A Scoring Index for Clinical Signs of Flea Allergy Dermatitis in the Cat

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ABSTRACT

This article describes the development, application, and validation of a scoring index for assessment of clinical signs in cats with flea allergy dermatitis (FAD). The Scoring Index for Clinical Signs of FAD was based on the evaluation and scoring of five signs over five anatomic areas, which is similar to the psoriasis area and severity index (PASI), a commonly used scoring method in human dermatology. The Scoring Index for Clinical Signs of FAD was used by different veterinarians to assess several groups of flea allergic research cats with varying signs of FAD. Analysis of the data shows a significant correlation and repeatability between investigators, making this a very useful scoring index.

INTRODUCTION

Clinical investigations of dermatologic conditions in the dog and cat have lacked the standardization or validation of a clinical scoring system. In many studies examining therapy for, or progression of, skin diseases in the dog and the cat, each investigator or group of investigators uses an assessment system that they design specifically for each study.[1–3] In most cases, each pet is evaluated by the same observer and/or assessed by the owner.[4–6] There is a paucity of data[5] to show that these assessment methods are repeatable or would correlate with interpretations of the same patients on the same day by other clinical evaluators.

In the cat, clinical signs of flea allergic dermatitis (FAD) are highly variable, much more so than in the dog. They vary from a crusting, papular eruption (miliary dermatitis) accompanied by signs of self-trauma[7] to a noninflammatory alopecia[8] (Figures 1 and 2). The wide range of signs can be localized or generalized. In the cat they may be more noticeable over the head, neck, or other regions of the body, whereas FAD lesions in the dog generally are most prevalent over the caudal dorsal region.[9] The wide range of signs of FAD in the cat make the assessment and comparison of the severity of clinical signs extremely difficult.

The scoring index for feline FAD described herein evolved after the first author had used many various methods of assessing clinical signs and realized the need for a scoring system that not only was repeatable but also could be used by multiple investigators, could be applied to cats with different signs, and could show con-

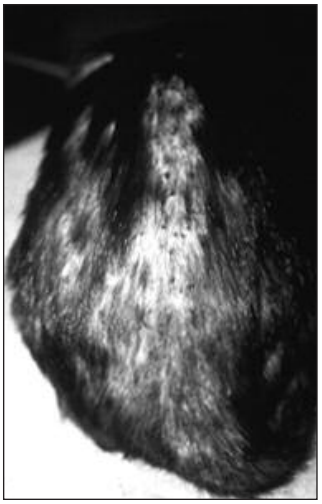

Figure 1. *Cat with generalized miliary dermatitis. If this was generalized over all five areas of the body, the cat might have a total score somewhere close to 50. (University of Florida case material.)*

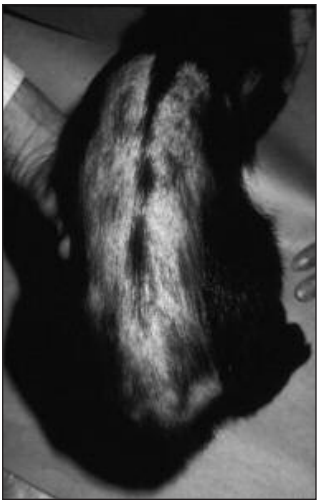

Figure 2. *Cat with noninflammatory self-induced alopecia due to excessive grooming because of flea allergy. A cat like this without any inflammation might have a total clinical score of only 6 to 9 depending on what percentage of the body was affected. (University of Florida case material.)*

sistent correlation of scoring between observers evaluating the same cats on the same days.

The psoriasis assessment severity index (PASI) scoring system was created in 1978 for use in human medicine[10] and has become a popular method for clinical studies.[11–16] The PASI was established using a scoring system regarding severity of lesions over different body regions. The feline scoring system described herein was modeled from the PASI and also from a recently used similar index for assessment of clinical signs of FAD in dogs.[17] The existence of a colony of flea allergic cats at the University of Florida for several years and the opportunity to observe signs in a very highly controlled environment were ideal circumstances for the evolution of a dermatologic scoring index. For the development of this index, certain anatomic areas were selected because of their historical involvement in cases of feline FAD. The anatomic areas of the index were altered until investigators found a model that was statistically repeatable and correlated between investigators. The objective of this study was to validate this scoring system, and the purpose of this article is to describe the scoring index.

MATERIALS AND METHODS

Animal Facilities

All cats were cared for and housed in facilities according to the principles outlined in the National Institutes of Health (NIH) Guide for the Care and Use of Laboratory Animals under the supervision of the Animal Resources Department of the University of Florida. Cats were housed in concrete-block runs with bedding boxes containing carpet remnants, which were not removed or washed during the time of flea exposure to allow the propagation of fleas and the completion of their life cycle. Cats were allowed to groom normally but were checked with a flea comb weekly to ensure that fleas or flea feces were present.

Animals

All cats used in the validation of this index were flea allergic research cats. Some cats were originally random source cats that became sensitized to fleas after they were used for the rearing of fleas. Other cats were purpose-bred and were obtained from Liberty Research Labs[a]

[a]Liberty Research Labs, Waverly, NY.

or were offspring of cats from Liberty Research Labs born in the facilities at the University of Florida. These cats had become sensitized to fleas either through repeated exposure or by repeated skin testing and flea feeding. All cats used for evaluation had positive immediate and/or delayed reactions to the feeding of fleas via flea cages and/or positive enzyme linked immunoassay (ELISA) reactivity to flea salivary antigens. Most cats developed signs of FAD with exposure; in some cases signs were mild even after weeks of high-level exposure.

Three groups of cats were evaluated for 18 months using this system. The groups did not all consist of completely separate cats because there was some crossover among groups.

Group 1

Group 1 contained 27 cats from the long-term feline flea allergy colony at the University of Florida. These cats were historically known to develop various signs of FAD when flea populations were introduced onto their haircoats. Evaluation of all cats in group 1 using the index was done independently by the same two investigators on two separate dates (on the same days for both investigators). The first evaluation by both scorers was done after all 27 cats had received 5 weeks of flea exposure in which 100 fleas were placed on each cat weekly, and the second evaluation was done by both scorers after 8 weeks of the addition of 100 fleas/cat/week.

Group 2

Group 2 consisted of 22 cats with FAD in which the subjects were evaluated by the same two investigators on one date. The same investigators evaluated group 1. No flea exposure had been planned (i.e., no intentional flea exposure in prior 7 months) but flea exposure was suspected to have occurred and flea feces and/or tapeworm infestation was noted.

Group 3

Group 3 included 17 cats known to have FAD, which were scored by five different evaluators over 1 week; 100 fleas had been applied to every cat 1 month earlier. Two of the five evaluators were the same as those that evaluated groups 1 and 2.

Fleas

For evaluations of groups 1 and 3, *Ctenocephalides felis* fleas were obtained from the insectary at Heska Inc, Ft. Collins, Colorado, as newly emerged unfed young adults, which were already counted and placed into individual containers and shipped to the University of Florida overnight. The fleas were raised on an artificial dog model using dried bovine blood as a larval food source.[18,19] Newly emerged fleas had not been exposed to dog or cat blood and had not been given an opportunity to feed. The fleas that were found on cats in group 2 were likely from contamination by *Ctenocephalides felis*, which had come from someone's pet(s) and were carried into the facility unintentionally.

Evaluation System

The system used numerical scoring applied to careful examination of five anatomic areas of the body including the (1) head and neck, (2) dorsal thorax, (3) ventral thorax and abdomen, (4) lumbar sacral area and tail head, and (5) perineum and rear legs. Five clinical signs (papules, alopecia, erythema, scale, and excoriations/crusts) were scored for each of the regions using 0 = absent, 1 = mild, 2 = moderate, and 3 = severe. The sums of numerical scores of lesions from each of the five areas were added, resulting in a final feline FAD index score. The maximum score possible for any one cat was 75. A cat with severe miliary dermatitis likely would have a score of 20 to 35, whereas a completely hairless cat without any inflammatory lesions would have a maximum score of

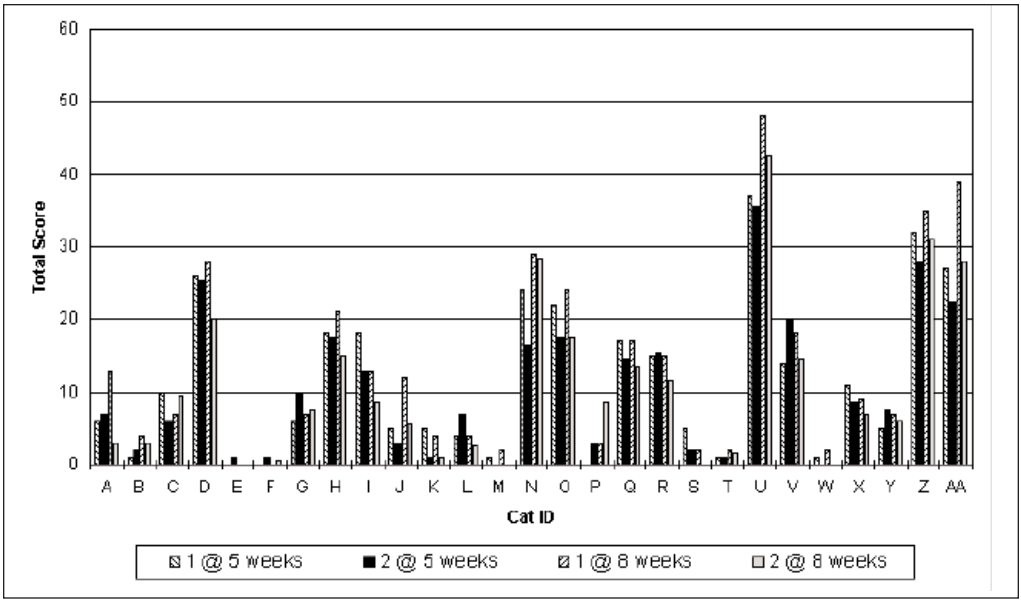

Figure 3. *Clinical flea allergy dermatitis scores of 27 cats using the index and given on two separate dates by two independent evaluators.*

only 15. It is unlikely that any cat could develop a score near the maximum of 75. Cats with FAD tend to have varied signs but are unlikely to develop total alopecia of all sites in addition to crusting, scaling, and severe self-trauma. In general, cats with scores of 50 had weight loss of 20% or more and vomited hair daily from grooming. For humanitarian reasons, severely affected cats were evaluated and treated with imidacloprid,[b] and some were bathed and treated with oral antibiotics (amoxicillin with clavulanic acid[c]) for secondary infection.

STATISTICS

Data were analyzed using statistical analysis system (SAS) for Windows version 6.12.[20] The relationship between investigators' scores using the scoring index were examined using the PROC CORR procedure of SAS. Because data were ordinal (on a scale), data were rank transformed before analysis. All means and standard deviations presented here are from the analysis of the untransformed data. However, all correlation coefficients (r) and hypothesis testing (P values) are representative of the rank transformed data. A correlation coefficient ≥0.75 was considered positive and a P value ≤.05 was considered significant. Data are presented as mean ± standard deviation, unless otherwise indicated.

[b]Advantage®, Bayer Corp, Shawnee Mission, KS.
[c]Clavamox®, Pfizer Inc, Exton, PA.

RESULTS

Because of time and cat differences among the three groups, the data were analyzed within each group.

Group 1

There was a positive correlation (r = 0.89, P = .0001; Figure 3) when two investigators used

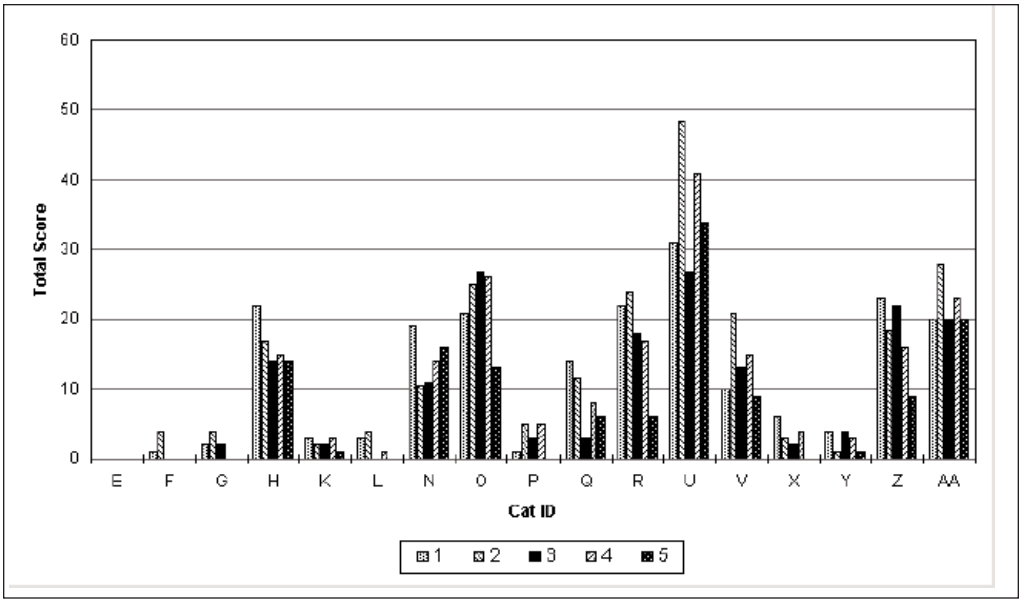

Figure 4. *Clinical flea allergy dermatitis scoring index used independently and blindly by five individuals on the same 17 cats.*

the FAD feline scoring index to evaluate 27 cats after 5 weeks of flea exposure and again after 8 weeks of flea exposure.

Group 2

There was a positive correlation ($r = 0.90$, $P = .0001$) when the same two investigators used the same system to evaluate a group of 22 cats after no known flea exposure (though flea exposure was suspected based on the condition of some of the animals). Clinical signs were not as severe at this observation period because fleas had not been intentionally applied. It did not appear from examination of cats and flea combing at this date that all cats had acquired fleas.

Group 3

There were also positive correlations ($r = 0.81$ to 0.95, $P = .0001$) when the same system was used by five investigators to evaluate 17 cats after 1 month of flea exposure (Figure 4).

DISCUSSION

The results of this study show that the feline scoring index for FAD described herein is a useful and validated assessment method for the clinical evaluation of cats with signs of FAD. Correlations between evaluators were always greater than 80% regardless of the severity or length of flea exposure.

A repeatable scoring system for signs of pets involved in clinical trials of dermatologic treatments has long been needed. The validation of this scoring system creates an assessment method available for use in future studies of various treatments as well as the evolution of signs of FAD in research cats. This scoring index could be easily applied to feline patients in a clinical setting as well.

It is important to note that this scoring index showed excellent correlation statistics when the same group of cats had several weeks of flea exposure and higher scores as well as when the clinical signs were very mild and affected only a few cats, as noted in the instance of accidental flea contamination with group 2. This indicates that the index can be applied to cats with various lengths of exposure and severity of signs with equivalent correlations between investigators.

One might question whether the evaluators' training in dermatology might have aided in the high correlation. The first investigator completed her dermatology residency at Louisiana State University. The second investigator, though trained in dermatology at University of Florida, taught at the College of Veterinary Medicine Virginia/Maryland before returning to the University of Florida. The third investigator was a resident in dermatology but had received his original dermatology training at Michigan State University. The fourth investigator was a veterinary student. The diversity of the group that participated in the evaluation depicted in Figure 3 indicates that although the correlations varied between investigators, they were still all very high and could be used in other feline populations with FAD.

Evaluations of groups 1, 2, and 3 were conducted for 18 months. The fact that the different groups were evaluated with blocks of time between them and still showed excellent correlation lends support to the usefulness of the application of this index over time.

Some authors consider any correlation value greater than 0.38 a positive correlation.[21] The authors of this study chose a much more specific r value of ≥0.75, and in all instances actual r values exceeded this value.

This scoring index could be used by investigators or practitioners for evaluation of feline patients with FAD and could be modified for scoring of other feline skin diseases. This modification could be done by changing the body sections and or the weight assigned to each as well as altering which lesions are assessed within each area.

CONCLUSION

This article describes the development and application of a clinical scoring index for feline FAD. The scoring index has been validated by applying it to various groups of cats with FAD assessed by different investigators and comparing the correlation values. There is an excellent correlation of clinical scores in which the correlation coefficient (r) is ≥0.75. Thus, the description and validation of this scoring index provides a useful clinical and research tool for assessment of cats with clinical signs of FAD and should have future applications to a variety of research and clinical settings.

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