The Treatment of Gastro-Enteritis in the African Child

BY

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The purpose of this paper is to emphasise the importance of adequate and immediate fluid therapy in the African child. Gastro-enteritis and pneumonia are the two most important causes of death in the African to-day and both are eminently treatable! A severely dehydrated child should be classed as a medical emergency and immediate treatment should be undertaken.

Diagnosis

The first step in the treatment is the correct diagnosis, and in the case of gastro-enteritis this is usually not difficult. The doctor should, however, bear in mind that a child has an extremely "sensitive" gastro-intestinal system and will respond to a host of stimuli by vomiting or passing loose stools. It is thus imperative to proceed beyond a history of simply "D and V," namely, to obtain a more detailed story and to carry out a thorough physical examination.

Besides asking the usual routine questions such as whether the child has a cough, is sucking, etc., others that may well be asked with profit in this case are the colour of the stool, the texture and the number passed. When asking what the colour is it is as well to ask the patient to point to something of the same colour in the room, since the African appears to have little sense of colour, and "blue" is quite a popular answer. When asking how many stools a day the child passes, one should ask how many are made at night as well as by day. It is in fact more satisfactory if the stools are inspected by the doctor himself and, if the child is not co-operative, examination of the nappy is the next best thing.

After a history is taken the child should be examined. Even though the child may be dehydrated, other diseases must be excluded and the respiratory system, fontanelle and ears carefully examined and stiffness of the neck excluded. The classical skin changes of kwashiorkor must not be overlooked.

Prevention

In the African this is largely impracticable. It is, however, just as well to stress the importance of boiling the utensils which she uses in the preparation and administration of the child's food. Since boiling tends to shorten the life of rubber teats, it is more economical to soak them in 1 per cent. Milton's solution (three teaspoons to a quart of water).

If the child with gastro-enteritis is hospitalised it is desirable that he should have his own feeding utensils and be separated from the other inmates. In a recent article (Mirvish, 1956) in the *South African Medical Journal* the author points out that thermometers might be sufficient to carry infection from one child to another despite precautions, and he recommends that each child should have his own thermometer. In the present-day treatment of the African these precautions appear to be impracticable.

Drugs Used in the Treatment of Gastro-Enteritis

(i) *Sulpha Drugs.*—Drugs such as sulphaguanidine and sulphathalazole play an important part in the treatment of gastro-enteritis and, together with Mist. kaolin, are routinely prescribed by us for all cases of gastro-enteritis. Sulphadiazine, sulphamezathine and the absorbable sulpha drugs have been shown to be as effective as the non-absorbable variety, and consequently in a busy out-patient department it would probably be better to use one of these in case some primary infection, e.g., otitis media, has been missed. The dose: 1½ grs./lb. body weight.

(ii) *Oral Streptomycin.*—We have found this to be highly effective and routinely administer it together with the above in all the more severe forms of gastro-enteritis. "Guanimycin" is a trade preparation incorporating streptomycin and sulphaguanidine, the dose of streptomycin being 20 mg./lb. body weight.

(iii) *Chloromycetin.*—This is said to act synergistically with streptomycin given by mouth and to forestall bacterial resistance (Elek *et al.*, 1953). Of 107 patients treated with this drug by Boling and Finch (1952), none developed gastro-intestinal side effects, nor were any cases of anaemia or agranulocytosis noted. We have recently been using this combination of chloramphemical and streptomycin in very severe cases with apparently good results. The dose of chloromycetin is 40 mg./lb. body weight.

(iv) *Other Broad-Spectrum Antibiotics.*—These may also be used, but in our experience have not proved as effective and certainly no more effective than the above. *Novobiocin* is said to be of value in staphylococcal enteritis.

In addition to these drugs the patient is given a 5 per cent. glucose or dextrose in water with nothing else for 24 hours. If the patient is being treated as an outpatient, the mother is instructed

to give the child for the next 24 hours water only, with a little sugar added to 1 pint of water, 2 tablespoons of sugar and half a teaspoon of salt. The amount to be calculated as for parenteral fluids as described below. It is important when dealing with the African to stress that after 24 hours the child should be put back on his normal diet. I have seen a grossly malnourished child brought in to outpatients; a week previously the mother had been told to put the child on a water and sugar diet, and because the doctor had forgotten to tell her to put the child back on to a full diet after 24 hours, she had simply carried right on with the sugar and water. Ideally, of course, the diet should gradually be built up so that the child only returns to its normal diet after about five days, but in the African we have found this impracticable.

When there is no vomiting, milk would appear to be the best rehydrating and electrolyte replacing fluid (Levin, 1955).

Fluid Therapy

The importance of fluid therapy in the child is frequently not realised. In Mitchell Nelson's "Textbook of Paediatrics," published over six years ago, it is stated that "possibly a third to a half of infants and children admitted to a hospital with acute illness require parenteral administration." If a child with gastro-enteritis is ill enough to be admitted, he almost certainly needs parenteral fluid therapy.

In all patients that are clinically dehydrated parenteral fluids *must* be given—either subcutaneously or intravenously.

Degree of Dehydration

It is important to gauge the degree of dehydration with a view to the amount of fluid that must be given. We have divided them into three broad groups—mildly, moderately and severely dehydrated.

Mildly Dehydrated.—The child looks ill, with dryness of the tongue and mucous membranes. The anterior fontanelle may or may not be depressed, there may or may not be some loss of eyeball tension, and the temperature may be raised one or two degrees or may be normal.

Moderately Dehydrated.—Here there is some loss of skin turgor and the skin feels almost doughy. When a fold of skin is picked up between thumb and forefinger and released, it takes longer than normal to return. The anterior fontanelle is depressed at this stage and there is some loss of eyeball tension. The child is restless and feels cold, despite a slight rise in temperature.

Severely Dehydrated.—Loss of skin turgor is pronounced, fontanelle markedly depressed and there is gross loss of eyeball tension. The child is completely apathetic and listless and appears semi-comatose. Signs of circulatory collapse are evident, with coldness of the skin and extremities. Fever may be present in the absence of detectable foci of infection (Silver *et al.*, 1955).

The above three divisions are artificial, and while serving as a guide it is the doctor's experience and judgment that must determine the extent of dehydration. If the child's weight was known prior to the onset of illness the extent of dehydration can be marked out much more accurately on the formula:

1 lb. weight = ± 450 c.c. fluid deficit.

Amount of Fluid to be Given

When administering fluid three factors must be borne in mind, and the amount given is based on these factors.

I. The amount of fluid needed for daily maintenance.

II. The amount of fluid the child has lost.

III. The amount of fluid the child will continue losing in excess of his daily maintenance while receiving the fluid therapy.

I. This amount depends on the child's age and weight:

Infants under 1 year: 80 c.c./lb. body weight/day.
1 to 2 years: 65 cc./lb. body weight/day.
2 to 4 years: 50 c.c./lb. body weight/day.
4 to 10 years: 35 c.c./lb. body weight/day.
Over 10 years: 2 to 3 litres per day.

II. This amount is determined by the degree of dehydration:

Moderately dehydrated—has lost 5 per cent. of his body weight.

Severely dehydrated—has lost 10 per cent. of his body weight.

In order to estimate how much fluid this represents, his body weight is converted to kilograms (2.2 lb. = 1 kilogram), and 5 or 10 per cent. of this is taken, as the case may be, e.g., a severely dehydrated child weighing 22 lbs. (10 kilos) needs 10 per cent. of 10 kilos, i.e., 1 litre of fluid.

III. Relevant factors which increase the daily loss are:—

(i) Vomiting—restore an equal volume.
(ii) Diarrhoea—restore an equal volume.
(iii) Fever—ten per cent. of daily main-

tenance is added for every degree Fahrenheit rise in temperature.

(iv) Hyperventilation.

These means of water loss are especially interesting as regards electrolytic balance. and a careful history covering these points should be sought.

During the early part of the year we gave all patients who were moderately or severely dehydrated 100 c.c. fluid per pound body weight. Our results were moderately successful. but we feel it is preferable to remember the above figures and work out the volume accordingly.

Electrolyte Balance

It is not sufficient simply to restore the volume of fluid lost, for an attempt must also be made to restore the electrolyte balance to normal.

When determining what to give, the same three factors must be borne in mind as when determining how much to give, namely:—

I. The amount of electrolytes needed for daily maintenance.

II. The amount the child has lost.

III. The amount of electrolytes the child will continue losing in excess of his daily maintenance while undergoing fluid therapy.

Ideally the Na, Cl and K levels and also CO_2 level should be known at the beginning and constant checks made; this is impracticable in the African at the present moment.

Do not start intravenous potassium administration until the patient is excreting urine in adequate amounts.

I.—Na Cl—5—8 m Eq./Kg./day of sodium.
5—8 m Eq./Kg./day of chloride.
K —2—3 m Eq./Kg./day of potassium.

Note.—1 Grm. Na Cl contains 17 m Eq. Na and 17 m Eq. Cl.
1 Grm. K Cl contains 13.5 m Eq. K and 13.5 m Eq. Cl.

The chloride content of the 1 ml. plasma or blood equals ½ ml. N. saline.

Protein.—If on fluid therapy for longer than 24 hours, then give 5 per cent. Amigen or Plasma (5 per cent. protein) to cover protein requirements, 1-2 grms./kilo/day.

Potassium may be given by mouth as KCL or, in a more palatable mixture, e.g.:

$KHCO_3$	1 gm.
K Citrate	1 gm.
K Acetate	1 gm.
Water	8 c.c.

½-1 teaspoon 2-3 times daily in deficiency.
½-1 teaspoon once per day in maintenance.

II. In general, the amount of fluid the child has lost should be replaced with half strength Ringer's Lactate. However, the following features should be looked out for:

(1) Fast deep breathing (hyperpnoea) occurs with metabolic acidosis or is a cause of respiratory alkalosis.
Acidosis: Deep and sighing breathing.
If diagnosed, the rapid administration of 15-20 c.c./lb. body weight of m/6 Na-r-lactate is required.
1 litre of M. lactate contains 1,000 m Eq. of Na and of lactate.
1 litre of M/6 lactate contains 167 m Eq. of each.

(2) Apnoea or shallow breathing occurs in metabolic alkalosis or respiratory acidosis. In gross metabolic alkalosis NH_4Cl may be added 1 to 2 per cent. soln. Broadly speaking, however, supplying a substance influencing the p.H. is of secondary importance; one must simply supply electrolytes and the body will deal with the p.H.

(3) Tetany occurs with alkalosis, respiratory or metabolic.

(4) Twitchings or convulsions and muscle cramps occur with hyponatremia (decreased serum sodium and water intoxication).

(5) Signs of hypokalaemia:
Weakness and hypotonia of skeletal muscles, sometimes—
Flaccid paralysis.
Dyspnoea—a gasping type of respiration. Nausea and vomiting.
Cyanosis. Abdominal distention. Cardiomegaly and systolic murmurs.
Increased pulse pressure and Corrigan's pulse. Elevated pressure and signs of cardiac failure.
Characteristic E.C.G. changes. A general flattening out.

III. (i) Vomiting—replace with 1/3 N. saline.
(ii) Diarrhoea—replace with Darrow's solution.
(iii) Fever— + 10 per cent. maintenance for every degree Fahrenheit rise in temperature.
(iv) Hyperventilation—half strength N. saline.

Method of Administration

Intravenous infusion is the most effective and should be used whenever possible.

Complications of Intravenous Therapy

(1) Underhydration—ineffective. The commonest complication.

(2) Overhydration — pulmonary congestion, oedema and C.C.F.

(3) Hyperkalaemia. Signs and symptoms:
(a) Listlessness and mental confusion.

(b) Numbness and tingling of the hands and feet, with a sensation of weakness.
(c) Cold, grey, pale skin.
(d) Flaccid paralysis of the extremities.
(e) Bradycardia.
(f) Peripheral vascular collapse, diminished heart sounds and low blood pressure.
(g) Cardiac arrest.
(h) Characteristic E.C.G. changes. A steeple curve effect.

(4) Only Na Cl replacement and not potassium. The Na Cl tends to overhydrate and expand the extra-cellular fluid compartment and *to some extent the intracellular compartment as well.* The excess of the Na ions tends to increase Na shift into the cells and the K out, and thus increase the K loss in the urine. Clinical oedema may be present.

Note that "so-called normal physiological isotonic saline is neither normal nor physiological nor isotonic from the point of view of clinical therapeutics," and "there are no paediatric indications for using 0.9 saline subcut. and almost no indication for using it I-V" (Levin, 1955). Hanser, however, recommends the use of normal saline subcutaneously.

Half normal saline with 2½ per cent. glucose is an excellent solution for subcutaneous and I-V use, however. It supplies 77 m. Eq./L of Na 4 and of Cl.

"The best time to put up on I-V infusion is when one wonders if it will be necessary" (Levin, 1955).

Subcutaneous Fluids

In casualty work up to 600 ml. of fluid may be given subcutaneously at once, using hyaluronidase.

Use 2½ per cent. dextrose in N/2 saline.

Never use:

A. 5 per cent. dextrose in water.
B. Normal saline (Levin, 1955).

A. is hypotonic and this, together with the glucose, renders absorption very slow. In fact, before absorption begins there is a redistribution of plasma and electrolyte with respect to the subcutaneous pool. This may be just enough to cause the death of the child.

B. is hypertonic, which causes an initial extracellular and hence intracellular dehydration and results in collapse of the infant.

Summary

(1) Attention is drawn to the high death rate in African children due to gastro-enteritis, which is a treatable disease.

(2) Every child with diarrhoea and/or vomiting should not immediately be labelled as gastro-enteritis; other causes should first be excluded.

(3) The drugs commonly used in the treatment of gastro-enteritis are reviewed.

(4) The importance of immediate fluid replacement is stressed.

(5) It is shown how to determine how much fluid the child should be given.

(6) It is also shown what type of electrolyte and how much the child should be given.

(7) The routes of administration and dangers of each are mentioned.

Acknowledgment

I wish to thank Dr. Gelfand for his encouragement and help and Dr. R. M. Morris, O.B.E., Secretary for Health. for his permission to publish this paper.

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