



Case Report

Systemic illness with eosinophilia and urticaria-like rash caused by prolonged bedbug exposure

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ABSTRACT

Bedbugs are blood-feeding nocturnal ectoparasites, which are well-adapted to human habitats. In recent decades, bedbug infestation has been an emerging health problem worldwide, affecting all socio-economic population strata. The clinical presentations of bedbug exposure are variable, ranging from simple pruriginous bite lesions to severe cutaneous and systemic manifestations. Diagnosis is challenging and depends on awareness, clinical experience, and a thorough medical history. In our case, cutaneous lesions were accompanied by severe systemic symptoms and hypereosinophilia, leading to prolonged illness and hospitalization. The differential diagnosis of such presentations should include bedbug exposure, to avoid long-lasting disease, unnecessary diagnostic procedures, and the associated psychological burden for the patient.

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Introduction

Bedbugs (family: Cimicidae; order: Hemiptera) are obligatory blood-feeding nocturnal ectoparasites of worldwide distribution. Humans are parasitized by two species, *Cimex lectularius* (common bedbug) mainly in temperate climates and *Cimex hemipterus* (tropical bedbug) predominantly in subtropical and tropical regions [1,2]. Adults have oval-shaped flat bodies with a length of 5–7 mm. Bedbugs have a live span of 6 to 12 months and are well adapted to human dwellings. They infest microenvironments such as cracks in furniture, mattresses, curtains, carpets, wallpaper, and electric outlets, where they can survive 80–140 days without feeding [3].

In the last five decades, a massive resurgence of bedbugs has been recognized in most parts of the world, including high-income countries [2]. The epidemiology of cimicids in South America is not well understood; in Chile, however, the distribution of bedbugs is wide, now reaching down to the southernmost Magallanes Region [4]. The assumed main reason for the emergence and reemergence is their growing resistance to pesticides [3]; other factors in-

clude inadequate pest control programs, the increased travel market and second-hand furniture trade, and the decreased infestation of housing with natural predators such as spiders, ants, and cockroaches [5,7,9]. The bedbug “epidemic” does not only generate health problems but also causes economic damage due to the enormous costs of housing sanitation and negative effects on the tourist industry [2].

Bedbug bites are painless but frequently result in local immune reactions to saliva components, manifesting as erythematous maculopapular or urticarial-like lesions (wheals), from <5 mm to several centimeters in diameter, frequently accompanied by pruritus. Typically, groups of three (or more) bite lesions appear in a linear, curvilinear or zig-zag pattern (“breakfast, lunch and dinner”), mainly in exposed areas such as arms, forearms, legs, and ankles [5,6,9]. More severe local or systemic reactions are infrequent but possible. Although bedbugs may harbor various pathogenic microorganisms (e.g., *Trypanosoma cruzi*, *Rickettsia rickettsii*, *Coxiella burnetii*, *Borrelia recurrentis*), there is no evidence for their vector capacity [8].

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Case presentation

A 38-year-old Chilean woman presented in Santiago with a 6-month history of recurrent pruriginous rash, lasting for several days. For 3 months, she also suffered fatigue, night sweats, headache, arthralgia, diffuse abdominal pain, loss of appetite, and a weight loss of 4 kg. The woman worked as a software engineer and had recently moved to Concepción, where she lived with her family and a pet dog. She had traveled to the USA and Europe (>2 years ago) and to Latin America and south-east Asia (>5 years ago). Past medical history included Lyme disease, treated in Europe 12 years ago, and an allergy to gadolinium-based contrast agents. During initial evaluation, the patient described malaise and tiredness; physical examination showed pallor and discrete generalized weakness. Her skin was normal, but she presented several photos showing disseminated urticaria-like lesions (Figure 1, upper row). A complete blood count revealed eosinophilia (1510 cells/ μ L, 22%). Further laboratory exams including liver panel, urinalysis, inflammatory markers, and broad panel of immunological and autoantibody tests were normal. Chronic infections (hepatitis B and C, syphilis, HIV, Lyme borreliosis, toxoplasmosis) and helminthic diseases (*Toxocara* spp., *Fasciola hepatica*, *Trichinella spiralis*, *Strongyloides stercoralis*, *Schistosoma* spp.) were ruled out by serological and parasitological exams. With persisting symptoms, the patient was referred to hematology and hospitalized. Due to her persisting complaints, a PET-CT and a transthoracic echocardiogram were performed, which were unremarkable. Bone-marrow biopsy showed a mild reactive eosinophilia, and an analysis for FIP1L1-PDGFR fusion gene was negative. Eosinophilic fasciitis (Shulman's syndrome), associated with Lyme disease, and eosinophilic cellulitis (Well's disease) were discussed as possible etiologies. A dermatologist recommended a biopsy if skin lesions reoccur, and the patient was discharged with symptomatic treatment (acetaminophen). Two weeks later, the patient presented with increasing left-sided headache and photophobia, dizziness, bouts of

blurred vision, and mild iron deficiency anemia. Other systemic complaints and urticaria-like lesions as well as eosinophilia were persistent. A cerebral MRI and 4-limb electromyography were performed, without pathological findings. Due to her chronic pain, fatigue, and anxiety, she received psychological and psychopharmacological treatment (duloxetine, amitriptyline). Subsequently, a biopsy of a skin lesion was taken, showing acanthosis, mild spongiosis, exocytosis of lymphocytes and neutrophils, edema of the papillary dermis, and mild superficial and deep perivascular lymphocytic infiltrate without vasculitis.

The patient returned after 1 month, reporting that she had discovered a multitude of insects in her bed's base (Figure 1, lower row). She had purchased the bed about 3 weeks before the onset of skin lesions. The bed was in her residence in Concepción, where she commuted to from Santiago for work reasons. Insects were identified as adults and nymphs of *Cimex lectularius* (common bedbug). After she changed her bed and contracted a professional pest management company, she recovered from her illness without recurrence of symptoms or sequelae.

Discussion

Bedbug attacks typically cause multiple pruriginous skin lesions, similar to other insect bites. More severe manifestations include bullous lesions, regional lymphangitis, and secondary skin infections [10]. Some severe cutaneous lesions have shown signs of severe vasculitis similar to Churg-Strauss syndrome [11]. Associated sleep deprivation and psychological problems are frequent but underestimated [12]. Systemic manifestations are very rare and caused by two pathophysiological mechanisms; (1) chronic blood loss resulting in iron deficiency anemia, which seems associated with cognitive impairment, mental illness, and substance abuse [13], and (2) severe systemic allergic responses, leading to asthmatic reactions and anaphylaxis [10]. Multisystemic illness, as occurred in our patient, has only been described twice: in a German



Figure 1. Upper row shows urticaria-like skin lesions, which appeared intermittently over 9 months. Lower row showing multiple nymphal instars and adults of *Cimex lectularius*, collected from the patient's bed base.

patient with bullous lesions, low-grade fever, and general malaise [14], and a case from France with typical bite lesions, accompanied by fatigue, fever, arthralgia, and hypereosinophilia [15]. It has been proposed that repeated bites can cause a serum sickness-like reaction (SSLR), responsible for such severe manifestations [6,10]. Our case was clinically and histologically compatible with this hypothesis [16].

Bedbugs are reclusive night-active ectoparasites and often remain unrecognized. Since lesions are variable and do not differ from those of other insects, the dermatological diagnosis is challenging [10]. This problem is even more apparent if, as in our case, skin changes are transient and only visible in photos taken by the patient. Recognition depends on the awareness and experience of health care personnel and a thorough medical history, which should include travel history, changes of sleeping place, acquisition of furniture, and symptoms within the household group [5]. Due to the lack of training, the management of bedbugs is often delayed, leading to prolonged exposure and further spread of the ectoparasite [17]. Diagnosis is straight forward if patients detect bedbugs or their fecal matter in or around beds. Atypical or severe cases pose far more diagnostic difficulties and may involve a broad range of medical specialties, as shown in our case. The differential diagnosis of patients presenting with systemic symptoms and/or eosinophilia is broad and might not include ectoparasitic infestation. As diagnostic tests for *Cimex* exposure are lacking, the conundrum might be difficult to unravel and at the end often relies on patients' self-diagnosis [10].

In conclusion, our case highlights that prolonged bedbug exposure can cause severe systemic illness and hypereosinophilia. In such cases the pattern of skin lesions together with a meticulous anamnesis of recent living and sleeping conditions can give crucial diagnostic clues. In suspected cases, patients should be advised to search for signs of these arthropods in typical microhabitats or seek professional help to detect the infestation by trained sniffer dogs or bedbug traps [3,18], to avoid prolonged illness and unnecessary medical procedures.

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Patient consent

The patient provided written informed consent for the use of clinical data and graphic material.

Author contributions

I. B. W. wrote the original draft of the manuscript and performed the literature search. V. P. and M.S. contributed to the clinical

care of the patient. A.C. performed the histopathological analyses. T. W. contributed to the conceptualization, supervision, and visualization of the manuscript. All authors contributed to the review and editing of the manuscript.

Declaration of competing interest

The authors have no competing interests to declare.

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