

Is a pH Of 6.73 Compatible With Life?

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Abstract

In patients with metabolic acidosis hemodialysis (HD) therapy should be applied if the acidosis is too deep ($\text{pH} < 7.1$) or it cannot be taken under control despite conservative treatment. We present a chronic kidney disease (CKD) patient who was brought to the emergency room with severe metabolic acidosis ($\text{pH} 6.73$) and treated with emergency HD without any sequela. The 76 year old male patient was brought to the emergency room due to mental fog, disruption in general condition and respiratory distress. He had a medical history of low clearance CKD. Physical examination revealed mental fog, blood pressure of 60/40 mmHg, respiratory rate per minute of 20 and that he was dehydrated. Isotonic saline 500 cc was given and the infusion was started at 200 cc/hour. Arterial blood gas analysis showed $\text{pH}: 6.73$, $\text{pCO}_2: 23$ mmHg, $\text{HCO}_3^- 2.9$ mmol/L and lactate: 3.1 mmol/L. HD was performed within half an hour. He underwent HD on the following 3 consecutive days. He completely recovered, was planned to continue HD 3 times a week and discharged from hospital on the 10th day of his hospitalization. In conclusion; Metabolic acidosis is an important and urgent HD indication in patients with CKD. We showed that $\text{pH} 6.73$ is compatible with life by presenting this case.

INTRODUCTION

In the treatment of renal impairment, despite conservative precautions, hemodialysis therapy (HD) can be necessary in some patients (1). HD treatment is usually used for one or more reasons in these patients. Emergency hemodialysis indications include hyperkalemia, hypervolemia, metabolic acidosis, hypercalcemia, hyperuricemia, hyperphosphatemia, metabolic alkalosis, hyponatremia, intoxication due to medicine or toxic substances and occurrence of uremic symptoms or findings such as neurological (uremic encephalopathy), cardiovascular (pericarditis) and gastrointestinal (inappetency, nausea, vomiting) (1-4). HD therapy should be applied in patients with metabolic acidosis, if acidosis is very severe ($\text{pH} < 7.1$) or it cannot be taken under control despite conservative treatment (1,3). We present a CKD patient who was brought to the emergency room with severe metabolic acidosis ($\text{pH} 6.73$) and treated with emergency HD without any sequela.

CASE

A seventy-six year old male patient was brought to the emergency room due to mental fog, disruption in general condition and respiratory distress. He had a medical history of low clearance CKD. In the history obtained from his son,

we learned that he did not use prescribed medicines for the last 20 days and that his general condition has worsened for the last 3 days. On physical examination we found that his general condition was bad, he had mental fog, his blood pressure was only 60/40 mmHg, his respiratory rate per minute was 20 and he was in dehydrated condition. After taking blood for examination, isotonic saline 500 cc was given and the infusion was started at 200 cc/hour. The blood gas showed a $\text{pH}: 6.73$, $\text{pCO}_2: 23$ mmHg, $\text{HCO}_3^- 2.9$ mmol/L and lactate: 3.1 mmol/L. Hemodialysis was planned. Until the HD treatment, 100 mEq (10 ampoules) NaHCO_3 was given intravenously (IV). The blood pressure was measured as 80/50 mmHg after IV liquid and NaHCO_3 treatment.

HD was performed within half an hour right after his emergency treatment. His results were as follows; urea 437 mg/dL, $\text{Kre} 20.9$ mg/dL, sodium 146 mEq/L, potassium 6.1 mEq/L, calcium 10.2 mg/dL and phosphorus 17.7 mg/dL. The HD order was given as follows; time: 3 hours and blood flow rate: 200 ml/min. Ultrafiltration wasn't performed. Blood gas was taken again towards the end of HD and $\text{pH}: 7.27$, $\text{pCO}_2: 45$ mmHg, $\text{HCO}_3^- 20.6$ mmol/L and lactate: 2.2 mmol/L was obtained. HD was ended after 3 hours. Isotonic infusion was continued at a dose of 100 cc per hour. The blood pressure stabilized at about 100/60

mmHg without any inotrope support. 4 hours after HD, blood gas was taken again because of tachypnoe. Severe metabolic acidosis (pH:7.23, pCO₂:9.4 mmHg, HCO₃:3.9 mmol/L and lactate:3.1 mmol/L) was found but HD therapy was not performed because of risk of a dialysis disequilibrium syndrome. 100 mEq (10 ampoule) NaHCO₃ was given IV in five minutes, NaHCO₃ infusion was started at adose of 20 mEq per hour.

Tachypnoe and methabolic acidosis decreased after 4 hours. (pH:7.39, pCO₂:21.7 mmHg, HCO₃:13.0 mmol/L and lactate:1.2 mmol/L) (Table). The patient underwent HD the following 3 consecutive days. He completely recovered, was planned to continue HD 3 times a week and discharged from hospital on the 10th day of his hospitalization.

Table 1

Blood Gas Analysis of Patient

	pH	pCO ₂ *	HCO ₃ **	Laktat**
Application Time	6,73	23	2,9	3,1
After Dialysis	7,27	45	20,6	2,2
4 Hours After Dialysis	7,23	9,4	3,9	3,1
8 Hours After Dialysis	7,39	21,7	13,0	1,2

* mmHg

** mmol/L.

DISCUSSION

HD should be applied during occurrence of hyperkalemia, hypervolemia, metabolic acidosis, hypercalcemia, hyperuricemia, hyperphosphatemia, metabolic alkalosis, hyponatremia, intoxication due to medicine or toxic substances and occurrence of neurological (uremic encephalopathy), cardiovascular (pericarditis) and gastrointestinal (inappetency, nausea, vomiting) symptoms or findings (1-4). HD is applied for one or more reasons (1). In our case, emergency HD was performed due to serious metabolic acidosis (pH 6,73), uremic encephalopathy (urea 437 mg/dL, kre 20.9 mg/dL) and hyperpotassemia (potassium 6.1 mEq/L).

Acid-base balance is normally provided by excretion daily acid from kidneys (5). The elimination of this acid load is basicly provided by hydrogen and amonium excretion by urine. When number of nephrons decrease in CKD, the definite acid excretion is continued by increasing amonium ion excretion per nephron in the beginning (5). However, when the glomerular filtration (GFR) rate decreases under 40-50 ml/min, total amonium excretion starts to decrease (5-7). The obvious effect of decrease in GFR is progressive

metabolic acidosis due to increase in hydrogen ions (5,7,8). Alkali therapy is recomended as HCO₃ level will be over 22 mEq/L in patients with CKD (9-10). Metabolic acidosis was serious (pH:6,73 HCO₃ 2,9 mmol/L) in our patient and renal function tests as well as potassium level were very high. This is why we applied HD with parenteral NaHCO₃ treatment.

It is recomended that the duration of HD should be short, blood flow rate and surface area should be kept low in first HD because of dialysis disulbrium risk (11,12). Thus, the period is 2-2.5 hours and blood flow rate is 150-250 ml/min during the first HD (13). However in some situations such as hyperkalemia due to rhabdomyolysis or severe metabolic acidosis this period and blood flow rate may not be enough. In such situations extending the period or increasing blood flow rate carries the potential dialysis disequilibrium risk. Therefore, we used a dialysis period of 3 hours by keeping blood flow rate at 200 ml/min with blood gas control. We applied parenteral NaHCO₃ treatment with close blood gas control. Dialysis disequilibrium syndrome was not observed in our patient.

Some clinicians are afraid that HD cannot be tolerated because of low blood pressure in hypotensive patients. However, especially in patients with severe metobolic acidosis, the reason of hypotension can be the negative effect of acidosis on cardiac function (14). Thus, necessary approaches including HD should be applied to improve acidosis in these patients. We succeeded to treat out patient by applying HD, IV NaHCO₃ and fluid treatment despite the hypotension.

In conclusion; Metabolic acidosis is an important and urgent HD indication in patients with CKD. Even if CKD patients who have severe metabolic acidosis are hypotensive, they should performed HD. We showed that pH 6.73 is compatible with life by presenting that case.

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