



Severe Hyponatremia and Ascites Associated with Preeclampsia

Sarah Ghazali¹ , Mayasem Al-Domyati²

Abstract

Hyponatremia and ascites are rare findings in preeclampsia (PE) and have been suggested to be a feature of severity and associated with adverse pregnancy outcomes. The presence of both with PE was reported once in the literature. To our knowledge, this is the second case of PE with hyponatremia and ascites and the first case of recurrent ascites with PE. A 29-year-old gravida 2, para 1, was admitted with early-onset PE at 26 weeks of gestation. Admission labs revealed severe hyponatremia. Ultrasound showed significant maternal ascites and a growth-restricted fetus with abnormal umbilical artery Doppler. Few days later, the patient developed oliguria and had a cesarean section. The maternal hyponatremia was corrected after delivery and the ascites had completely resolved in her post-partum visit. Neonatal hyponatremia was also noted. The exact pathophysiology of these findings is unknown. Nephrotic syndrome with hypoalbuminemia may be the contributing factor.

Keywords: Preeclampsia, Hyponatremia, Ascites, Hypoalbuminemia

Introduction

Preeclampsia (PE) is a devastating multisystem medical disorder that affects 2% to 5% of pregnancies (1). It is a leading factor in maternal mortality causing 1.5 maternal deaths per 100 000 live births globally per year (2).

Hyponatremia (hypoNa) and ascites with PE have been reported several times in the literature independently. To our knowledge, the presence of both in association with PE has only been reported once (1). Accordingly, this is the second case and the first case of recurrent ascites with PE. The exact mechanism causing hyponatremia with ascites is poorly understood. We hypothesize that the hypoalbuminemia which is secondary to nephrotic-range proteinuria may be a contributing factor to the hyponatremia and ascites in our patient.

Case Report

The patient was a 29-year-old lady, gravida 2, para 1, at 26 weeks of pregnancy. In her previous delivery, she gave birth to a baby weighing 1 kg at birth in Yemen by cesarean section at 36 weeks with severe PE. A surgical drain was kept in the abdomen for postoperative drainage of massive ascites as per patient's history. Her hypertension and ascites had resolved post delivery. In her pregnancy, she was followed up in a private hospital and diagnosed with pregnancy-induced hypertension after 20 weeks of gestation, for which she was given alpha methyl dopa a

couple of weeks prior to presentation. She came to our emergency room complaining of headache, blurred vision and epigastric pain. She was found to be hypertensive with blood pressure (BP) of 160/110 mm Hg that required 2 doses of 5 mg intravenous hydralazine to control. Urine dipstick revealed 3+ proteinuria. PE was diagnosed and magnesium sulfate loading dose was started. Afterwards, she was admitted to the labor room at a maintenance dose of magnesium sulfate. Dexamethasone was given for fetal lung maturity. Initial work-up for PE showed a normal complete blood cell count, normal liver enzymes, low albumin (21 g/L), low serum sodium (114 mmol/L), low serum chloride (83 mmol/L) and normal creatinine. Repeat labs revealed persistent hyponatremia. 24-hour urine protein excretion was 4.7 g. The patient stayed in the labor room for 3 days, during which she completed dexamethasone and 48 hours of magnesium sulfate. Her blood pressure was difficult to control eventually requiring 3 antihypertensive meds (methyldopa, nifedipine and hydralazine). Afterwards, she was transferred to the antenatal ward. Eleven days post admission fetal medicine consultation was done. Ultrasound was performed which showed fetal growth restriction with absent end-diastolic flow in the umbilical artery Doppler and a normal amniotic fluid volume. Biophysical profile was 10/10. Significant maternal ascites was also noted (Figure 1).

Labs showed hypoalbuminemia (17 g/L), persistent

Received 13 January 2018, Accepted 7 August 2018, Available online 27 August 2018

¹Department of Obstetrics and Gynecology, King Abdulaziz University, Jeddah, Saudi Arabia. ²King Abdulaziz University, Jeddah, Saudi Arabia.

*Corresponding Author: Sarah Ghazali, MD, FRCSC; Tel: +966565597653, Email: sarah_ghazali@hotmail.com





Figure 1. Trans-abdominal Ultrasound Showing Significant Maternal Ascites with Clear Delineation of the Uterus and Maternal Bowel.

hyponatremia (116 mmol/L) and hypochloremia (85 mmol/L). Maternal abdominal ultrasound was ordered which showed marked ascites and a coarse appearing liver for further work-up, bilateral increased renal cortical echogenicity and left renal small stone. Liver enzymes remained normal. Hepatitis serology was negative. Medical consultation regarding the findings was done and correction of hyponatremia was initiated by 80 cc of normal saline per hour. No obvious cause of ascites was detected. Three days later, the patient had oliguria with only 600 cc of urine in 24 hours, so the decision to deliver was made at 27 weeks +6 days. Cesarean section was done. At the point of entry into the peritoneal cavity, a small incision was done and a suction device with a guard was inserted. Approximately 2 L of clear ascetic fluid was removed and a live-born female fetus was delivered weighing 686 g with Apgar scores of 4, 6 and 7 at 1, 5 and 10 minutes. She was admitted to the NICU and initial serum sodium was 127 mmol/L that was corrected. The ascetic fluid was sent for cytology, chemistry and cell count. Only the 2 former tests were done which showed the fluid to be a transudate with a protein level of 2 g/L and LDH level of 9. The mother was discharged day 4 post cesarean section. Blood pressure was fairly controlled with systolic BP of 130-140 and a diastolic of 90 by 40 mg nifedipine extended release. Her serum sodium had normalized to 143 mmol/L. Follow up abdominal ultrasound was done 2 months post delivery that showed a normal liver with homogeneous echogenicity, no ascites and tiny non-obstructive renal stones with no hydronephrosis. She was seen in the clinic after the ultrasound. She had stopped her medication and her BP was still elevated, so she was advised to restart her medication. She was then lost to follow up. The baby was discharged from the NICU at 68 days of life weighing 1.68 kg in good condition with only stage 1 retinopathy of prematurity.

Discussion

HypoNa is defined as a serum sodium concentration (Na^+) less than 135 mmol/L. Severe hypoNa leading to neurological complications such as cerebral edema, convulsions and coma occurs when serum Na^+ acutely drops to less than 125 mmol/L. Rapid correction of serum Na^+ can lead to central pontine myelinolysis (3). The exact incidence of hypoNa associated with PE is unknown. There are 2 descriptive studies reporting an incidence of 0.33% (4) and 9.7% respectively (5). Its presence is almost always associated with severe features of PE and adverse outcomes. The exact cause of hypoNa associated with PE is unknown. Some reports suggest that it might be secondary to a syndrome of inappropriate antidiuretic hormone secretion (SIADH). It is known that PE causes a decrease in plasma volume and this may stimulate the release of ADH which leads to hypoNa (6). In normal pregnancy, there is an increased production of ADH that is counteracted by placental vasopressinase activity. It is believed that the placental dysfunction that occurs in PE leads to decreased vasopressinase activity resulting in excess circulating concentration of ADH (1, 7). To diagnose SIADH, the following 5 criteria must be present: low serum osmolality (<275 mOs/kg), high urine osmolality (>100 mOs/kg), normovolemia, high urine sodium (>20 mmol/L) and exclusion of other causes. In our case, serum osmolality was unfortunately not measured. There was a urine osmolality of 371 mOs/kg, but urinary sodium was 12 mmol/L, which is less than 20 in the definition of SIADH.

Others have reported that hypoNa in PE is secondary to nephrotic syndrome (8). Nephrotic syndrome is associated with hypervolemic hypoNa. HypoNa with edema points to increased total body water and sodium. The increase in the total body water is greater than the total body sodium level, leading to hypoNa and edema.

In our case, the nephrotic range of proteinuria with its secondary hypoalbuminemia may be the cause of hypoNa and significant maternal ascites. Hypoalbuminemia associated with hypoNa has been described in the literature with correction of the hypoNa with albumin infusion (9, 10). Nguyen et al described a phenomenon which was created by Pitts RF and was called the Gibbs-Donnan effect (11). They stated that the reduced permeability of protein across the capillary membranes causes different ionic concentrations between the plasma and interstitial fluid, thus the non-permeating negatively charged proteins present mostly in the plasma will draw the electropositive ions (Na^+ , K^+) and force back negative ones. Therefore, a reduction in plasma protein concentration will affect the plasma Na^+ concentration. The correction of hypoNa in patients who were infused with Albumin is thought to be due to its ability to attract the electropositive Na^+ ions into the plasma, thus causing an increase in the plasma Na^+ concentration. Therefore, whether hypoNa is an independent severe feature in PE

or merely an association with hypoalbuminemia needs to be further studied. The neonate was also born with hyponatremia. Her serum sodium concentration was 127 mmol/L, which was addressed and corrected. Neonatal hyponatremia secondary to maternal hyponatremia with PE has been described previously and is an important aspect to be addressed to avoid neonatal complication (12-14). The electrolyte levels in the neonate in the first hours of life reflect those of the mothers and this occurs secondary to placental hemostasis, if this is not addressed it can lead to neonatal convulsions that may lead to cerebral damage if not promptly corrected (15).

Ascites with PE has also been reported several times. The incidence of ascites in patients with HELLP syndrome has been reported to be up to 10% in one study (16). The ascites in PE is thought to be secondary to the diffuse endothelial dysfunction leading to capillary leaks resulting in proteinuria, hypoalbuminemia and decreased oncotic pressure. This plus the renal retention of sodium and water will lead to the expansion of the extracellular fluid and third spacing leading to edema and ascites. Ascites is also a common finding in patients with nephrotic syndrome secondary to the hypoproteinemia (17). Devarbhavi et al found that ascites in pregnancy-specific liver diseases occurred more commonly in those with lower albumin level. Our patient had a very low albumin level (1.7 g/dL) (18). Another mechanism causing ascites may be secondary to liver involvement and the development of a transient portal hypertension that occurs secondary to vasospasm and endothelial cell dysfunction in the liver and kidneys. There is also plugging of the liver sinusoids with platelet, fibrin and red blood cells (18,19). The ascetic fluid in our patient was analyzed and showed a low protein content (2 g/L) indicating a transudate which can occur secondary to liver involvement or hypoalbuminemia. Tarn et al described that the ascetic fluid LDH >400, fluid/serum LDH ratio >0.6, and fluid/serum total protein (TP) >0.5 indicate a non-hepatic cause of ascites (20). The absence of all three criteria indicates a hepatic cause of ascites. In our patient, the LDH level was 9, ascetic fluid/serum LDH was 0.05 and fluid/serum TP was 0.04 which indicate a possible hepatic cause of the ascites.

Conclusions

HypoNa and ascites are infrequent complications of PE. The occurrence of both is even rare. The exact mechanism causing them is unclear. PE-induced nephrotic syndrome with secondary severe hypoalbuminemia +/- transient portal hypertension may have contributed to our case. Further studies are needed to assess the correlation of hyponatremia with the hypoalbuminemia in patients with PE. Measurement of electrolytes and ultrasound assessment of the extra-uterine space for evidence of ascites should be performed in PE patients. Neonatal hyponatremia should be excluded in all maternal cases of hyponatremia.

Conflict of Interests

Authors have no conflict of interests.

Ethical Issues

The study was approved by the Ethics Committee of King Abdulaziz University Code of Ethics: 468-17). Informed consent was taken from the patient.

Financial Support

None.

References

1. Anglim B, Levins K, Bussmann N, Imcha M. Severe hyponatraemia associated with pre-eclampsia. *BMJ Case Rep.* 2016;2016. doi:10.1136/bcr-2016-215036
2. MacKay AP, Berg CJ, Atrash HK. Pregnancy-related mortality from preeclampsia and eclampsia. *Obstet Gynecol.* 2001;97(4):533-538.
3. Goh KP. Management of hyponatremia. *Am Fam Physician.* 2004;69(10):2387-2394.
4. Hinkson L, Armbrust R, Moller A, Henrich W. Case report of severe maternal hyponatremia complicating preeclampsia. *J Matern Fetal Neonatal Med.* 2018;31(14):1948-1949. doi:10.1080/14767058.2017.1332032
5. Razavi AS, Chasen ST, Gyawali R, Kalish RB. Hyponatremia associated with preeclampsia. *J Perinat Med.* 2017;45(4):467-470. doi:10.1515/jpm-2016-0062
6. Wilson HJ, Shutt LE. Syndrome of inappropriate ADH secretion in a woman with preeclampsia. *Int J Obstet Anesth.* 2007;16(4):360-362. doi:10.1016/j.ijoa.2007.02.005
7. Sandhu G, Ramaiyah S, Chan G, Meisels I. Pathophysiology and management of preeclampsia-associated severe hyponatremia. *Am J Kidney Dis.* 2010;55(3):599-603. doi:10.1053/j.ajkd.2009.09.027
8. Hayslett JP, Katz DL, Knudson JM. Dilutional hyponatremia in pre-eclampsia. *Am J Obstet Gynecol.* 1998;179(5):1312-1316.
9. da Cunha DF, Barbosa AA, Manfrin A, Tiveron FS, da Cunha SF. Sodium serum levels in hypoalbuminemic adults at general medical wards. *Rev Hosp Clin Fac Med Sao Paulo.* 1999;54(2):39-42.
10. Dandona P, Fonseca V, Baron DN. Hypoalbuminaemic hyponatraemia: a new syndrome? *Br Med J (Clin Res Ed).* 1985;291(6504):1253-1255.
11. Nguyen MK, Kurtz I. Quantitative interrelationship between Gibbs-Donnan equilibrium, osmolality of body fluid compartments, and plasma water sodium concentration. *J Appl Physiol* (1985). 2006;100(4):1293-1300. doi:10.1152/jappphysiol.01274.2005
12. Burrell C, de Swiet M. Severe hyponatraemia and pre-eclampsia. *BJOG.* 2004;111(9):1020-1022. doi:10.1111/j.1471-0528.2004.00237.x
13. Goodlin R, Mostello D. Maternal hyponatremia and the syndrome of hemolysis, elevated liver enzymes, and low platelet count. *Am J Obstet Gynecol.* 1987;156(4):910-911.
14. Ravid D, Massarwa LE, Biron-Shental T, Fejgin MD. Hyponatremia and preeclampsia. *J Matern Fetal Neonatal Med.* 2005;18(1):77-79. doi:10.1080/14767050500127682
15. Valerio E, Fantinato M, Giovannini IA, Baraldi E,

- Chianchetti L. Severe asymptomatic maternal antepartum hyponatremia leading to neonatal seizures: prevention is better than cure. *Matern Health Neonatol Perinatol.* 2015;1:25. doi:10.1186/s40748-015-0027-0
16. Woods JB, Blake PG, Perry KG Jr, Magann EF, Martin RW, Martin JN Jr. Ascites: a portent of cardiopulmonary complications in the preeclamptic patient with the syndrome of hemolysis, elevated liver enzymes, and low platelets. *Obstet Gynecol.* 1992;80(1):87-91.
 17. Ackerman Z. Ascites in Nephrotic syndrome. Incidence, patients' characteristics, and complications. *J Clin Gastroenterol.* 1996;22(1):31-34.
 18. Devarbhavi H, Rao P, Patil M, Adarsh CK. Characteristics of ascites in patients with pregnancy-specific liver diseases. *Clin Gastroenterol Hepatol.* 2012;10(5):559-562. doi:10.1016/j.cgh.2011.11.029
 19. Calvin S, Silva M, Weinstein L, Finley P, Witte M. Characterization of ascites present at cesarean section. *Am J Perinatol.* 1991;8(2):99-102. doi:10.1055/s-2007-999354
 20. Tarn AC, Lapworth R. Biochemical analysis of ascitic (peritoneal) fluid: what should we measure? *Ann Clin Biochem.* 2010;47(Pt 5):397-407. doi:10.1258/acb.2010.010048

Copyright © 2019 The Author(s); This is an open-access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.