Clinical and histopathological study of Simulium (blackfly) dermatitis from North-Eastern India – a report

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Abstract

Background Simulium dermatitis is a common problem in humans and animals in areas where Simulium species occur. It is characterized by chronic eruptions of pruritic papules, vesicles, and erythematous wheals resulting from a hypersensitivity reaction to biting of simuliiids or blackflies. It can result in severe skin complications where the man-biting species of Simulium are available.

Materials and methods We report two clinical cases of Simulium dermatitis from the North-Eastern region of India. Histopathological study was carried out in one of the cases and the other one was successfully treated with medication.

Results Clinical features like intense itching, which accompanies the eruption, resulting in excoriations, scarring, and permanent hyperpigmentation were reported. Histopathological study revealed the characteristic features of Simulium bite reaction, such as vesicles filled with serous fluid, dermal edema, and perivascular infiltrates rich in eosinophils and lymphocytes.

Conclusion The clinical manifestations and severity of Simulium dermatitis are serious matters of concern in hypersensitive persons.

Introduction

Simulium, commonly known as blackfly or buffalo gnat or Turkey gnat, is a member of the family Simuliidae of the Culicomorpha infraorder. Geographically, from the Tropics to the Arctic Circle, these stout-bodied little insects are found by millions wherever running water is present for larval growth.1

Blackflies are severe biters and have been found to cause allergic reactions. They are very active during daylight hours. The bite is usually inflicted on the lower extremities of the body.2 It has been well stated that perhaps no other insect of equal size can inflict so painful a bite as blackfly. Both domesticated animals and man are viciously attacked. The extreme pain, intense itching, and the resultant local swelling are often accompanied by complications that indicate the presence of an active toxin. Death appears to result from a toxemia caused by the bite or as a result of anaphylaxis.3

In the Oriental Region, several man-biting simuliiid species have been known, for example Simulium (Simulium) indicum Becher, 1885, widely distributed at the southern foot of the Himalayas, from Pakistan in the west, through India and Nepal to Myanmar and Southern China in the east.4-5 Here we report two cases of Simulium dermatitis discussing the clinical and histopathological features.

Case reports

In February 2010, two persons were attacked by a swarm of small flies near a stream known as “Sessa Nullah” at Sessa (altitude: 3250 m; latitude: 27°06’00” N and longitude: 92°24’00” E) of West Kameng District of Arunachal Pradesh, North-East India. The flies were later identified to be Simulium (Simulium) indicum Becher, a notorious man-biting species of simuliiid found in the Oriental Region.

Case 1

A 47-year-old light pigmented woman with no personal or family history of atopic dermatitis or other skin disorders was attacked by Simulium flies. She did not notice the bites until several hours had passed, and then she found small wheals with hemorrhagic centers on the lower legs. Within a short period of time, the wheals rapidly enlarged, and erythematous and mildly edematous papules were noticed at the site of the bite. Intense and...
persistent itching further complicated the reactions. The area became sore and painful, purpuric, and pruritic lesions were observed (Fig. 1). The patient consulted a physician for treatment, and the symptoms were diagnosed as superficial dermatitis. She was treated with a topical fluorinated corticosteroid and an oral antihistamine. The lesions healed slowly over a period of three weeks with desquamation and slight hyperpigmentation.

**Case 2**

A 26-year-old light pigmented girl was attacked by a blackfly. A drop of blood was noticed at the site of the bite on the posterior ankle of the right leg. Some hours later the area where the drop of blood was spotted showed severe inflammation and became erythematous and so acutely tender that walking was difficult. The temperature of the site rose and fever appeared. There was no family or personal history of skin diseases with the same manifestations. After 24 hours, a skin biopsy from the site of the bite was obtained for histopathological studies.

The excision biopsy of the skin showed orthokeratinization of the epidermis (Fig. 2). The dermis showed granular degeneration and focal fragmentation of the collagen fibers, interstitial edema, and infiltration with lymphocytes and eosinophils. The dermis showed periadnexal lymphoplasmacytic infiltrate with eosinophils. The cellular infiltrate was more pronounced around the blood vessels, nerves, and glands. Intraspinous vesiculation occurred in the epidermis. The vesicles were located beneath the horny layer and contained serous fluid and occasionally red blood cells and eosinophils. The capillaries were dilated and congested. There was a marked perivascular infiltration by lymphocytes and eosinophils. The infiltration and interstitial edema had spread and reached deeply as far as the subcutaneous tissues with septal inflammation.

The biopsy site was cleaned with full-strength hydrogen peroxide daily, and bacitracin ointment was applied to the wound site. The wound was covered daily with a non-stick pad. Once the sutures were removed, the surgical site required no special treatment. Because the area remained a little crusty, petroleum jelly and bacitracin were applied until the wound had healed. The surgical site continued to heal over the next 1–2 months. Unlike the first case, there was no hyperpigmentation observed at the site.

**Discussion**

Insect bites and the associated hypersensitivity reaction or papular urticaria are widely observed throughout the world. Although it is a common problem, *Simulium* bite-induced hypersensitivity is less studied, and only a few reports are available. The present case reports have described *Simulium* bite reactions in humans from North-Eastern India for the first time.

Unlike the mosquito bite, one cannot sense the bite of *Simulium* until itching starts or bleeding occurs in some cases. It is believed that at least two substances are injected with the stabbing mechanism; one of them is...
thought to have anesthetic properties as these attacks are not usually detected for several hours, at which time hemorrhagic lesions are noted at the bite site. The second substance is thought to be a protein acted upon by enzymes contained in eosinophilic granulocytes.

Previously reported histopathological findings in insect bite-induced hypersensitivity reaction have been shown to vary with the particular arthropod, age of the lesion, and sensitivity of the patient. Characteristic insect bite lesions demonstrate prominent papillary dermal edema and perivascular lymphocytes, eosinophils, and neutrophils. Vesicular lesions show intraepidermal and subepidermal edema and, occasionally, some hemorrhage. In addition, there may be superficial and deep perivascular and interstitial infiltrate with variable density of lymphocytes and eosinophils present.

The *Simulium* bite reactions are also found to differ among individuals, and the severity depends on the individuals’ sensitivity and immune response. Two distinct reaction patterns have been observed in the present report. The first consisted of pruritic, erythematous vesicular patches with associated lesions (Fig. 1); the second type consisted of edematous, acutely tender, and erythematous bite sites.

The histopathological study performed in the second case is supported by the findings of some previous workers, and the results are comparable. Gudgel and Grauer (1954) have reported the clinical history and findings in several cases of reaction to the bites of blackfly in Japan. They also reported that pruritis was especially intense after these bites, and lesions were kept raw with retarded healing due to excoriation. Their biopsies were made at six weeks and seven months, and showed marked epidermal changes including hyperkeratosis, parakeratoses, serious crust, intracellular edema with true vesicle formation, elongation of rete pegs and papillae, plus a chronic round cell infiltrate containing eosinophils with predominating distribution around blood vessels and glands and extending throughout the corium.

Stokes (1914) performed biopsies on 4-hour, 24-hour, 5-day and 18-day-old lesions caused by *Simulium* bites. He found that the principal changes were in the corium and consisted of vascular dilatation, edema, and polymorphonuclear leukocytic perivascular infiltrate with an early high eosinophilia but, in older lesions, an increase in mast and small round cells was noted. The epidermis showed edema and “pseudovesicles” as well as an occasional true vesicle.

Large blackfly populations and strong bite reactions can be life threatening and have been reported to kill domestic animals as well as humans; injection of venom into the skin causes intense itching, local swelling, and soreness. The flies’ bites are painful due to the release of pharmacologically active substances, such as histamine, leukotrienes, prostaglandins, platelet-activating factors and eosinophilic chemotactic factor, and IgE-sensitized basophils and mast cells after contact with antigens in the flies’ saliva. In hypersensitive person, bites can be fatal.

Continued and repeated exposure to the inciting antigen results in not only immediate skin reactions but also a cycle of delayed-type hypersensitivity-mediated lesions. From a medical perspective, *Simuliiidae* are particularly important as vector of filaroid nematode *Onchocerca volvulus*, which causes “river blindness” in humans in Africa, Central and South America (Wolf et al., 1990); however, various reports on *Simulium* dermatis made it noteworthy to consider this as a serious problem. Fortunately, there are no known cases of onchocerciasis in North-Eastern India – particularly in Arunachal Pradesh, although cases of *Simulium* dermatis are frequent.

The present study revealed that the fly has the ability to cause rapid and extensive pathology in human, livestock, and wildlife. Areas of future investigation might include the underlying immunological features of *Simulium* bite reaction and characterization of the components of saliva of the fly, which is responsible for the discussed pathogenesis.

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