AMERICAN ACADEMY OF PEDIATRICS

Subcommittee on Acute Gastroenteritis, Provisional Committee on Quality Improvement

Clinical Practice Guideline: The Management of Acute Gastroenteritis in Young Children

ABSTRACT

This practice parameter formulates recommendations for health care providers about the management of acute diarrhea in children ages 1 month to 5 years. It was developed through a comprehensive search and analysis of the medical literature. Expert consensus opinion was used to enhance or formulate recommendations where data were insufficient.

The Provisional Committee on Quality Improvement of the American Academy of Pediatrics (AAP) selected a subcommittee composed of pediatricians with expertise in the fields of gastroenterology, infectious diseases, pediatric practice, and epidemiology to develop the parameter. The subcommittee, the Provisional Committee on Quality Improvement, a review panel of practitioners, and other groups of experts within and outside the AAP reviewed and revised the parameter. Three specific management issues were considered: (1) methods of rehydration, (2) refeeding after rehydration, and (3) the use of antidiarrheal agents. Main outcomes considered were success or failure of rehydration, resolution of diarrhea, and adverse effects from various treatment options. A comprehensive bibliography of literature on gastroenteritis and diarrhea was compiled and reduced to articles amenable to analysis.

Oral rehydration therapy was studied in depth; inconsistency in the outcomes measured in the studies interfered with meta-analysis but allowed for formulation of strong conclusions. Oral rehydration was found to be as effective as intravenous therapy in rehydrating children with mild to moderate dehydration and is the therapy of first choice in these patients. Refeeding was supported by enough comparable studies to permit a valid meta-analysis. Early refeeding with milk or food after rehydration does not prolong diarrhea; there is evidence that it may reduce the duration of diarrhea by approximately half a day and is recommended to restore nutritional balance as soon as possible. Data on antidiarrheal agents were not sufficient to demonstrate efficacy; therefore, the routine use of antidiarrheal agents is not recommended, because many of these agents have potentially serious adverse effects in infants and young children.

This practice parameter is not intended as a sole source of guidance in the treatment of acute gastroenteritis in children. It is designed to assist pediatricians by providing an analytic framework for the evaluation and treatment of this condition. It is not intended to replace clinical judgment or to establish a protocol for all patients with this condition. It rarely will provide the only appropriate approach to the problem. A technical report describing the analyses used to prepare this guideline and a patient education brochure are available through the American Academy of Pediatrics.

BACKGROUND

Although most children with gastroenteritis who live in developed countries have mild symptoms and little or no dehydration, a substantial number will have more severe disease. In the United States, an average of 220 000 children younger than 5 years are hospitalized each year with gastroenteritis, accounting for more than 900 000 hospital days. Approximately 9% of all hospitalizations of children younger than 5 years are because of diarrhea.[1] In addition, approximately 300 children younger than 5 years die each year of diarrhea and dehydration (R. I. Glass, written communication, February 1995). Clinicians should be aware that young infants who were premature and children of teenaged mothers who have not completed high school, had little or no prenatal care, and belong to minority groups are at higher risk of death caused by diarrhea (R. I. Glass, written communication, February 1995).

In the United States, the incidence of diarrhea in children younger than 3 years has been estimated to be 1.3 to 2.3 episodes per child per year; rates in children attending day care centers are higher.[2] Hospitalization and outpatient care for pediatric diarrhea result in direct costs of more than $2.0 billion per year.[3–5] There are also indirect costs to families. Surveys show that many health care providers do not follow recommended procedures for management of this disorder.[6] This practice parameter is intended to present current knowledge about the optimal treatment of children with diarrhea.

Children Covered by the Parameter

In this practice parameter, acute gastroenteritis is defined as diarrheal disease of rapid onset, with or without accompanying symptoms and signs, such as nausea, vomiting, fever, or abdominal pain. Although the emphasis of this parameter is on diarrhea, vomiting can be an important component of gastroenteritis and is addressed specifically below. These recommendations apply to children 1 month to 5 years of age who live in developed countries and who have no previously diagnosed disorders, including immunodeficiency, affecting major organ systems. Episodes of diarrhea lasting longer than 10 days, diarrhea accompanying failure to thrive, and vomiting with no accompanying diarrhea are not addressed. Although most patients meeting the criteria of this parameter will have viral or self-limited bacterial diarrhea, children with bacterial dysentery or protozoal disease can be treated according to the principles presented herein but may benefit from specific antimicrobial therapy.

Outcomes Studied

The major outcomes studied in this analysis of management options were success or failure of rehydration, resolution of diarrhea, and adverse effects of antidiarrheal agents.

Target Audience and Settings

This parameter was designed to aid physicians, nurse practitioners, physician assistants, nurses, and other health care providers who care for children with acute diarrheal disease in outpatient and inpatient settings. It is meant to guide treatment of such children; clinical judgment guided by the special circumstances of each situation will determine the ultimate care of any individual child and may vary from the management outlined herein.

Sources of Information

Ideally, medical information and recommendations are derived from well-designed, properly analyzed scientific studies. When such data are not available on a given subject, consensus may be obtained from experts in the field. In this parameter, three specific topics have received in-depth analysis: rehydration, reintroduction of feeding, and the use of medications designed to influence diarrhea and to provide symptomatic relief. These issues were chosen because of their importance in the management of diarrhea, because there is evidence that practitioners need more information in these areas, and because data are available for study.

In researching these key aspects of the management of acute gastroenteritis, references were identified through MEDLINE searches using the terms *gastroenteritis, diarrhea,* and *diarrhea, infantile* to provide an initial, broad database of articles. In addition, specific MEDLINE searches were conducted for various antidiarrheal agents. To supplement the MEDLINE results, articles also were obtained from a number of other sources, including personal files of subcommittee members, bibliographies of articles identified through the computer search, the Centers for Disease Control and Prevention report on management of acute diarrhea in children,[7] the *Federal Register* notice,[8] and a petition to the Food and Drug Administration from the consumer group Public Citizen (written communication, January 1993). More than 4000 articles were included on the original list; after evaluation for relevance and validity, 230 articles were selected for complete review.

Sufficient randomized trials with similar outcomes performed in developed countries were available on early refeeding to allow the combining of results for meta-analysis. Many controlled studies on oral rehydration therapy (ORT) in developed countries were available, but the outcomes of these studies varied; it was not possible to combine their results quantitatively. Many trials on ORT performed in developing countries were available but were not included in this analysis. Few studies on specific antidiarrheal agents were available, although the committee examined reports on drug therapy from developing as well as developed countries. Recommendations have been drawn from analysis of available literature and have been augmented by expert consensus opinion. The sources and validity of data underlying the committee's conclusions are indicated. Further details on the literature review and analyses are available in the technical report. A summary of the technical report follows this practice parameter.

Other clinical decisions must be addressed when t children with gastroenteritis, eg, when to obtain stc tures, the appropriate use of antibiotics, and the prev of diarrhea. Extensive evaluation of these issues h been included as part of this parameter. For add information, the reader is referred to the general articles that address many of these issues in detail.

REHYDRATION AND REFEEDING: SCIENTIFIC BACKGROUND

ORT

Recommendation. **ORT is the preferred treatment of and electrolyte losses caused by diarrhea in children mild to moderate dehydration** (based on evaluati controlled clinical trials documenting the effectiven ORT; an explanation of what constitutes a recommenc can be found in the technical report).

Replacement of fluid and electrolyte losses is the c central element of effective treatment of acute dia Beginning with initial studies conducted 150 years investigators have demonstrated that stool losses of w sodium, potassium, chloride, and base must be restor ensure effective rehydration.[9–11] Approximately 60 ago, intravenous (IV) therapy became the first succe routine method of administration of fluid and electro and was widely accepted as the standard form of rehy tion therapy.[12] The treatment of diarrhea was adva further in the mid-1960s with the discovery of cou transport of sodium and glucose (or other small, org molecules), providing scientific justification for ORT a alternative to IV therapy.[12]

ORT has obvious potential advantages over IV ther it is less expensive and can be administered in m settings, including at home by family members. The studies comparing oral glucose-electrolyte solutions v standard IV therapy were conducted successfully patients with cholera in Bangladesh and India in the 1960s.[13,14] The solutions used were similar to the rehydration salt solution recommended by the Wc Health Organization and the United Nations Childre Fund that has been used successfully throughout the wo for more than 20 years.

During the past decade, a series of studies from dev oped countries has proved the effectiveness of ORT co pared with IV therapy in children with diarrhea fr causes other than cholera.[15–19] These studies evaluated gluco electrolyte ORT solutions with sodium concentratic ranging from 50 to 90 mmol/L compared with rapi administered IV therapy. These ORT solutions successfu rehydrated more than 90% of dehydrated children and h lower complication rates than those for IV therapy.[15] T cost of ORT, when hospitalization can be spared, is su stantially less than that of IV therapy,[17] but the frequency stools, duration of diarrhea, and rate of weight gain a similar with both therapies.[15–19]

A variety of oral solutions are available in the Unite States (Table 1). Those most readily available commercial and used most commonly have sodium concentratio ranging from 45 to 50 mmol/L, which is at or just less tha the lower concentration of the solutions studied. Althoug these products are best suited for use as maintenance solu tions, they can rehydrate satisfactorily otherwise health

TABLE 1. Composition of Representative Glucose-Electrolyte Solutions*

Solution	CHO, mmol/L	Na, mmol/L	K, mmol/L	Base, mmol/L	Osmolality
Naturalyte (unlimited beverage)	140	45	20	48	265
Pediatric electrolyte (NutraMax)	140	45	20	30	250
Pedialyte (Ross)	140	45	20	30	250
Infalyte (formerly Ricelyte; Mead Johnson)	70	50	25	30	200
Rehydralyte (Ross)	140	75	20	30	310
WHO/UNICEF oral rehydration salts†	111	90	20	30	310

* Adapted from Snyder J. The continuing evolution of oral therapy for diarrhea. *Semin Pediatr Infect Dis.* 1994;5:231–235. CHO, carbohydrate; Na, sodium; K, potassium; WHO, World Health Organization; UNICEF, United Nations Children's Fund.
† Available from Jalanas Bros Packaging Co, 2533 SW Blvd, Kansas City, MO 64108.

...ldren who are mildly or moderately dehydrated.[15,16,20] Glucose-electrolyte solutions such as these, which are formulated on physiologic principles, must be distinguished from other popular but nonphysiologic liquids that have been used inappropriately to treat children with diarrhea (Table 2). These beverages have inappropriately low electrolyte concentrations for ORT use and are hypertonic, owing to their high carbohydrate content.[6] Parents should be discouraged from using nonphysiologic solutions to treat children with diarrhea.

Although glucose-electrolyte ORT is extremely effective in replacing fluid and electrolyte losses, it has no effect on stool volume or the duration of diarrhea. To address this limitation, investigators have administered cereal-based solutions that include naturally occurring food polymers from starch, simple proteins, and a variety of other substrates. Starch and simple proteins provide more cotransport molecules with little osmotic penalty, thus increasing fluid and electrolyte uptake by enterocytes and reducing ... losses.[21,22] The best studied of these solutions contain rice, 50 g/L, instead of glucose. These solutions are not the ... as rice water, which has a low concentration of glucose and glucose polymers and is used inappropriately in some parts of the United States, nor are they the same as a commercial product that derives its carbohydrates from glucose polymers purified from rice. Cereal-based ORT can reduce stool volume by more than 30% in children with toxicogenic diarrhea and by close to 20% in those with nontoxicogenic diarrhea.[22] Cereal- or rice powder–based solutions are not presently available commercially; early refeeding, however, can provide similar benefits (see following text).

Hypo-osmolar solutions containing glucose polymers to supply transport molecules also have been developed (Table 1). These solutions have shown no appreciable additional benefit compared with the standard glucose-electrolyte oral solution.[23]

Early Feeding of Appropriate Foods

Recommendation. **Children who have diarrhea and are not dehydrated should continue to be fed age-appropriate diets. Children who require rehydration should be fed age-appropriate diets as soon as they have been rehydrated** (based on evaluation of controlled clinical studies documenting the benefits of early feeding of liquid and solid foods).

Optimal oral therapy regimens have incorporated early feeding of age-appropriate foods as an integral component. When used with glucose-electrolyte ORT, early feeding can reduce stool output as much as cereal-based ORT can.[24,25] A variety of early feeding regimens have been studied, including human milk,[26–29] diluted and full-strength animal milk and animal milk formulas,[26,27,29–31] diluted and full-strength lactose-free formulas,[26,32,33] and staple food diets with milk.[28,30,31,34–37] These studies have demonstrated that unrestricted diets do not worsen the course or symptoms of mild diarrhea[27,28] and can decrease stool output[32,36,37] compared with ORT or IV therapy alone. The literature from developed countries on early refeeding[27,32,34,35] allows for meta-analysis, which shows that the duration of diarrhea may be reduced by 0.43 days (95% confidence interval, −0.74 to −0.12). Although these beneficial effects are modest,

TABLE 2. Composition of Representative Clear Liquids Not Appropriate for Oral Rehydration Therapy*

Liquid	CHO, mmol/L	Na, mmol/L	K, mmol/L	Base, mmol/L	Osmolality
Cola	700 (F,G)	2	0	13	750
Apple juice	690 (F,G,S)	3	32	0	730
Chicken broth	0	250	8	0	500
Sports beverage	255 (S,G)	20	3	3	330

* Adapted from Snyder J. The continuing evolution of oral therapy for diarrhea. *Semin Pediatr Infect Dis.* 1994;5:231–235. CHO, carbohydrate; F, fructose; G, glucose; K, potassium; Na, sodium; S, sucrose.

of major importance is the added benefit of improved nutrition with early feeding.[32,33]

A meta-analysis was performed to evaluate the use of lactose-containing feedings in children with diarrhea and concluded that 80% or more of children with acute diarrhea can tolerate full-strength milk safely.[38] Although reduction in intestinal brush-border lactase levels is often associated with diarrhea,[39] most infants with decreased lactase levels will not have clinical signs or symptoms of malabsorption.[7,39] Infants fed human milk can be nursed safely during episodes of diarrhea.[26] Full-strength animal milk or animal milk formula usually is well tolerated by children who have mild, self-limited diarrhea.[27,38] The combination of milk with staple foods, such as cereal, is an appropriate and well-tolerated regimen for children who are weaned.[28,30,34–37] In the past, the American Academy of Pediatrics (AAP) recommended gradual reintroduction of milk-based formulas or cow's milk in the management of acute diarrhea, beginning with diluted mixtures.[40] This recommendation has been reevaluated in light of recent data. If children are monitored to identify the few in whom signs of malabsorption develop, a regular age-appropriate diet, including full-strength milk, can be used safely.

The question of which foods are best for refeeding has been an issue of continuing study. Although agreement is not universal, clinical experience based on controlled clinical trials suggests that certain foods, including complex carbohydrates (rice, wheat, potatoes, bread, and cereals), lean meats, yogurt, fruits, and vegetables, are better tolerated.[24,25,36,37] Fatty foods or foods high in simple sugars (including tea, juices, and soft drinks) should be avoided.[7] Note that this is not the classic BRAT diet, which consists of bananas, rice, applesauce, and toast. Although these foods can be tolerated, this limited diet is low in energy density, protein, and fat.

REHYDRATION AND REFEEDING: MANAGEMENT GUIDELINES

The following therapeutic recommendations are based on the evaluation of available literature augmented by expert opinion, as described in previous sections. These recommendations are presented in schematic form in the algorithm.

General Considerations

Evaluation of Dehydration

Available published data have provided rigorous justification for the principles of ORT for diarrhea. Successful implementation of ORT starts with an evaluation of the child's degree of dehydration. Guidelines for assessment of dehydration and rehydration are listed in Table 3. If an accurate recent weight is available, determination of the percentage of weight lost is an objective measure of dehydration. Capillary refill time can be a helpful adjunctive measure to determine the degree of dehydration.[41] Although refill can be affected by fever, ambient temperature, and age,[42] the clinician should consider delayed capillary refill to be a sign of significant dehydration until proven otherwise. Urinary output and specific gravity are helpful measures to confirm the degree of dehydration and to determine that rehydration has been achieved. Parents should be taught the natural history of diarrhea and the signs of dehydration.

Electrolyte Measurement

Most episodes of dehydration caused by diarrhea are natremic, and serum electrolyte determinations are unn essary. Electrolyte levels should be measured in modera dehydrated children whose histories or physical findi are inconsistent with straightforward diarrheal episo and in all severely dehydrated children. Clinicians sho be aware of the features of hypernatremic dehydrati which can lead to neurologic damage and which requi special rehydration techniques. This condition can res from ingestion of hypertonic liquids (boiled milk a homemade solutions to which salt is added) or the loss hypotonic fluids in the stool or urine. Irritability and fe may be present, and a doughy feel to the skin is a distii tive feature. The typical loose skin and tenting of the sk associated with the more common isotonic and hypotoi dehydration may not be present. In children receiving therapy, electrolyte levels should be measured initially a as therapy progresses. ORT can be used effectively in t treatment of both hypernatremic and hyponatremic deh dration, as well as isonatremic dehydration.

Vomiting

Vomiting occurs frequently in the course of acute gastr enteritis and sometimes may be the only manifestatio Almost all children who have vomiting and dehydratio can be treated with ORT.[7] The key to therapy is to admini ter small volumes of a glucose-electrolyte solution fr quently. Studies have indicated that therapy can b initiated with 5-mL (1-teaspoon) aliquots given every 1 2 minutes. Although this technique is labor intensive can be done by a parent and will deliver 150 to 300 mL/h

As dehydration and electrolyte imbalance are correcte by the repeated administration of small amounts of the solu tion, vomiting often decreases in frequency. As the vomi ing lessens, larger amounts of the solution can be give at longer intervals. When rehydration is achieved, othe fluids, including milk, as well as food, may be introduced.

The use of a nasogastric tube is another option in a child with frequent vomiting; continuous rather than bolus infu sion of ORT solution can result in improved absorption of fluid and electrolytes. Nasogastric infusion also can b used as a temporary expedient while IV access is being sought; however, nasogastric infusion should not be used in a comatose patient or in a child who may have ileus or an intestinal obstruction.

The committee did not evaluate the use of antiemetic drugs. Consensus opinion is that antiemetic drugs are not needed. Physicians who feel that antiemetic therapy is indicated in a given situation should be aware of potential adverse effects.

If vomiting continues despite efforts to administer an oral rehydrating solution, IV hydration is indicated, with return to the oral route when vomiting abates.

Refusal to Take an Oral Rehydrating Solution

Experience gained from more than 25 years of ORT use indicates that children who are dehydrated rarely refuse ORT; however, those who are not dehydrated may refuse the solution because of its salty taste. Children with mild diarrhea and no dehydration should be fed regular diets and do not require glucose-electrolyte solutions. As long as it is clear to the physician and parents that the child is not

TABLE 3. Assessment of Dehydration*

Variable	Mild, 3%–5%	Moderate, 6%–9%	Severe, ≥10%
Blood pressure	Normal	Normal	Normal to reduced
Quality of pulses	Normal	Normal or slightly decreased	Moderately decreased
Heart rate	Normal	Increased	Increased†
Skin turgor	Normal	Decreased	Decreased
Fontanelle	Normal	Sunken	Sunken
Mucous membranes	Slightly dry	Dry	Dry
Eyes	Normal	Sunken orbits	Deeply sunken orbits
Extremities	Warm, normal capillary refill	Delayed capillary refill	Cool, mottled
Mental status	Normal	Normal to listless	Normal to lethargic or comatose
Urine output	Slightly decreased	<1 mL/kg/h	<<1 mL/kg/h
Thirst	Slightly increased	Moderately increased	Very thirsty or too lethargic to indicate

* Adapted from Duggan et al.[7] See text regarding hypernatremic dehydration. The percentages of body weight reduction that correspond to different degrees of dehydration will vary among authors. The critical factor in assessment is the determination of the patient's hemodynamic and perfusion status. If a clinician is unsure of the category into which a patient falls, it is recommended that therapy for the more severe category be used.

† Bradycardia may appear in severe cases.

dehydrated and is in stable condition or showing improvement, special solutions need not be added to the regular feeding routine; however, young children should be given more fluids than usual during an episode of diarrhea.

Some practical techniques exist to induce reluctant children to drink glucose-electrolyte solutions. Administering the solution in small amounts at first may allow the child to get accustomed to the taste. Some commercial solutions have flavors added that do not alter their basic composition but may make them more palatable. Glucose-electrolyte solutions can be frozen into an ice-pop form, which may appeal to some children.

IV Therapy

Clinical studies strongly emphasize ORT; yet the clinician must know when and how to administer IV therapy, which maintains an important role in the treatment of children with diarrhea. All children who are severely dehydrated and in a state of shock or near shock require immediate and vigorous IV therapy. Children who are moderately dehydrated and who cannot retain oral liquids because of persistent vomiting also should receive fluids by the IV route, as should children who are unconscious or have ileus. Administration of ORT is labor intensive, requiring caregivers who can administer small amounts of fluid at frequent intervals. If such personnel are not available, IV therapy is indicated.

Clinicians must evaluate a child's condition in light of the circumstances. If staff are skilled in IV administration and are unable to devote time to oral rehydration, and if reliable parents are not available, insertion of an IV line will be more expedient. Facility in IV therapy should not lead automatically to its use. Because children may show considerable improvement after periods of IV therapy, a child who is not severely dehydrated may be able to go home and complete rehydration orally, if proper follow-up is available, after receiving IV fluids for several hours in an emergency department or a similar facility.

The committee emphasizes the need for clinicians to recognize the advantages and disadvantages of both ORT and IV therapy in selecting the best treatment for an individual patient in a specific setting.

Costs

The major factor affecting the cost of rehydrating a child is the setting in which therapy occurs, with the expense increasing as one moves from home to office to emergency department or hospital ward. Oral rehydration is better suited to less-intensive levels of care, but clinicians must be certain that adequate assistance and supervision are available to provide effective therapy. If appropriate assistance is not available, a child may require hospital care for ORT. Clinicians should document the requirements of these patients to justify the need for such services to insurers.

Specific Therapy

The treatment of a child with diarrhea is directed primarily by the degree of dehydration present.

No Dehydration

ORT. Although ORT has been used to replace ongoing stool losses in children with mild diarrhea and no dehydration by giving 10 mL/kg for each stool,[7] these children are the least likely to take ORT, in part because of the salty taste of the solutions. If the stool output remains modest, a supplemental glucose-electrolyte solution may not be required if age-appropriate feeding is continued and fluid consumption is encouraged.

Feeding. Continued age-appropriate feeding, with the foods discussed above and increased fluid intake, may be the only therapy required if hydration is normal, which is the case in most US children with diarrhea. Infants should continue to drink human milk or regular strength formula. Older children may continue to drink milk.

Mild Dehydration (3% to 5%)

ORT. Dehydration should be corrected by giving 50 mL/kg ORT plus replacement of continuing losses during a 4-hour period.[7] Replacement of continuing losses from stool and emesis is accomplished by giving 10 mL/kg for each stool;[7] also, emesis volume is estimated and replaced. Reevaluation of hydration and replacement of losses should occur at least every 2 hours.

Feeding. As soon as dehydration is corrected, feeding should begin and should follow the guidelines given above.

Moderate Dehydration (6% to 9%)

ORT. Dehydration is corrected by giving 100 mL/kg ORT plus replacement of continuing losses during a 4-hour period. Rapid restoration of the circulating volume helps correct acidosis and improves tissue perfusion, which aids the early refeeding process. At the end of each hour of rehydration, hydration should be assessed, and continuing stool and emesis losses should be calculated with the total added to the amount remaining to be given. This task may be accomplished best in a supervised setting, such as an emergency department, urgent-care facility, or physician's office.

Feeding. When rehydration is complete, feeding should be resumed and should follow the guidelines given above.

Severe Dehydration (≥10%)

Severe dehydration causes shock or a near-shock condition and is a medical emergency. The key to the treatment of the severely dehydrated child is bolus IV therapy with a solution such as normal saline or Ringer's lactate. A common recommendation is to give 20 mL/kg of body weight during a 1-hour period; however, larger quantities and much shorter periods of administration may be required.

Electrolyte levels must be determined in children with severe dehydration. Frequent clinical reevaluation is critical. If the patient does not respond to rapid bolus rehydration, the clinician should consider the possibility of an underlying disorder, including, but not limited to, septic shock, toxic shock syndrome, myocarditis, myocardiopathy, or pericarditis.

For appropriate guidance in treating these critically ill patients, the reader is referred to comprehensive reviews.[43–45]

ORT. When the patient's condition has stabilized and mental status is satisfactory, ORT may be instituted, with the IV line kept in place until it is certain that IV therapy is no longer needed.

Feeding. When rehydration is complete, feeding should be resumed and should follow the guidelines given above.

THERAPY WITH ANTIDIARRHEAL COMPOUNDS

Drugs are used to alter the course of diarrhea by decreasing stool water and electrolyte losses, shortening the course of illness, or relieving discomfort. Passage of a formed stool is not in itself a measure of successful therapy, because water can remain high in formed stools. Such cosmetic changes may give patients or their families a false sense of security, causing a delay in seeking more effective therapy.

A variety of pharmacologic agents have been used to treat diarrhea. These compounds may be classified by their mechanisms of action, which include: (1) alteration of intestinal motility, (2) alteration of secretion, (3) adsorption of toxins or fluid, and (4) alteration of intestinal microflora. Some agents may have more than one mechanism of action. Many of the agents have systemic toxic effects that are augmented in infants and children or in the presence of diarrheal disease; most are not approved for children younger than 2 or 3 years. Few published data are available to support the use of most antidiarrheal agents to treat acute diarrhea, especially in children. For the purposes of this review, these drugs have been grouped for analysis by their proposed mechanisms of action. Agents for which there are sufficient available data are considered individually. Ta 4 lists generic and brand names of the drugs commo used to treat persons with diarrhea.

Recommendation. **As a general rule, pharmacolo agents should not be used to treat acute diarrhea** (based limited studies and strong committee consensus).

Drugs That Alter Intestinal Motility

Loperamide

Loperamide is a piperadine derivative, chemically relat to meperidine, which decreases transit velocity and m increase the ability of the gut to retain fluid. Loperami also may inhibit calmodulin, a protein involved in int tinal transport. Loperamide is more specific for the μ-opia receptors of the gut and thus has fewer of the effects on t central nervous system associated with other opiates Under certain controlled conditions, it also has been show to have antisecretory properties, but this effect was n seen in an adult volunteer model of acute gastroenteritis Well-designed clinical trials in both adults and childre have demonstrated some beneficial effects of loperamide the treatment of acute diarrhea.[47–49] Loperamide, whe used in conjunction with oral rehydration, reduced the vc ume of stool losses and shortened the course of disease i children 3 months to 3 years of age. These effects, althoug statistically significant, were not clinically significant, an the small number of studies makes it difficult to combin them in a meaningful way. In addition, many of the studie and case reports involving children have shown unaccep ably high rates of side effects, including lethargy, ileus, res piratory depression, and coma, especially in infants.[7,48,50–5 Death also has been associated with loperamide therapy.[51

Recommendation. **Loperamide is not recommended t treat acute diarrhea in children** (based on limited scientifi evidence that the risks of adverse effects of loperamide out weigh its limited benefits in reducing stool frequency, anc on strong committee consensus).

Other Opiates

Few data support the use of other opiate analogues or opiate and atropine combinations (Table 4) to treat diarrhea in children. The potential for toxic side effects is a major con-

TABLE 4. Medications Used to Relieve Symptoms in Patients With Acute Diarrhea*

Alteration of intestinal motility
Opiates
Loperamide (Imodium, Imodium-AD, Maalox Antidiarrhea, Pepto Diarrhea Control)
Difenoxin and atropine (Motofen)†
Diphenoxylate and atropine (Lomotil)†
Tincture of opium (paregoric)†
Alteration of secretion
Bismuth subsalicylate (Pepto-Bismol)
Adsorption of toxins and water
Attapulgite (Diasorb, Donnagel, Kaopectate, Rheaban)
Alteration of intestinal microflora
Lactobacillus (Pro-Bionate, Superdophilus)

* The actual formulations marketed under these trade names change frequently. More changes are anticipated in the near future based on Food and Drug Administration rulings. Other medications with similar mechanisms of action may be available.

† Requires prescription.

cern.[49,56-59] Opiates can produce respiratory depression, altered mental status, and ileus. These drugs pose an additional danger to individuals with fever, toxemia, or bloody stools, because they have been shown to worsen the course of diarrhea in patients with shigellosis,[60] antimicrobial-associated colitis,[61] and diarrhea caused by *Escherichia coli* 0157:H7.[62]

Recommendation. **Opiates as well as opiate and atropine combination drugs are contraindicated in the treatment of acute diarrhea in children** (based on limited scientific evidence and strong committee consensus).

Anticholinergic Agents

Parasympatholytic agents have been used in the treatment of acute gastroenteritis to decrease the cramping associated with diarrhea. They exert their effect on gastrointestinal tract smooth muscle by decreasing motility and reducing t[illegible] Few data are available to document the efficacy of these agents in children with diarrhea. A placebo-controlled tri[illegible]f the drug mepenzolate bromide in adults failed to demonstrate a positive effect, and many anticholinergic side effects were reported.[63] A dry mouth, the most frequently observed side effect, may alter the clinical evaluation of dehydration. Infants and young children are especially susceptible to the toxic effects of anticholinergic drugs.[64] Coma, respiratory depression, and paradoxical hyperexcitability have been reported.[64]

Recommendation. **Anticholinergic agents are not recommended in the management of diarrhea in children** (based on limited scientific evidence and strong committee consensus).

Alteration of Secretion

Bismuth Subsalicylate

Bismuth subsalicylate, as well as bismuth subnitrate and bismuth subgallate, has been used as adjunctive therapy for acute diarrhea. The mechanism of action of these compo[illegible]s is uncertain, although laboratory studies have sho[illegible]n that bismuth subsalicylate inhibits intestinal secretion [illegible]used by enterotoxicogenic *E coli* and cholera toxins.[65] Con[illegible]olled trials have demonstrated that bismuth subsalicylate reduced the frequency of unformed stools and increased stool consistency in adults with traveler's diarrhea[66] and in volunteers receiving the Norwalk virus.[67] A controlled clinical trial in children with acute diarrhea demonstrated that the administration of bismuth subsalicylate was associated with a decreased duration of diarrhea and a decreased frequency of unformed stools.[68] A second controlled trial in children receiving only oral therapy for acute diarrhea found that bismuth subsalicylate administration was associated with a shorter duration of diarrhea, decreased total stool output, decreased need for intake of an oral rehydration solution, and reduced hospitalization,[69] although criteria for hospital discharge were not standardized in this study. Overall, the beneficial effects have been modest, and the treatment regimen involves a dose every 4 hours for 5 days. Salicylate absorption after ingestion of a bismuth subsalicylate compound has been reported in adults[70] and children.[71] Insufficient data exist as to the risk of Reye syndrome associated with this compound; such a risk is of at least theoretical concern. Bismuth-associated encephalopathy and other toxic effects have been reported after the long-term ingestion of high doses of bismuth-containing compounds.[72]

Recommendation. **The routine use of bismuth subsalicylate is not recommended in the treatment of children with acute diarrhea** (based on limited scientific evidence that the benefit of bismuth subsalicylate is modest in most children with diarrhea because of concerns about toxic effects, and on committee consensus; further studies may demonstrate a therapeutic role for this agent).

Adsorption of Fluid and Toxins

Adsorbents

Several antidiarrheal compounds are reported to work by adsorbing bacterial toxins and by binding water to reduce the number of bowel movements and to improve stool consistency. Kaolin-pectin, fiber, and activated charcoal are classified in this category, but the only such agent currently used widely is attapulgite. No conclusive evidence is available to show that these agents reduce the duration of diarrhea, stool frequency, or stool fluid losses.[50] Disadvantages include adsorption of nutrients, enzymes, and antibiotics in the intestine.[73]

Recommendation. **Adsorbents are not recommended for the treatment of diarrhea in children** (based on limited scientific evidence and committee consensus; efficacy has not been shown, although major toxic effects are not a concern).

Alteration of Intestinal Microflora

Lactobacillus

Lactobacillus is administered to patients with acute diarrhea to alter the composition of the intestinal flora.[74] Normally, saccharolytic bacteria in the intestine ferment dietary carbohydrates that have not been absorbed completely, causing a decrease in pH that produces short-chain fatty acids and deters intestinal pathogens. The short-chain fatty acids are absorbed through the colonic mucosa and facilitate absorption of water. When a patient has diarrhea, the fecal flora are diminished, production of short-chain fatty acids is reduced, and colonic absorption of water is impaired.[75] There is no consistent evidence that administration of *Lactobacillus*-containing compounds alters the course of diarrhea.[76,77] The supplementation of infant formula with *Bifidobacterium bifidum* and *Streptococcus thermophilus* has been shown to reduce the incidence of acute diarrhea and rotavirus shedding in hospitalized infants.[78] Two studies of young children demonstrated a reduction in the duration of diarrhea caused by rotavirus associated with the administration of *Lactobacillus GG*.[79,80] Additional research is needed in the area of bacterial interference using *Lactobacillus*-containing compounds.[77]

Recommendation. ***Lactobacillus*-containing compounds currently are not recommended in the treatment of acute diarrhea in children** (based on limited scientific evidence and committee consensus; efficacy has not been shown, although toxic effects are not a concern).

Newer Treatments for Diarrhea

Several medications have shown promise in the treatment of acute diarrhea on an experimental basis, mostly in studies involving adults. These include derivatives of berberine,[81] nicotinic acid, clonidine,[82] chloride channel

blockers,[83] calmodulin inhibitors,[84] octreotide acetate,[85] and nonsteroidal anti-inflammatory drugs. All of these agents must be considered experimental at this time.

Other Agents

A variety of drugs not discussed herein are used in clinical practice to treat diarrhea. Little evidence exists regarding their safety or efficacy; therefore, they cannot be recommended.

RESEARCH ISSUES

In developing this practice parameter, the committee reviewed a large body of literature, but only a fraction was amenable to rigorous scientific analysis. Only the issue of refeeding was supported by a sufficient number of comparable studies to allow meta-analysis. The systematic evaluation of the evidence for the remaining questions points to areas that need more research. In particular, the usefulness of drug therapy for acute gastroenteritis needs to be examined more closely. In developed countries, studies of ORT that focus on factors such as barriers to implementation, costs, and acceptability to parents and health care providers would help facilitate its use.

The practice parameter, "The Management of Acute Gastroenteritis in Young Children," was reviewed by the appropriate committees and sections of the AAP, including the Chapter Review Group, a focus group of office-based pediatricians representing each AAP district: Gene R. Adams, MD; Robert M. Corwin, MD; Lawrence C. Pakula, MD; Barbara M. Harley, MD; Howard B. Weinblatt, MD; Thomas J. Herr, MD; Kenneth E. Mathews, MD; Diane Fuquay, MD; Robert D. Mines, MD; and Delosa A. Young, MD. Comments also were solicited from relevant outside medical organizations. The clinical algorithm was developed by James R. Cooley, MD, Harvard Community Health Plan.

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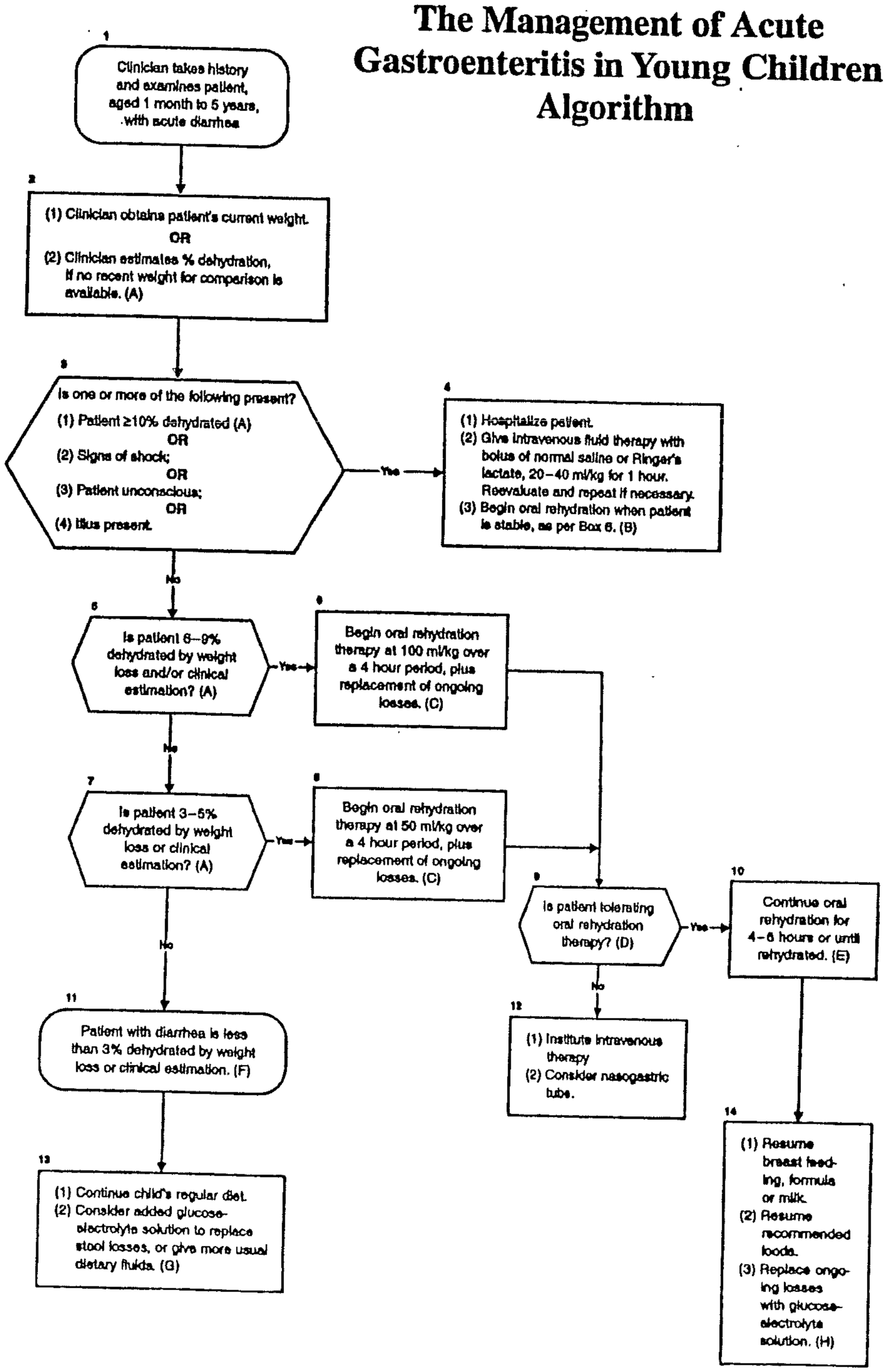
The Management of Acute Gastroenteritis in Young Children Algorithm



Rehydration and Refeeding Algorithm

A. See Table 3 for guidance in the assessment of the degree of dehydration.

B. Restoration of cardiovascular stability is critical and is accomplished by giving bolus IV therapy with normal saline or Ringer's lactate solution (see text). In the patient who does not respond, consider the possibility of an underlying disorder, such as myocarditis, myocardiopathy, pericarditis, septic shock, or toxic shock syndrome. When the patient is in stable condition and has achieved satisfactory mental status, ORT can be used according to the ORT guidelines.

C. Solutions containing 45 to 90 mmol/L sodium should be given in a volume of 100 mL/kg for moderate dehydration and 50 mL/kg for mild dehydration. Giving the child these volumes requires patience and persistence, and progress must be monitored frequently.

D. Intractable, severe vomiting, unconsciousness, and ileus are contraindications to ORT. Persistent refusal to drink may require a trial of IV therapy.

E. The rehydration phase usually can be completed in 4 hours; reevaluation should occur every 1 to 2 hours. See text for guidance to decide when rehydration has been achieved.

F. The type and intensity of therapy will vary with the individual clinical situation.

G. Often, a child has diarrhea but remains adequate hydrated. The parent can be reassured but should b taught to assess hydration and to identify a worsenir condition. If the stool output remains modest, OR might not be required if early, age-appropriate feedin is instituted and increased consumption of usu dietary fluids is encouraged. More significant sto losses can be replaced with an oral rehydrating solutio at the rate of 10 mL/kg for each stool.

H. Breastfeeding should be resumed. Nonlactose formul milk-based formula, or milk may be given, although small percentage of children will not tolerate lactose containing fluids. Lactose-containing solutions seem t be tolerated better when combined with complex carbo hydrates in weaned children. Children who are eatin foods may resume eating, although certain foods are tol erated better than others. Recommended foods include complex carbohydrates (rice, wheat, potatoes, bread, and cereals), lean meats, yogurt, fruits, and vegetables. Avoid fatty foods and foods high in simple sugars (including juices and soft drinks). Supplement feeding with an oral electrolyte solution, 10 mL/kg for each diarrheal stool and the estimated amount vomited for each emesis.

Technical Report Summary: Acute Gastroenteritis

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INTRODUCTION

The practice parameter on acute gastroenteritis is intended to present current knowledge about optimal treatment of children with diarrhea. This technical report details the process followed in its development, and presents the evidence used to formulate the final recommendations.

METHODS

The approach to developing this guideline was based on the principles for guideline development outlined by Eddy and Woolf.

Development of the Evidence Model

Definitions

In this report and in the practice parameter, acute gastroenteritis is defined as diarrheal disease of rapid onset of 14 days' duration or less. Episodes of diarrhea may or may not be accompanied by other signs and symptoms, such as vomiting, fever, or pain.

The parameter applies to children aged 1 month to 5 years who live in developed countries and who have no previously diagnosed disorders affecting major organ systems, including immunodeficiency. Not addressed are episodes of diarrhea lasting longer than 10 days, diarrhea accompanying failure to thrive, or vomiting with no accompanying diarrhea. The practice parameter is not intended to apply to chronic intestinal disorders, inflammatory bowel disease, or other previously diagnosed chronic conditions affecting major organ systems. Children with dysentery can be treated according to the principles presented here but may benefit from specific antimicrobial therapy.

Target Audience

The intended users of the practice parameter include pediatricians, family physicians, general practitioners, emergency physicians, public health nurses and nurse practitioners, physician assistants, and staff members of nutritional support groups (eg, Supplemental Feeding Program for Women, Infants, and Children [WIC]), and other individual and organizations interested in the nutrition of children.

The practice settings targeted are the offices of private pediatricians and family physicians, hospital outpatient departments, emergency departments, acute inpatient facilities, acute care ambulatory facilities, public health clinics, and WIC programs and other nutritional support programs.

Interventions

Diagnostic interventions discussed by the subcommittee (but not necessarily included in the parameter) included tests designed to determine the severity of the patient's condition (including urinalysis), the likely cause (stool pattern and microscopic examination), and positive identification of the organism (stool culture, blood culture, sensitivities, microscopic examination for ova and parasites, and rapid identification tests). Therapeutic interventions considered included hospital vs home therapy, rehydration/restoration of electrolyte balance (oral or intravenous [IV]) adjunctive drug therapy for symptom relief or hastening of recovery, empirical antimicrobial therapy, and restoration of normal nutritional status (when to resume feeding, what foods, progression of foods, timetable of progression of foods, etc). Public health interventions considered included the primary prevention of disease through appropriate day care procedures, including hand washing, diapering, and breastfeeding.

Outcomes

The subcommittee listed the following health outcomes as potentially related to the parameter:

1. Restoration of function: return to normal functioning and state of well-being, return to normal nutritional status, and return to normal daily activities (eg, day care/school).
2. Prevention of adverse health events: hospitalization, inappropriate emergency department visits, acute complications of acute gastroenteritis (eg, shock, acute renal failure, sagittal sinus thrombosis, and seizures), severe electrolyte imbalance, cardiac arrhythmias, and death.
3. Prevention of iatrogenic complications: worsening of dehydration, electrolyte imbalance, seizures, adverse-drug effects, and emergence of antibiotic-resistant organisms.
4. Avoidance of long-term complications of acute gastroenteritis: intractable diarrhea, prolonged carrier state of infectious organisms, and transmission of disease.
5. Improved patient (parental) satisfaction.
6. Cost.

Clinical outcomes used to measure improved status were expected to be state of hydration and electrolyte balance (weight, blood chemistry levels, and urine output); severity and duration of diarrhea, change in stool patterns, patient functioning (days in the hospital, and number of days out of school or day care), and the presence or absence of infectious organisms in the stool.

Although all of these outcomes were considered by the subcommittee in the initial stages of work on the parameter, not all were addressed in the parameter because of limitations in the available data.

Evidence Model

Each subcommittee member was asked to prepare a draft evidence model to help the subcommittee consider the aspects of the problem for which evidence would be required. After consideration of their models, the subcommittee chose three clinical management issues on which to focus. The three specific questions were as follows:

1. Is oral rehydration therapy (ORT) as effective as IV therapy for dehydration secondary to acute gastroenteritis?
2. For children without dehydration, or after a rehydration phase, does altering diet hasten the resolution of the disease?
3. Does drug therapy improve the course of diarrhea?

Literature Review

A literature search was conducted by staff at the American Academy of Pediatrics via the National Library of Medicine database using the terms *gastroenteritis* and *diarrhea, infantile*. The list of resulting articles was selectively reviewed by limiting studies to those involving human subjects and children older than 1 month and to the English-language literature.

For symptomatic drug therapy, staff performed a literature search using the terms *gastroenteritis* and *diarrhea.* Additional terms added to the search included *antacids, laxatives, digestants, antiemetics, bismuth, loperamide, attapulgite, diphenoxylate, scopolamine, hyoscyamine, lactobacillus, kaolin, pectin, hydroxyquinolones, toxiferine, dicyclomine, mepenzolate, donnatal, propantheline,* and *clidinium.* Addition of the term *parasympathetics* yielded no additional information. The resulting list of articles was selectively reviewed by limiting studies to those involving human subjects, and children older than 1 month, and to the English-language literature.

Additional articles were identified by subcommittee member input, bimonthly manual searches of current pediatric journals available in the American Academy of Pediatrics' library, comparison with bibliographies from other reviews, including The Public Citizen's group report to the Food and Drug Administration, *The Federal Register* notice, and the *MMWR* Recommendations and Reports on "The Management of Acute Diarrhea in Children: Oral Rehydration, Maintenance, and Nutritional Therapy." The subcommittee's literature database was compared with that in Current World Literature (sections on gastroenterology and nutrition, pathophysiology and physiology of carbohydrate absorption, and normal growth and nutrition). The two reference lists contained compatible information. This process produced no unpublished original studies.

Article Selection

Based on titles and abstract review, subcommittee members selected articles for full review. The reviewers were asked to include any article that reported outcomes of interests, specifically duration of disease, complications of therapy, parental satisfaction, and cost. Committee members were also asked to consider articles most useful if the population studied was comparable to the US population. To address the question of ORT vs IV therapy, only randomized clinical trials were considered.

A literature review form developed for this project was used by the subcommittee members to review all selected articles (Appendix). Reviewers classified articles by study type and study question. If the reviewers decided that an article did not meet the criteria listed above, it was no longer included as part of the data. If reviewers determined that an article was appropriate for inclusion, then the reviewer went on to summarize the population studied, methods, and outcomes. The form took less than an hour to complete.

The methodologists sorted the forms and articles as to clinical question and compared outcomes. Articles were incorporated into evidence tables, which formed the basis for discussion of the guidelines and also served as the background for decision making when studies could not be combined statistically.

Statistical Methods

When sufficient studies were available, the effectiveness of therapy was summarized by pooling data across studies. The difference between treatment and control groups was used as the measure of the relative benefit of one form of therapy over another. The overall impact of a therapy was calculated as the weighted average of the outcome measure across all studies (eg, mean duration and proportion of treatment failures). Pooled 95% confidence intervals (CIs) were calculated for each trial and for the combined data. The similarity of data from different studies was assessed reviewing plots of the data and by performing a tes homogeneity. Sensitivity analyses were performed to as the importance of individual studies on overall conclusi

Recommendations and Level of Evidence

Recommendations are made based on the quality of sci tific evidence. In the absence of high-quality scient evidence, subcommittee consensus or a combination of e dence and consensus is used as the basis for recommend tions.

Clinical Options are actions for which the subcommitt failed to find compelling evidence to support or refu A health care provider might or might not wish to imp ment clinical options in the treatment of a given child.

No recommendation is made when scientific eviden is lacking and there is no compelling reason to make a expert judgment.

RESULTS

The literature search identified 230 articles that coul potentially be included in the parameter. Of these, 88 com pared ORT with IV therapy for dehydration, 46 compared different refeeding strategies, and 76 reported the effect of symptomatic drug therapy. An additional 20 article contained potentially useful general information.

ORT vs IV Therapy

Of the 88 articles initially accepted by the reviewers, five contained primary data concerning the outcomes of interest in children in developed countries.Unfortunately, these articles reported different outcomes. Outcomes reported in the studies included duration of diarrhea, weight gain, length of hospital stay, stool volume, costs, time to rehydration, stool frequency, electrolyte balance, and sodium intake. It was not possible to pool the estimates of effect across studies.

Complications of ORT and IV therapy were discussed in the five articles with original data. Two studies measured duration of illness, and two studies measured weight gain at hospital discharge. One of these studies found a statistically significant reduction in the duration of diarrhea among children receiving ORT. The other study of duration showed no difference between treatment groups. Neither study showed a significant difference in weight gain.

Although it was not possible to combine statistically the results of the five studies with original data, the tables were presented to all of the subcommittee members. These summaries, as well as data in the articles themselves, provided the basis for the recommendations. Based on an evaluation of the randomized trials documenting the effectiveness of ORT, the subcommittee recommended the use of ORT as the preferred treatment of fluid and electrolyte losses due to diarrhea in children with mild to moderate dehydration.

Refeeding

Of the 46 articles reviewed that dealt with early refeeding, 10 were combined into an evidence table. The other articles had outcomes that were not comparable or did not present original data. Four of the studies were conducted in developing countries, and six were conducted in developed countries. The studies used a variety of early refeeding regimens, including: breastfeeding, dilute soy, cow's milk for-

mula, and rice-based formula. Because all of the studies compared dilute formula with undiluted formula and gradual reintroduction of feeding with reinstitution of normal feedings upon rehydration and used a comparable outcome measurement (duration of diarrhea), the results of the 10 studies were pooled. Data were insufficient to combine other outcomes, such as weight gain, stool output, or length of hospital stay.

The difference in the duration of diarrhea between dilute and undiluted feeding was used as the measure of effectiveness of the therapy. Combined data from all 10 studies revealed that in children who received full-strength feedings, diarrhea lasted 0.3 days (95% CI, –0.53, –0.07) less than in those in whom feedings were gradually reintroduced. However, a test of homogeneity yielded significant results (P=.011), indicating that the effectiveness of the therapy [illegible] not uniform among studies. A plot of the data from the [illegible]dies suggested that studies from developing countries [illegible]e associated with less of an effect of early refeeding than s[illegible]dies from developed countries. The plot also suggested that the study by Santosham et al might be influencing the results substantially.

Sensitivity analyses were performed to examine the impact in different studies on the duration of diarrhea. When studies from developing countries were excluded from the analysis, early refeeding was associated with 0.67 fewer days of diarrhea (95% CI, –0.96, –0.38) compared with gradual refeeding. However, the results of a test for homogeneity remained significant (P<.001). When the study by Santosham et al was excluded, the duration of diarrhea was 0.43 days less (95% CI, –0.74, –0.12), and the results of a test for homogeneity were not significant (P=.14). Exclusion of the study by Santosham et al from the original group of studies also resulted in nonsignificant results of a test of homogeneity. However, the observed reduction in the number of days of diarrhea also became nonsignificant.

In summary, these results suggest that early refeeding may be [illegible]ociated with a small reduction in the duration of diarrhea when studies from developed and developing countries are [illegible]nbined. When studies from only developed countries are considered, there is a reduction in the duration of diarrhea of about half a day. There is no evidence that early refeeding prolongs diarrhea over gradual refeeding. Based on this statistical analysis, the subcommittee observed that early refeeding appears to be associated with a clinically meaningful reduction in the duration of diarrhea and recommended the return to full-strength formula or normal feeding during an episode of diarrhea as soon as rehydration has been achieved.

harmacologic Therapy for Diarrhea

he literature search identified 76 articles that considered rug therapy for diarrhea. The search was not limited to udies performed in developed countries.

Four clinical trials of loperamide contained primary data id were compared in a table. The complications of these ur trials were considered by the subcommittee. In addi-n, the four trials were combined in an evidence table that compared the duration of diarrhea in the study vs control groups. The subcommittee was impressed with the number of reports of toxic effects, especially in infants, and decided that the risks of adverse effects outweighed the limited benefits of loperamide, thus recommending that it not be used in children.

Four trials considered diphenoxylate in the treatment of acute diarrhea, but various outcomes, including duration of diarrhea, the proportion of patients responding, stool frequency, and water content of stools, were measured. Only two studies, which were summarized in an evidence table, reported duration of diarrhea. Complications reported in two studies ranged from sedation to poisoning. In light of the evidence, the subcommittee decided not to recommend the use of opiates in the management of acute diarrhea in childhood.

Two trials measured the effectiveness of bismuth subsalicylate in diarrheal disease in children. Both studies showed a decrease in duration of diarrhea in the treatment groups. However, the subcommittee observed that the benefit of bismuth subsalicylate would be minimal in most children and that there were no data about potential toxic effects. The subcommittee did not recommend the routine use of bismuth subsalicylate but recognized that future studies may demonstrate a role for this agent.

The remaining studies dealt with other pharmacologic agents or case reports of the agents mentioned above. There was not enough information on any one agent to recommend its routine use in children with diarrhea.

DISCUSSION

The parameter contains the following subcommittee recommendations:

1. Oral rehydration therapy is recommended as the preferred treatment of fluid and electrolyte losses due to diarrhea in children with mild to moderate dehydration.
2. Appropriate diets are recommended during an episode of diarrhea as soon as rehydration has been achieved.
3. Pharmacologic agents are not recommended to treat acute childhood diarrhea.

Oral rehydration therapy was studied in-depth, but variation in measured outcomes prevented pooling of results across studies. Refeeding was covered by enough comparable studies to perform a meta-analysis and to use these data in forming recommendations. Insufficient data were available on specific drugs to demonstrate their efficacy.

The step-by-step method followed in the development of the practice parameter outlined in this technical report helped to define the questions to be addressed and to arrive at consensus opinion. Ultimately, only the question of refeeding lent itself to meta-analysis. However, the systematic evaluation of the evidence for the remaining questions points to areas needing more research. In particular, the usefulness of drug therapy for acute gastroenteritis and the use of oral rehydration in developed countries need to be examined more closely.