

THE MANAGEMENT OF GASTRO-ENTERITIS WITH DEHYDRATION IN OUT-PATIENTS*

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Gastro-enteritis in non-European infants remains a serious public-health and paediatric problem in South Africa. In the major cities of the Union over 10,000 children die every year from this disease.¹ Of every 1,000 non-European children born, 135 do not reach school age, and 49 of these die of gastro-enteritis between the ages of 3 months and 2 years. In comparison, of every 1,000 European children born, only 29 fail to reach school age, and of these 1 may die from gastro-enteritis.¹ In Cape Town over the past 20 years there has been a steady decline in the infantile mortality rate

in both non-Europeans and Europeans. In European infants there has been a concomitant fall in the mortality rate from gastro-enteritis, until in 1957 it was 1.4 per 1,000 live births, but in non-European infants there has actually been a slight rise in the infantile mortality rate from this condition² (Fig. 1).

Dehydration and metabolic imbalances are potent factors in the causation of death in these infants. In-patient hospital care is possible for only a very small minority, for the hospital beds available are totally inadequate to deal with the overwhelming numbers that present for treatment. The majority have to be managed as out-patients. Resuscitation by means of parenteral fluids given in the out-patient department is used in several centres.^{3,4} This paper describes the method used at the Red Cross War Memorial Children's Hospital and reviews the findings and results over a period of 6 months.

Cases in the series. During the 6-month period November 1958 to April 1959 (see Table I) an estimated 9,000 cases of gastro-enteritis were seen in the out-patient department. Of these, a total of 1,185 children were dehydrated and received parenteral fluid therapy in the out-patient resuscitation room. Clinical data in this report were obtained by analysis of the 1,185 children presenting with dehydration. Of these children 161 attended only once or failed to attend until complete recovery, and are not considered in the assessment of results.

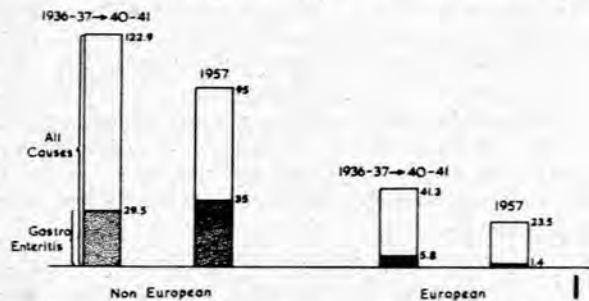


Fig. 1. Annual infant mortality rates, City of Cape Town for the 5 years ended 30 June 1941 and for the year 1957.

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TABLE I. GASTRO-ENTERITIS: 6 MONTHS, NOVEMBER 1958 - APRIL 1959

Estimated number of cases seen	9,000
Total number of cases with dehydration	1,185
Number of cases outcome unknown	161 (13.6%)
Total number of cases included in series	1,024
Number of cases admitted	101 (9.9%)
Number of cases treated solely in out-patient department	923

Of the remaining 1,024 cases, 101 children were admitted either because of the failure of out-patient treatment or because of the occurrence of complications. In easier circumstances many more would have been admitted at their first attendance.

Seasonal incidence. Gastro-enteritis occurs throughout the year but, as is well-known, there is a marked seasonal increase during the summer months. This is reflected by the



Fig. 2. Gastro-enteritis with dehydration: seasonal evidence of cases.

number of cases receiving parenteral fluids every month (Fig. 2). As can be seen, the largest number of cases occurs between December and April, with a peak incidence during February and March. These findings parallel the seasonal occurrence of deaths from gastro-enteritis in Cape Town.⁵

Race and sex. Of the 1,185 children treated, 806 were Coloured and 379 were African. There were slightly more males than females in each group, giving a total of 651 males and 534 females.

Age incidence. Analysis of the ages of the infants treated with parenteral fluids (Fig. 3) shows that the incidence of gastro-enteritis with dehydration is highest at the ages of 2-6 months, with the peak incidence occurring during the 3rd and 4th months of life. After the age of 6 months the incidence drops sharply, but a significantly large number of cases were seen and treated up to the age of 2 years. After

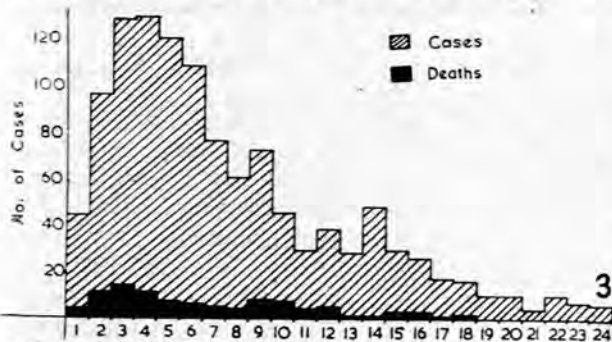


Fig. 3. Gastro-enteritis with dehydration: distribution of cases and deaths by age (in months).

2 years only sporadic cases of gastro-enteritis with dehydration occurred. The age incidence seen in this series again parallels that found in a study of deaths from gastro-enteritis in Cape Town⁵ and is similar to the age incidence found elsewhere by various authors.^{2,3,6,7} The high incidence of gastro-enteritis and dehydration in the younger infant with its relatively greater water content and turn-over emphasizes the fact that it is the younger infant that requires parenteral fluid therapy most frequently.

Nutrition. Malnutrition predisposes to illness of all kinds and gastro-enteritis is no exception. In the well-nourished European population gastro-enteritis is a mild disease with a low mortality. In the non-European population, where malnutrition is rife, gastro-enteritis is a major killer. In this series (Fig. 4) if the average weight found for each month of life is taken it is only during the first month that the average weight approaches that of the third percentile of the Anthropometric Chart of the Children's Medical Centre, Boston. This discrepancy in weight increases with increasing age, and at 1 year the average weight of the infants is only 13 lb. 8 oz. as compared with the lowest American figure of 18 lb. 8 oz. This difference cannot be accounted for by dehydration. In severely dehydrated infants the gain in weight after rehydration may be up to 17% of the original weight, but on an average it is 10%.⁴ If the average weight per month of life of those children who died is studied, it is found that their weights are below those of the series in general and that this discrepancy also increases with increasing age. At 1 year the average weight of the children dying is only 12 lb. Malnourished children have a relatively greater proportion of water to total body mass than adequately nourished children,⁸ and so loss of water has serious consequences in malnourished infants.

TREATMENT

A standard regime is used at this hospital in the treatment of gastro-enteritis.⁹ In children presenting without clinical evidence of dehydration, milk feeds are stopped for 24 hours and the infant put on half-strength Darrow's solution in 2½% dextrose water by mouth. The mother is advised to give the infant small but frequent feeds of this solution with a total intake over the first 24 hours of 3-4 oz. per lb. body-weight. Thereafter the infant is put on to milk feeds. These are also given in amounts to make a total intake of 3 oz. (or slightly more) per lb. body-weight per day. The milk feeds are given as full-strength milk, and no attempt is made to start with diluted feeds and work up to full strength gradually. Skimmed milk is usually given because it is cheap and readily available. Occasionally, after 24 hours on half-strength Darrow's solution, the infant is put back onto full-strength full-cream milk feeds. Our impression is that the type of milk feed makes very little difference. The initial 24 hours on half-strength Darrow's solution seems, however, to be of importance. Infants are not kept on Darrow's solution for longer than 24 hours unless vomiting persists. To keep a child on clear fluids orally until diarrhoea has ceased is unnecessary and only adds to the usually coexistent malnutrition.

Routine antibiotic or chemotherapeutic agents are given to all children with gastro-enteritis. The majority initially receive one dose of long-acting penicillin by injection and a soluble sulphonamide orally for 5 days. If there is no response

to treatment, or if deterioration in the infant's condition occurs, therapy is usually changed to oral chloromycetin. Most patients respond to penicillin and sulphadiazine. Occasionally, when an infant presents with a history of blood in the stools chloromycetin is used from the commencement of treatment.

Parenteral Fluid Therapy

Indications. Parenteral fluid therapy is indicated if there is more than minimal dehydration, acidosis, shock, or intractable vomiting. Signs of dehydration include loss of tissue turgor, sunken dry eyes, sunken fontanelle, and a dry mouth and tongue.

Parenteral fluids are given either subcutaneously or intravenously. In this series, 480 infants were initially given subcutaneous fluids and 705 intravenous therapy. Subcutaneous fluids were administered to infants with mild dehydration and who were not shocked or acidotic. The amount of fluid to be given is calculated on the estimated degree of dehydration and the body weight. Practically speaking the subcutaneous fluids

are usually given in amounts approaching 10% of the body weight. The total amount is given either as half-strength Darrow's solution in 2½% dextrose water, or half the quantity is given as half-normal saline in 2½% dextrose water and the other half as Darrow's solution. The fluids are administered into two sites, usually the lower part of the axillae. Hyaluronidase is given to promoted spread and absorption.

Intravenous fluids are administered to all severely dehydrated infants or those presenting with dehydration and signs of circulatory collapse or acidosis. Most of the infants receiving intravenous therapy are kept on the drip from 12 to 24 hours whilst the replacement and maintenance fluid for that period is given. Both replacement and maintenance fluid are given as half-strength Darrow's solution in 2½% dextrose water. Small oral feeds of the same solution are also given. As with subcutaneous fluids, the amount given is calculated according to the degree of dehydration and the body weight. In practice the degree of dehydration is usually taken as 10%, and so in 24 hours the infant gets 50 c.c./lb. body-weight as replacement and 80 c.c./lb. as maintenance fluid, e.g. a total of 130 c.c./lb./day. Intravenous fluids are administered in scalp veins or occasionally, in older children, in arm veins. It has very seldom been found necessary to do a 'cut down' on a vein to administer intravenous fluids.

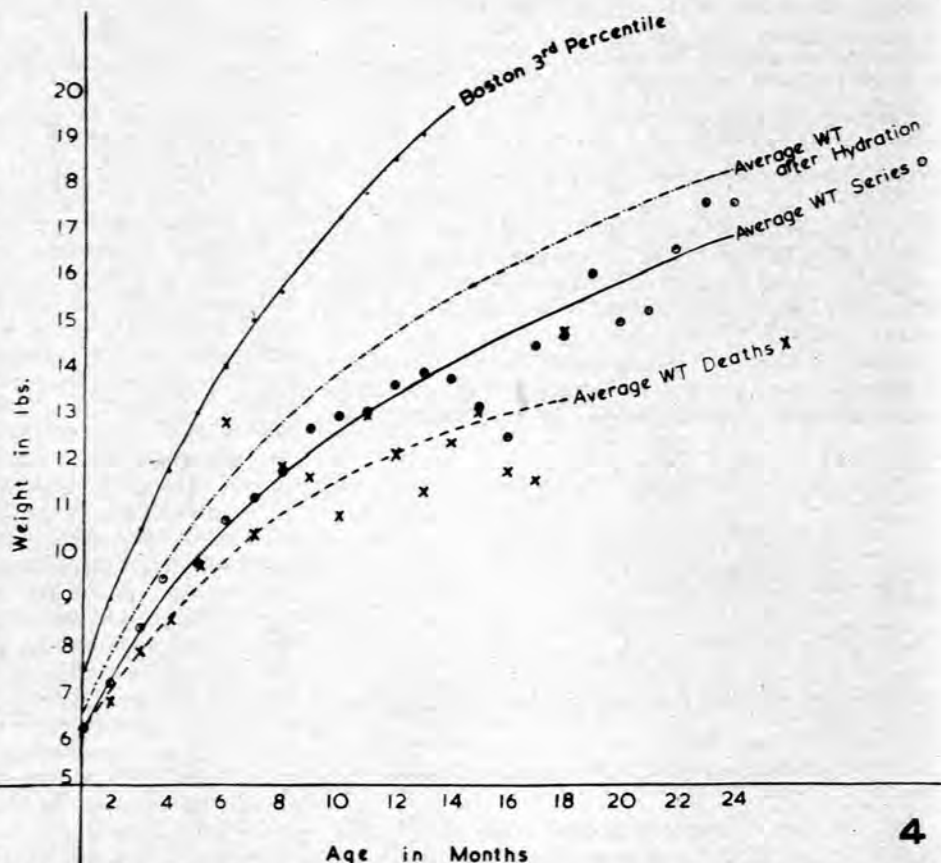


Fig. 4. Gastro-enteritis with dehydration: average weight by age (in months) of cases, cases after hydration and deaths. Boston 3rd percentile curve shown for comparison.

The resuscitation room. This is a large room in the out-patient department fitted with several examination couches with overhead beams attached from which intravenous drip sets may be hung (Fig. 5). All non-European cases of gastro-enteritis with dehydration presenting at the hospital are initially treated in this room. The mother or responsible relative stays with the child while parenteral fluids are being administered and takes the infant home when it is rehydrated. The infant is seen the following day and progress checked; if indicated, further parenteral fluids are given. Only a small percentage (9.8%) eventually have to be admitted to the wards for in-patient treatment.

Results of Treatment

Most of the cases recovered within 3 or 4 days of rehydration, and required no further treatment. In 17% of the cases repeated parenteral fluid infusions were required for correction of recurrent dehydration. Of the 1,024 cases on which we had adequate follow-up record, 97 died. Of these children, 68 died at home or in the out-patient department. Very few died while actually receiving parenteral fluids. There were also 29 who died after admission to the wards. This gives a total mortality rate of 9.5% for all cases of gastro-enteritis with dehydration treated during the 6 months under review. In the 923 cases treated solely as out-patients, there were 68 deaths, giving a mortality rate of 7.4%. In the 101



Fig. 5. Resuscitation room for out-patients at the Red Cross War Memorial Children's Hospital, showing couches with overhead beams for intravenous drip sets.

patients admitted there were 29 deaths giving a mortality of 28.7% (Table II).

TABLE II. MORTALITY

		% Mortality
Total number with known outcome ..	1,024	
Total number of deaths	97	9.5%
Number treated solely in out-patient department	923	
Number of these who died	68	7.4%
Number of cases admitted	101	
Number who died after admission	29	28.7%

It is difficult to find mortality figures to compare with our findings. Practically all published figures relate to gastro-enteritis with or without dehydration and not as in our series only to those with dehydration. Before parenteral fluid therapy was introduced shortly before 1930, the death rate in infants suffering from gastro-enteritis was about 50%.⁸ After its introduction the mortality rate was rapidly halved and there has been a steady decline in mortality with the introduction of antibiotics and isolation techniques. The mortality in Toronto is now less than 1% and other series from Western European countries show an equally low death rate. In the trials of the Medical Research Council on gastro-enteritis (1953), the mortality rate was 3%.¹⁰ Among European in-patients at the Red Cross War Memorial Children's Hospital in 1958 there were no deaths.

Non-European in-patient mortality figures reported from other centres vary from 25%¹¹ to 44%¹² and are comparable with the mortality in in-patients in this series. The children that are admitted are the most severely ill, and often have contributing parenteral illness or complications of water

and electrolyte imbalance. The mortality rate for out-patients (7.4%) compares favourably with that obtained in a similar series done at Groote Schuur Hospital,⁴ where the mortality was found to be 13%, even though that study included infants without dehydration. In that series the only parenteral fluids given were subcutaneous infusions, and this supports our impression that intravenous fluids are more effective than subcutaneous fluids.

The largest number, approximately 50% of the total number of deaths, occurred in the age group under 5 months. There were no deaths in this series after the age of 18 months, and very few over the age of 1 year. Only 11 deaths occurred in the age group 13 - 18 months. Heavier mortality took place in the age group 10 - 12 months. Malnutrition is a possible, and indeed a highly probable, contributing factor here (Fig. 3).

As can be seen from the figures presented, a large number of children severely ill with gastro-enteritis were treated during the 6 months under consideration. When the social background and state of nutrition of these children is taken into account, the total mortality rate of 9.5% is satisfactory and surprisingly low. As the number of non-European in-patient hospital beds cannot possibly cope with the number of children presenting with gastro-enteritis and dehydration, a resuscitation room in the out-patient department is a vital and indispensable part of the arrangements required to cope with the situation. This type of treatment could also be given at some peripheral clinics and so relieve the hospitals of a considerable part of their very heavy case load. It would not be necessary for specially skilled medical staff to give the treatment, since peripheral clinics would almost certainly deal with the infants at an earlier stage of their illness, when it would be sufficient to inject the fluid subcutaneously. Even the more seriously dehydrated and shocked children would benefit by receiving such treatment while awaiting transport to the bigger centre where, if no other arrangement could be made, out-patient intravenous therapy could be undertaken. Further daily subcutaneous infusions could then be given at the peripheral clinics, if thought necessary. Such an arrangement would clearly be of advantage to all, not least the patient.

SUMMARY

1. The extent of the gastro-enteritis problem in non-European infants at this hospital is indicated—about 9,000 cases presenting in 6 months.
2. The number of these who were found to be suffering from dehydration amounted to 1,185.
3. Only 101 could be admitted; 1,084 had out-patient treatment only.
4. The close relationship between malnutrition and gastro-enteritis is shown. Practically all the patients were malnourished and those children who died showed the grossest degree of malnutrition.
5. Rehydration by the subcutaneous and intravenous routes is discussed.
6. The recovery rate in out-patients is gratifyingly high.
7. The death rate in in-patients was 28.7%, for the series as a whole 9.5%, and for out-patients alone 7.4%.
8. A plea is made for the initiation of peripheral clinics, where much of the rehydration work could be undertaken, with consequent benefit to all concerned.

ADDENDUM

Since the completion of this paper, attempts have been made to trace the 161 cases in which the outcome was unknown. Over 100 of these children have been traced and the mortality rate among them was lower than that for the series as a whole, being about 5%. It transpired that many of these infants had been referred to hospital from peripheral clinics for parenteral fluid therapy. Follow-up was undertaken at the clinic and the child was not sent back to hospital. In other cases the infant had responded to treatment so rapidly that the mother did not consider it necessary to bring the child back.

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