On the rise worldwide: Bed Bugs and Cimicosis

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Abstract
After they became rare in developed nations over some 30-50 years ago, bed bugs have dramatically increased in incidence and rapidly spread worldwide over the last two decades. Insecticide resistance along with an increase in travel and trade are thought to be the main contributing factors for the resurgence of this public health pest. Bed bugs are not only a hotelier's nightmare, but they have also conquered many a private home.

Keywords: bed bugs, insecticides, bullae, hygiene, cimicosis

Introduction

Bed bugs belong to the family Cimicidae and there are two species involved in the modern resurgence; the Common bed bug, Cimex lectularius and the Tropical bed bug, Cimex hemipterus. They are wingless insects with an oval-flat shape that allows them to hide in narrow cracks and crevices. The adults are dark brown, 4-5mm long, becoming to around 10mm when fully blood-engorged. There are five smaller juvenile stages (nymphs) that are similar in appearance, although lighter in colour. All nymphs require a blood meal to moult to the next stage, and both adults also bloodfeed for nutrition, and egg development in the case of the female. Bed bugs are solely haematophagous ectoparasites. After feeding they return to a harbourage and do not remain on the host. The main hosts are humans, but pets, bats, and birds may act as secondary hosts.

Epidemiology

In the past, bed bugs were particularly an affliction of the poor. However, in the early part of the modern resurgence it was the tourist areas and the hospitality sector that were initially impacted.1-3 Today, bed bugs have conquered quite diverse locations, ranging from hospitals, hotels and homes, to trains, cruise ships, and even airplanes. Most commonly, bed bugs travel in comfort as stowaways in luggage, although they can be transferred via furnishing and other belongings, as well by spreading to adjoining properties. After feeding they return to a harbourage and do not remain on the host. The main hosts are humans, but pets, bats, and birds may act as secondary hosts.

There has been long speculation whether bed bugs can transmit diseases, and in fact more than 40 different pathogens have been implicated. This has included Hepatitis B and C viruses, Human Immunodeficiency Virus (HIV), and Coxiella burnetii (Q fever). Recently, research has indicated that bed bugs are capable of transmitting the agent of Chagas Disease, Trypanosoma cruzi, in the laboratory. However, to date there is not one piece of evidence that bed bugs have transmitted any pathogen to humans.4,6

Clinical Features

During the act of feeding, saliva is injected which contains a variety of anticoagulants as well as other proteins whose function has yet to be determined. Contrary to popular belief, there is no evidence that bed bugs inject an anaesthetic. One protein, Nitrophorin, is involved in the transport of nitric oxide into the wound. This results in local vasodilation that increases blood supply to the feeding insect. The same protein can also induce a sensitivity to the bite.6
Table 1. Bed bug infestation

<table>
<thead>
<tr>
<th>Bites on the body</th>
<th>Wheals, 4-6cm in diameter, lines of bites</th>
<th>Any exposed body part</th>
<th>Often intense itching</th>
<th>Occasional central haemorrhage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bed Sheet, mattress (clothing)</td>
<td>Small blood spots</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Droppings (black dots)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Shed nymphal skins</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Eggs, small (~1mm in length), white, oblong, glued to the substrate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Space</td>
<td>Pungent smell (most commonly noticed when an insect is squashed, or during the control program)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Table 2. Differential diagnosis of epidermatozoonoses

<table>
<thead>
<tr>
<th>Bite preference</th>
<th>Pattern</th>
<th>Itching</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bed Bugs</td>
<td>Any exposed parts of the body, arms, legs, face, torso</td>
<td>In small infestations, bites will be random. In larger infestations, bite can occur in lines along the limbs and across the shoulder. Large wheals (up to 6cm across) may form, even some 14 days after the bite</td>
<td>Often intense, especially in the morning, but can be variable between individuals</td>
</tr>
<tr>
<td>Fleas</td>
<td>Exposed parts of the body, especially the legs</td>
<td>Random, usually not grouped or in lines</td>
<td>During the day</td>
</tr>
<tr>
<td>Mosquitoes</td>
<td>Exposed skin, particularly legs and arms</td>
<td>Random</td>
<td>Variable between individuals</td>
</tr>
<tr>
<td>Ticks</td>
<td>Potentially anywhere on the body</td>
<td>Erythema migrans with Lyme disease. Localised macules/papules at the bite site may occur</td>
<td>Low / no</td>
</tr>
<tr>
<td>Itch Mites (Scabies, Sarcoptes scabiei)</td>
<td>Forearms, inter digital, genital area</td>
<td>Skin rashes, subcutaneous courses</td>
<td>At night</td>
</tr>
<tr>
<td>Harvest mites (Trombidiosis)</td>
<td>Skin surfaces under tight clothing</td>
<td>Red macules and wheals</td>
<td>Severe itching</td>
</tr>
<tr>
<td>Cheyletiellosis</td>
<td>Arms and trunk, contact points with pets</td>
<td>Polymorphic rash</td>
<td>Variable</td>
</tr>
<tr>
<td>Bird mites (Pediculosis)</td>
<td>All over</td>
<td>Macular rash</td>
<td>Variable itching</td>
</tr>
<tr>
<td>Head Lice (Pediculosis)</td>
<td>In the hair of the head</td>
<td>Bar-shaped scratch effects with lichenification and hyper-pigmentation (Vagabond’s disease)</td>
<td>Night and day, generally mild itching</td>
</tr>
<tr>
<td>Spiders, e.g. long-legged sac spiders</td>
<td>Arms, face</td>
<td>Necrotic lesion at bite site</td>
<td>Immediate severe pain, no itching</td>
</tr>
</tbody>
</table>

The diagnosis of Cimicosis is via the clinical appearance of the bite reaction and confirmation of an actual bed bug infestation (Table 1). The most commonly affected body parts are those that are left uncovered during sleep (Fig. 2, 3, 4), notably the arms, shoulders and legs. In young children, the face and even the eyelids can be bitten. Rarely, however, armpits are bitten, which are often preferred by other insects and ticks (Table 2).

The degree of the bite reaction often depends on the level of prior exposure. With low level sensitization, individuals may develop a 1-2 cm wheal, with a small central haemorrhagic point. This haemorrhagic point can be recognized easily by diascopy. In contrast, a highly sensitized person will react immediately and may develop a wheal up to 15cm across (6 inches). If many bed bugs are present, an urticarial rash may develop as a result of the large number of bites and subsequent trauma to the area from scratching. On rare occasions, vesicles and bullae (Fig. 5) may form on the arms and legs. In the course of Cimicosis, papules that are extremely itchy may develop and can persist for several days to weeks. Due to the strong pruritus eczematous lesions, bacterial infections may occur, although this is extremely rare. There are case reports of systemic reactions such as anaphylaxis and asthma, although these are uncommon.
Through repeated exposure, some individuals may develop a tolerance to the bites. The clinical symptoms are then largely inapparent with small punctures at the bite site. Small blood spots are then the only clues that an infestation may be present.

**Differential Diagnosis**

Since reactions to stings and bites of various arthropods are non-specific, bed bug bites are commonly misdiagnosed. Single bites, notably that of other insects such as mosquitoes, fleas and biting midges may appear very similar morphologically (Table 2).

Consideration of where the bites are on the body can assist in the differential diagnosis. For bed bugs, lines of bites are very common in moderate to large infestations and this clinical picture is virtually unique amongst blood sucking arthropods. For the most part, the identification of the actual pest is required to confirm the diagnosis. Histologically, bed bug bites...
The lesions can show a central haemorrhagic point. These do not show a central haemorrhagic point in the lesion which allows a correct diagnosis. However, in young children the diagnosis can sometimes be difficult.

**Treatment**

The treatment of *Cimicosis* is symptomatic. Local lesions can be treated with antipruritics e.g. Polidocanol 2-4% in Lotio alba (aqueous lotion) and topical antiseptic. Spirit of menthol may also be helpful. Local treatment with antihistamines is controversial. In severe reactions topical glucocorticoids such as Betamethasone may be required. In severe itching, the use of oral anti-histamines is recommended. With infected bites, antibiotic therapy may be required. Uncomplicated bed bug bites tend to stop itching within 1-2 weeks, although temporary scarring from the bite may remain for several months.

**Management**

Treatment of patients with bed bug bites ultimately comes down to removing the source of the irritant, namely the eradication of the active infestation. Bed bugs have a typical pungent odor. This can be used to detect bed bugs through specially trained sniffer dogs that can rapidly locate the insects. Due to insecticide resistance, bed bugs are very difficult to control with traditional insecticides alone, and non-chemical means of eradication must be employed to reduce the overall insect biomass. Bed bug control should be undertaken by professionals trained in bed bug management, and the process may take some weeks to achieve.

**Prevention**

When travelling (1) always inspect the bed and surrounds for bed bugs hiding beneath the mattress and/or in seams of the bedding. Also, look for blood stains or small black dots (Figure 6, Table 1). (2) If present, request another room. (3) Always keep your luggage on the desktop or the luggage rack. A good preventative is to seal luggage in plastic or garbage bags during travelling, even when in transit. (4) When returning home, all clothing should be washed in at temperatures exceeding 60°C or frozen for one week with delicate fabrics. If there is no choice, then repellents containing N, N-Diethyl-meta-toluamide (DEET) should reduce the biting rate, but will not completely prevent all bed bug bites.15,11

Bed bugs can enter homes via an array of additional ways, particularly from objects bought second hand at flea markets or thrift stores, for example wooden frames, vintage clothes, furniture and the like. These should be heat-treated for a minimum of 10-20 minutes to kill bugs and their eggs.

**Competing Interests**

None declared

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**References**
