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# Hemorrhagic erucism due to *Lonomia* spp. in Peru – A call for action

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ABSTRACT

Envenomation due to exposure to caterpillars is an emerging public health problem. A life-threatening bleeding diathesis has been described in South America after exposure to *Lonomia obliqua* or *L. acheolus*. Deforestation, forest degradation, and global warming might increase the frequency of human exposure to these insects. Prompt recognition and administration of antivenom are crucial to ensure a favorable outcome.

## 1. Introduction

The order Lepidoptera, comprising moths and butterflies, is considered one of the most diverse insect groups. Caterpillars, the worm-like larval forms, have evolved defensive mechanisms against their natural predators. These consist of bared setae, hollow plume-like sharp hairs connected to poison sacs that release poison when they pierce the skin [1,2]. Caterpillar envenomation in humans can be classified clinically as (a) erucism, (b) lepidopterism, (c) dendrolimiasis, (d) ophthalmia nodosa, and (e) consumptive coagulopathy with secondary fibrinolysis [3]. Lepidopterism refers to the reactions from moths or butterflies, while erucism refers to any response to caterpillars [4].

Caterpillar exposure is infrequent and most often affects children or field workers such as farmers or fishermen. Seasonal outbreaks have been documented and usually coincide with the synchronous hatching of eggs or the dispersal of their setae by the wind [1,5]. Local and self-limiting reactions are the most frequently described clinical manifestations. These are characterized by mild to severe burning pain that develops shortly after exposure, localized edema, and erythema. Severe, systemic, and potentially life-threatening reactions are almost exclusively related to exposure to *Lonomia* spp. This type of erucism, also known as lonomism, is geographically restricted to South America and manifests as a hemorrhagic diathesis [4,6].

We herein report the first case of hemorrhagic erucism in Loreto, in the Amazon of Peru, highlighting the importance of a timely diagnosis and treatment for the attainment of a favorable outcome.

## 2. Exemplary case

A 34-year-old American woman, living in Peru for several months for work-related reasons, accidently touched an army of caterpillars while climbing a tree (Fig. 1). She experienced immediate paresthesia and severe stabbing and burning pain in her right palm with radiation to her forearm. Twenty-four hours later, the patient noticed bleeding from an old abrasion on her right foot. A few hours later, she noted painless ecchymosis in her arms, the right axillary, and the right iliac crest region. She was hospitalized three days after contact with the caterpillars due vaginal bleeding, worsening generalized ecchymosis, and headache.

On physical examination, she had multiple and large hematomas in her upper and lower extremities and torso, with the largest in the right

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axillary region measuring 8 × 10 cm and over the right iliac crest measuring 15 × 5 cm (Fig. 2). Laboratory findings were significant for a hemoglobin of 9.5 g/dl; platelets count of 121,000 $mm^3$, thrombin time greater than 50 s, and an unmeasurable international normalized ratio (INR) and fibrinogen levels.

The patient was treated with Lonomia antivenom obtained from Colombia's National Institute of Health. Due to the persistence of severe headaches and abnormal coagulation studies, the patient was transferred to a reference hospital in the capital city of Lima. In that facility, the patient was treated with additional vials of antivenom and a transfusion of cryoprecipitate, which led to the resolution of bleeding and normalization of the coagulation parameters.

## 3. Discussion

Caterpillar-induced bleeding due *L. achelous* was first reported in Venezuela in 1967 [7]. Only two species have been conclusively linked to envenomation accidents. *L. achelous*, found in the Amazonian regions of Brazil, Colombia, Venezuela, Ecuador, Peru, and the French Guiana, and *L. obliqua*, restricted to the southern portions of Brazil, Paraguay, and Argentina. Other species are nevertheless likely responsible for human envenomation [6,8,9]. Although Peru has the highest diversity of the region with 19 recorded species, few cases of lonomism have been described [6]. A total of six cases of hemorrhagic erucism have been reported in Peru, with three reported from the department of Junin, two from Huánuco, and one in a Canadian traveler who acquired the disease in the northeastern region of the country [10–12] (Table 1).

The mechanism of action of the venom of *L. obliqua* consists of two toxin procoagulants: a factor X activator known as Losac or Stuart factor activator and a prothrombin activator named Lopap. Fibrinolysis results from the exuberant formation of fibrin due to thrombin generation [17]. Lonomin II and V, the most important toxins of *L. achelous,* have a direct fibrinolytic activity and degrade coagulation factor XIII, respectively [17,18]. In addition, the procoagulant effect of the *L. obliqua* toxin is maximized by venom-induced platelet dysfunction [19]. Furthermore, a cellular and humoral response leads to the release of substances such as bradykinin, prostaglandins, metalloproteases, hyaluronidases, tumor necrosis alpha, interleukin-6, and other molecules that contribute to the pro-inflammatory action of the venom [20,21]. The lethal dose of *L. obliqua* venom in mice is about 10 mg/kg body weight [17].

Despite the difference between the toxin's mechanism of action, the clinical manifestations of envenomation are indistinguishable between the species and range from local cutaneous reactions to a life-threatening systemic hemorrhagic syndrome. The cutaneous manifestations typically present immediately or up to 72 h after contact with the caterpillar. Hemorrhage can present 1 h to ten days after exposure and predominantly affects the mucous membranes and soft tissues but can also affect vital organs such as the brain and the lungs [12,20,22]. The development of acute kidney injury is associated with delayed presentation to care and portends a guarded prognosis [23,24]. This has been almost exclusively reported after envenomation with *L. obliqua* and is attributed to ischemia, a direct toxin effect on the kidney, and the deposition of fibrin in the glomeruli [25,26]. Importantly, renal dysfunction can be permanent in survivors [24].

Cases typically present with normal platelet, hemoglobin count, and liver function tests, differentiating lonomism from other causes of hemorrhagic fever in the tropics, such as yellow fever and dengue. Prolonged prothrombin, partial thromboplastin, and thrombin times associated with low to undetectable fibrinogen levels and increased fibrin degradation products are characteristic. The degree of hypofibrinogenemia correlates with the severity of the hemorrhagic manifestations and can be used to monitor the effectiveness of treatment [25].

Treatment consists of administering antifibrinolytics such as ε-aminocaproic acid at a dose of 30 mg/kg followed by 15 mg/kg every 4 h

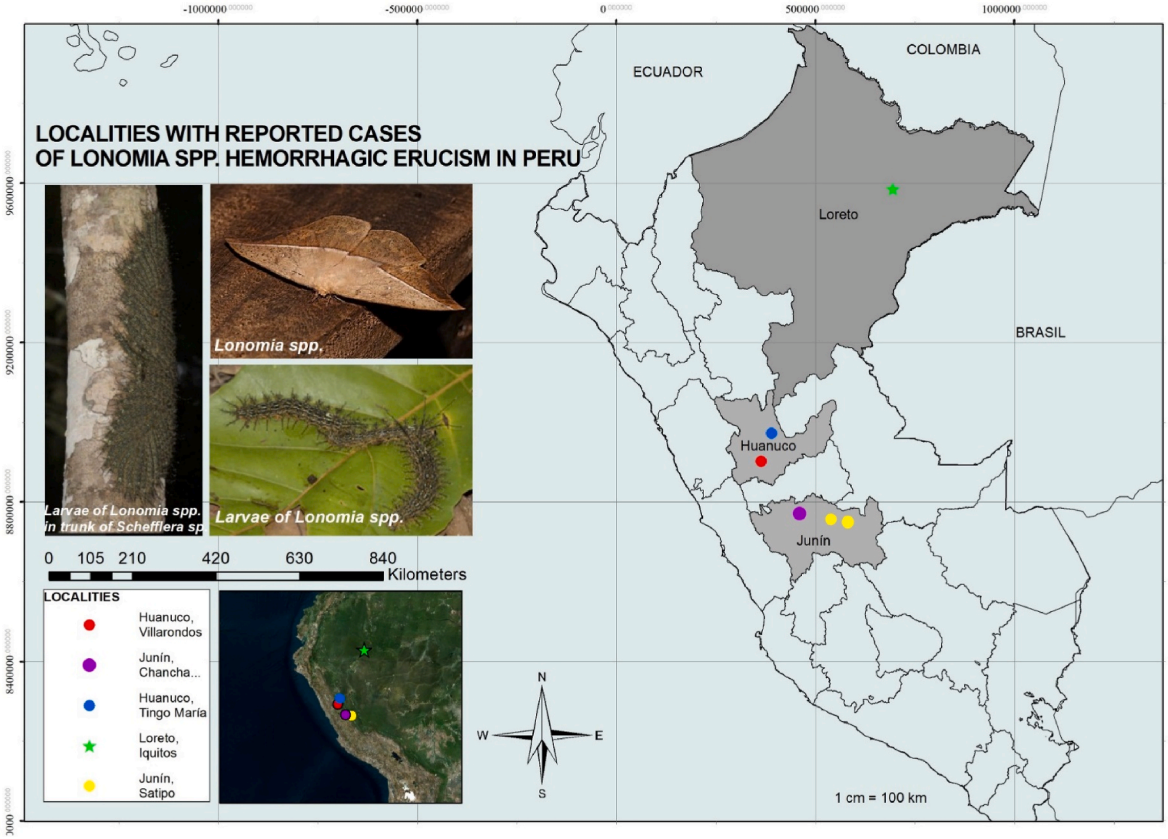


**Fig. 1.** *Lonomia* spp. encountered by our patient (A and B). The gregarious nature (A) may lead to contact with large number of caterpillars exposing individuals to a considerable amount of venom. Adult Lonomia moth (C). The maps illustrate the location of the cases of lonomism reported in Peru.

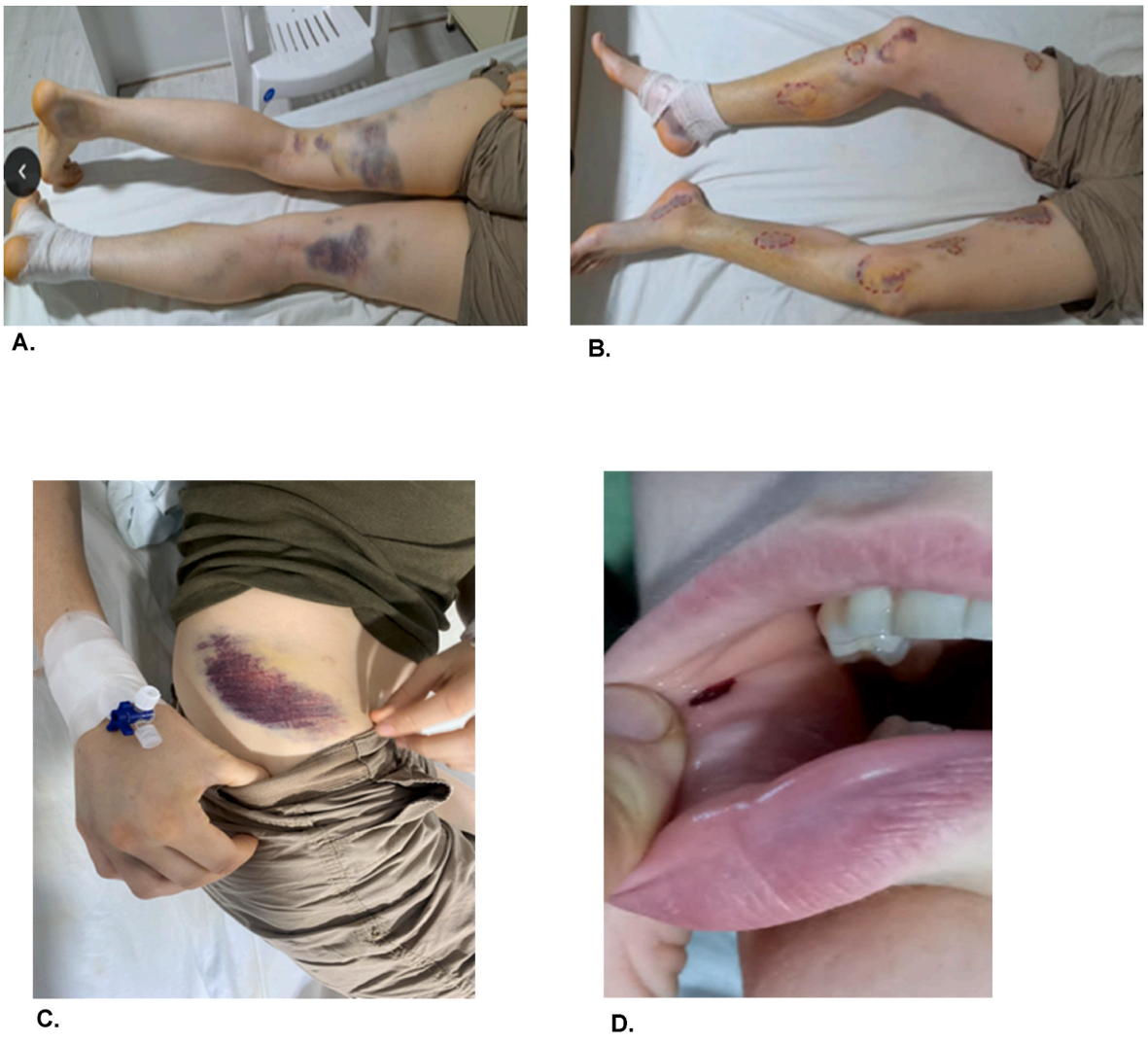


**Fig. 2.** Hemorrhagic manifestations present at admission involving both of her legs (A and B), right iliac crest (C), and the oral mucosa (D).

until normalization of the coagulation parameters. More importantly, whole blood or fresh frozen plasma is contraindicated as it can exacerbate consumptive coagulopathy [18]. Antivenim was first developed by the Butantan Institute in Brazil in 1996 and is effective when administered 12–24 h after envenomation. It is indicated when there is evidence of bleeding, with doses varying between five and ten vials depending on the severity of presentation. Each 10 ml vial contains heterologous F (ab') 2, neutralizing approximately 3.5 mg of *L. obliqua* venom [8,27,28]. The lethality in the absence of treatment is approximately 1.5–2 %, three to four times that of snakebites [24]. The antivenin can be obtained from the Butantan Institute in Sao Paulo, Brazil, or the National Institute of Health of Colombia. Contact information: https://en.butantan.gov.br/about-envenoming.php and https://www.ins.gov.co/Direcciones/Produccion/Paginas/Suero-antiofidico-polivalente.aspx, respectively.

We describe the first cases of lonomism from the Amazon Region of Loreto in Peru and the second travel-related case in the literature. The only described travel-related case involved a Canadian citizen who had visited Peru and unfortunately died as a result of the envenomation [12]. According to biologists from the Loreto Regional Hospital and based on their appearance, the *Lonomia* species responsible for the envenomation in our case was likely other than *L. obliqua* or *L. acheoulus*. Unfortunately, we did not have a specimen for further identification and analysis.

Lonomism is likely an underappreciated condition in many of the Peruvian Amazon's local indigenous and riverine communities due to their difficulty in accessing healthcare facilities [8]. Deforestation and human encroachment in the fringes of biodiversity-rich areas increase the risk of interaction between populations and wildlife. Occupational and accidental exposure to caterpillars is thus predicted to occur as their distribution increases in areas closer to populated areas due to the loss of their natural habitat and attraction to the lights of human settlements, increasing the potential for occupational exposure [6,29]. The burden of erucism in rural tropical areas is undoubtedly underestimated, underscoring the need to improve surveillance of an emerging public health problem in the Americas [2,6,23,30].

## 4. Conclusion

More reported cases of caterpillar-induced hemorrhage are expected as deforestation, forest degradation, and global warming continue to go unchecked. It is, therefore, essential for healthcare professionals around the globe to be acquainted with this emerging public health problem. Prompt recognition and administration of antivenom are crucial to ensure a favorable outcome. There is an urgent need for countries at risk of lonomism to develop and maintain a national stockpile of the life-saving antivenin. Hemorrhagic erucism should be considered in the differential diagnosis of hemorrhagic syndromes in the tropics.

**Table 1**
Reported cases of Lonomism in Peru.

| Year of the Incident (ref.) | Locality | Gender | Age (years) | Clinical Manifestations, Treatment, and Outcome |
|---|---|---|---|---|
| 2006 [13] | Satipo, Junín | Female | 32 | **Presentation**: generalizing pain, nausea, vomiting ecchymosis, gingivorrhagia **Treatment**: supportive. No antivenom used **Outcome**: full recovery |
| 2007 [14] | Chanchamayo Junín | Female | 12 | **Presentation**: pain at the inoculation site, vomiting, headache, epistaxis, and ecchymosis. **Treatment**: blood transfusion and transfer to reference hospital **Outcome:** unknown |
| 2008 [12] | Northeastern Peru | Female | 22 | **Presentation**: headache, ecchymosis, acute kidney injury, respiratory distress due to alveolar distress, microangiopathic hemolytic anemia, and disseminated intravascular coagulation **Treatment**: supportive, invasive mechanical ventilation, and antivenom **Outcome**: death |
| 2010 [10] | Villarondos, Huánuco | Female | 5 | **Presentation**: vomiting, fever, epistaxis, hematemesis, gingivorrhagia, ecchymosis **Treatment**: supportive requiring admission to the intensive care unit, and antivenin **Outcome**: full recovery. |
| 2014 [15] | Tingo María, Huánuco | Male | 10 | **Presentation**: pain at the inoculation site, right hip pain, shortness of breath, hemarthrosis, hemopericardium, acute gastrointestinal bleeding, hematuria **Treatment**: supportive requiring admission to the intensive care unit. Antivenin **Outcome**: full recovery |
| 2020 [16] | Satipo, Junín | Male | 48 | **Presentation**: pain at the inoculation site, headache, abdominal pain, ecchymosis, gingivorrhagia and intracranial hemorrhage **Treatment**: supportive and antivenin **Outcome**: full recovery |

## CRediT authorship contribution statement

**Edgar A. Ramírez García:** Writing – review & editing, Writing – original draft, Investigation, Data curation, Conceptualization. **Maria José Valentina Canchanya-Olimar:** Writing – original draft, Investigation. **Mariana Rojas del Águila:** Writing – original draft, Methodology, Data curation. **Nelson Iván Agudelo Higuita:** Writing – review & editing, Writing – original draft, Data curation, Conceptualization. **Andrés F. Henao-Martínez:** Writing – review & editing, Writing – original draft. **Carlos Franco-Paredes:** Writing – review & editing. **Luis A. Marcos:** Writing – review & editing, Conceptualization. **Juan C. Celis Salinas:** Writing – review & editing. **Martín Casapia Morales:** Writing – review & editing, Writing – original draft.

## Disclosures regarding real or perceived conflicts of interest

None.

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## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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