

Dehydration: Pediatric

Gastrointestinal

Clinical Decision Tools for RNs with Additional Authorized Practice [RN(AAP)s]

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Background

Dehydration can occur with many childhood illnesses and is defined as an abnormal decrease in the volume of circulating plasma (Cellucci, 2019; Richardson, 2020).

Dehydration implies loss of water from both extracellular (intravascular and interstitial) and intracellular spaces and most often leads to elevated plasma sodium and osmolality (Cellucci, 2019; Richardson, 2020). Hypovolemia is a generic term encompassing volume depletion and dehydration (Cellucci, 2019; Richardson, 2020). Volume depletion is the loss of salt and water from the intravascular space (Cellucci, 2019; Richardson, 2020). Mild, moderate, and severe dehydration corresponds to deficits of three to five percent, six to nine percent, and $\geq 10\%$ weight loss, respectively (Cellucci, 2019; Richardson, 2020). The assessment and management of dehydration should take into consideration the degree of dehydration, maintenance fluid requirements, and ongoing fluid losses (Cellucci, 2019; Richardson, 2020). The mechanisms of dehydration may be broadly divided into three categories: 1) increased fluid loss, 2) decreased fluid intake, or 3) both (Cellucci, 2019).

Pediatric dehydration is frequently the result of increased output from gastroenteritis, characterized by vomiting, diarrhea, or both (Cellucci, 2019). Other causes of dehydration may include metabolic diseases (e.g., diabetic ketoacidosis), cutaneous losses (e.g., excessive sweating, fever, burns), or third-space losses (e.g., bowel obstruction, ileus) (Cellucci, 2019). Decreased fluid intake is especially worrisome when the client is vomiting, or when there is concurrent fever or tachypnea as both symptoms increase insensible fluid losses (Cellucci, 2019).

Immediate Consultation Requirements

The RN(AAP) should seek immediate consultation from a physician/NP when any of the following circumstances exist:

- moderate to severe dehydration as evidenced by:
 - altered mental status (e.g., lethargy),
 - cyanosis,
 - weak rapid pulse,
 - tachypnea,
 - marked decreased urine output,
 - sunken fontanelle,
 - hypotension, and/or
 - delayed capillary refill greater than two seconds (see Classification chart).
- mild dehydration that fails to respond to oral rehydration after four hours,
- unable to tolerate fluids by mouth,
- infant less than six months of age,
- hypotonia,
- malnutrition or child on fortified feeds,
- hematemesis,
- bilious emesis,
- absent bowel sounds,
- focal abdominal pain,
- bloody stool,
- seizure activity,
- immunocompromised client,
- inability of the child's care to be managed at home,
- short-gut syndrome,
- ileostomy,
- congenital heart disease, and/or
- repeated presentations for same/similar symptoms (Interprofessional Advisory Group [IPAG], personal communication, October 2, 2019; The Royal Children's Hospital Melbourne [RCHM], n.d.).

Predisposing and Risk Factors

Infants are at highest risk of dehydration because of their greater fluid requirements, higher evaporative loss, and inability to communicate thirst needs (Cellucci, 2019). In addition, predisposing conditions and risk factors related to dehydration in pediatrics include any condition or illness that results in increased fluid loss, decreased fluid intake, or both. Some examples are listed below:

- infection,
- trauma,

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- stomatitis,
- burns,
- ascites,
- pyloric stenosis,
- renal failure,
- metabolic causes (e.g., new-onset diabetes mellitus),
- central nervous system related (e.g., increased intracranial pressure),
- pregnancy (vomiting), and/or
- eating disorder (vomiting) (Cellucci, 2019).

Health History and Physical Exam

Subjective Findings

The goals of the history and physical examination are to determine the severity and etiology of the child's condition. Accurate classification of the degree of dehydration as mild, moderate, or severe allows for appropriate therapy. All body systems must be reviewed and assessed to ascertain the underlying cause of dehydration. The following information is important:

- feeding pattern and fluid intake;
- vomiting including onset, duration, frequency, volume, colour;
- diarrhea including duration, frequency, consistency, blood, or mucus;
- number of wet diapers compared with normal, suggesting oliguria or anuria;
- activity level;
- possible ingestions that may cause vomiting;
- heat and sunlight exposures for insensible losses;
- onset, duration, and timing (e.g., relationship to meals, at night) of symptoms of pain;
- immunization status;
- recent exposure to illness, injury, or stress;
- fever;
- irritability;
- weight loss;
- recent travel; and/or
- past medical history, including diabetes, cardiac disease, renal disease, cystic fibrosis (Cellucci, 2019; Richardson, 2020).

Objective Findings

The calculation of a percentage weight loss using an accurate and recent pre-illness weight is the most effective way to determine the degree of hydration (Cellucci, 2019; Richardson, 2020). If a calculation of recent loss of weight is not possible, the degree of dehydration can be estimated by the clinical signs below (Cellucci, 2019; Richardson, 2020).

| Mild | Moderate Requires Immediate Consultation | Severe Requires Immediate Consultation |
|--|---|---|
| <ul style="list-style-type: none"> dehydration may have no clinical signs or increased thirst as the only finding, and 3-5% weight loss. | <ul style="list-style-type: none"> delayed central capillary refill time of more than 2 seconds, increased respiratory rate, increased heart rate, weak peripheral pulses, mild decreased skin turgor, decreased urine output, and/or fontanelle may be normal to slightly depressed, and 6-9% weight loss. | <ul style="list-style-type: none"> very delayed central capillary refill time (more than 3 seconds), mottled skin, tachycardia with thready pulse, irritable or altered level of consciousness, hypotension, deep breathing, decreased skin turgor, cyanosis, oliguria or anuria, absence of tears, and/or sunken fontanel, and ≥ 10 % weight loss. |

(Cellucci, 2019; Richardson, 2020; Vega & Avva, 2022)

Differential Diagnosis

Dehydration is a sign of an underlying disorder (Cellucci, 2019). The causes listed above must be included in the differential diagnosis for dehydration.

Making the Diagnosis

The diagnosis of dehydration is based on clinical evaluation of clients as a combination of signs and symptoms are used to assess the degree of dehydration (Cellucci, 2019).

Investigations and Diagnostic Tests

Cellucci (2019) suggests that investigations and diagnostic tests be reserved for moderately or severely ill children when electrolyte disturbances are more common, and for children who will likely require IV rehydration therapy. Tests related to the underlying cause may be required to identify and treat the primary cause of dehydration (e.g., throat culture, stool cultures).

Management and Interventions

Goals of Treatment

The primary goals of immediate treatment are to rehydrate the client, maintain fluid requirements, and prevent ongoing losses (Burns, Dunn, Brady, Starr, & Blosser, 2017; Richardson, 2020).

Non-Pharmacological Interventions

The RN(AAP) should recommend oral rehydration as it is effective, safe, and inexpensive compared to intravenous therapy (Cellucci, 2019). Oral fluids should be used for children with mild to moderate dehydration who are accepting fluids by mouth (Cellucci, 2019). Oral fluid therapy is not appropriate in children with protracted vomiting; severe dehydration with shock; impaired consciousness; paralytic ileus; and monosaccharide malabsorption (Cellucci, 2019).

Oral Rehydration Solution (ORS)

Oral rehydration solutions containing sodium and glucose (e.g., Pedialyte, Gastrolyte™) are required to prevent additional fluid loss and are effective for the treatment of dehydration regardless of age, cause, or type of electrolyte imbalance (Cellucci, 2019). The 1:1 ratio of sodium to glucose is ideal to optimize sodium/glucose cotransport (Cellucci, 2019). Apple juice diluted 1:1 with water followed by preferred liquids is effective for mild gastroenteritis (Dynamed, 2020). The use of sports drinks, sodas, or water do not meet the requirements for glucose and sodium content and must be avoided as death due to hyponatremia from water intoxication can occur (Cellucci, 2019; Richardson, 2020). Breastfeeding should continue if the infant has adequate suck, and this can alternate with ORS (Richardson, 2020).

Administration for Initial Oral Rehydration

| Degree of dehydration | Amount of ORS | Duration | Reassess | Comments |
|-----------------------|---|--------------|---------------|--|
| Mild | 50 mL/kg | over 4 hours | after 4 hours | <ul style="list-style-type: none"> encourage small frequent amounts (e.g., 5 mL every 5 minutes and increase as tolerated); alternatively, calculate the volume required over a 4-hour period and divide into 4 smaller amounts. Further divide each amount into 12 smaller amounts to be given orally every 5 minutes via syringe over the course of an hour. |
| Moderate and Severe | Consult physician/NP or implement an applicable RN Clinical Protocol within RN Specialty Practices. | | | |

(Cellucci, 2019; Richardson, 2020)

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If signs of dehydration remain after the four-hour period, the RN(AAP) should consult the physician/NP. If signs of dehydration have resolved after the four-hour period, ORS should be continued as the child desires to manage ongoing fluid losses (e.g., diarrhea, vomiting). Give extra oral replacement solution after each emesis (e.g., 2 mL/kg) or diarrheal stool (e.g., 5-10 mL/kg) (Richardson, 2020). Breastfeeding should continue uninterrupted. Formula feeds should resume within six to 12 hours for bottle-fed infants (Richardson, 2020). A full, age-appropriate diet should be reinstated as soon as they have been rehydrated and are not vomiting (Richardson, 2020).

Pharmacological Interventions

Antispasmodic and antidiarrheal agents should not be used (Richardson, 2020). Explain to the parents/caregivers that it is best to consider diarrhea as a purging process, to rid the intestinal tract of organisms (Richardson, 2020). The most important part of managing diarrhea is the replacement of lost fluids. There is also a very limited role for antiemetic agents.

The pharmacological interventions recommended for the treatment of dehydration in the pediatric population are in accordance with the *Emergency Department use of Oral Ondansetron for Acute Gastroenteritis-related Vomiting in Infants and Children* (Canadian Pediatric Society, 2018).

The Canadian Pediatric Society (2018) recommends a single dose of oral ondansetron therapy for infants and children aged six months and older with mild to moderate dehydration and suspected acute gastroenteritis. Ondansetron is not recommended in children with gastroenteritis whose predominant symptom is diarrhea because diarrhea is a common adverse effect of ondansetron. A single dose of ondansetron should be given 15 to 30 minutes before initiating oral rehydration therapy.

| | Drug | Dose | Route | Frequency | Duration |
|--------------------------------------|-------------|--------|-------|-----------|----------|
| Pediatric (≥ 8 kg to ≤ 15 kg) | | | | | |
| | Ondansetron | 2 mg | p.o. | once | n/a |
| Pediatric (15 kg to ≤ 30 kg) | | | | | |
| | Ondansetron | 4 mg | p.o. | once | n/a |
| Pediatric (> 30 kg) | | | | | |
| | Ondansetron | 6-8 mg | p.o. | once | n/a |

Client and Caregiver Education

The RN(AAP) provides client and caregiver education as follows:

- Educate about handwashing with soap after toileting, before meals, and especially after diaper changing.
- Advise that diaper changing areas should be separate from eating areas.

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- Advise to disinfect diaper changing area with 70% alcohol solution or bleach, which will kill rotavirus.
- Advise about water purification, which is to boil water for 20 minutes or use chlorine tablets or solution.
- Avoid foods with excessive sugar, high-fat, and fried foods until condition resolved.
- Advise to monitor intake and output including vomiting, diarrhea, and wet diapers.
- Recommend vaccination to prevent viral illnesses (e.g., rotavirus vaccination for infants).
- Discuss safe food preparation (e.g., hygienic food practices; ensure meat is fully cooked) (Burns et al., 2017).

Monitoring and Follow-Up

The RN(AAP) should:

- re-evaluate the child with mild symptoms (treated at home) every 24 hours for two days and reassess the child's weight at follow-up.
- ensure that the parent/caregiver is aware of the signs and symptoms of dehydration.
- instruct to monitor intake and output and to return immediately if dehydration worsens or if the child cannot ingest an adequate quantity of fluid.
- monitor output by assessing the number of wet diapers. The frequency should return to pre-diagnosis levels. The child should be reassessed if they have not voided in six hours (Richardson, 2020).

Complications

The following complications can occur as a result of unmanaged dehydration in pediatrics:

- shock from decreased total body water, hypoxemia, and tissue acidosis;
- water intoxication; or
- death from severe complications when severe dehydration is not addressed by prompt rehydration (Cellucci, 2019).

Referral

Refer to a physician/NP if client presentation is consistent with those identified in the *Immediate Consultation Requirements* section or clients who do not respond to treatment (IPAG, personal communication, October 2, 2019).

References

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