

# Osmotic Demyelination Syndrome in A Normonatremic Patient with Chronic Kidney Disease

## Kronik Böbrek Yetmezliğine Bağlı Osmotik Demiyelinizasyon Sendromlu Normonatremik Bir Olgu

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### Keywords

Osmotic demyelination syndrome,  
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### Abstract

Osmotic demyelination syndrome (ODS), also known as central pontine myelinolysis, is a neurological disorder characterised by myelin loss in the central pons and other parts of the brain, such as the basal ganglia, lateral geniculate bodies, external and internal capsules and cerebellum. ODS is a demyelinating disorder associated with rapid correction of hyponatraemia. Classically, this is associated with hyponatraemia, but it can also occur in the presence of normonatremia. Changes in osmolality are found to be responsible in the pathogenesis of the lesions. Rarely, pontine myelinolysis with delirium was also described in normonatremic patients. We report the clinical and radiological findings of a normonatremic 45-year-old female patient with chronic kidney disease, who experienced central pontine myelinolysis. This report aims to show that pontine myelinolysis may also occur in normonatremic circumstances, and early, rapid management of the disorder is important to prevent permanent damage.

### Öz

Santral pontin miyelinolizis olarak da bilinen osmotik demiyelinizasyon sendromu (ODS) pons ve beynin basal gangliyon, lateral genikulat cisimler, eksternal ve internal kapsül ve cerebellumda miyelin kaybı ile giden nörolojik bir hastalıktır. ODS hiponatreminin hızlı düzeltilmesi ile birlikte gelişen bir demiyelinizasyon hastalığıdır. Klasik olarak hiponatremi ile ilişkilendirilse de, normonatremi varlığında da görülebilir. Lezyonların patogeneziinde ozmolaritedeki değişiklikler sorumlu tutulmuştur. Hastalarda normal sodyum seviyelerinde deliryum kliniği ile birlikte pontin miyelinolizis nadiren de olsa tanımlanmıştır. Deliryum kliniği ile acil servise başvuran, kronik böbrek yetmezliği ile birlikte normonatremik santral pontin miyelinolizi, 45 yaşındaki kadın hastanın klinik ve radyolojik bulgularını sunduk. Olgunun sunulmasındaki amaç, hasta normonatremik bile olsa pontin miyelinolizis gelişebileceğine dikkat çekerek; kalıcı hasar gelişmeden erken tedavi başlanmasıın sekelli iyileşmeyi engelleyeceğini vurgulamaktı.

## Introduction

Osmotic demyelination syndrome (ODS) was first defined and described in 1959 (1). Central pontine myelinolysis is a neurological disease characterized with demyelination within the pons, demyelination also occurs in extrapontine regions, including the thalamus, subthalamic nucleus, amygdaloid nucleus, corpus geniculatum laterale and cerebellum. Rapid correction of hyponatremia is an important risk factor for the development of ODS. On the other hand, ODS has also been reported in normonatremic and hypernatremic patients, especially in association with conditions like chronic alcoholism, liver transplantation, diabetes mellitus, hypokalaemia, hepatocellular dysfunction, lithium toxicity, chemotherapy and chronic renal failure (2-4).

The mechanism that causes ODS is not absolutely known but some logical reasons are to be thought. One of them is the penetration of complement and other cytotoxic plasma components through to blood-brain barrier due to osmotic changes. These consequent events induce astrocyte apoptosis and eventually disrupts the structure of oligodendrocytes, myelin and afterwards microglia activation occurs according to the release of inflammatory cytokines. Hyponatremia causes intracellular volume changes so that intracellular soluble matters redistribute and adapt to osmotic changes; thus, body is protected but intracellular organic osmotic particles reduces and in five days stores of these particles are rebuilt. Serum osmolality increases again and brain faces osmotic dehydration risk (5). In classic ODS hypertonic fluid that causes edema is located at the extracellular space until the endothelial integrity is ensured. This fluid shows its toxic effects on myelin and oligodendrocytes. During the hemodialysis plasma becomes more hyponatraemic than brain cells, this rapid shift causes brain edema in extracellular space. In ODS pathologic mechanism, there is a rapid change in the amounts of plasma soluble. The only thing that effects the serum osmolality is not the sodium; blood urea nitrogen (BUN) and glucose also differs before and after the hemodialysis and this changes the serum osmolality. As known, three components that determines osmotic gradient are BUN, glucose and sodium. The changes in the level of these, provokes brain edema (6). We reported a rare clinic

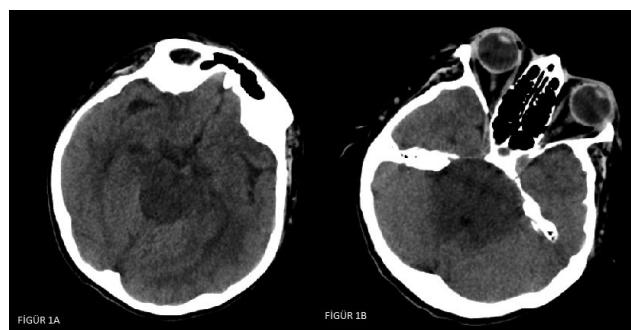
and radiologic case which is seen in a normonatremic patient who has ODS due to chronic renal disorder to evaluate the physiopathologic mechanisms that underlie.

## Case Report

Forty-five years old woman consulted to emergency service having unreasonable speaking and impairment of consciousness. The patient was having dialysis because of kidney failure for two years. The complaints started two days ago and progressed. Delirium and hallucinations were observed in examination. Beside the enhanced bilateral deep tendon reflexion, the plantar reflex bilaterally was extensor determined in neurologic examination. The clinical follow-up is presented below with the patients informed consent.

In routine bio-chemical tests, urea was 57 mg/dL, creatinine was 5.89 mg/dL. Sodium level was 137 mEq/L and the other electrolyte levels, sedimentation, C-reactive protein and biochemistry parameter were regular. Vitamin B12 was 929 pg/mL and folic acid was 6.67 ng/mL. Cerebrospinal fluid and electroencephalography examination was regular.

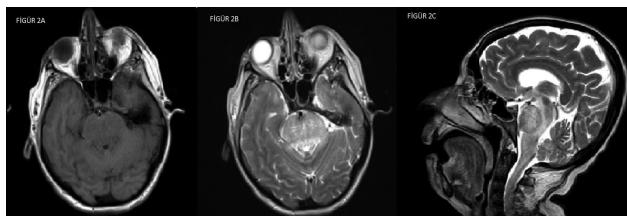
In cranial computed tomography examination hypodensity was determined in a part of pons and mesencephalon (Figure 1). In view of cranial magnetic resonance (MR), volumetric dilatation was evidently taking attention in the level of pons and parenchymal intensity alteration having dimensions of 37x33x45mm was seen bilaterally extending to cerebral pedicle, including a part of the pons and mesencephalon and slightly compressing IV. ventricle in T2A sequences in high signal intensity (Figure 2, 3). The diffusion



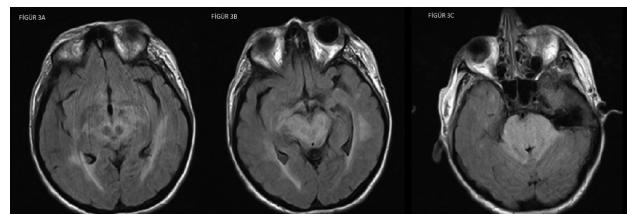
**Figure 1.** Patients computed tomography imaging demonstrating density reduction in the pons and cerebral pedicles accompanied by pressure on the 4<sup>th</sup> ventricle are observed

weighted MR images of the patient show observed diffusion restriction in the areas of demyelination (Figure 4).

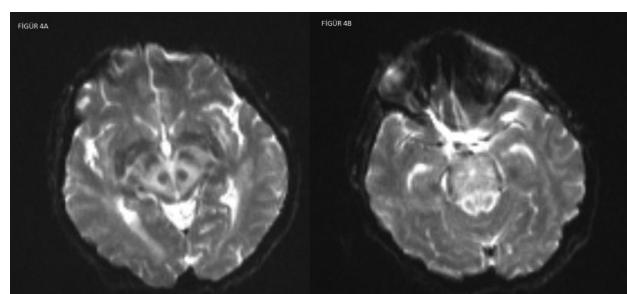
In clinical follow-up after reaching the conscious status, the neurologic symptoms were getting worse so that the patient was taken to the intensive care unit. Dialysis therapy was continued and decreasing levels in urea (51 mg/dL) and creatine (4.33 mg/dL) were observed. After the second week of hospitalization, recovery began in neurologic examination and the patient was extubated without any loss in consciousness or motor capability. After two months, there was no any anomaly in neurologic examination except from the increase in bilateral deep tendon reflexes.



**Figure 2.** Sequences of magnetic resonance imaging: Axial T1 (a), Axial T2 (b) and Sagittal T2 (c) demonstrating diffusion enlargement in the pons and mesencephalon without significant mass formation. In T1-weighted sequences; cerebral pedicles, mesencephalon, and pons are hypointense, and in T2-weighted sequences, there is a signal increase



**Figure 3.** Axial fluid-attenuated inversion recovery sequences demonstrating corticospinal tracts and transverse pontine fibers in the demyelination areas



**Figure 4.** Diffusion-weighted images demonstrating diffusion restriction of mesencephalon and pons

## Discussion

The mechanism that causes ODS is not certainly known and there is no specific therapy. Supporting therapy and therapy for inhibiting complications should be considered. One third of the patients who developed ODS and survived, heals without any sequel, one third is harmed but lives an independent life and one third has a permanent damage.

When the diagnosis is determined, therapy is most likely supportive. Reports on small case series or single case reports of treatments including steroids, intravenous immunoglobulin, and thyrotropin releasing hormone, have all shown good outcomes but are difficult to interpret for the above reason. These therapy methods are not proposed to ODS patients because there are no tests done on human (7).

In the study of Abbott et al. (8), where they examined 34 ODS patients, death percentage was 6%, fully cured patients' rate was 30%, the rate of the harmed patient but living without any help was 32%, dependent living patient rate was 32%. In the literature review of Martin (7), ODS death rate was found to be 40-50%, hospitalization in intensive care units was 10-20%. In the literature death rate differs within a wide range from 6% to 90%. Menger and Jörg (9) reported that 40% of patients are recovering without any neurologic sequel.

Bacillus, perforant artery infarcts, demyelination diseases, pontin gliomas and hypertensive encephalopathies take place in radiologic differential diagnosis. Massless density reduction mainly in pons and also in thalamus and basal ganglia is defined in computed tomography for ODS (10). MR is a more sensitive neuro imaging method in diagnosis. In MR imaging, hypointense signal changes in T1-weighted images and hyperintense signal changes in T2-weighted images are observed at the areas of demyelination (11,12). Diffusion limitation is defined in the myelinolysis areas at the beginning of the symptoms, but in some studies, it is defined that diffusion findings shows late onset till 24-hours after the clinical symptoms (13). Typically, lesions do not show any contrasting (14,15). In this reported case, neuroradiologic images are found compatible with ODS. Massless diffuse expansion in T2 weighted images and signal enhancement on flair images are

observed at pons and mesencephalon as MR findings. In diffusion-weighted images, diffusion limitation was identified at mesencephalon and pons where corticospinal tracts and transverse pontine fibers are protected. The protection of ventrolateral pons and corticospinal tracts are diagnostic in ODS where as in this case (14-16).

Although the rapid correction of hyponatremia is an important risk factor, the phenomenon can also be seen in normonatremic chronic kidney failure (1). In this case findings came out in the presence of normonatremic chronic kidney failure. Pontine myelinolysis is a rare disease and it must be especially considered in chronic kidney failure patients who have unconsciousness when they are hospitalised in emergency. The most important point is the rapid diagnosis of this disease and initializing rapid supportive therapy so it can be defeated without any sequels.

#### Ethics

**Informed Consent:** An informed consent was obtained from all patients.

**Peer-review:** Externally peer-reviewed.

#### Authorship Contributions

Surgical and Medical Practices: F.E.U., Ö.O., Concept: Ö.O., H.I.Ö.K., B.K., Design: Ö.O., H.I.Ö.K., B.K., Data Collection or Processing: F.E.U., Ö.O., Analysis or Interpretation: Ö.O., H.I.Ö.K., B.K., Literature Search: Ö.O., H.I.Ö.K., B.K., Writing: Ö.O., B.K.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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