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Charcoal Hemoperfusion in Calcium Channel Antagonist Poisoning

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In cases with calcium channel blockers (CCB) poisoning, apart from fluid and vasopressor treatment support, medical treatments such as calcium infusion, glucagon, hyperinsulinemic euglycemia therapy, and lipid emulsion therapy can be used. However, it is known that extracorporeal treatments such as therapeutic plasma exchange (TPE), continuous venous-venous hemodiafiltration (CVVHDF), and charcoal hemoperfusion (CHP) can be performed.[1,2] We hereby present 2 successful CHP treatments in 2 patients with high-dose CCB suicidal poisoning.

A 17-year-old girl was admitted to the emergency department (ED) of our hospital with the complaint of taking 50 tablets containing 240 mg verapamil-HCl and 4 mg trandolapril for suicidal purposes. In ED, where the patient arrived 2 hours after drug intake, an isotonic fluid bolus, calcium gluconate, and lipid infusion was administered after gastric lavage and activated charcoal administration, and then she was transferred to our pediatric intensive care unit (PICU). After lipid infusion, calcium gluconate infusion and glucagon, respectively, adrenaline and noradrenaline infusions were started in PICU. Upon detection of complete atrioventricular (AV) block on electrocardiographic examination, a single dose of atropine was administered, but no response was obtained because the patient had a pacemaker implant. Although adrenaline and noradrenaline infusions were increased to the highest dose, a stress dose of hydrocortisone loading was initiated in the patient whose hypotension did not improve. Charcoal hemoperfusion (Adsorba 150 C, Hemoperfusion cartridge, Gambro) was applied to the patient, who was still hypotensive and a significantly marked improvement was obtained. In the 4th hour of the procedure, the heartbeat of the patient increased above 80 bpm, the AV block disappeared, and the pacemaker was turned off. Due to the normotensive course of the patient whose blood gas parameters gradually improved after hemoperfusion and the need for inotropes decreased, all inotropes were terminated at the 36th hour of hospitalization. The patient's follow-up vasoactive inotrope score is shown in Figure 1.

A 16-year-old girl was admitted to the ED of the external center with the complaint of taking 3 tablets containing 10 mg dapagliflozin and 30 tablets containing 10 mg amlodipine and 5 mg perindopril arginine for suicidal purposes. She was admitted to our PICU because of her hypotensive course during the follow-up of the patient, who underwent gastric lavage and activated charcoal administration in the ED 5 hours after drug intake. The patient was administered with lipid infusion, insulin infusion, calcium gluconate infusion, and glucagon. Despite these treatments and even after the inotropic doses (adrenaline and noradrenaline) were increased to the highest levels, the patient's hypotension continued, and therefore, a stress dose of hydrocortisone infusion therapy was started. Due to her continuing hypotensive course, CHP (Adsorba 150 C, Hemoperfusion cartridge, Gambro) was performed at the 24th hour of her hospitalization and a significantly marked improvement was obtained. The patient, who was noticed to be tachypneic on the fourth day of his hospitalization, whose chest radiography was found to be compatible with bilateral pulmonary edema and whose kidney function tests were found to be increased, was connected to a noninvasive mechanical ventilator bilevel positive airway (BIPAP), and underwent CVVHDF. Dialysis was stopped on the fifth day, she left BIPAP

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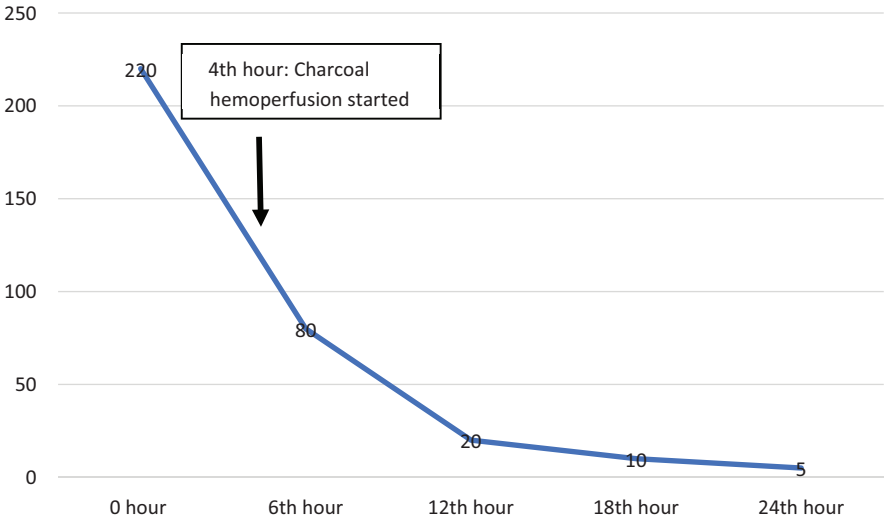

Figure 1. Vasoactive inotrope score follow-up.

on the sixth day, and inotropic treatments were reduced and she was transferred to the pediatric service on the 10th day of her hospitalization. Blood values of the patients at the time of hospitalization to the PICU and the vital sign follow-ups of the cases before, during, and after hemoperfusion are shown in Table 1.

Charcoal hemoperfusion is an effective and reliable adsorption method that can be applied in many situations, including severe drug poisoning. The CHP set, which we used in both cases, contains a polypropylene cartridge with a cellulose-coated membrane with a total surface area of 150 000 m^2. In this method, the patient's blood is continuously perfused from a

Table 1. The Vital and Laboratory Parameters of the Cases at PICU Administration and During Charcoal Hemoperfusion Procedure (The 1st, 3rd, and 6th Hour of the Procedure and 6 Hours After the Procedure)

			Case 1	**Case 2**		
PICU administration	Vital findings	TA (mmHg)	75/30 (44)	48/22 (35)		
		HR (bpm)	48	96		
		RR (min)	18	26		
		BT (°C)	36	36		
		SpO_2 (%)	97	95		
	Blood gas parameters	pH	7.15	7.21		
		pCO_2 (mm Hg)	28	47		
		BE (mmol/L)	-17.8	−8.6		
		HCO_3 (mmol/L)	11	17.2		
		Lactate (mmol/L)	13.2	2.5		
	Blood parameters	WBC (x10^3/µL)	21750	33320		
		Cr (mg/dL)	2.23	1.61		
		INR	1.9	1.32		
	ECHO findings	EF (%)	30	70		
			Charcoal hemoperfusion			
Case 1		**1st hour**	**3rd hour**	**6th hour**	**12th hour**	
	HR (bpm)	87	97	109	93	
	TA (mmHg)	89/28	112/49	115/54	116/63	
	RR	34	33	27	26	
	SpO_2 (%)	98	96	89	93	
	BG (mg/dL)	75	206	175	88	
Case 2	HR (bpm)	134	134	134	148	
	TA (mmHg)	92/46	103/48	103/60	114/53	
	RR	36	38	28	37	
	SpO_2 (%)	100	97	98	100	
	BG (mg/dL)	81	80	64	118	

TA, tension arterial; HR, heart rate; RR, respiratory rate; BT, body temperature; SpO_2, peripheric oxygen saturation; BE, base excess; WBC, white blood cell; Cr, creatinine; INR, international normalized ratio; EF, ejection fraction; BG, blood glucose; PICU, pediatric intensive care unit.

small cartridge containing charcoal granules.[3] It is known that CHP has been used in pediatric patients since the 1980s.[4] We thought that the fixed-dose combination product (verapamil /trandolapril) exposed in the first patient may have increased the toxicity compared to the use of a single CCB or angiotensin converting enzyme inhibitor. On the other hand, trandolapril may also have impaired the response to the antidotal treatment that we applied for CCB poisoning. Although hemodialysis is an effective treatment option for trandolapril, we did not consider it due to the lack of fluid overload findings in our patient.[5] In fact, it has been stated that hemoperfusion is more effective than hemodialysis in verapamil intoxication.[6] In addition, hemoperfusion continues to be an alternative treatment option, especially for drugs with low volume distribution and high protein binding.[7] Ezidiegwu et al[8] stated that they benefited more from TPE than CHP in a case with massive amlodipine intoxication. Our first choice was CHP for the second patient because of our experience with the first patient. The limitation of this case report is that drug levels could not be determined in both patients. Since we could not monitor serum drug levels in both patients, we do not have any evidence regarding the level of drug elimination of CHP in acute CCB poisoning. The toxic dose for verapamil is between 800 mg and 24 g, while the toxic dose of trandolapril has only been demonstrated in animal studies.[9,10] There is no specified toxic dose for perindopril, and besides, there are very few case reports of its intoxication.

Clinical symptoms may vary in CCB intoxications. This variability generally depends on the exposure dose, the type and dose of other concomitant medications, the underlying clinical condition, the time of admission of the patient, and therefore the time of first intervention. Charcoal hemoperfusion should be considered either alone or in combination with other extracorporeal therapies as a rescue therapy in selected patients with shock refractory to all other standard measures.

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