Case Report

# Peritoneal dialysis for the rescue in critical refractory metabolic acidosis in diabetic ketoacidosis

**Harpreet Singh[1], Relangi H. S. Krishna[1], Arihant Jain[1], Navneet Sharma[1]**

[1]*Department of Internal Medicine, Post Graduate Institute of Medical Education and Research, Chandigarh, India*

## Abstract

Diabetic ketoacidosis is one of the most serious complications of diabetes mellitus. Role of bicarbonate therapy in severe diabetic ketoacidosis is controversial. There are only few case reports of management of refractory diabetic ketoacidosis with renal replacement therapy. Here, we present a case of young male with severe diabetic ketoacidosis, which was refractory to fluid resuscitation, insulin and was managed successfully managed with peritoneal dialysis.

**Keywords:** CVVHDF: continuous venovenous hemodiafiltration, DKA: Diabetic ketoacidosis, PD: peritoneal dialysis

## Case

A 35-year-old gentleman presented with complaints of diffuse pain abdomen and shortness of breath of 1 day duration associated with drowsiness of 4 hours duration. Patient was a known case of Type 1 Diabetes Mellitus on Injection Mixtard (70:30) 45 units/day and he had missed his insulin for last 5 days. On presentation, his Glasgow coma scale was E1V2M4, systolic blood pressure was 70 mm of Hg with feeble pulse, respiratory rate of 36 per minute, blood sugar of 490 mg/dL, and serum ketones of 5.6 with calculated serum osmolality of 308.68 mosm/L. Blood gas analysis showed pH of 6.785, bicarbonate 4.3 meq/dL, anion gap of 8.7 and lactate of 0.16 mmol/L [Table 1]. On chest radiography, there was consolidation in the left lung field. Computed tomography of head showed cerebral edema. His other investigations showed serum sodium of 137 mmol/L, potassium 4.4 mmol/L and chloride 124 mmol/L, blood urea 54 mg/dL, serum creatinine 1.2 mg/dL with urine output of 1.6 litres in first 24 hours. His haemoglobin was 12.5 g/dL, total leucocyte count of 4600 per mm3 and platelet count 103000 per mm3. Patient was started on treatment with normal saline at initial rate of 15-25 ml/kg/h and regular insulin at 0.1 U/kg/hour. Later on, intravenous antibiotics were added in view of consolidation. His urine routine examination, urine culture sensitivity, blood culture sensitivity were normal. Vasopressors were added (nor adrenaline, adrenaline and vasopressin) because of persistent shock, he was put on mechanical ventilation due to persistent altered sensorium and respiratory failure. Due to severe metabolic acidosis, he was given intravenous bicarbonate of 260 Meq in the initial 24 hours. However, his metabolic acidosis and shock persisted, so, he was started on peritoneal dialysis. After 12 hours of peritoneal dialysis, his arterial blood pH improved to 7.118 with bicarbonate of 15.1 meq/dl. So his peritoneal dialysis was continued and his arterial blood pH improved to 7.311 with bicarbonate of 14.0 meq/dL after 36 hours. His peritoneal dialysis was given for total of 80 cycles. Vasopressors were tapered off and he was subsequently extubated on day 5 of admission. Patient required 4 more cycles

**Table 1: Improvement in pH and $HCO^{3-}$ with peritoneal dialysis**

| Time since admission | pH | $HCO^{3-}$ | $Na^+/Cl^-$ | $K^+$ | Anion Gap |
|---|---|---|---|---|---|
| 0 h | 6.785 | 4.3 | 137/124 | 4.4 | 8.7 |
| 18 h | 6.939 | 6.5 | 140/122 | 4.3 | 11.5 |
| 24 h | 7.103 | 10.4 | 144/124 | 3.8 | 9.6 |
| 36 h (Start of PD) | 7.097 | 10.1 | 148/124 | 3.3 | 13.1 |
| 48 h (12 h after PD) | 7.118 | 15.1 | 145/125 | 3.07 | 4.9 |
| 72 h (36 h after PD) | 7.311 | 14.0 | 143/124 | 2.6 | 5.0 |

**Address for correspondence:** Dr. Harpreet Singh, Department of Internal Medicine, Post Graduate Institute of Medical Education and Research (PGIMER), 4th Floor, Nehru Hospital, Chandigarh - 160 012, India.
E-mail: hs.30.singh@gmail.com

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**Table 2: Characteristics of patients of DKA managed with renal replacement therapy[6-8]**

| Profile of patient | Kawata *et al.*, 2006 | Lee *et al.*, 2015 | Agha *et al.*, 2015 | Present case |
|---|---|---|---|---|
| Age | 24 years | 26 years | 23 years | 35 years |
| Type of DM | DM-1 | DM-1 | DM-1 | DM-1 |
| Severity of DKA (pH) | 6.844 | 6.800 | 6.771 | 6.785 |
| Precipitating factors | Non-compliance | None | Non-compliance | Non-compliance Infection |
| Type of renal replacement therapy | CVVHDF | CVVHDF | Hemofiltration | Peritoneal dialysis |

CVVHDF: Continuous veno venous hemodiafiltration.

of haemodialysis for persistent oliguria with rising serum creatinine levels – which was probably due to persistent shock related acute cortical necrosis. He was discharged on day 16 of illness.

## Discussion

Diabetic ketoacidosis, as defined by ADA, is random blood sugar of >250 mg/dl, arterial blood pH of <7.3 or bicarbonate of <15 mmol/L, ketonuria and ketonemia.[1] Correction of initial fluid deficit, electrolyte imbalances and insulin replacement are cornerstones of treatment in DKA. Our patient did not show improvement in his metabolic acidosis despite adequate fluid resuscitation, insulin and bicarbonate replacement.

Persistent metabolic acidosis is associated with impaired cardiac contractility and reduced cardiac output.[2,3] These effects become more prominent as pH falls below 7.1-7.2.[2] It is also associated with diminished response to both endogenous and exogenous administered catecholamine's – which leads to persistent shock, organ dysfunction and also increases risk of arrhythmia.[4] Role of bicarbonate therapy is not clearly defined in these type of cases.

In a systematic review by Chua *et al.* about role of bicarbonate therapy, there was no evidence of better control of blood sugars or clinical efficacy and there was retrospective evidence of increased risk for cerebral edema and prolonged hospitalization in children.[5]

Our patient was given peritoneal dialysis for refractory metabolic acidosis and hemodynamic instability. He showed improvement in metabolic acidosis, which subsequently led to improvement in his shock and sensorium. Hyperchloremic metabolic acidosis in our case might have been due to urinary loss of ketoanions, it has been reported in recovery phase of diabetic ketoacidosis.[6] In review of literature, we could find only 3 cases about use of renal replacement therapy in refractory metabolic acidosis in diabetic ketoacidosis; two patients had hypotension, therefore, they were given continuous venovenous hemodiafiltration [Table 2].[7-9] Non-compliance was the precipitating cause in 2 cases. All patients improved with renal replacement therapy.

## Learning points

Intravenous fluids, correction of electrolyte imbalance and insulin replacement are the cornerstone of treatment in Diabetic ketoacidosis (DKA). Role of bicarbonate in diabetic ketoacidosis is still controversial. Renal replacement therapy in the form of continuous venovenous hemodiafiltration or peritoneal dialysis can be used for treatment of refractory diabetic ketoacidosis in hemodynamically unstable patients.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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## Conflicts of interest

There are no conflicts of interest.

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