Serious skin poisoning by Paraquat

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ABSTRACT

Paraquat is a highly toxic non-selective herbicide and is responsible for high accidental or provoked lethality rates, mainly due to respiratory failure. Although oral poisoning is the primary and most severe, prolonged contact with the substance in a large body area can lead to similar toxicity and death – a fact that is little elucidated in the literature. This is the case report of a 22-year-old man admitted to a hospital due to complaints of malaise, nausea, fever, headache, abdominal pain, diarrhea, burns and dyspnea. The initial diagnostic suspicion was hantaviruses, leptospirosis, dengue and pulmonary thromboembolism, and there was subsequently proven exogenous intoxication with pesticides by inhalation and cutaneous route. Imaging tests revealed diffuse pulmonary fibrosis and he also had renal, hepatic and coagulation alterations. As there is no specific antidote, symptomatic and supportive treatment was performed using activated charcoal, antibiotics, corticosteroids, antioxidants and hemodialysis. However, the patient had a progressive worsening of the condition and died due to acute respiratory distress syndrome and pulmonary fibrosis. Paraquat, although banned in Brazil in 2020, continues to be used illegally. In addition, its substitute, the Diquat, has similar toxicity. Thus, it is essential that health professionals recognize the diagnosis of intoxication by such substances and their different exposure routes. New control measures for these substances and greater investment in health education are also needed to prevent accidental exposure, as reported.

Keywords: Paraquat, Herbicides, Diquat, Poisoning.

INTRODUCTION

Paraquat is a fast-acting, non-selective contact herbicide. In intoxication, it acts as an inducer of oxidative stress, leading to multiple organ failure, mainly involving the lungs, kidneys and liver. In more severe poisonings, the lung is the main affected organ and respiratory failure is the most common cause of death. It is considered reasonably safe for use in agriculture as it is inactivated when in contact with the soil[1,2].

This study aims to describe a case of cutaneous intoxication by Paraquat with evolution to death in an occupational context and alert to the health risks caused by contact with this substance, taking into account the fact that Brazil is a country with a predominantly agricultural economy, in which the distribution of such a substance, despite being illegal, still occurs. It is also the objective of this work to describe the main pharmacokinetic characteristics of the product.

In addition, the research in question is the result of a case assisted by the Center for Information and Toxicological Assistance of Paraná (CIATOX-PR) of the State Health Department, which was submitted for analysis and approval by the Research Ethics Committee of the institution, with the CAAE 57422422.0.0000.5225.

CASE REPORT

Male patient, 22 years old, farmer and from the countryside of the State of Paraná. He had rheumatic fever in childhood, which progressed to mitral stenosis, and percutaneous mitral valvuloplasty was performed.

In early 2016, the patient unloaded a truck with soy straw for approximately six hours without using personal protective equipment. The material was moistened with Paraquat. When he got home, he performed skin decontamination with a bath and washing of the clothes used.

The patient evolved with malaise, nausea, fever, headache, abdominal pain, diarrhea and sought a hospital in the city of origin on the same day. The following day, he evolved with burn-like lesions all over the body and dyspnea (Figure 1). Symptomatic medication and antibiotic therapy were used.

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Due to the rapid progression of the condition, after two days, he was transferred to a referral health service in another city. Five days after exposure, the patient developed respiratory failure and diffuse pulmonary fibrosis, as evidenced by imaging tests. He also presented renal, hepatic and coagulation alterations.

Initially, hantaviruses, leptospirosis, dengue and pulmonary thromboembolism were suspected and, later, intoxication with pesticides by inhalation and cutaneous route. The Center for Information and Toxicological Assistance of Paraná was contacted only five days after the exposure, when family members took a container of Paraquat to the hospital and raised the possibility of intoxication. Prior to contact, activated charcoal was administered by the decision of the medical team, even without a history of ingestion of the product, and symptomatic and supportive treatment was provided.

During hospitalization, he presented a worsening of the condition, requiring mechanical ventilation, and was using antibiotics, corticosteroids, antioxidants and hemodialysis. The use of oxygen was avoided when possible. In addition, he received 25 bags of packed red blood cells or plasma. Thirty days after exposure, the patient died due to complications from the intoxication (acute respiratory distress syndrome and pulmonary fibrosis).

DISCUSSION

Paraquat is widely used to combat invasive weeds in crops[3]. It does not exist in a natural state, having been first synthesized by Weidel and Russo in 1882 and started to be used in 1962. The first fatal cases were accidental and date back to 1964[4]. However, since then, deaths from occupational intoxication or suicide have also been reported.

In humans, small ingestions can lead to death (10-20 ml of the 20% solution), with the lowest lethal dose ever reported being 1g[3]. The biochemical mechanism responsible for such toxicity is not fully elucidated. However, it is known that it causes tissue damage through the formation of free radicals and reactive oxygen species, which cause damage to membranes, proteins and DNA[4].

Intoxication can occur dermally, intramuscularly, intravenously and orally, the latter being the most serious. In cutaneous exposure, intact skin is practically impermeable to the herbicide, becoming vulnerable when ulcerated thanks to prolonged contact or high concentration of the toxic[4]. In addition, when there is exposure of a large body area, there may be toxicity similar to that caused by ingestion[3], as observed in the case described here.

When in contact with the skin, irritation, peeling, dermatitis, erythema, blisters, ulcers and burns may occur. Inhalation can cause nasal irritation, epistaxis, headache and cough. Finally, after ingestion, pain in the oropharynx, esophagus and abdomen, gastrointestinal irritation, nausea, vomiting, diarrhea, local ulcer and tissue necrosis may occur[2,3,4].

The lungs are the main target organs in these intoxications, resulting in severe lesions and fibrosis, characterized by edema, hemorrhage and interstitial inflammation. Such changes are noted in imaging tests, in addition to the presence of cough, dyspnea, tachypnea, peripheral cyanosis and hypoxemia[5].

Figure 1. Image of the patient with lesions on the 5th day of hospitalization (A) and lesions already in the healing process on the 15th day (B).

In laboratory tests, intoxication generates an increase in aminotransferases, bilirubin, amylase and creatine kinase due to liver, biliary and pancreatic injuries and heart failure. Kidney injuries can also cause proteinuria, hematuria, hypokalemia and hyponatremia[4,5].

Diagnostic confirmation is performed by colorimetric, chromatographic, electrophoretic and immunological methods. The urine test with sodium dithionite, serum level measurement and serial arterial blood gas analysis have a good predictive value in prognosis[3,4].

Treatment consists of preventing the absorption of the substance with gastric lavage, use of adsorbents and laxatives in oral intoxications. Excretion measures such as provoked diuresis, hemodialysis and plasmapheresis should also be performed. Finally, antioxidants and iron chelators can reduce cell damage. The use of supplemental oxygen should not be routine, as it potentiates lung damage[6].

There is still no specific antidote for this herbicide, with average mortality greater than 70%, accounting for up to 13% of deaths related to pesticide poisoning[7].

Currently, more than 50 countries prohibit the commercialization of Paraquat, including China and, since 2007, the European Union. In Brazil, the National Health Surveillance Agency decreed in 2020 the ban on its use[6].

An alternative to the herbicide is Diquat, also potentially toxic and without a specific antidote, despite having a higher lethal dose (30-60 ml). The main organ affected, in this case, is the kidney[8].

Although there are restrictive measures for the use of Paraquat and attempted substitutions, the product is still illegally marketed in Brazil, with China being one of the main exporters, in which its use was banned in 2016[1]. An example of this is the notification of seven suicide attempts involving this herbicide in 2021 in Paraná, with four of them evolving to death[9].

CONCLUSION

Accidents with pesticides are common in Brazil, both due to lack of guidance and improper handling, in addition to indiscriminate sales. Due to the lack of effective treatment, little knowledge of health teams about diagnosis and treatment and an extended time interval until the institution of detoxification and support measures, the mortality rates remain high.

In this scenario, despite being prohibited, Paraquat continues to be sold illegally in the country and, together with its similar - Diquat, continues to cause victims. It is worth mentioning that great attention is given to cases of ingestion with such substances, but little is said about other exposure routes, including skin exposure, which can also lead to dismal outcomes.

The risks involved in intoxication with such substances make it important to discuss the case for medical knowledge and to alert the need for new inspection measures to restrict access to the illegal product. In addition, greater investment is needed in health education for the population in order to avoid accidental exposure to Paraquat and Diquat, as reported in this case.

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CONFLICTS OF INTEREST
There is not.

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