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Simultaneous application of intravenous fat emulsion and charcoal hemoperfusion in quetiapine overdose case

Case Report

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Abstract: The simultaneous application of intravenous fat emulsion and charcoal hemoperfusion in the case of severe quetiapine poisoning is described. The initial blood concentration of quetiapine was 5.9 μg/mL and rapid deterioration in the patient status was observed. When a lipid emulsion was infused a fast blood pressure recovery occurred which allows to perform extracorporeal clearance using charcoal hemoperfusion. At the end of the procedure the quetiapine concentration was decreased down to 1.5 μg//mL and fast recovery of the patient was observed.

Keywords: *Quetiapine overdose • Intravenous fat emulsion • Charcoal hemoperfusion*

1. Introduction

The possibility of intravenous fat emulsion (IFE) to diminish the effect of lypophilic compound acting on the CNS was reported for the first time in 1962 by Russel et. al. in the experimental study on rats treated with phenobarbital [1]. The application of fat emulsion in clinical practice was introduced by Weinberg and co-authors describing the effect of fat emulsion on local anesthetics effects and toxicity [2-4].

There are two theories about the mechanism of action of IFE in case of local anesthetics – 'lipid sink' theory and 'lipid flux' theory [5]. The lipid sink theory is more acceptable to describe the effect of IFE in cases of lipophilic drugs, since it could be explained as a kind of extraction of the drug from the blood and tissues expanding the lipid compartment [2,5].

However, the intravenous application of fat emulsion in the case of life-treating poisoning with lipophilic drugs is a promising alternative in clinical toxicology. There is a number of recent studies showing rapid recovery of the patient suffering from hemodynamic disturbances in cases of calcium antagonist and beta-blocker poisonings [6-9]. The usage of IFE is also indicated for treatment of psychoactive drugs overdose where fast improvement of the consciousness is required [10-12]. These types of lipophilic drugs, which are also highly bound to the plasma proteins, are not suitable for extracorporeal clearance. Therefore, the lipid extraction *in situ* is a good alternative to improve the vital signs of the patient and to decrease the toxic effects of the poison. We would like to share our experience with a quetiapine overdose treated simultaneously with application of intravenous fat emulsion and charcoal hemoperfusion,.

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Quetipaine fumarate is a dibenzothiazepine drug, considered as antipsychotic drug because of its minimal extrapyramial side effects, absence of tardive dyskinesia and minimal elevation of serum prolactin levels. A challenge at severe quetipine-overdose poisoning is the treating of hemodynamic disturbances (hypotension) as the therapy with β-adrenergic agonists should not be applied (paradoxal effect could be observed in the setting of α-adrenergic blockage by the quetiapine) [13].

2. Case report

A 34-year-old male was admitted to the emergency unit of Military Medical Academy by ambulance service. The man was found in the bed in a state of unconsciousness by his mother. He was on therapy with quetiapine and biperiden for schizophrenia and depression. On admission he was in sopor (GCS 11), pupils were normal and reacted on light, blood pressure 120/80 mm Hg, heart rate 82 b/min, pale skin and dry mucosa. The toxicological analysis (GC-MS screening) of urine and stomach content (nasogastric tube) found quetiapine and caffeine, and quetiapine blood concentration at admission was 5.9 μg/mL (HPLC), corresponding to comatose-lethal range. All other laboratory data were within normal limits (biochemical parameters, blood count, coagulation tests and blood gases). In the emergency department a series of seizures and apneic pauses were observed, blood pressure was 110/60 mm Hg, heart-rate 130 b/min, the consciousness was estimated of GCS 7. The patient was admitted to ICU and put on mechanical ventilation. Two hours later the blood pressure dropped to 75/40 mm Hg. However, quetiapine possess alpha-blocking activity and treatment with epinephrine and dopamine is contraindicated (risk of paradoxal reaction). Then Intralipid (Fresenius – Kabi) was applied (100 mL for 30 min, followed by 100 mL per hour, total volume of 500 mL). In 10-15 min a spontaneous increase of blood pressure to 120/80 mm Hg (HR 88 b/min) was registered and a positive change in the consciousness of the patient was noticed. Next a charcoal hemoperfusion was performed (Adsorba 300C, Gambro; 5h) to accelerate the excretion and to prevent re-entry of the drug from the lipid-depot in the blood. On the 3rd hour, after the beginning of the procedure, 0.5 mg atropine was used (*s.c.*) to stimulate the hemodynamic. The concentrations of quetiapine and serum triglycerides are shown in Table 1. The patient was discharged from the hospital on the 5th day after admission.

3. Discussion

Quetiapine is an atypical antipsychotic drug which is widely used in Bulgaria and a high rate of suicide attempts (overdoses) with this drug are registered. The lipophilicity of the drug and its affinity to plasma proteins (*ca*. 83% protein binding) determine this drug as not suitable for extracorporeal clearance using hemodialysis. On the other hand, the increasing number of data about application of intravenous fat emulsion infusion gives promising results for such type treatment of drugs overdose.

In the present case the patient with acute quetiapine intoxication rapidly deteriorated consciousness, breathe rate and blood pressure. The alpha-blockage effect excludes application of catecholamines to increase and stabilize the blood pressure. The usage of Intralipid emulsion followed by charcoal hemoperfusion results in fast recovery of the hemodynamic parameters and the consciousness. Our hypothesis was that the fat emulsion will extract the drug itself, but we need to eliminate the drug as lipid-drug complex from the blood and the body, respectively. In our opinion it is an important step to prevent the re-absorption of the drug from its blood lipophilic complex. At the same time the adsorption on charcoal reduced the serum triglycerides and the risk of secondary lipemia (as a side effect of intravenous fat emulsion infusion). As it can be seen from the results in Table 1, the combination of IFE application and performing an extracorporeal clearance – charcoal hemoperfusion reduced significantly the plasma concentration of quetiapine. It should be mentioned that the serum triglycerides were even lower than the initial value.

Table 1. Quetiapine plasma concentration (total and lipid-bound) and serum triglycerides level.

Parameter / Time	Before IFE and hemoperfusion	After IFE and hemoperfusion (6h later)	3rd day (discharged)
Plasma quetiapine (total), μg/mL	5.9	1.5	0.6
Plasma lipid-bound quetiapine, μg/mL	not analysed	0.9	0.4
Serum triglycerides, mmol/L	3.89	1.90	1.47

In conclusion, the intravenous application of fat emulsion leads to rapid improvement of hemodynamic and consciousness in quetiapine overdose. In our opinion, the simultaneous performing of charcoal hemoperfusion with IFE infusion increases the clearance of the lipophilic drug from the organism, preventing the secondary re-adsorption of the drug into the body and accelerates the patient recovery.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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