Successful single-pass albumin dialysis in the management of severe calcium channel blocker poisoning

Ağır seyirli kalsiyum kanal blokeri zehirlenmesi tedavisinde başarılı tek geçiş albümin diyalizi

Cite this article as: Yeşilbaş O, Ramoğlu MG, Kahraman Çayan Ö, Cem E, Seven P. Successful single-pass albumin dialysis in the management of severe calcium channel blocker poisoning. Turk Pediatri Ars 2020; 55(1): 82–4.

Dear Editor,

Cardiac conduction disturbances, severe hypotension, cardiogenic shock, and pleural effusion, which lead to high disability and mortality rates, may occur as a result of calcium channel blocker (CCB) poisoning (1–3). In cases of toxicity with these drugs, which do not have specific antidotes, gastric lavage and active charcoal, and treatment with fluid load, high-dose calcium, insulin-glucose, glucagon, lipid emulsion and vasopressor-inotropic drugs may be used, if needed. Clearance of these drugs, which have a high degree of plasma protein binding, is not possible with classic hemodialysis (1, 2). In this article, we describe successful single-pass albumin dialysis (SPAD) in a pediatric patient who presented with severe verapamil intoxication that was unresponsive to classic treatments.

A 15-year old female patient was hospitalized in our Pediatric Intensive Care Unit eight hours after ingesting eight tablets of verapamil (each tablet containing 240 mg), which belonged to her grandmother with the aim of suicide. A prolonged QTc interval (510 ms) was found on electrocardiographic examination in the patient who was bradycardic (58/min), hypotensive (75/41 mm Hg), and somnolent [Glasgow Coma Score (GCS): 11], and whose capillary refill time was found to be prolonged (4 s) and oxygen saturation at room temperature was 96%. Her serum calcium level was found as 6.9 mg/dL (serum albumin level was normal) and her ionized calcium level was 0.82 mmol/L. Blood gases revealed lactic acidosis (pH: 7.26/pCO_2: 32 mm Hg/hCO_3: 18 mmol/L/lactate: 4.2 mmol/L). After fluid load was performed (1500 mL of 0.9% sodium chloride), intravenous adrenaline infusion (0.1 mcg/kg/min), high-dose calcium (15 mL calcium gluconate every 4 hours), fluid with electrolytes containing glucose with a rate of 8 mg/kg/min, crystallized insulin (0.1 u/kg/h) and lipid infusion (2 g/kg/day) were initiated. The rate of insulin infusion was adjusted according to blood glucose values and the rate of adrenaline infusion was adjusted dynamically according to arterial blood pressure measurements. Dobutamine was added to treatment after the blood pressure was normalized (10 mcg/kg/min). Under inotropic treatment, her echocardiographic examination was found to be normal. Subsequently, the patient developed hypotension and the rate of adrenaline infusion was increased up to 0.3 mcg/kg/min. However, hypotension continued and therefore, a noradrenaline infusion was added to the treatment. The rate of infusion was increased up to 0.3 mcg/kg/min to pro-

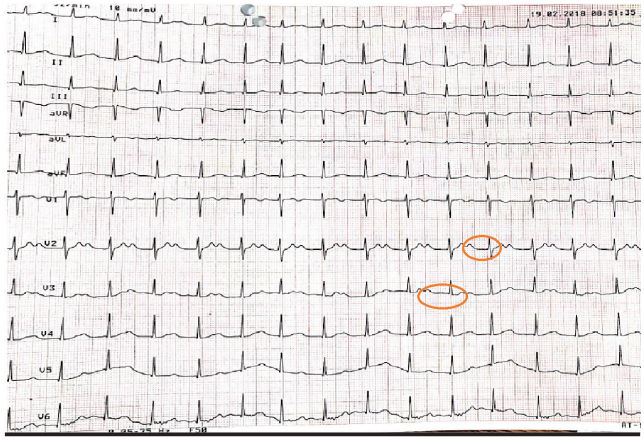

Figure 1. The patient's electrocardiogram compatible with first-degree atrioventricular block before single-pass albumin dialysis (red markers indicate prolonged P-R interval)

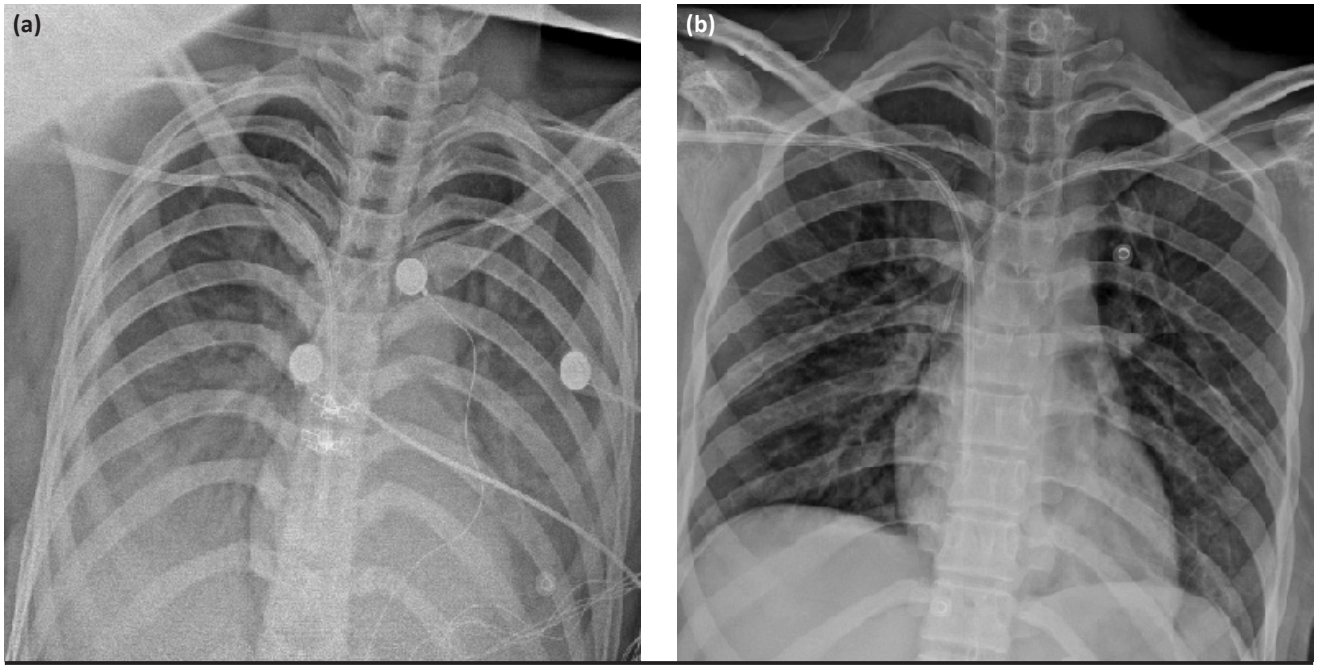

Figure 2. (a) Lung radiography showing closed costophrenic sinuses and pleural effusion. (b) Lung radiography following bilateral chest tube placement

vide normal blood pressure. Intramuscular glucagon (0.5 mg) was administered twice. Despite all supportive treatments, the need for inotropic-vasopressor medications did not decrease, GCS did not increase and first-degree atrioventricular (AV) block developed (Fig. 1). In the 16th hour of hospitalization, it was decided to perform SPAD. Intravenous access was provided using a 12 Fr dialysis catheter in the right subclavian vein. Sixty grams of 20% albumin was added to each 5-L dialysis bag, and a dialysate solution containing 1.13% albumin was obtained. The procedure was initiated with continuous veno-venous hemodialysis (CVVHD), and the dialysis rate was adjusted to 4000 mL/1.73 m^2/h in the first two hours. The blood flow rate was adjusted to 150 mL/min. An ABYLE HFT 14 (Bellco®, Mirondola, Italy) dialysis filter was used during the procedure. Intravenous heparin infusion (10 u/kg/h following 50 u/kg loading) was initiated for anticoagulation. After two hours of SPAD, the rate of adrenaline and noradrenaline infusion could be reduced up to 0.2 mcg/kg/min. Subsequently, the dialysis rate was reduced to 2000 mL/1.73 m^2/h and adrenaline and noradrenaline infusions could be discontinued after eight hours. The ten-hour SPAD treatment was terminated, because the patient's blood pressure was normal, GCS increased to 15, the lactate levels decreased to normal values, and the AV block disappeared. In the 30th hour of hospitalization, her respiratory distress increased and her lung radiography and thoracal ultrasonography were compatible with bilateral pleural effusion (Fig. 2). Chest tubes were inserted bilaterally and the pleural fluid sample was compatible with exuda. No growth occurred in blood and pleural fluid cultures. The patient's respiratory distress regressed and her chest tubes were removed on the fifth day of hospitalization. She was transferred to the pediatric ward on the seventh day of hospitalization. She was discharged with cure on the eighth day of hospitalization.

Use of a molecular adsorbent recirculating system (MARS) and therapeutic plasma exchange (TPE) in CCB intoxications has been reported in the literature (1, 2, 4). Successful single-pass albumin dialysis, which can also clear protein-bound toxins in addition to classic hemodialysis, can be performed in classic hemodialysis devices using dialysates prepared with albumin. Therefore, it appears that SPAD will be able to find a wider area of use compared with complex and high-cost systems including MARS. In addition, it also has the advantage of clearing toxins continuously, because it can be applied with the CVVHD mode in contrast to TPE (5). In the application of single-pass albumin dialysis, free toxins, which tend to bind to protein at the side of blood, are transferred to the side of the dialysate with the mechanism of diffusion and proceed towards the part of waste by binding to the albumin inside the dialysate, when the dialysate containing albumin is confronted with blood. As free toxins at the side of blood are cleaned, protein-bound toxins gradually become free and are transferred to the side of dialysate with diffusion, and the process proceeds in this way (6).

In conclusion, SPAD should be kept in mind in severe poisoning with drugs that have a high degree of plasma protein binding, including CCBs, when response to standard treatments cannot be obtained.

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Peer-review: Externally peer-reviewed.

Author Contributions: Concept - O.Y., M.G.R.; Design - O.Y., Ö.K.Ç.; Supervision - O.Y.; Funding - O.Y., E.C.; Materials - Ö.K.Ç., E.C., P.S.; Data Collection and/or Processing - O.Y., M.G.R., P.S.; Analysis and/or Interpretation - O.Y., M.G.R.; Literature Review- Ö.K.Ç., E.C., P.S.; Writer - O.Y.; Critical Review – O.Y., M.G.R.

Conflict of Interest: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

Hakem Değerlendirmesi: Dış bağımsız.

Yazar Katkıları: Fikir - O.Y., M.G.R.; Tasarım - O.Y., Ö.K.Ç.; Denetleme - O.Y.; Kaynaklar - O.Y., E.C.; Malzemeler - Ö.K.Ç., E.C., P.S.; Veri Toplanması ve/veya İşlenmesi - O.Y., M.G.R., P.S.; Analiz ve/veya Yorum - O.Y., M.G.R.; Dizin Taraması - Ö.K.Ç., E.C., P.S.; Yazıyı Yazan - O.Y.; Eleştirel İnceleme - O.Y., M.G.R.

Çıkar Çatışması: Yazarlar çıkar çatışması bildirmemişlerdir.

Mali Destek: Yazarlar bu çalışma için finansal destek almadıklarını beyan etmişlerdir.

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Received / Geliş Tarihi: 16.06.2019
Accepted / Kabul Tarihi: 26.08.2019

DOI: 10.14744/TurkPediatriArs.2019.27880