Abstract:

The clinical and epidemiological spectrum of acute gastroenteritis is likely to change dramatically in the face of rotavirus vaccination. Acute gastroenteritis will become less common and severe and other viruses may predominate, such as norovirus. Oral rehydration is generally underemployed in the management of gastroenteritis. A greater emphasis on "frontloaded" care in the waiting room, the use of newer antiemetics and more prescriptive oral fluid management will reduce the need for inpatient care. When this fails, nasogastric administration of fluids is a valuable but underutilized treatment. Nasogastric rehydration is as effective, quicker, and easier to employ than intravenous rehydration at the expense of a less pleasant but short procedural experience for the child. It should be strongly considered when the insertion of an intravenous cannula is anticipated to be difficult.

Keywords:

gastroenteritis; rotavirus; oral rehydration; antiemetics; nasogastric rehydration; intravenous rehydration

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A Practical Guide to Successful Rehydration

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Acute gastroenteritis (AGE) is a common problem in acute pediatric practice. Before the introduction of routine rotavirus vaccination, this organism alone accounted for 20 to 60 deaths, 55 000 to 70 000 hospitalizations, and 205 000 to 272 000 emergency department (ED) visits in the United States each year.[1] Morbidity and mortality usually relates either to severe and undermanaged dehydration or electrolyte disturbance, although inappropriate fluid therapy represents an additional risk. This review will focus on the likely impact of rotavirus vaccination on the epidemiology of AGE in the ED, the treatment of AGE accompanied by mild to moderate dehydration and a discussion of the use of nasogastric (NG) rehydration.

A PRACTICAL APPROACH TO GASTROENTERITIS MANAGEMENT

The clinical scenario of a child with vomiting and fever followed by diarrhea and varying degrees of dehydration is familiar to the pediatric clinician. Rotavirus has been historically the most commonly identified causative agent,[2] although increasing evidence shows that the widespread introduction of rotavirus vaccination in 2006 is having a dramatic effect on the prevalence and severity of rotavirus disease.[3-5]

This will inevitably change the spectrum of acute gastrointestinal disease for EDs in three main ways:

1. The absolute number of children presenting to hospital EDs with clinical gastroenteritis will decrease—children will experience fewer rotavirus infections, and those who do will have milder disease. In addition, the median age of presentation will temporarily increase as the

vaccination is rolled out to the preschool age group, leaving older children protected only by natural and herd immunity. These assertions are supported by data from Royal Children's Hospital, Melbourne, Australia (personal communication, S Hopper, March 31, 2010) which show both the numbers of children diagnosed with clinical gastroenteritis and subsequent admission rate has approximately halved since a peak in 2006. In addition, the median age of admitted patients has risen from around 18 months to 3 years of age.

2. It is likely that other viral enteric pathogens, such as norovirus, will account for a greater percentage of ED visits. In some surveillance literature, this is the second most common agent.[6,7] The epidemiology of norovirus[8] disease is probably different from rotavirus:[9] droplet infection, transmission by fomites and a very low infectious dose are also characteristic of norovirus. Thus norovirus often results in large outbreaks. In addition, norovirus figures prominently in adult surveillance data, whilst the frequency of rotavirus tapers off throughout childhood. Perhaps the age distribution of gastroenteritis will even out across the pediatric age cohorts. Clinically, when compared to rotavirus infection, norovirus may produce a shorter, sharper period of vomiting,[10] more abdominal pain, and proportionately less diarrhea,[11-13] although some reports show very little difference between these viruses.[14] It may be that future management priorities for children with gastroenteritis will reflect these differences; the diagnosis and management of undifferentiated pain, nausea and vomiting may become more important, and severe dehydrating diarrhea will be less problematic.
3. Other conditions that resemble gastroenteritis in their early phases will become proportionately more common and "typical gastroenteritis" will become less common. Physicians will need to maintain or even increase their clinical suspicion around "atypical" presentations of conditions such as intussusception, appendicitis, sepsis, meningitis and raised intracranial pressure. Furthermore, coupled with the likely changing nature of viral gastroenteritis, clinical acumen will play an even greater role in the management of the gastrointestinal presenting complaint.

THE MANAGEMENT OF "SIMPLE GASTROENTERITIS"

The first step is to correctly diagnose gastroenteritis, that is, exclude alternative diagnoses. Once a clinician has determined that the diagnosis of gastroenteritis is likely, ED management depends on the estimated level of dehydration and the likelihood of success of various hydration strategies.

Clinicians need to appreciate that the clinical estimation of dehydration is difficult. Overestimation of the degree of dehydration is very common.[15] Few children have a recent pre-morbid weight to guide accurate determination of dehydration and so clinical assessment remains the next best guide. Many classification schemes exist and most suggest three levels of dehydration. Roughly speaking they are: (1) none or mild dehydration, (2) moderate dehydration, and (3) severe dehydration/shock. In these schemes, no single symptom or sign stands as a reliable indicator, and combinations of signs act as a guide at best. The British National Institute for Clinical Excellence (NICE) guideline[2] discusses and summarizes prior schemes and proposes a new scheme (Table 1) which recognizes many of the limitations in the accurate determination of the degree of dehydration. It attempts to reflect the continuous spectrum of the level of dehydration and quite appropriately places this assessment scheme as a guide to fluid management.

When it comes to the likelihood of success of a given rehydration strategy, clinicians need to consider a multitude of factors. A cautious approach is warranted in the face of a young infant, fulminant disease or children with relevant cardiac, gastrointestinal or renal co-morbidities. Newer antiemetics can increase the likelihood of success.[16,17] There is increasing evidence that ondansetron has a role in reducing vomiting, improving oral intake and reducing the hospitalization rate in the vomiting phase of gastroenteritis. However, without proper parental education and a commitment to an assertive fluid administration strategy, the success of ondansetron alone may be limited.

Clinicians will be familiar with the ED presentation of the child who is vomiting and "cannot keep anything down" but whose parents use well intentioned but inadequate measures to give oral fluids. The inadequacy of these attempts is commonly born out of a few misconceptions that need to be addressed:

- "Fluid will only make my child vomit more and/or have more diarrhea"
- "S/he won't drink from the bottle/cup"

TABLE 1. Clinical detection of dehydration and assessment of severity.[2]

	Increasing severity of dehydration →		
	No clinically detectable dehydration	Clinical dehydration	Clinical shock
Symptoms (remote and face-to-face assessments)	Appears well	Appears to be unwell or deteriorating	-
	Alert and responsive	Altered responsiveness (for example, irritable, lethargic)	Decreased level of consciousness
	Normal urine output	Decreased urine output	-
	Skin colour unchanged	Skin colour unchanged	Pale or mottled skin
	Warm extremities	Warm extremities	Cold extremities
Signs (face-to-face assessments)	Alert and responsive	Altered responsiveness (for example, irritable, lethargic)	Decreased level of consciousness
	Skin colour unchanged	Skin colour unchanged	Pale or mottled skin
	Warm extremities	Warm extremities	Cold extremities
	Eyes not sunken	Sunken eyes	-
	Moist mucous membranes (except after a drink)	Dry mucous membranes (except for 'mouth breather')	-
	Normal heart rate	Tachycardia	Tachycardia
	Normal breathing pattern	Tachypnoea	Tachypnoea
	Normal peripheral pulses	Normal peripheral pulses	Weak peripheral pulses
	Normal capillary refill time	Normal capillary refill time	Prolonged capillary refill time
	Normal skin turgor	Reduced skin turgor	-
	Normal blood pressure	Normal blood pressure	Hypotension (decompensated shock)

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- "It will only make his/her abdominal pain worse"
- "S/he cannot be rehydrated while still vomiting"

"Front loaded" care, that is, ED triage and waiting room strategies to address these concerns are valuable and often overlooked. By establishing basic therapy, they will go a long way in differentiating those who need further care from those who are suitable for discharge and home care. In addition to verbal advice, syringes and oral rehydration fluids, simple measures such as written information, visual reminders, and a parent friendly fluid balance sheet, are valuable.[18] The benefits of these simple interventions are numerous (Table 2).

Where vomiting is a prominent symptom, consideration should be given to processes that facilitate the administration of ondansetron at or shortly after triage; this may be in the form of a standing order for the triage nurse or done in consultation with the ED or fast track doctor.

Children who exhibit no sign of dehydration can generally be managed with continued attempts at

TABLE 2. Benefits of aggressive waiting room rehydration.

Caregivers feel that treatment has been commenced.
The central message of the importance of oral rehydration has been delivered early.
Medical staff have an accurate record of the child's ability to successfully tolerate appropriate fluid.
The documentation of a weight gain during the waiting room stay provides reassurance as to the likely success of continued home care.

oral rehydration. Observation is prudent in circumstances where co-morbidities, patient age, or doubt about the caregivers' ability to provide suitable treatment, observation and follow-up give rise to concerns. When there is diagnostic confidence, a suitable home situation, a clear understanding of the management on the part of the caregivers and access to timely follow-up, outpatient care is indicated. It is helpful to provide caregivers written instructions which include the child's weight (ideally naked if they weigh <10 kg) so the follow-up clinician can objectively assess dehydration. Conversely, children with signs of severe dehydration or shock require immediate intravenous (IV) fluid resuscitation.

The real challenge and area of controversy is the management of children who have some signs of dehydration (ie, those that are probably moderately dehydrated). Of course, rehydration is indicated, but where, how much and by what method?

Certainly, those children who demonstrate the ability to rehydrate orally can be discharged if the conditions listed for outpatient care are met. How can the clinician be confident that oral rehydration can be successful? There is no firm evidence as to what "tolerating sufficient fluids" means, but Reid and Bonadio[19] used 30 to 90 mL of clear fluids (without vomiting) as an endpoint for a "trial of fluids." Other sources are less specific.[20-22] If one were to use a "trial of fluids," a more generous target of 10 mL/kg is reasonable (ie, 100 mL for your average 10-kg 1-year-old child). Keep in mind that this is 1% of body weight and approximates the goal for the first hour suggested in the NICE[2] and American Academy of Pediatrics recommendations.[23]

Under what conditions is it safe to discharge the vomiting child? Not every vomiting child becomes worse and many trials show that oral rehydration can succeed despite the presence of vomiting.[24] However, it has been shown that 10 episodes or more of vomiting during the 24 hours before presentation is a significant predictor of repeat ED visits within 3 days.[25] Nonetheless, a vomiting child whose oral intake is substantial, is keeping up with diarrheal losses and whose caregivers are willing to persist in administration of fluids is well placed to be discharged. For the aforementioned reasons, it is precisely such children for whom "front-loaded" therapy provides a huge therapeutic benefit for the child and allows for improved medical decision making by the ED team.

Why is Enteral Rehydration Underutilized?

The reasons (or perhaps "excuses") for the underutilization of enteral rehydration are well documented (Table 3).[19,26-28] Many of these putative reasons have been disputed in the literature. Atherly-John et al[29] compared both staff and department time for ED based treatment of gastroenteritis. Each was significantly less in the oral rehydration arm (staff time 36 vs 65 minutes, department time 225 vs 358 minutes). In the office setting, Duggan[30] showed that given the direction and equipment, parents were very successful in maintaining hydration, with an unscheduled return visit rate of 11% and an admission rate of less than 1%. In the ED setting, the introduction of a preformatted set of instructions about oral rehydration for parents to use in the waiting room was associated with a statistically and clinically significant reduction in the admission rate (from 22.5% to 5.1%).[18] Even most children with vomiting can be adequately rehydrated with oral therapy. In fact, for many children vomiting eases with oral hydration[21] and, when compared to IV rehydration, vomiting is on average only marginally greater (10 vs 12 episodes per day).[20] Intractable vomiting leading to failure of enteral rehydration is uncommon.[21]

TABLE 3. Barriers to the use of enteral rehydration.

Perceived inconvenience
Fears that oral rehydration takes longer
Lack of confidence in the parents' ability to continue oral rehydration at home
Lack of likelihood of success in the face of vomiting or fluid refusal
Staff preference
Parental or primary caregiver expectation
Perceived lack of effectiveness in moderate dehydration
Cost of oral rehydration solution in the outpatient setting
Fears of lower reimbursement

Interestingly, when given a choice, it seems that parents prefer IV rehydration. Karpas et al[31] surveyed 260 parents who came to the ED with a chief complaint of vomiting and/or diarrhea. After a brief presentation of educational materials, they were asked to indicate their preferred route of rehydration (oral or IV) should their child need it. Nearly twice as many parents chose IV over oral (62% vs 38%). Despite an apparently unbiased presentation of the options, most parents who chose IV rehydration did so due to pessimism about oral rehydration. This perception may in large part be due to the fact that caregivers had already attempted some form of oral rehydration at home and came to the ED for "something more."

Following actual treatment however, parents' attitudes are quite different—satisfaction is much greater with oral rehydration[29] than with IV rehydration (78% vs 38% were highly satisfied with all aspects of their visit). Furthermore, Nager and Wang[22] found on telephone follow up a universal acceptance of NG rehydration, so if caregiver perceptions can be altered only following the intervention, what about ED staff whose preferences and lack of familiarity are certainly crucial factors? Training and support are required for any change as altering entrenched patterns of behaviour requires more than simply conveying the knowledge.[26] Taylor contends that the resistance to change is rooted in the culture of medicine rather than science.[32] The notion that a complex technological based solution is better than a simple "low-tech" approach pervades attitudes, and it is likely that some of the above rationales follow from this. The perceived "set and forget" convenience of IV treatment is likely to be a big driver as well.

WHEN ORAL REHYDRATION "FAILS"

What about the child in whom attempts at oral rehydration in ED have failed (persistent vomiting, inadequate oral intake, excessive diarrhea) or are deemed unsuitable and the clinician feels that more aggressive treatment is warranted. Broadly, there are three choices: continued oral rehydration, IV rehydration and NG rehydration.

Regional differences are great: in the developing world, Europe[33] and Oceania[34] enteral (oral and NG) rehydration is common whilst North American physicians seem to prefer IV rehydration.[26] Moreover, NG rehydration is very uncommon in North America, possibly occurring at a rate of less than 1%.[27]

Enteral vs Intravenous Rehydration

There are numerous controlled trials comparing enteral with IV rehydration. They have been best summarized in two excellent reviews. In 2004, Fonseca et al[35] conducted a meta-analysis which included sixteen trials involving 1545 children and in 2006, a Cochrane review[24] included seventeen trials involving 1811 participants. Both rehydration methods have a high success rate with enteral rehydration failing once in every 25 attempts.[24] The 4% failure rate is offset by developed country evidence which consistently found enteral rehydration to result in shorter hospital stays (by 1.2 days[24] or 21 hours[35]) and reduced rates of admission. This not only reduces costs but also reduces iatrogenic risks.[32] In terms of major complications, seizures were uncommon and not statistically related to the route of administration;[24] death was also uncommon and reported only in low to middle income countries.[35] Less severe complications were also rare - paralytic ileus occurred in 3% of children undergoing oral rehydration while phlebitis occurred in 2% of children treated with IV rehydration. Lastly, total weight gain, duration of diarrhea, serum sodium disturbances, total sodium intake, and total oral intake were equivalent between treatment categories. It should be noted that both reviews combined oral and NG methods of enteral fluid administration for analysis.

Nasogastric Rehydration

Of the numerous oral rehydration papers, only 3 studied NG rehydration as the sole oral rehydration intervention,[20,22,36] and another 4 employed a mixture of NG and oral rehydration.[21,37-39] The 5 English-language articles are summarized in Table 4.

The conclusions drawn from review of these articles are similar to those stated in both Fonseca's review and the Cochrane review in terms of efficacy, safety, and failure rate. Hospital length of stay and costs are generally lower but are, of course, system dependent. They also show that NG treatment can be employed successfully when attempts at oral treatment fail; IV rehydration is by no means inevitable. Finally, the Iranian study demonstrates that NG rehydration is an option even in the face of severe dehydration, a point to be kept in mind when IV insertion is difficult or impossible.

Nasogastric Rehydration—Potential Problems

The potential problems of NG rehydration are:

1. An exacerbation of vomiting: Intractable vomiting from NG rehydration is uncommon (Nager and Wang, 1/46; Gremse, 1/12; Sharifi, 1/236; Mackenzie, 0/14).[20-22,36] Furthermore, it is unknown if ondansetron administration would reduce these events even further.
2. Unrecognized misplacement of the NG tube: The exact incidence of NG tube misplacement in pediatric gastroenteritis is unknown but it has been reported to occur in 4% of adult critical care patients.[40] In the pediatric non-critical care setting low oesophageal placement is not uncommon (7%; 95% CI, 6%-9%), but airway placement is extremely uncommon (0%; 95% CI, 0%-1%).[41-43] Clinical methods of detection have sufficient

TABLE 4. Summary of IV vs NG/oral rehydration trial literature.

Study	N, age	Intervention	Outcomes: no difference	Outcomes: difference	Findings
Sharifi et al[36] Iran 1985 Inpatients	n = 470 <18 months moderate/ severe dehydration 20% were shocked, 1/3 were malnourished	**IV :** (n = 235) Ringer's lactate bolus 20-30 ml/kg Then replacement over 24 hours **Enteral:** (n = 234) ORS via NG (40 ml/kg/hour for 6 hours), then 10 ml/kg/hour for 24 hours	Periorbital oedema	Fluid and electrolyte intake Electrolyte disturbances Resolution of acidosis Vomiting Mortality Weight gain Duration of diarrhoea Seizures One child "failed" nasogastric rehydration	Greater in NG group Fewer in NG group Quicker in NG group Less in NG (19% vs 30%) Less in NG (2/234 vs 5/234) Higher in NG (8.9% vs 7.2%) Shorter in NG (4.8 vs 5.5 d) Fewer in NG group (2 vs 6) 5 children in the IV group developed phlebitis
Vesikari et al[39] Finland 1987 Inpatients	n = 37 <5 years old moderate dehydration	**IV:** (n = 15) Modified Ringers, 35 – 40 ml/kg, over 6 hours plus 5% dextrose at maintenance **Enteral:** (n = 22) "ORS-60" (65 – 80 ml/kg over 6 hours);Then 30 ml/kg for 6 hrs **13/22 received NG fluids**	Total amount of fluid input Total Na received Serum electrolyte changes Rate of rehydration Correction of acidosis Total duration of diarrhoea	Weight gain Resumption of feeding at 12 hours Hospital length of stay Discharge weight loss 2 in NG group switched to IV fluids	1.6% greater in NG group 17/22 (NG) vs 6/15 (IV) 2.7 (NG) vs 3.9 (IV) days lower in NG group 4 in IV group had NG inserted to assist with refeeding
Mackenzie and Barnes[21] 1991 Australia Inpatients	n = 111 3-36 months old moderate dehydration	**IV:** (n = 52) 5% dextrose, 0.18% saline with K, deficit replaced over 24 hrs, plus maintenance **Enteral:** (n = 52) ORS Deficit replaced over 6 hours, plus maintenance fluid **14/52 received NG fluids**	All recovered completely Rehydration at 24 hours Number of stools Acid-base and electrolyte Status changes	Rate of rehydration vomiting 2/52 in NG group required IV fluids	Slower in NG group More frequent in NG group (52% vs 22%) 7/52 in IV group developed phlebitis
Gremse[20] 1995 United States outpatients	n = 24 2- 19 months old mild to moderate dehydration	**IV:** (n = 12), 5% dextrose, 0.45% NS, +/- K, rate unspecified **Enteral:** (n = 12) Rehydralyte, deficit replaced over 6 hours	Request for change in therapy Rate of rehydration Duration of vomiting	Hospital length of stay Cost of hospitalization Duration of diarrhoea 1/12 in NG group received IV fluids	NG group shorter (1.8 vs 2.8d) NG cheaper ($2831 vs $1318) NG group shorter (23 vs 44 h) Each child in IV group had 1.9 IV catheters
Nager and Wang[22] 2002 United States ED patients	n = 100 3-36 months old moderate dehydration	**IV**: (n = 44), normal saline, 50 ml/kg over 3 hours. **Enteral:** (N = 46), Pedialyte, 50 ml/kg over 3 hours	Discharge from ED Fluid input/output serum Electrolyte changes (clinically significant) Rate of return to ED	Extra NG/IV attempts weight gain Rate of vomiting Cost per treatment episode Readmission	2 (NG) vs 27 (IV) Lower in NG group (2.2% body weight vs 3.6%) Higher in NG group NG cheaper ($526 vs $643) 3 in NG, 0 in IV group

ORS, oral rehydration solution; NS, normal saline; K, potassium, Na, sodium.

reliability to obviate the need for routine radiography[24], although it is fair to say that experience in insertion and verification are very important.

3. Difficulty in NG insertion: repeated insertion attempts occur at a rate of 4% to 6%.[22,43] Absolute inability to insert the tube is rare. It is the author's opinion that NG insertion is easier in infants and toddlers who struggle less and are easier to contain, and thus, insertion becomes more difficult after 3 years of age. Table 5 describes the NG insertion procedure.
4. Nasogastric tube falling out: Only occasionally does the NG tube come out during vomiting or fall out.[24]
5. Discomfort related to NG placement: the issue of pain and discomfort related to NG insertion in children is poorly studied and opinions on the experience of NG insertion range from "usually well tolerated"[44] to "somewhat unpleasant or distressing."[2] Others compare the negative aspects of NG insertion to IV insertion: "in our experience IV catheter insertion is more painful, uncomfortable and restrictive";[27] "NG rehydration may be regarded as invasive and unpleasant but maybe less so than the IV route."[45] Where evidence exists, it seems that NG insertion is indeed more unpleasant than IV. The Babl et al[46] survey of staff at an Australian tertiary pediatric ED found NG insertion to be the most distressing of all commonly performed procedures in their opinion (7.8 on a 10-point scale); IV insertion however was not far behind at 7.3. This difference is small and of uncertain clinical significance. On the other hand, IV insertion was rated as being more painful (5.2/10 vs 4.6). Our yet to be published data found the FLACC (Face, Legs, Activity, Cry, Consolability) scores with NG insertion to be on average two points higher than those of IV insertion. In a small randomized, controlled trial looking at the role of nebulized lignocaine,[47] assessment of videotaped NG

insertion showed the distress was in general severe; FLACC Faces, Legs, Activity, Cry, Consolability scores were 9.8 and 9.5/10 in the placebo and lignocaine arms, respectively. In the adult emergency literature, where self-rated pain scores are more easily obtained, NG insertion is rated by patients as the most painful of all ED procedures—more so than incision and drainage of abscess or fracture reduction and much more painful (4.6/10 on a visual analogue scale) than IV insertion (1.9/10).[48]

6. The inability of the child to regulate fluid intake
7. Local trauma with NG tube placement

Intravenous Rehydration—Potential Problems

The downsides of NG insertion need to be balanced against the potential problems associated with the use of IV rehydration. Repeated attempts at IV insertion are not unexpected. Nager and Wang[22] reported that one third of patients underwent more than one insertion attempt and in the Alabama study of Gremse,[20] patients in the IV arm required an average of 1.9 IV cannulas over 2.8 days. The number of actual attempts at insertion was not reported. In the wider literature, the rate of successful IV insertion at first attempt varies from 53% to 90%, depending on the operator and patient.[49] A prospective pediatric ED study found that insertion was more difficult in younger patients, those with impalpable veins and those with veins that are harder to see,[50] just the sort of patients with gastroenteritis who need rehydration. In addition, phlebitis occurs at a rate of approximately 2%.[24] Some authors contend that IV rehydration increases the chance of fluid overload and electrolyte disturbance as the child's gastrointestinal homeostatic mechanisms are bypassed. This is an attractive first principle proposition without much evidence to support it. Certainly, serum electrolyte testing is

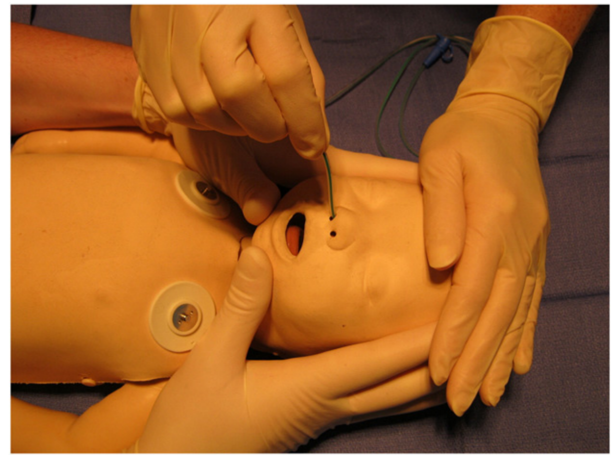

Figure 1. Positioning the patient. The assistant holds the shoulders down and the head still, the operator inserts the tube directly posteriorly.

TABLE 5. Procedure description for NG tube insertion.

- Inspect the nostrils
- Position the child supine, with neck neutral or flexed
- Steady the head and restrain the arms (Figure 1)
- Measure for insertion depth: nose to tragus to xiphisternum
- Insert the lubricated tube, directly posteriorly
- On meeting resistance at 5-7 cm, pause and wait until the child swallows (a pacifier can encourage swallowing)
- Advance the tube further
- At the measured length, secure the tube close to the nose (no free loop)
- Hook the tube around the ear, and secure to/under clothes (Figure 2)—mittens may be required
- Confirm position with pH testing (auscultation is unreliable)
  - pH of aspirate <4 confirms correct position
  - pH of aspirate >4 may be due to malposition, milk in stomach or acid suppression drugs
  - If no aspirate, advance the tube 1-2 cm and try again
  - If in doubt, strongly consider x-ray verification

Suspect respiratory insertion
- With insertion: coughing, color change, choking
- With starting fluids: coughing

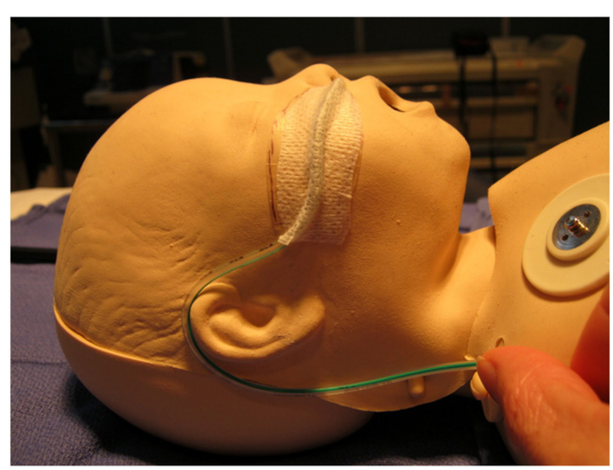

Figure 2. Securing the tube. Tape the tube close to the nose, run it around the ear, and secure it to (or under) the clothes.

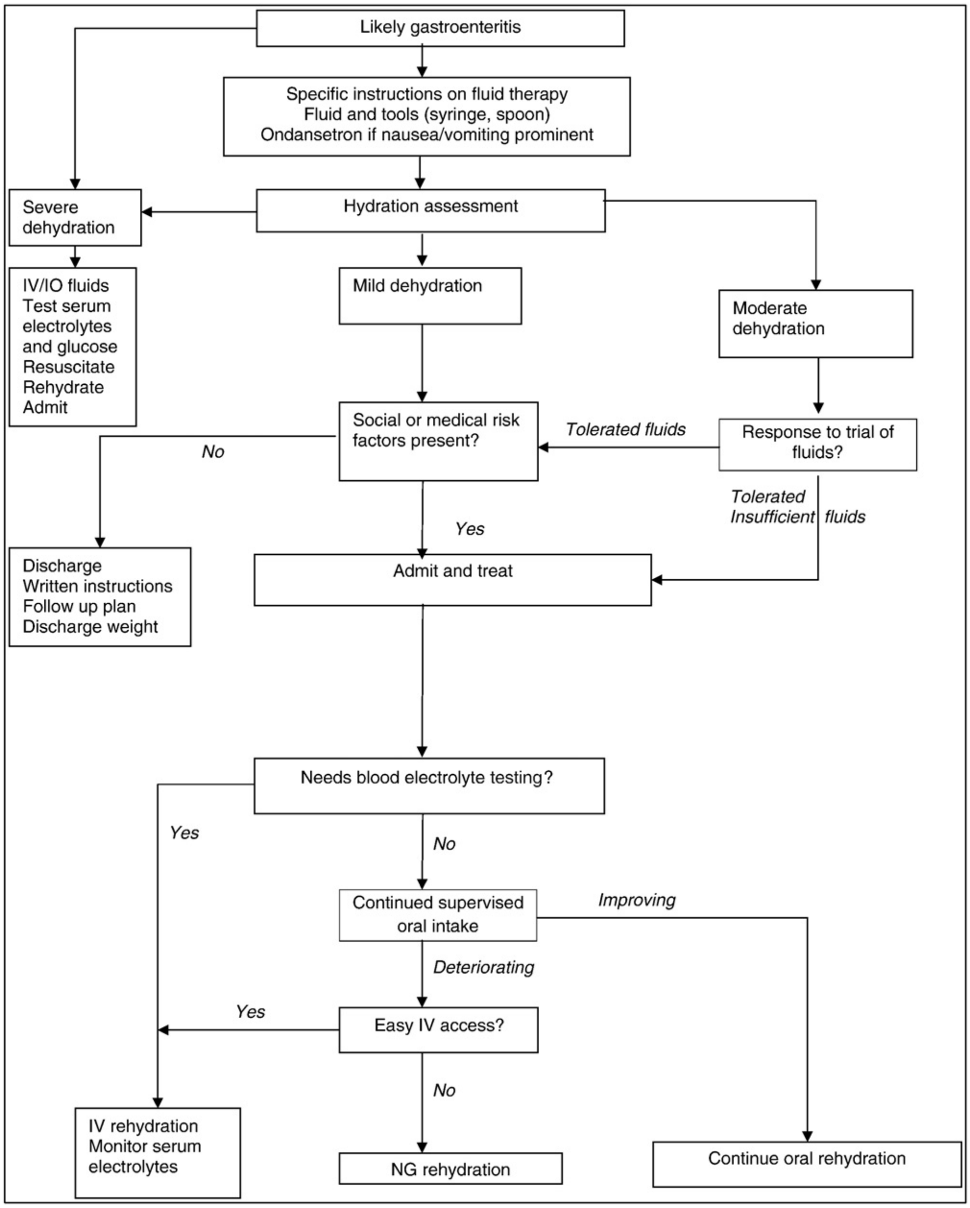

Figure 3. Suggested flow chart for managing acute gastroenteritis. *Medical risk factors: ileostomy, short gut syndrome, complex/cyanotic congenital heart disease, renal transplant/insufficiency, age <6 months, malnutrition, fortified feeds, use of hypertonic fluids, other chronic diseases. #Risk factors for electrolyte disturbance: severe dehydration, renal disease, diuretic use, altered conscious state, "doughy" skin, treatment with hypertonic or hypotonic fluids, profuse or prolonged losses, ileostomy.

routinely recommended at the commencement of IV rehydration,[2] in cases of severe dehydration and when electrolyte disturbance is suspected on clinical grounds. These circumstances are not specified, however examples include a young or malnourished child, severe or prolonged diarrhea or when fluids with high or low sodium have been used (Figure 3). Leading on from this, if a clinician was moved to check serum electrolytes, then an IV line might as well be inserted at the same time. This way the child would undergo one noxious procedure rather than 2.

So, Nasogastric Or Intravenous Rehydration?

Given this information, when might NG rehydration be preferable to IV rehydration? Firstly, oral rehydration should be deemed unsuitable, either through failure of attempts, or where parental or disease factors make continued oral fluids undesirable. Difficult IV insertion, either due to the child (eg, volume depleted, obese, ex-premature infants), the disease (eg, decreased peripheral perfusion) or the operator (eg, those less experienced with pediatric IV insertion), would be the most likely situation for NG rehydration. In such situations, rather than persist in repeated attempts at cannulation, it seems appropriate to turn to NG rehydration (Figure 3).

SUMMARY

The landscape of gastroenteritis is changing as a result of rotavirus vaccination: gastroenteritis is less common, it may become a disease of older children, and other viral syndromes may predominate. Oral rehydration is underemphasized and underemployed. Waiting room strategies can increase the chances of successful rehydration. Oral and NG rehydration are very effective. Nasogastric rehydration is as effective, quicker and easier to employ than IV rehydration at the expense of a less pleasant but short procedural experience for the child.

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