# MANAGEMENT OF CHOLERA AND OTHER ACUTE DIARRHOEAS IN ADULTS AND CHILDREN

WORLD HEALTH ORGANIZATION
ORGANISATION MONDIALE DE LA SANTE
WHO/BD/CHOLERA/74.27
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## Introductory Note

The Cholera Research Laboratory (CRL) has produced this special reprint for distribution to the Medical Community. The principles of oral rehydration and intravenous treatment presented in this monograph have been discovered and developed by physicians working at the Cholera Research Laboratory (CRL), Dacca and also by those working under the auspices of the Johns Hopkins University Center for Research and Training in Calcutta, India. This document presents a consensus of the best possible approach to patients with cholera and other acute diarrheas that is currently available.

CONTENTS

## PREFACE

These guidelines attempt to present the newest developments in the field of treatment and are based on practical experience gained in countries invaded recently for the first time by cholera. Since the publication in 1970 of "Principles and Practice of Cholera Control" (Wld Hlth Org. Publ. Hlth Pap., No. 40) the treatment procedures have become greatly simplified, mainly as a result of the success of rehydration by oral fluid. This simple method has been found to be suitable for the treatment of the entire group of acute diarrhoeas of which cholera is only a small part. For a wider and more complete coverage of the problem, it is recommended that physicians refer to these guidelines instead of to Chapter 10 of Public Health Paper, No. 40.

## INTRODUCTION

Effective treatment of cholera can reduce mortality in all ages to less than 1%. Such treatment is neither technically difficult nor expensive. The basis of adequate treatment is prompt and complete replacement of water and electrolytes lost in the stool. Fluids may be given either parenterally or by mouth depending upon the condition of the patient. Certain antibiotics are useful because they shorten the duration of diarrhoea. The fluid and electrolyte therapy effective for cholera is equally effective for acute dehydrating diarrhoea caused by other enteropathogenic bacteria.

## GENERAL PRINCIPLES OF TREATMENT

### OBJECTIVES OF TREATMENT

(1) rapid replacement of water and salt already lost and to treat shock;

(2) correction of acidosis and potassium depletion;

(3) maintenance of normal hydration until diarrhoea ceases, by replacing further stool losses as they occur;

(4) reduction of magnitude and duration of diarrhoea with suitable antibiotics.

## REHYDRATION AND MAINTENANCE - CHOICE OF METHODS

Fluid replacement is conveniently divided into two phases. The first, rehydration, consists of rapid replacement of the water, sodium, and hydrogen carbonate lost up to the time of admission. At the end of this phase the patient may continue to have rapid stool loss but should be in a state of corrected water and electrolyte balance and no longer have serious acidosis. The second phase, maintenance, is the period during which continuing stool losses are replaced volume per volume as they occur. This continues until diarrhoea ceases.

The selection of treatment techniques must take into consideration the degree of dehydration, the patient's age, the treatment materials available, and their cost. Treatment is greatly simplified by use of single appropriate parenteral and oral solutions. Oral therapy should be used whenever possible, though if shock is present, intravenous fluids must be employed first until shock is corrected. Base-containing solutions are essential for the correction of acidosis. The special needs of children for potassium and glucose must be recognized.

### Intravenous solutions

In untreated patients of all ages the water and electrolyte deficit is equivalent to an isotonic salt solution rich in bicarbonate and potassium. Replacement fluids are designed to correct this deficit and to replace the water and electrolytes lost in continuing stool output. The approximate composition of cholera stool in adults and children is shown in the Table. Stool osmolarity is about 290 mOsm/litre. A single isotonic electrolyte solution can be used for the treatment of all patients provided urine output is restored promptly and water is given freely by mouth. Ideally the intravenous solution should contain a base (25-50 mEq/litre as acetate, lactate or bicarbonate), potassium (about 15 mEq/litre), and glucose (about 50 mM/litre). Several intravenous solutions may be used. They are listed below and described in the Table in order of preference.

(1) "Diarrhoea treatment solution" (DTS) is a specially composed solution (not commercially available) containing (per litre of distilled water) 8 g glucose, 4 g sodium chloride, 6.5 g sodium acetate (or 5.4 g sodium lactate), and 1 g potassium chloride. This may be used as a single parenteral solution for cholera and gastroenteritis in all ages. Acetate is the preferred base because it is more stable on storage than lactate. Bicarbonate is less desirable because it must be added after sterilization and the solution used promptly. This solution has the great advantage of containing all the required salts and glucose in a single bottle.

(2) Ringer's lactate (Hartmann's Solution for Injection, BPC and USP). This is a second choice which is available commercially. When used in children, potassium and glucose supplementation by mouth is required.

(3) "5:4:1 solution" is another specially prepared solution of proven value. It is not available commercially. It contains 5 g of sodium chloride, 4 g of sodium bicarbonate and 1 g of potassium chloride per litre. When used in children, 1% glucose (10 g per litre) should be added.

(4) 2 saline : 1 lactate. These are given in a ratio of two units of physiological saline to one unit of 1/6 molar sodium lactate; "sets" of three bottles in this 2:1 ratio are repeated throughout the course of fluid replacement. This combination is satisfactory for adults but is poorly suited for children because the use of separate bottles may delay base administration and because oral supplementation of potassium and glucose is required.

(5) Normal saline. This is the poorest choice. If it is the only solution available it may be used. The addition of 50 ml of sterile 7.5% sodium bicarbonate per litre of saline (44 mEq) or 1 molar sodium lactate (50 mEq) permits the correction of acidosis, thus improving the effectiveness of the solution.

(6) Five per cent. dextrose. This has no place in the treatment of dehydrating diarrhoea.

Technique of intravenous infusion

In most patients, even those in shock, an intravenous infusion can be started in an arm or leg vein, or on the back of the hand. In children the external jugular or scalp veins may also be used. In dangerously dehydrated cases, attempts should be made to start the infusion in different sites at the same time. In the case of patients in extremis, two infusions can be given simultaneously until blood pressure is restored. Large-bore needles (No. 18 for adults, No. 22 for children) that permit a rapid flow are essential. Venesections are unnecessary, waste valuable time, and often become infected.

Oral replacement of water and electrolytes

Oral therapy with a solution of glucose and electrolytes has proved to be effective in the treatment of cholera. Its advantages are: low cost, wide availability of the necessary ingredients, and reduction in intravenous fluid requirements. It requires the same level of careful patient supervision as does intravenous therapy. Severely dehydrated patients (i.e. pulseless) or those unable to drink, or without bowel sounds, require initial intravenous rehydration (see page 8). Thereafter, oral maintenance therapy can be started. Additional intravenous maintenance fluids are not usually needed. This reduces the intravenous fluid requirements by 80% in severe cases and permits the available supplies to be used for the initial treatment of a maximum number of patients. If necessary, even normal saline can be used for intravenous rehydration in patients who are to receive oral maintenance therapy because the oral solution corrects the bicarbonate and potassium deficits. Patients with mild to moderate dehydration can usually be treated with the oral solution alone and require no intravenous fluid. Oral solutions can be given by mouth or nasogastric tube. The latter is especially convenient in children and gives the patient more opportunity to rest or sleep.

A single oral solution can be used safely for all patients and simplifies the management of large epidemics. The solution must supply enough sodium, chloride, bicarbonate, and potassium to correct any remaining electrolyte deficits and to replace ongoing stool losses. Glucose in an appropriate concentration is added to permit sodium and water absorption; without glucose the oral solution is not absorbed and is useless.

... 4

The oral solution can be prepared as needed, by adding ordinary table salt, baking soda, potassium chloride, and glucose to drinking water. The solution should not be autoclaved or heated and need not be sterile.

Several solutions have been successfully employed. A simple and effective composition is (in grams per litre of drinking water): NaCl 3.5; $NaHCO_3$ 2.5; KCl 1.5 and glucose 20. The electrolyte concentrations are shown in the Table. If potassium chloride is not available, potassium citrate (2.7 g/1) or potassium acetate (2.5 g/1 of anhydrous salt) are suitable, but in this case sodium bicarbonate should be reduced to 1 gram and sodium chloride increased to 5 grams/litre. The glucose and salt may be pre-weighed and placed in moisture-proof plastic, glass or foil containers for use when needed. This solution has been used successfully in children and adults with dehydration due to cholera and acute non-cholera diarrhoea. When used to replace continuing stool losses in cholera, about 1.5 volumes of oral solution are given to replace each volume of stool lost. This provides adequate replacement of stool losses of water and electrolytes as well as water needs for urinary and evaporative losses.

Vomiting usually stops after initial intravenous rehydration of severely dehydrated patients and seldom interferes seriously with oral therapy. When vomiting occurs, the amounts of vomitus are small in relationship to the volumes of stool and of oral solution and can be replaced by additional oral solution. The probable causes of vomiting - acidosis and dehydration - will thus be corrected by the oral solution. Vomiting is less common when the oral solution is given by nasogastric tube. If vomiting is very severe and the patient shows signs of increasing dehydration, water and electrolytes must be replaced intravenously.

## ESTIMATION OF FLUID REQUIREMENTS FOR REHYDRATION

The objective is to estimate the volume of the fluid deficit which the patient has developed since the onset of diarrhoea. This is done by weighing the patient and estimating his degree of dehydration.

1. Weigh the patient

A simple scale is used to determine the patient's weight at the time of admission. This is very important in estimating the volume of fluid required for rehydration, especially for children.

2. Estimate the degree of dehydration

Mild dehydration (slightly decreased skin turgor, tachycardia, thirst): represents a fluid deficit of about 5% of lean body weight. This would be 50 ml/kg in children or 2500 ml in a 50 kg adult. Lesser degrees of dehydration may be manifest only as increased thirst and watery diarrhoea.

Moderate dehydration (definitely decreased skin turgor, postural hypotension, tachycardia, weak pulse, increased thirst): represents a fluid deficit of about 8% of body weight. This would be 80 ml/kg in children or 4000 ml in a 50 kg adult.

Severe dehydration (severely decreased skin turgor, hypotension, stupor or coma, sunken eyes or fontanelle, weak or absent radial pulse, cyanosis of extremities, shock): represents a fluid deficit of 10-11% of body weight. This would be 100-110 ml/kg in children or 5000-5500 ml in a 50 kg adult.

JUDGING THE ADEQUACY OF REHYDRATION

After the rehydration fluid has been given, the adequacy of fluid replacement should be assessed by a combination of the following simple bedside methods. Routine evaluation should employ all of these methods.

(1) Return of pulse to normal strength and rate. The pulse rate will be below 90/minute in adults, 100 in children, and the pulse volume will be full. Bedside evaluation of the pulse is a simple and useful means of assessing fluid replacement. While correction of the blood pressure is valuable in determining the correction of shock, it is insensitive as a method of determining full rehydration because it is corrected by the replacement of half or less of the fluid deficit.

(2) Return of skin turgor to normal. If skin turgor has returned to normal and the pulse remains rapid and weak, other causes of shock should be considered - e.g. sepsis. Skin turgor may appear normal in the presence of fluid deficit in persons with increased subcutaneous fat, particularly in plump infants. Conversely, it may appear decreased even in the absence of fluid deficit in elderly persons or marasmic infants.

(3) Return of a feeling of comfort to the patient, with the disappearance of cyanosis, muscular cramps, and nausea and vomiting. Vomiting will not usually last longer than four hours after admission to hospital in an adequately treated patient. Children who are stuporous or comatose at the onset of treatment may not become fully alert for 12-24 hours despite adequate rehydration.

(4) Return of normal fullness to the neck veins

(5) Weight gain. Persons with severe dehydration should gain about 10% in body weight after rehydration. This is an especially useful guide to the rehydration of small children.

(6) Return of urine output to normal. This usually occurs within 12-20 hours after initial rehydration.

If signs of dehydration persist, rehydration is not complete and additional fluid must be given.

## ESTIMATION OF FLUID REQUIREMENTS FOR MAINTENANCE

Maintenance fluid requirements depend upon the volume of stool passed after rehydration. The greatest stool volume is passed in the first 24 hours of treatment but this volume varies greatly from patient to patient. Accurate measurement of stool losses is very helpful in determining maintenance requirements and is easily accomplished by use of a "cholera bed". Any simple bed or cot can be altered to provide a hole 23 cm (9 in) in diameter beneath the patient's buttocks (see Fig.). A rubber sheet with a central sleeve passing through the hole covers the bed. All stool is easily passed through this hole and collected for

measurement in a bucket beneath the bed. Urine should be passed separately from stool if possible. The bucket may be calibrated in litres to facilitate measurement of stool losses. All fluid intake and stool output should be recorded on a bedside chart.

During active diarrhoea, patients should be examined frequently for signs of dehydration or evidence of adequate hydration. This is important in all patients, but especially so in small children in whom accurate measurement of stool loss is often impossible.

Important signs of dehydration are:

1. Thirst.
2. Poor urine output (after urine flow has resumed).
3. Weak or rapid radial pulse.
4. Diminished skin turgor.

## SPECIFIC GUIDELINES FOR FLUID REPLACEMENT IN ADULTS

### REHYDRATION

The route of rehydration depends upon the severity of the initial fluid deficit. Intravenous rehydration is essential for severely dehydrated patients. Intravenous rehydration should be accomplished within two hours. For severe dehydration give 40% of the fluid deficit (40 ml/kg) as rapidly as possible to correct shock. This should be done within 15 minutes. The remainder (60 ml/kg) is given within two hours. For mild or moderate dehydration, intravenous rehydration need not be used. If it is used, the estimated deficit is replaced at a uniform rate over a two-hour period.

Rehydration by the oral route is effective for patients with mild or moderate dehydration. No patient in shock or with an altered state of consciousness should be rehydrated orally. For rehydration the solution may also be given by nasogastric tube. Initial therapy should be 15 ml/kg/hour for mild dehydration and 25 ml/kg/hour for moderate dehydration. This means

600-1000 ml/hour for a 40 kg adult. This is continued for four hours. At this point the adequacy of rehydration should be confirmed by careful reexamination of the patient. Further oral solution should then be given as described for maintenance therapy.

MAINTENANCE

This is accomplished by either oral or intravenous replacement of the stool losses that occur after rehydration until diarrhoea ceases. The objective is to prevent the recurrence of dehydration. Maintenance fluids should be started as soon as rehydration is completed. Vigorous diarrhea may not resume until the end of rehydration or even later. The rate of administration of maintenance fluid must be adjusted to match the stool output of the individual patient.

When intravenous fluids are used for maintenance therapy, the stool losses are replaced with equal volumes of intravenous fluid. Water is given freely by mouth after vomiting ceases. Rates of stool loss vary from 100 to 1000 ml per hour, being greatest in the first 24 hours of treatment. Patients with very rapid stool loss requirereexamination and determination of fluid requirements every one to two hours to prevent the recurrence of serious dehydration.

Following rehydration, most adults are alert and cooperative. Such patients can be immediately started on maintenance therapy by the oral or nasogastric route. The aim of oral maintenance is to provide an amount equalling about 1.5 times the stool volume.

Adults with profuse watery diarrhoea should drink, or be given by nasogastric tube, about 700 ml per hour for the first four to six hours after rehydration. Milder cases may be given less (300 ml per hour), severe cases more (1200 ml per hour). During this period, the individual rate of stool loss will become apparent. The hourly intake during subsequent four-hour periods should be about 1.5 times the output of the preceding four-hour period. Fluid therapy is discontinued when diarrhoea stops. Additional water may be given if the patient desires, but is not usually necessary. If emesis occurs its volume should be estimated and added to the volume of oral solution being given.

All intake and output should be recorded on a bedside chart. After each four-hour period the net fluid balance is calculated by subtracting the combined output of stool and vomitus from the oral intake of the glucose-electrolyte solution. If the oral intake is significantly less than 1.5 times the output, or if the patient shows physical signs of inadequate hydration, the volume of oral fluid must be increased or an intravenous infusion reinstituted. Less than 5% of severe cases will require such intravenous supplementation. Patients may eat while receiving oral maintenance therapy, and are encouraged to do so.

## SPECIFIC GUIDELINES FOR FLUID REPLACEMENT IN CHILDREN

With treatment methods that adhere to the established concepts of water and electrolyte replacement in child, mortality from cholera can be essentially nil. The guidelines to treatment are similar to those given for adults, with the exceptions or modifications noted below.

### GENERAL REQUIREMENTS FOR FLUID REPLACEMENT

(1) Water and electrolyte requirements should be based on careful estimates of the initial deficit and ongoing losses. Frequent evaluation of the state of hydration, observation of stool losses, and measurement of body weight provide the best basis for determining requirements. Changes in the rate of stool loss must be accompanied by changes in fluid administration. Bedside physical examination is of great value, specifically the evaluation of pulse rate and volume, skin turgor, level of consciousness, and urine output. Facial oedema or pulmonary oedema are signs of overhydration. Body weight can be measured accurately with an inexpensive pan balance.

(2) Initial rehydration is accomplished best with an isotonic electrolyte solution to correct isotonic dehydration. Maintenance therapy can be provided with the same solution. The additional water required to replace evaporative and urinary losses should be provided by encouraging the child to drink. A single isotonic intravenous

solution can be used throughout provided water is given freely by mouth after completion of initial rehydration. When oral maintenance with liberal amounts of glucose-electrolyte solution is employed, additional oral water is not usually needed because the kidneys can produce concentrated urine and excrete any slight excess of sodium that may occur. If children feel thirsty despite adequate rehydration and maintenance therapy, extra oral water can be given as desired.

(3) Specific supplies for intravenous fluid replacement are useful, including short needles (No. 22) and paediatric scalp-vein sets ("wing" or "butterfly" needles). Doctors and assistants should be experienced in their use and skilled in starting infusions in arm veins, scalp veins, or the external jugular vein.

(4) When possible, children should be treated in an area separate from adults, equipped with appropriate supplies, and staffed with persons trained in nursing and treating children. The child's mother may be of considerable help in providing care, oral therapy, feeding, etc. There is no reason to isolate a child with cholera from its mother.

REHYDRATION

Initial fluid requirements are determined as described above, employing a direct measurement of body weight. Intravenous rehydration is suitable for all patients whereas oral rehydration is suitable only for those with mild to moderate dehydration.

In severe dehydration, initial fluid replacement should be rapid. Give 40 ml/kg intravenously as rapidly as possible, in 30 minutes or less. Then give the remainder of the rehydration requirements more slowly, at the rate of 60 ml/kg during the next three to six hours. This replaces 100 ml/kg and should correct the initial deficit unless further large stool losses have occurred, in which case a larger volume of fluid replacement is required. Children with mild or moderate dehydration may be given the entire deficit intravenously at a uniform rate during the first four to six hours. Alternatively, those with

mild to moderate dehydration may be rehydrated orally by giving the solution at a rate of 125-500 ml/hour (15 to 25 ml per kg per hour) depending on the size of the child and the degree of dehydration. Fluid can be given from a cup or by spoon, or by nasogastric tube. Children permitted to drink freely will usually rehydrate themselves in four to six hours. If an infant is too weak to drink, intravenous rehydration must be employed. Infants should never be force-fed and their head should be raised to avoid the aspiration of fluid or vomitus.

When rehydration is completed and the child's hydration is judged to be normal by careful physical examination, he should be weighed again. This "normal weight" may be used for reference purposes to aid in determining further fluid requirements during the remainder of his illness. Alternatively, the admission weight plus the estimated fluid deficit on admission may be used for reference as "normal weight". Weight gain after rehydration should not exceed admission weight plus 10%; if this occurs, excessive fluid has been given. Periorbital and facial oedema are early physical signs of overhydration.

MAINTENANCE

Stool output during the first 24 hours of treatment ranges from 50 to 300 ml/kg. Additionally, water from evaporation and urine output average about 100 ml/kg/day. The accurate measurement of stool losses in small children is difficult, requiring greater dependence on careful clinical observations and body weight to determine fluid requirements.

When an intravenous electrolyte solution is used for maintenance the volumes given are those necessary to maintain normal hydration and body weight and are approximately equal to stool losses. Additionally, water must be given freely by mouth (about 100 ml/kg/day). If the child cannot drink, this amount of water should be given by nasogastric tube or intravenously as 5% dextrose in water. The greatest stool losses usually occur in the first eight to 12 hours of treatment. Frequent observation is especially important during this period.

An alternative form of maintenance therapy is the administration of isotonic fluids intraperitoneally. The same sterile

fluids are employed as for intravenous maintenance. Fifty to 80 ml/kg are given through a No. 18 needle placed in the mid line, after sterilizing the skin, just below the umbilicus. The fluid may be given in about 10 minutes, and the needle removed. This can be repeated when necessary, as determined by stool output. Liberal amounts of water should be given by mouth, as described above. Most children will absorb fluid rapidly enough to maintain normal hydration. A few, with high stool outputs, will require additional intravenous fluids, since peritoneal absorption may not be sufficiently rapid to replace very large losses.

Children with profuse diarrhoea may be started on oral or nasogastric maintenance immediately after rehydration and should receive five to 15 ml/kg/hour, depending on the stool rate. When possible, they should be allowed to drink the fluid ad libitum, a technique which permits most children to replace their own fluid needs satisfactorily. Nasogastric infusion may be used for those with very high stool rates or those who tire of drinking. In this case, maintenance therapy is divided into four to six-hour periods, as with adults, the rate of administration in a given period being about 1.5 times the previous period's output.

As the infant's stool volume decreases and the stool becomes firmer, the oral solution can be mixed with formula or given alternately with breast milk. Older children should continue to drink the oral solution to replace stool losses.

A very few infants and younger children will demonstrate glucose intolerance. In this case the oral therapy solution will cause a marked increase in stool volume, large amounts of glucose can be detected in the stool, and dehydration recurs. Such children must receive their maintenance requirements intravenously. A regular diet can be begun shortly after rehydration though milk may have to be withheld in some children because of transient lactose intolerance which results in increased stool volume when milk is added to the diet.

## ADJUNCTS TO THERAPY

The following are useful adjuncts to cholera therapy, but are in no way substitutes for full replacement of water and electrolytes lost in the stool.

## TETRACYCLINE

Tetracycline should be given to adults in a dosage of 500 mg by mouth every six hours for 48 hours. The dose in children is 50 mg per kg per day of tetracycline suspension, divided into four doses administered at six-hour intervals. This will:

(a) reduce the duration of diarrhoea by 50%, to an average of about two days;

(b) reduce the volume of diarrhoea after initiation of treatment by 60%, to an average of about six to 10 litres in adults with severe disease;

(c) reduce the duration of vibrio excretion to an average of one day and a maximum of 48 hours.

This will lessen the expense and duration of treatment, permitting the treatment of more patients when supplies and personnel are limited. Because of the likelihood of vomiting, tetracycline should not be administered until the patient is fully rehydrated and not vomiting (about one to two hours after rehydration). There is no need to give tetracycline parenterally.

If tetracycline is not available, other useful antibacterial agents, which are only slightly less effective, are furazolidone and chloramphenicol. The former is given in a 100 mg dose every six hours to adults, or 5 mg per kg per day divided into four doses in children. The latter is given in a dosage of 500 mg every six hours in adults, or 75 mg per kg per day divided into four doses in children. The palmitate form of chloramphenicol is less effective and should not be used. Furazolidone or chloramphenicol should be given for 72 hours.

## WATER BY MOUTH

Patients on intravenous maintenance therapy should be allowed to drink water as desired, after nausea and vomiting subside. A portion of oral water is absorbed during cholera and is essential for the replacement of insensible losses and urinary

output occurring during therapy. Additional oral water is not usually required during maintenance therapy with the oral glucose-electrolyte solution. However, moderate amounts of water may be given safely in addition to the required volume of oral solution if the patient desires it.

ORAL POTASSIUM AND GLUCOSE SUPPLEMENTATION

If intravenous fluids are used for maintenance therapy and if they contain insufficient amounts of potassium and/or glucose for children these should be given by mouth or nasogastric tube. A satisfactory solution can be made from either 100 g potassium acetate, potassium citrate or potassium bicarbonate dissolved in one litre of water. This contains about 1 mEq potassium per ml. Children should receive 1 ml/kg four times daily. Adults may be given 40 ml four times daily. Alternatively, in some areas, green coconut water provides a cheap source of potassium, and about 20 ml/kg/day in children, or 170 ml for each litre of stool in adults, will replace nearly all potassium losses.

Glucose supplementation may be given to children who are not receiving oral therapy by adding 50 g/litre to their drinking water.

There are no other adjuncts of confirmed value in the treatment of cholera. This includes steroids, cardiac stimulants, diuretics, plasma volume expanders, vasopressors, and anti-diarrhoeal mixtures.

## DIET

There is no good reason to limit diet during cholera after nausea and vomiting cease. Patients should be permitted to eat a normal diet for their age as soon as they so desire. Resumption of breast feeding for small children provides an important source of water and protein requirements. This is especially important for children with undernutrition.

## TERMINATION OF TREATMENT

Fluid replacement should continue until diarrhoea ceases. Tetracycline should continue until the full course is completed

even though diarrhoea may cease before this time. If these guidelines are followed, bacteriological relapse or recurrence of diarrhoea are very unlikely. The patient may be discharged within 24 hours of the cessation of diarrhoea and the completion of antibiotic therapy. During epidemics, when treatment facilities are overcrowded, patients can be discharged when diarrhoea stops and can complete tetracycline therapy at home. The duration of care may thus be limited to two to three days.

## COMPLICATIONS

A common complication is that of pyrogen reactions resulting from the administration of incorrectly prepared fluids or the repeated use of rubber tubing for parenteral fluid administration. This can be avoided by using pyrogen-free fluids and disposable administration sets.

Virtually all serious complications of cholera are prevented by appropriate replacement of water and electrolytes, and glucose administration. If replacement is inadequate the following may occur:

(1) Persistence or recurrence of dehydration, hypovolaemia, and shock owing to inadequate volume replacement. If a cholera patient does not appear to be responding adequately to therapy, the first priority is a careful assessment of the adequacy of fluid replacement by the methods described.

(2) Persistence of nausea or vomiting, which may be due to uncorrected acidosis or hypovolaemia.

(3) Renal failure, caused by prolonged or repeated episodes of hypotension as a result of inadequate fluid replacement.

(4) Hypokalemia. This is rarely symptomatic in adults but in children may cause abdominal distension, paralytic ileus, cardiac arrythmias, and weakness.

(5) Overhydration. This may result from excessive intravenous fluid replacement and is manifest by swelling of the eyelids, full neck veins, a slow full pulse, and,

eventually, frank cardiac failure. Acute pulmonary oedema may be due to over-replacement of intravenous electrolyte solutions, especially if metabolic acidosis is uncorrected.

(6) Hypoglycaemia occurs in a small percentage of children who do not receive glucose, and is an important cause of seizures.

(7) Abortion often occurs in women in the third trimester of pregnancy if they become severely dehydrated.

A further danger is that of incorrect diagnosis. During cholera epidemics other serious illnesses causing diarrhoea may be diagnosed clinically as "cholera". Such illnesses may include meningitis, typhoid fever, various bacteraemias, amoebiasis, and heavy metal poisoning. These obviously require specialized treatment and will not respond to therapy for cholera.

## USE OF THESE GUIDELINES IN THE TREATMENT OF OTHER ACUTE DIARRHOEAS

The principles of water and electrolyte replacement described for cholera apply fully to the treatment of any type of watery diarrhoea. This includes acute dehydrating gastroenteritis of infants and children. The techniques for judging rehydration requirements, the intravenous or oral solutions used, and their rate of administration are the same as in cholera. Cholera differs from other types of gastroenteritis primarily in the rapidity with which severe dehydration may develop and in the duration of severe diarrhoea even when the patient is taking nothing by mouth. Thus, although rehydration requirements for severe dehydration are similar regardless of the cause of the diarrhoea, the volume of fluid required for maintenance in non-cholera diarrhoea is usually much less than in cholera.

Several specific aspects of the treatment of acute gastroenteritis should be emphasized:

(1) Oral therapy. Most patients with acute gastroenteritis can be treated entirely with the oral glucose-electrolyte solution provided treatment is started promptly

before dehydration becomes severe. Most children with mild or moderate dehydration will rehydrate themselves satisfactorily if simply given the oral solution to drink freely.

(2) Diet. Malabsorption of dietary constituents, especially lactose, is more common following acute gastroenteritis than after cholera. This is especially true of patients with repeated episodes of acute watery diarrhoea. Milk intake will cause their diarrhoea to worsen. They require special dietary management aimed at the maintenance of nutrition while reducing the dietary content of non-tolerated foods.

(3) Malnutrition. Diarrhoea is a common companion of malnutrition. In addition to adequate water and electrolyte replacement such patients require very careful dietary management which is beyond the scope of these guidelines.

(4) Antibiotics. Antibiotics should not be used routinely for acute non-specific gastroenteritis. In the vast majority of cases the bacterial etiology is unknown and antibiotics are useless and waste money.

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TABLE 1. COMPOSITION OF CHOLERA STOOLS IN ADULTS AND CHILDREN AND OF FLUIDS GENERALLY USED FOR TREATMENT OF CHOLERA

| CHOLERA STOOL (average values) | Concentrations (mEq or mM/L) | | | | |
|---|---|---|---|---|---|
| | $Na^+$ | $K^+$ | $Cl^-$ | $HCO_3^-$ | Glucose |
| Adult | 135 | 15 | 100 | 45 | - |
| Child | 105 | 25 | 90 | 30 | - |
| IV SOLUTIONS | | | | | |
| 1. DTS | 118 | 13 | 83 | 48 | 50 |
| 2. Ringer's Lactate | 131 | 4 | 111 | 29 | - |
| 3. "5:4:1" | 134 | 13 | 99 | 48 | - |
| 4. 2 Saline : 1 Lactate | 154 | - | 103 | 51 | - |
| 5. Normal Saline | 154 | - | 154 | - | - |
| ORAL SOLUTION | 90 | 20 | 80 | 30 | 111 |
| Half-Darrow's Solution with 25% glucose* | 61 | 17.5 | 52 | 26 | 150 |

* This solution is used widely for treatment of diarrhoea in children but has not been tried for cholera because of its low sodium content.

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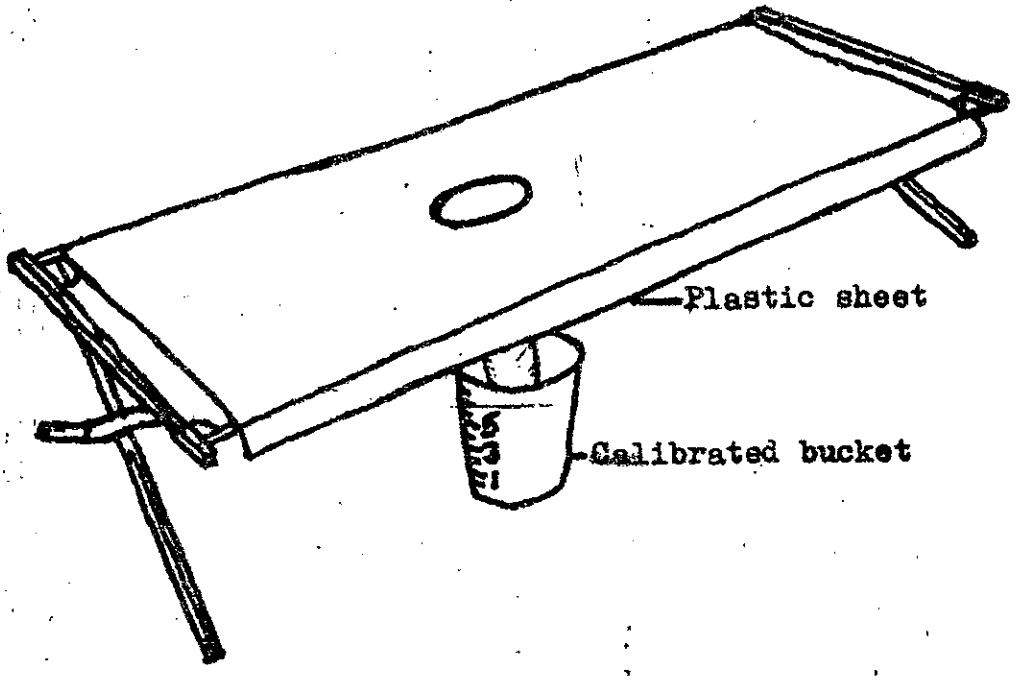
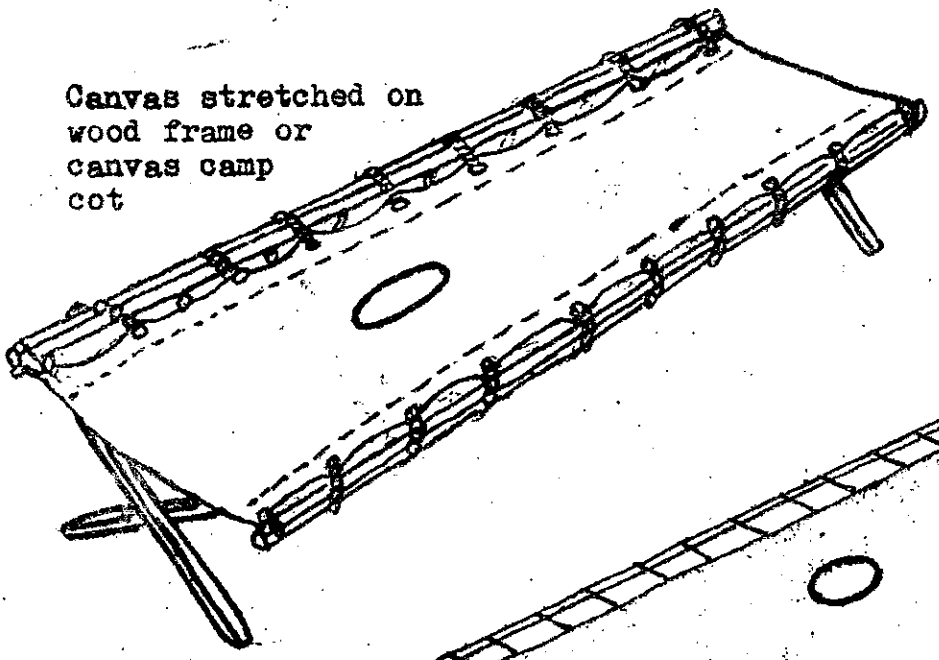
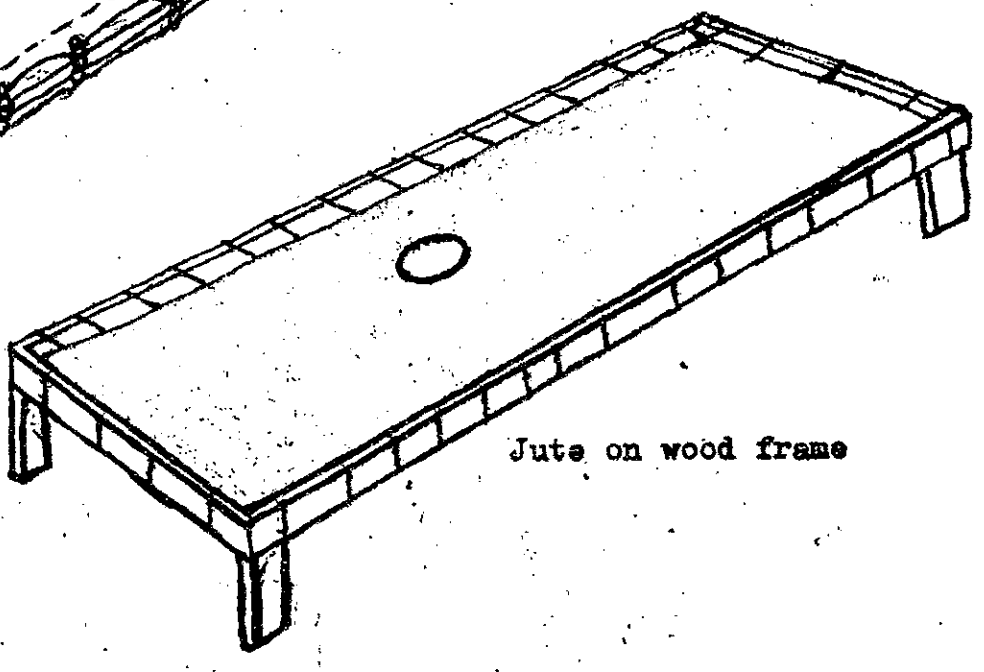



Canvas stretched on wood frame or canvas camp cot






Calibrated plastic bucket


Bucket with calibrated stick

Bucket is placed under hole in cot to collect stool.

CRL publications can be obtained from Publications Unit, Cholera Research Laboratory, G.P.O. Box 128, Dacca - 2.

List of current publications available:

A. CRL Annual Report 1976.

B. Working Paper:

No. 1. The influence of drinking tubewell water on diarrhea rates in Matlab Thana, Bangladesh by George T. Curlin, K.M.A. Aziz and M.R. Khan.

C. Scientific Report:

No. 1. Double round survey on pregnancy and estimate of traditional fertility rates by A.K.M. Alauddin Chowdhury.

No. 2. Pattern of medical care for diarrheal patients in Dacca urban area by Moslemuddin Khan, George T. Curlin and Md. Shahidullah.

No. 3. The effects of nutrition on natural fertility by W. Henry Mosley.

No. 4. Early childhood survivorship related to the subsequent interpregnancy interval and outcome of the subsequent pregnancy by Ingrid Swenson.

No. 5. Household distribution of contraceptives in Bangladesh — The Rural Experience by Atiqur R. Khan, Douglas H. Huber and Makhlisur Rahman.

No. 6. The role of water supply in improving health in poor countries (With special reference to Bangladesh) by John Briscoe.