



# Acute gastroenteritis in children

**BACKGROUND** Gastroenteritis (GE) is inflammation of the mucous membranes of the gastrointestinal tract, and is characterised by vomiting and/or diarrhoea. The most common causes are viruses, but bacterial, protozoal and helminthic GE occur, particularly in developing countries. Vomiting and diarrhoea can be nonspecific symptoms in children, and the diagnosis of viral GE should be made after careful exclusion of other causes.

**OBJECTIVE** This article outlines the assessment and management of children with acute GE.

**DISCUSSION** The most important complication of GE is dehydration. The amount of weight loss as a percentage of normal body weight provides the best estimate of degree of dehydration. Clinical signs are not present until the child has lost at least 4% of their body weight. The best signs for identifying dehydration include decreased peripheral perfusion, abnormal skin turgor, and an abnormal respiratory pattern. Fluid replacement is the mainstay of management and most infants and children can be rehydrated safely with oral rehydration solution. Antiemetics and antidiarrhoeals are not indicated in children with acute GE.

**G**astroenteritis (GE) is inflammation of the mucous membranes of the gastrointestinal tract, and is characterised by vomiting and/or diarrhoea. Acute diarrhoea is defined as the abrupt onset of increased fluid content of stool above the normal value of 10 mL/kg/day.<sup>1</sup> In practical terms it is associated with increased frequency and fluid consistency of stools.

General practitioners commonly manage GE in children. Parents or carers will consult a GP in up to 75% of cases of childhood GE.<sup>2,3</sup> A United Kingdom study estimated that an average of 10 100 new episodes of infectious intestinal disease in children aged less than 5 years of age are seen in general practice each week.<sup>4</sup>

In Australia, there are approximately 4000 episodes of diarrhoea per 1000 children less than 15 years of age per year.<sup>5</sup> In the United States there are 1–2 episodes of acute diarrhoea per child below 5 years of age annually, with 220 000 hospital admissions (approximately 10% of all admissions for children in this age range) and 325–425 deaths per year.<sup>6,7</sup>

Over the past 2 decades, worldwide mortality from viral GE has fallen, mostly as a consequence of widespread use of oral rehydration solutions (ORS).<sup>8</sup>

## Aetiology

Viruses account for approximately 70% of episodes of acute infectious diarrhoea in children, with rotavirus (*Figure 1*) being the most common cause. Rotavirus infection is associated with approximately half of acute GE hospitalisations in children,<sup>9</sup> peaking in the 6–24 months age group. Rotavirus also causes the majority of cases of severe viral GE in developing countries.<sup>10</sup>



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Figure 1. Negatively stained rotavirus particles seen by electron microscopy in faecal extract. Reproduced with permission: Professor Ruth Bishop

Bacteria account for approximately 15% of episodes; bacterial GE is generally more common in the first few months of life, and then in the school aged child.<sup>1</sup> The most common bacterial causes are salmonella spp., *Campylobacter jejuni*, *Escherichia coli*, and shigella spp. *Giardia lamblia* is the most common protozoal cause of

GE, but tends to be associated with more persistent diarrhoea. Other protozoa include cryptosporidium spp. and *Entamoeba histolytica*.

### Clinical features

Children with viral GE typically present with watery diarrhoea without the presence of blood, with or without vomiting, low grade fever and anorexia. Most are less than 5 years of age. The typical peak period is in the autumn or winter months. A history of contact with GE may be present.

Bacterial GE may be associated with food or water borne infections. It is usually characterised by the presence of bloody diarrhoea, mucous in the stools and a high fever. A travel history should be sought. Haemolytic uraemic syndrome should be considered in any child with bloody diarrhoea, pallor, and poor urine output. It is characterised by acute renal impairment, thrombocytopenia and microangiopathic haemolytic anaemia.<sup>11</sup>

It must be noted that GE is a diagnosis of exclusion as vomiting and diarrhoea can be nonspecific symptoms in young children, and it is important to exclude other

**Table 1. Guidelines to the assessment and management of dehydration<sup>14</sup>**

Assessment of dehydration	Signs	Treatment
No/mild dehydration ≤4% body weight loss	No signs or decreased peripheral perfusion,* thirsty, alert and restless  be seen again within 8 hours	ORS/water/usual fluids if no dehydration. ORS only is preferred in high risk patients, particularly those <6 months of age. Child should be assessed regularly, especially if <6 months and should
Moderate 4–6% body weight loss	Decreased peripheral perfusion, thirsty, alert and restless, rapid pulse, sunken eyes and fontanelle, dry mucous membranes, deep acidotic breathing,* pinched skin retracts slowly* (1–2 seconds)	Infants in this group may require rehydration via the nasogastric route
Severe >7% body weight loss	All of the above plus In infants: drowsy, limp, cold, sweaty, cyanotic limbs and altered conscious level In older children: apprehensive, cold, sweaty, cyanotic limbs, rapid weak pulse, low blood pressure	Intravenous rehydration is required until organ perfusion is restored. ORS can then be given Check electrolytes

\* These are the only signs proven to discriminate between hydration and dehydration (≥4%)

Figure 2a–c. Assessment of capillary refill. Reproduced with permission: Advanced Paediatric Life Support 4th ed: instructor materials. Advanced Life Support Group, 2005



Figure 2a. Press for 5 seconds



Figure 2b. Release. Colour should return within 2 seconds in the well perfused, warm child



Figure 2c. A delay of more than 2 seconds in association with other signs of shock and in a warm child suggests poor peripheral perfusion

causes for these symptoms. Other causes of these symptoms include:

- surgical conditions (acute appendicitis/pelvic abscess, malrotation with volvulus of the midgut, intussusception)
- inflammatory bowel disease
- systemic infections (eg. urinary tract infections, pneumonia, meningitis), and
- metabolic conditions (eg. diabetes mellitus).

## Assessment of dehydration

The most important complication of GE is dehydration. The risk of dehydration is increased with younger age, and is most common in:

- infants less than 6 months of age
- those with anatomical abnormalities of their gut (eg. short gut syndrome), and
- those on hyperosmolar feeds (eg. polyjoule).

The amount of weight loss as a percentage of normal body weight provides the best estimate of degree of dehydration, however, it is not always practical to calculate this. If a child is seen early in the episode, it is important to measure weight accurately for later comparison if required. Clinical signs are not present until the child has lost at least 4% of their bodyweight (*Table 1*). The best signs for identifying dehydration include:

- decreased peripheral perfusion as evidenced by prolongation of capillary refill time (*Figure 2a–c*)
- abnormal skin turgor (pinched skin retracts slowly in 1–2 seconds), and

- abnormal respiratory pattern (deep acidotic breathing).<sup>12</sup>

These are the only signs proven to discriminate between hydration and dehydration (4% or greater).<sup>13</sup>

## Which children require hospital admission?

Children without dehydration can be managed at home and should be offered their normal fluids (see *Resources*). These can be given as small volumes but more frequently. Children with mild to moderate dehydration should be observed for 4–6 hours to ensure successful rehydration (2–4 hours) and maintenance of hydration (1–2 hours). Children at high risk of dehydration on the basis of age (<6 months), high frequency of stools (>8 per 24 hours) or vomits (>4 per 24 hours) should be observed for at least 4–6 hours to ensure adequate maintenance of hydration, and hospital admission should be considered.

Hospital admission is required for children:

- with severe dehydration (>7% body weight loss)
- whose carers or parents are thought to be unable to manage the child's condition at home.

Hospital admission should be considered for:

- children with significant comorbidity (eg. short bowel syndrome, diabetes, congenital heart disease).<sup>15</sup>

## What fluids to use?

Several studies have shown that ORS correct dehydration more quickly and with fewer adverse effects than intravenous therapy.<sup>16,17</sup> Most infants and children can be rehydrated safely with ORS. This may

be given orally or if this is unsuccessful, via nasogastric administration. The use of ORS is based on the principle of glucose facilitated sodium transport in the small intestine. The compositions of ORS currently available in Australia are listed in *Table 2* and suitable fluids for nondehydrated children in *Table 3*. The preferred ORS are those that are hypotonic with an osmolarity between 200–250 mOsm/L.<sup>17</sup> Children who refuse to drink can sometimes tolerate ORS icy-poles.

### Which children require investigation?

All children requiring intravenous rehydration should have blood taken for electrolytes, urea and creatinine. Stool cultures should be obtained if there is a history of bloody diarrhoea, recent travel, or if the history is suggestive of food poisoning.

Damage to the intestinal villi can cause transient lactose malabsorption. In any child with prolonged watery diarrhoea (>7 days) associated with signs of carbohydrate malabsorption (excoriation of buttocks), faeces should be tested for reducing substances. If confirmed lactase deficiency (reducing substances in stool >0.5%) lactose free feeds may be indicated for 2–4 weeks. Lactose free feeds can be given in the form of soy based preparations; low lactose feeds by reduced lactose cow's milk based preparations.<sup>18</sup>

### When should medications be used?

Antidiarrhoeal agents such as loperamide should not be used to treat acute diarrhoea in children. This is

based on evidence that the risks of adverse effects of loperamide outweigh its limited benefit in reducing stool frequency.<sup>15,19</sup> Antiemetics have no proven benefit and the risk of adverse effects such as acute dystonic reactions preclude their use in children.<sup>20</sup>

Patients with invasive bacterial infections with *Salmonella typhi*, shigella, cholera, and those with amoebiasis and giardiasis should be treated with antibiotics. Consider antibiotic use in infants less than 6 months of age with other salmonella infections, those who are systemically unwell, and the immunocompromised.<sup>15</sup>

### Breast and formula feeding

Breastfed children should continue to breastfeed through the rehydration and maintenance phases of their acute GE.<sup>21</sup> Additional ORS can be given if required. In the dehydrated child who is normally fed with formula, formula feeds should stop during rehydration and restart as soon as the child is rehydrated.<sup>15</sup> Dilution of formula is unnecessary when formula is reintroduced.<sup>19</sup>

### When should solids be restarted?

Studies have shown that an early return to feeding shortens the duration of diarrhoea and improves weight gain without increasing vomiting or diarrhoea.<sup>20,22,23</sup> Often the child will refuse food initially. In general, food should not be stopped for more than 24 hours, and children should be offered solid food if hungry. The complete resumption of a child's 'normal' feeding (including lactose containing formula) after 4 hours of rehydration with ORS, has led to significantly higher weight gain and does not result in worsening of diarrhoea or lactose intolerance after rehydration and during hospitalisation.<sup>21</sup>

### Conclusion

Vomiting and diarrhoea can be nonspecific symptoms in children, and the diagnosis of viral GE needs to be made after excluding other causes. Children need to be assessed carefully for signs of dehydration. Children without dehydration can be managed at home and should be offered their normal fluids. Most infants and children can be rehydrated safely with ORS. Children with severe rehydration (>7%) require hospital admission and those with lesser degrees of dehydration require observation and early review to ensure rehydration is occurring appropriately.

**Table 2. Oral rehydration preparations available in Australia\***

	Na	K	Cl	Citrate	Glucose
Gastrolyte	60	20	60	10	90
Hydrolyte	60	20	60	10	90
Repalyte	45	20	35	30	80

\* Concentrations expressed as mmol/L of prepared solution

**Table 3. Suitable fluid for nondehydrated children<sup>14</sup>**

Solution	Dilution
Sucrose (table sugar)	1 teaspoon in 200 mL boiled water
Fruit juice	1 part in 6 parts water
Cordials	1 part in 16 parts water
Lemonade	1 part in 6 parts water

### Summary of important points

- Diagnosis of acute gastroenteritis is made after a careful exclusion of other causes.
- Dehydration is the most important complication.
- The best signs for identifying dehydration are decreased peripheral perfusion as evidenced by prolongation of capillary refill time, abnormal skin turgor and abnormal respiratory pattern.
- Children at high risk (<6 months or significant comorbidity) should be referred for paediatric care.
- Antiemetics and antidiarrhoeals are not indicated in children with acute gastroenteritis.

### Resources

#### Royal Children's Hospital fact sheets

[www.rch.org.au/kidsinfo/factsheets.cfm?doc\\_id=5353](http://www.rch.org.au/kidsinfo/factsheets.cfm?doc_id=5353)

(Please note that the correct fluid recipe for lemonade and water is 1:6. The ratio given in the fact sheet is now outdated).

#### Royal Children's Hospital. *Clinical practice guidelines: diarrhoea and vomiting*

[www.rch.org.au/clinicalguide/cpg.cfm?doc\\_id=5192](http://www.rch.org.au/clinicalguide/cpg.cfm?doc_id=5192)

#### Royal Children's Hospital. *Paediatric handbook*.

7th ed. Blackwell Publishing, 2003. (Available from RCH Child Information Centre 03 9345 6429)

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