Severe hypernatremic dehydration in term and late preterm neonates

CPSP
CANADIAN PAEDIATRIC SURVEILLANCE PROGRAM

PROTOCOL

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Question

In neonates born at 35 weeks or greater and aged 30 days or less, what is the minimum incidence of hospital admission for severe hypernatremia in the context of dehydration with weight loss greater than 12% of birthweight?

Background

Severe neonatal hypernatremia, most commonly secondary to dehydration, is associated with significant morbidity and mortality. Early recognition and treatment can avoid potential long-term consequences, such as neurological sequelae.

International incidence estimates of neonatal hypernatremia vary considerably. Most literature comes from countries that are differently resourced than Canada,

such as Iran, Turkey, and India. The incidence of severe neonatal hypernatremia in Canada is not known; however, the incidence of neonatal readmission to hospital is approximately 4.0%, with 3.3% of those readmissions being for dehydration. Among infants readmitted for dehydration, it is estimated that from 1–50% have severe hypernatremia [1,2]. Neonatal readmissions as a whole have increased as postnatal length of stay has decreased since the late 1990s [1].

Neonatal hypernatremia can be difficult to appreciate clinically as fluid shifts into the extracellular space and the infant can maintain a hydrated appearance. Measuring weight loss is the best method of assessment. Breastfeeding difficulty is by far the most common risk factor for severe hypernatremic dehydration, with lower parity, late prematurity (34 to 36 weeks gestation), and lower socioeconomic status also reported as risk factors in some studies [3,4]. Initial presentation and complications can include seizures, lethargy, jaundice, and apnea.

Outcome literature is based on small cohort studies and case series; however, the risk of severe morbidity and mortality seems to be correlated with increasing serum sodium levels. Koklu et al. demonstrated developmental delay in over 50% of infants at 1 year of age in those with serum sodium levels over 150 mmol/L at admission [5]. Another study demonstrated that among a cohort of infants who had a mean serum sodium of 158 mmol/L, 25% had developmental delay at 6 months of age and 12% had persistent abnormalities at 2 years of age [6]. On the other hand, one study in the United States demonstrated no difference in development between cases and controls up to 5 years of age [7]. Mortality has been reported, both in hospital and after discharge.

A literature review did not reveal any Canada-specific information on the epidemiology of this condition [3,4,8]. The goals of this surveillance study are to identify a minimum incidence of severe hypernatremic dehydration among term and late preterm neonates in Canada, as well as related risk factors, postnatal services used, geographical location, and resources required for management. This information can be used to help identify gaps in care, advocate for funding/programs to reduce the occurrence of this preventable condition, and support breastfeeding while reducing the risk of significant dehydration among infants in their first month of life.

Methods

Through the established methodology of the Canadian Paediatric Surveillance Program (CPSP), approximately 2700 paediatricians and paediatric subspecialists in Canada will receive a monthly electronic reporting form. Participants will be asked to voluntarily indicate if they have encountered a new case of severe hypernatremic dehydration meeting the case definition, within the prior 30 days. Clinicians who report encountering a case will be directed to complete a detailed online clinical questionnaire.

The CPSP methodology should capture most affected patients, since it is likely that neonates aged 30 days or less who develop severe hypernatremia will be assessed by a general paediatrician or subspecialist. Neither the Canadian

Institute for Health Information (CIHI) nor the Canadian Neonatal Network (CNN) databases would be adequate for data collection. CIHI collects diagnostic codes for all admitted patients but is not linked to laboratory data. The CNN collects only data on infants admitted to level 3 neonatal intensive care units (NICUs) and in most centres only for preterm infants. Additionally, many of these infants may be cared for in paediatric intensive care or paediatric ward settings and not in the NICU.

Case definition

Report any neonates born at ≥ 35 weeks gestation and aged ≤ 30 days who meet ALL three of the following criteria:

1) Were admitted to hospital
2) Had weight loss > 12% of birthweight
3) Had a peak serum sodium level > 150 mmol/l

Exclusion criteria
Neonates who were never discharged from hospital after birth

Objectives

1) Obtain epidemiologic data on the minimum incidence of severe hypernatremic dehydration in term and late preterm neonates in Canada
2) Identify the timing, presentation, and risk factors predisposing neonates to this condition
3) Establish the prevalence of co-occurring hyperbilirubinemia
4) Identify the resource usage of these neonates

Duration

May 2026 to April 2028

Expected number of cases

The published literature was searched for an idea of incidence/prevalence of severe hypernatremic dehydration in neonates but no specific Canadian statistics were found. The most comparable data came from a study in Norway which demonstrated readmission for dehydration greater than 12% of birthweight at 1 per 1000 births [2]. Statistics Canada recorded 351 670 livebirths in 2022, of which approximately 325 000 would be born at 35 weeks gestation and above. This results in an estimate of 325 to 550 neonates per year with severe hypernatremic dehydration. Clinical experience would suggest that this number is a very high estimate and it is likely that the number of cases per year will be smaller.

Study limitations

As the CPSP is a voluntary surveillance program, it is possible that not every case of severe neonatal hypernatremic dehydration in Canada will be captured. The CPSP's average response rate is approximately 80%. Complete information

may not be available to the reporting physician and thus a complete picture of the presentation and risk factors may not be available, specifically as it pertains to breastfeeding issues – a consistently reported risk factor. Some cases may be seen by non-reporting physicians and may not be captured. Low socioeconomic status has been identified as a risk factor but this is difficult to capture with the CPSP methodology as it may not have been documented in the medical record at the time of care.

Ethical approval

- Health Canada and Public Health Agency of Canada Research Ethics Board
- University of Manitoba Health Research Ethics Board

Analysis

Data will be summarized using descriptive statistics. Analysis will be completed within six months of study completion.

Knowledge translation

Results will be presented at conferences of the Canadian Paediatric Society (CPS) and the Pediatric Academic Societies, as appropriate, and presented locally by investigators. Results will also be presented in the CPSP Annual Results document and may be highlighted in other CPS-related publications.

References

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