

Re-evaluation of Skin Lesion Distribution in Atopic Dermatitis

Analysis of cases 0 to 9 years of age

T. AOKI, T. FUKUZUMI, J. ADACHI, K. ENDO, and M. KOJIMA

Department of Dermatology, Habikino Hospital of Osaka Prefecture, Osaka, Japan

Distribution of skin lesions was studied in 1,012 patients under 10 years of age, with atopic dermatitis. Of these, 812 (80.2%) had an atopic history; 200 did not. Both categories were divided by age into five subgroups (3-5 months, 6-11 months, 1 year, 2-4 years and 5-9 years) and the incidence of lesions in each of 52 skin regions was compared between the positive and negative history groups and between different age groups. The results were as follows.

1. There was a change in predilection site, from the head (the scalp, face and peri-auricular area) to the neck and flexures (cubital and popliteal fossae) between 1 and 2 years of age.
2. The trunk (shoulders, chest, abdomen and back) was the most common predilection site in both infants and children.
3. Only the upper arm was affected more frequently on the external side than the internal side in all age groups.
4. The nose, mamillae, palms and feet were the least affected areas in all age groups.
5. Incidences in the positive history group were no higher than in the negative group. *Key words: skin manifestation, atopic dermatitis.*

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Dr T. Aoki, Department of Dermatology, Habikino Hospital of Osaka Prefecture, 7-1, Habikino-3, Habikino City, Osaka 583, Japan.

Atopic dermatitis (AD) is known to show a typical morphology and distribution of skin lesions. This is one of the four major diagnostic criteria of AD of Hanifin & Rajka (1). They give only a short description, as:

- 1) flexural involvement in adults and adolescent,
- 2) facial and external involvement in infancy and childhood, but actual patterns are various and complicated. These are also described in detail as predilection sites in Rajka's monograph (2).

Typical lesions we see in AD are a combination of morphology and distribution; in a strict sense, distribution means the sites of primary appearance of the lesions and morphology means modified appearance caused by scratching. But two are not sharply demarcated because obviously scratched lesions are more easily recognizable to physicians.

In this investigation, only the distribution of skin lesions was dealt with for the purpose of obtaining precise knowledge of regions primarily affected in AD.

PATIENTS AND METHODS

All infants and children with possible AD (chronic eczema accompanied by itching, of at least one month's duration in young infants) under 10 years of age and attending the Dermatology Clinic of our Hospital during 24 months (January 1989 to December 1990) constituted the study material.

Their families were interviewed and history was carefully noted concerning personal and family history (parents, siblings, uncles and aunts and grandparents) regarding atopy. Fifty-two skin regions (shown in Fig. 1) were examined and the presence or absence of lesions was recorded. Some of the regions were, of necessity, combined. Particular attention was paid to several regions which have not previously been described as predilection sites of AD. These were the pre-auricular regions, para-axillar regions (combination of pre- and post-axillar regions) and ankle joint regions. In this study, even mild eruptions like small papules or slight erythema were not discriminated from and were dealt with the same way as scratched, eroded or lichenified lesions.

Therefore, the results show all possible skin regions where AD eruptions may appear.

Since the patients already fulfilled two of the four major criteria of Hanifin & Rajka for AD, viz., pruritus and chronicity, they were divided into two groups, one that satisfied the third criterion (personal or familial atopic history) and the other that did not. Of the fourth criterion, typical morphology and distribution, the latter was the subject of the present investigation.

The incidence of lesions in each region was compared between positive and negative history groups and between different age groups.

All data were dealt with by personal computers.

Statistical analysis was made by χ^2 -test or median value test.

Diaper dermatitis was not included in the analysis.

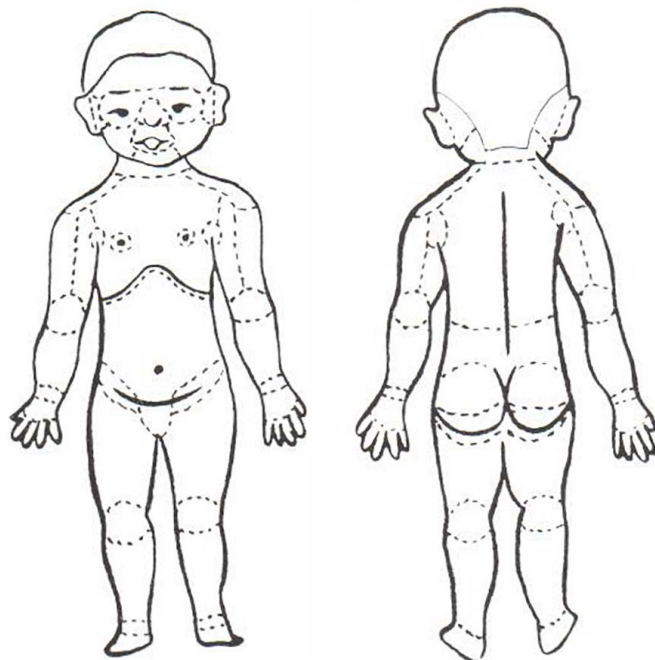


Fig. 1. Schematic view of body, showing part of 52 skin regions used for examination.

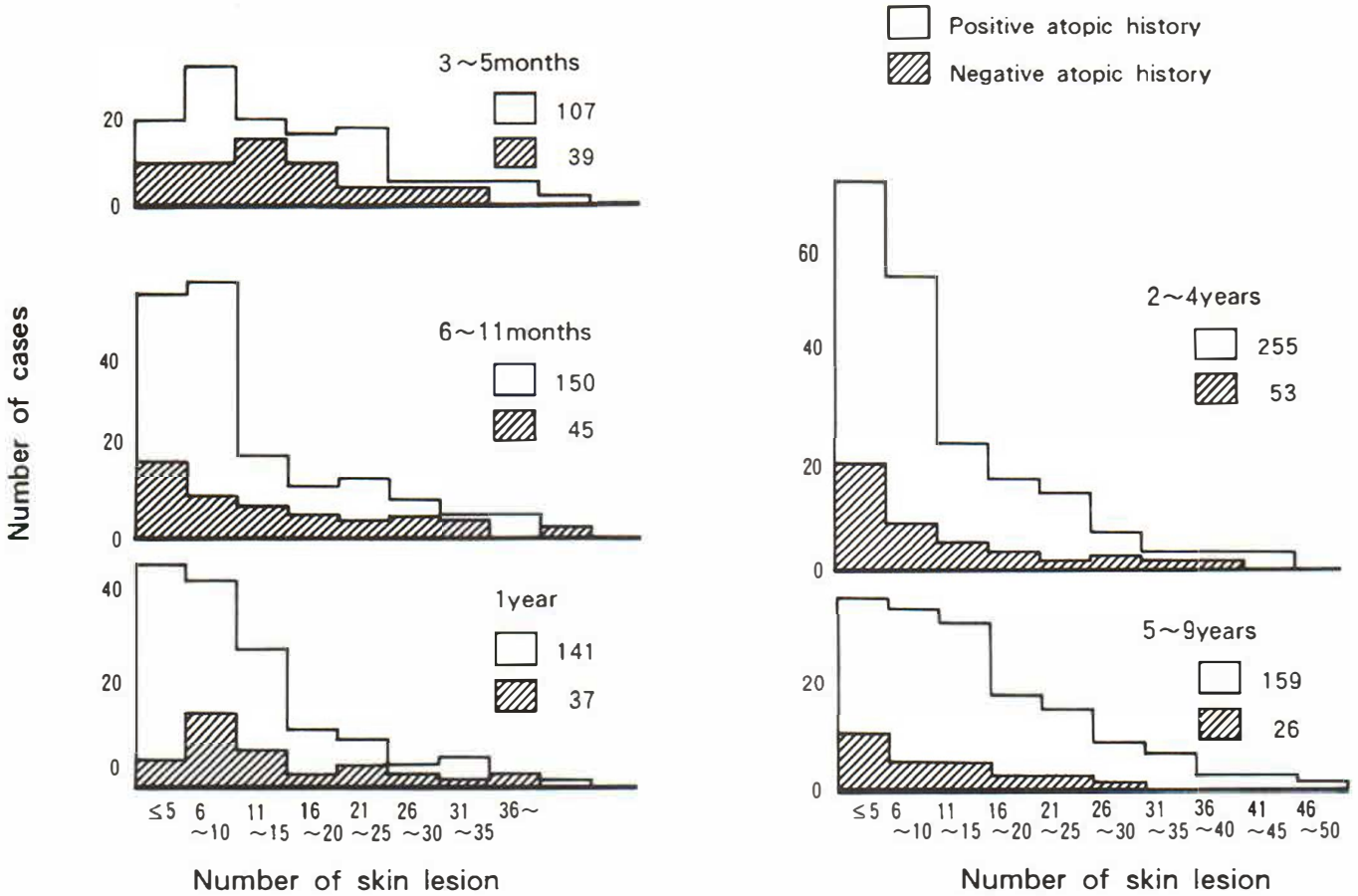


Fig. 2. Number of affected skin regions in each age group. □, Positive history group; ■, negative history group. Both columns should be read from the bottom.

RESULTS

Number of patients

Altogether 1,012 patients visited us, of whom 812 (80.2%) had an atopic history (positive history group), while 200 did not (negative history group). Both categories were divided according to age into sub-groups (3-5 months, 6-11 months, 1 year, 2-4 years and 5-9 years) respectively. The number of patients in each age group is shown in Fig. 2.

Number of affected regions

Numbers of affected skin regions in each age group were distributed as shown in Fig. 2. In the positive history group, patients with fewer affected regions were apparently more frequent in two groups, 6-11 months and 2-4 years, than in the remaining three groups. There were statistically significant differences between each of the former two and each of the latter three ($p < 0.01$) by median value test, but not between other pairs. There was no statistical difference between positive and negative history groups in any age sub-group, nor between any two age sub-groups of the negative history group.

Incidence of skin involvement in 52 regions in the positive and negative history groups

Incidences in the positive history group are shown in Fig. 3 (for head and neck), Fig. 4 (for trunk) and Figs. 5 and 6 (for

extremities). The data in the negative history group are not shown, but incidences were mostly similar to those of the positive history group. A statistical difference ($p < 0.05$) by χ^2 -test was noted only sporadically in 15 of 260 (52 regions \times 5 age groups) tests, showing that ear involvement in the 2-4-year sub-group was more frequent in the negative than in the positive history group (with 5% risks). In all 15 cases, incidences were higher in the negative than in the positive history subjects. Eight of the 15 were in the age group 6-11 months and concerned the back, waist, shoulder regions, external upper arms, extensor and flexor forearms, hips and extensor upper legs.

These differences seemed to be anecdotal and it was concluded that skin lesion distribution was no different between the positive and the negative history group.

Predilection sites in 3-5-month sub-group of the positive history group

In the 3-5-month sub-group, lesions occurred most frequently in the head and neck region, viz., the cheeks (81.3%), forehead (61.7%), scalp (60.7%) and chin (42.1%). The pre-auricular region (46.7%) may be considered part of the cheek but it is the region often involved independently in young infants who have just started to scratch and it actually showed a high figure. The ears themselves (31.8%) were not very frequently involved but the peri-auricular region (47.7%)

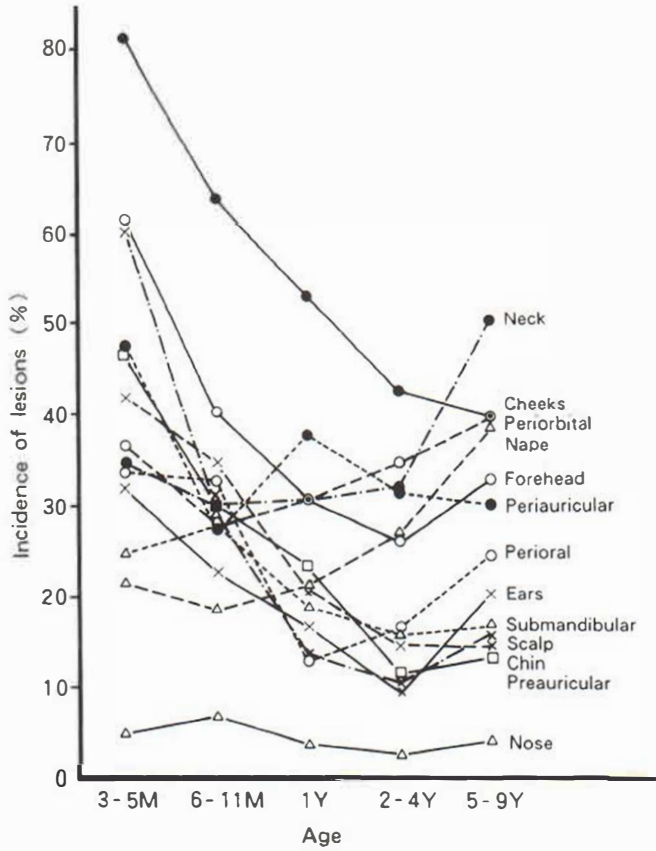


Fig. 3. Change in percentile involvement by age for head and neck regions in positive history group.

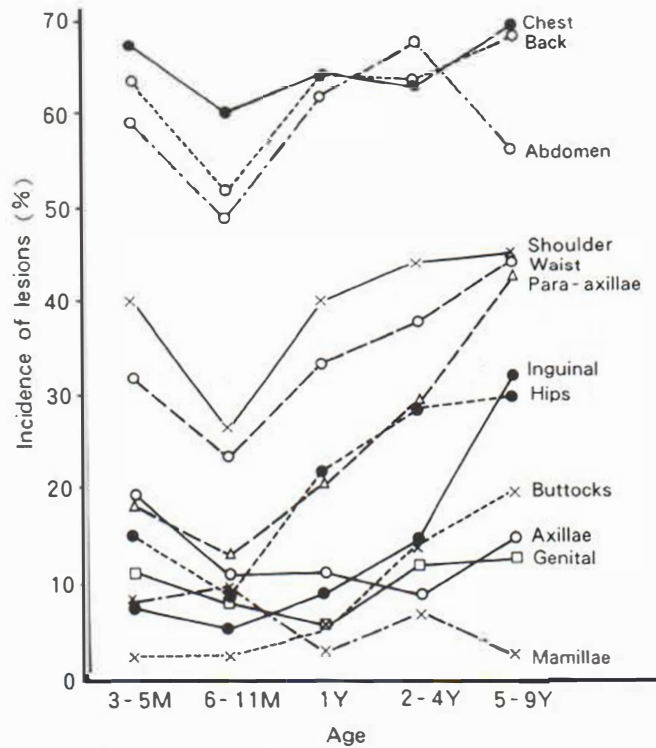


Fig. 4. Change in percentile involvement by age for trunk regions in positive history group.

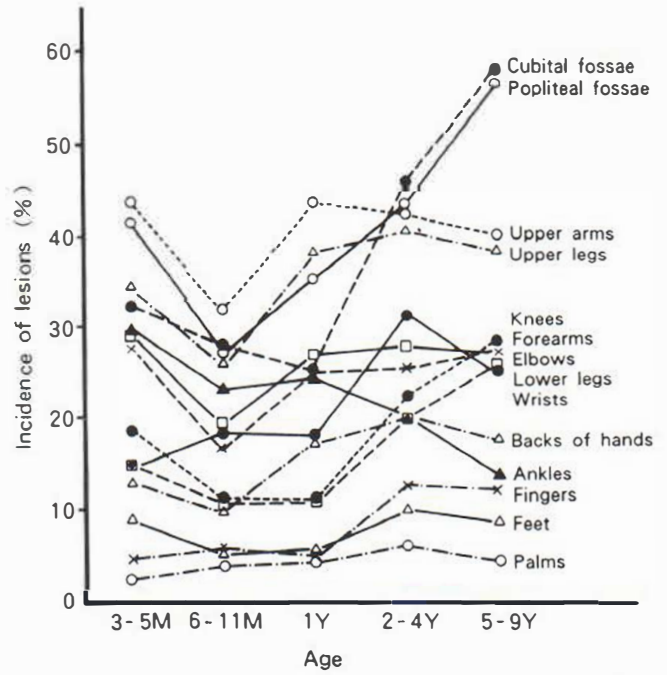


Fig. 5. Change in percentile involvement by age for extremity regions in positive history group.

which included supra-, post- and infra-auricular areas, was frequently involved. When both were combined, it reached 55.1%. Incidences of neck (34.5%) and nape (21.5%) involvement, were not very high.

On the trunk, the chest (67.3%), back (63.6%) and abdomen (58.9%) all showed very high incidences. The shoulders (upper part of shoulder joint but not including upper back) (40.2%) and waist (including loins) (31.8%) followed. On the extremities, the external upper arms (43.9%) and popliteal fossae (41.5%) showed high incidences and the upper legs (34.6%), cubital fossae (32.7%) and ankle regions (30.2%), i.e., the transitional zones from the extensor aspects

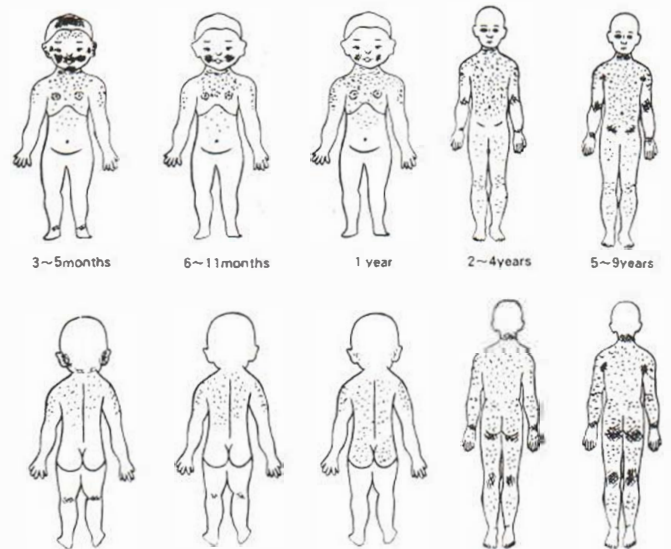


Fig. 6. Schematic change in typical distribution of skin lesions by age in positive history group.

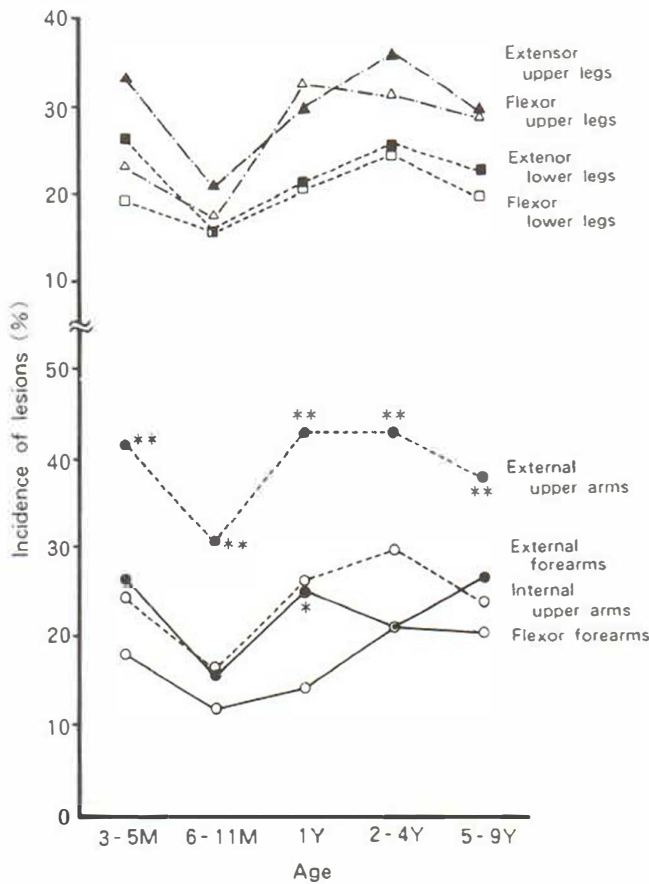


Fig. 7. Comparison of incidences between the external (extensor) and internal (flexor) regions of the extremities in the positive history group. Statistical difference: ** < 0.01, * < 0.05.

of the lower legs and the backs of the feet followed. Least affected regions were the nose (4.7%), mamillae (8.4%), palms (2.8%), fingers (4.7%), inguinal region (7.5), buttocks (2.8%), and feet (9.3%). The other regions were affected between 10 and 30%.

Comparison of 3-5-months vs. 5-9 year sub-groups in the positive history group

Incidences in 5-9-year sub-group differed from the 3-5-month group, as follows.

In the head and neck region (Fig. 3), the neck (50.3%) and nape (38.4%) both had increased incidence by about 50%, whereas the scalp (15.7%) decreased to about 1/4, the perioral regions (24.5%) also decreased to about 1/3, the forehead (32.7%) and the cheeks (39.6%) decreased to about 1/2. The periorbital regions (39.6%) were very similar. The pre-auricular regions (13.2%) were less than 1/3. The nose (3.8%) similarly, was least affected.

On the trunk (Fig. 4), the inguinal regions (32.1%) were four fold, the hips (including rump) (29.6%) three fold, and the buttocks (19.5%) were seven fold more affected. Waist involvement (44.0%) increased by nearly 50%, but the genital region (12.6%) was no different. High incidences on the chest (69.2%), back (67.9%) and abdomen (56.0%) were not changed. The axillae (14.5%) were no different but the para-axillar regions (42.1%) were more than twofold increased.

The para-axillar region means the anterior and posterior folds outside of the armpit. Mamillae (2.5%) were similarly least affected.

On the extremities (Fig. 5), the cubital fossae (58.5%), elbows (27.5%) and wrists (25.8%) were more affected, though less than twofold. Knee (28.9%) and popliteal fossa (56.6%) incidences were slightly increased, but the backs of the ankles (13.8%) were decreased to about half. The other regions were not much different.

Change in incidence by age in the positive history group

Incidences of skin lesions showed variously changing patterns according to age, as shown in Figs. 3-5. These patterns may be influenced by the fact that the sub-groups 6-11 months and 2-4 years included more patients with fewer affected regions. This may (or may not) be related to the observation that the incidence curves often show a dip at these two age intervals.

Understanding these, we can now conclude as follows. Involvement of the cheeks, forehead, scalp, chin, peri-auricular regions and ankle regions decreased constantly or almost constantly from early infancy to older childhood. Conversely, involvement of the inguinal regions, buttocks, para-axillar regions, hips, cubital and popliteal fossae, knees and elbows increased constantly or almost constantly from early infancy to older childhood. These changes are shown in schematic form in Fig. 6.

Comparison of flexor and extensor involvement of the extremities in the positive history group

External and internal involvement of the upper arms, and extensor and flexor involvement of the forearms and the upper and lower legs were compared in all age groups (Fig 7). Statistically (χ^2 -test) significant, higher involvement of the external (extensor) region than the internal (flexor) region was detected only on the upper arms in all age groups ($p < 0.01$) and on the forearms only at 1 year of age.

DISCUSSION

Most frequently involved regions (shown in Table 1) were mostly as described previously (2); onset of the disease was first on the scalp and face in early infancy, with subsequent shift to the flexor regions of the extremities. This shows that the change in skin lesions of atopic dermatitis from the infant

Table 1. Areas with very high lesion frequency in four age groups.

Age	3-5M	6-11M	1Y	2-4Y	5-9Y
Scalp	+++				
Forehead	+++	+			
Cheeks	+++++	+++	++	+	
Chest	+++	+++	+++	+++	+++
Abdomen	++	+	+++	+++	++
Back	+++	++	+++	+++	+++
Neck					++
Cubital				+	++
Popliteal	+			+	++

+: > 40%, ++: > 50%, +++: > 60%, ++++: > 80%

Table II. Areas with very low lesion frequency in four age groups.

Age	3-5M	6-11M	1Y	2-4Y	5-9Y
Nose	--	-	--	--	--
Mamillae	-	-	--	*	--
Palms	--	--	--	-	--
Fingers	--	-	-	-	-
Forefeet	-	--	--	-	-
Soles	---	---	---	---	---
Toes	--	---	--	--	--

-, < 10%, --, < 5%, ---, < 1%

period to childhood occurs between ages 1 year and 2 years. This is a year younger than the first description by Sulzberger (see ref. 2). Therefore, 2 years of age was analysed separately from 3 and 4 years, but 2 years was found in many respects to be nearer to 3 and 4 years rather than to 1 year.

The chest, back and abdomen were the sites of predilection from infancy through childhood. One reason for these high incidences is their expansive area but we know that wide patchy lesions were often observed on the upper chest around the clavicular area. This may be regarded as one of typical lesions of AD. The buttocks are known as the sites frequently involved from school age (3). In this paper, involvement started to increase at 2-4 years.

The neck and cubital and popliteal fossae are usually highly involved in late childhood and are known as specific lesions, but they were also involved in early infancy and incidences were low in transitional ages. Pathomechanisms probably differ between early infancy and late childhood.

Least affected lesions are summarized in Table II. The mamillae and hands (palms and fingers at least) were not so frequently affected. These are listed in Hanifin & Rajka's minor criteria. The feet have been reported to be a predilection site (4) but were extremely rarely affected in this study, possibly related to the Japanese custom that people usually take off their shoes when at home.

Hanifin and Rajka's description that external involvement is one of typical distribution in infants and children was supported only regarding the upper arms, but not as regards forearms and legs. This does not necessarily exclude the possibility that easily recognizable patchy lesions are more often

present on the extensor than on the flexor sides of the forearms and legs.

There was practically no difference in the distribution or incidences of skin lesions between the positive atopic history group and the negative group. Reliability of anamnesis depends on the memory, interest, intelligence and age of a subject and on the number and composition of his family members. It also depends on the enthusiasm of the interviewing doctor. In this investigative study, atopic history was very carefully recorded. Nevertheless it was shown that atopic history may be an unreliable condition for the diagnosis of AD, although it may support the diagnosis in each individual case. It should be remembered that atopic history is not a condition for the diagnosis of bronchial asthma.

Whether the present analysis of the distribution of skin lesions can directly lead to specific markers useful for the diagnosis of atopic dermatitis is still uncertain. In this study, primary lesions of erythema and papules were evaluated as equally as scratched, croded, and lichenified lesions. Scratched patchy lesions are apparently more noticeable to the clinician and they may be more useful as markers of AD. This must be analysed in our further investigation.

To summarize, our analysis of atopic skin lesions seems to indicate that most of the central portions of the body – except peripheral portions such as the nose, hands and feet – can be affected in atopic dermatitis. Nevertheless, there was an uneven distribution of the lesions on what we call predilection sites. Lesions are exaggerated by scratching. Discovery of local factors that cause itching and scratching on the predilection sites seems to be important for the understanding of the pathogenesis of atopic dermatitis.

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