Dehydration: Infant

Description/Etiology
Dehydration is a life-threatening condition in infants and newborns, particularly during the first 28 days of life (often called the neonatal period). Causes of both hypernatremic infant dehydration (i.e., dehydration coupled with high serum sodium levels) and non-hypernatremic infant dehydration include:

- failure to establish adequate lactation and feeding in an exclusively breast-fed infant
  - This may result from early post-birth discharge, maternal stress, illness, or fatigue, infrequent or ineffective sucking by the infant leading to limited maternal milk production, elevated mature breast milk sodium (Na) concentrations (the high Na concentrations that are normal in colostrum should decrease during the transition to mature breast milk production), and/or maternal belief that breastfeeding is the only option even if having difficulty establishing lactation
- gastroenteritis
- feeding even a small amount of inappropriate fluid—such as cow’s milk, soy or rice milk, or other liquids with high renal solute loads—before age 1 year
- infant vomiting and/or diarrhea due to infectious disease; this is less common in the United States than in the developing world, where infectious disease is a greater threat

Treatment of dehydration involves treating the underlying cause (e.g., inadequate feeding, gastroenteritis, infection), administering fluids and/or formula as prescribed, and monitoring laboratory values for adequate response.

Facts and Figures
Data on infant and newborn dehydration in the United States are scarce. Researchers in Turkey have noted the incidence as 4.1% (Unal et al., 2008) and 5.6% (Uras et al., 2007). In Messina, Italy, during a 6-month period in 1999 and 2000, 7.7% of neonates had weight loss ≥ 10% of birth weight and 2.8% presented with hypernatremic dehydration secondary to the failure of exclusive breastfeeding to meet infant nutrition needs (Manganaro et al., 2001).

Fever is often associated with dehydration during the first week of life (Boutin et al., 2017)

Water accounts for 75% of a newborn’s body mass, which is higher than at any other stage of life. Infants consume an average of 780 ml of breast milk per day during the first 6 months of life; as they start to consume food, their fluid intake falls to approximately 120 ml/kg per day.

Risk Factors
Risk factors include those conditions noted in Description/Etiology, above. Data suggest psychiatric morbidity, a poor relationship with one’s own mother, perceiving oneself as an unsuitable mother, unplanned pregnancy, and higher postpartum anxiety levels may contribute to continued high breast milk Na levels and subsequent neonatal hypernatremic dehydration (Ozbek et al., 2008).

Signs and Symptoms/Clinical Presentation
Infants with any type of dehydration can present with any of the following signs and symptoms: weight loss > 7%–10% of birth weight; ≤ 5 wet diapers per day; lethargy, listlessness, or excessive sleepiness; dry mouth that appears sticky inside; dry, wrinkled
skin; dark yellow, concentrated urine; infrequent, small, dark, sticky stools; a weak cry; failure to regain the normal 5%–7% postnatal weight loss after 10–14 days; and sunken anterior and posterior fontanels (i.e., soft spot on the skull). Vomiting and diarrhea suggest dehydration caused by gastroenteritis, infection, or other conditions, such as pyloric stenosis or gastroesophageal reflux disease (GERD).

**Nutritional Assessment**

› Patient Medical History
  - Assess risk factors; frequency/duration of feeding; frequency of urination/stooling; for maternal stress, fatigue, and level of social/physical support, especially for first-time mothers; and for reports that the infant is exceptionally “easy” (e.g., quiet, sleepy, and easily satisfied with short feedings, which can indicate inadequate nutritional intake)
  - Use a validated pediatric dehydration assessment tool, such as the Clinical Dehydration Scale (CDS), which is designed for children ages 1–36 months and identifies the extent of dehydration based on general appearance, eyes, mucous membranes, and tears

› Physical Findings of Particular Interest
  - Patients may exhibit weight loss > 10% of birth weight and a failure to regain normal 5%–7% postnatal weight loss after 10–14 days
  - Dry, wrinkled skin may be present in infants with dehydration from any cause

› Patient Dietary History
  - Assess type, frequency, and duration of feeding with mother or caregiver

› Anthropometric Data
  - Assess height and weight using the Centers for Disease Control and Prevention (CDC) Clinical Growth Charts for infants, birth to 36 months

› Laboratory Tests and Diagnostic Tests of Particular Interest to the Nutritionist
  - A comprehensive metabolic panel (CMP) may show abnormalities
    - Serum Na will be elevated in infants with hypernatremic dehydration, although total body Na can be low, normal, or high
  - CBC results may show abnormalities

› Other Diagnostic Tests/Studies
  - CT scans and MRI may be ordered to assess for cerebral and pulmonary edema

**Treatment Goals**

› Resolve Dehydration and Malnutrition and Educate About Prevention
  - Assess for dehydration and administer fluids and formula, as ordered; assess infant response to prescribed I.V. fluid replacement and/or addition of formula to breastfeeding schedule
  - Educate the infant’s mother on appropriate frequency and duration of feeding
    - Neonates should be fed on demand 8–12 times/day with 20–45 minutes per feeding for the first 2–4 weeks of life; if infant demands < 8 feedings/day, wake to feed
  - Educate on appropriate frequency of urination (one wet diaper on day one, two on day two, three on day three, increasing to 6–8/24 hours by day seven) and stooling (e.g., 2–3 stools/24 hours by the third day of life, 4–5 stools/24 hours by day five, and a stooling frequency that ranges from 1–2 stools/day to 1 stool every two to three days thereafter)
  - Educate on additional signs and symptoms of inadequate nutrition and fluid intake (for details, see Signs and Symptoms/ Clinical Presentation, above)

› Assess for and Educate About Contributing Factors to Dehydration
  - Assess maternal (and partner, if present) anxiety level and coping skills; provide emotional support; educate and encourage discussion about infant dehydration, its causes and manifestations, potential complications, treatment risks and benefits, and individualized prognosis
  - Educate on appropriate use of prescribed supplemental formulas and infant formulas to supplement breast milk and on inappropriate nutrition sources, such as cow’s milk, soy and rice milk, and other incomplete nutritional sources that should not be used until the infant is at least 1 year of age
  - Request referral to a social worker for identification of local new mother educational/support programs, lactation consultation, and in-home lactation support for families
Food for Thought

› With more health care insurance plans promoting early discharge, more women will be released from the hospital after giving birth prior to fully establishing lactation

› The first pediatric study of recombinant human hyaluronidase-enabled subcutaneous rehydration was safe and effective for patients aged 2 months–10 years (Allen et al., 2009)

› Capillary blood ketone levels may be a useful indication of hypernatremic dehydration in the early neonatal period. Investigators evaluating capillary ketone levels in 585 full-term neonates 2–4 days of age noted that capillary levels of beta-hydroxybutyrate, the main ketone in the blood, were 87% accurate in predicting hypernatremic dehydration due to inadequate breastmilk intake (Futatani et al., 2017)

› Traditional Latin cultures often regard sunken anterior and posterior fontanelles as a sign of illness in neonates, but not necessarily an indication that rehydration is needed. Culturally appropriate family education can increase family recognition of sunken fontanelles as indications of dehydration in neonates and a need for medical evaluation (Pachter et al., 2016)

Red Flags

› Consequences of neonatal hypernatremic dehydration can be severe if untreated, including cerebral edema, convulsions, intracranial hemorrhage, disseminated intravascular coagulation, venous sinus thrombosis, renal failure, permanent brain injury, cognitive and motor deficits, spasticity, seizure disorders, and death

› A rare cause of neonatal hypernatremic dehydration is nephrogenic diabetes insipidus (NDI), which may be due to a genetic abnormality, tumors, infiltrative lesions, malformations, or neurosurgical procedures. The dehydration of NDI is distinct from that associated with diabetes mellitus and is caused by an inability to concentrate urine in the renal tubular collecting ducts, leading to extremely diluted urine and hypernatremia. Due to the risk of severe dehydration, NDI initially is treated only in the inpatient setting

What Do I Need to Tell the Patient/Patient’s Family?

› Reassure that inadequate lactation is not the fault of the mother or infant

› Educate that initial lactation challenges do not preclude nursing, and that learning techniques for infant latching on and strategies to promote appropriate nursing frequency/duration can resolve the problem in the majority of cases

› Emphasize the importance of frequent contact between mother and treating clinician, as needed

References


