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Date: 9 January 2018

Sources: Medline, Embase.

1. Hyponatremia associated with preeclampsia.

Razavi A.S., Chasen S.T., Gyawali R., Kalish R.B.

Journal of Perinatal Medicine. 45 (4) (pp 467-470), 2017. Date of Publication: 01 May 2017.

AN: 616744351

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

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Institution

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Publisher

Walter de Gruyter GmbH (E-mail: info@degruyter.com)

2. Exercise-Associated Hyponatremia in a Lactating Female.

Bailowitz Z; Grams R 2nd; Teeple D; Hew-Butler T.

Clinical Journal of Sport Medicine. 27(4):e55-e57, 2017 Jul.

[Case Reports. Journal Article]

UI: 28653967

A 37-year-old woman presented to the emergency department with severe headache, which quickly progressed to altered mental status and seizure activity in hospital. Her initial serum sodium concentration ([Na]) was 126 mmol/L. In the 24 hours before admission, she exercised vigorously for 120 minutes (interval training plus yoga) and also consumed more than 4 liters of fluid during that time to both stay hydrated and facilitate milk production because she was actively nursing 2 children. Her serum [Na] and altered mental status corrected slowly over the next 48 hours with furosemide, hypertonic saline, and fluid restriction. This case is unique because it discusses the possible pathogenic role that lactation-induced oxytocin release may have on sustained antidiuresis and dilutional exercise-associated hyponatremia (EAH). This would be the first report documenting EAH in a lactating woman, which may highlight an underrecognized risk factor for physically active women who are concurrently breast-feeding.

Version ID

1

Status

MEDLINE

3. Case report of severe maternal hyponatremia complicating preeclampsia.

Hinkson L., Armbrust R., Moller A., Henrich W.

Journal of Maternal-Fetal and Neonatal Medicine. (pp 1-2), 2017. Date of Publication: 31 May 2017.

AN: 616576001

The incidence of preeclampsia associated maternal and neonatal hyponatremia is reportedly rare and can be life threatening in severe cases. The timely diagnosis and careful management requires a multidisciplinary approach between obstetric, neonatal, endocrinology, and intensive care teams. We report firstly, on a case of severe hyponatremia associated with preeclampsia, secondary to inappropriate Anti-Diuretic Hormone secretion, followed by a review of cases over a one year period at our institution.

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Institution

(Hinkson, Armbrust, Moller, Henrich) Department of Obstetrics, Charite University Hospital, Berlin, Germany

Publisher

Taylor and Francis Ltd (E-mail: healthcare.enquiries@informa.com)

4. Severe hyponatraemia associated with pre-eclampsia.

Anglim B., Levins K., Bussmann N., Imcha M.

BMJ Case Reports. 2016 (no pagination), 2016. Date of Publication: 2016.

AN: 611918455

Pre-eclampsia is a multisystem disorder with incidence rates ranging from 2% to 5%. Hyponatraemia is a rare complication of pre-eclampsia. A 41-year-old, para 0+1 in vitro fertilisation monochorionic diamniotic triplet pregnancy woman presented at 25 weeks with dyspnoea and general malaise. Her antenatal course was complicated by the diagnosis of intrauterine growth restriction in triplet one at 27 weeks of gestation. At 27+3 weeks gestation, she was diagnosed as having pre-eclampsia. Subsequent biochemical analysis demonstrated hyponatraemia with serum sodium falling steadily to 117 mmol/L over the next 19 days. She was admitted to intensive care unit for stabilisation of fulminant pre-eclampsia and severe hyponatraemia at 30 +5 weeks of gestation. Hypertonic saline and intravenous labetalol were administered prior to delivery by caesarean section. She recovered well postdelivery with stabilisation of her blood pressure and normalisation of her sodium level to 135 mmol/L. Awareness and frequent monitoring of hyponatraemia should become an integral part of monitoring women with pre-eclampsia.

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PMID

27558187 [<http://www.ncbi.nlm.nih.gov/pubmed/?term=27558187>]

Institution

(Anglim, Levins, Imcha) Limerick Maternity Hospital, Limerick, Ireland (Bussmann) CUMH, Cork, Ireland

Publisher

BMJ Publishing Group (E-mail: subscriptions@bmjgroup.com)

5. Triplet pregnancy associated with severe hyponatraemia and preeclampsia.

Finnan M., Iftikhar A., Shannon J.

Irish Journal of Medical Science. Conference: 24th Sylvester O'Halloran Perioperative Scientific Symposium. Limerick Ireland. Conference Publication: (var.pagings). 185 (2 SUPPL. 1) (pp S135), 2016. Date of Publication: March 2016.

AN: 72312882

Severe hyponatraemia associated with pre-eclampsia is rarely seen in pregnancy, with only a small number of reported cases. While often possible to classify hyponatraemia in such cases (hypovolaemic, euvolaemic, hypervolaemic), the underlying mechanism is seldom clear and commonly used drugs are often contraindicated. Urgent delivery may be indicated to prevent life-threatening events including maternal seizures, foetal jaundice, tachypnoea, seizures or polyhydramnios. A 41 year old female with pre-eclampsia presented at 27 weeks gestation of a triplet pregnancy with lower limb oedema and mild dyspnoea. She was found to be hyponatraemic. A gradual decline in sodium occurred; at 30 weeks serum sodium was 117 with oedema extending to her abdomen and upper extremities. She was admitted to ICU to optimise sodium and had C-section under general anaesthetic when sodium reached 122. Sodium returned to normal 4 days post delivery and triplets were eventually discharged. Most reported cases to date are of hypervolaemic hyponatraemia and neurological signs and symptoms are often absent. Severe hyponatraemia may, however, precipitate seizures making it difficult to

differentiate from eclampsia. Treatment of hyponatraemia in the pre-eclamptic (as in this case) should include blood pressure control, close monitoring of sodium levels and fluid restriction. Worsening severe hyponatraemia is an indication for delivery but low sodium levels should be managed effectively prior to anaesthesia. Early recognition is vital, therefore, and where possible (with multidisciplinary team input) sodium levels should be optimised to prevent further morbidity and ensure that the patient is effectively managed prior to anaesthesia, if ultimately required.

Institution

(Finnan, Iftikhar, Shannon) Department of Anaesthesia, University Hospital Limerick, Ireland

Publisher

Springer-Verlag London Ltd

6. Severe Hyponatremia Associated with Use of Black Cohosh during Prolonged Labor and Unsuccessful Home Birth.

Blitz MJ; Smith-Levitin M; Rochelson B.

Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations

American journal of perinatology reports. 6(1):e121-4, 2016 Mar.

[Journal Article]

UI: 26989565

Introduction There has been an increase in the use of herbal supplements during pregnancy, which are frequently of unproven efficacy and safety. We present a case of severe hyponatremia and altered mental status associated with the use of black cohosh during prolonged labor. Case A 39-year-old primigravida at 38(5/7) weeks of gestational age presented to the emergency department after she became disoriented and lethargic while laboring at home with a midwife. She had consumed several doses of black cohosh to induce and augment labor. On presentation, she was nonverbal and unable to follow commands. Her serum sodium was 114 mmol/L (range, 132-145 mmol/L), serum osmolality was 253 mOsm/kg (range, 275-300 mOsm/kg), urine osmolality was 190 mOsm/kg (range, 300-900 mOsm/kg), and urine sodium was <10 mmol/L. The patient soon became uncooperative and combative and a cesarean section was performed. Postoperatively, she was transferred to the intensive care unit for monitoring and correction of her sodium. Her mental status returned to baseline and she was subsequently discharged home without further complication. **Discussion** Clinically significant hyponatremia associated with pregnancy is rare. Further investigation is needed to evaluate the safety and efficacy of black cohosh and other commonly used herbal supplements during pregnancy and labor.

Status

PubMed-not-MEDLINE

Authors Full Name

Blitz, Matthew J; Smith-Levitin, Michelle; Rochelson, Burton.

Institution

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Rochelson, Burton. Division of Maternal-Fetal Medicine, Department of Obstetrics and Gynecology, Hofstra North Shore-LIJ School of Medicine, Manhasset, New York.

PMID

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4794442>

Date Created

20160318

Year of Publication

2016

7. Preeclampsia associated hyponatremia.

Razavi A., Chasen S., Gyawali R., Kalish R.

American Journal of Obstetrics and Gynecology. Conference: 35th Annual Meeting of the Society for Maternal-Fetal Medicine: The Pregnancy Meeting. San Diego, CA United States. Conference Publication: (var.pagings). 212 (1 SUPPL. 1) (pp S156), 2015. Date of Publication: January 2015. AN: 71742742

OBJECTIVE: Hyponatremia has been associated with neurological injury, including seizures and cerebral edema. While preeclampsia (PEC) associated hyponatremia has been reported in small series, the prevalence is unknown. The objective of our study was to evaluate the prevalence and clinical factors associated with hyponatremia in patients with PEC. **STUDY DESIGN:** We reviewed all patients who delivered at our institution from September 2013-June 2014. Patients with PEC were identified from our electronic medical record. Charts were reviewed for lab data, demographic data, medical history and pregnancy complications. Mild and severe PEC were defined using standard criteria. As sodium levels are approximately 5mEq/L lower in pregnancy, hyponatremia was defined as sodium level <130 mEq/L. Elevated liver transaminases (LFTs) were defined as twice normal; elevated creatinine was defined as >.9mg/dl. Chi square and Mann-Whitney U were used in statistical analysis with p<.05 considered significant. **RESULTS:** We identified 332 pregnancies complicated with PEC including 277 singletons and 55 twins. The median sodium level was 135mEq/L (range 124-143). Hyponatremia was noted in 32 (9.7%) patients. Severe PEC was present in the majority of patients with hyponatremia, and hyponatremia was more common in severe PEC compared to milder hypertensive disorders (p<.001). Hyponatremia also occurred more frequently in twins (p=.001) and in older women (p=.017). Women with hyponatremia were more likely to have elevated LFTs (p<.001) and elevated creatinine levels (p<.001). When diagnosing PEC, edema was more frequently the presenting symptom in patients with hyponatremia (p<.001). Only 1 patient (without hyponatremia) had an eclamptic seizure. **CONCLUSION:** Hyponatremia appears to be more common among women with PEC, particularly in those with severe PEC as well as twin gestation. Because hyponatremia can be associated with major morbidity, including brain injury, monitoring sodium levels should be considered in twin gestations complicated with PEC as well as all patients diagnosed with severe PEC. (Table presented) .

Institution

(Razavi, Chasen, Gyawali, Kalish) Weill Medical College, Cornell University, Obstetrics and Gynecology, New York, NY, United States

Publisher

Mosby Inc.

8. Severe postpartum symptomatic hyponatremia due to DDAVP.

Gupta S., Barnes M.

American Journal of Kidney Diseases. Conference: National Kidney Foundation 2014 Spring Clinical Meetings. Las Vegas, NV United States. Conference Publication: (var.pagings). 63 (5) (pp A52), 2014. Date of Publication: May 2014.

AN: 71448401

DDAVP or desmopressin is an antidiuretic hormone analogue that is widely used to treat central diabetes insipidus, hemophilia, von Willebrand's disease and nocturnal enuresis. DDAVP induced hyponatremia has been well described. We present a case of severe symptomatic hyponatremia secondary to incorrect dosing of DDAVP following pregnancy. A twenty two year old female presented to the emergency room with complaints of nausea, vomiting and lightheadedness. The patient denied any history of trauma, headache, vision changes, abdominal pain or diarrhea. Her past medical history was significant for histiocytosis X involving the pituitary gland causing central diabetes insipidus, diagnosed at age three. She had a spontaneous vaginal delivery of a normal healthy child ten days prior to admission following an uneventful pregnancy. In the triage bay, she had a seizure and was noted to have severe hyponatremia with sodium of 109. CT scan of the head, thyroid stimulating hormone, serum cortisol, magnesium, B12 and ionized calcium were normal. Further questioning revealed that when she became pregnant her DDAVP dose was doubled which she apparently continued to take postpartum. In addition she had increased her fluid intake due to feeling dehydrated. DDAVP doses often need to be increased during pregnancy secondary to increased production of vasopressinase by the placenta. This case emphasizes the importance of close monitoring and correct dosing of desmopressin. It also highlights the importance of educating the patient and physicians about the need for free water restriction to avoid such life threatening adverse events.

Institution

(Gupta, Barnes) William Beaumont Hospital, Royal Oak, MI, United States

Publisher

W.B. Saunders

9. Severe hyponatremia associated with pre-eclampsia.

Camara-Lemarroy C.R., De Leon-Cruz A., Rodriguez-Gutierrez R., Galarza-Delgado D.A. Gynecological Endocrinology. 29 (8) (pp 801-803), 2013. Date of Publication: August 2013. AN: 369274905

Background: Pre-eclampsia associated hyponatraemia is a very rare condition that can potentially lead to serious maternal and fetal complications and that constitute a diagnostic and therapeutic challenge even for an experienced physician. Case report: A 25-year old female presented to the clinic at 25.3 weeks of gestation with mild physical signs of edema along with hypertension, proteinuria, and a severe hyponatremia (113mEq/L). Hyponatremia was classified as hypervolemic and resolved 72 hours after the delivery with water restriction. Conclusions: The pathogenesis of pre-eclampsia associated hyponatremia is relatively unknown. A non-osmotic stimulation of vasopressin release in the setting of a hypervolemic state with low effective circulating plasma volume is thought to be the main mechanism. Advanced maternal age and nephrotic range proteinuria have been postulated as risk factors, but their causal role remains unclear. Fluid restriction is a reasonable treatment, and maternal outcomes are favourable. This condition is a rare indication for urgent delivery, but neonatal outcomes are variable. © 2013 Informa UK Ltd. All rights reserved.

PMID

23706139 [<http://www.ncbi.nlm.nih.gov/pubmed/?term=23706139>]

Institution

(Camara-Lemarroy, De Leon-Cruz, Rodriguez-Gutierrez, Galarza-Delgado) Departamento de Medicina Interna, Hospital Universitario Dr. Jose E. Gonzalez, Universidad Autonoma de Nuevo Leon, Monterrey, N.L. Mexico, Madero y Gonzalitos S/N, Monterrey, NL 64700, Mexico

Publisher

Informa Healthcare (69-77 Paul Street, London EC2A 4LQ, United Kingdom)

10. Pre-eclampsia associated with severe hyponatremia.

Thiruveedi S., Benz R.L.

American Journal of Kidney Diseases. Conference: National Kidney Foundation 2013 Spring Clinical Meetings. Orlando, FL United States. Conference Publication: (var.pagings). 61 (4) (pp A95), 2013. Date of Publication: April 2013.

AN: 71024142

Hyponatremia can result from any CNS disorder and several endocrine disorders. Pre-eclampsia associated with severe hyponatremia is seldom seen with very few documented cases on our literature search. There is no prior reported case with initial serum sodium of 116 in the setting of pre-eclampsia and here we present one such rare case. A 26 year old Indian nulliparous female with well controlled hypothyroidism and uneventful pregnancy until 30 weeks of gestation presents with 5 days of vomiting, edema, lethargy, and decreased urine output. On examination BF was 160/100. She had anasarca and encephalopathy but without focal neurological deficit. Sodium was 116, bicarbonate 16, urine protein creatinine ratio 6.49 gm/gm, urine osmolality 429, serum osmolality 251, urine sodium <10 and uric acid 8.4. TSH, Cortisol and MRI brain were normal. Although SIADH is possible with higher urine osmolality than serum osmolality, she was initially presumed to have decreased effective circulatory volume with nephrotic syndrome and preeclampsia as suggested by low urine sodium and high uric acid (which could also be from preeclampsia). She was initially volume resuscitated with normal saline at 100 ml/hour under close CVP monitoring in ICU with frequent electrolyte measurements. She received magnesium for seizure prophylaxis and steroids for fetal lung

maturity. Follow-up lab work supports the diagnosis of SIADH with urine osmolality 529, serum osmolality 280, and urine sodium 55. Subsequent mainstay of the treatment was free water restriction to 1 liter daily for the next 3 days. She had uneventful cesarean section 72 hours later when serum sodium was 137. She had complete resolution of SIADH after delivery. The pathophysiology of SIADH in pre-eclampsia is poorly understood. Clinical management of severe hyponatremia is challenging with the obstetrician balancing threat of eclampsia and its associated risk to mother & fetus versus timing of delivery while waiting for a safer sodium level to induce. The nephrologist has limited therapeutic armamentarium in case of emergency. Furosemide and hypertonic saline are category c drugs while conivaptan and demeclocycline are contraindicated in pregnancy. Both mother & baby experienced healthy outcomes with free water restriction and timely induction of labor described herein.

Institution

(Thiruveedi, Benz) Lankenau Medical Centre, Wynnewood, PA, United States

Publisher

W.B. Saunders

11. Severe hyponatremia in twin pregnancy and preeclampsia a case report.

Patel-Chamberlin M., Thakar C., El-Khatib M.

American Journal of Kidney Diseases. Conference: National Kidney Foundation 2013 Spring Clinical Meetings. Orlando, FL United States. Conference Publication: (var.pagings). 61 (4) (pp A75), 2013. Date of Publication: April 2013.

AN: 71024063

Pregnancy is associated with resetting of osmostat resulting in reduced serum osmolality and mild hyponatremia. Severe hyponatremia is rare and is an uncommon complication of preeclampsia. There are only a few reported cases in literature. We report a case of severe hyponatremia in a 43 year old Caucasian patient admitted at 36 weeks of twin gestation with altered mental status and nausea. Upon presentation, patient was noted to be agitated. The systolic blood pressure was 152/92mmHg. She had 3+ pitting edema of bilateral lower extremities. Serum sodium (Na) was 111 meq/L, blood urea nitrogen was 17mg/dL and creatinine was 0.82mg/dL. Coagulation panel was unremarkable, liver function panel was notable for albumin of 2.3. A random urine protein to creatinine ratio was measured at 0.290. Serum and urine osmolality was measured at 234 and 481mmol/L respectively. Urine Na was <5 mmol/L. Patient was given 100 ml of 2% saline, repeat Na was 112 meq/L three hours later; another 100ml of 2% saline was repeated and patient was taken to the operating room for an emergent cesarean section. Post-operatively, Na was 113 meq/L, anti-diuretic hormone (ADH) level was <0.8pg/ml. Patient remained agitated and altered. She started on 3% saline infusion and intravenous phenytoin. Hypertonic saline was continued for 24 hours till serum Na increased to 122meq/L. Patient's mental status dramatically improved and returned to baseline by hospital day 2. Though ADH levels in physiological hyponatremia of pregnancy is low, our case is the first reported case with undetectable levels of ADH and severe hyponatremia and pre-eclampsia. The exact pathophysiological mechanism of severe hyponatremia in the setting of pre-eclampsia needs to be further investigated.

Institution

(Patel-Chamberlin, Thakar, El-Khatib) University of Cincinnati, Cincinnati, OH, United States

Publisher

W.B. Saunders

12. Hyponatremia in pre-eclampsia - Rare but easily missed.

Naquib Q.S., Sivarajasingam S., Badial G., Visvanathan D., Gupta M.

BJOG: An International Journal of Obstetrics and Gynaecology. Conference: 10th International Scientific Congress of the Royal College of Obstetricians and Gynaecologists, RCOG 2012.

Kuching, Sarawak Malaysia. Conference Publication: (var.pagings). 119 (SUPPL. 1) (pp 111), 2012. Date of Publication: June 2012.

AN: 70780975

Objective: Hyponatraemia in pre-eclampsia is a rare but potentially fatal complication. Maternal symptoms include headache, lethargy, nausea, drowsiness, muscle cramps, confusion, convulsions and coma. Death can occur in up to 50% of cases if the serum sodium falls below 120 mmol/L. Fetal and neonatal hyponatremia as a consequence can cause polyhydramnios, jaundice and tachypnoea of the newborn. Neonatal seizures can occur if serum sodium level falls below 130 mmol/L. Maternal symptoms can easily be mistaken for pre-eclampsia and even eclampsia. A literature review from 1998 to 2011 revealed nine case reports. We are reporting the 10th from our hospital in 2011 to remind obstetricians of the need to be aware of this complication and manage it appropriately. Results: A 33 year old primigravidae booked at 9 weeks with a normal blood pressure (BP) and urine analysis. She had a 1:8 risk of Down syndrome on quadruple serum screening but declined invasive testing. Fetal growth surveillance by ultrasound was arranged. She attended regular antenatal checks which were uneventful. At 30 weeks and 6 days gestation, a blood pressure of 140/80 mm Hg with 2 plus proteinuria (PCR 135) was noted. Her blood screen for pre-eclampsia was normal. Twenty-four hour urine collection showed a total protein of 0.7 g. She was admitted at 32 weeks and 4 days of gestation with headache, a BP of 132/80 mm Hg and 3 plus proteinuria. Ultrasound revealed a growth restricted fetus with cerebral redistribution. Her serum biochemistry showed a sodium of 129, potassium of 4.9 mmol/L and a Urate level of 0.44. Platelet count and haematocrit were normal. An ultrasound of the kidney, ureter and bladder was normal. Two weeks later the PCR was 686, with a sodium of 120 and potassium of 5.3 mmol/L. The Blood pressure was 147/93 mm of Hg. An ECG was normal. Treatment with oral salts and 0.9% saline, and labetolol was commenced. A decision was taken to deliver her by Caesarean section 2 days later as the sodium level fell to 118 mmol/L, Doppler's of the umbilical artery remained normal. The baby's weight was 1.5 kg, with good APGARs and normal cord blood gases. The baby had a sodium level on Day 1 of 131 and later that day 133 mmol/L. Conclusion: Hyponatraemia in pre-eclampsia is rare but must be picked up early and managed appropriately to prevent complication in both mother and baby.

Institution

(Naquib, Sivarajasingam, Badial, Visvanathan, Gupta) Whipps Cross University Hospital, London, United Kingdom

Publisher

Blackwell Publishing Ltd

13. A case of postpartum hyponatremia in diabetes insipidus.

Chandrasekhar A., Soler S., Miller M., Gopalakrishnan G.

Endocrine Reviews. Conference: 93rd Annual Meeting and Expo of the Endocrine Society, ENDO 2011. Boston, MA United States. Conference Publication: (var.pagings). 32 (3 Meeting Abstracts) (no pagination), 2011. Date of Publication: June 2011.

AN: 70676425

Background: Knowledge of how pregnancy affects vasopressin (AVP) metabolism is essential for management of patients with pre-existing diabetes insipidus (DI). The placenta produces vasopressinase, a cystine aminopeptidase which inactivates AVP. Vasopressinase levels increase 1000-fold in pregnancy, peak at term, and decline by one month postpartum. Desmopressin (DDAVP) is the drug of choice for treatment of DI during pregnancy, and is resistant to degradation by vasopressinase. We present a case of iatrogenic hyponatremia in a pregnant subject with pre-existing DI on DDAVP. **Clinical Case:** A 21 year-old female at 38 weeks' gestation underwent successful caesarean section. The patient's past medical history was significant for central diabetes insipidus diagnosed at age six secondary to infiltration of the hypothalamic-pituitary axis from Histiocytosis X. During pregnancy, her DDAVP dose was increased from one spray twice daily to four times daily. Peri-operatively, she received two liters of normal saline. On post-op day one, she took three sprays of DDAVP. On post-op day two, her serum sodium levels decreased from 134 to 122 over a 24-hour period. Laboratory values were as follows: serum osmolality of 248 mOsm (n 275-295), urine osmolality of 981 mOsm (n 50-1400), urine sodium of 38 (n 10-40 mEq/L), and urine specific gravity of 1.016 (n 1.010-1.020). The patient remained asymptomatic and was clinically euvolemic. She was placed on fluid restriction. Serum sodium normalized to 135 over a 36-hour period. Her DDAVP dose was decreased to one spray daily, and she was discharged. **Conclusion:** We conclude that increased DDAVP and IV fluids during labor caused an excess of free water relative to sodium, resulting in severe hyponatremia post-partum. Frequent monitoring of serum and urine electrolytes is critical in the management of DI patients on DDAVP during labor and delivery. Vasopressinase causes increased AVP requirements ante-partum, and decreased requirements post-partum. Therefore, titration of DDAVP dosing during and after pregnancy may be necessary. The rate of metabolic clearance of DDAVP increases only minimally during pregnancy, supporting the idea that vasopressinase primarily affects degradation of endogenous AVP. Increased awareness of the potential consequences of excess DDAVP and IV fluid administration in pregnant subjects with DI is crucial for prevention and diagnosis of iatrogenic hyponatremia.

Institution

(Chandrasekhar, Soler, Miller, Gopalakrishnan) Department of Medicine, Alpert Medical School of Brown University, Providence, RI, United States

Publisher

Endocrine Society

14. Late occurrence of severe hyponatremia followed by extrapontine osmotic demyelination syndrome after successful conservative management of postpartum hemorrhage due to placenta accreta by uterine artery embolization.

Imoto S., Takeda A., Koyama K., Taguchi S., Horibe K., Nakamura H.

Journal of Maternal-Fetal and Neonatal Medicine. 23 (7) (pp 742-746), 2010. Date of Publication: July 2010.

AN: 359017868

Development of severe hyponatremia followed by extrapontine osmotic demyelination syndrome was reported as a significant late complication after successful conservative management of postpartum hemorrhage due to placenta accreta by uterine artery embolization. © 2010 Informa UK Ltd.

PMID

19757336 [<http://www.ncbi.nlm.nih.gov/pubmed/?term=19757336>]

Institution

(Imoto, Takeda, Nakamura) Department of Obstetrics and Gynecology, Gifu Prefectural Tajimi Hospital, 5-161 Maebata-cho, Tajimi, Gifu 507-8522, Japan (Koyama) Department of Radiology, Gifu Prefectural Tajimi Hospital, Tajimi, Gifu, Japan

(Taguchi) Department of Endocrinology, Gifu Prefectural Tajimi Hospital, Tajimi, Gifu, Japan

(Horibe) Department of Neurology, Gifu Prefectural Tajimi Hospital, Tajimi, Gifu, Japan

Publisher

Informa Healthcare

15. Pathophysiology and Management of Preeclampsia-Associated Severe Hyponatremia.

Sandhu G., Ramaiyah S., Chan G., Meisels I.

American Journal of Kidney Diseases. 55 (3) (pp 599-603), 2010. Date of Publication: March 2010.

AN: 50730191

PMID

20005030 [<http://www.ncbi.nlm.nih.gov/pubmed/?term=20005030>]

Institution

(Sandhu, Ramaiyah, Chan, Meisels) Division of Nephrology, Department of Medicine, St. Luke's-Roosevelt Hospital Center, New York, NY, United States

Publisher

W.B. Saunders (Independence Square West, Philadelphia PA 19106-3399, United States)

16. Severe hyponatraemia associated with pre-eclampsia.

Linton A., Gale A.

Journal of Obstetrics and Gynaecology. 29 (2) (pp 143-144), 2009. Date of Publication: February 2009.

AN: 354305079

PMID

19274550 [<http://www.ncbi.nlm.nih.gov/pubmed/?term=19274550>]

Institution

(Linton, Gale) Department of Obstetrics and Gynaecology, Lancashire Teaching Hospitals, Preston, United Kingdom (Linton) Department of Obstetrics and Gynaecology, Sharoe Green Unit, Royal Preston Hospital, Fulwood Road, Preston PR2 9HT, United Kingdom

Publisher

Informa Healthcare (69-77 Paul Street, London EC2A 4LQ, United Kingdom)

17. Pre-eclampsia presenting as hyponatremia: An uncommon presentation of pre-eclampsia in a twin pregnancy - A case report and review of the literature.

Jhaveri K.D., Aelion A., Wanchoo R.

Clinical Nephrology. 72 (6) (pp 492-496), 2009. Date of Publication: 2009.

AN: 355748002

Pre-eclampsia affects 5-8% of pregnancies in the USA and 3-14% of pregnancies worldwide. Classically, the syndrome includes hypertension and proteinuria that may be associated with edema, headache and worsening epigastric pain. This is postulated from vasospasm and endothelial cell damage. Hyponatremia in pre-eclamptic pregnancies has been described in few cases, most of which were twin pregnancies, and four of them had nephrotic syndrome. The management of hyponatremia requires a multidisciplinary approach and significant attention, as this condition can predispose to convulsions along with pre-eclampsia, thus, endangering the life of the mother and the child. We describe a case of a patient who developed preeclampsia and hyponatremia in the absence of proteinuria, at 34 weeks of a twin pregnancy; there was progression to oliguria with complete remission following delivery by cesarean section. © 2009 Dustri-Verlag Dr. K. Feistle.

PMID

19954728 [<http://www.ncbi.nlm.nih.gov/pubmed/?term=19954728>]

Institution

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(Wanchoo) Rogosin Institute, New York, NY, United States

Publisher

Dustri-Verlag Dr. Karl Feistle (Bajuwarenring 4, Oberhaching 82041, Germany)

18. The case: a female with hyponatremia. Diagnosis: Postpartum panhypopituitarism (Sheehan syndrome).

Bamoulid J; Courivaud C; Kazory A; Bonneville JF; Ducloux D.

Kidney International. 76(3):351-2, 2009 Aug.

[Case Reports. Journal Article]

UI: 19904259

Status

MEDLINE

Authors Full Name

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Date Created

20091111

Year of Publication

2009

19. Syndrome of inappropriate anti-diuretic hormone (SIADH) and pre-eclampsia - A rare association.

Ramaiyah S., Meisels I., Sandhu G., Chan G.

American Journal of Kidney Diseases. Conference: 2009 Spring Clinical Meetings of the National Kidney Foundation, NKF. Nashville, TN United States. Conference Publication: (var.pagings). 53 (4) (pp A64), 2009. Date of Publication: April 2009.

AN: 70141655

Introduction: Pre-eclampsia is rarely associated with hyponatremia. SIADH as a cause of hyponatremia in pre-eclampsia is very rare. There are 9 case reports in the literature of which only 2 were due to SIADH. We report the third case of a rare association of pre-eclampsia and SIADH and discuss the clinical significance. Case : A 30 year old healthy female in her first pregnancy presented at 32 weeks gestation with premature contractions. Lab tests showed a serum sodium(Na) of 123mmol/L, potassium 4.3mmol/L, BUN 9mg/dL, Creatinine 0.6mg/dL. She was tocolysed with Nifedipine. At 33 weeks follow up, her Na was 124mmol/L. Renal and liver function tests remained normal. She had proteinuria of 5940mg in 24 hours. Urine osmolality was 325 and urine Na was 77mmol/L. TSH, T4 and cortisol levels were normal. SIADH was diagnosed and the patient was placed on fluid restriction. Over the next 3 days, her Na stabilized to 128mmol/L but on day 4 she developed worsening pre- eclampsia, blood pressure elevation (150/90) and hyponatremia. Labor was induced and a healthy neonate was delivered. The maternal Na rose to 136 mmol/L in 48 hours and proteinuria resolved. Fetal Na was 128mmol/L at birth and 137mmol/L in 48 hours. Comment: In pregnancy, osmotic release of ADH is reset to a lower threshold and serum Na drops by 4mmol/L. However, these physiological changes do not usually cause significant hyponatremia. The mechanism of SIADH in pre-eclampsia is not clear. It may include defective inactivation of ADH by placenta or increased production of ADH and oxytocin by the placental unit in pre-term labor. Acute hyponatremia may be associated with seizures and in pre-eclampsia, the risk is likely to be higher. Fetal Na rapidly equilibrates with maternal Na. Suppression of fetal ADH axis increases fetal urine output and may lead to polyhydramnios. In stable patients fluid restriction and close monitoring should be instituted. Oral NaCl or hypertonic saline may be helpful in worsening hyponatremia. Drugs including

demeclocycline and conivaptan are contra-indicated in pregnancy. Definitive treatment remains timely delivery of the fetus which leads to resolution in all reported cases.

Institution

(Ramaiyah, Meisels, Sandhu, Chan) St.Lukes-Roosevelt hospital, Columbia University College of Physicians, New York, NY, United States

Publisher

W.B. Saunders

20. Water intoxication presenting as maternal and neonatal seizures: A case report.

Chapman T.H., Hamilton M.

Journal of Medical Case Reports. 2 (no pagination), 2008. Article Number: 366. Date of Publication: 04 Dec 2008.

AN: 354063533

Introduction: We present an unusual case of fitting in the mother and newborn child, and the challenges faced in the management of their hyponatraemia due to water intoxication. Case presentation: A previously well 37-year-old, primigravid Caucasian woman presented with features mimicking eclampsia during labour. These included confusion, reduced consciousness and seizures but without a significant history of hypertension, proteinuria or other features of pre-eclampsia. Her serum sodium was noted to be low at 111 mmol/litre as was that of her newborn baby. She needed anti-convulsants with subsequent intubation to stop the fitting and was commenced on a hypertonic saline infusion with frequent monitoring of serum sodium. There is a risk of long-term neurological damage from central pontine myelinolysis if the hyponatraemia is corrected too rapidly. Mother and baby went on to make a full recovery without any long-term neurological complications. Conclusion: There is little consensus on the treatment of life-threatening hyponatraemia. Previous articles have outlined several possible management strategies as well as their risks. After literature review, an increase in serum sodium concentration of no more than 8-10 mmol/litre in 24 hours is felt to be safe but can be exceeded with extreme caution if life-threatening symptoms do not resolve. Formulae exist to calculate the amount of sodium needed and how much hypertonic intravenous fluid will be required to allow safer correction. We hypothesise the possible causes of hyponatraemia in this patient and underline its similarity in symptom presentation to eclampsia. © 2008 Chapman and Hamilton; licensee BioMed Central Ltd.

Institution

(Chapman, Hamilton) Department of Intensive Care, St Georges Hospital, London SW17 0QT, United Kingdom

Publisher

BioMed Central Ltd. (Floor 6, 236 Gray's Inn Road, London WC1X 8HB, United Kingdom)

21. Syndrome of inappropriate ADH secretion in a woman with preeclampsia.

Wilson H.J., Shutt L.E.

International Journal of Obstetric Anesthesia. 16 (4) (pp 360-362), 2007. Date of Publication: October 2007.

AN: 47380332

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 122 mmol/L and by day 6, in the absence of fluid restriction, it had fallen to 116 mmol/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 48 h. 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. © 2007 Elsevier Ltd. All rights reserved.

PMID

17643289 [<http://www.ncbi.nlm.nih.gov/pubmed/?term=17643289>]

Institution

(Wilson, Shutt) Department of Anaesthesia, St Michael's Hospital, Bristol, United Kingdom

Publisher

Churchill Livingstone (1-3 Baxter's Place, Leith Walk, Edinburgh EH1 3AF, United Kingdom)

22. Pre-eclampsia and hyponatraemia.

Ray C.D., Shenoy J.V., Hare A.A.

Journal of Obstetrics and Gynaecology. 26 (7) (pp 695-696), 2006. Date of Publication: 01 Oct 2006.

AN: 44663894

PMID

17071447 [<http://www.ncbi.nlm.nih.gov/pubmed/?term=17071447>]

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(Ray, Shenoy, Hare) Norfolk and Norwich University Hospital, Norwich, United Kingdom (Ray) 2 Mosely Court, Norwich NR5 9PN, United Kingdom

Publisher

Informa Healthcare (69-77 Paul Street, London EC2A 4LQ, United Kingdom)

23. Hyponatremia and preeclampsia.

Ravid D., Massarwa L.-E., Biron-Shental T., Fejgin M.D.

Journal of Maternal-Fetal and Neonatal Medicine. 18 (1) (pp 77-78), 2005. Date of Publication: July 2005.

AN: 41224366

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. © 2005 Taylor & Francis.

PMID

16105796 [<http://www.ncbi.nlm.nih.gov/pubmed/?term=16105796>]

Institution

(Fejgin) Sackler School of Medicine, Tel-Aviv University, Tel-Aviv, Israel

Publisher

Informa Healthcare (69-77 Paul Street, London EC2A 4LQ, United Kingdom)

24. Early postpartum hyponatremia in a patient with transient Sheehan's syndrome.

Munz W., Seufert R., Knapstein P.-G., Polmow K.

Experimental and Clinical Endocrinology and Diabetes. 112 (5) (pp 278-280), 2004. Date of Publication: May 2004.

AN: 38679273

In modern day health care, Sheehan's syndrome is a rare disorder affecting the postpartum period. We present a case of a 33-year-old woman with atonic hemorrhage developing a transient Sheehan's syndrome associated with hyponatremia six days postpartum. Evaluation of cranial computer tomography and magnetic resonance imaging of the pituitary demonstrated normal finding. Immediate replacement therapy using sodium, chloride, hydrocortisone, fludrocortisone and levothyroxine revealed regression of the Sheehan's syndrome to complete recovery. The present report shows that Sheehan's syndrome can be associated with hyponatremia and illustrates the need to include hyponatremia as an initial symptom in the differential diagnosis of Sheehan's syndrome.

PMID

15146375 [<http://www.ncbi.nlm.nih.gov/pubmed/?term=15146375>]

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Publisher

MVS Medizinverlage Stuttgart (Steiermarkerstr. 3-5, Stuttgart D-70469, Germany)

25. Severe hyponatraemia as a result of primary polydipsia in labour.

Graham K; Palmer J.

Australian & New Zealand Journal of Obstetrics & Gynaecology. 44(6):586-7, 2004 Dec.

[Case Reports. Journal Article]

UI: 15598305

Status

MEDLINE

Authors Full Name

Graham, Kathryn; Palmer, John.

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Comments

Comment in: Aust N Z J Obstet Gynaecol. 2005 Jun;45(3):259-60; author reply 260; PMID:

15904460 Comment in: Aust N Z J Obstet Gynaecol. 2005 Dec;45(6):541; PMID: 16401233

Comment in: Aust N Z J Obstet Gynaecol. 2005 Jun;45(3):259; author reply 260; PMID: 15904461

Date Created

20041215

Year of Publication

2004

26. Severe hyponatraemia and pre-eclampsia.

Burrell C., De Swiet M.

BJOG: An International Journal of Obstetrics and Gynaecology. 111 (9) (pp 1020-1022), 2004.

Date of Publication: September 2004.

AN: 39223057

PMID

15327622 [<http://www.ncbi.nlm.nih.gov/pubmed/?term=15327622>]

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(Burrell) Luton and Dunstable Hospital, Lewsey Road, Luton LU4 0DZ, United Kingdom

Publisher

Blackwell Publishing Ltd (9600 Garsington Road, Oxford OX4 2XG, United Kingdom)

27. Perinatal water intoxication due to excessive oral intake during labour.

Johansson S., Lindow S., Kapadia H., Norman M.

Acta Paediatrica, International Journal of Paediatrics. 91 (7) (pp 811-814), 2002. Date of Publication: 2002.

AN: 34876169

The increased body water in pregnant women and the birth-related activation of water-sparing systems contribute to a high risk of perinatal water intoxication if the mother drinks too much water during labour. This study reports on four newborn term infants and one mother presenting with life-threatening symptoms due to hyponatraemia from excessive oral intake during labour. Awareness of this diagnosis in the delivery unit is very important, because the clinical picture may mimic that of pre-eclampsia or dehydration. Conclusion: Guidelines are proposed to prevent and treat perinatal water intoxication due to excessive oral intake during labour.

PMID

12200908 [<http://www.ncbi.nlm.nih.gov/pubmed/?term=12200908>]

Institution

(Johansson, Lindow, Kapadia, Norman) Neonatal Research Unit, Astrid Lindgren Children's Hospital, Karolinska Hospital, SE-171 76 Stockholm, Sweden

Publisher

Blackwell Publishing Ltd (9600 Garsington Road, Oxford OX4 2XG, United Kingdom)

28. Hyponatremia and hypoglycemia in acute Sheehan's syndrome.

Bunch TJ; Dunn WF; Basu A; Gosman RI.

Gynecological Endocrinology. 16(5):419-23, 2002 Oct.

[Case Reports. Journal Article]

UI: 12587538

We report the case of a 23-year-old Saudi Arabian woman who presented to the medical intensive care unit with severe hyponatremia and hypoglycemia following a Cesarean section delivery complicated by hemorrhage due to disseminated intravascular coagulopathy. She was treated successfully for adrenal insufficiency acutely, and was later discharged on hormone replacement therapy. To our knowledge, this is the first case report of acute Sheehan's syndrome presenting with both hyponatremia and suggestive hypoglycemia. Pituitary necrosis is an uncommon complication of peripartum hemorrhagic shock. Since the initial description by Sheehan in 1937, the incidence of the syndrome has gradually declined through improved management of hemodynamic complications leading to the infarction of the gland. There are many studies describing complications of late Sheehan's syndrome; however, relatively few contain descriptions of the acute phase. In addition, the diagnosis of this syndrome is often determined after resolution of the acute process with resultant lack of data regarding immediate endocrine and imaging abnormalities. In this report, we describe the complete endocrine and imaging assessment of a patient presenting in critical condition due to necrosis of the pituitary gland in the immediate postpartum period.

Status

MEDLINE

Authors Full Name

Bunch, T J; Dunn, W F; Basu, A; Gosman, R I.

Institution

Bunch, T J. Department of Internal Medicine, Mayo Clinic, Rochester, MN 55905, USA.

Date Created
20030217
Year of Publication
2002

29. Dilutional hyponatremia in preeclampsia with and without nephrotic syndrome.

Magriples U., Laifer S., Hayslett J.P.

American Journal of Obstetrics and Gynecology. 184 (2) (pp 231-232), 2001. Date of Publication: 2001.

AN: 32141672

This report includes cases of hyponatremia in preeclampsia. Two patients were identified with preeclampsia complicated by hyponatremia, one with and the other without nephrotic syndrome. Together with 3 cases of hyponatremia recently reported, these additional cases from the same geographic area suggest that hyponatremia is not a rare complication of preeclampsia.

PMID

11174509 [<http://www.ncbi.nlm.nih.gov/pubmed/?term=11174509>]

Institution

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(Magriples) Department of Obstetrics and Gynecology, Yale University School of Medicine, United States

(Laifer) Bridgeport Hospital, United States

Publisher

Mosby Inc. (11830 Westline Industrial Drive, St. Louis MO 63146, United States)

30. Dilutional hyponatremia in pre-eclampsia.

Hayslett J.P., Katz D.L., Knudson J.M.

American Journal of Obstetrics and Gynecology. 179 (5) (pp 1312-1316), 1998. Date of Publication: 1998.

AN: 28533793

OBJECTIVE: The objective of this report is to describe a defect in water metabolism, characterized by hyponatremia, in patients with pre-eclampsia- induced nephrotic syndrome
STUDY DESIGN: This was an observational study of 3 women
RESULTS: Hyponatremia was observed in 3 women with pre-eclampsia characterized by various extrarenal manifestations, as well as by nephrotic syndrome with normal or nearly normal renal function. Restriction in water intake partially corrected hyponatremia before delivery in each case, and no complications were observed in the neonates. The mechanism of impaired excretion of water in these patients is proposed to involve persistent and inappropriate production of vasopressin through stimulation of the nonosmotic mechanism for vasopressin secretion in response to a reduction in effective plasma volume.
CONCLUSIONS: These results indicate for the first time that women with pre-eclampsia are, at least when nephrotic, at risk for development of dilutional hyponatremia, which can cause neurologic complications that simulate those of eclampsia.

PMID

9822522 [<http://www.ncbi.nlm.nih.gov/pubmed/?term=9822522>]

Institution

(Hayslett, Katz, Knudson) Department of Internal Medicine, Yale University, School of Medicine, New Haven, CT, United States

Publisher

Mosby Inc. (11830 Westline Industrial Drive, St. Louis MO 63146, United States)

31. Inappropriate secretion of antidiuretic hormone in Sheehan's syndrome: A rare cause of postpartum hyponatremia.

Putterman C., Almog Y., Caraco Y., Gross D.J., Ben-Chetrit E.

American Journal of Obstetrics and Gynecology. 165 (5 I) (pp 1330-1333), 1991. Date of Publication: 1991.

AN: 21349931

A 27-year-old woman experienced hemorrhagic shock after delivery. One week later she was seen in an obtunded state of consciousness. The results of laboratory evaluation were consistent with the syndrome of inappropriate antidiuretic hormone secretion caused by hypopituitarism. Hydrocortisone rapidly corrected sodium levels. Syndrome of inappropriate secretion of antidiuretic hormone caused by Sheehan's syndrome should be considered in the differential diagnosis of postpartum hyponatremia.

PMID

1957856 [<http://www.ncbi.nlm.nih.gov/pubmed/?term=1957856>]

Institution

(Putterman, Almog, Caraco, Gross, Ben-Chetrit) Department of Internal, Medicine A, Hadassah University Hospital, POB 12000, Jerusalem 91120, Israel

Publisher

Mosby Inc. (11830 Westline Industrial Drive, St. Louis MO 63146, United States)

32. Postpartum preeclampsia-induced shock and death: a report of three cases.

Kalur JS; Martin JN Jr; Kirchner KA; Morrison JC.

American Journal of Obstetrics & Gynecology. 165(5 Pt 1):1362-8, 1991 Nov.

[Case Reports. Journal Article]

UI: 1957863

Three patients with preeclampsia died as a result of prolonged postpartum hypotension that was unrelated to blood loss. Autopsy failed to reveal a cause of death. The sudden onset of hypotensive shock within 24 hours of delivery occurred in all patients, with coexistent hyponatremia present in the two patients in whom it was evaluated. These three maternal deaths appear to have occurred as a result of the previously described entity of postpartum preeclamptic shock.

Version ID

1

Status

MEDLINE

Authors Full Name

Kalur, J S; Martin, J N Jr; Kirchner, K A; Morrison, J C.

Institution

Kalur, J S. Jacobson, Maynard, Tuschman & Kalur, Attorneys at Law, Cleveland, OH 44114-1192.

Date Created

19911227

Year of Publication

1991

SEARCH STRATEGY:

- 1 hyponatremia {Including Related Terms} (8453)
- 2 preeclampsia {Including Related Terms} (10107)
- 3 "pre eclampsia".mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] (33812)
- 4 2 or 3 (33812)
- 5 severe or extreme or acute {Including Related Terms} (10857)
- 6 1 and 4 and 5 (0)
- 7 1 and 4 (24)
- 8 postpartum {Including Related Terms} (13803)
- 9 1 and 8 (7)
- 10 exp hyponatremia/ (9264)
- 11 exp preeclampsia/ (30134)
- 12 10 and 11 (24)
- 13 7 or 9 or 12 (33)
- 14 [from 13 keep 2,5-6,9,17,24,29,33,38-39,45,47-49,53,55-56,59,61,64,66,69-70,72-73,78,81,86] (0)
- 15 exp Hyponatremia/ (9264)
- 16 hyponatremia.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] (13462)
- 17 15 or 16 (13462)
- 18 exp Pre-Eclampsia/ (30134)
- 19 "pre eclampsia".mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] (33812)
- 20 preeclampsia.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] (19048)
- 21 18 or 19 or 20 (41077)
- 22 (severe or extreme or acute).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] (2071425)
- 23 17 and 21 and 22 (10)
- 24 from 23 keep 1-2,4,6-8,10 (7)
- 25 17 and 21 (33)
- 26 from 25 keep 1-2,4,7,9,12-14,16-17,19-22,24,26 (16)
- 27 exp Postpartum Period/ (62313)
- 28 (postpartum or postnatal).mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] (165021)
- 29 27 or 28 (198796)
- 30 17 and 29 (91)
- 31 from 30 keep 9,12,18,30-31,45-47,49,53,68-69 (12)
- 32 24 or 26 or 31 (27)
