Diabetic Ketoacidosis Complicated with Pneumomediastinum and Pneumorrhachis: A Case Report

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Spontaneous pneumomediastinum is an uncommon complication of diabetic ketoacidosis. Pneumorrhachis secondary to pneumomediastinum in the setting of diabetic ketoacidosis is a very rare condition. We reported the clinical course of spontaneous pneumomediastinum associated with pneumorrhachis in a 27-year-old woman with diabetic ketoacidosis. Pneumomediastinum and pneumorrhachis are both benign self-limiting complications of diabetic ketoacidosis. Treatment is usually conservative and involves correcting any metabolic factors.

Key words: diabetic ketoacidosis, pneumomediastinum, pneumorrhachis

Introduction

Diabetic patients may show many pulmonary abnormalities, including a higher risk of pulmonary infection, physiological changes, and pneumomediastinum or pneumothorax(1). Pneumorrhachis, or air in the spinal canal, has been reported in the patients with diabetic ketoacidosis only rarely(2,3,6). We reported the clinical course of a case of spontaneous pneumomediastinum that was associated with pneumorrhachis in a patient with diabetic ketoacidosis.

Case Report

The patient was a 27-year-old woman with a history of diabetes mellitus since a teenager who was being treated with oral hypoglycemic agents at a local hospital. Nausea, vomiting and poor appetite developed over a number of weeks, and she had withheld her oral hypoglycemic agents herself for a number of days. She arrived at our emergency room in a state of drowsy consciousness. Her mother denied the patient had a fever, abdominal pain, chest pain or shortness of breath. A physical examination revealed the patient to be dehydrated with a blood pressure of 81/57 mmHg and a heart rate of 119 per minutes. Her body temperature was 34.6°C. The respiratory rate was 18 per minutes. Hamman’s crunch sign was present. Laboratory investigations showed the blood glucose level to be 823 mg/dL. Arterial blood gas analysis, while the patient was being treated using a O₂ nasal cannula at 3 L/min, showed a pH 7.127, a bicarbonate of 2.6 mmol/l, PCO₂ of 8 mmHg, PO₂ of 159 mmHg and a base excess of -24.1 mmol/l. Blood urea and creatinine were elevated at 54 mg/dL and 2.5 mg/dL respectively. Leukocytosis (WBC 29500/μL)
and thrombocytosis (Platelet 692000/μL) were also present. Serum and urine ketone body tests were both positive. A chest X ray showed air streaks in the region of the upper mediastinum and lower neck suggesting pneumomediastinum (Fig. 1). Chest computed tomography (CT) revealed pneumomediastinum with air present within the prevertebral soft tissue, bilateral neck and bilateral chest wall; interestingly, there was also epidural pneumatosis in C-spine and T-spine (Fig. 2 and 3). The patient received treatment with intravenous insulin, intravenous fluid and potassium substitution.

The hyperglycemia and metabolic acidosis were corrected. She improved gradually over the next 48 hours. Panendoscopy revealed the presence

![PA chest radiograph showing air streaks in the upper mediastinum and lower neck suggesting pneumomediastinum](image1)

![Mediastinal window of an unenhanced chest CT showing gas collections in the epidural space](image2)
of lower esophageal ulcers and candidiasis. Diflucan and proton pump inhibitor treatment were instituted. Four days later, the chest X ray showed complete resolution of the pneumomediastinum.

**Discussion**

Spontaneous pneumomediastinum, defined as the presence of air in the mediastinal space spontaneously, has been reported in association with asthma exacerbation, emesis, coughing, labor, seizure, excessive shouting, and drug inhalation. It is believed to result from rupture of the alveoli following an activity that produces high intrathoracic pressure swings. The air penetrates the peribronchial and perivascular space to reach the mediastinum. Subpleural alveolar rupture may result in pneumothorax. Subcutaneous emphysema is a finding frequently associated with mediastinal emphysema via the same pathogenesis. Pneumorrhachis, also called epidural pneumatisis, is defined as the gas in the spinal canal and has been reported to be association with pneumomediastinum in a few cases. Pneumorrhachis may result from gas passing from the posterior mediastinum through the intervertebral foramen into the epidural space.

Spontaneous pneumomediastinum is a rare complication of diabetic ketoacidosis and was first described by Hamman in 1937. At least 50 cases have been reported in the English literature. Most previous authors have believed that vomiting and Kussmaul respiration, a hyperpnoea phenomenon secondary to metabolic acidosis during diabetic ketoacidosis, results in intrathoracic pressure swings and further alveolar rupture. However, pneumomediastinum in association with severe DKA has been described in the absence of coughing, hyperpnoea and vomiting. This observation implies that pneumomediastinum sometimes precedes the onset of diabetic ketoacidosis and perhaps initiates or hastens progression of this metabolic abnormality. Severe vomiting and chest pain should create a suspicion of Boerhaave’s syndrome, and further carefully study of each patient is then needed to rule out esophageal perforation.

Pneumorrhachis secondary to pneumomediastinum in the setting of diabetic ketoacidosis is a very rare condition and there have been only a very few reports.

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Fig. 3 Pulmonary window of an unenhanced chest CT showing gas collections in the mediastinum, pericardium, pleural space (arrows) and epidural space (arrowhead)
in the English literature\(^{(2,3,6)}\). We presented here another new case with such complications. However, we believed the incidence of pneumorrhachis may have been underestimated in the past. In a review of mediastinal emphysema as a complication of diabetic ketoacidosis, only five out of forty patients described in the literature had received a CT scan; nonetheless, out of these five patients, two had epidural pneumatoasis\(^{(9)}\). Therefore, it is possible that the number of cases of epidural pneumatoasis\(^{(9)}\) detected will increase significantly if a CT scan is performed on every case of pneumomediastinum.

Pneumomediastinum and pneumorrhachis are both benign self-limiting complication of diabetic ketoacidosis. Treatment is usually conservative and involves correcting any metabolic problems. The air in the images usually disappears over several days after the diabetic ketoacidosis has been treated, as was the case with the present patient.

References

自發性氣縱膈為一少見的糖尿病酮酸中毒併發症，而因此導致椎管積氣則更為罕見。在此我們報告一位27歲女性因糖尿病酮酸中毒入院，胸部X光有自發性氣縱膈，胸部電腦斷層則顯示另有椎管積氣。在經過胰島素及支持性治療後，酮酸中毒改善，而追蹤胸部X光可見氣縱膈已自發性消失。文献回顧顯示，糖尿病酮酸中毒病患併發氣縱膈及椎管積氣雖罕見，不過通常為一良性的合併症，一般保守性治療及矯正代謝異常後，皆可自發性恢復。

關鍵詞：糖尿病酮酸中毒，氣縱膈，椎管積氣