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Ashwini A
Department of Veterinary Medicine, Veterinary College Hassan, Hassan, Karnataka, India

Deepa Chirayath
Department of Veterinary Clinical Medicine, Ethics and Jurisprudence College of Veterinary and Animal Sciences, Mannuthy, Thrissur, Kerala, India

Chetan Kumar GK
Department of Veterinary Medicine, Veterinary College Hassan, Hassan, Karnataka, India

Corresponding Author:
Ashwini A
Department of Veterinary Medicine, Veterinary College Hassan, Hassan, Karnataka, India

Flea allergy dermatitis in cats-clinical signs, diagnosis using intradermal skin test and treatment

Ashwini A, Deepa Chirayath and Chetan Kumar GK

Abstract
Flea allergy dermatitis (FAD) is considered to be the most common skin hypersensitivity disorder of cats in geographical regions where fleas are endemic. The clinical signs and feline cutaneous reaction patterns observed in flea allergic cats are not pathognomonic for FAD and may also occur in other ectoparasitic infestations or other allergic dermatologic disorders (Scott, 2001). Hence, there is a need for diagnostic test, which can establish whether cats have allergic sensitization to fleas and to assist clinicians in ruling in or ruling out FAD as a possible aetiology of pruritus and other dermatologic signs in cats. Intradermal skin test (IDST) using flea allergenic extract as test antigen, histamine as positive control and saline as negative control is the principal test in diagnosing FAD. This study also helps to evolve a better diagnostic and therapeutic protocol for dermatologic disorders especially of FAD in cats.

Keywords: Cat, FAD, IDST, flea allergen

1. Introduction
The dermatologic diseases in cats can be broadly categorized into parasitic, bacterial, fungal, viral and protozoal skin diseases, hypersensitivity disorders, autoimmune and immune mediated dermatoses, endocrine and metabolic diseases, congenital and hereditary defects, nutritional skin diseases, cutaneous neoplasms and miscellaneous skin diseases (Miller *et al*., 2013) [4]. Fleas are the insects of the order Siphonoptera. Fleas are primary ectoparasites, which cause discomfort, allergic manifestations and anaemia. They have an efficient vectorial ability for various pathogens. Adults of *Ctenocephalides* spp. may cause iron deficiency anaemia in puppies and kittens. Adult animals may suffer from blood loss and chronic anaemia in long standing cases (Traversa, 2013) [9]. More than 2000 species of fleas are identified, out of which *Ctenocephalides felis* is the most common species, accounted for 90 and 99 per cent of infestation and allergy in dogs and cats respectively. Other species of fleas included *C. canis*, *Pulex irritans* and *Echidnophaga gallinacean* (Dryden and Rust, 1994) [2]. Allergies in cats have not yet been well defined. Hence it is difficult to make an equivocal diagnosis of allergy in this species. Another reason is that, the clinical manifestations of allergy in cats are not as site specific as in dogs. Flea allergy dermatitis is the most frequently encountered dermatologic disease associated with fleas in geographical regions endemic to fleas. These have manifested with different clinical signs and have many possible differential diagnoses (Noli, 2009) [5]. Intradermal skin test using allergens derived from whole fleas is one of the principal tests for diagnosis of flea allergy dermatitis in cats. Allergens are available commercially from a variety of manufacturers. Intradermal skin test using allergens derived from whole fleas was one of the principal tests for diagnosis of FAD in cats

2. Headings and Footnotes
2.1 Materials and Methods
Dermatologic cases suspected for flea allergy dermatitis (FAD) were subjected for intradermal skin test using flea allergenic extract as test allergen, histamine as positive control and phosphate buffered saline as negative control.

2.1.1 Intradermal skin test
Cats suspected for FAD were physically restrained with the owner's consent. Intradermal skin test was performed using aqueous flea allergenic extract of the *Ctenocephalides* spp. as a test allergen, histamine phosphate as a positive control and phosphate buffered saline as a negative control. Results were read after 15 minutes. Owners were advised to observe the site after 24 hour for the presence of any delayed reactions. The positive cases were subjected to detailed

study. Therapy was initiated with topical selamectin spot-on. Glucocorticoids and antihistamines were given to reduce pruritus and inflammation and to hasten recovery. Response to treatment was evaluated clinically after one week.

2.1.2. Materials used for IDST

1. Flea antigen at 1:1000 w/v (final concentration) was used as test allergen.
2. Histamine at 1:100,000 w/v was used as positive control.
3. Phosphate buffered saline (diluent) was used as negative control
4. Sterile 1 ml tuberculin type syringes with 26 gauge needles, ½ inch length

All intradermal skin testing reagents were held at approximately 4 ºC before use.

2.1.3 Procedure

Selected cats were physically retrained without any sedation. The inguinal area was prepared by clipping gently. The site was cleaned with 70 per cent alcohol and allowed to dry by evaporation. Injection sites were marked with felt-tipped pen. The injection sites were at least 2.5 cm apart from each other. A volume of 0.05 ml of each reagent was injected intradermally by gently stretching the skin around the test site using separate 1 ml tuberculin syringes with 26 gauge needles. Needle was inserted into the skin at an angle of approximately ten degrees with the bevel upwards. Intradermal tests were performed in a blinded manner; one investigator administered the injections, whilst the other investigator, who assessed the test responses, was unaware which reagent was injected at each test site (Bond *et al*., 2006) [1].

Sites were examined after 15 min for evidence of immediate (IgE mediated) reactivity such as erythema, induration and size of the wheal. A subjective score assigned from 0 to +4, as compared with the negative and positive controls. An immediate reaction obtained with 2+ or greater score was considered as positive result. If the intradermal skin test was negative at 15 minutes, owners were advised to reexamine the site after 24 hours to check for delayed hypersensitivity (Kunkle *et al*., 2003) [3].

2.2 Results

In parasitic dermatitis caused by fleas, *Ctenocephalides felis* was identified as etiology in 95 per cent cases and *Ctenocephalides canis* was identified in 5 per cent cases. In this study all the cats which were subjected to intradermal skin test had shown immediate skin reactions at 15 to 20 min of evaluation. This had indicated the type-1 (immediate) IgE-mediated response.

2.2.1 Clinical signs

During dermatologic examination of the hair coat, presence of live fleas and flea dirt were noticed. Pruritus was generalized in nature, with predominant scratching in the areas of ear, neck and lumbo-sacral region. Alopecia observed was generalized in distribution. Some cases showed symmetric alopecia and self-inflicted alopecia in the areas of ventral abdomen, neck and lumbo-sacral region. Miliary dermatitis (cutaneous reaction pattern in cats, characterized by papules surmounted by crusts) predominantly in the areas of neck, base of the ear, ventral abdomen, and lumbo-sacral region were noticed in many cases. Excoriations and ulcerations at lateral aspects of both sides of neck were observed in some cats. Eosinoplilic plaque was recognized at the right lateral aspect of face in some cats.

2.3 Treatment and Response

All positive cases of FAD were managed using topical anti-flea agent selamectin spot-on (Revolution® for cats, 45 mg, Zoetis) monthly. Oral prednisolone @ 2.2 mg/kg every 24 h for seven days (tapered to 2.2 mg/kg every 48 h for the next seven days) and chlorpheniramine maleate @ 2 mg per cat orally every 12 h for seven days were used to decrease inflammation and pruritus. Amoxicillin-clavulanic acid @ 13.5 mg/kg twice daily for 14 days was given to treat secondary bacterial infections. All the animals were given oral supplement of essential fatty acids (Catstar®, SkyEC). Response to treatment was evaluated clinically after one week.

After one week of review all the positive cases had shown significant improvement in clinical condition. Fleas and flea dirt was not noticed in any of the treated animal. Miliary dermatitis was resolved in all the affected animals. Complete reduction of pruritus was noticed.

2.4 Discussion

Cats may develop flea bite hypersensensitivity at any age and FAD has no breed or sex predisposition (Scott, 2001, Noli, 2009 and Miller *et al*., 2013) [6, 5, 4]. In this study, flea control measures had not been adopted in any case. Selamectin, applied topically at a minimum dosage of 6 mg/kg body weight to cats, was highly effective in the treatment of flea bite dermatitis and FAD. It was effective without the need for additional environmental control measures. Selamectin was selected based on ease of application and availability, margin of safety and efficiency to eliminate all the stages of fleas. Antihistamine and corticosteroids were given to hasten the clinical recovery by decreasing pruritus and inflammation associated with FAD. Concurrent secondary bacterial overgrowth with staphylococcal colonization was commonly associated with FAD, hence antibacterial therapy was administered. Oral essential fatty acids (omega-3 and omega-6) may be helpful as adjunctive therapy as skin barrier care. This treatment regimen was in accordance with Sous (2012) [8] and Miller *et al*. (2013) [4].

Intradermal skin testing with flea extracts is more accurate in the diagnosis of FAD in terms of sensitivity, specificity and overall accuracy than the *in vitro* FcεRI-□ based serological test. The advantage of intradermal skin test over *in-vitro* IgE assays is, intradermal skin test is capable of detecting both immediate (IgE mediated) and delayed skin reactions and in the contrary, *in-vitro* IgE serological assay do not detect cats with only delayed cellular reactivity independent of IgE antibody responses (Miller *et al*., 2013) [4]. Bond *et al*. (2006) [1] opined that live flea challenge was a better test to detect cats with FAD than either intradermal or serological testing. Live flea challenge is not a feasible test in as it is not sensible to maintain flea colony under practice conditions and fleas have the potential to harbour bacterial pathogens such as *Bartonella henselae*, *Rickettsia felis* and *Mycoplasma* species (Traversa, 2013) [9].

Distribution of lesions in flea allergy dermatitis

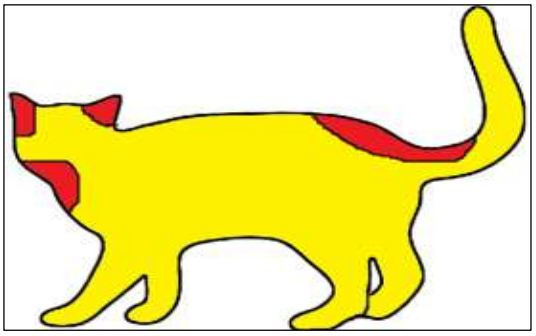

Fig 1: Miliary dermatitis, predominantly in ear, neck and lumbo-sacral region

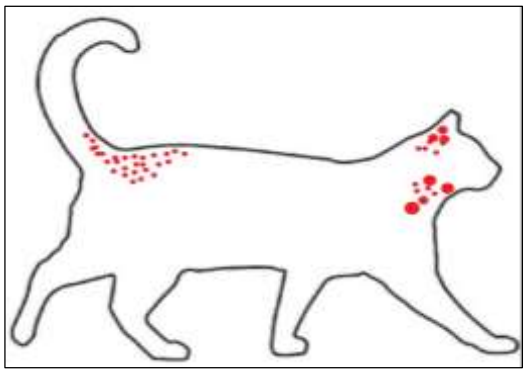

Fig 2: Generalized pruritus, predominantly in ear, neck and lumbo-sacral region

Fig 3: *Ctenocephalides felis* (10 X)

Fig 4: *Ctenocephalides felis (10 X)*

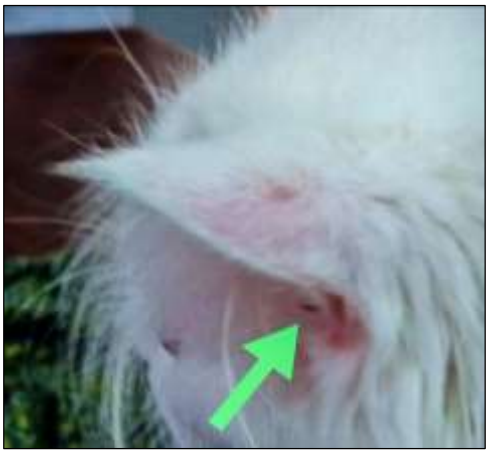

Fig 5: Clinical signs recorded in flea allergy dermatitis

Fig 6: Live flea at base of the ear

Fig 7: Miliary dermatitis in flank region

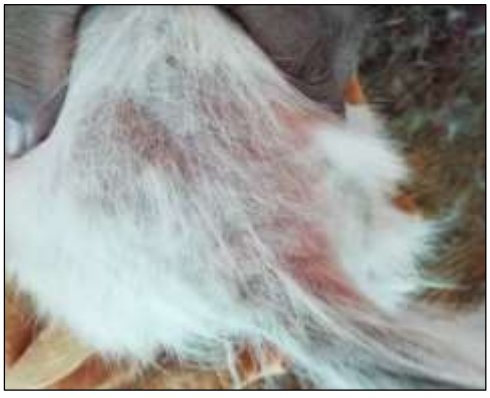

Fig 8: Alopecia in lumbo-sacral region

Fig 8: Flea dirt at tail region

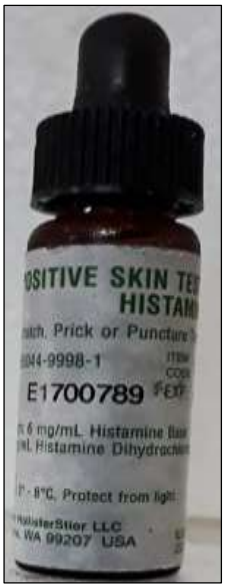

Fig 9: Histamine-Positive control

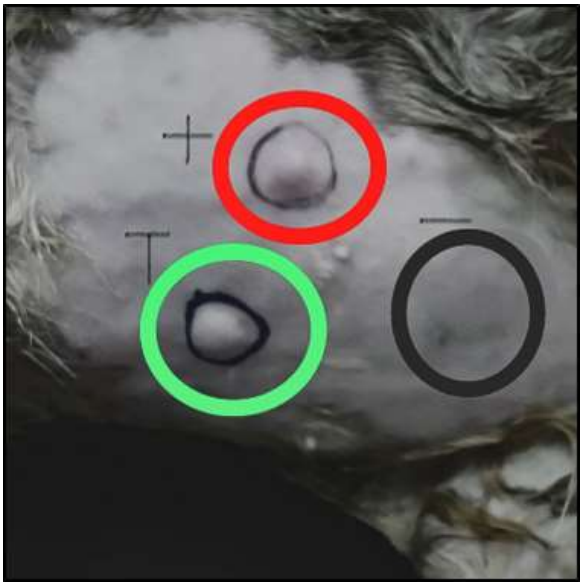

Fig 10: Positive

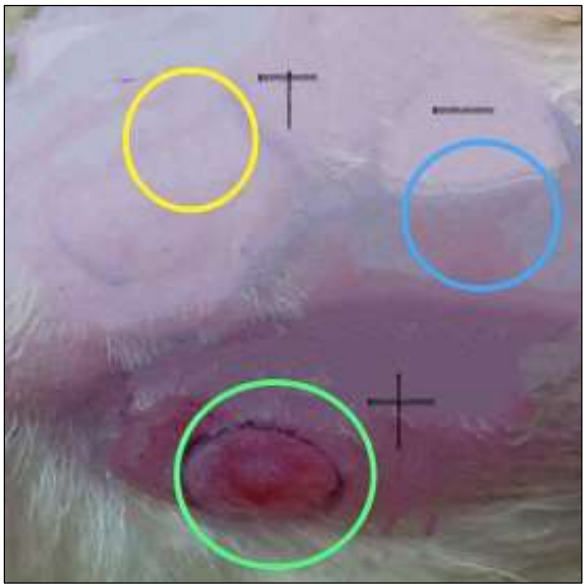

Fig 11: Negative

- **Positive control:** Histamine.
- **Negative control:** Phosphate buffered saline.
- **Test allergen:** Flea allergenic extract.

Reactions were read after 20 minutes of intradermal injection.

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