is the most dangerous form of food in the tropics, where it is more often than not diluted by the vendors with unsterilized water, often taken from whatever filthy source may be available at the time, the C. vibrio often finds a very palatable home.

Other uncooked foods, such as raw vegetables and fruit—these may harbour the C. vibrio from 3 to 20 days. Shell-fish and oysters from contaminated waters also serve as excellent media for the germ.

The predisposing causes of Cholera.—The older writers on cholera appear to lay a good deal of unnecessary stress on chills being an exciting cause of cholera. It must be admitted that a chill over the tummy does often cause an upset in the bowels, but as a rule this quickly settles, yet it is not difficult to see that it may powerfully predispose to the disease anyone who may have swallowed the specific organism, by producing congestion of the intestinal mucus membrane, and thus rendering more favourable conditions for the multiplication of the Comma bacillus. The common custom of wearing a flannel belt around the abdomen at night is to guard against such chills, and such a belt has come to be described in the home as a 'Cholera Belt.'

Fasting.—The acid secretion of the stomach is highest during the period of digestion, and has been found to act as a powerful protection against the C. vibrio. During periods of fasting, the acid content is at its lowest, and at this period it has been found that, if contaminated foods are taken, they can easily cause an attack of cholera. (Mahommedans who are fasting during their religious periods often fall victims to cholera when these periods coincide.)

Saline purges taken too much during the epidemics of cholera to cure innocent diarrhœas, have often predisposed the takers to actual attacks of cholera.

It has also been noted that people visiting endemic areas are more likely to catch it than old residents who have already acquired some degree of natural immunity.

The blood changes in Cholera.—The very great loss of fluid from the body must necessarily produce marked changes in the composition of the blood, which bears over 60 per cent of this loss. It is surprising that these changes were not more closely investigated by our earlier workers.

The red blood corpuscles are naturally greatly increased as a consequence of abstraction of fluid from the blood. In the very acute stages, they number anything from 6 to 8 millions per c. mm. About the fourth day of the disease there is usually a rapid fall, the fluid by now having been replaced.

The white corpuscles show also a marked increase, and leucocytosis has been found to be a constant feature in cholera. A very high leucocyte count has been thought by some writers to be a bad prognostic indication.

The large mono-nuclears are comparatively much increased while the lymphocytes show a decrease. This is of important diagnostic help, and serves to differentiate cholera from those very acute cases of dysentery or ptomaine poisoning which sometimes so closely resemble cholera clinically.

The specific gravity of the blood is also not only a valuable diagnostic aid in cholera, but as we shall see later, a very valuable guide too, as to the amount of fluid to be transfused.

The sp. gr. of the blood rises markedly in cholera, and while in normal individuals it is about 1054-56, it is in cholera found to be as high as 1068-72.

The loss of salt from the blood and its importance.—With the great loss of fluid from the blood, it follows that the concentration of its salts would go up ordinarily, but in cholera it has been found that the chlorides of the blood are also drained away with the fluid, leaving the serum with a percentage of chlorides as low as 0·6 per cent. In addition, the alkalis of the blood are also depleted, and a condition of acidosis is thus easily induced.

These two salt losses pointed out the way to the scientific basis for the use of hypertonic saline, and alkaline saline transfusions introduced with such great success by Sir Leonard Rogers, I.M.S. (now retired), to whom Bengal in particular, and the cholera-world in general, owe a debt of eternal gratitude.

Clinical features and the treatment of Cholera.—My description of the clinical features of cholera and their treatment will be embodied under the heading 'The story of three cases of Cholera': this will make the subject more interesting from a nurse's point of view.

It is the month of April in Calcutta. Cases of diarrhœa are becoming frequent, and one hears that the cholera season has started.

Mr. A. finds the heat very oppressive, and his thirst insatiable. He longs for cold drinks which he feels his body badly needs in these sweltering days. He has been told and has also read that drinks cooled by the addition of ice from local vendors are not safe, but he thinks such people unduly fussy. He has an ice cream at one of the stalls in the New Market or he has some iced water with his meals at one of the cheaper local restaurants, enjoys it and goes home to bed.

Soon after, or at midnight, or perhaps still later, he is awakened by a feeling of great nausea. He has a large vomit, answers an urgent call of nature, to find he has passed a large watery bile-coloured stool, followed by another and still another, till they become almost plain water. While he is passing these frequent stools, copious vomiting also takes place, and he finds himself extremely prostrated with little or no pulse at the wrist, cold clammy skin, pinched face with sunken, deeply encircled eyes, extreme restlessness, frequent painful muscular cramps, and supression of urine. All these, he finds have come on very rapidly within a few hours, and he wonders, and quite rightly, whether he has come in for an attack of cholera.

He finds himself rushed to the closest hospital, where he is admitted to the cholera ward. On admission, his blood pressure is taken, and found to be below 60 or for that matter too low even to be measured at all. His finger is pricked, a thick dark drop of blood is squeezed out and drawn up in a pipette. This is transferred to bottles containing solutions of glycerine and water of known predetermined specific gravity and sp. gr. of his blood is determined. It is found that instead of being the normal 1056 it is 1068. His body is cold and clammy, but his rectal temperature registers 102°F. While all this is being done with all necessary speed, A. is continuing to vomit and purge, and have painful muscular cramps. His voice sinks to a mere hoarse whisper, his pulse is just perceptible to the trained finger, the coldness of his skin is death-like, his fingers are shrivelled and cyanotic, his restlessness and jactitation testify to his speechless agony, and only one faculty appears to remain preserved, and that is his intellect. He is extremely collapsed. The intravenous saline apparatus is ready for transfusion. Two pints of Rogers' Alkaline saline (sodium chloride, grs. 90, sodii

bicarb., grs. 160, sterile distilled water pint one)—are transfused intravenously rather speedily to combat the extreme collapse, the saline being given at the rate of 2 ounces per minute or 1 pint in ten minutes. When the alkaline solution has been almost completely run in, 2 further pints of hypertonic saline are also given but now more slowly, *i.e.* at the rate of about 1 pint in 20 minutes. Soon the clinical picture is changed. A. is beginning to look a new man—he takes notice; his eyes brighten up, the dark circles clear up; he raises his voice to be easily heard; his pulse can be easily felt and his blood pressure registers a reading of over a hundred now. Soon he falls asleep, but not for long. With the restoration of the blood pressure, and the circulation some more toxins are reabsorbed; the vicious cycle of vomiting and purging, now of much less severity, set in. The blood pressure begins to fall while the sp. gr. of the blood starts to rise, and a second transfusion—though a smaller one—becomes necessary Next day A. manages to take fluids by mouth and retain them. His blood pressure fluctuates but does not fall below 90, and he passes urine. The danger period is over, and in four days he is quite convalescent.

While A. is convalescing, B. is admitted in an extreme degree of collapse. His B.P. cannot be recorded, the sp. gr. of his blood is 1070, and his rectal temp. is 104°F. Two pints of alkaline saline are transfused speedily, followed by four pints of hypertonic saline, and one of normal saline. He is improved at the end of this, but in less than 2 hours he is back to where he came in. More saline is transfused and he begins to improve. The improvement continues, but his blood pressure does not remain higher than 90, whereas his temperature has shot up to 106°F. He is suffering from hyperpyrexia—that bugbear in the treatment of cholera, which is responsible, when unrecognized and not promptly treated,—for more than 30% of deaths. He is given an iced saline enema, tepid-sponged, and ice applied to his head. Slowly his temp. drops to 101° and he is better. Twenty-four hours pass, and no urine is passed. There is a fear of Uræmia setting in—another complication of cholera, which is the cause of 20% of deaths. Concentrated sodii bicarb., and glucose in solution is given, followed by injections of pituitrin (1 c.c.) which send the blood pressure up, and after much anxiety, at last a couple of ounces of concentrated highly acid urine are passed. With much alkaline medication, the patient eventually makes a recovery.

While B. is convalescing, C. is admitted. He is quite different from both A. and B. His blood pressure is very low, the sp. gr. of his blood is very high, and his rectal temp. below normal, but he gives no history of purging or vomiting. He only complains of a very acutely distended abdomen, which when first seen makes the casual onlooker think of a surgical emergency—an acute abdomen. He is a case of 'Cholera Sicca'—a very rare but highly fatal type of cholera which is only very occasionally met with. Despite all saline transfusions, he rapidly gets worse and in less than twenty-four hours' time, he is dead.

These three cases illustrate the type of cholera cases met with; the first, the moderately severe one, which with a couple of transfusions goes on to a quick convalescence and recovery; the second, an extremely severe one with the two dreaded complications, hyperpyrexia and threatened uræmia, which require very prompt treatment, and only after prolonged, and repeated transfusions, settles satisfactorily; the third, a very rare and fatal type, which fortunately is only met once in a lifetime.

In the successful treatment of cholera, certain fundamental principles must strictly be adhered to, and to quote Sir Leonard Rogers, 'though these are sufficiently obvious to us, yet it is only by the most minute and unremitting attention to details, that the best possible results can be obtained and there is probably no disease in which sudden changes for the worse so frequently occur, requiring an accurate knowledge of the condition present and prompt application of correct measures to combat them successfully.' **The Fundamental Principles are** —*First.*—The specific gravity of the blood should be estimated in order to find out the loss of fluid from the blood and serve as a reliable guide to the necessity for administering a saline transfusion, and the requisite amount to be administered. This estimation should be made regularly every morning and evening, and whenever there are any signs of collapse or dehydration.

The normal healthy figure for the specific gravity of the blood for the average Calcutta European and Anglo-Indian is 1056. If the sp. gr. of the blood is 1063, give

3 pints of saline : if 1064, four ; if 1065, five ; and if higher up to a maximum of 7 pints. The sp. gr. of the blood can be safely reduced to 1052-54.

Second.—The blood pressure should be recorded at the same time, as a fall to a dangerously low level, below 80-70 in adults and 40-30 in children, is a very urgent indication for a saline transfusion, even though, as in the case of weak, debilitated, anæmic people whose sp. gr. are usually below normal and so are little, if at all, raised above the normal in an attack of cholera, the sp. gr. of the blood is not much raised.

Third.—The rectal temperature should then be taken, as this will serve as a reliable guide as to at what temperature the saline ought to be given. If the rectal temp. is sub-normal, transfuse at a temp. of 102° but if the rectal temp. is 102-104° cool the saline to 90°F. Hyperpyrexia is no contra-indication to the use of saline transfusion, provided it is given iced or cooled.

Fourth.—In the presence of painful muscular cramps which persist, TRANSFUSE with saline at once : this is also a very important indication for its use.

Fifth.—Use Rogers' alkaline saline, followed by hypertonic to replace the lost salts and increase them a little above the normal physiological standard in order to retain the fluid in the blood vessels, and maintain the blood pressure and circulation, and thus lead to the successful excretion of toxin.

Sixth.—Give a good deal of alkaline bicarbonate of soda and salt solution—both intravenously and by mouth—so long as the urine is acid, in order to deal with the tendency to acidosis which predisposes to suppression of urine with consequent uræmia.

Seventh.—Look out for saline hyperpyrexia after transfusions, and renewed absorption of intestinal toxins with returning circulation. This accounts for a number of deaths in cholera – deaths which are preventable.

Eighth.—Watch the blood pressure—and the amount of urine excreted, and use all available means to maintain the B. P. at a level (110-120 in adults, 60-70 in children) which is necessary to ensure free renal secretion.

Ninth.—Give choleraphage four-hourly by mouth, and intravenously whenever a transfusion is given, to combat the toxins.

Tenth.—Allow and encourage your patient to take water and sodii. bicarb and glucose solution by mouth in small quantities even though he is vomiting. It is surprising how much one can get down by this way with a little perseverance. 'Nothing is more cruel, and unnecessary than to withhold water from those in the throes of cholera, while there can be little doubt that some of the toxins are removed through the active secretion of watery fluid by the stomach.'

These are the pillars upon which the edifice of the treatment of cholera is built, and even if one of them is taken away the whole is weakened, while if the first four corner-stones are removed, partly or completely, the edifice will soon break down, and prove a disaster.

In concluding, I acknowledge with great pleasure that most of my knowledge of cholera and this lecture have been obtained from that wonderful book *Bowel Diseases in the Tropics* by Sir Leonard Rogers, C.I.E, M.D, F.R.C.P., F.R.C.S., F.R S., I.M.S. (Retired), knowledge which has been successfully applied by others and me in the treatment of the many patients that have been admitted to the cholera wards of the Presidency General Hospital, Calcutta.—*Reprinted from the Nursing Journal of India*

POSTS VACANT

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