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Case Report

Hyperkalemia in an intravenous catheter direct thrombolysis patient: a case report

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Abstract: Heparin may cause hyperkalemia by blocking aldosterone biosynthesis in the adrenal gland. A 68-year-old female patient was diagnosed as deep vein thrombosis and received intravenous catheter direct thrombolysis. The patient suffered hyperkalemia without systemic infection, cardiac or renal failure, adrenal insufficiency, or sudden anemia. The plasma potassium level normalized after heparin changed to fraxiparine. Here, we have reviewed the literature and discussed risk of heparin-induced hyperklamia.

Keywords: Heparin, hyperkalamia

Introduction

Heparin is commonly used for anticoagulation purpose. Its main adverse events include bleeding, heparin-induced thrombocytopenia and osteoporosis. However, Heparin may cause hyperkalemia by blocking the biosynthesis of aldosterone in the adrenal gland. Although there are reports of heparin-induced hyperkalemia in dialysis patients, there are no such reports in thrombolysis patient.

We herein report a DVT patient with heparin-induced hyperkalemia who showed improvement after changing unfractionated heparin (UFH) to low-molecular-weight heparin (LMWH).

Case report

Our patient was a 68-year-old female who came to hospital for "felt left leg edema for 6 hours" without pale, cyanosis, bubble, numb, or gangrene. The patient did not complain for palpitation, chest distress, hemoptysis or cough. The ultrasound show full of hypoecho signal filled from femoral vein to popliteal vein. The D-Dimmer was 47.90 mg/L in emergency department. In the past history, the patient suffered hypertension and diabetes mellitus. Her medication included telmisartan (80 mg, p.o. qd), lacidipine (4 mg, p.o. qd), gliclazide (30 mg, p.o. bid) and metformin (500 mg, p.o. bid). She received nephrolithotomy in both sides 20 years ago.

The patient was diagnosed as DVT and admitted in vascular surgery department. She received intravenous catheter direct thrombolysis (ICDT) under inferior vena cava filter protection. The serum creatinine (SC) was 129 umol/L, and serum potassium (SP) was 5.14 mmol/L before ICDT. We chose nonionic contrast media (Iodixanol, Nycomed) to avoid nephrotoxic effects. Urokinase dosage was adjusted by activated partial thromboplastin time and fibrinogen degradation products. UFH was used in the rest time for anticoagulation purpose. There were totally 43750 u UFH and 2.75 million units urokinase injected through catheter in 72 hours. The patient's leg edema diminished. Venography confirmed thrombolysis succeed.

However, patient's SP (6.66 mmol/L) increased without obvious kidney injury (SC was 122 umol/L) 12 hours after we removing catheter. Dextrose, insulin and lasix were administered to treat the hyperkalemia. In the next day, SP decreased to 5.59 mmol/L, but serum sodium (SS) decreased from 134 mmol/L to 127 mmol/L. There were 18 grams sodium chloride administrated by intravenous, and 3 grams through oral. We also used sodium polystyrene

sulfonate combined with dextrose and insulin to treat electrolyte disturbance. SP decreased to 5.3 mmol/L but SS was 123 mmol/L after treatment. In the third morning after thrombolysis, SP was 5.9 mmol/L and SS was 125 mmol/L. Another 9.5 grams sodium chloride were administrated by intravenous as well as 3 grams through oral. Heparin was suspected as the cause of her refractory hyperkalemia and hyponatremia. LMWH was administrated instead of UFH. Urine sodium and chloride in 24 hours were increased, while urine potassium was in normal level in forth day urine sample.

After the episode of hyperkalemia described above, there was no recurrence of hyperkalemia and the patient was discharged in good condition.

Discussion

We have reported a case of DVT patient with heparin-induced hyperkalemia, which improved after changing to LMWH. The patient complicated with old age (>60 years), diabetes mellitus, hypertension (treated by ACEIs) and minor renal insufficiency. All of those factors may lead to hyperkalemia.

Anticoagulation is the basic therapy to DVT patients. UFH is still the first choice in ICDT. Heparin-induced hyperkalemia is usually reported in hemodialysis patients for inhibition of aldosterone production, but vascular surgeons usually neglect it [1].

The maximum antagonism of aldosterone effects by heparin occurs after 4-6 days of therapy just like the patient in our report. It may occur at any dosage in clinical use [2]. The most important mechanism of heparin-induced hyperkalemia appears to involve reduction in both the number and affinity of the angiotensin II receptors in the zona glomerulosa [3]. Adrenal hemorrhage inducing adrenal insufficiency is also considered in some research [4].

Aldosterone suppression has been reported secondary to both LMWH and UFH [5, 6]. But some reports showed that the incidence of hyperkalemia was lower with LMWH than with UFH [7, 8].

Although patients who receive heparin have reduced aldosterone levels, most patients are able to compensate by an increase in renin synthesis to maintain normal potassium values and remain asymptomatic [2]. However, patients with hyperkalemia risk factors, such as diabetes mellitus, renal insufficiency, or drugs that interfere with potassium excretion are especially predisposed to hyperkalemia [9].

Several published studies indicated that elderly patients were at a higher risk for developing drug-induced hyperkalemia. Homeostatic capacity decreasing during aging process may increase vulnerability to adverse drug-related outcomes [10].

Diabetes mellitus may cause hyporeninemic hypoaldosteronism and renal tubular impairment, which relate to kidney potassium excretion. Insulin deficiency also limits the ability of the body to shift potassium into cells. Renal impairment reduces aldosterone effects on increasing potassium secretion. The hyperkalemia risk in diabetes patients who concomitant with chronic kidney disease is likely further increased [11].

Drugs have been identified as a primary cause or contributing factor of hyperkalemia in 35-75% of hospitalized patients [4, 12]. A wide range of drugs can cause hyperkalemia by a variety of mechanisms. Mechanism of drug-induce hyperkalemia includes promoting transcellular potassium shifts, impairing renal potassium excretion, and increasing potassium supply.

Angiotensin-converting enzyme inhibitors (ACEIs), including telmisartan, are well known drugs which may impair urinary potassium excretion by interfering with one or more of these three disturbances: aldosterone secretion deficiency in the adrenal gland, decreased delivery of sodium to the distal nephron, and abnormal functioning of the cortical collecting tubule [13-15]. Calcium channel blockers such as verapamil, diltiazem, amlodipine, and benidipine, may also lead to hyperkalemia, but not including lacidipine as we known [4, 16, 17].

Heparin-induced hyperkalemia may be asymptomatic, but dramatic and life threatening, posing diagnostic and management problems. Though more and more risk factors were attentioned, it is still diffcult to evaluate total risk ratio of drug induced hyperkalemia if the patient has two or more risk factors. Preven-

tion bases on the awareness of this complication. Most heparin-induced hyperkalemia reports focus on hemodialysis or cardiac failure patients. As nonionic contrast media is widely used, renal insufficiency patients are able to receive endovascular therapy. Heparin is a basal drug in endovascular therapy, but heparin-induced hyperkalemia does not attract enough endovascular doctors' attention. Our report shows the necessity of monitoring the potassium levels during administration of heparin.

If hyperkalemia occurs, prompt administration of definitive therapy to antagonize the adverse cardiac effects of potassium and return both serum and total body potassium to normal can optimize outcomes.

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Disclosure of conflict of interest

None.

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