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Hyponatraemia

Hyponatraemia (low blood sodium levels) in pregnancy, labour and the postnatal period. Includes hyponatraemia in infants.

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P204 - Hyponatraemia
(107)

980403-001

Hyponatraemia in the newborn. Modi N (1998), Archives of Disease in Childhood: Fetal and Neonatal Edition vol 78, no 2, March 1998, pp F81-F84

Hyponatraemia is common infants in neonatal intensive care units. The author considers the role of sodium, antidiuretic hormone, chronic lung disease, the consequences of hyponatraemia, and treatment. 22 references. (SJH)

970804-015

Water intoxication in a three day old: a case presentation. Sanchez VR, Greene CV (1997), Mother Baby Journal vol 2, no 4, July 1997, pp 5-11.

The case of a newborn who developed water intoxication is described and reference made to the literature. Care must be taken to avoid the dangers of excessive water supplementation of the breastfed infant. (SJH)

970715-022

Maternal and neonatal hyponatraemia: a comparison of Hartmanns solution with 5% dextrose for the delivery of oxytocin in labour. Higgins J, Gleeson R, Holohan M, and others (1996), European Journal of Obstetrics & Gynecology and Reproductive Biology vol 68, September 1996, pp 47-48

We performed a randomised controlled trial to compare the effect on neonatal and maternal serum sodium of using oxytocin in Hartmanns solution compared to the standard 5% Dextrose regimen for induction or augmentation in labour. We found significantly decreased maternal and neonatal serum sodium concentrations in the 5% Dextrose group compared to the Hartmanns group. (Author)

961205-018

Late hyponatremia in very-low-birth-weight infants: incidence and associated risk factors. Kloiber LL, Winn NJ, Shaffer SG, and others (1996), Journal of the American Dietetic Association vol 96, no 9, September 1996, pp 880-884

Objective: To determine the incidence of late hyponatremia in very-low-birth-weight infants and to identify associated risk factors. Low serum sodium concentration in otherwise healthy premature infants beyond 2 weeks of life is referred to as late hyponatremia. Design: Retrospective cohort review. Setting/subjects: The intensive care nursery at St Luke's Hospital Perinatal Center, Kansas City, Mo. Criteria for subject selection were birth weight of 1,500 g or less; survival for more than 21 days; development of late hyponatremia or hospitalization for 42 days or more; and measurement of serum sodium concentration at least once between the 14th and 56th day of life. Of 515 infants admitted to the nursery for the 1992 calendar year, 124 had a birth weight of 1,500 g or less and survived for more than 21 days; however, 16 of these infants were discharged at 42 days of life or less, 11 did not have a serum sodium concentration measurement after the second week of life, and 1 did not have complete medical records. Thus, the final sample was 96 subjects. Statistical analyses: Percentages to determine incidence of late hyponatremia; t test or x2 test to determine differences between infants with and without late hyponatremia; multiple logistic regression to determine the strongest indicators of late hyponatremia. Results: Incidence of late hyponatremia was 62.5%. Significant risk factors for late hyponatremia were birth weight of 1,00 g or less (P < .001), feedings of fortified human milk (P < .013), and occurrence of an intraventricular hemorrhage (P < .036). Fortified human milk feeding was a significant risk factor for late hyponatremia in both weight groups (ie, birth weight greater than or less than 1,000 g).

Conclusion: Despite standard fortification, human milk may contain an insufficient quantity of sodium to meet the needs of very-low-birth-weight infants. (Author)

950523-034

Hyponatraemia and non-electrolyte solutions in labouring primigravida. Stratton JF, Stronge J, Boylan PC (1995), European Journal of Obstetrics & Gynecology and Reproductive Biology vol 59, no 2, April 1995, pp 149-151

We performed a prospective randomised study on one hundred primigravid women who required oxytocin to augment labour, comparing dextrose infusion with normal saline. After delivery, the 45 patients whose oxytocin was infused in dextrose had significantly lower serum sodium levels in both mother and baby compared to the 48 patients who had their oxytocin administered in normal saline. This was particularly evident in those cases where epidural analgesia was employed. (Author)

941028-010

Sodium balance in very-low-birth-weight infants. Maguire D, Doyle P (1994), Critical Care Nurse vol 14, no 5, October 1994, pp 62-66

Maintaining sodium balance in the very-low-birth-weight infant is not straight-forward. (Author)

941026-014

Hyponatremic seizures among infants fed with commercial bottled drinking water - Wisconsin, 1993. Bruce RC, Kliegman RM (1994), Morbidity and Mortality Weekly Report (MMWR) vol 43, no 35, 9 September 1994, pp 641-643

Two cases of infants treated for hyponatremic seizures caused by water intoxification associated with bottled drinking water are reported and the incidence in Wisconsin 1984-1993 is discussed. (KL)

930110-044

Urinary arginine vasopressin excretion and hyponatremia in the sick neonates. Kojima T, Isozaki Y, Hirata Y, and others (1992), American Journal of Perinatology vol 9, no 5/6, September/November 1992, pp 329-333

We attempted to clarify the renal physiologic response to arginine vasopressin (AVP) in the 12 sick neonates: three with respiratory distress syndrome (RDS), three with meconium aspiration syndrome, two with transient tachypnea of the newborn, two with neonatal asphyxia, and two low birthweight infants during the first 2 days of life. Plasma atrial natriuretic factor (ANF), urinary AVP, osmolality, free water clearance and creatinine clearance (Ccr) were measured at 8 to 16 hours of life (stage 1) and 24 to 32 hours of life (stage 2). Urinary AVP was expressed as the ratio of AVP to Ccr (urine AVP/Ccr). These subjects were divided into two groups: group A represented five infants with a urine AVP/Ccr ratio of 2000 or higher and group B, seven infants with a ratio of less than 2000 at stage 1. Hyponatremia occurred in two infants of group A at stage 1. Number of infants on mechanical ventilation was four in group A and one in group B. There were no significant differences in gestational age, birthweight, Apgar scores at 1 and 5 minutes, blood gas pH and mean arterial blood pressure between groups A and B. A good correlation was observed between logarithm of urine AVP/Ccr ratio and urinary osmolality ($p < 0.01$). A negative correlation was observed between logarithm of urine AVP/Ccr ratio and free water clearance ($p < 0.01$). Body weight of infants of group A at stage 2 was greater than at stage 1 ($p < 0.05$). Higher plasma ANF concentrations were observed in infants of group A at stage 2 when compared with those at stage 1 ($p < 0.1$). These results suggest that the syndrome of inappropriate excretion of antidiuretic hormone may occur in the early neonatal age. (Author)

921128-035

Early hyponatraemia and neonatal drug withdrawal. Winrow AP, Kovar IZ, Jani BR, et al (1992), Acta Paediatrica vol 81, no 10, October 1992, pp 847-848

No abstract available.

920721-044

Excess water administration and hyponatraemic convulsions in infancy. (1992), Lancet vol 339, no 8786, 18 January 1992, pp 153-154

There has been a pronounced increase in the number of cases of hyponatraemic convulsions during the past decade in the United States. The disorder is largely a feature of inappropriate feeding practices, most commonly in children from deprived inner city families. In many cases water had been given because the family had run out of formula feed. (SJH)

920424-040

Maternal hyponatremia and the syndrome of hemolysis, elevated liver enzymes, and low platelet count. Goodlin R, Mostello D (1987), American Journal of Obstetrics & Gynecology (AJOG) vol 156, no 4, April 1987, pp 910-911

A patient with the syndrome of hemolysis, elevated liver enzymes, and low platelet count and hyponatremia is described. Hyponatremia could explain the central nervous system symptoms sometimes seen in cases of toxemia. (Author)

920318-099

Neonatal hyponatremia associated with low maternal breast milk sodium content. Shaffer S, Feretti D (1990), Clinical Pediatrics vol 29, no 2, February 1990, pp 119-121

Disorders of breast milk sodium content are rare. The following is a report of neonatal hyponatremia associated with an unusually low maternal breast milk sodium concentration. (Author)

920318-007

Iatrogenic hyponatraemia of the newborn due to maternal fluid overload: a prospective study. Tarnow-Mordi WO, Shaw JCL, Liu D, and others (1981), British Medical Journal vol 283, 5 September 1981, pp 639-642

Over five weeks 136 out of 246 deliveries were studied. Maternal plasma sodium concentrations were normal at admission. At delivery no significant difference was found between maternal and infant cord plasma sodium concentrations. Twenty four of the 41 mothers who had received only oral fluids during labour had infants whose cord plasma sodium concentrations were normal. Of the 95 mothers who had been given intravenous fluids, however, only 14 had infants with normal plasma sodium concentrations, 31 had a concentration of 130 mmol (mEq) 1 or less and nine of these had a concentration of 125 mmol/l or less. There was a highly significant inverse relation between cord plasma sodium concentration and rate of fluid administration, suggesting that hyponatraemia was due to intravenous treatment with predominantly sodium-free solutions. Endogenous antidiuretic activity probably increases during labour, and synthetic oxytocin in large doses has been shown to have an antidiuretic effect. The dose used in this study did not appear to have such an effect. Glucose solutions are often used as a vehicle for oxytocin; 83% of all fluid intake in this study was 5% or 10% glucose in water. Fluid balance in labour should be supervised closely, and oxytocin should be given in a more concentrated solution. (Author)

920304-033

Renal response to arginine vasopressin in premature infants with late hyponatraemia. Kovacs L, Sulyok E, Lichardus B, and others (1986), Archives of Disease in Childhood vol 61, 1986, pp 1030-1032

To assess the influence of late hyponatraemia on the renal responsiveness to endogenous arginine vasopressin (AVP), urinary excretion and plasma concentration of sodium, plasma and urine osmolality, free water clearance, and urinary AVP concentration and excretion were measured in 11 healthy premature infants with a mean birth weight of 1360 g and mean gestational age of 31 weeks. Studies were performed on days 1, 5 and 19. The development of late hyponatraemia was associated with a pronounced decline in urine osmolality, whereas urine flow rate and free water clearance increased significantly. Mean (SEM0 urine AVP concentration and excretion also rose significantly from 2.15 (0.31) pg/ml and 0.36 (0.55) pg/min/m2 on the first day to 6.5 (0.96) pg/ml and 3.85 (0.63) pg.min.m2 on the 19th day, respectively. When renal response to AVP was compared at different ages the highest urine osmolality and steepest

response curve was observed on the first day. With development of hyponatraemia the renal response became blunted. It is concluded that the limited tubular sodium transport and hyponatraemia hinders the establishment of intrarenal osmotic gradient, impairs renal response to AVP, and prevents excessive water retention and further fall of plasma sodium. (Author)

900307-002

Iatrogenic neonatal and maternal hyponatraemia following oxytocin and aqueous glucose infusion during labour. Singhi S, Chookang E, Hall JS, and others (1985), British Journal of Obstetrics and Gynaecology vol 92, no 4, April 1985, pp 356-363

Maternal and umbilical cord serum sodium and osmolality were studied prospectively in 140 deliveries to investigate whether transplacental hyponatraemia, seen following oxytocin infusion during labour, was due to the antidiuretic effect of oxytocin or was secondary to the infusion of aqueous glucose used as a vehicle for oxytocin, or both. Forty-five women received oxytocin in aqueous glucose for induction or augmentation of labour (oxytocin group), 43 received aqueous glucose infusion alone (glucose group) and 52 did not receive any intravenous infusions (control group). Mean cord sodium levels were significantly lower in the oxytocin (131.4, SD 3.6 mmol/l) and glucose groups (132.5, SD 3.2 mmol/l) than in the control group (135.0, SD 3.0 mmol/l). Hyponatraemia (Na less than 130 mmol) was seen in 47% and 30% of the infants in the oxytocin and glucose groups respectively, in contrast to only 5.8% of the infants in the control group. Significant negative linear correlations were seen between serum sodium and the dose of oxytocin (P less than 0.01) and log of the volume of glucose solution infused (P less than 0.001). The hyponatraemic newborn infants had a significantly higher incidence of transient neonatal tachypnea (7/37, 19%) than the normonatraemic infants (2%). Our results strongly suggest that infusion of oxytocin and glucose both cause maternal and transplacental hyponatraemia, even in recommended doses. This should be taken in account while planning a safe dose of oxytocin and glucose for infusion during labour. (Author)

890928-037

Water intoxication and hyponatraemic convulsions in neonates. Miller JJ, McVeagh P, Fleet GH, and others (1989), Archives of Disease in Childhood vol 64, no 5, May 1989, pp 734-735

We studied two neonates fed diluted formula and excessive water who developed hyponatraemic convulsions; treatment included intravenous hypertonic saline and water restriction. Educating mothers is important to stop recurrences. (Author)

881012-009

Pathogenesis of oxytocin-induced neonatal hyperbilirubinaemia. Singhi S, Singh M (1979), Archives of Disease in Childhood vol 54, no 5, May 1979, pp 400-402

100 term (gestation at least 37 weeks), vertex presenting, vaginally delivered, and fetomaternal blood-group-compatible neonates were studied to evaluate the pathogenesis of neonatal hyperbilirubinaemia induced by oxytocin. 50 infants were born after oxytocin infusion for augmentation of labour and the other 50 were delivered spontaneously. The babies born after oxytocin induction of labour attained significantly higher serum bilirubin levels at age 72 +/- 12 hours than the controls. Infants born after oxytocin showed significant hyponatraemia, hypo-osmolality, and enhanced osmotic fragility of erythrocytes at birth. These biochemical and physiological alterations can be explained by the antidiuretic effects of oxytocin and concomitant administration of large quantities of electrolyte- free dextrose solutions used to administer it. Our observations suggest that cord serum sodium and/or osmolality should be estimated and infants with serum sodium less than 125 mmol/l and/or osmolality less than 260 mmol/kg should be considered for prophylactic administration of phenobarbitone. (Author)

880902-004

The use of intravenous fluids during labor. Keppler AB (1988), Birth vol 15, no 2, June 1988, pp 75-79

This is an interesting and well referenced paper in which the practice of administering intravenous fluids to women in labour in order to treat/prevent dehydration and ketosis is discussed. Both these conditions are side-effects of the

almost universal practice of withholding food and drink in labour. It is clear from reading the article that the use of intravenous therapy in labour is practised much more widely in America than in Britain. As regards dehydration, reference is made to a paper by Lind (1), which notes that, at term, a healthy pregnant woman carries approximately two litres of extravascular water, thus she is unlikely to become dehydrated in the course of normal labour. Furthermore, the intravenous fluids usually administered are known to cause several potentially serious maternal and neonatal complications. Ketonuria in labour is then considered. Ketonuria has long been associated with prolonged labour, but it has never been established whether it is a cause or effect of prolonged labour. Chez and Curcio (2) in an admittedly small study found that sporadic ketonuria is a feature of normal pregnancy. In addition, the increased glomerular filtration rate of pregnancy means that the level of ketonuria in no way reflects the level of ketonaemia and often precedes it. Finally, the paper considers the benefits and risks of two commonly used intravenous solutions; 5% dextrose and Ringer's lactate (this contains sodium chloride, sodium lactate, potassium chloride and calcium chloride). Both are associated with a number of side effects, including maternal and fetal hyperglycaemia which leads to fetal hyperinsulism, neonatal hypoglycaemia and neonatal jaundice. There is evidence that fetal hyperglycaemia increases the risk of asphyxial brain damage. In addition, maternal and neonatal hyponatraemia occur when 5% dextrose is used. The paper concludes that intravenous therapy does have a place in the management of labour, but that its routine use in normal healthy labouring women is unnecessary and unwise. 1. Lind T. Fluid balance during labour - a review. Journal of the Royal Society of Medicine, vol 76, 1983, pp 870-875. 2. Chez RA and Curcio FD. Ketonuria in normal pregnancy. Obstetrics and Gynaecology, vol 69, 1987, pp 272-274. (MIDIRS)

880724-040

Fluid therapy for induced labour under epidural analgesia: biochemical consequences for mother and infant. Evans SE, Crawford JS, Stevens ID, et al (1986), British Journal of Obstetrics and Gynaecology vol 93, no 4, April 1986, pp 329-333

The increasing use of epidural anaesthesia in labour has led to much discussion on the type of intravenous fluid one should use to counteract the vaso-dilatory effects of the anaesthetic agents. This study was conducted to find out which intravenous agent caused least biochemical imbalance in both mother and baby. It is well documented that if glucose solutions are used alone then hyponatraemia (Tarnow-Mordi et al, 1981) results in both mother and baby. Glucose and saline combinations appear to cause neonatal hypoglycaemia and acidosis (Kenepp et al, 1982),(Mendiola et al, 1982). In this study two fluids were used: Hartmann's solution which is predominantly saline based and an isotonic dextrose/saline solution, which was infused at rates less than 6g/hr. 50 women with comparable height, weight, and age took part in the study. The women were fasted overnight and given nil by mouth during labour, apart from sips of water. All the women had their labours induced by artificial rupture of membranes, followed by an infusion of syntocinon. Epidural anaesthesia was established in each woman and a fluid preload of one litre was given in each case. Group I received Hartmann's solution while Group 2 received the dextrose saline mixture. None of the women showed signs of severe hypotension. The women in Group 2 (the dextrose/saline group) received a lower volume of fluid than the women who had Hartmann's solution. Although glucose levels in the group receiving the dextrose/saline mixture were higher than the Hartmann's group, none of the women could be considered hyperglycaemic. Findings for the infants reflected the same results, but after 12 hours there was no significant difference between the two groups. The sodium levels in the group receiving dextrose/saline were lower than in the group receiving Hartmann's but this difference was resolved after 12 hours in the infants. Those infants in both groups who were breastfed had higher plasma/ sodium levels after 12 hours than those infants who were artificially fed. Beta hydroxybutyrate was significantly raised in the group receiving Hartmann's solution with 7 women having levels of > 1000 umol/litre at delivery. In the dextrose/saline group the maximum recorded level was 646 umol/litre. [The authors question whether this finding is significant but state that levels of beta hydroxybutyrate show a considerable degree of ketosis.] Neither group showed evidence of lactic acidosis or neonatal hypoglycaemia. The authors conclude that neither fluid used had more than a minimal effect of the biochemical balance and the ketosis was probably due to the extensive fasting. They suggest that when glucose is used the maximum infusion rate should not exceed 10g/hr and only solutions which do not include glucose should be used when rapid expansion of the blood volume is required. (MIDIRS)

2023-11315

Higher versus lower sodium intake for preterm infants. Diller N, Osborn DA, Birch P (2023), The Cochrane Database of Systematic Reviews issue 11, 12 October 2023 , Art. No: CD012642
Full URL: https://doi.org/10.1002/14651858.CD012642.pub2

Background

Infants born preterm are at increased risk of early hypernatraemia (above-normal blood sodium levels) and late hyponatraemia (below-normal blood sodium levels). There are concerns that imbalances of sodium intake may impact neonatal morbidities, growth and developmental outcomes.

Objectives

To determine the effects of higher versus lower sodium supplementation in preterm infants.

Search methods

We searched CENTRAL in February 2023; and MEDLINE, Embase and trials registries in March and April 2022. We checked reference lists of included studies and systematic reviews where subject matter related to the intervention or population examined in this review. We compared early (< 7 days following birth), late (≥ 7 days following birth), and early and late sodium supplementation, separately.

Selection criteria

We included randomised, quasi-randomised or cluster-randomised controlled trials that compared nutritional supplementation that included higher versus lower sodium supplementation in parenteral or enteral intake, or both. Eligible participants were preterm infants born before 37 weeks' gestational age or with a birth weight less than 2500 grams, or both. We excluded studies that had prespecified differential water intakes between groups.

Data collection and analysis

Two review authors independently assessed eligibility and risk of bias, and extracted data. We used the GRADE approach to assess the certainty of evidence.

Main results

We included nine studies in total. However, we were unable to extract data from one study (20 infants); some studies contributed to more than one comparison. Eight studies (241 infants) were available for quantitative meta-analysis. Four studies (103 infants) compared early higher versus lower sodium intake, and four studies (138 infants) compared late higher versus lower sodium intake. Two studies (103 infants) compared intermediate sodium supplementation (≥ 3 mmol/kg/day to < 5 mmol/kg/day) versus no supplementation, and two studies (52 infants) compared higher sodium supplementation (≥ 5 mmol/kg/day) versus no supplementation. We assessed only two studies (63 infants) as low risk of bias.

Early (less than seven days following birth) higher versus lower sodium intake

Early higher versus lower sodium intake may not affect mortality (risk ratio (RR) 1.02, 95% confidence interval (CI) 0.38 to 2.72; I2 = 0%; 3 studies, 83 infants; low-certainty evidence). Neurodevelopmental follow-up was not reported. Early higher versus lower sodium intake may lead to a similar incidence of hyponatraemia < 130 mmol/L (RR 0.68, 95% CI 0.40 to 1.13; I2 = 0%; 3 studies, 83 infants; low-certainty evidence) but an increased incidence of hypernatraemia ≥ 150 mmol/L (RR 1.62, 95% CI 1.00 to 2.65; I2 = 0%; 4 studies, 103 infants; risk difference (RD) 0.17, 95% CI 0.01 to 0.34; number needed to treat for an additional harmful outcome 6, 95% CI 3 to 100; low-certainty evidence). Postnatal growth failure was not reported. The evidence is uncertain for an effect on necrotising enterocolitis (RR 4.60, 95% CI 0.23 to 90.84; 1 study, 46 infants; very low-certainty evidence). Chronic lung disease at 36 weeks was not reported.

Late (seven days or more following birth) higher versus lower sodium intake

Late higher versus lower sodium intake may not affect mortality (RR 0.13, 95% CI 0.01 to 2.20; 1 study, 49 infants; very low-certainty evidence). Neurodevelopmental follow-up was not reported. Late higher versus lower sodium intake may reduce the incidence of hyponatraemia < 130 mmol/L (RR 0.13, 95% CI 0.03 to 0.50; I2 = 0%; 2 studies, 69 infants; RD −0.42, 95% CI −0.59 to −0.24; number needed to treat for an additional beneficial outcome 2, 95% CI 2 to 4; low-certainty evidence). The evidence is uncertain for an effect on hypernatraemia ≥ 150 mmol/L (RR 7.88, 95% CI 0.43 to 144.81; I2 = 0%; 2 studies, 69 infants; very low-certainty evidence). A single small study reported that later higher versus lower sodium intake may reduce the incidence of postnatal growth failure (RR 0.25, 95% CI 0.09 to 0.69; 1 study; 29 infants; low-certainty evidence). The evidence is uncertain for an effect on necrotising enterocolitis (RR 0.07, 95% CI 0.00 to 1.25; 1 study, 49 infants; very low-certainty evidence) and chronic lung disease (RR 2.03, 95% CI 0.80 to 5.20; 1 study, 49 infants; very low-certainty evidence).

Early and late (day 1 to 28 after birth) higher versus lower sodium intake for preterm infants

Early and late higher versus lower sodium intake may not have an effect on hypernatraemia ≥ 150 mmol/L (RR 2.50, 95% CI 0.63 to 10.00; 1 study, 20 infants; very low-certainty evidence). No other outcomes were reported.

Authors' conclusions
Early (< 7 days following birth) higher sodium supplementation may result in an increased incidence of hypernatraemia and may result in a similar incidence of hyponatraemia compared to lower supplementation. We are uncertain if there are any effects on mortality or neonatal morbidity. Growth and longer-term development outcomes were largely unreported in trials of early sodium supplementation.

Late (≥ 7 days following birth) higher sodium supplementation may reduce the incidence of hyponatraemia. We are uncertain if late higher intake affects the incidence of hypernatraemia compared to lower supplementation. Late higher sodium intake may reduce postnatal growth failure. We are uncertain if late higher sodium intake affects mortality, other neonatal morbidities or longer-term development.

We are uncertain if early and late higher versus lower sodium supplementation affects outcomes. (Author)

2023-08877

Clinical features, genetic background, and outcome in infants with urinary tract infection and type IV renal tubular acidosis. Tseng M-H, Huang J-L, Huang S-M, et al (2020), Pediatric Research vol 87, no 7, 2020, pp 1251-1255

Background
Type IV renal tubular acidosis (RTA) is a severe complication of urinary tract infection (UTI) in infants. A detailed clinical and molecular analysis is still lacking.

Methods
Infants with UTI who exhibited features of type IV RTA were prospectively enrolled. Clinical, laboratory, and image characteristics and sequencing of genes responsible for phenotype were determined with follow-up.

Results
The study cohort included 12 infants (9 males, age 1–8 months). All exhibited typical type IV RTA such as hyperkalemia with low transtubular potassium gradient, hyperchloremic metabolic acidosis with positive urine anion gap, hypovolemic hyponatremia with renal salt wasting, and high plasma renin and aldosterone levels. Seven had hyperkalemia-related arrhythmia and two of them developed life-threatening ventricular tachycardia. With prompt therapy, all clinical and biochemical abnormalities resolved within 1 week. Five had normal urinary tract anatomy, and three of them carried genetic variants on NR3C2. Three variants, c.1645T>G (S549A), c.538G>A (V180I), and c.1-2C>G, on NR3C2 were identified in four patients. During follow-up, none of them had recurrent type IV RTA, but four developed renal scaring.

Conclusions
Genetic mutation on NR3C2 may contribute to the development of type IV RTA as a complication of UTI in infants without identifiable risk factors, such as urinary tract anomalies. (Author)

2023-08346

Late-Onset Hyponatremia in Premature Infants. Marin T, Dowell SH, Wright K, et al (2023), The Journal of Perinatal and Neonatal Nursing vol 37, no 4, October/December 2023, pp 325-331

Late-onset hyponatremia (LOH) frequently affects premature infants 2 or more weeks of age due to inadequate sodium intake and excessive kidney loss. Late-onset hyponatremia typically occurs in infants who are physiologically stable and is defined as serum sodium of 132 mEq/L or less or between 133 and 135 mEq/L if receiving sodium supplementation. Recent evidence suggests that spot urine sodium levels may improve the recognition of LOH, as low levels of excreted urine reflect a total body sodium deficit and negative balance. Untreated LOH may result in poor somatic growth, neurodevelopmental delay, higher incidence of bronchopulmonary dysplasia, and more severe retinopathy of prematurity. The primary prevention of LOH is to maintain serum sodium between 135 and 145 mEq/L; however, there are currently no formal protocols guiding sodium supplementation. The purpose of this article is to present on overview of LOH pathophysiology and its effect on somatic growth, neurodevelopment outcomes, and other related sequelae. We further discuss general management strategies and describe a protocol for sodium supplementation that is presently undergoing an evaluation for effectiveness. (Author)

2023-07102

Postoperative free water administration is associated with dysnatremia after congenital heart disease surgery in infants. Kronborg JR, Lindhardt RB, Vejlstrup N, et al (2023), Acta Anaesthesiologica Scandinavica 3 March 2023, online

Full URL: https://doi.org/10.1111/aas.14223

Dysnatremia after congenital heart disease (CHD) surgery is common. European guidelines on intraoperative fluid therapy in children recommend isotonic solutions to avoid hyponatremia, but prolonged cardiopulmonary bypass and administration of high sodium-containing solutions (i.e., blood products and sodium bicarbonate) are associated with postoperative hypernatremia. The aim of the study was to describe fluid composition prior to and during the development of postoperative dysnatremia. A retrospective observational, single-center study including infants undergoing CHD surgery. Demographics and clinical characteristics were registered. Highest and lowest plasma sodium values were recorded and associations with perioperative fluid administration, blood products, crystalloids, and colloids were explored in relation to three perioperative periods. Postoperative dysnatremia occurred in nearly 50% of infants within 48 h after surgery. Hypernatremia was mainly associated with administration of blood products (median [IQR]: 50.5 [28.4–95.5] vs. 34.5 [18.5–61.1] mL/kg; p = 0.001), and lower free water load (1.6 [1.1–2.2] mL/kg/h; p = 0.01). Hyponatremia was associated with a higher free water load (2.3 [1.7–3.3] vs. 1.8 [1.4–2.5] mL/kg/h; p = 0.001) and positive fluid balance. On postoperative day 1, hyponatremia was associated with higher volumes of free water (2.0 [1.5–2.8] vs. 1.3 [1.1–1.8] mL/kg/h; p < 0.001) and human albumin, despite a larger diuresis and more negative daily fluid balance. Postoperative hyponatremia occurred in 30% of infants despite restrictive volumes of hypotonic maintenance fluid, whereas hypernatremia was mainly associated with blood product transfusion. Individualized fluid therapy, with continuous reassessment to reduce the occurrence of postoperative dysnatremia is mandatory in pediatric cardiac surgery. Prospective studies to evaluate fluid therapy in pediatric cardiac surgery patients are warranted. (Author)

2023-06624

Acute porphyria presenting as abdominal pain in pregnancy. Sohail QZ, Khamisa K (2021), Canadian Medical Association Journal (CMAJ) vol 193, no 12, March 2021, E419-E422

Full URL: https://doi.org/10.1503/cmaj.202384

Acute porphyrias are rare genetic disorders that present with neurologic and systemic symptoms, including abdominal pain, hyponatremia and seizures. (Author, edited)

2023-05173

Understanding the risk factors for adverse events during exchange transfusion in neonatal hyperbilirubinemia using explainable artificial intelligence. Zhu S, Zhou L, Feng Y, et al (2022), BMC Pediatrics vol 22, no 567, September 2022

Full URL: https://doi.org/10.1186/s12887-022-03615-5

Objective

To understand the risk factors associated with adverse events during exchange transfusion (ET) in severe neonatal hyperbilirubinemia.

Study design

We conducted a retrospective study of infants with hyperbilirubinemia who underwent ET within 30 days of birth from 2015 to 2020 in a children's hospital. Both traditional statistical analysis and state-of-the-art explainable artificial intelligence (XAI) were used to identify the risk factors.

Results

A total of 188 ET cases were included; 7 major adverse events, including hyperglycemia (86.2%), top-up transfusion after ET (50.5%), hypocalcemia (42.6%), hyponatremia (42.6%), thrombocytopenia (38.3%), metabolic acidosis (25.5%), and hypokalemia (25.5%), and their risk factors were identified. Some novel and interesting findings were identified by XAI.

Conclusions

XAI not only achieved better performance in predicting adverse events during ET but also helped clinicians to more deeply understand nonlinear relationships and generate actionable knowledge for practice. (Author)

2023-04371

Metabolic Emergencies in Newborns in a Subsaharian Neonatology Department: Evaluation of Glucose, Sodium and Potassium Disorders. Sow NF, Sow A, Seck MA, et al (2022), Open Journal of Pediatrics vol 12, no 1, March 2022, pp. 263-273

Full URL: https://doi.org/10.4236/ojped.2022.121029

Introduction: Metabolic neonatal adaptation is a complex phenomenon and metabolic disorders can be frequent in immature newborns or in life-threatening situations. In Low and Middle income countries (LMIC) the difficult access to some diagnostic tests makes the management of the metabolic emergencies challenging. The main objectives of this study were to assess the frequency and circumstances of occurrence and to describe the clinical picture associated with glucose, sodium and potassium disorders in neonates. Patients and Methods: Our study was a retrospective and descriptive study conducted in the neonatology unit of National Children Hospital Albert Royer in Dakar (Senegal) from January 1 to December 31, 2014. Results: The prevalence of the studied metabolic disorders was 46.7%. The most common metabolic disorder noted was Hyperglycemia followed by Hyponatremia. Thermoregulation disturbances were found particularly in newborns with serum sodium disorders (hyponatremia 33.5% and hypernatremia 59.7%). Neurological signs were noted in case of blood sugar abnormalities (hypoglycemia 26.1% and hyperglycemia 29.8%). Half of the newborns with hyperglycemia (82 cases/50%) had blood sugar levels greater than or equal to 2 g/l. Hypernatremia was severe (Serum sodium> 180 mmol/l) in 12 neonates (16.7%). The main diagnoses retained were sepsis (159 cases/45.4%), prematurity (96 cases/27.4%), intrauterine growth retardation (66 cases/18.9%), malformations (63 cases/18%), perinatal asphyxia (44 cases/12.6%) and malnutrition (36 cases/10.3%). For most metabolic disorders, the correction was late and was done beyond 48 hours. On average, the correction time varied between 3 hours and 6 days. The most frequent complications were cerebral edema (12 cases), brain death (8 cases) and increased intracranial pressure (3 cases). The most lethal disorders were Hyperkalemia followed by Hyperglycemia. Conclusion: Metabolic disorders especially glucose, sodium and potassium disorders are common in newborns. They are medical emergencies that can lead to vital instability and death. Their management is challenging in low-income countries due to the lack of adapted facilities and means to diagnose them. It is therefore important to improve the availability of technical methods and means of biological analysis in hospital laboratories and to monitor closely all newborns for early diagnosis of these disorders. (Author)

2023-02288

Persistent dyselectrolytemia in a neonate induced by liposomal amphotericin B. A case report. Puertas Sanjuan A, Parramón-Teixidó CJ, Hernandez-Perez S, et al (2023), Frontiers in Pediatrics 10 January 2023, online

Full URL: https://doi.org/10.3389/fped.2022.1099305

Background: Nephrotoxicity is the most frequent serious adverse effect associated with amphotericin B deoxycholate treatment, for this reason, in recent years it has been relegated from routine clinical practice and replaced by the new liposomal formulations that have less nephrotoxicity. Nevertheless, dyselectrolytemia are a frequent adverse effect of the use of liposomal amphotericin B that usually are resolved with the withdrawal of the drug.

Case presentation: We present a preterm neonate of 25 weeks gestation, with preserved renal function and most electrolytes within normal limits for gestational age except for mild hyponatremia in the first month of life. Due to an infection of the central nervous system and growth of Candida albicans, he required treatment with endovenous liposomal amphotericin B as well as intrathecal amphotericin B deoxycholate showing severe hydroelectrolyte disturbances and clinical worsening compatible with possible tubulopathy showing hypokalemia and severe hyponatremia a few days after starting treatment that persisted over time even after withdrawal of both drugs. Subsequently to the main alterations described, hypomagnesemia, hypophosphatemia, glycosuria and tubular proteinuria were also observed. Calcium levels remained stable after amphotericin B administration and did not require supplementation. In preterm or low birth weight newborns who present unjustified, severe and difficult to correct hydroelectrolyte disturbances despite the usual treatment, a possible tubulopathy should be considered, whether hereditary, primary or secondary to toxins or drugs.

What Is New and Conclusion: We present the first case reported in a neonate in whom dyselectrolithemia has been maintained over time after withdrawal of liposomal amphotericin B. (Author)

2022-09894

Sodium glycerophosphate use in parenteral nutrition improves mineral metabolism in extremely low birth weight infants. Hsu P-C, Tsao P-N, Chou H-C, et al (2023), The Journal of Pediatrics vol 253, February 2023, pp 63-71.e2

Objective

To evaluate the clinical effect of sodium glycerophosphate (NaGP) in parenteral nutrition solutions on mineral metabolism in extremely low birth weight (ELBW) infants.

Study design

NaGP was introduced for use in place of potassium phosphate (K3PO4) in January 2018; this retrospective cohort study included 95 ELBW infants treated with K3PO4 between January 2015 and December 2017 and 77 infants treated with NaGP between August 2018 and January 2021. Mineral intake over the first 14 days; changes in serum calcium, phosphorus, sodium, and alkaline phosphatase (ALP) levels over the first 1-3 months; and the rates of electrolyte imbalance and clinical morbidity were compared. High-risk infants who had nil per os (NPO) status for >14 days and prolonged parenteral nutrition exposure were further analyzed as a subgroup.

Results

The use of NaGP instead of K3PO4 significantly increased Ca and P intake, but intakes remained below the recommended range (Ca, 64-140 mg/kg/day; P, 50-108 mg/kg/day). Compared with levels in the K3PO4 group, the NaGP group had significantly higher serum Ca and P levels after day 14 and lower ALP levels after day 56. In the subgroup analysis, the NaGP group had significantly lower incidences of hypophosphatemia, hyponatremia, bronchopulmonary dysplasia, and ALP >500 IU/L.

Conclusions

Although the administration of NaGP instead of K3PO4 in parenteral nutrition regimens still did not provide adequate Ca and P intake for ELBW infants, higher intake significantly improved serum Ca and P levels, especially in ELBW infants with prolonged parenteral nutrition exposure. (Author)

2022-07084

Severe hyponatraemia peripartum associated with omeprazole therapy. Morton A (2022), Obstetric Medicine 13 July 2022, online

Hyponatraemia is the most commonly encountered electrolyte abnormality in pregnancy and may be associated with adverse maternal and neonatal outcomes. Rapid onset, severe hyponatraemia has been reported with proton-pump inhibitor therapy in non-pregnant individuals. Gastro-oesophageal reflux is very common during pregnancy, and proton-pump inhibitors are available without a prescription in many countries. A case of severe maternal hyponatraemia in the setting of recent omeprazole therapy is presented. Health professionals should be aware of this complication given the availability of proton-pump inhibitors without prescription and high rates of gestational gastro-oesophageal reflux. (Author)

2022-05837

Possible additional criteria for the diagnosis of preeclampsia with severe features. Morton A (2023), Obstetric Medicine vol 16, no 1, March 2023, pp 9–11

Preeclampsia is a disorder affecting multiple organ systems. Preeclampsia with severe features may prompt consideration of delivery. The diagnostic criteria for preeclampsia with severe features, while focusing upon maternal cardiopulmonary, neurological, hepatic, renal and haematological systems, vary considerably in International practice guidelines. In the absence of alternative causes. severe hyponatraemia, pleural effusions and ascites, and abrupt severe maternal maternal bradycardia are proposed as possible additional criteria for the diagnosis of preeclampsia. (Author)

2022-05734

Peripartum hyponatraemia: an overview of physiology, prevention and management. Demertzidou E, Zill-E-Huma R, Modi M (2022), Obstetrician and Gynaecologist vol 24, no 3, July 2022, pp 188-194

Key content

• Hyponatraemia in labour is a common but underreported condition. It can cause considerable complications, altering the management of labour, and fetal and maternal outcomes.

• Pregnant women are predisposed to hyponatraemia because of the physiological changes in water and sodium homeostasis occurring in pregnancy and the peripartum period.

• Prevention is key to improving women's wellbeing in the peripartum period. Fluid balance charts, alongside the partogram, should be an integral part of any low and high-risk labour management strategy.

• There is an urgent need for national guidance to enable clinicians to make appropriate decisions.

Learning objectives

• To understand sodium homeostasis in pregnancy and be aware of the importance of fluid balance in labour.

• To know how to prevent hyponatraemia and to detect the condition in its early stages.

• To learn about the fetal impact of maternal hyponatraemia and the need for neonatal involvement in these cases.

(Author)

2022-04376

Clinical Effects of Inadvertent Increased Lipid Infusion in Neonates Two Case Reports. Hulgan CM, Snow T, Check J (2023), Advances in Neonatal Care vol 23, no 1, February 2023, pp 23-30

Background:

Utility of total parenteral nutrition (TPN) with an intravenous lipid emulsion (IVLE) component is common in the neonatal intensive care unit; however, there are inherent risks to TPN use. With IVLE administered separate from other TPN components, opportunities exist for additional error and subsequent potential harm.

Clinical Findings:

We present 2 cases in term infants where IVLE infusions were noted to be inadvertently administered at higher than

prescribed rates, prompting concern for lipemia and end-organ damage due to hyperviscosity.

Primary Diagnosis:
Both infants developed iatrogenic hypertriglyceridemia and hyponatremia.

Intervention:
Upon recognition of the error, IVLE was immediately discontinued in each case. Triglyceride levels were serially monitored until they reached a normal level. Electrolyte panels and hepatic function panels were also drawn to assess for electrolyte derangements and function. Radiologic studies were performed for evaluation of end-organ effects of hyperviscosity.

Outcomes:
Triglyceride levels for both infants normalized within 7 hours. Both infants survived to discharge without any known effects related to the inadvertent excessive lipid infusion.

Conclusion:
It is helpful to perform a root-cause analysis for these types of events; have the exact amount of lipids in the bag needed and no overfill; consider having lipids in 4-hour dosage aliquots; require 2 nurses to verify infusion rates hourly; and educational sessions and unit protocols for any infusion may reduce the risk of administration error. (Author)

2022-01303

Nursing diagnoses of hospitalized infants with physiologic hyperbilirubinemia: A cross sectional study. Khudhair AF, Nikfarid L, Varzeshnejad M, et al (2022), Journal of Neonatal Nursing vol 28, no 4, August 2022, pp 270-278

Background and aim
Nursing diagnoses are the common language of nurses which indicate the labels given to human responses to health problems/developmental processes. Neonatal physiologic hyperbilirubinemia is a developmental disorder common in neonates. The responses to this health problem need to be identified.

This study aimed to find physiologic hyperbilirubinemia related nursing diagnoses in some domains of the NANDA-I classification in hospitalized newborns in a maternal-neonatal educational hospital in Tehran, Iran.

Methods
In this cross-sectional study, a checklist contains labels, defining characteristics and related factors of selected nursing diagnosis of six domains of the NANDA-I classification and a maternal-neonatal information questionnaire were used for conveniently selected 140 hospitalized newborns with physiologic hyperbilirubinemia. The data was analyzed using SPSS software 23 (IBM Corp, Armonk, NY).

Findings
Risk for deficient fluid volume, Risk for electrolyte imbalance (hyponatremia/hypocalcemia/hypernatremia), risk for vascular trauma, risk for impaired skin integrity, risk for infection, risk for injury (retinal damage/bilirubin hyperbilirubinemia) and risk for thermal injury were the nursing diagnoses identified for more than 90% of the neonates.

Conclusion
The nursing diagnoses identified in this study for physiologic neonatal hyperbilirubinemia can guide clinical neonatal nurses in providing high-quality care in neonatal settings. (Author)

2022-00025

A case series of severe symptomatic peripartum hyponatraemia. Carlson-Hedges L, Pillai A (2023), Obstetric Medicine vol 16, no 3, September 2023, pp 196–199

This single centre case series describes the presentation and management of six cases of peripartum hyponatraemia in women who were otherwise deemed low-risk at delivery. It highlights presenting symptoms such as fatigue, confusion and seizures as well as the effects on the neonate. It also focuses on areas of interest such as fluid intake, hormonal effects of ADH and oxytocin and the association with birthing pools for future research. (Author)

2021-13913

Comparison of isotonic and hypotonic intravenous fluids in term newborns: is it time to quit hypotonic fluids. Tuzun F, Akcura Y, Duman N, et al (2022), Journal of Maternal-Fetal and Neonatal Medicine vol 35, no 1, 2022, pp 356-361

Objective

Hypotonic fluids have been traditionally used in newborns. National Institute for Health and Clinical Excellence-2015 (NICE) fluid therapy guideline recommends the use of isotonic fluids as maintenance fluid therapy in term newborns. However, there is no clear evidence supporting this recommendation. This study aims to compare isotonic (5% dextrose in 0.9% sodium chloride (NaCl)) and hypotonic (5% dextrose in 0.45% NaCl) parenteral fluid therapies in hospitalized term newborns with regard to changes in plasma Na (pNa) and complications related with fluid therapy.

Methods

This was a retrospective cohort study performed in a tertiary university hospital NICU between January 2016 and April 2018. Term newborns who were initially isonatremic or mildly dysnatremic (pNa <130 or >155 meq/L) and receiving fluid therapy for maintenance or replacement therapy after 48th postnatal hours were eligible for the study. Infants having specific diagnoses requiring extraordinary fluids were excluded. The primary outcome evaluated was the change in mean plasma Na (ΔpNa meq/L/h) at 24 h or at the end of intravenous (i.v.) fluid therapy. Secondary outcomes evaluated were the risk of hyponatremia, hypernatremia, and adverse events attributable to fluid administration.

Results

Among the 108 included newborns, 57 received hypotonic fluid (5% dextrose solution in 0.45% NaCl) and the remaining received isotonic fluid (5% dextrose solution in 0.9% NaCl) therapy. The hypotonic fluid group showed a greater ΔpNa compared to the isotonic group (0.48 ± 0.28 vs. 0.27 ± 0.21 meq/L/h, p = .001). The risk of experiencing unsafe plasma Na decrease in the hypotonic fluid group (ΔpNa >0.5 meq/L/h) was higher than the isotonic fluid group (odd ratio: 8.46; 95% confidence interval (CI): 2.3–30.06). Six mildly hypernatremic babies between 48 and 72 h of postnatal age showed insufficient Na reduction despite the appropriate amount of fluid. No significant difference was found between the two groups in terms of other outcomes.

Conclusion

The results of this study suggested that as maintenance or replacement fluid therapy in the newborn, hypotonic fluids, even 5% dextrose in 0.45% NaCl, can lead to unsafe plasma Na decreases in term newborns, while isotonic fluids are safe when started after the first few days of life. Although the results parallel NICE guidelines, before making recommendations regarding the removal of hypotonic fluids entirely from clinical practice in term newborns following the renal adaptation period; larger randomized controlled studies involving a wide range of babies are needed. (Author)

2021-12163

Association of early dysnatremia with mortality in the neonatal intensive care unit: results from the AWAKEN study. Basalely AM, Griffin R, Gist KM, et al (2021), Journal of Perinatology vol 42, no 10, October 2022, pp 1353–1360

Objective

To determine the association of dysnatremia in the first postnatal week and risk of acute kidney injury (AKI) and mortality.

Study design
A secondary analysis of 1979 neonates in the AWAKEN cohort evaluated the association of dysnatremia with (1) AKI in the first postnatal week and (2) mortality, utilizing time-varying Cox proportional hazard models.

Result
Dysnatremia developed in 50.2% of the cohort and was not associated with AKI. Mortality was associated with hyponatremia (HR 2.15, 95% CI 1.07–4.31), hypernatremia (HR 4.23, 95% CI 2.07–8.65), and combined hypo/hypernatremia (HR 6.39, 95% CI 2.01–14.01). In stratified models by AKI-status, hypernatremia and hypo/hypernatremia increased risk of mortality in neonates without AKI.

Conclusion
Dysnatremia within the first postnatal week was associated with increased risk of mortality. Hypernatremia and combined hypo/hypernatremia remained significantly associated with mortality in neonates without AKI. This may reflect fluid strategies kidney injury independent of creatinine and urine-output defined AKI, and/or systemic inflammation. (Author)

2021-10485

Systematic Review of Case Reports of Poor Neonatal Outcomes With Water Immersion During Labor and Birth. Vanderlaan J, Hall P (2020), The Journal of Perinatal and Neonatal Nursing vol 34, no 4, October/December 2020, pp 311-323

Water immersion is a valuable comfort measure in labor, that can be used during the first or second stage of labor. Case reports of adverse outcomes create suspicion about water birth safety, which restricts the availability of water birth in the United States. The objective of this study was to synthesize the information from case reports of adverse water birth events to identify practices associated with these outcomes, and to identify patterns of negative outcomes. The research team conducted a systematic search for cases reports of poor neonatal outcomes with water immersion. Eligible manuscripts reported any adverse neonatal outcome with immersion during labor or birth; or excluded if no adverse outcome was reported or the birth reported was unattended. A qualitative narrative synthesis was conducted to identify patterns in the reports. There were 47 cases of adverse outcomes from 35 articles included in the analysis. There was a pattern of cases of Pseudomonas and Legionella, but other infections were uncommon. There were cases of unexplained neonatal hyponatremia following water birth that need further investigation to determine the mechanism that contributes to this complication. The synthesis was limited by reporting information of interest to pediatricians with little information about water birth immersion practices. These data did not support concerns of water aspiration or cord rupture, but did identify other potential risks. Water immersion guidelines need to address infection risk, optimal management of compromised water-born infants, and the potential association between immersion practice and hyponatremia. (Author)

2021-10277

Problem solving in clinical practice: the sick infant with low sodium and high potassium. Tse Y, Singhal N, McDonald L, et al (2021), Archives of Disease in Childhood: Education & Practice Edition Vol 106, no 1, February 2021, pp 23-27

Many paediatricians will be faced with a sick infant who on investigation is found to have hyponatraemia and hyperkalaemia at some time in their career. The focus of initial management includes the treatment of potentially life-threatening hyperkalaemia with concurrent investigation aiming to elucidate whether the underlying cause reflects a primarily renal or endocrine pathology. We describe the presentation of two infants who each presented with one of the more common underlying diagnoses that led to this biochemical disturbance and discuss the approach to immediate treatment, diagnostic work-up and longer term management. (Author)

2021-04471

Frequency and Severity of Chlorothiazide-Induced Hyponatremia in the Neonatal Intensive Care Unit. Harkin M, Johnson PN, Neely SB, et al (2022), American Journal of Perinatology vol 39, no 12, September 2022, pp 1354-1361

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Objective Although thiazide diuretics are commonly used in the neonatal intensive care unit (NICU), the risk of thiazide-induced hyponatremia in infants has not been well documented. The primary objective of this study was to determine the frequency and severity of hyponatremia in neonates and infants receiving enteral chlorothiazide. Secondary objectives included identifying: (1) percent change in serum sodium from before chlorothiazide initiation to nadir, (2) time to reach nadir serum sodium concentration, and (3) percentage of patients on chlorothiazide receiving sodium supplementation.

Study Design This was a retrospective cohort study of NICU patients admitted between July 1, 2014 and July 31, 2019 who received ≥1 dose of enteral chlorothiazide. Mild, moderate, and severe hyponatremia were defined as serum sodium of 130 to 134 mEq/L, 120 to 129 mEq/L, and less than 120 mEq/L, respectively. Data including serum electrolytes, chlorothiazide dosing, and sodium supplementation were collected for the first 2 weeks of therapy. Descriptive and inferential statistics were performed in SAS software, Version 9.4.

Results One hundred and seven patients, receiving 127 chlorothiazide courses, were included. The median gestational age at birth and postmenstrual age at initiation were 26.0 and 35.9 weeks, respectively. The overall frequency of hyponatremia was 35.4% (45/127 courses). Mild, moderate, and severe hyponatremia were reported in 27 (21.3%), 16 (12.6%), and 2 (1.6%) courses. The median percent decrease in serum sodium from baseline to nadir was 2.9%, and the median time to nadir sodium was 5 days. Enteral sodium supplements were administered in 52 (40.9%) courses. Sixteen courses (12.6%) were discontinued within the first 14 days of therapy due to hyponatremia.

Conclusion Hyponatremia occurred in over 35% of courses of enteral chlorothiazide in neonates and infants. Given the high frequency of hyponatremia, serum sodium should be monitored closely in infants receiving chlorothiazide. Providers should consider early initiation of sodium supplements if warranted.(Author)

2021-03824

The incidence of transient infantile pseudohypoaldosteronism in Ireland: A prospective study. Kaninde A, Grace ML, Joyce C, et al (2021), Acta Paediatrica vol 110, no 4, April 2021, pp 1257-1563

Aim

To review the clinical course, outcome and incidence of infantile salt wasting associated with urinary tract infection (UTI) and/or urinary tract malformation (UTM) over a two-year surveillance period on the island of Ireland.

Methods

A two-year (2013-14) prospective surveillance undertaken via the Irish and Ulster Paediatric Surveillance Units. Monthly prepaid postcards were circulated to consultant paediatricians (n = 260) at all paediatric units on the island of Ireland. Infants under one year of age presenting for the first time with hyponatraemia (Na < 130 mmol/L) and/or hyperkalaemia (K > 5.0 mmol/L) associated with urosepsis/UTM were reported.

Results

All 7 reported patients (6 male) had culture-proven UTI, and 5 (71%) also had an underlying UTM (one diagnosed antenatally). Four (57%) patients had a documented elevated serum aldosterone supporting secondary pseudohypoaldosteronism (PHA) as the underlying diagnosis. Data on aldosterone were not reported in the other 3 patients, but clinical features were suggestive of secondary PHA. The estimated incidence for the Irish population of transient PHA is 1 per 13,200 total live births per year.

Conclusions

Salt wasting is a rare complication of UTI, especially if associated with underlying UTM. Boys appear to be at particular risk. (Author)

2021-03307

Comparison of isotonic versus hypotonic intravenous fluid for maintenance fluid therapy in neonates more than or equal to 34 weeks of gestational age – a randomized clinical trial. Dathan K, Sundaram M (2022), Journal of Maternal-Fetal and Neonatal Medicine vol 35, no 25, 2022, pp 6338-6345

Background and objectives

The use of hypotonic fluids as maintenance therapy in the neonatal population has been in practice for a long time, but there is a lack of evidence for the choice of this fluid in neonates. This study compared isotonic (sodium chloride, 0.9%, and dextrose, 5%) versus hypotonic (sodium chloride, 0.15%, and dextrose, 5%) intravenous fluid for maintenance fluid therapy in neonates more than or equal to 34 weeks of gestational age.

Methods

In this triple-blind randomized clinical trial, we recruited 60 neonates admitted to a neonatal intensive care unit of a tertiary care children's hospital from June 2017 through May 2018 with normal baseline serum sodium levels, anticipated to require intravenous maintenance fluids for 24 hours or longer (intention-to-treat analyses). Patients were randomized to receive isotonic or hypotonic intravenous fluid at maintenance rates for 72 hours. The primary outcome was the incidence of hyponatremia (defined as serum sodium <135mEq/L) at 24 hours in both groups. The secondary outcomes were incidence of hypernatremia at 24 hours (defined as serum sodium >145 mEq/L), the incidence of hypo and hypernatremia at 48 and 72 hours, mean serum sodium at 24, 48, and 72 hours, rate of change of serum sodium during the study period, mean serum osmolality at the end of the study period, the absolute difference in osmolality during the study period, the absolute difference in weight during the study period and edema during the study period.

Results

Of 60 enrolled neonates, 31 received isotonic fluids and 29 received hypotonic fluids. Three patients in the hypotonic group developed hyponatremia and none in isotonic group at 24 h (RR = 0.13; 95% CI = 0.007 − 2.485; p = .106). Fourteen neonates developed hypernatremia in the isotonic group and one in hypotonic group at 24 h (RR = 13.09; 95% CI = 1.83 − 93.4; p = .0001).

Conclusions

Our study results do not support the hypothesis that isotonic fluid is superior to hypotonic fluid in reducing the proportion of neonates developing hyponatremia after 24 hours of intravenous fluid therapy. The proportion of neonates developing hypernatremia is significantly higher after using isotonic fluid for maintenance therapy.

TRIAL REGISTRATION CTRI/2017/05/008585 (Author)

2021-02023

The incidence of transient infantile pseudohypoaldosteronism in Ireland: A prospective study. Kaninde A, Grace ML, Joyce C, et al (2020), Acta Paediatrica 27 November 2020, online

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All 7 reported patients (6 male) had culture-proven UTI, and 5 (71%) also had an underlying UTM (one diagnosed antenatally). Four (57%) patients had a documented elevated serum aldosterone supporting secondary

pseudohypoaldosteronism (PHA) as the underlying diagnosis. Data on aldosterone were not reported in the other 3 patients, but clinical features were suggestive of secondary PHA. The estimated incidence for the Irish population of transient PHA is 1 per 13,200 total live births per year.

Conclusions
Salt wasting is a rare complication of UTI, especially if associated with underlying UTM. Boys appear to be at particular risk.

20210114-16*

A single-center experience on exchange transfusion therapy in 123 full-term cases of severe neonatal hyperbilirubinemia in Wuhan. Duan L, Gan S, Hu H (2021), Journal of Maternal-Fetal and Neonatal Medicine Vol 34, no 3, 2021, no 466-472

Full URL: https://doi.org/10.1080/14767058.2020.1844659

Objective
To describe the clinical experience in application of exchange transfusion therapy (ETT) in the treatment of severe neonatal hyperbilirubinemia.
Methods
The clinical data and examination results of severe neonatal hyperbilirubinemia full-term cases treated by ETT were analyzed retrospectively, the etiology and risk factors of severe neonatal hyperbilirubinemia were statistically analyzed, and the statistical characteristics of the children in each etiological group and the incidence of adverse events of ETT were analyzed.
Results
The age of jaundice, peak total bilirubin after phototherapy and ETT in 123 full-term infants were 2.0 (1.0, 3.0) days, 4.0 (2.0, 7.0) days and 4.0 (2.0, 7.0) days, respectively, of which 68 were male and 55 were female. The main pathogeny of severe neonatal hyperbilirubinemia was blood group incompatibility hemolytic disease of newborn (HDN). Age of ETT, total bilirubin after ETT, gender and BAEP results were different between ABE and non-ABE infants. Weight loss can be used as a predictor of hospitalization length. The major adverse events related to ETT were hypocalcemia, hypomagnesemia, hyponatremia and thrombocytopenia.
Conclusions
ETT can rapidly reduce the level of total bilirubin to prevent ABE and play an important role in the treatment of neonatal hyperbilirubinemia, but the whole process of ETT needs to be closely monitored. (Author)

20201208-41*

Comparison of plasma electrolytes of perinatally asphyxiated and normal term babies. Odo KE, Odetunde OI, Chinawa JM, et al (2019), Journal of Neonatal-Perinatal Medicine vol 12, no 4, 2019

OBJECTIVES: The objective of this study is to document and compare plasma electrolytes of asphyxiated newborns of different degree within 48 hours of life.
STUDY DESIGN: A comparative cross-sectional study was conducted in the newborn special care unit at the University of Nigeria Teaching Hospital (UNTH), Enugu, South-East Nigeria. Sodium, potassium, bicarbonate and ionized calcium levels were estimated in the plasma samples of neonates with perinatal asphyxia of different degree and healthy newborns (control group) within 48 hours of birth.
MAIN OUTCOME MEASURES: The plasma sodium, potassium, bicarbonate and ionized calcium levels were estimated in both, the study subjects and controls.
RESULTS: Mean plasma sodium level was significantly lower (134.93±5.24 mmol/l vs 141.90±3.36 mmol/l; P < 0.05), mean plasma bicarbonate level was significantly lower (16.98±3.99 mmol/l vs 18.54±2.36 mmol/l; P < 0.05), and mean plasma ionized calcium level was significantly lower (1.10±0.14 mmol/l vs 1.25 0.11 mmol/l; P < 0.05) in subjects compared to controls while mean plasma potassium was significantly higher (5.07±0.93 mmol/l vs 4.65±0.51 mmol/l P < 0.05) in subjects compare to controls.
CONCLUSION: The tendency to have hyponatremia, hyperkalemia, acidosis and hypocalcemia is very high among the

study subjects which underscores the need for great vigilance in electrolyte monitoring when managing an asphyxiated baby. (Author)

20201021-61*

Severe hyponatremia in preeclampsia: a case report and review of the literature. Pu Y, Wang X, Bu H, et al (2021), Archives of Gynecology and Obstetrics vol 303, no 4, April 2021, pp 925-931

Purpose

To summarize the clinical characteristics and treatments of preeclampsia complicated with hyponatremia.

Methods

We reported a new case of preeclampsia complicated with severe hyponatremia; searched for relevant articles from the PubMed, Scopus and Cochrane databases; and reviewed all reported cases.

Results

Twenty-one reported cases were found. Our case is 22nd, and the serum sodium level in this case was the lowest reported. After treatment comprising fluid restriction, hypertonic saline and caesarean section, a relatively good outcome was achieved. In all reported cases, SIADH, preeclampsia or the combined effect of preeclampsia and induced nephrotic syndrome were the speculated pathogeny. Termination was performed due to adverse manifestations; six cases underwent transvaginal deliveries, and sixteen cases underwent caesarean section. Fifteen patients recovered from hyponatremia within 72 h after delivery.

Conclusion

The pathogenesis of hyponatremia occurring in patients with preeclampsia is still unclear. Termination of the pregnancy led to a stabilization of the sodium level, ICU monitoring was necessary, and fluid restriction and hypertonic saline intake were applied; however, there was no evidence of the effectiveness of the treatments. (Author)

20200929-29

Use of vasopressin in neonatal hypertrophic obstructive cardiomyopathy: case series. Boyd SM, Riley KL, Giesinger RE, et al (2021), Journal of Perinatology vol 41, no 1, January 2021, pp 126-133

Objective

To determine the effect of vasopressin on arterial blood pressure in infants with neonatal hypertrophic obstructive cardiomyopathy (HOCM).

Study design

Retrospective case study in Neonatal ICU involving six infants; five born to mothers with diabetes mellitus (mean gestational age 37.5 ± 0.9 weeks). Vasopressin infusion was started at a mean dose of 0.3 ± 0.2 mU/kg/min.

Result

Initiation of vasopressin was followed by improved mean ($p = 0.004$), systolic ($p = 0.028$), and diastolic ($p = 0.009$) arterial pressure within 2 h. Heart rate ($p = 0.025$) and oxygen requirement ($p = 0.021$) also declined after initiation. Serum sodium declined initially and recovered by 72 h ($p = 0.017$).

Conclusion

Although there is limited experience with vasopressin use in neonatal HOCM, our case series suggests it may be beneficial for improving systemic hypotension and stabilization of hemodynamics. The potential for hyponatremia is high, necessitating careful fluid/electrolyte management. A prospective randomized trial is necessary to confirm safety and efficacy of vasopressin treatment in neonatal HOCM. (Author)

20200616-54*

Effect of Vasopressin on Systemic and Pulmonary Hemodynamics in Neonates. Budniok T, ElSayed Y, Louis D (2021), American Journal of Perinatology vol 38, no 12, October 2021, pp 1330-1334

Objective Despite its increasing use in neonates, the literature on the use of vasopressin (VP) in neonates is limited. The aim of this study is to evaluate the systemic and pulmonary effects of VP in neonates and to assess its safety among them.

Study Design This retrospective study enrolled all neonates in two level III neonatal intensive care units in

Winnipeg, Manitoba, who had received VP therapy between 2011 and 2016. Infants with congenital malformations/chromosomal disorders were excluded. The changes in cardiovascular and pulmonary parameters were collected from patient charts. The primary outcome was the mean blood pressure (MBP) post-VP initiation. Secondary outcomes included systolic blood pressure (SBP) and diastolic blood pressure (DBP), vasoactive inotropic score (VIS), pH, urine output, lactate, base deficit (BD), mean airway pressure (MAP), and oxygen requirement. Results A total of 33 episodes from 26 neonates were analyzed. The postnatal age at VP initiation was 14 days (interquartile range [IQR]: 4-25), and the median starting dose was 0.3 mU/kg/min (IQR: 0.2-0.5). MBP improved significantly after VP initiation from 28 to 39 mm Hg 24 hours after VP initiation ($p < 0.001$). Similar changes are observed with SBP and DBP. VIS declined from 15 to 6 at 24 hours, while pH, lactate, BD, and oxygen requirement improved significantly. While urine output marginally improved, there were no changes to MAP 24 hours post-VP initiation. Hyponatremia was observed in 21 episodes (64%) and severe hyponatremia in 7 episodes (33%). Conclusion VP appears to be a promising rescue therapy in catecholamine resistant shock or refractory pulmonary hypertension in neonates. (Author)

20200421-47*

Preeclampsia And Low Sodium (PALS): A Case and Systematic Review. Powel JE, Rosenthal E, Roman A, et al (2020), European Journal of Obstetrics & Gynecology and Reproductive Biology vol 249, June 2020, pp 14-20

Normal physiologic changes in pregnancy include mild hyponatremia. In some cases of preeclampsia, more significant hyponatremia has been associated with syndrome of inappropriate antidiuretic hormone secretion and hypervolemic hyponatremia.

A 45-year-old gravida 2, para 0010 with a dichorionic twin gestation was diagnosed with preeclampsia at 30 weeks 6 days and noted to have concomitant hyponatremia of 125 mEq/L at our institution. Her hyponatremia was initially managed with furosemide and water restriction. She was delivered at 33 weeks 5 days due to worsening preeclampsia and continued significant hyponatremia despite treatment. Her hyponatremia resolved within 48 hours after delivery.

Our objectives were to discuss trends, treatment, and outcomes of cases with hyponatremia in preeclampsia. We performed a systematic review of the literature using Ovid Medline (1963 - 2017), Scopus (1962 - 2017), and PubMed (1963 - 2017, including Cochrane database). Relevant articles describing any case report of hyponatremia in preeclampsia were identified from the above databases without any time, language, or study limitations. Studies were deemed eligible for inclusion if they described a case of hyponatremia in the setting of preeclampsia. 18 manuscripts detailing 55 cases were identified. Pertinent demographic data and laboratory values were extracted. Maternal management strategy, diagnosis, delivery, and neonatal outcome data were also collected. Mean, range, standard deviation, and percentage calculations were used as applicable.

Advanced maternal age (46%), nulliparity (79%), and multifetal gestation (34%) were noted in patients with preeclampsia and low sodium. Hyponatremia was detected on average at 34 weeks gestation. 64% were diagnosed with preeclampsia with severe features. When reported, diagnoses related to hyponatremia were syndrome of inappropriate antidiuretic hormone secretion (41%) or hypervolemic hyponatremia (59%). Indications for delivery included severe hyponatremia unresponsive to conservative measures in addition to other known obstetric or preeclamptic indications. Hyponatremia resolved within 48 hours on average in cases where postpartum resolution was reported.

It may be prudent to screen women with preeclampsia for electrolyte disturbances as part of their evaluation, especially in the setting of severe features. Initially, hyponatremia may be treated with medical management. In addition to established obstetric or preeclamptic indications, delivery may be considered if severe hyponatremia no longer responds to conservative measures. (Author)

20190926-1*

The Early Notification scheme progress report: collaboration and improved experience for families. NHS Resolution (2019), London: NHS Resolution September 2019. 70 pages

Full URL: https://resolution.nhs.uk/wp-content/uploads/2019/09/NHS-Resolution-Early-Notification-report.pdf

The Early Notification (EN) scheme is a national programme for the early reporting to NHS Resolution of infants born

with a potential severe brain injury following term labour. It aims to support the stated government priorities to halve the rate of stillbirth, neonatal death and brain injury and improve the safety of maternity care while also responding to the needs of families where clinical negligence is identified including through the early admission of liability, where appropriate. The scheme uses the expertise of NHS Resolution in clinical negligence claims handling to proactively assess the legal risk, investigate care, and provide early support to families where liability is established. Furthermore, the scheme aims to improve the experience for NHS staff by time limiting the need for protracted involvement in the legal process and rapidly sharing learning from avoidable harm. This report describes the development and progress of this innovative scheme to date with an overview of the cases reported in year one from 1 April 2017 to 31 March 2018. Furthermore, it includes an analysis of the issues identified in a cohort of cases with recommendations for future work. This report is aimed at multiple levels of the system, including staff and clinical teams, trust boards and policymakers. The report is divided into two sections: the first describes the process and outcomes of the first year of the EN scheme, and the second identifies clinical learning from the cases. We have summarised high-level recommendations early in the report with a more detailed description later. Prior to the establishment of the EN scheme in April 2017, the average length of time between an incident occurring and an award for compensation being made was 11.5 years. Through the EN scheme, families with a baby affected by a severe brain injury attributable to substandard care are able to receive significantly earlier answers to their questions, avoiding full court proceedings. Through our expert claims handling, timely compensation is provided to families and staff are better supported, significantly reducing the burden of the legal process for all involved. In its first year of operation - April 2017 to March 2018 - the 746 qualifying cases reported to the EN scheme were cross-referenced against the National Neonatal Research Database (NNRD). To date, 24 families have received an admission of liability, formal apology and in some cases, financial assistance with their care and other needs within 18 months of the incident. There are a further number of cases currently being reviewed. This short duration is unprecedented for claims related to brain injury and/or cerebral palsy. NHS Resolution The Early Notification scheme progress report Executive summary Executive summary 6 Analysis of a pragmatic sample of 96 of the total 197 cases where NHS Resolution panel solicitors were instructed to investigate liability (the clinical trust or internal review classified the case as likely to have involved substandard care, or the family instructed solicitors) identified the following clinical issues: • Key themes in investigations included limited support to staff, insufficient family involvement, and confusion over duty of candour. • Issues with fetal monitoring were a leading contributory factor in 70% of cases. In 63%, at least two or more factors were identified; a delay in acting on a pathological CTG was the most common factor. • Impacted fetal head and/or difficult delivery of the head at caesarean section was a contributory factor in 9% of cases in this cohort. This is a high incidence for a problem that has not previously been reported by NHS Resolution. • Concurrent maternal medical emergencies in labour occurred in 6% including significant maternal hyponatraemia and were important contributors to neonatal seizures and encephalopathy. • Immediate neonatal care and resuscitation remains an important but an underrecognised factor affecting 32% of the cohort. To prioritise further research and safety initiatives, NHS Resolution, together with key partners, provide recommendations, which are presented in the report. (Publisher, edited) (57 references)

20190626-21*

Maternal and neonatal hyponatremia during labor: a case series. Solomon N, Many A, Orbach R, et al (2019), Journal of Maternal-Fetal and Neonatal Medicine vol 32, no 16, 2019, pp 2711-2715

Background: Hyponatremia during labor and delivery may result in severe maternal and neonatal sequelae. Our aim was to describe the direct effect of hyponatremia in labor on pregnancy outcome.

Methods: A case series of parturients diagnosed with hyponatremia during labor and their neonates. Clinical presentation, laboratory workup, and maternal and neonatal outcomes are presented.

Results: Four parturients and their corresponding six neonates were diagnosed with hyponatremia. Of these, two cases were caused by water intoxication and two were preeclampsia induced. While two were identified due to maternal or neonatal symptoms, two were diagnosed by routine laboratory testing. In all cases, low maternal sodium resulted in similarly low neonatal sodium. Neonatal symptoms included respiratory distress syndrome (RDS), lethargy, and jaundice.

Conclusion: Psychogenic drinking during labor and preeclampsia may predispose to maternal hyponatremia, resulting

in neonatal hyponatremia. Early recognition and treatment can prevent further maternal deterioration and adverse neonatal sequelae. (22 references) (Author)

20190619-41*

Hyponatremia Among Parturients Transferred to the Hospital After Prolonged Labor During an Attempted Home Birth.
Lassey SC, Napoe GS, Carusi D, et al (2019), Obstetrics & Gynecology vol 134, no 1, July 2019, pp 106-108
Full URL: https://journals.lww.com/greenjournal/Abstract/publishahead/Hyponatremia_Among_Parturients_Transferred_to_the.97687.aspx

BACKGROUND: Hypovolemic hyponatremia has not been widely reported in the obstetric literature. Anecdotally, we noticed severe hyponatremia in several of our patients who presented as home birth transfers, leading to a review of home birth cases and hyponatremia. Given the morbidity associated with hyponatremia, it is important to be aware of its potential occurrence.
CASE: We present the cases of two patients transferred to our hospital with hyponatremia after prolonged labor. These women presented with altered mental status, somnolence, and decreased urine output. Both were admitted to the intensive care unit but made a full recovery.
CONCLUSION: Hyponatremia is a serious potential complication of prolonged labor. We propose mechanisms for this condition and recommendations for surveillance and prevention. (10 references) (Author)

20190404-7*

Nutritional management of young infants presenting with acute bronchiolitis in Belgium, France and Switzerland: survey of current practices and documentary search of national guidelines worldwide. Valla FV, Baudin F, Demaret P, et al (2019), European Journal of Pediatrics vol 178, no 3, March 2019, pp 331-340
Feeding difficulties are common in young infants presenting with acute bronchiolitis, but limited data is available to guide clinicians adapting nutritional management. We aimed to assess paediatricians' nutritional practices among Western Europe French speaking countries. A survey was disseminated to describe advice given to parents for at home nutritional support, in hospital nutritional management, and preferred methods for enteral nutrition and for intravenous fluid management. A documentary search of international guidelines was concomitantly conducted. Ninety-three (66%) contacted physicians responded. Feeding difficulties were a common indication for infants' admission. Written protocols were rarely available. Enteral nutrition was favoured most of the time when oral nutrition was insufficient and might be withheld in case of severe dyspnoea to decrease respiratory workload. Half of physicians were aware of hyponatremia risk and pathophysiology, and isotonic intravenous solutions were used in less than 15% of centres. International guideline search (23 countries) showed a lack of detailed nutritional management recommendations in most of them.
Conclusion: practices were inconsistent among physicians. Guidelines detailed nutritional management poorly. Awareness of hyponatremia risk in relation to intravenous hypotonic fluids and of the safety of enteral hydration and nutrition is insufficient. New guidelines including detailed nutritional management recommendations are urgently needed. (35 references) (Author)

20190401-11

Dysnatremia in extremely low birth weight infants is associated with multiple adverse outcomes. Monnikendam CS, Mu TS, Aden JK, et al (2019), Journal of Perinatology vol 39, no 6, June 2019, pp 842-847
Objective
The objective of this study is to discern patterns of serum sodium in a broad cohort of extremely low birth weight (ELBW) infants and associate those patterns with hospital outcomes.
Study Design
Retrospective cohort study of ELBW infants from 323 neonatal intensive care units (NICUs) discharged from 2004 to 2014. We included patients who survived at least 7 days and had daily sodium levels available, and categorized infants by their minimum and maximum sodium levels.
Results

We identified 26,871 infants of whom 12,428 met inclusion criteria. Only 1964 (15.8%) maintained eunatremia for the first week. We found most dysnatremias to be associated with increased overall mortality compared with eunatremic patients including moderate hyponatremia (12.9% vs. 8.6%, $p < 0.05$) and severe hypernatremia (34.8% vs. 8.6%, $p < 0.001$). Most of these associations were maintained after regression modeling for mortality.
Conclusion
Sodium fluctuations occurring within the first week of life are associated with increased mortality. [Please note: this article is a digital version which may undergo minor changes in the future]
(20 references) (Author)

20181016-73*

Late onset hyponatremia in preterm newborns: is the sodium content of human milk fortifier insufficient?. Gokçe IK, Oguz SS, et al (2020), Journal of Maternal-Fetal and Neonatal Medicine vol 33, no 7, 2020, pp 1197-1202

Introduction: In this study, we aimed to define the incidence and time to detection of late onset hyponatremia (LOH) as well as factors affecting its development in preterm newborns. We also aimed to determine the daily sodium requirement of these patients.
Methods: We studied a total of 145 very low birth weight infants with a full or nearly full enteral diet and followed them up until discharge. We recorded demographic and clinic characteristics. We measured serum sodium (SNa) levels at least once a week after the second week. We compared infants with LOH with other infants to analyze possible risk factors.
Results: Twenty-nine (20%) infants developed LOH in an average of 23.4 ± 7.8 days. The mean SNa level of these infants was 124.6 ± 5.6 mmol/L. Logistic regression analysis showed that a birth weight of less than 1000 g, preterm early membrane rupture, and nutrition with fortified human milk alone were risk factors for LOH. The mean daily amount of sodium added to the nutrition of hyponatremic preterm infants was 3.6 ± 2.1 mmol/L. Subgroup analysis showed that the incidence of LOH was two times higher (39.2%) in infants with a birth weight of less than 1000 g.
Conclusion: We observed the development of LOH within three to four weeks in nearly half of preterm infants fed with fortified human milk, especially those with a birth weight of less than 1000 g. We believe that the sodium content of currently used human milk fortifiers should be increased. (Author)

20180803-16*

Epidemiological and clinical characteristics of 304 patients with infantile hypertrophic pyloric stenosis in Anhui Province of East China, 2012-2015. Li J, Gao W, Zhu J, et al (2018), Journal of Maternal-Fetal and Neonatal Medicine vol 31, no 20, 2018, pp 2742-2747

Objective: To analyze the clinical and epidemiological features of patients with infantile hypertrophic pyloric stenosis (IHPS) so as to provide scientific evidence for diagnosis and prevention of IHPS.
Methods: We performed a retrospective study of infants with IHPS diagnosed from 2012 to 2015 at Anhui Provincial Children's Hospital. Demographic characteristics and clinical data were collected.
Results: Three hundred four patients (264 males and 40 females) were studied, of which 94.7% were full term and 75.7% were bottle fed or mixed fed; 16.8% of the patients had other congenital malformations in combination with IHPS. The proportion of IHPS cases with hyponatremia, hypokalemia, and hypochloremia was 18.4%, 12.5%, and 53.9%. A negative correlation was found between duration of disease and serum electrolytes. The mean pyloric muscle thickness, pyloric length, and diameter were 4.8 ± 0.7 mm, 19.4 ± 2.5 mm, and 13.3 ± 1.8 mm, respectively. There were significant differences in muscle thickness, pyloric length, and diameter between short (≤14 d) and long (>14 d) durations of disease. All patients underwent pyloromyotomy, and postoperative recovery was good.
Conclusions: IHPS occurs mainly in male, full-term, bottle-fed or mixed-fed infants. Patients with long duration of disease were more likely to develop electrolyte disorder and thicker muscle layer. More attention should be paid to early discovery and diagnosis, which will help to improve the curative effect and prognosis of IHPS. (36 references) (Author)

20180316-23

A One-Month-Old Boy With a Seizure During a Febrile Illness. Muto T, Nago N, Kurahashi H, et al (2018), Clinical Pediatrics vol 57, no 3, March 2018, pp 355-357

A case report of a one-month-old infant admitted to hospital with fever, who later suffered a seizure. Syndrome of inappropriate secretion of antidiuretic hormone (SIADH) was considered to be a cause of hyponatraemia in the infant. Discusses causes of seizures in infants, concerns the authors had for their particular patient, and the pathology of SIADH. (15 references) (KRB)

20171102-153*

Central pontine myelinolysis during pregnancy: pathogenesis, diagnosis and management. Sánchez-Ferrer ML, Prieto-Sánchez MT, Orozco-Fernández R, et al (2017), Journal of Obstetrics and Gynaecology vol 37, no 3, April 2017, pp 273-279

Central pontine myelinolysis (CPM) is a rare condition usually caused by rapid sodium correction in hyponatraemia after a severe neurological syndrome. Only few cases have been reported during pregnancy, most of which were reported in patients with hyperemesis. We describe the successful management of the first case of twin pregnancy in a patient who presented with CPM after treatment for premature labour and then review the literature on CPM in pregnancy (aetiology, diagnosis and management). Our patient required emergency delivery to achieve electrolyte and fluid balance. At six months, the twins remained asymptomatic and the mother had minor sequelae. The aetiology is not clear, and there is no evidence regarding the optimal treatment or prognosis of CPM. In our patient, desmopressin-contaminated atosiban showed a certain probability in the Karch-Lasagne algorithm of a causality relationship between hyponatraemia and the drug. To our knowledge, this is the first case of myelinolysis reported in a twin pregnancy possibly related to desmopressin-contaminated atosiban. (40 references) (Author)

20170824-7*

Hyponatremia associated with preeclampsia. Razavi AS, Chasen ST, Gyawali R, et al (2017), Journal of Perinatal Medicine vol 45, no 4, May 2017, p 467

Objective:

The objective of our study was to evaluate the prevalence and clinical factors associated with hyponatremia in patients with preeclampsia.

Study design:

This is a descriptive study of all patients who delivered at our institution from 2013 to 2014. Patients with preeclampsia were identified from electronic medical records. Preeclampsia with and without severe features was defined using the criteria outlined in the American Congress of Obstetricians and Gynecologists Hypertension in Pregnancy guidelines. As sodium levels have been shown to be approximately 5 mEq/L lower in pregnancy, hyponatremia was defined as a sodium level <130 mEq/L.

Results:

We identified 332 pregnancies complicated by preeclampsia, including 277 singletons and 55 twins. Hyponatremia was noted in 32 (9.7%) patients. Preeclampsia with severe features was present in the majority of patients with hyponatremia, and hyponatremia was more common in those with preeclampsia with severe features compared to those without (P<0.001). Hyponatremia also occurred more frequently in twins (P=0.001) and in older women (P=0.017). Only one patient without hyponatremia had an eclamptic seizure.

Conclusion:

Hyponatremia is not uncommon in preeclampsia, and is even more common in those with preeclampsia with severe features and twin gestations. As women with preeclampsia are at risk for hyponatremia, serum sodium should be monitored, especially in women with preeclampsia with severe features or twin gestations. (16 references) (Author)

20170727-27

Poor feeding, weight loss, and electrolyte abnormalities in a term infant. Kandavel P, Selewski D, Shah M, et al (2017), Clinical Pediatrics vol 56, no 8, July 2017, pp 789-791

A report on a case of persistent hyponatraemia and poor feeding, eventually diagnosed as pseudohypoaldosteronism (PHA) type 1. The article goes on to discuss electrolyte abnormalities in infants more broadly, the symptoms patients

may present with, and potential causes and treatments. (4 references)

20170606-19*

Transient pseudohypoaldosteronism in infancy secondary to urinary tract infection. Abraham MB, Larkins N, Choong CS, et al (2017), Journal of Paediatrics and Child Health vol 53, no 5, May 2017, pp 458-463

Aim

Hyponatraemia with hyperkalaemia in infancy is a typical presentation of congenital adrenal hyperplasia. In the presence of pyelonephritis, the same biochemical picture can occur with transient type 1 pseudohypoaldosteronism (PHA-1) also termed type 4 renal tubular acidosis. Recognition of PHA-1 enables appropriate management thus avoiding unnecessary investigations and treatment. To improve awareness of this condition, we present a case series to highlight the clinical and biochemical features of PHA-1.

Methods

A retrospective chart review of patients diagnosed with transient PHA-1 at a tertiary children's hospital in Western Australia was conducted.

Results

Five male infants (32 days to 6 months) with transient PHA-1 were identified. Failure to thrive was the most common symptom with hyponatraemia on presentation. Two infants had antenatally diagnosed bilateral hydronephrosis and urinary tract infection (UTI) on admission. Two infants were treated for congenital adrenal hyperplasia and received hydrocortisone. All infants had UTI and required parenteral antibiotics. The condition was transient and hyponatraemia corrected by day 4 in all infants. There was no correlation between plasma sodium and aldosterone levels. The severity of PHA-1 was independent of the underlying renal anomaly. Four infants had hydronephrosis and vesicoureteric reflux. Surgical intervention was required in two infants.

Conclusions

PHA-1 may be precipitated by UTI or urinary tract anomalies in early infancy. Urine analysis should be performed in infants with hyponatraemia. Diagnosis of PHA-1 facilitates appropriate renal investigations to reduce long-term morbidity. (Author)

20170425-20*

Sodium supply influences plasma sodium concentration and the risks of hyper- and hyponatremia in extremely preterm infants. Späth C, Sjöström ES, Ahlsson F, et al (2017), Pediatric Research vol 81, no 3, March 2017, pp 455-460

BACKGROUND:

Hyper- and hyponatremia occur frequently in extremely preterm infants. Our purpose was to investigate plasmasodium (P-Na) concentrations, the incidence of hyper- and hyponatremia, and the impact of possible predisposing factors in extremely preterm infants.

METHODS:

In this observational study, we analyzed data from the EXtremely PREterm (< 27 wk.) infants in Sweden Study (EXPRESS, n = 707). Detailed nutritional, laboratory, and weight data were collected retrospectively from patient records.

RESULTS:

Mean ± SD P-Na increased from 135.5 ± 3.0 at birth to 144.3 ± 6.1 mmol/l at a postnatal age of 3 d and decreased thereafter. Fifty percent of infants had hypernatremia (P-Na > 145 mmol/l) during the first week of life while 79% displayed hyponatremia (P-Na < 135 mmol/l) during week 2. Initially, the main sodium sources were blood products and saline injections/infusions, gradually shifting to parenteral and enteral nutrition towards the end of the first week. The major determinant of P-Na and the risks of hyper- and hyponatremia was sodium supply. Fluid volume provision was associated with postnatal weight change but not with P-Na.

CONCLUSION:

The supply of sodium, rather than fluid volume, is the major factor determining P-Na concentrations and the risks of hyper- and hyponatremia. (30 references) (Author)

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20170329-76*

A study of acute kidney injury in hospitalized preterm neonates in NICU. Nagaraj N, Berwal PK, Srinivas A, et al (2016), Journal of Neonatal-Perinatal Medicine vol 9, no 4, 2016

OBJECTIVES: This study was carried out to determine the incidence, clinical features, etiology and outcome of functional and intrinsic acute kidney injury (AKI) in preterm neonates.

METHODS: This is a prospective observational study on premature infants admitted to the neonatal intensive care unit (NICU) over an eight month period. All biochemical parameters of renal function tests were monitored and statically analyzed.

RESULTS: The study included 450 infants; of them 300 were inborn and 150 infants were outborn and transported to the NICU. Mean gestational age, weight, and age at the time of AKI diagnosis were 32.3 weeks, 1.66 kg and 3.23 days respectively. The male: female ratio was 1.84:1. Incidence of AKI was higher in low birth weight babies. Sluggishness and refusal for feed were most common symptoms. Birth asphyxia and septicemia were the most common early and late cause of AKI. Hyponatremia was the most common electrolyte disturbance. The incidences of AKI, functional renal failure, and intrinsic renal failure were 12%, 48.14%, and 51.85% respectively.

CONCLUSIONS: AKI is not uncommon in preterm infants. The early recognition and aggressive management of episodes of shock which often precede AKI could be life-saving. (Author)

20170322-20*

Comparison of sodium ion levels between an arterial blood gas analyzer and an autoanalyzer in preterm infants admitted to the neonatal intensive care unit: a retrospective study. Kim H, Kim JK, Cho SC (2016), BMC Pediatrics vol 16, no 101, July 2016

Full URL: https://bmcpediatr.biomedcentral.com/articles/10.1186/s12887-016-0636-4

Background

The difference in sodium ion levels determined with direct and indirect methods often exceeds the permissible limit clinically. Additionally, no previous study has assessed the difference in the sodium ion levels between direct and indirect methods in premature infants. Therefore, the present study aimed to compare sodium ion levels obtained using an arterial blood gas analyzer (ABGA; direct method) and an autoanalyzer (indirect method) to determine whether they are equivalent in premature infants.

Methods

The present retrospective study included 450 preterm infants (weight, <2500 g) who were admitted to the neonatal intensive care unit (NICU) of our hospital between March 2012 and April 2014. We compared sodium ion levels in 1041 samples analyzed using an ABGA (Stat Profile® CCX Series, Nova Biomedical, Waltham, MA) and an autoanalyzer (ADVIA® 2400 Clinical Chemistry System, Siemens, Tarrytown, NY). The data were evaluated using Spearman's correlation coefficient analysis, Bland-Altman plot, Deming regression analysis, and multivariate logistic regression analysis.

Results

The mean sodium ion levels were 134.6 ± 3.5 mmol/L using the ABGA and 138.8 ± 4.7 mmol/L using the autoanalyzer ($P < 0.001$). Among the 1041 samples, 957 (91.9 %) showed lower sodium ion levels with the ABGA than with the autoanalyzer and 74 (7.1 %) showed lower sodium ion levels with the autoanalyzer than with the ABGA. The incidence of hyponatremia identified using the ABGA was 51.9 % (541/1041), while the incidence of hyponatremia identified using the autoanalyzer was only 14.0 % (146/1041). The Deming regression analysis of the sodium ion levels between the ABGA and the autoanalyzer yielded the following formula: autoanalyzer Na (mmol/L) = 20.7 + (0.9 × ABGA Na [mmol/L]). In the multivariate logistic regression analysis, low plasma protein level (<4.3 g/dL) was found to be an independent risk factor for a sodium ion level difference of >4 mmol/L between the two methods (odds ratio = 2.870, $P < 0.001$).

Conclusion

The sodium ion levels determined using the ABGA and the autoanalyzer might not be equivalent in premature infants admitted to the NICU. Therefore, clinicians should be careful when diagnosing sodium ion imbalance in premature infants and providing treatment. (17 references) (Author)

20160204-10*

Case 1: Hypertension and hyponatremia in a neonate. Vayngortin T, Fischer A, Lemley KV, et al (2016), NeoReviews vol 17, no 1, January 2016, e 37

Discusses the case of a three-week-old baby boy, born at 32 weeks' gestation, who was admitted to the neonatal intensive care unit with acute-onset hypertension and hyponatremia. (JSM)

20151217-5*

Intravenous fluid therapy in children and young people in hospital. National Institute for Health and Care Excellence (2015), London: NICE 9 December 2015

Full URL: http://www.nice.org.uk/guidance/ng29

Covers general principles for managing intravenous fluids for children and young people under 16 years, including assessing fluid and electrolyte status and prescribing IV fluid therapy (IF). It includes recommendations on principles and protocols for intravenous fluid therapy, assessment and monitoring, fluid resuscitation, routine maintenance, replacement and redistribution, managing hypernatraemia and hyponatraemia that develops during intravenous fluid therapy, training and education. It does not include recommendations relating to specific conditions. (Publisher, edited)

20150910-32

Severe hyponatremia in a 1-week-old male infant. Huebner K, Davis TK, Jackson T, et al (2015), Clinical Pediatrics vol 54, no 4, April 2015, pp 396-400

Presents the case of an 8 day-old infant who was taken to hospital with 'puffy hands and feet'. He was diagnosed with posterior urethral valves and profound hyponatraemia. (9 references) (MB)

20140718-47*

Vasopressin improves hemodynamic status in infants with congenital diaphragmatic hernia. Acker SN, Kinsella JP, Abman SH, et al (2014), Journal of Pediatrics vol 165, no 1, 2014, pp 53-58.e1

OBJECTIVE:
To assess the ability of vasopressin to stabilize hemodynamics in infants with systemic hypotension secondary to congenital diaphragmatic hernia (CDH).
STUDY DESIGN:
A retrospective chart review was performed to identify 13 patients with CDH treated with vasopressin for refractory hypotension to assess the effect of vasopressin on pulmonary and systemic hemodynamics and gas exchange in this setting. Data collected included demographics, respiratory support, inotropic agents, pulmonary and systemic hemodynamics, urine output, and serum and urine sodium levels during vasopressin therapy.
RESULTS:
Vasopressin therapy increased mean arterial pressure and decreased pulmonary/systemic pressure ratio, heart rate, and fraction of inspired oxygen. In 6 of 13 patients, extracorporeal membrane oxygenation therapy was no longer indicated after treatment with vasopressin. Improvement in left ventricular function and oxygenation index after vasopressin initiation was associated with a decreased need for extracorporeal membrane oxygenation therapy. Prolonged vasopressin treatment was associated with hyponatremia, increased urine output, and increased urine sodium.
CONCLUSIONS:
Vasopressin stabilized systemic hemodynamics without adverse effects on pulmonary hemodynamics in a subset of infants with CDH. Our results suggest a potential role for vasopressin therapy in patients with CDH with catecholamine-resistant refractory hypotension. (Author)

20140303-26*

Postoperative decrease in plasma sodium concentration after infusion of hypotonic intravenous solutions in neonatal surgery. Edjo Nkilly G, Michelet D, Hilly J, et al (2014), British Journal of Anaesthesia vol 112, no 3, 2014, pp 540-545

BACKGROUND: Hypotonic i.v. solutions can cause hyponatraemia in the context of paediatric surgery. However, this has not been demonstrated in neonatal surgery. The goal of this study was to define the relationship between infused perioperative free water and plasma sodium in neonates. METHODS: Newborns up to 7 days old undergoing abdominal or thoracic surgery were included in this prospective, observational study. Collected data included type and duration of surgery, calculated i.v. free water intake, and pre- and postoperative plasma sodium. Statistical analyses were performed using the Pearson correlation, Mann-Whitney test, and receiver operating characteristic analysis with a 1000 time bootstrap procedure. RESULTS: Thirty-four subjects were included. Postoperative hyponatraemia occurred in four subjects (11.9%). The difference between preoperative and postoperative plasma sodium measurements (ΔNaP) correlated with calculated free water intake during surgery (r=0.37, P=0.03), but not with preoperative free water intake. Calculated operative free water intake exceeding 6.5 ml kg(-1) h(-1) was associated with ΔNaP≥4 mM with a sensitivity and specificity [median (95% confidence interval)] of 0.7 (0.9-1) and 0.5 (0.3-0.7), respectively. CONCLUSIONS: Hypotonic solutions and i.v. free water intake of more than 6.5 ml kg(-1) h(-1) are associated with reductions in postoperative plasma sodium measurements ≥4 mM. In the context of neonatal surgery, close monitoring of plasma sodium is mandatory. Routine use of hypotonic i.v. solutions during neonatal surgery should be questioned as they are likely to reduce plasma sodium. (Author)

20131011-43

A fine line. Paul SP, Goodman A (2013), Midwives no 2, 2013, pp 46-47

Dr Siba Prosad Paul and Dr Alexander Goodman explain the circumstances in which dilutional hyponatraemia may occur, in both women and newborns, as well as the symptoms it presents with and preventative measures. (Author)

20130729-70*

Intravenous fluids for reducing the duration of labour in low risk nulliparous women (Cochrane Review). (Assessed as up-to-date: 17 June 2013). Dawood F, Dowswell T, Quenby S (2013), The Cochrane Database of Systematic Reviews Issue 6, 2013

Background:

Several factors may influence the progression of normal labour. It has been postulated that the routine administration of intravenous fluids to keep women adequately hydrated during labour may reduce the period of contraction and relaxation of the uterine muscle, and may ultimately reduce the duration of the labour. It has also been suggested that intravenous fluids may reduce caesarean sections (CS) for prolonged labour.

However, the routine administration of intravenous fluids to labouring women has not been adequately elucidated although it is a widely-adopted policy, and there is no consensus on the type or volume of fluids that are required, or indeed, whether intravenous fluids are at all necessary. Women may be able to adequately hydrate themselves if they were allowed oral fluids during labour.

Furthermore, excessive volumes of intravenous fluids may pose risks to both the mother and her newborn and different fluids are associated with different risks.

Objectives:

To evaluate whether the routine administration of intravenous fluids to low-risk nulliparous labouring women reduces the duration of labour and to evaluate the safety of intravenous fluids on maternal and neonatal health.

Search methods:

We searched the Cochrane Pregnancy and Childbirth Group's Trials Register (13 February 2013).

Selection criteria:

Randomised controlled trials of intravenous fluid administration to spontaneously labouring low-risk nulliparous women.

Data collection and analysis:

The review authors independently assessed trials for inclusion, trial quality and extracted data.

Main results:

We included nine randomised trials with 1781 women. Three trials had more than two treatment arms and were included in more than one comparison.

Two trials compared women randomised to receive up to 250 mL/hour of Ringer's lactate solution as well as oral intake versus oral intake only. For women delivering vaginally, there was a reduction in the duration of labour in the Ringer's lactate group (mean difference (MD) -28.86 minutes, 95% confidence interval (CI) -47.41 to -10.30). There was no statistical reduction in the number of CS in the Ringer's lactate group (risk ratio (RR), 0.73 95% CI 0.49 to 1.08).

Three trials compared women who received 125 mL/hour versus 250 mL/hour of intravenous fluids with free oral fluids in both groups. Women receiving a greater hourly volume of intravenous fluids (250 mL) had shorter labours than those receiving 125 mL (MD 23.87 minutes, 95% CI 3.72 to 44.02, 256 women). There was no statistically significant reduction in the number of CS in the 250 mL intravenous fluid group (average RR 1.00, 95% CI 0.54 to1.87, three studies, 334 women). In one study the number of assisted vaginal deliveries was lower in the group receiving 125 mL/hour (RR 0.47, 95% CI 0.27 to 0.81).

Four trials compared rates of intravenous fluids in women where oral intake was restricted (125 mL/hour versus 250 mL/hour). There was a reduction in the duration of labour in women who received the higher infusion rate (MD 105.61 minutes, 95% CI 53.19 to 158.02); P < 0.0001, however, findings must be interpreted with caution as there was high heterogeneity amongst trials (I2 = 53%). There was a significant reduction in CS in women receiving the higher rate of intravenous fluid infusion (RR 1.56, 95% CI 1.10 to 2.21; P = 0.01). There was no difference identified in the assisted delivery rate (RR 0.78, 95% CI 0.44 to 1.40). There was no clear difference between groups in the number of babies admitted to the NICU (RR 0.48, 95% CI 0.07 to 3.17).

Two trials compared normal saline versus 5% dextrose. Only one reported the mean duration of labour, and there was no strong evidence of a difference between groups (MD -12.00, 95% CI -30.09 to 6.09). A trial reporting the median suggested that the duration was reduced in the dextrose group. There was no significant difference in CS or assisted deliveries (RR 0.77, 95% CI 0.41 to 1.43, two studies, 284 women) and (RR 0.59, 95% CI 0.21 to 1.63, one study, 93 women) respectively. Only one trial reported on maternal hyponatraemia (serum sodium levels < 135 mmol/L). For neonatal complications, there was no difference in the admission to NICU) or in low Apgar scores, however 33.3% of babies developed hyponatraemia in the dextrose group compared to 13.3 % in the normal saline group (RR 0.40, 95% CI 0.17 to 0.93) (P = 0.03). One trial reported a higher incidence of neonatal hyperbilirubinaemia in the dextrose group of babies. There was no difference in neonatal hypoglycaemic episodes between groups.

Authors' conclusions:

Although the administration of intravenous fluids compared with oral intake alone demonstrated a reduction in the duration of labour, this finding emerged from only two trials. The findings of other trials suggest that if a policy of no oral intake is applied, then the duration of labour in nulliparous women may be shortened by the administration of intravenous fluids at a rate of 250 mL/hour rather than 125 mL/hour. However, it may be possible for women to simply increase their oral intake rather than being attached to a drip and we have to consider whether it is justifiable to persist with a policy of 'nil by mouth'. One trial raised concerns about the safety of dextrose and this needs further exploration.

None of the trials reported on the evaluation of maternal views of being attached to a drip during their entire labour. Furthermore, there was no objective assessment of dehydration. The evidence from this review does not provide robust evidence to recommend routine administration of intravenous fluids. Interpreting the results from trials was hampered by the low number of trials contributing data and by variation between trials. In trials where oral fluids were not restricted there was considerable variation in the amount of oral fluid consumed by women in different arms of the same trial, and between different trials. In addition, results from trials were not consistent and risk of bias varied. Some important research questions were addressed by single trials only, and important outcomes relating to maternal and infant morbidity were frequently not reported. (Author)

20130326-33*

Bolus fluid therapy and sodium homeostasis in paediatric gastroenteritis. Freedman SB, Geary DF (2013), Journal of Paediatrics and Child Health vol 49, no 3, 2013, pp 215-222

AIM:

The study aims to assess the risk of developing hyponatraemia when large-volume bolus fluid rehydration therapy is administered.
METHODS:
We conducted a prospective randomised study in a tertiary-care centre emergency department. Participants included children with gastroenteritis and dehydration requiring intravenous rehydration. They were randomised to receive 60 mL/kg (large) or 20 mL/kg (standard) 0.9% saline bolus followed by maintenance 0.9% saline for 3 h. Biochemical tests were performed at baseline and 4 h. The primary outcome measure was the development of hyponatraemia at 4 h. Secondary outcome measures were (i) change in sodium relative to baseline value; (ii) magnitude of decrease among those who experienced a decrease; (iii) risk of hypernatraemia; (iv) correlations between urine parameters and hyponatraemia; and (v) fluid overload.
RESULTS:
Eighty-four of 224 (38%) participants were hyponatraemic at baseline. At 4 h, 22% (48/217) had a dysnatraemia, and similar numbers of children were hyponatraemic in both groups: large (23% (26/112)) versus standard (21% (22/105)) (P = 0.69). Among initially hyponatraemic children, 63% (30/48) who received large-volume rehydration and 44% (15/34) of those administered standard rehydration were isonatraemic at 4 h (P = 0.10). Overall, children who received 60 mL/kg experienced a larger mean increase (1.6 ± 2.4 mEq/L vs. 0.9 ± 2.2 mEq/L; P = 0.04) and were less likely to experience a sodium decrease of ≥2 mEq/L (8/112 vs. 17/105; P = 0.04) than those administered 20 mL/kg.
CONCLUSIONS:
Large-volume bolus rehydration therapy with 0.9% saline is safe. It does not promote the development of hyponatraemia over the short term, but hastens the resolution of baseline hyponatraemia. (Author)

20130131-23

A pinch of salt. Paul SP, Smith BA, Luthra KK (2013), The Practising Midwife vol 16, no 2, February 2013, pp 13-16

Pregnant women in labour are generally encouraged by their carers to continue taking plenty of oral fluids. This is sometimes supplemented by intravenous fluids either due to a clinical necessity or in preparation for a caesarean section. It is important that there is clear documentation of the amount of fluids received by pregnant women in the perinatal period as excessive maternal fluid has been associated with low serum sodium in neonates. This often goes under-recognised; therefore it is important to consider this in a neonate presenting with hyponatraemia in the first day of life. Presented here is a case of neonatal hyponatraemis secondary to excessive fluid taken in the perinatal period. (11 references) (Author)

20130116-60*

Pregnancy with known syndrome of inappropriate antidiuretic hormone. Nawathe A, Govind A (2013), Journal of Obstetrics and Gynaecology vol 33, no 1, January 2013, pp 9-13

Syndrome of inappropriate antidiuretic hormone (SIADH) is rarely encountered in pregnancy. We report a case of severe hyponatraemia with idiopathic SIADH. A total of 18 cases of hyponatraemia in pregnancy have been reported; seven fit the criteria of SIADH. Unlike our case, none were diagnosed before pregnancy. Of the cases, 13 were associated with pre-eclampsia. Our patient developed intrauterine growth restriction (IUGR) but did not develop pre-eclampsia. (Author)

20130104-62#

Electrolytes in sick neonates - which sodium is the right answer?. King RI, Mackay RJ, Florkowski CM, et al (2013), Archives of Disease in Childhood: Fetal and Neonatal Edition vol 98, no 1, January 2013, pp F74-F76

INTRODUCTION:
Hypoproteinaemia leads to spuriously high-sodium values when measured by indirect ion-selective electrodes (ISE) as used in main laboratory analysers compared with direct ISE employed in point-of-care analysers (POCT). The authors, therefore, investigated the occurrence of hypoalbuminaemia and its effect on measured sodium from POCT and the main laboratory analyser of neonatal intensive-care samples.

METHOD:
Sodium, in paired retrospective samples, measured by the main laboratory and neonatal unit blood-gas (POCT) analysers were compared.
RESULTS:
Hypoalbuminaemia (<30 g/l) was present in 1400/2420 paired results. Sodium was higher when measured by laboratory analyser, the difference increased with decreasing albumin; sodium (laboratory - POCT)=7.6 (±1.1)-0.22 (±0.04)×albumin. A difference >3 mmol/l was present in 31% and consequently underestimated (9.4%) hyponatraemia and overestimated (3.8%) hypernatraemia.
CONCLUSION:
Hypoalbuminaemia is common in sick neonates and monitoring electrolytes using POCT and laboratory analysers frequently yield significantly different results with consequent misclassification. In these patients, measurement of electrolytes by direct ISE (blood-gas analyser) may be more accurate. (9 references) (Author)

20121214-14

Prevalence of hyponatremia at diagnosis and factors associated with the longitudinal variation in serum sodium levels in infants with cystic fibrosis. Guimaraes EV, Schettino GCM, Camargos PAM, et al (2012), Journal of Pediatrics vol 161, no 2, August 2012, pp 285-289

OBJECTIVE:
To determine the prevalence of hyponatremia at diagnosis in patients with cystic fibrosis and identify the factors associated with changes in serum sodium concentration over time.
STUDY DESIGN:
This longitudinal study investigated whether variations in serum sodium concentration were associated with age, diet, infection status, and climate/temperature. Multivariate analysis was performed using the random-effects model for longitudinal data.
RESULTS:
Hyponatremia at diagnosis was observed in 19 of the 20 patients (95%). Factors identified as associated with variations in serum sodium concentration were diet (P = .008) and climate/temperature (P = .005). Intake of solid foods appeared to greatly increase the serum sodium concentration (increase of 5 mEq/L after introduction of solid foods); however, a confounding factor between diet and age cannot be definitively ruled out. Climate/temperature contributed in an inverse way; a 1°C-increase in ambient temperature was associated with a 0.5-mEq/L decrease in serum sodium concentration.
CONCLUSION:
Infants with cystic fibrosis who feed on breast milk or formula and live in a high-temperature environment are at increased risk for hyponatremia, even when receiving a higher salt intake in accordance with recommendations. (22 references) (Author)

20121101-1*

Intravenous 0.18% saline/4% glucose solution ('hypotonic saline') in children: reports of fatal hyponatraemia - do not use in children aged 16 years or less, except in specialist settings under expert medical supervision. The Medicines and Healthcare products Regulatory Agency, The Commission on Human Medicines (2012), Drug Safety Update vol 6, issue 3, October 2012, A2

Full URL: http://www.mhra.gov.uk/Safetyinformation/DrugSafetyUpdate/CON199559

Four children have died of cerebral oedema caused by very low levels of serum sodium after receiving intravenous hypotonic saline (0.18% saline/4% glucose solution) in hospital. This solution is now contraindicated in children except under expert medical supervision in paediatric specialist settings - such as renal, cardiac, liver, high dependency and intensive care units. (4 references) (Author)

20120314-45

Isotonic versus hypotonic fluid supplementation in term neonates with severe hyperbilirubinemia - a double-blind,

randomized, controlled trial. Balasubramanian K, Kumar P, Saini SS, et al (2012), Acta Paediatrica vol 101, no 3, March 2012, pp 236-241

AIM: To compare the incidence of hyponatremia in full-term neonates with severe hyperbilirubinemia, receiving intravenous fluid supplementation with 0.2% saline in 5% dextrose versus 0.9% saline in 5% dextrose, to prevent blood exchange transfusion (BET). METHODS: In this double-blind, randomized, controlled trial, full-term newborns (≥37 weeks), appropriate for gestational age, with severe non-haemolytic hyperbilirubinemia (serum bilirubin ≥ 20 mg/dL) were enrolled. Eligible neonates were randomized to receive either 0.2% saline in 5% dextrose (hypotonic fluid group) or 0.9% saline in 5% dextrose (isotonic fluid group) over 8 hrs, in addition to phototherapy. The primary outcome was proportion of neonates developing hyponatremia (serum Na < 135 mmol/L) after 8 h. RESULTS: Forty-two neonates were analysed in each group. Proportion of neonates developing hyponatremia after 8 h was higher in hypotonic fluid group as compared to isotonic fluid group (48.8% vs. 10.5%, p < 0.001). However, a larger proportion in isotonic fluid group developed hypernatremia (39.5% vs. 12.2%, p < 0.001). The rate of BET was similar in both groups. CONCLUSION: In full-term neonates with severe hyperbilirubinemia, administration of hypotonic fluid to prevent BET was associated with a higher incidence of hyponatremia while isotonic fluid was associated with an increased incidence of hypernatremia. (22 references) (Author)

20120111-52

Hypotonic versus isotonic maintenance fluids after surgery for children: a randomized controlled trial. Choong K, Arora S, Farrokhyar F, et al (2012), Pediatrics vol 128, no 5, November 2011, pp 857-866

OBJECTIVE: The objective of this randomized controlled trial was to evaluate the risk of hyponatremia following administration of a isotonic (0.9% saline) compared to a hypotonic (0.45% saline) parenteral maintenance solution (PMS) for 48 hours to postoperative pediatric patients. METHODS: Surgical patients 6 months to 16 years of age with an expected postoperative stay of >24 hours were eligible. Patients with an uncorrected baseline plasma sodium level abnormality, hemodynamic instability, chronic diuretic use, previous enrollment, and those for whom either hypotonic PMS or isotonic PMS was considered contraindicated or necessary, were excluded. A fully blinded randomized controlled trial was performed. The primary outcome was acute hyponatremia. Secondary outcomes included severe hyponatremia, hypernatremia, adverse events attributable to acute plasma sodium level changes, and antidiuretic hormone levels. RESULTS: A total of 258 patients were enrolled and assigned randomly to receive hypotonic PMS (N = 130) or isotonic PMS (N = 128). Baseline characteristics were similar for the 2 groups. Hypotonic PMS significantly increased the risk of hyponatremia, compared with isotonic PMS (40.8% vs 22.7%; relative risk: 1.82 [95% confidence interval: 1.21-2.74]; P = .004). Admission to the pediatric critical care unit was not an independent risk factor for the development of hyponatremia. Isotonic PMS did not increase the risk of hypernatremia (relative risk: 1.30 [95% confidence interval: 0.30-5.59]; P = .722). Antidiuretic hormone levels and adverse events were not significantly different between the groups. CONCLUSION: Isotonic PMS is significantly safer than hypotonic PMS in protecting against acute postoperative hyponatremia in children. (44 references) (Author)

20111125-15

Neonatal hyponatremia: differential diagnosis and treatment. Marcialis MA, Dessi A, Pintus MC, et al (2011), Journal of Maternal-Fetal and Neonatal Medicine vol 24, suppl 1, October 2011, pp 75-79

Hyponatremia is very frequent in neonates, especially in VLBW. Recent data have shown that hyponatremia is not so benign as previously believed,and several clinical studies have indicated that preterms with mild to moderate chronic hyponatremia may experience poor growth and development retardation. The aim of this review is to present how to differentiate hypovolemic, euvolemic and hypervolemic hypernatremias, suggesting algorithms for practical management. (27 references) (Author)

20111003-2510

Severe hyponatraemia as a result of primary polydipsia in labour. Graham K, Palmer J (2005), Australian and New Zealand Journal of Obstetrics and Gynaecology (ANZJOG) vol 44, no 6, 2005, pp 586-587

Hyponatraemia is a rare, but potentially fatal consequence of primary polydipsia. In pregnancy, fluid overload with

resultant hyponatraemia can more readily occur because of physiological changes in the hypothalmus, high levels of circulating oxytocin, the tendency to encourage oral intake in labour and some medical interventions. As the serum sodium falls, symptoms of hyponatraemia are initially mild, but seizures , respiratory arrest and death can occur at lower concentrations. This report describes the development of primary polydipsia in labour, resulting in severe hyponatraemia with associated neurological dysfunction, and illustrates the importance of input and output monitoring in labour. (Author)

20100427-7

Dialysis for severe hyponatraemia in preeclampsia. Hennesy A, Hill I (2010), Obstetric Medicine vol 3, no 1, March 2010, pp 38-39

Severe hyponatraemia is a rare complication of preeclampsia. In the case presented, the rapid recovery of liver function test abnormalities and thrombocytopenia were accompanied by acute renal failure, relative oliguria and progressive hyponatraemia contributing to confusion and ileus. Dialysis was instigated and the patient promptly recovered. Renal function recovered fully. (14 references) (Author)

20100317-2*

Clinical characteristics of Taiwanese children with congenital adrenal hyperplasia caused by 21-hydroxylase deficiency in the pre-screening era. Lee CT, Tung YC, Hsiao PH, et al (2010), Journal of the Formosan Medical Association vol 109, no 2, 2010, pp 148-155

BACKGROUND/PURPOSE: Data about the clinical manifestations of congenital adrenal hyperplasia caused by 21-hydroxylase deficiency (21-OHD) are lacking in Taiwan. Therefore, this study analyzed the clinical features of 21-OHD in Taiwanese children to improve the diagnosis of this disorder, and to provide background information regarding the ongoing neonatal screening program for 21-OHD in Taiwan. METHODS: Eighty children with 21-OHD, 39 with the salt-wasting (SW) type and 41 with the simple-virilizing (SV) type, were evaluated by a review of their medical records. Their clinical symptoms and signs, laboratory findings, and genetic mutations were analyzed. RESULTS: The most frequent features in 21-OHD patients were hyperpigmentation and signs of androgen excess. Clinical manifestations related to hyponatremia such as poor feeding, poor weight gain, and dehydration were noted most frequently in patients with SW-type 21-OHD. Five patients had low serum cortisol with elevated plasma adrenocorticotropic hormone levels, and 22 patients had elevated dehydroepiandrosterone sulfate levels. All had elevated blood levels of 17-hydroxyprogesterone, androstenedione and testosterone. Hyponatremia and hyperkalemia were detected in 29 patients with SW-type 21-OHD. In terms of molecular diagnosis, mutations at IVS2-12A/C --> G and gene deletion were the most frequent mutations detected in SW-type 21-OHD, while I172N and mutation at IVS2-12A/C --> G were most frequent in SV type. CONCLUSION: Taiwanese children with 21-OHD have characteristic clinical findings such as hyperpigmentation, androgen excess, and failure to thrive. There is a good correlation between genotype and pheno-type. Laboratory tests, including serum 17-hydroxyprogesterone, androstenedione, and testosterone levels are more sensitive than serum cortisol or dehydroepiandrosterone sulfate levels for diagnosing 21-OHD in prepubertal children. (Author)

20091118-20

Nephrogenic syndrome of inappropriate antidiuresis: a novel cause of euvolemic hypotonic hyponatremia in newborns. Diagnosis and practical management. Marcialis MA, Dessi A, Contu S, et al (2009), Journal of Maternal-Fetal and Neonatal Medicine vol 22, suppl 3, October 2009, pp 67-71

Hyponatremia, defined by a serum sodium concentration of less than 135 mmmol/l, is a complex clinical occurrence frequently manifested in newborns admitted to the neonatal intensive care unit. The pathogenetic mechanisms and clinical timing underlying the onset of hyponatremia have not been well established in the newborn. Aim of this review is to present a practical approach and management of hypotonic hyponatremia in newborns, with particular emphasis on nephrogenic syndrome of inappropriate antidiuresis, recently described by us for the first time in the literature in a newborn. (18 references) (Author)

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20090922-87*

Physiological partial aldosterone resistance in human newborns. Martinerie L, Pussard E, Foix-L'Helias L, et al (2009), Pediatric Research vol 66, no 3, September 2009, pp 323-328

In the neonatal period, the human kidney is characterized by an impaired ability to regulate water and sodium homeostasis, resembling partial aldosterone resistance. The aim of our study was to assess this hormonal insensitivity in newborn infants and to determine its relationship with neonatal sodium handling. We conducted a prospective study in 48 healthy newborns and their mothers. Aldosterone, renin, and electrolyte concentrations were measured in umbilical cords and in maternal plasma. Urinary aldosterone concentrations and sodium excretion were determined at urination within 24 h after birth. A significant difference was observed between aldosterone and renin levels in newborn infants compared with their mothers (817 +/- 73 versus 575 +/- 55 pg/mL and 79 +/- 10 versus 15 +/- 2 pg/mL, respectively, p < 0.001). This hyperactivation of the renin-angiotensin-aldosterone system was associated with hyponatremia and hyperkalemia in the newborn infants, and high urinary sodium loss, consistent with a partial aldosterone resistance at birth. Unlike plasma aldosterone, urinary aldosterone concentration was found highly correlated with plasma potassium concentrations, thus representing the best index for accurate evaluation of mineralocorticoid sensitivity. Our study represents a comprehensive characterization of the renin-aldosterone axis in newborn infants and provides evidence for physiologic partial aldosterone resistance in the neonatal period. (Author)

20090514-5*

Case report: severe neonatal hyperkalemia due to pseudohypoaldosteronism type 1. Schweiger B, Moriarty MW, Cadnapaphornchai MA (2009), Current Opinion in Pediatrics vol 21, no 2, 2009, pp 269-271

Hyponatremia and hyperkalemia in infancy can represent a variety of renal and genetic disorders with significant long-term health implications. We report a newborn with severe hyperkalemia and hyponatremia from autosomal recessive pseudohypoaldosteronism type 1 requiring aggressive therapy. The evaluation and treatment of children with disorders of mineralocorticoid action are discussed. (Author)

20090402-17

Severe hyponatraemia associated with pre-eclampsia. Linton A, Gale A (2009), Journal of Obstetrics and Gynaecology vol 29, no 2, February 2009, pp 143-144

Describes the case of a pre-eclamptic woman who developed hyponatraemia at 36 weeks' gestation. Outlines the symptoms, diagnosis and management. (6 references) (CR)

20090310-31

Hyponatremia complicating labour--rare or unrecognised? A prospective observational study. Moen V, Brudin L, Rundgren M, et al (2009), BJOG: An International Journal of Obstetrics and Gynaecology vol 116, no 4, March 2009, pp 552-561

OBJECTIVE: The aim of this study was to investigate the occurrence of hyponatraemia following delivery, with a hypothesis that hyponatraemia has a high prevalence in labouring women. DESIGN: Prospective observational study. SETTING: Consultant-led delivery suite in County Hospital, Kalmar, Sweden. SAMPLE: A total of 287 pregnant women at term (37 full gestational weeks). METHODS: Oral fluids were allowed during labour. Blood samples were collected on admission, after delivery, and from the umbilical artery and vein. MAIN OUTCOME MEASURE: Hyponatraemia defined as plasma sodium < or =130 mmol/l after delivery. RESULTS: Hyponatraemia was found in 16 (26%) of the 61 mothers who received more than 2500 ml of fluid during labour. Two-thirds of fluids were orally ingested. Decrease in plasma sodium concentration during labour correlated with duration of labour and the total fluid volume administered. Analysis by multivariate logistic regression showed that hyponatraemia was significantly correlated with fluid volume (P < 0.001) but not with oxytocin administration or epidural analgesia. Hyponatraemia correlated significantly with prolonged second stage of labour, instrumental delivery, and emergency caesarean section for failure to progress (P = 0.002). CONCLUSIONS: Hyponatraemia is not uncommon following labour. Tolerance to a water load is diminished during labour; therefore, even moderate fluid volumes may cause hyponatraemia. Women should not be encouraged to drink excessively during labour. Oral fluids, when permitted, should be recorded, and

intravenous administration of hypotonic fluids should be avoided. When abundant drinking is unrecognised or intravenous fluid administration liberal, life-threatening hyponatraemia may develop. The possibility that hyponatraemia may influence uterine contractility merits further investigation. (35 references) (Author)

20090202-2*

Childbirth drink danger revealed. BBC News (2009), BBC News 30 January 2009

Warns pregnant women of the dangers of drinking too much water during childbirth. Reports that the a Swedish study has found that women who drink more than 2.5 litres while in labour have a 25% chance of hyponatraemia, a condition which can cause headaches, nausea and vomiting, or more severe problems if left unchecked. States that UK Midwives encourage women to sip water during labour, not drink lots of it. (JSM)

20090130-3*

Women who drink too much in labour risk convulsions and coma. Simpson A (2009), The Telegraph 27 January 2009

News item reporting that women who drink more than four pints of water during labour significantly increase their risk of suffering from hyponatraemia, resulting in low blood sodium levels. (TC)

20081118-66

Neonatal seizure due to maternal water intoxication in labour - a case report. Shivashankar G, Coe A, Satodia P (2008), Infant vol 4, no 6, 2008, pp 196-197

We present a case report of a full term newborn presenting with seizures due to hyponatraemia at three hours of age. Mother had dilutional hyponatraemia secondary to excessive water intake during labour. (6 references) (Author)

20081023-14

Syndrome of inappropriate antidiuretic hormone secretion in an infant with respiratory syncytial virus bronchiolitis. Szabo FK, Lomenick JP (2008), Clinical Pediatrics vol 47, no 8, October 2008, pp 840-842

Reports on a case of a one-month-old female infant with respiratory syncytial virus bronchiolitis and severe hyponatraemia due to syndrome of inappropriate antidiuretic hormone secretion. (13 references) (SB)

20080429-41

Hyponatraemia and hypokalaemia during intravenous fluid administration. Armon K, Riordan A, Playfor S, et al (2008), Archives of Disease in Childhood vol 93, no 4, April 2008, pp 285-287

BACKGROUND: Hospital-acquired hyponatraemia is associated with excessive volumes of hypotonic intravenous fluids and can cause death or permanent neurological deficit. METHODS: A cross-sectional survey was carried out in 17 hospitals on all children receiving intravenous fluids during 1 day of a specified week in December 2004. RESULTS: 77 of 99 children receiving intravenous fluids received hypotonic solutions and 38% received >105% of fluid requirements. 21 of 86 children were hyponatraemic, but the electrolytes of only 79% had been checked in the preceding 48 h. CONCLUSIONS: Intravenous fluids should be used with caution as regards the tonicity and volume administered, and with appropriate monitoring of serum electrolytes. (10 references) (Author)

20080211-107

Hyponatraemia complicating vaginal delivery. Green A, Popham P (2008), International Journal of Obstetric Anesthesia vol 17, no 1, January 2008, pp 93-94

Reports a case of hyponatraemia during labour, resulting in an acute confusional state, complicated by hyperventilating. Following fluid restriction the patient's mental state returned to normal and there were no long-term neurological consequences. Retrospective estimation suggested the patient had drank in excess of 10 litres of water and sports drinks during her labour which had lasted 10 hours. (10 references) (TC)

20071204-10

Water intoxication - a dangerous condition in labor and delivery rooms. Ophir E, Solt I, Odeh M, et al (2007), Obstetrical and Gynecological Survey vol 62, no 11, November 2007, pp 731-773

Water intoxication, a form of acute hyponatremia, has been described in various clinical situations. Although hyponatremia is a common metabolic disorder in hospitalized patients, it is generally not well known as a hazard in the labor and delivery room. However, several factors predispose laboring women to develop hyponatremia. Moreover, because the fetus acquires water from the maternal circulation via the placenta, and there is a close correlation between maternal and cord blood serum sodium levels, the newborn infant of a hyponatremic mother is also at considerable risk of developing water intoxication. We review the epidemiology, pathophysiology, clinical features, and treatment of this hazardous disorder. We emphasize the need for awareness of this condition, and call attention to the risk of fluid overload during labor. (65 references) (Author)

20071026-11

Syndrome of inappropriate ADH secretion in a woman with preeclampsia. Wilson HJ, Shutt LE (2007), International Journal of Obstetric Anesthesia vol 16, no 4, October 2007, pp 360-362

While preeclampsia is common in pregnancy, associated hyponatraemia is rare with very few cases reported in the literature. We report the case of a previously healthy nulliparous woman who presented at 34 weeks' gestation with hypertension and proteinuria. On admission her serum sodium was 122mmol/L and by day 6, in the absence of fluid restriction, it had fallen to 116mmol/L. Urine and plasma osmolalities suggested a syndrome of inappropriate antidiuretic hormone secretion. She was delivered on the sixth day by caesarean section because of fetal distress and worsening preeclampsia. Postoperatively fluid intake was restricted and her sodium normalised within 48h. Preeclampsia results in a low effective circulating volume which can cause a non-osmotic release of antidiuretic hormone and a resultant increase in the urine/plasma osmolality ratio to greater than 1. In patients with preeclampsia, hyponatraemia may further increase the risk of seizures and should therefore be closely monitored and treated without delay. (11 references) (Author)

20061002-32

Hypotonic versus isotonic saline in hospitalised children: a systematic review. Choong K, Kho ME, Menon K, et al (2006), Archives of Disease in Childhood vol 91, no 10, October 2006, pp 828-835

BACKGROUND: The traditional recommendations which suggest that hypotonic intravenous (IV) maintenance fluids are the solutions of choice in paediatric patients have not been rigorously tested in clinical trials, and may not be appropriate for children. AIMS: To systematically review the evidence from studies evaluating the safety of administering hypotonic versus isotonic IV maintenance fluids in hospitalised children. METHODS: Data sources: Medline (1966-2006), Embase (1980-2006), the Cochrane Library, abstract proceedings, personal files, and reference lists. Studies that compared hypotonic to isotonic maintenance solutions in children were selected. Case reports and studies in neonates or patients with a pre-existing history of hyponatraemia were excluded. RESULTS: Six studies met the selection criteria. A meta-analysis combining these studies showed the hypotonic solutions significantly increased the risk of developing acute hyponatraemia (OR 17.22, 95% CI 8.67 to 34.2), and resulted in greater patient morbidity. CONCLUSIONS: The current practice of prescribing IV maintenance fluids in children is based on limited clinical experimental evidence from poorly and differently designed studies, where bias could possibly raise doubts about the results. They do not provide evidence for optimal fluid and electrolyte homeostasis in hospitalised children. This systematic review indicates potential harm with hypotonic solutions in children, which can be anticipated and avoided with isotonic solutions. No single fluid rate or composition is ideal for all children. However, isotonic or near-isotonic solutions may be more physiological, and therefore a safer choice in the acute phase of illness and perioperative period. (40 references) (Author)

20060612-46

Fluid and electrolyte management in the very low birth weight neonate. Bhatia J (2006), Journal of Perinatology vol 26,

suppl 1, May 2006, pp S19-S21

Fluid and electrolyte management in the very low birth weight infant is critical to survival. The amount of fluid present in the plasma, interstitial fluid, and cellular fluid changes throughout the fetal and neonatal period, presenting a challenging situation. One of the many factors influencing fluid requirements is the insensible water loss by mechanisms such as evaporation. Low birth weight infants are especially susceptible to this due to their large body surface area and immature skin, often resulting in hypernatremia and the complications associated with it. However, some infants may experience hyperkalemia, hyperglycemia, and/or hyponatremia, resulting in various other complications. Careful monitoring is essential in deciding how to manage these infants. This article aims to discuss the management of fluid and electrolytes in very low birth weight infants and address ways to decrease the morbidity and mortality associated with the imbalances in fluid and electrolytes seen in this population. (23 references) (Author)

20060227-32

Bronchiolitis with hyponatremia. Ashraf A (2006), Clinical Pediatrics vol 45, no 1, January/February 2006, pp 101-103

Presents and discusses the case of a six month old baby girl diagnosed with bronchiolitis with hyponatremia after she presented with a three day history of coughing and a one day history of laborious breathing. (9 references) (JSM)

20050916-71

Hyponatremia and preeclampsia. Ravid D, Massarwa LE, Biron-Shental T, et al (2005), Journal of Maternal-Fetal and Neonatal Medicine vol 18, no 1, July 2005, pp 77-78

A 33-year-old healthy woman, gravida 1 with twins pregnancy was admitted with mild preeclampsia and unusual hyponatremia which resolved promptly postpartum. This is the seventh reported case of hyponatremia complicating preeclampsia, four of the patients carried twins and four had nephrotic syndrome. (5 references) (Author)

20050601-41*

Phototherapy-mediated syndrome of inappropriate secretion of antidiuretic hormone in an in utero selective serotonin reuptake inhibitor-exposed newborn infant. Vanhaesebrouck P, De Bock F, Zecic A, et al (2005), Pediatrics vol 115, no 5, May 2005. 4 pages

Although selective serotonin reuptake inhibitors (SSRIs) have gained wide acceptance in the off-label treatment of mental disorders in pregnant women, there seems to be an increased risk for serotonergic adverse effects in newborn infants who are exposed to SSRIs during late pregnancy. Hyponatremia as a result of the syndrome of inappropriate secretion of antidiuretic hormone (SIADH) is a relatively common serious side effect of the use of SSRIs in (mostly elderly) adults. Severe hyponatremia as a result of an SIADH is proposed here as part of a neonatal serotonin toxicity syndrome in a newborn infant who was exposed prenatally to an SSRI. The definite reversal to normal serum sodium levels after fluid restriction, the lack of any alternative cause for the SIADH, and the positive temporal relation with a high score on a widely used adverse drug reaction probability scale offer solid support for the hypothesis of a causal relationship between the SIADH and the prenatal sertraline exposure in our neonate. Moreover, accumulative data on the acute enhancement of serotonergic transmission by intense illumination led us to hypothesize that phototherapy used to treat hyperbilirubinemia in the newborn infant could have been the ultimate environmental trigger for this proposed new cause of iatrogenic neonatal SIADH. The speculative role of phototherapy as a physical trigger for this drug-related adverse event should be confirmed in other cases by thorough study of the serotonin metabolism, assay of SSRI levels in cord blood, and serial measurement of plasma levels in exposed neonates. As phototherapy is used frequently in jaundiced neonates and an apparently increasing number of infants are born to mothers who take SSRIs, serotonin toxicity in neonates deserves increased attention. (Only the abstract is published in the print journal. Full article available online at http://www.pediatrics.org/cgi/doi/10.1542/peds.2004-2329) (Author)

20041223-4

Maternal water intoxication as a cause of neonatal seizures. West CR, Harding JE (2004), Journal of Paediatrics and Child Health vol 40, no 12, December 2004, pp 709-710

A term infant was admitted at 6 h of age with seizures related to hyponatraemia. During the last hours of labour the infant's mother had drunk 3 L of water. After delivery the serum sodium was 121 mmol/L in the mother and 126 mmol/L in the infant. Both resolved spontaneously. We discuss this case and the impact of maternal fluid intake during labour on the fetus and neonate. Women should be advised that excessive oral fluid intake during labour could adversely affect both mother and infant. (11 references) (Author)

20040304-29

Sodium handling in congenitally hypothyroid neonates. Asami T, Uchiyama M (2004), Acta Paediatrica vol 93, no 1, January 2004, pp 22-24

Early observations emphasized the possible development of hyponatraemia in hypothyroid children and adults, but recently this has been questioned. AIM: To investigate whether hyponatraemia develops in hypothyroid status by examining sodium handling in screening-detected neonates and infants with congenital hypothyroidism (CH). METHODS: Serum thyroid-stimulating hormone (TSH), free thyroxine (FT4), sodium (Na), creatinine (Cr), urinary Na, Cr, fractional sodium excretion rate (FENa) and other chemicals were measured before and after L-thyroxine (LT4) replacement therapy in 32 screening-detected CH neonates (11M, 21F) and 16 age-matched control neonates. RESULTS: No cases of hyponatraemia were found in the 32 CH neonates. Their serum Na concentrations (139.1 +/- 1.5 mmol/L, ranging from 136 to 142 mmol/L, median 139 mmol/L) were not statistically different from those of 16 control neonates (139.3 +/- 1.3 mmol/L, ranging from 137 to 142 mmol/L, median 139 mmol/L). No correlation was found between serum levels of TSH and FT4 and serum Na or FENa. No significant changes were found in serum Na concentrations in hypothyroid neonates two months after LT4 replacement therapy. The serum Na concentration (139.1 +/- 0.3 mmol/L, n = 25) before treatment did not change statistically (138.9 +/- 0.2 mmol/L, n = 25) two months after LT4 replacement therapy. CONCLUSION: As seen in various earlier reports, hyponatraemia can occur in hypothyroid patients, but no causal relationship exists between them. When hyponatraemia is detected in hypothyroid children, it does not seem to be directly related to lack of thyroid hormones and therefore other possible causes should be sought. (16 references) (Author)

20030320-71

Maternal hyponatremia. Borcherding KE, Ruchala PL (2002), AWHONN Lifelines vol 6, no 6, December 2002/January 2003, pp 514-519

Prevention and assessment are key for managing this rare but potentially devastating condition. (19 references) (Author)

20020813-94

Perinatal water intoxication due to excessive oral intake during labour. Johansson S, Lindow S, Kapadia H, et al (2002), Acta Paediatrica vol 91, no 7, 2002, pp 811-814

This study on four newborn babies and one mother who experienced seizures or other serious central nervous system (CNS) failures caused by the mother drinking 'excessive' amounts of liquid during labour. The cases are described individually and recommendations for changes in practice put forward. In the first case the baby, after a normal birth, had a left-sided seizure lasting 15 minutes at five hours of age. Blood tests showed marked hyponatraemia (deficient sodium in the blood) but after fluid restriction and intravenous infusion of hypertonic sodium solution the baby recovered completely and developed normally. His mother had drunk eight to ten litres of fluid in the 13.5 hours that she had been in hospital before delivery. After the birth she complained of a severe headache and excreted nine litres of fluid over the next 24 hours but suffered no other problems. In the second case, the mother estimated that she drank four litres of water during the 12 hours of her labour. Her baby girl was grey-white and lifeless 20 minutes after a normal birth, with a heart rate below 60 beats per minute. Following artificial ventilation for a few minutes she breathed spontaneously again but was admitted to intensive care where, over the next few hours, she had brief but generalised seizures. Extensive blood tests revealed no abnormalities other than hyponatraemia and, after treatment by fluid restriction and intravenous sodium, she recovered. A third case, where the baby required resuscitation at

birth, was irritable, had episodes of seizures in the first hours after birth plus computerised tomography (CT) scan evidence (on day three) of a minor cerebral infarction, also had marked hyponatraemia at birth. Here, the mother had drunk at least eight litres of water during labour, as well as being given oxytocin intravenously five hours before delivery. Again the baby recovered fully, neurological tests being normal at ten months of age. Finally, in case four, nine hours after arriving at hospital, a healthy 33-year old primigravida, with normal blood pressure and no proteinuria, become sleepy and started to vomit. An emergency caesarean section was performed during which she had seizures. Her electrolyte status showed a grave hyponatraemia, but there were no other indicators of pre-eclampsia. The baby was irritable, with episodes of hypertonia (increased muscle tone) and apnoea (absence of breathing) but, after the same treatment as above, recovered fully, as did his mother who, it emerged, had drunk 'several' litres of water and fruit juice over the nine hours preceding delivery. The researchers describing these cases note that no previous reports of adverse effects of high oral fluid intake in labour have been reported although it is known that water intoxication, leading occasionally to death, can result from excessive drinking during lengthy strenuous physical activity. They attribute these events to a change in maternal behaviour as these women, when questioned, said that 'information given by antenatal health care centres' had stressed 'the importance of drinking adequately during labour'. These particular individuals had followed the advice to excess, unaware that there might be any risks associated with drinking too much. The authors discuss why the labouring woman is at higher than normal risk of water intoxication since she has increased extracellular fluid volume, often peripheral oedema and 'water-sparing systems' are activated in labour. In adults the main symptoms of water intoxication could mimic different conditions such as dehydration or pre-eclampsia, leading to misdiagnosis followed by inappropriate or even harmful treatment. Neonatal hyponatraemia can have a number of causes but none of these was present in these cases. The authors state that 'the significance of nutrition and fluid balance during labour has been repeatedly confirmed and should continue to be of primary concern' but they wish to 'draw attention to the new serious risk of perinatal water intoxication caused by excessive maternal oral intake in labour' and suggest a number of preventative measures, including that information given to women should be 'balanced, as regards volume and composition'. Abstract writer's comments: This paper is relevant for anyone who believes that the freedom for women to choose to eat and drink at will during labour matters. Although there was no long-term morbidity for either the babies or the one mother affected, all the babies required immediate intensive care, and the mother an emergency caesarean section. These are not the first reported cases - a previous paper from New Zealand (1) described a similar situation. Various questions are begged by this study. The women stated that they had heard a message antenatally about the importance of drinking 'adequately' in labour. What had these women actually been told at antenatal clinic or classes? Was this information/advice the main determinant of their behaviour? Furthermore, what constitutes excessive drinking in labour? One of the women in question had drunk, she thought, four litres over 12 hours of her labour - is this too much for everyone? Clearly it was in her case. We do not know how much is too much but surely we do not want a return to the days of limitation of oral intake in labour, which is both psychologically and physically stressful (2) and possibly affects the course of labour itself. If excessive oral intake can cause this type of symptom, we, as midwives and childbirth educators, need to look at our antenatal practice in this area. At the very least, we should ensure that each woman is aware that she should not make herself drink more than her body demands during labour because she might suffer water intoxication with potentially harmful effects to her baby or herself. 1. Paech MJ. Convulsions in a healthy parturient due to intrapartum water intoxication. International Journal of Obstetric Anesthesia 1998;7:59-61. 2. Simkin P. Stress, pain and catecholamines in labor: part 1. A review. Birth 1986;13:227-33.

20020613-32

Symptomatic hyponatremia following Cesarean section. Lurie S, Feinstein M, Mamet Y (2002), Journal of Maternal-Fetal and Neonatal Medicine vol 11, no 2, February 2002, pp 138-139

A rare occurrence of the syndrome of inappropriate antidiuretic hormone secretion is described in a 32-year old previously healthy nulliparous woman who underwent a Cesarean section for non-progressive labor. (8 references) (Author)

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20020118-3

The diagnosis and management of neonatal urinary ascites. Oei J, Garvey PA, Rosenberg AR (2001), Journal of Paediatrics and Child Health vol 37, no 5, October 2001, pp 513-515

Urinary ascites in a newborn infant is unusual and most commonly indicates a disruption to the integrity of the urinary tract. The following report describes a case of urinary ascites, probably due to bladder rupture caused by umbilical artery catheterization, associated with hyponatemia, hyperkalemia and elevated serum creatinine. This unusual biochemical profile is characteristic of urinary 'autodialysis' and was corrected by bladder drainage. (8 references) (Author)

20000806-31$

Vomiting and hyponatraemia in pregnancy. George LD, Selvaraju R, Reddy K, and others (2000), BJOG: An International Journal of Obstetrics and Gynaecology vol 107, no 6, June 2000, pp 808-809

Reports two cases of women diagnosed with Addison's disease in pregnancy. The symptoms of the condition are described and the difficulties in diagnosing this condition are discussed. (12 references) (SB)

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