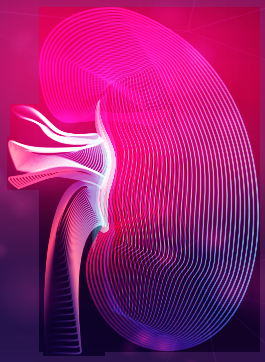

# BÖLÜM 9

# GEBELİKTE ELEKTROLİT BOZUKLUKLARI

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## GEBELİKTE HİPONATREMİ

Gebelikte, hormonal ve santral sinir sistemindeki değişimler, farklılaşmış tuz ve su düzenlenmesine yol açmaktadır. Hiponatremi, gebelik boyunca en sık gözlenen elektrolit bozukluğudur. Normal gebelikte, hastalarda hafif, hipoozmolar hiponatremi gelişebilir. Serum sodyum kayması ile serum sodyum düzeyi, en düşük 130 mEq/L seviyesine kadar, fizyolojik olarak kabul edilebilmektedir. Bu kaymaya ek olarak, serum ozmolalitesinde ortalama 5-10 mOsm/kg'lık bir azalma da görülebilir. Bir çok gebede, serum sodyum düzeyinde, gebelik öncesi değerlerine göre 4-5 mEq/L'lik bir azalma saptanır [1,2]. Bu azalma tipik olarak gebeliğin 8-10. haftaları arasında ortaya çıkar ve tüm gebelik boyunca sürer [2]. Genellikle gebelik sonrasında sodyum seviyesi birkaç gün içerisinde normale dönerken, bazı olgularda düzelmenin görülmesi iki ayı bulabilir. Gebelerde, hiponatreminin patolojik nedenleri genellikle araştırılmaz, ancak altta yatan başka bir hastalıktan şüphelenildiğinde, serum sodyum düzeyi 130 mEq/L'den düşük olduğunda ya da hasta semptomatikse araştırılması gerekmektedir. Gebelerde hiponatremiyi yönetebilmek için, tuz ve su dengesinin normal düzenlenmesini, aynı zamanda gebelik sırasında, önemli hormonal oyuncular olan arjinin vazopressin (AVP) (vazopressin ya da anti-diüretik hormon (ADH)), atriyal natriüretik peptit (ANP), oksitosin, 17-estradiol, progesteron ve relaksinin etkileriyle gelişen, beklenen fizyolojik değişimleri bilmek gereklidir.

### Gebe Olmayan Hastalarda Tuz ve Su Dengesi

Gebe olmayan sağlıklı bir kadında, normal serum ozmolalitesinin sağlanmasında, ANP en önemli düzenleyici hormon olarak karşımıza çıkmaktadır. ANP, hipotalamusun 'vazopressin nöronları' olarak adlandırılan *supraoptik sinir* (SOS) ve *para-*

## KAYNAKLAR


1. Brunton PJ, Arunachalam S, Russel JA. Control of neurohypophysial hormone secretion, blood ozmolality and volume in pregnancy. J Physiol Pharmacol. 2008;59(Suppl 8):27–45.
2. Pazhayattil GS, Rastegar A, Brewster UC. Approach to the diagnosis and treatment of hyponatremia in pregnancy. Am J Kidney Dis. 2015;65(4):623–7. https://doi.org/10.1053/j.ajkd.2014.09.027. Epub 2014 Dec 24.
3. Joo KW, et al. Antiduiuretic action of oxytocin is associated with increased urinary excretion of aquaporin-2. Nephrol Dial Transplant. 2004;19:2480–6. https://doi.org/10.1093/ndt/gfh413. Advance Access publication 27 July 2004.
4. Knight S, Snellen H, Humphreys M, Baylis C. Increased renal phosphodiesterase-5 activity mediates the blunted natriuretic response to ANP in the pregnant rat. Am J Physiol Renal Physiol. 2007;292:F655–9.
5. Harris K, Shankar R, Black K, Rochelson B. Reset ozmostat in pregnancy: a case report. J Matern Fetal Neonatal Med. 2014;27(5):530–3. https://doi.org/10.3109/14767058.2013.819333 Epub 2013 July 23.
6. Mathot M, Maton P, Henrion E, François-Adant A, Marguglio A, Gaillez S, et al. PseudoBartter syndrome in a pregnant mother and her fetüs. Pediatr Nephrol. 2006;21(7):1037–40. Epub 2006 May 30.
7. Irani M, Fisher N, Mor A, Bensinger G. Urinary retention and syndrome of inappropriate antidiuretic hormone secretion (SIADH) secondary to impacted gravid uterus. J Obstet Gynaecol Res. 2016;42(6):734–7. https://doi.org/10.1111/jog.12963. Epub ahead of print.
8. Bodenmann PG, et al. Preeclampsia and electrolyte disturbances in a case report. Nephrol Ther. 2014;10(1):51–7.
9. Sandhu G, Ramaiah S, Chan G, Meisels I. Pathophysiology and management of pre-eclampsiaassociated severe hyponatremia. Am J Kidney Dis. 2010;55(3):599–603.
10. Sutton RA, Schonholzer K, Kassen BO. Transient syndrome of inappropriate antidiuretic hormone secretion during pregnancy. Am J Kidney Dis. 1993;21:444–5.
11. Roberts TJ, Nijland MJM, Williams L, Ross MG. Fetal diuretic responses to maternal hyponatremia; contribution of placental sodium gradient. J Appl Physiol. 1999;87(4):1440–7.
12. Chapman T, Hamilton M. Water intoxication presenting as maternal and neonatal seizures: a case report. J Med Case Rep. 2008;2(1):366.
13. Basu A, Dillon RDS, Taylor R, Davison JM, Marshall SM. Is normalization of serum potassium and magnesium always necessary in Gitelman Syndrome for a successful obstetric outcome? BJOG Int J Obstet Gynecol. 2004;111:630–4.
14. Cheung KL, Lafayette RA. Renal physiology of pregnancy. Adv Chronic Kidney Dis. 2013;20(3):209–14.
15. Gunganah K, Carpenter R, Drake WM. Eplerenone use in primary aldosteronism during pregnancy. Clinical case reports. London: Department of Endocrinology, St. Bartholomew's Hospital. Accepted 25 July 2015.
16. Kellerman E. Renal control of electrolytes and acid-base balance during pregnancy. In: Alvarez RR, editor. Kidney in pregnancy, clinical monographs in obstetrics and gynecology. New York: Wiley; 1976. p. 85–96.
17. Landau E, Amar L. Primary aldosteronism and pregnancy. Ann Endocrinol (Paris). 2016;77(2):148–60.
18. Kosaka KN, Onada T, Ishikawa N, Iwanaga J, Yamamasu, Tahara H, et al. Laparascopic adrenalectomy on a patient with primary aldosteronism during pregnancy. Endocrinol J. 2006;53:461–6.
19. Ada ED, et al. Pregnancy, primary aldosteronism, and adrenal CTNNB1 mutations. NEJM. 2015;373:1429–36.

20. Riester A, Reincke M. Progress in primary aldosteronism review. Mineralocorticoid receptor antagonists and management of primary aldosteronism in pregnancy. Eur J Endocrinol. 2015;172:R23–30. Munich, Germany.
21. Srisuttayasathien M. Hypokalemia induced rhabdomyolysis as a result of distal renal tubular acidosis in a pregnant woman: a case report and literature review. Case Rep Obstet Gynecol. 2015:947617. Department of Obstetrics and Gynecology, Chaophraya Yommaraj Hospital, Thailand. 2015. Hindawi Publishing Corporation.
22. Muthukrishnan J, Harikumar KVS, Ratan J, Kirtikumar M. Pregnancy predisposes to rhabdomyolysis due to hypokalemia. Saudi J Kidney Dis Transpl. 2010;21(6):1127–8. Department of Endocrinology, Medwin Hospital, Hyderabad, India.
23. Kulkarni M, Srividya TV, Gopal N. Hypokalemia paraplegia in pregnancy. J Clin Diagn Res. 2014;8(6):OD03–4.
24. Santra G, Paul R, Das S, Pradhan S. Hyperventilation of pregnancy presenting with flaccid quadriparesis due to hypokalemia secondary to respiratory alkalosis. J Assoc Physicians India. 2014;62(6):536–8.
25. Caretto A, Primerano L, Novara F, Zuffardi O, Genovese S, Rondinelli M. A therapeutic challenge: Liddle's syndrome managed with amiloride during pregnancy. Case Rep Obstet Gynecol. 2014;2014:156250. Hindawi Publishing Corporation.
26. Ribeiro RBF, da Silveira Junior SAD, Silva CCB, Gontijo GR. Gitelman syndrome: from diagnosis to follow-up during pregnancy. Braz J Nephrol. 2015;37(2). Sau Paulo.
27. Iheonunekwu NC, Ibrahim TM, Davies D, Pickering K. Thyrotoxic hypokalemic paralysis in a pregnant Afro-Caribbean woman. A case report and review of the literature. West Indian Med J. 2004;53(1):47–9.
28. Myopathy MKD. Hypokalemia and Pica (geophagia) in pregnancy. Ulster Med J. 2006;75(2):159–60.
29. Dalton LM, Ní Fhloinn DM, Gaydadzhieva GT, Mazurkiewicz OM, Leeson H, Wright CP. Magnesium in pregnancy. Nutr Rev. 2016;74(9):549–57. https://doi.org/10.1093/nutrit/nuw018. Epub 2016 Jul 21. https://www.ncbi.nlm.nih.gov/pubmed/27445320.
30. Beloosesky R, Khatib N, Ginsberg Y, et al. Maternal magnesium sulfate fetal neuroprotective effects to the fetüs: inhibition of neuronal nitric oxide synthase and nuclear factor kappalight-chain-enhancer of activated B cells activation in a rodent model. Am J Obstet Gynecol. 2016;215(3):382.e1–6. https://doi.org/10.1016/j.ajog.2016.03.032. Epub 2016 Mar 24. https://www.ncbi.nlm.nih.gov/pubmed/27018467.
31. Crowther CA, Hiller JE, Doyle LW, Haslam RR, Australasian Collaborative Trial of Magnesium Sulfate Collaborative Group. Effect of magnesium sulfate given for neuroprotection before preterm birth: a randomized control trial. JAMA. 2003;290:2669–76.
32. Marret S, Marpeau L, Zupan-Simunek V, PREMAG Trial Group, et al. Magnesium sulfate given before very preterm birth to protect infant brain: the randomized controlled PREMAG trial. BJOG. 2007;114:310–8.
33. Rouse DJ, Hirtz DG, Thorn E, et al. A randomized controlled trial of magnesium sulfate for the prevention of cerebral palsy. NEJM. 2009;359:895–905.
34. Abad C, Vargas FR, Zoltan T, Proverbio T, Piñero S, Proverbio F, Marín R. Magnesium sulfate affords protection against oxidative damage during severe preeclampsia. Placenta. 2015;36(2):179–85. https://doi.org/10.1016/j.placenta.2014.11.008. Epub 2014 Nov 25. https://www.ncbi.nlm.nih.gov/pubmed/25486968.
35. Jafrin W, Mia AR, Chakraborty PK, Hoque MR, Paul UK, Shaha KR, Akhter S, Roy AS. An evaluation of serum magnesium status in pre-eclampsia compared to the normal pregnancy. Mymensingh Med J. 2014;23(4):649–53. https://www.ncbi.nlm.nih.gov/pubmed/25481580.
36. de Sousa Rocha V, Della Rosa FB, Ruano R, Zugaib M, Colli C. Association between magnesium status, oxidative stress and inflammation in preeclampsia: a case-control study. Clin Nutr.

2015;34(6):1166–71. https://doi.org/10.1016/j.clnu.2014.12.001. Epub 2014 Dec 5. https://www.ncbi.nlm.nih.gov/pubmed/25559945.

37. Udenze IC, Arikawe AP, Azinge EC, Okusanya BO, Ebuehi OA. Calcium and magnesium metabolism in pre-eclampsia. West Afr J Med. 2014;33(3):178–82. https://www.ncbi.nlm.nih.gov/pubmed/26070821.
38. Touyz RM. Role of magnesium in the pathogenesis of hypertension. Mol Asp Med. 2003;24:107–36.
39. Spinnato JA, Livingston JC. Prevention of preeclampsia with antioxidants: evidence from randomized trials. Clin Obstet Gynecol. 2005;48:416–29.
40. Chen Q, Zhao M, Guo F, Yin YX, Xiao JP, Stone PR, Chamley LW. The reduction of circulating levels of IL-6 in pregnant women with preeclampsia by magnesium sulfate and nifedipine: in vitro evidence for potential mechanisms. Placenta. 2015;36(6):661–6. https://doi.org/10.1016/j.placenta.2015.03.009. Epub 2015 Apr 9.
41. Das M, Chaudhuri PR, Mondal BC, Mitra S, Bandyopadhyay D, Pramanik S. Assessment of serum magnesium levels and its outcome in neonates of eclamptic mothers treated with low-dose magnesium sulfate regimen. Indian J Pharmacol. 2015;47(5):502–8. https://doi.org/10.4103/0253-7613.165183. https://www.ncbi.nlm.nih.gov/pubmed/26600638.