

Cocaine-induced diffuse alveolar hemorrhage: A case report and review of the literature

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ABSTRACT

Cocaine is one of the most commonly abused drugs in the United States. Ingestion of cocaine may result in a wide array of disease processes due to its stimulant properties, contaminants, or to downstream effects, such as myocardial infarction, stroke, or cardiac arrest. Pulmonary complaints are common in patients seeking treatment for cocaine-associated medical problems and include acute eosinophilic pneumonia, pneumothorax, pneumomediastinum, diffuse alveolar hemorrhage (DAH), pulmonary hypertension and granulomatosis. We present a case of DAH due to cocaine abuse and rapid resolution with mechanical ventilation and supportive care.

KEYWORDS: diffuse alveolar hemorrhage, respiratory failure, cocaine, crack

INTRODUCTION

Cocaine is one of the most commonly abused drugs in the United States with about 1.5 million active users.¹ Toxic effects depend on the quantity of cocaine ingested, the route and frequency of administration (e.g., smoked versus inhaled), contaminants in the drug (e.g., levamisole), and the size of inhaled particles, among others.² Pulmonary complaints are common in patients seeking treatment for cocaine-associated medical problems.⁴ Its toxic effects include acute eosinophilic pneumonia, pneumothorax, pneumomediastinum, diffuse alveolar hemorrhage (DAH), pulmonary hypertension and granulomatosis associated with contaminants.³

DAH due to cocaine use is an important cause of cocaine related morbidity. In an autopsy review of 52 patients with toxicological confirmation of cocaine use, some degree of alveolar hemorrhage was observed in 71% of cases.⁵ However, the literature regarding DAH and cocaine use is sparse, perhaps due to variability in cocaine consumption, the presence of multiple co-morbidities, and differences in the natural history of cocaine associated lung disease. We present a case of diffuse alveolar hemorrhage due to cocaine abuse and rapid resolution with mechanical ventilation and supportive care.

CASE PRESENTATION

A 31-year-old man with a history of substance abuse presented to the Emergency Department (ED) after being found unconscious in a bathroom in a bar. His family reported that he intermittently used intranasal cocaine. EMS reported agonal respirations at 4 breaths/min, blood pressure of 104/68 mm Hg, pulse of 82/min, oxygen saturation 87% on room air and a fluctuating mental status. Supplemental oxygen was provided, and empiric administration of IV naloxone had no appreciable effect on the respiratory status. He developed small amounts of epistaxis and hemoptysis in the ED. His family reported that he took no medications. Initial labs, including a complete blood count with differential and tests of coagulation were normal. A urine toxicology screen was positive for cocaine and tetrahydrocannabinol (THC). Chest radiography was normal. After an initial improvement, his respiratory status began to rapidly worsen. A CT angiogram of the chest demonstrated diffuse, bilateral, upper and lower lung zone airspace disease (**Figure 1**). The patient's oxygen levels began to rapidly decrease, necessitating invasive mechanical ventilation. He was transferred to our institution for hypoxic respiratory failure and diffuse parenchymal lung disease (DPLD). He was admitted to the Medical Intensive Care Unit (MICU).

The following disorders were considered: massive aspiration, ANCA-positive vasculitis, non-cardiogenic and cardiogenic pulmonary edema, and DAH. His nares were noted to have minimal dried blood, but there was no evidence of

Figure 1. CT scan of the chest showing DPLD.



bleeding in the visualized posterior oropharynx. Electrocardiogram revealed no evidence of myocardial ischemia. The troponin-I level was less than 0.15ng/ml (normal < 0.15ng/ml), and the B-type natriuretic peptide was 12.7 pg/ml (normal 0.0–33.3 pg/ml). The procalcitonin level was markedly elevated at 10.95 ng/ml (normal 0.00–0.05 ng/ml). He was treated with a lung protective strategy (tidal volume of 6cc/kg of ideal body weight, plateau pressure < 30 cm H₂O). He required high levels of ventilatory support, with a fraction of inspired oxygen (FiO₂) of 100%, and positive end-expiratory pressure (PEEP) of 12 cm H₂O. There were scant bloody secretions aspirated from the endotracheal tube. Oxygen saturation decreased to 84% despite an FiO₂ of 100%, and improved transiently in response to two recruitment maneuvers, in which 30cm H₂O of PEEP was applied for 30 seconds. Broad spectrum antibiotic therapy with IV vancomycin and piperacillin-tazobactam was initiated. A repeat chest x-ray demonstrated an appropriately positioned endotracheal tube, bilateral diffuse hazy parenchymal opacities, air bronchograms, and evidence of pneumopericardium and pneumomediastinum (**Figure 2**). He developed palpable subcutaneous emphysema in the neck and upper chest wall believed to be due to barotrauma from high transpulmonary pressures. Extracorporeal membrane oxygenation (ECMO) was considered. Over the next 12 hours the patient's oxygenation stabilized and both the FiO₂ and PEEP were decreased. Fiberoptic bronchoscopy revealed no visible evidence of mucosal damage and no active bleeding. Serial bronchoalveolar lavage (BAL) of the right middle lobe demonstrated increasingly blood-tinged fluid (**Figure 3**). The BAL fluid cytology was positive for hemosiderin-laden macrophages, and negative for microorganisms. These findings supported a diagnosis of DAH. During the next 24 hours, the patient's oxygenation improved significantly and he tolerated further decreases in his PEEP and FiO₂. His sputum became clear. Repeat chest x-ray showed near complete resolution of the bilateral opacities (**Figure 4**). He was rapidly weaned from mechanical ventilation and extubated on the third day of his MICU stay. At this time, labs including a CBC, metabolic panel, creatinine and LFTs were normal. On further questioning, the patient admitted use of marijuana and intranasal cocaine; he denied using other drugs. Microbiologic studies of the BAL fluid remained negative for bacteria, viruses, fungi, *Pneumocystis jirovecii*, and acid-fast bacilli. The patient was transferred to the medical floor on hospital day four to continue his recovery and to receive substance abuse counseling. He was discharged home on hospital day seven with no further complications.

DISCUSSION

Cocaine, especially in the form of crack (smoked free-base cocaine), is a highly addictive substance that blocks the reuptake of biogenic amines at synaptic junctions. It is a sympathicomimetic agent that stimulates alpha

Figure 2. Chest X-ray on Day 2 of ICU admission showing pneumomediastinum and pneumopericardium.

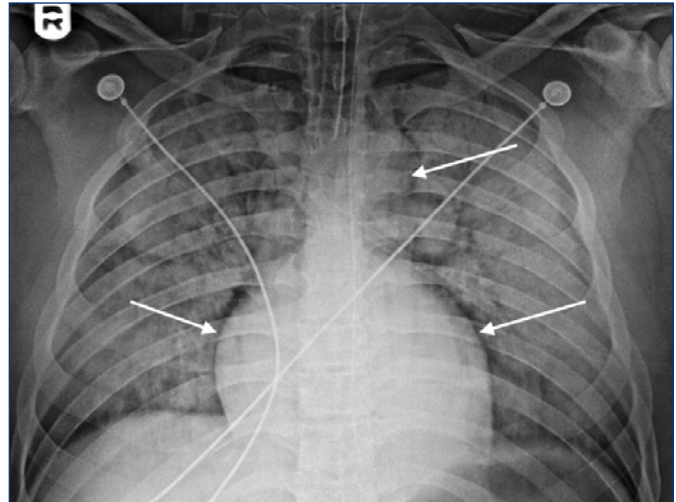


Figure 3. Serial aliquots of a right middle lobe bronchoalveolar lavage. The progressively bloody fluid between the first and fourth aliquots is characteristic of DAH.

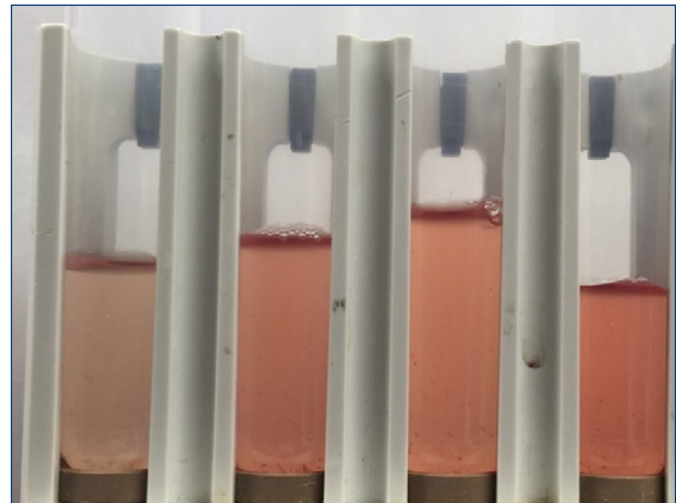


Figure 4. Chest X-ray showing resolution of pulmonary changes.



(preferentially) and beta receptors. It is well absorbed into the body via mucosal surfaces and in the lungs across the alveolar membrane.

Hemoptysis and shortness of breath are common symptoms of diffuse alveolar hemorrhage due to cocaine. The exact pathogenesis of cocaine-induced DAH is unclear. Current theories include vasoconstriction-mediated hypoxic alveolar epithelial or capillary endothelial cell damage, and direct cytotoxic effects of substances co-ingested with cocaine.⁷

In the case presented above, numerous other possible causes of pulmonary hemorrhage were considered and excluded, leaving cocaine-induced DAH as the most likely cause of the patient's presentation. The rapid improvement without immunosuppressive therapy argued against a vasculitic process. Interestingly, the procalcitonin level was markedly elevated, which in the appropriate context suggests the presence of a bacterial pneumonia. However antibiotic therapy was stopped after three days, by which time the patient had rapidly improved and the infectious workup failed to reveal a pathogen. The ECG was without ischemic signs, and cardiac enzymes were normal, arguing against cardiogenic pulmonary edema and resultant hemorrhage. Aspiration pneumonitis would not likely have resulted in such a widely and symmetrically distributed disease process. Although the patient's urine was also positive for tetrahydrocannabinol, and synthetic cannabinoids have been reported to cause DPLD⁹, the patient gave no history of using this type of drug. Barotrauma developed due to high transpulmonary pressures likely from high levels of PEEP applied to the patient's noncompliant lungs. While crack cocaine abuse with subsequent valsalva maneuvers can precipitate barotrauma, this patient's development of pneumomediastinum and pneumopericardium later in the course of mechanical ventilation suggested an iatrogenic cause, likely from the effort to maintain alveolar recruitment and adequate oxygenation. In the setting of cocaine ingestion, hemoptysis, hypoxic respiratory failure, diffuse airspace opacities on radiography, and rapid resolution in a short period with supportive care, cocaine-induced DAH was the most likely diagnosis.

Diffuse alveolar hemorrhage from cocaine can be a life-threatening condition making early identification and treatment crucial.

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