

remains, but if not, even one drachm to the pint may be injected subcutaneously. The best method of giving the fluid depends on the degree of concentration of the blood. If the sp. gr. is over 1060, it is generally advisable to give a slow isotonic intravenous injection at the rate of about one ounce a minute, so as not to run any risk of producing œdema of the lung, the blood pressure being fairly high at this stage. One or two pints will suffice if the sp. gr. is not over 1063, which is rarely the case at this period. If the sp. gr. is not over 1060, a pint of isotonic solution should be injected subcutaneously, the best position being under the skin of the anterior abdominal wall where it causes less pain than over the ribs. This injection may be repeated every four to six hours until the sp. gr. falls to 1050, or even lower, well below normal, to allow excess of fluid for excretion. It is not advisable to carry the dilution below 1045 for fear of producing œdema of the lungs. If the respirations are already increased in frequency and depth, indicating commencing uræmia, I have found it advantageous to prop the patient up in bed, which appears to ease the breathing and lessen the danger of hypostatic congestion of the lungs. By these means, together with the use of cardiac stimulants and vaso-constrictor drugs if the blood pressure is also deficient, as detailed in my book, many patients may be tided over the dangerous later stages of deficient urinary excretion, who would otherwise be certainly lost. Subcutaneous salines were largely used by the Italian doctors at Palermo for this purpose with good results, which has led me to give them more frequently than I previously did.

An illustrative case may help to make the subject clearer. In a recent very severe attack of cholera in a well-known European patient, the collapse stage was successfully treated by an intravenous injection of five pints of hypertonic saline, and some seventy grains of permanganate of potash by the mouth within five hours in keratine coated pills, as made for me by Parke, Davis & Co., the rice water stools changing to green small ones within eight hours under this active treatment. The sp. gr. of the blood, however, again reached 1064 in spite of a practically normal blood pressure, so rectal salines were commenced and served to dilute the blood slightly for a time. At the beginning of the second day the sp. gr. was again 1064, and no urine has been passed except a few ounces shortly after the first intravenous injection. It was clear that the kidneys could not excrete as long as the blood was so deficient in fluid. Yet the blood pressure was quite normal and the general condition of the patient good, so that without the aid of the sp. gr. test it would not have been possible to detect the dangerous state the blood was in, and the need for further immediate active treatment. Two and half pints of normal saline (1½ drams to the pint) were now slowly injected intravenously, which diluted the blood down to a little below the normal point, and

a few hours later urinary excretion commenced again and continued during the second night. During the third day it ceased once more and the position became very anxious, although there were still no signs of actual uræmia. The sp. gr. was found to have again risen to 1060, so a pint of saline of a strength of one drachm to the pint was injected subcutaneously and repeated after five hours. This sufficed to re-establish the renal functions, and later on nearly three hundred ounces of urine were passed within forty-eight hours, with the elimination of all the toxins from the system and great improvement in the general condition. It is not too much to say that on two occasions in the above case a critical condition was detected and successfully dealt with mainly through the knowledge gained from the estimations of the sp. gr. of the blood. Personally, with all my present experience, I do not feel that I can do my best for a cholera patient without the aid of this simple apparatus, which is indeed at least as indispensable as a manometer for estimating the blood pressure, great as is the value of the last-named instrument in the treatment of Cholera Asiatica.

A PRELIMINARY NOTE ON A NEW METHOD OF INTRAPERITONEAL ADMINISTRATION OF ROGERS' HYPERTONIC SOLUTION IN CHOLERA.

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THE introduction of the hypertonic solution by Major Rogers in conjunction with the administration of permanganates in the treatment of cholera has, I think, convinced everyone who has had much experience of the disease that the true basis of procedure has been discovered, and the success which has attended the practical application of his reasoning is such as to encourage the less favourably circumstanced among us to hope for an improvement in our own results. The much larger proportion of cases of cholera which occur in India do not, however, occur within reach of special cholera wards with a trained staff and efficient nursing, where accurate observations are the prelude to treatment which is impracticable in a coolie hut or a Bengali village house. And yet, there must be a considerable number of men who, like myself, have found it exceedingly desirable that their methods, such or similar conditions obtaining, should be attended with more hopeful results.

During the working season of 1910-11 on the Lower Ganges Bridge, labour was very difficult to obtain, and that which was ultimately recruited quite late in the season proved exceedingly undesirable from the hygienic standpoint, with the result that cholera was both introduced by arrivals from places where the disease was epidemic, and kept alive by intercommunication with

adjacent villages, where it is probably endemic. The occurrence of the disease was followed by panic and wholesale desertions, so that the important work of completing the river training bunds before the Ganges was again in flood was for a time in jeopardy. A longer working season than usual saved the situation, but the position had to be faced as to what would happen when a still greater labour force must be introduced in subsequent seasons for the earthwork on the "Approach Banks" which aggregate some sixteen crores of cubic feet. Within the limits of the project's jurisdiction our sanitary measures were hurried on and tube wells sunk at frequent intervals along the line which these gigantic banks would follow. At the same time an anti-cholera scheme, to operate in an area extending for twelve miles by three miles on the left bank, around the sites of the bridge land terminals, received the sanction of the two Provincial Governments and the Government Railway Board. This scheme places six medical parties in fairly equal sub-division in these two areas, who, like the medical staff on the bridge project, work under my direction. These parties are primarily "preventive" in character, making systematic visits to all inhabitants of villages with the object of instructing them in the elementary facts concerning cholera and collecting information which it is hoped may direct us to foci of infection wherever the disease occurs. The sinking of tube wells on a large scale with the object of providing, wherever possible, a comparatively safe, as opposed to a probably polluted water-supply is also part of the scheme. But the question of the treatment to be adopted was one which could not receive too much consideration. The *kaviraj* and quack abound, and it was felt that unless our treatment "scored," and these hindrances to any improvement in village conditions were driven to apply their energies in less pernicious directions, the "preventive" work would be exceedingly difficult to carry on. The exhibition of permanganates was simple and put into practice at once, and in several villages the permanganate pills and solution have become very popular and have, I believe, accounted for many recoveries in early cases. Adrenalin chloride, as advocated by Drake Brockman, was also added to our armamentarium and justified its inclusion, but the typical well-set case proved intractable, and although the injection intravenously of hypertonic solution was done in quite a number of cases, the results were disappointing, and I had to reluctantly conclude that it was useless to persevere with it under the conditions in which this work must be carried on.

Whilst carrying out the intravenous method, in several cases, instead of repeating intravenously, I adopted the plan of giving an intraperitoneal injection of the fluid and thought that I could trace considerable improvement in some and recovery in one case to this method. The

technique, as adopted, was so simple that I had no trouble in making my staff familiar with it, and it is the method now being followed, and which in Paksey, the headquarters of the bridge project, has so far met with a very considerable measure of success. Our first cases of cholera amongst coolies occurred this year at the beginning of February and up to the present (March 6th), eighteen cases have been treated. Four were secured early or were mild in character, and yielded to the permanganates and adrenalin chloride alone. The other fourteen cases were all of a severe character and were treated with the above drugs with the addition of intraperitoneal injections of Rogers' hypertonic solution of amounts varying from sixty to one hundred ounces. Amongst these fourteen cases there has, up to the present, been one death, and that, in a man who was admitted in a very bad general condition with no peripheral pulse and with a marked abdominal distension which could only be slightly reduced.

One recognises that it would be absurd to base any claim to have secured exceptional results on so few cases, but Major Rogers suggests that, if explained in a preliminary note of this character, the method might be tried by others, under similar circumstances, during the present cholera season and its value or otherwise more thoroughly demonstrated.

The same general indications noted by Rogers for the intravenous injection are accepted for the intraperitoneal. It is noted that a blood pressure which falls below 70 degrees continues to fall rapidly, as a rule, to between 30 and 40, so that preparations for the injection are made as soon as the blood pressure is discovered to be below the first figure. The most convenient instrument for taking blood pressure observations we have found to be Leonard Hill's new type of Sphygmometer, which is portable and easily manipulated by one person. For the actual puncture of the abdominal wall I use a trocar-cannula specially made for me by Messrs. Smith, Stanistreet & Co., of Calcutta.

The site of the puncture, just below and a little to one side of the umbilicus (where the peritoneum is attached to the posterior surface of the anterior abdominal wall) is marked by the application of a small pure carbolic acid swab and the tissues grasped with both hands by an assistant on the other side of the selected spot, which is, while being drawn quite taut, also brought into the middle line immediately below the umbilicus. The previously sterilised trocar-cannula is thrust boldly through and the trocar extracted. The rubber tubing leading from the reservoir is slipped on to the cannula and well over its shoulder. The hypertonic solution is then allowed to run in at the rate of about a pint in four or five minutes—the temperature being regulated in the same way as for the intravenous method. The amount required cannot be indicated by the improvement in the blood pressure observable, as

such improvement is not immediate, but a fair clinical indication of, when to stop is when the patient experiences a desire to micturate. Micturition, though attempted, does not indeed ensue at this point but generally coincides with the return of the blood pressure in the radial artery some few hours later. The one apparent risk—that of injuring the intestine during the process of puncturing is, I am convinced, apparent only. I made examinations *post mortem* in the early cases, where I now feel that the method failed because too small amounts were given, and in no case was there any evidence of intestinal injury, nor has there been any sign of peritonitis in any of the cases which have recovered.

The treatment has already been carried out by the four Assistant-Surgeons serving with me, both under my supervision and independently, with satisfactory results.

To reduce the risk of sepsis as much as possible I have arranged with Messrs. Smith, Stanistreet & Co. to put up a compact cholera outfit which will contain everything required, including a sixty-eight ounce flask in which the boiling of the necessary solution and the sterilisation of the trocar-cannula is performed at the same time and the necessity of transferring the fluid from one flask to another is obviated.

I shall be glad if others who may have the opportunity of giving this method a trial will communicate their results to enable a reliable opinion as to its value to be obtained.

CHOLERA IN THE CAMPBELL HOSPITAL, 1911.

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DURING 1911, 232 cases of cholera were admitted, of whom 134 or 58% recovered. Clinical history in detail is not available in 38 cases: 68.5% of these recovered; of the remainder 10 died either in the admission room or within ten minutes of admission. Excluding these we have 184 cases left (forming the subject of this paper), of whom 58.6% recovered. It is very important to note that 78% of the 184 cases were admitted in a totally collapsed condition with no radial pulse at all.

Treatment.—As soon as possible after admission all cases with a blood pressure below 80 mm. received intravenous injections of hyper-

tonic Saline (Dr. Rogers' Formula) with a view to raise the blood pressure to 110 or over, m.xv of Pituiterin or Adrenalin was added to each injection as a matter of routine. The temperature of the saline in flask varied from 100° to 105° F. There was no case of hyperpyrexia; specific gravity of the blood was not taken in the cases under consideration; treatment being guided mainly by blood pressure indications and other symptoms. In a great majority of cases injections had often to be repeated, as after a few hours of one injection the B. P. fell to 70 or under. Divided doses of calomel and camphor as a matter of routine till the stools changed colour. Calcium permanganate water was given *ad lib.* to drink, but generally the patients could, with difficulty, be persuaded to drink it in any quantity, owing to its unpleasant taste. Stimulants with strychnine and digitalis were freely used. Rectal salines every two or four hours in all cases that were not markedly improved after the first injection and in uræmia. To raise the B. P. in collapse and in threatened uræmia, pituiterin, adrenalin, strophanthin, digitalin and strychnine were extensively used. For uræmia, subcutaneous rectal and intravenous salines according to circumstances, the vaso-constrictors noted above and dry-cupping were used. After-diarrhœa was never checked, but some cases with severe flux of yellow colour received bismuth.

Severity of cases.—It has already been pointed out that 78 per cent. of the cases were admitted absolutely pulseless and totally collapsed. Against such heavy odds we were fortunate enough to secure a recovery of 58 per cent. All doubtful cases had their diagnosis confirmed by bacteriological examination of the stools. Four cases had bloody stools and they died. The following table A shows the number of cases and duration of the disease before admission into hospital.

Cases in which the duration could not be ascertained, mainly owing to such cases being 'picked up' unconscious by the police, are grouped as 'unknown.' It will be seen that the earlier the cases came in, the greater was the rate of recovery. The table further shows the cause of death as influenced by early or late treatment. Death from uræmia has risen directly with delay in obtaining treatment and death from collapse has proportionately decreased.

A.

Duration of disease before admission in hours	3	6	12	18	24	36	48	Days. 3	Days. 4	Days. 6	Un-known	Total.
Number of cases	3	31	59	16	20	2	11	2	3	1	45	184
Percentage of recovery	33	61	64	62	60	50	54	100	0	0	55	58.7
Cause of death { Collapse %	33	19	18	12	5	...	18	22	
{ Uræmia %	...	9	14	25	30	50	27	...	100	100	15	