Predictive equation to identify infection due to anthropophilic or zoophilic dermatophytes based on clinical features and risk factors: A ten-year retrospective study

Sir,

Studies on the clinical features and risk factors differentiating anthropophilic cutaneous dermatophytosis and zoophilic cutaneous dermatophytosis are limited. Thus, we aimed to determine the correlation among the associated factors and the type of causative dermatophytes and further to develop an equation to predict the presence of zoophilic dermatophytes in patients with cutaneous dermatophytosis.

This ten-year, retrospective cross-sectional study was conducted at the Department of Dermatology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand. We included patients diagnosed with either anthropophilic or zoophilic cutaneous dermatophytosis of glabrous skin (based on results of fungal culture) and whose clinical pictures were available. Patients with concomitant dermatologic conditions that may have interfered with the clinical evaluation, and cases without fungal culture results were excluded. The clinical findings were reviewed by dermatologists and the clinical features are illustrated in Figure 1.

The sample size was calculated using a Chi-square test. It was calculated based on prevalence of the causative organism. It was estimated that the error may be higher than 0.05, so it was recommended to use 0.07. However, this is a retrospective study and all data of patients were collected to do the analysis. A previous study reported the prevalence of *Trichophyton mentagrophytes var. mentagrophytes* to be 52%.[1] Using a 2-sided Type I error of 0.07 and 95% confidence interval, a sample size of 196 patients was required. However, we only included patients who had complete data and pictures of the clinical findings. Therefore, 167 patients with complete data were included in the analysis.

Out of 167 patients (mean age, 44 years) included in the study, 108 (64.7%) patients had anthropophilic cutaneous dermatophytosis and the remainder (n = 59, 35.3%) had zoophilic cutaneous dermatophytosis. All patients were Asian. The patients with anthropophilic cutaneous dermatophytosis included *Trichophyton rubrum* (n = 95, 56.9%), *T. tonsurans* (n = 7, 4.2%), *Epidermophyton floccosum* (n = 3, 1.8%), *Trichophyton interdigitale* (n = 2, 1.2%) and *Microsporum*

Figure 1: A red-rubber-ring appearance

Figure 2: A ring-within-a-ring appearance which is characterized by annular polycyclic erythematous rings with active border

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Table 1: Demographic data, duration of symptoms, previous topical medication usage, history of contact with pet, distribution of lesions and morphological features evaluated by dermatologists in patients with anthropophilic and zoophilic dermatophytoses

	Number (%)		*P*-value
	Anthropophilic (*n*=108)	Zoophilic (*n*=59)	
Female	46 (42.6)	39 (66.1)	0.006*
Age (y), mean±SD	44.9±18.5	42.9±17.8	0.497
Median duration of symptoms (months)	3.0	1.0	0.001*
Underlying diseases†	44 (40.7)	21 (35.6)	0.619
Dyslipidemia	16 (14.8)	8 (13.6)	1.000
Hypertension	22 (20.4)	13 (22.0)	0.844
Diabetes mellitus	11 (10.2)	6 (10.2)	1.000
Cardiovascular disease	5 (4.6)	1 (1.7)	0.425
Other underlying diseases	22 (20.4)	10 (16.9)	0.683
Previous topical medication usage‡	76 (70.4)	40 (67.8)	0.729
Corticosteroids	23 (21.3)	28 (47.5)	0.001*
Immunomodulators	1 (0.9)	0 (0)	1.000
Antifungals	12 (11.1)	4 (6.8)	0.423
Antibiotics	1 (0.9)	2 (3.4)	0.285
Local herb	6 (5.6)	1 (1.7)	0.423
Unidentified OTC medications	39 (36.1)	8 (13.6)	0.002*
Contact with pets§	26 (37.1)	38 (76.0)	<0.001*
Cat	6 (8.6)	29 (58.0)	<0.001*
Dog	17 (24.3)	9 (18.0)	0.504
Rabbit	1 (1.4)	3 (6.0)	0.305
Other	4 (5.7)	0 (0)	0.141
NA	37	9	
Affected area			
Exposed area	10 (9.3)	30 (50.8)	<0.001*
Unexposed area	59 (54.6)	15 (25.4)	
Both exposed and unexposed areas	39 (36.1)	14 (23.7)	
Morphological feature			
Redness	83 (76.9)	54 (91.5)	0.020*
Induration	81 (75.0)	54 (91.5)	0.013*
Vesicles/pustules	14 (13.0)	24 (40.7)	<0.001*
A red-rubber-ring appearance	2 (1.9)	14 (23.7)	<0.001*
Active border	96 (88.9)	48 (81.4)	0.240
Scale	103 (95.4)	54 (91.5)	0.326
Excoriation	45 (41.7)	23 (39.0)	0.869
PIH	86 (79.6)	26 (44.1)	<0.001*
A ring-within-a-ring appearance	73 (67.6)	22 (37.3)	<0.001*

*P<0.05.†One patient might have had one or more underlying diseases. ‡One patient might have used one or more previous topical medications. §One patient might have contacted one or more kinds of pet. OTC: Over-the-counter, PIH: Post-inflammatory hyperpigmentation, NA: Not available, SD: Standard deviation

Table 2: Logistic regression equation predicting zoophilic dermatophytosis

Model	Logistic regression equation			
Final	ln odds	=	0.158+	$1.198X_1+1.459X_2–1.215X_3–1.202X_4$
Simplified	Score	=		$X_1+1.218X_2–1.014X_3–1.003X_4$
		=		$X_1+X_2–X_3–X_4$

X_1, contact with pets; X_2, vesicles/pustules; X_3, involving unexposed area; and X_4, a ring-within-a-ring appearance, where 0=No and 1=Yes

audouinii (n = 1, 0.6%). The zoophilic cutaneous dermatophytosis included *T. mentagrophytes* (n = 34, 20.4%), *Microsporum canis* (n = 23, 13.8%) and *Trichophyton erinacei* (n = 2, 1.2%). The baseline characteristics and morphological features are detailed in Table 1. Of the 51 patients who reported using topical corticosteroids, 26 (51%) had a ring-within-a-ring appearance. However, that appearance was not significantly associated with a history of previous topical corticosteroid usage (P = 0.307).

A logistic regression analysis was performed to obtain an equation to predict zoophilic cutaneous dermatophytosis. Variables in an equation predicting zoophilic dermatophytosis included contact with pets, vesicles/pustules, involving unexposed area, and a ring-within-a-ring appearance

Table 3: The sensitivity, specificity, and accuracy of each cut-off point in the simplified predictive equation

			Number		Sensitivity (%)	Specificity (%)	Accuracy (%)
			Zoophilic dermatophytosis (*n*=50)	Anthropophilic dermatophytosis (*n*=71)			
Score	–1, 0, 1, 2	Indicate zoophilic dermatophytosis	46	41	92	42	63
	–2	Indicates anthropophilic dermatophytosis	4	30			
	0, 1, 2	Indicate zoophilic dermatophytosis	40	13	80	82	81
	–2, –1	Indicate anthropophilic dermatophytosis	10	58			
	1, 2	Indicate zoophilic dermatophytosis	24	5	48	93	74
	–2, –1, 0	Indicate anthropophilic dermatophytosis	26	66			

[Table 2]. The receiver operating characteristic curve of the simplified predictive equation for zoophilic cutaneous dermatophytosis had an area under the curve of 0.835. The scores ranged from –2 to +2 [Table 3]. With a score ≥ 0, the simplified equation showed the best sensitivity (80%), specificity (82%) and accuracy (81%) in the prediction of zoophilic cutaneous dermatophytosis. Thus, score ≥ 0 was used as the cut-off value.

As fungal culture is still limited to some hospitals and takes approximately one month to obtain results, this study created a new and simplified equation from clinical data to distinguish cases of zoophilic cutaneous dermatophytosis from those due to anthropophilic dermatophytes. The equation contained only four variables, showed high sensitivity and specificity, and made it easy for physicians to determine the type of causative dermatophytes resulting in appropriate treatment and disinfection methods to be implemented promptly well before the fungal culture results became available.

This study revealed that redness, induration, vesicles/pustules and a red-rubber-ring appearance were significantly found in lesions from zoophilic cutaneous dermatophytosis, corresponding with the findings of earlier studies, which reported that zoophilic cutaneous dermatophytosis tend to form more inflammatory lesions.[1-3] Moreover, a red-rubber-ring appearance, which is characterized by the presence of one or more bright erythematous and edematous rings with central clearing skin,[1] was significantly reported in cases of zoophilic cutaneous dermatophytosis. As patients with zoophilic cutaneous dermatophytosis tend to have vesicles which resemble eczema, it follows that use of topical corticosteroids was found in a significantly higher proportion of cases of zoophilic cutaneous dermatophytosis.

A ring-within-a-ring appearance was seen predominantly in patients with anthropophilic cutaneous dermatophytosis. Specifically, it was significantly associated with *Trichophyton rubrum* infection ($P = 0.016$). Previous reports demonstrated a ring-within-a-ring appearance, or tinea pseudoimbricata, to be associated with repeated inflammatory responses and this may result from topical steroid abuse.[4,5] However, a significant association between the use of topical corticosteroids and a ring-within-a-ring appearance was not found in our study, which comprised a larger number of patients than in the previous studies. Thus, a ring-within-a-ring appearance might be associated with anthropophilic cutaneous dermatophytosis rather than with a history of steroid use.

Differentiation between anthropophilic cutaneous dermatophytosis and zoophilic cutaneous dermatophytosis is important because it influences not only the appropriate treatment but also facilitates the elimination of the source of infection.[3] In anthropophilic cutaneous dermatophytosis, apparels of the infected patients should not be shared with others and should be disinfected in order to prevent the spread of dermatophytes.[2] As pets act as reservoirs for zoophilic cutaneous dermatophytosis,[2,3] wearing of protective clothing before handling infected pets and timely and adequate treatment of those pets have been recommended.[3]

The main limitation of our study is that since it was a retrospective one, some data was unfortunately missing.

In conclusion, the presence of redness, inflammation, vesicles/pustules, or a red-rubber-ring appearance may suggest zoophilic cutaneous dermatophytosis; in contrast, lesions with post-inflammatory hyperpigmentation or a ring-within-a-ring appearance may point towards a diagnosis of anthropophilic cutaneous dermatophytosis. Moreover, our new equation to differentiate anthropophilic cutaneous dermatophytosis and zoophilic cutaneous dermatophytosis is practically useful and can promptly guide treatment and disinfection methods.

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Declaration of patient consent

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Conflicts of interest

There are no conflicts of interest.

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Pressure-induced facial follicular papules: 15 cases of an under-recognised dermatosis

Sir,

Repetitive prolonged pressure and friction results in cutaneous changes such as knuckle pads from boxing and prayer sign on the forehead. Relieving pressure/friction is an important element of treatment. The association with pressure appears under-recognised in a follicular facial eruption leading to inadequate management. We describe 15 patients with this distinctive eruption that, once identified, can be easily treated by a simple change in posture.

We evaluated ten men and five women, aged 10–59 years who presented to the department of dermatology at the All India Institute of Medical Sciences, New Delhi, with asymptomatic, hyperpigmented papules on the face that appeared insidiously over a period of two months to 20 years.

There were tiny, closely aggregated keratotic papules on a background of ill-defined dark brown pigmentation [Figure 1]. In three patients, there were a few slightly larger, yellowish-white to dark brown comedones. Papules were noted on the cheek in eight (53.3%) patients, chin in four (26.6%), left mandibular jawline in two (13.2%) and both the jawline and neck in one (6.6%). The eruption was bilateral in two and unilateral in nine patients with the left side affected in eight and the right in one; it was located centrally on the chin in the remaining four patients [Table 1]. All patients were right handed.

Seven (46.6%) patients had a history of atopy; there were no other cutaneous or systemic illnesses. Thirteen (86.7%) patients were in the habit of resting their face on their hand for long periods while studying or watching television. In all these patients, the papules corresponded exactly to the area of the face that rested on the palm.

Dermoscopy was done in four patients, out of which two revealed coiled hair shafts in the affected area. There were no follicular plugs. Two patients consented for skin biopsy. The histopathological findings included focally compact hyperkeratosis, papillomatosis and mild acanthosis with one biopsy showing a keratotic follicular plug [Figure 2].

All patients were advised to stop resting their face on their hand and prescribed topical tretinoin 0.05% for application at night. There was near complete resolution in patients who were compliant with instructions [Figure 3 and Table 1].

The development of grouped follicular papules exclusively on portions of the face rested on the palm for several hours a day with resolution when posture was changed provides strong evidence for prolonged pressure as the cause of this eruption. Patients rested their face on the hand in slightly different ways and this resulted in papules at different places but the distribution

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