

# A Case Report of Severe Paraquat Poisoning in an HIV-Positive Patient

## *An Unexpected Outcome and Inspiration*

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**Abstract:** We described and analyzed the treatment process of an HIV-positive patient with severe paraquat (PQ) poisoning.

A 34-year-old man ingested about 50 mL of a 20% solution of PQ in a suicide attempt. He was treated with gastric lavage, oral administration of adsorbent, and symptomatic treatments at the local hospital, and was transferred to our emergency department. Ten hours after the exposure, the concentration of plasma PQ was 2.17 mg/L and was substantially above the survival limits of the severity index for PQ poisoning (SIPP) curve (0.30 mg/L). The equation produced by Jones et al (Jones AL, Elton R, Flanagan R. Multiple logistic regression analysis of plasma paraquat concentrations as a predictor of outcome in 375 cases of paraquat poisoning. *QJM*. 1999;92:573–578) predicted a 20.5% probability of survival at admission. Unfortunately, the patient was diagnosed as HIV infected, and CD4<sup>+</sup> lymphocyte count also confirmed that the patient was in a state of mild suppression of immunological function.

Immediately, the patient received normative immunosuppressive therapy and hemoperfusion (HP). On the 15th day after poisoning, the patient recovered well and was discharged.

All along, the evolution of the patient's status was in accordance with the characteristics of PQ poisoning, but the extent and duration of damage was mismatching and drastically alleviated by the previous biological indices. The particular case of treatment may be indirectly supporting the effectiveness of immunosuppressive therapy in treating patients with PQ poisoning.

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**Abbreviations:** CK = creatine kinase, Cr = creatinine, CT = computed tomography, cTn-I = cardiac troponin-I, CTX = cyclophosphamide, HP = hemoperfusion, PQ = paraquat, SIPP = severity index for PQ poisoning.

## INTRODUCTION

Paraquat (PQ), a nonselective contact herbicide, has been widely used in many countries since the 1960s. It has

attracted medical controversy because of high mortality (typical case fatality 50%–90%).<sup>1</sup> Ingestion of small quantities (>10 mL) may initiate an irreversible lung fibrosis and renal failure leading to death. Current treatment for PQ poisoning focuses on reducing absorption, increasing its elimination.<sup>2</sup> Several other interventions have been proposed, but none has been shown to be effective in clinical trials. The immunosuppressive therapy is the most promising therapy, though it has not been widely used due to the lack of supporting evidence.<sup>3</sup> Here, we present a case in which the immunosuppressive status may provide some kind of protection from PQ toxicity. Informed consent was obtained from the patients for publication of this case report.

## CASE PRESENTATION

A 34-year-old man, typical Mongoloid, agricultural worker, ingested about 50 mL of a 20% solution of PQ in a suicide attempt, and vomited some yellow-green frothy liquid. The ingested volume was superior to the previously published lethal dose for this PQ formulation. One hour later, he was treated with gastric lavage, oral administration of adsorbent, and symptomatic treatments at the local hospital. About 10 hours after the ingestion, he was transferred to our emergency department with complaints of burning sensation of mouth, sore throat, and epigastric discomfort. Upon admission, he weighed 56 kg and had a temperature of 36.9°C, heart rate of 96 beats/min, respiration of 22 times/min, and blood pressure of 135/82 mm Hg. Physical examination revealed nothing abnormal except for oropharyngeal congestion and aphthae. The electrocardiogram was normal and chest computed tomography (CT) scans were clear.

In terms of laboratory tests, white blood cell count was 6200 cells/ $\mu$ L with 73.6% neutrophils and 14.6% lymphocytes, hemoglobin concentration 12.5 g/dL, platelet count 16,800 cells/ $\mu$ L, and C-reactive protein level 3.6 mg/L (reference range 0–8.0 mg/L). The level of serum blood urea nitrogen and creatinine (Cr) were 2.7 mmol/L (reference range 2.9–8.2 mmol/L) and 67  $\mu$ mol/L (reference range 59–104  $\mu$ mol/L), respectively. The serum alanine aminotransaminase was 24 U/L (reference range 5–40 U/L), aspartate aminotransaminase 20 U/L (reference range 8–40 U/L), total bilirubin 9.0  $\mu$ mol/L (reference range 1.0–21.0  $\mu$ mol/L), creatine kinase (CK) 112 U/L (reference range 38–174 U/L), MB isoenzyme of creatine kinase (CK-MB) 27 U/L (reference range 2–25 U/L), and cardiac troponin-I (cTn-I) 0.07  $\mu$ g/L (reference range 0–0.04 U/L). The prothrombin time, partial thromboplastin time, fibrinogen, arterial blood gas, and blood lactic acid were all normal. The result of urine PQ semiquantitative detection by dithionite test was strongly positive. The concentration of plasma PQ was measured by solid-phase extraction using exchange resin and liquid chromatography coupling tandem mass spectrometry, 10 hours after the exposure, and the result (2.17 mg/L) was substantially above the

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survival limits of the severity index for PQ poisoning (SIPP) curve (0.30 mg/L).<sup>4</sup> The equation produced by Jones et al<sup>5</sup> predicted a 20.5% probability of survival at admission. In brief, laboratory results revealed that he had lethal PQ poisoning and mildly elevated serum CK-MB and cTn-I. Unfortunately, the patient was diagnosed as HIV infected (ELISA+, Western-blot+), which was not established and treated previously. On admission, the number of lymphocyte of this patient was 905 cells/ $\mu$ L, and CD4<sup>+</sup> lymphocyte count was 380 cells/ $\mu$ L.

Hemoperfusion (HP) was immediately performed on this patient for 4 hours. Subsequently, the patient received normative immunosuppressive therapy (methylprednisolone and cyclophosphamide [CTX]).<sup>6</sup> Besides, antibiotics and large doses of antioxidants (vitamin C, ambroxol, glutathione, etc.) were administered through the venous channel.

From the admission, a progressive and moderate deterioration occurred. Two days later, mouth and tongue ulcerations appeared with purulent surface. The patient felt chest distress and tachypnea (respiratory rate 25–30 times/min). On the fourth day, the hypoxemia was major as assessed by a PaO<sub>2</sub> equal to 51.6 mm Hg. Chest CT scans showed scattered flocculent pieces and ground glass shadow with indistinct edges in the lungs (Figure 1A). A rapid impairment of renal function occurred with a maximum on the third day (serum Cr reached to 206  $\mu$ mol/L). HP was performed a total of 6 times following admission. On the seventh day, CTX (total dose of 3 g) and methylprednisolone (total dose of 2 g) were not administrated with gradually reducing dosage, whereas CD4<sup>+</sup> lymphocyte count reduced to 252 cells/ $\mu$ L. On the 12th day, the symptoms of the patient disappeared basically except for oropharyngeal ulcers, and the arterial blood gas, renal function, serum CK-MB, and cTn-I returned to normal. On the 15th day after poisoning, chest CT scans showed nothing abnormal in the lungs (Figure 1B), and the patient was transferred to another hospital for AIDS treatment. Fortunately, the survivor lives asymptotically in our 18-month follow-up by telephone.

## DISCUSSION

As a result of its local accumulation, the lung is the primary site of the toxic effects of PQ. PQ-induced lung injury involves

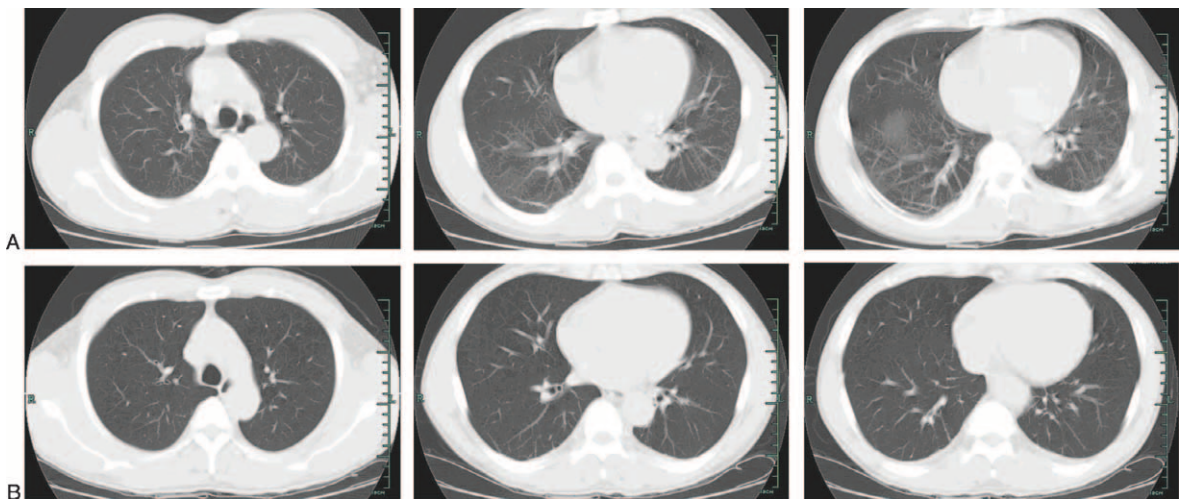
interstitial edema, alveolitis, and interstitial inflammation, ultimately resulting in fibrosis.<sup>7</sup> PQ-induced pulmonary fibrosis results from the direct damage caused by oxygen free radicals as well as from the indirect injury caused by inflammatory cells and fibroblasts.<sup>8–10</sup> Moreover, PQ-induced high expression of messenger RNA for pulmonary monocyte chemoattractant protein-1 and macrophage inflammatory protein-1 $\alpha$  is responsible for the fibrosis in the lungs.<sup>11</sup>

For the HIV-infected patients, the remarkable feature is impaired immune function, and HIV can infect a variety of cells such as CD4<sup>+</sup> lymphocytes and macrophages. HIV-encoded proteins or microRNAs trigger mitochondrial-mediated apoptosis, which may account for the progressive decline in CD4<sup>+</sup> lymphocytes in infected patients.<sup>12</sup> Simultaneously, functional impairment of HIV-infected macrophages may play a role in the immune deficiency.<sup>13,14</sup> These immune impairments may be conducive to ameliorate the acute inflammation and fibrosis in the lungs induced by PQ.

All along, the evolution of the patient's status was in accordance with characteristics of PQ poisoning, but the extent and duration of damage was mismatching and drastically alleviative by the previous biological indices, in spite of early treatment. The CD4<sup>+</sup> lymphocyte count also confirmed that the patient was in a state of mild suppression of immunological function on admission.

At the end of the conventional immunosuppressive therapy, CD4<sup>+</sup> lymphocyte count also confirmed that the patient was in a state of moderate suppression of immunological function. This patient must have an earlier and more severe immunosuppression state compared with the other patients with PQ poisoning; however, the patient's disease course was surprisingly smooth, and he recovered well and was discharged, without any immunosuppression-related complications. As this patient's probability of survival was 20.5% and plasma concentration (2.17 mg/L) at 10 hours after poisoning was far above the survival limits of SIPP; his recovery was basically unthinkable, even in some sense, a miracle.

We thought that the particular case of treatment can be indirectly supporting the effectiveness of immunosuppressive therapy in treating patients with PQ poisoning, and the degree of



**FIGURE 1.** Chest CT scans of the patient. (A) Chest CT scans on the fourth day after admission. It revealed scattered flocculent pieces and ground glass shadow with indistinct edges in the lungs. (B) Chest CT scans on the 15th day after admission. It showed nothing abnormal in the lungs. CT = computed tomography.

immunosuppression and duration remains to be further discussed.

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