Acute Gastroenteritis in Infancy

A PRACTICAL APPROACH WITH SPECIAL EMPHASIS ON FLUID REQUIREMENTS

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All medical officers working in hospitals in Africa are confronted with the problem of the African infant, fat and well fed, usually on breast milk, who presents with one or two days' history of diarrhoea with or without vomiting.

For the purpose of this paper it is not proposed to deal with the infant with chronic diarrhoea, usually malnourished, who presents a far more difficult problem. In the author's experience effective treatment in these cases in a busy, understaffed and overcrowded hospital proves almost impossible; but the fat, well-nourished baby with an acute history is in a different category, and often a few hours' active treatment will dramatically resuscitate a near moribund infant.

Assessment of Cases

The clinical picture varies from that of an infant who is bright-eyed and active and obviously not seriously ill to the infant with sunken eyeballs, a hazy stare, acidotic breathing, loss of skin turgor, limpness, cold extremities and a feeble or absent peripheral pulse. The former may be treated as an outpatient; the latter needs intravenous replacement of fluids.

The important signs of dehydration are well known. One is often misled, however, into believing that the infant is in a reasonable state of water and electrolyte balance by the absence of one particular positive finding. It must be stressed that in coming to a conclusion all one's findings should be assessed together and no single sign should outweigh another. Emphasis is laid on the following:

Skin Turgor.—This sign can often be misleading. In many fat infants the absence of loss of elasticity or "rebound" when a fold of abdominal skin is pinched between the fingers belies the actual clinical state. In other words, near normal skin turgor should not rule out severe water and electrolyte inbalance.

Pulse.—There is no point whatever in treating an infant with no perceptible radial pulse with anything but intravenous fluids. A good pulse, on the other hand, should not necessarily lead one to believe that the infant's condition is mild. Recently, working in an endemic malarious area, the author has been most impressed by cases in which the radial pulse was easily palpable and of apparently good volume. Other clinical signs, however, showed that there was considerable water and electrolyte inbalance.

Muscular Tone.—Generalised atonia is indicative of a severe constitutional disturbance. An infant of six months or over with atonic limbs, and whose head flops back when it is pulled into the sitting position by the arms, is severely ill and needs intravenous or at least subcutaneous replacement of fluids. It has been noted that such a limp infant may have both a good pulse and a normal skin turgor.

Breathing.—Heavy acidotic breathing, in the absence of chest signs, is also an extremely important finding and should prompt early intravenous therapy with molar/6 lactate solution.

Abdominal Distension.—The fact that the infant's diarrhoea has ceased for several hours should not fill one with complacency. A paralytic ileus may have developed and increasing abdominal distension will result. Intravenous fluids with potassium for these cases is imperative.

The "Look" of the Infant.—Those with long experience in treating sick infants probably need no more than a glance to determine whether the child is in need of urgent treatment or not. An effort should be made by the clinician to capture this picture in the mind, as it is of great value.

Treatment

The object of treatment in acute gastroenteritis is:—

(a) To replace fluid loss.
(b) Provide daily fluid requirements.
(c) Rest the bowel as much as possible, especially in the first 24 hours.
(d) Provide the appropriate drugs to combat the infection.

Depending on the severity, treatment may be classified under five headings:

(1) A sulpha drug, usually thalazole, with breast feeding or clear fluids for 24 hours, treated as an outpatient.

(2) A sulpha drug or broad spectrum antibiotic, plus half strength Darrow's/2½ per cent. dextrose water feeds at three- to four-hourly intervals for 24 hours, followed by skim milk and later full feeds.

(3) The same as (2) above, except that fluids are given by intragastric drip either continuously or in three- to four-hourly bursts.

(4) A broad spectrum antibiotic by mouth plus replacement of fluid lost by subcu-

taneous drip followed by (2) or (3) above.

(5) A broad spectrum antibiotic by mouth, intramuscularly or intravenously, with intravenous fluids as the only intake initially, followed later by skim milk and full feeds.

All groups should, in addition, receive antimalarial treatment in endemic areas. Where facilities are available for stool culture the appropriate antibiotic is used. Microscopic examination of the stool will reveal whether there are any bowel pathogens that require specific treatment. It should be noted that fungi, protozoa and the tubercle bacillus can cause acute gastroenteritis in its most fulminating form.

For practical reasons, mainly lack of supervision, treatment by gastric drip is considered unsatisfactory in a district hospital, but may be found very useful where adequate staff is available. Fluid requirements are assessed as in oral therapy below.

Three lines of treatment are considered in detail: oral replacement for mild, subcutaneous for moderate and intravenous for severe dehydration.

(a) *Oral Therapy*

A solution containing half strength Darrow's* with 2½ per cent. dextrose water is the only fluid given in the first 24 hours.

Replacement.—For practical purposes an infant with mild dehydration is assessed as having lost 5 per cent. of its body weight, i.e., 50 ml./kg. (25 ml./lb.), or just less than 1 oz./lb.

Maintenance.—An infant under one year of age requires 150 ml./kg. (80 ml./lb.), or just over 2½ oz./lb. per 24 hours. Thus in the first 24 hours an infant weighing 10 lb. should get 35 oz. of fluid. If possible, the replacement volume (10 oz.) and half the maintenance volume (12½ oz.) should be given in the first 12 hours.

Where nursing is a problem and an often ignorant mother has to be persuaded to give the child its requirements, a satisfactory scheme is to divide the 24-hourly amount into four parts and tell the mother that each amount must be given before a certain time. Stress should be laid on frequent small feeds. After 24 hours, if the condition of the infant is found to be satisfactory, step by step increases in the strength of the feeds is made through skim to breast or cow's milk. If diarrhoea persists after 24 hours, it may be advisable to continue half strength Darrow's solution for another 12 hours, but this treatment should not be extended for more than 48 hours without increasing the calorie intake.

Some authorities would stress the value of breast milk in the treatment of gastroenteritis and use clear fluids only to supplement the feeds or replace the deficit. The author believes that when dealing with the average African mother it is more important to break the routine completely, in an effort to prevent the surreptitious introduction of extra hazards such as porridge or tea into the treatment.

(b) *Subcutaneous Therapy*

The object in this form of treatment is to replace the deficit subcutaneously and continue maintenance as in (a) above. This form of treatment can be given to an infant as an outpatient where a bed is not available. If a "Y" form of drip set (with two needles at the receiving end) is not available, an ordinary drip set with a small-bore needle is quite adequate. The chest wall is the best site for giving subcutaneous fluids. Hyalase must be added to the fluid to aid diffusion. Depending on the size of the infant, 400 to 600 ml. may be given between the two sides of the chest wall and the complete amount may be given within an hour. It must be stressed that this form of treatment is only of benefit when the infant's circulation is capable of absorbing the fluid. Failure to improve the infant's state of hydration is not due to the method itself, but to incorrect clinical assessment.

Replacement and Maintenance.—An infant requiring subcutaneous fluids is assessed as having lost between 5 and 10 per cent. of its body weight (see (a) above and (c) below). Maintenance is as above. For the type of fluid to be used, see (c) below.

(c) *Intravenous Therapy*

It may be argued that, in the absence of adequate trained supervision, intravenous infusions should be avoided if possible. The author is firmly convinced that while there are dangers in this procedure, these are far outweighed by

* Oral Darrow's solution: Potassium chloride, 26 g. (6 dr. 56 gr.); sodium chloride, 40 g. (1 oz. 2¾ dr.); sodium lactate 70 per cent., 60 ml. (2 fl. oz.); aq. chloroform, ad 1,000 ml. (2 pints 1 fl. oz.). This makes up a solution that must be diluted ten times with ordinary water to produce Darrow's solution. Equal parts of Darrow's and 5 per cent. dextrose water are mixed to get the final half strength solution. Ready-made tablets which are added to half a pint of water are obtainable from Geddes Ltd., Salisbury, and are the most satisfactory way of making up the solution.

the advantages of direct replacement of a depleted circulation. In practice it has been noted that a dramatic-looking drip going into an infant's scalp seems to stimulate increased vigilance from the staff. In addition, recalcitrant vomiting and diarrhoea must cease once oral feeds are discontinued.

Armamentarium.—It should be possible to ban almost completely the outmoded "cut down." The method of choice in infants is by using the paediatric scalp vein set, as produced by Baxters, and entering any vein that is made visible by occluding the venous return. In practice the scalp is found to be the area where a vein is most easily found, but the back of the wrists should not be neglected, especially in premature infants who possess surprisingly large veins in this area. Besides the scalp vein set, a conventional drip set and the following solutions are required:

(1) 150 ml. bottles of Darrow's solution.

(2) 150 ml. bottles of N/2 saline in 2½ per cent. dextrose water.

(3) 150 ml. bottles of M/6 sodium R-lactate.

(4) 150 ml. or 1 litre bottles of 5 per cent. dextrose water.

Technique of Setting Up the Drip.—Except for the occipital part of the scalp, the rest of the head is shaved as cleanly as possible. In dark-skinned infants especially, veins are often not easily seen, but with a little patience one can usually be found. An attendant holds the head firmly and places the length of one finger firmly against the scalp between the ear and the outer angle of the eye. Veins are usually easiest to find in this area. Gentle tapping over a vein will make it stand out more clearly. In particularly fat infants all that may be seen is a dark line which, surprisingly, is often entered without difficulty. When the infant is very shocked arteries may be mistaken for veins, but can usually be seen or felt pulsating. The *gentle* technique of getting the needle into the vein can only come with experience, but several points are worthy of mention.

(1) A pair of mosquito forceps holding the needle may be found an advantage over thumb and forefinger.

(2) The skin over the area should be stretched with the free hand to prevent movement of the vein.

(3) Always proceed very slowly forward with the point of the needle under the skin, and watch the tubing behind the needle. Immediately there is reflux of blood, *do not* attempt to insinuate the needle further, as the wall of the vein will often be pierced on the other side.

(4) With a small strip of adhesive, anchor the part of the needle under the skin.

(5) Fold about one foot of two-inch plaster of Paris into a convenient size and, after wetting, mould the plaster under and around the hilt of the needle so that the latter is at its optimal angle in relation to the vein. A loop of the tubing is then fastened securely to another part of the scalp. When the plaster of Paris is dry, only exceptional manhandling can alter the position of the needle.

(6) If an artery has been entered by mistake and the child is severely shocked, the drip may run quite satisfactorily until the blood pressure has risen, when a vein will probably be found without difficulty.

(7) In a difficult case one may be left with several haematomas on the scalp, but these should not cause alarm, as they soon disappear.

(8) In a matter of extreme urgency the external jugular vein may be entered with a syringe and two-way tap or even with the scalp vein needle itself.

(9) After the initial spasm of the vein has worn off, the drip will proceed at a remarkable rate. Despite the internal dimensions of the needle, a blood transfusion may be given through this set, though not for any length of time.

Replacement.—An infant requiring intravenous fluid is assessed as having lost 10 per cent. of its body weight, i.e., 100 ml./kg. (50 ml./lb.).

Maintenance.—This is as before at 150 ml./kg. (80 ml./lb.).

Thus a 10 lb. infant will require a total of 1,300 ml. fluid in the first 24 hours, followed by 800 ml. daily maintenance.

The usual practice is to start with Darrow's solution (150 ml.), run as fast as it will go, followed by N/2 saline/2½ per cent. dextrose water either at the same rate or a little slower. If there is marked acidosis the initial bottle is of M/6 sodium R-lactate and given to a maximum of 30 ml./kg. (15 ml./lb.). Further lactate may be given later if there are still signs of acidosis. After the first two 150 ml. bottles are completed, the infusion is continued with 5 per cent. dextrose water and the condition of the infant re-assessed. The litre bottle of 5 per cent. dextrose water may be discontinued temporarily to give further electrolyte as required. A useful guide as to how fast to set the drip is based on the following formula (using Baxter drip sets):

Drops per minute X 6 = ml. per hour.

Thus if the drip is set at 10 drops per minute, 60 ml. will be delivered to the infant every hour.

Where electrolyte values are unobtainable it is safe to give an infant of 10 to 15 lb. 150 ml. Darrow's solution and 150 ml. N/2 saline/2½ per cent. dextrose water and the rest as 5 per cent. dextrose water per 24 hours. A larger infant should receive an extra 150 ml. Darrow's solution.

Of the four types of fluid mentioned above, 5 per cent. dextrose water is the only solution that should not be given subcutaneously, N/2 saline being used instead.

Five per cent. dextrose in normal saline, which has been extensively used in many district hospitals, should *never* be used in treating infants at any time.

Diarrhoea usually stops and stools become less frequent in the first 24 hours on intravenous fluids. If there has been a good response, oral feeds of half strength Darrow's solution or half strength skim milk may be started while the drip continues. When it becomes apparent that the oral feeds are being retained and utilised, the intravenous replacement is discontinued. In acute gastroenteritis it is seldom necessary to continue intravenous fluids for longer than 24 hours.

When there is any doubt as to whether fluids should be replaced subcutaneously or intravenously, it is a good rule to take the extra trouble and use the intravenous route.

It should be noted that infants suffering from conditions other than gastroenteritis may need parenteral fluid replacement, especially in hot areas of Africa, where excessive sweating, hyperventilation and inadequate fluid intake may result in severe dehydration. These infants should be treated in the same way except that potassium (i.e., Darrow's solution) should be avoided altogether.

Conclusion

Acute gastroenteritis in an otherwise fit infant is a common problem in Africa and is probably responsible for a large percentage of the total infant mortality rate. It is vitally important to be able to recognise when energetic treatment is required. Antibiotics have their place and must always be given, but they should not be regarded as the panacea. Rehydration must be the basis of treatment. Once this has been obtained, more than half the battle is over and it is then possible to search for the cause of the infection, should symptoms persist, in the knowledge that the infant's own resistance has been given full opportunity to assist the recovery.

Summary

A brief guide to the clinical assessment of acute gastroenteritis in infancy is made. Oral, subcutaneous and intravenous treatment is discussed and a practical approach to the technique of intravenous therapy is dealt with in detail.

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superstitions and fetishes, the air of mystery, th absurdities of diet and the like.

But in the present connection it is desirab to consider the necessity of planning the athlet career, the factors of encouragement, possibl deliberate retardation in the aim to produc ultimate maximum efficiency.

This demands the investigation of the so-calle "burnt-out athlete."

The term is applied to the schoolboy prodig whose early performances suggested promise superlative achievement in adult life, but who failure to live up to his promise is only t frequent. The pages of athletic history are fu of such cases. The explanation advanced is th a limited store of physical energy has becor prematurely exhausted—a sort of physical ins vency and bankruptcy when the call for payme is made; or perhaps some irreparable stra acquired at a critical period of development.

The idea is attractive. It provides the you athlete with an explanation that confers discredit but rather the reverse, and his admir with an excuse for their inadequacy as prophe

In not a few instances the boy's capabil may have been over-rated. Transferred fr the status of a whale in the small pond of sch life to that of a minnow in the river of university and still more the ocean of world-w competition, his real ability is revealed. I accepting a genuine superlativeness, the mist made in interpretation is that of presum athletic development to be one of continu uninterrupted improvement, whereas in my perience the graph described by such devel ment may be of varying type.

Rarely, the prodigy does conform to the t that improves continuously throughout the wh of his career. The few examples that may included have generally (not always) taken serious athletics at a relatively advanced ag a fact that provides food for thought for th responsible to schoolboys in respect to postpo ment. But of course this is a matter bey proof by performance.

In many instances there is a rapid rise efficiency in adolescence, a peak is reached improvement is at an end. This is the pen of over-precocity, of premature maturity, a evident on occasion in an intellectual spher

But there is a third type which is, I th more frequent than is generally recognised. graph shows evidence of improvement by ri to a certain level and then remaining horizo with a slow descent. This generally hap