

COVID-19 Diabetic Ketoacidosis : Fluid Vs Oxygen Resuscitation Dilemma

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INTRODUCTION:

Diabetic ketoacidosis (DKA) is a life threatening condition that has been implicated in coronavirus disease 2019 (COVID-19). The proposed pathophysiology includes hyperinflammatory process triggered by SARS-CoV2 causing pancreatic beta cells injury with subsequent insulinopenia. DKA in the presence of severe COVID-19 pneumonia prove a challenge to treating physician as we need to balance between metabolic and respiratory component during resuscitation.

CASE REPORT :

A 26-year-old obese man with no other medical illness, presented with one day history of shortness of breath, preceded by three days of non-productive cough. He has no fever, vomiting, abdominal pain, or diarrhoea. No prior osmotic symptoms such as excessive thirst, polyuria or polydipsia. He was alert, tachypneic at 38 breaths per minute with saturation of 84% under room air. He had bibasal crepitations on auscultation of the lungs. Cardiovascular and abdominal examinations were unremarkable.

His bedside dextrose level was 22.3 mmol/L, while serum ketone was 5.7 mmol/L. Arterial blood gas on High Flow Mask 15L/min showed metabolic acidosis with respiratory compensation; pH 7.17, pCO₂ 13.6 mmHg, pO₂ 159 mmHg, and HCO₃⁻ of 9.4 mmol/L. Total white count was elevated at 24.75 x 10³/uL. C-Reactive Protein was raised at 131 mg/L. His Rapid Test Kit and PCR came back as COVID-19 positive. Bedside Inferior Vena Cava scan measured 1.34 cm with 50% collapsibility. Chest radiograph revealed normal heart size with minimal bilateral lower zone consolidation.

Patient was started on High Flow Nasal Cannula, steroid, prophylaxis anti-coagulant and empirical intravenous antibiotic. DKA fluid resuscitation and fixed insulin infusion were initiated as per local protocol. Subsequently, patient deteriorated after 2 litres of crystalloid and later was intubated in view of acute respiratory distress syndrome (ARDS). He was admitted to Intensive Care Unit. Metabolic acidosis and ketonemia resolved after more than 48 hours of treatment. He recovered and discharged 8 days later.



Picture 1 : Patient's Chest Xray

Table 1 : Patient's Blood Parameter

| Renal Profile & Liver Function Test | Value |
|-------------------------------------|-------------------------------|
| Urea | 11.3 mmol/L |
| Creatinine | 89 umol/L |
| Sodium | 125 mmol/L |
| Potassium | 5.6 mmol/L |
| Chloride | 91 mmol/L |
| eGFR | 103 mL/min/1.73m ² |
| Total Protein | 85 g/L |
| Albumin | 39 g/L |
| Globulin | 46 g/L |
| A/G ratio | 0.8 |
| Total Bilirubin | 6.5 umol/L |
| ALP | 73 U/L |
| ALT | 54 U/L |

ACKNOWLEDGEMENT :

All authors have made substantial, direct and intellectual contribution to the work, and approved it for publication. Our utmost gratitude to all in the Emergency and Trauma Department Hospital Kajang for their support of this case report.

DECLARATION OF CONFLICT FOR ALL AUTHORS :

The authors declare that there are no conflict of interests.

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DISCUSSION:

Fluid replacement is critical in DKA management to restore circulatory volume, clearance of ketones and to correct electrolytes disturbances. However, aggressive fluid resuscitation may exacerbate 'lung leak'. As a consequence, extra-vascular lung water increases, causing poor gas exchange and further hypoxia. It became more difficult as both DKA and COVID-19 pneumonia can also induce ARDS.

In this case, initial fluid resuscitation was given as per usual local protocol. Unfortunately, he developed respiratory distress after initial fluid resuscitation. We learnt that a more tailored DKA fluid regime should be used in COVID-19 patient. This crucial step will help protect the lungs, however at the expense of prolonged ketonemia. A modified DKA fluid regime was proposed by Mount Sinai Health System network of hospitals in the US using a more judicious amount of fluids in COVID-19 patients.

Serial clinical evaluation should be performed to determine the need of further fluid boluses. With the advance of point-of-care ultrasonography, assessment of fluid tolerance and fluid responsiveness using static and dynamic parameters proved to be useful in managing this type of cases.

CONCLUSION:

DKA increase mortality in COVID-19 patients. Prompt recognition of DKA in COVID-19 and initiation of treatment is crucial in emergency department. This case report highlights the importance of individualized intravenous fluid replacement to avoid worsening respiratory distress in COVID-19 patients.