

# The adult respiratory distress syndrome in association with diabetic keto-acidosis

## A case report

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### Summary

A 41-year-old man presented in stupor, with keto-acidosis and acute severe respiratory failure. He had a history of alcohol abuse and had been on insulin therapy for diabetes secondary to chronic pancreatitis for 11 years. The condition was rapidly progressive and the patient died within 5 hours of presentation of profound hypoxia and hypotension despite aggressive therapy. Autopsy confirmed the clinical diagnosis of 'shock lung'. None of the more commonly associated precipitating factors of adult respiratory distress syndrome could be detected clinically or at autopsy and the pathogenesis of the condition remains elusive.

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Numerous conditions either predispose to or are associated with the development of adult respiratory distress syndrome (ARDS), such as aspiration, gas inhalation, sepsis, shock, trauma, intravascular coagulation, brain injury and acute pancreatitis. A less well-known and more uncommon condition associated with ARDS is diabetic keto-acidosis. The combination of these two conditions produces a very high mortality rate.<sup>1</sup>

This case report: (i) draws attention to this lethal association; and (ii) contributes to the limited information on ARDS in patients with diabetic keto-acidosis.<sup>1</sup>

### Case report

A 41-year-old man was admitted to a peripheral hospital with acute problems of a depressed level of consciousness, diabetic keto-acidosis and acute respiratory failure. The patient had been on insulin therapy for 11 years for diabetes mellitus secondary to chronic pancreatitis, and was known to have abused alcohol for many years, but had not recently been on a 'binge'. The patient had apparently complained of epigastric pain (for 3 days), polyuria and polydipsia and had also stopped his insulin therapy during this period. He was given an initial intravenous dose of semi-synthetic human soluble insulin 80 U and an unspecified dose of sodium bicarbonate, and transferred to Tygerberg Hospital.

On admission to medical casualty the patient was stuporous, shocked and centrally cyanosed. He was afebrile, had sinus tachycardia of 120/min and a systolic blood pressure of 70 mmHg. No specific cardiovascular disease could be detected clinically, nor was the patient in congestive cardiac failure. On examination of the chest there was central cyanosis and tachypnoea; on auscultation there were scattered rhonchi and diffuse crackles. Abdominal examination was unremarkable. The patient's level of consciousness was depressed and he responded inappropriately to verbal commands. There was no neck stiffness, and no localising neurological signs were present.

A urine specimen obtained by catheterisation of the bladder showed 3+ glycosuria and 3+ ketonuria, but no pus cells or organisms on microscopy. The serum glucose level was 18,9 mmol/l, sodium 132 mmol/l, potassium 3,6 mmol/l, chloride 88 mmol/l, urea 10,1 mmol/l and creatinine 437 mmol/l. The serum amylase level was 82 U/l and urine amylase 142 Somogyi units. While the patient was breathing 35% oxygen, arterial blood was withdrawn and the following blood gas and acid-base results were obtained: arterial partial pressure of oxygen (Pao<sub>2</sub>) 3,6 kPa, arterial carbon dioxide tension 2,7 kPa, pH 7,41, base excess -10, carbon dioxide content 13,3 mmol/l; the anion gap was 34,3 mmol. Blood taken on admission was sterile.

On chest radiography there were diffuse bilateral alveolar infiltrates which spared the upper and lower lung zones. The heart was not enlarged. The 12-lead ECG confirmed the sinus tachycardia and there were no signs of myocardial ischaemia.

Shortly after admission the patient had a cardiorespiratory arrest and was initially successfully resuscitated. He was mechanically ventilated and received 100% oxygen and 5 cm positive end-expiratory pressure (PEEP), but despite aggressive therapy, which included intravenous insulin, 0,45% saline and inotropic agents (dobutamine 10 µg/kg/min), an adequate blood pressure could not be maintained. The Pao<sub>2</sub> remained below 5 kPa. The patient was deeply unconscious and died within 2 hours of admission (and within 5 hours of presentation at the peripheral hospital). A clinical diagnosis of ARDS in association with diabetic keto-acidosis was made.

At autopsy the heart was macroscopically and microscopically normal and there were no obstructive lesions of the coronary arteries. The lungs were heavy (right lung 1022 g, left 1085 g) and on section the cut surface showed a heavily blood-stained watery fluid exuding from the distal lung. Microscopically there was congestion of the pulmonary capillaries, marked interstitial and intra-alveolar oedema, and early hyaline membrane formation (Fig. 1). Within the intra-alveolar septa the pulmonary capillaries showed neutrophil sequestration, and there were focal collections of neutrophils in the alveoli which, along with the hyaline membranes, are inevitably associated with injury to alveolar lining cells.<sup>2</sup> There was no evidence of bacterial or viral infections and no sign of pulmonary angiopathy. The pancreas was small and fibrotic and acute pancreatitis was not present. The brain and meninges were normal. These macroscopic and microscopic findings are compatible with the diagnosis of ARDS.

### Discussion

On the basis of the clinical findings, macroscopic appearance of the lungs, and histopathological features, we concluded that this patient died from ARDS in association with diabetic keto-

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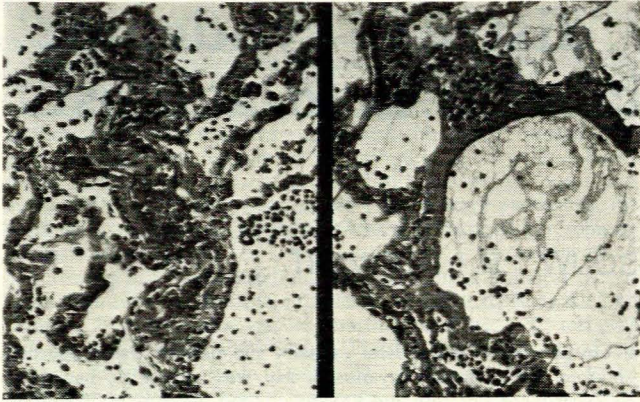


Fig. 1. Histopathological view of lung showing congestion of pulmonary capillaries, widening of the interalveolar septa and focal accumulations of neutrophils (left), and hyaline membrane formation (right).

acidosis. In a review of their own cases and those reported in the literature involving diabetes-associated ARDS, Carroll and Matz<sup>1</sup> reported an 83% mortality rate. This case clearly illustrates the aggressive nature of the condition, highlighting the need for early diagnosis and treatment.

The same authors<sup>1</sup> noted that an increase in the alveolar-arterial  $P_{O_2}$  gradient ( $P_{A-aO_2}$ ) preceded both the onset of symptoms and the clinically detectable signs of ARDS in all their patients. An increase in the  $P_{A-aO_2}$  gradient beyond 2 kPa apparently justifies immediate treatment by continuous positive airway pressure breathing and oxygen augmentation.<sup>1</sup> Whether early treatment will reduce mortality or not must remain conjectural until more information is obtained. In our patient ARDS was already advanced, and failure to obtain adequate oxygenation on 100% oxygen and 5 cm PEEP ( $P_{aO_2} < 5$  kPa) indicates a very large shunt fraction.

In some previous cases of diabetes-associated ARDS reported in the literature<sup>1</sup> the following conditions also coexisted:

pneumonia, haemorrhagic pancreatitis and systemic sepsis. None of these was detectable in our patient either clinically or at autopsy, and no organisms could be cultured from blood taken on admission. Profound metabolic acidosis is also reported to have been present in most patients. Our patient had received sodium bicarbonate at the peripheral hospital, and on admission there was metabolic acidosis, respiratory compensation, and a normal arterial pH. We were unable to confirm by direct measurement that the left atrial pressure was normal in our patient since he died shortly after admission, but clinical examination, ECG and autopsy revealed no evidence of a primary cardiac lesion.

Although the association between ARDS and diabetic keto-acidosis does not necessarily imply a causal relationship, there have been recent histopathological reports of pulmonary micro-angiopathy.<sup>3,4</sup> We were unable to detect pulmonary vascular abnormalities at autopsy in our case. Although increased pulmonary capillary permeability and altered intravascular colloid-hydrostatic forces have been postulated<sup>5</sup> the pathogenetic mechanism of ARDS in association with diabetes mellitus remains elusive.

The rapid decline and subsequent death of our patient is in accord with earlier case reports<sup>1</sup> and serves to remind clinicians dealing with diabetic patients of this uncommon but lethal complication of keto-acidosis.

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