Psoriasiform Dermatosis in a Rhesus Monkey

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We describe a dermatosis in a rhesus monkey (Macaca mulatta) that has the characteristic features of the human skin disease, psoriasis vulgaris. The monkey was affected by chronic erythematous, scaling plaques that occurred on the scalp, face, dorsal back, the extensor aspects of the limbs and the palms and soles. Subungual hyperkeratosis was present. Skin biopsies of the affected skin showed a regular acanthosis with reduction of granular cell layer, parakeratosis and supra papillary thinning of the epidermis. Foci of inflammatory cells were seen in the upper epidermis. The dermal changes were tortuous capillary loops and benign inflammatory infiltrate, particularly in the papillary dermis, all of which are features of the human skin disease psoriasis vulgaris. The presence of a nutritional deficiency syndrome was excluded and there was no evidence of any systemic disease.

Psoriasis vulgaris is a common human skin disease affecting approximately 2% of the population of the United Kingdom and Northwestern Europe [1]. Clinically, psoriasis vulgaris is characterized by erythematous scaling plaques often beginning on the extensor aspects of the body.

Histologically, psoriasis vulgaris is characterized as showing benign epidermal hyperplasia with epidermal thickening and the presence of parakeratosis. The dermal blood vessels are abnormally tortuous and dilated and a dermal inflammatory infiltrate is frequently seen. Epidermal foci of inflammatory cells may be seen [2].

There has, to date, been no animal model for psoriasis vulgaris. There have been several descriptions of animal models with epidermal hyperproliferation, for example, epidermal hyperproliferation seen after epidermal tape stripping as described by Marks, Pongsehirun, and Saylan, in 1973 [3], ultraviolet light stimulated epidermis described by duVivier in 1976 [4], and the essential fatty deficient hairless mouse described by Lowe and Stoughton in 1977 [5]. While these models showed a benign epidermal hyperplasia, there were many differences from psoriasis vulgaris.

We have had the opportunity recently to study a dermatosis in a female rhesus monkey (Macaca mulatta) that has the characteristics both clinically and histopathologically of psoriasis vulgaris.

CLINICAL DETAILS

A 4 kg multigravid rhesus monkey, which has been in captivity for at least 6 yr, developed a slowly progressive and then stable chronic dermatosis that was characterized by the appearance of raised erythematous scaling areas of skin on the scalp, face, dorsal back, extensor aspects and some flexural affects of the upper and lower limbs. There was also erythematous scaling of the palms and soles and subungual hyperkeratosis. She was otherwise apparently well with no obvious signs of systemic disease. She has maintained her weight, and had no diarrhea. Various skin scrapings were examined for acariosis, but no parasites were found. Numerous cultures for dermatophyllic fungi only revealed commensals. The clinical features are shown in Fig. 1 to 4.

INVESTIGATIONS

Blood and Serum Studies

Hemoglobin WBC, RBC differential and platelet counts were normal; SGOT, SGPT, alkaline phosphatase, blood urea nitrogen, cholesterol, total protein, LDH, bilirubin, creatinine, phosphate, calcium glucose, chloride, creatinine phosphokinase, potassium, sodium and uric acid levels in serum were all in the normal range. Pyridoxal phosphate and serum zinc were also unremarkable. Essential fatty acid levels were assayed in the serum using gas liquid chromatography with silic columns at 180°. There were readily measured levels of linoleic acid and arachidonic acid. W9, 20:3 eicosatrienoic acid, which is typically elevated in essential fatty acid deficiency, was not detected. These blood and serum levels were compared with known normals and with levels in blood obtained from a normal female rhesus monkey from the same animal care facility.

Clinical Course

The monkey has remained well, being fully active with no diarrhea, weight loss, loss of appetite or any significant systemic symptoms for approximately 6 mo since the onset of the skin rash. The rash itself is apparently nonpruritic. A possible Kober’s response was noted with psoriasiform changes appearing in an umbilical scar. 5 mg/ml triaminolone acetonide injected intrallesionally temporarily improved the clinical and histological abnormalities. The psoriasiform features returned to the injected site after 5 weeks.

SKIN BIOPSIES

Skin biopsies were taken from both involved and uninvolved skin, embedded in paraffin and stained with hematoxylin and eosin (H&E).

HISTOPATHOLOGY

A normal monkey was skin biopsied from dorsal forearm for comparison (Fig 5). From the affected monkey, noninvolved skin was taken from the upper arm and showed an epidermis approximately 6 to 8 epidermal cell layers thick with an intermittently present granular cell layer and the absence of any parakeratosis. There was a normal keratin layer. In addition, there was no obvious dermal inflammatory response. The normal monkey skin and noninvolved psoriasiform monkey skin were similar histologically.

The involved skin biopsy taken from the lower arm skin showed the following features (Fig 6). There was a marked epidermal thickening with regular acanthosis with club-shaped rete pegs. There was a lack of granular cell layer and obvious parakeratosis present in most areas. The dermal capillary loops
FIG 1. Right forearm and elbow showing erythematous well demarcated plaques of psoriasis.

FIG 2. Affected sole of feet of rhesus monkey with psoriasis (Left) compared with a normal monkey. There is a diffuse hyperkeratosis and subungual hyperkeratosis.

FIG 3. The great toe-nails of a normal monkey compared with the affected monkey (Left). Note subungual hyperkeratosis.

FIG 4. Affected monkey's forearm (Left) compared with normal monkey forearm. There is scaling and erythema.

FIG 5. Normal rhesus monkey (dorsal forearm) skin. Intermittent epidermal granular cell layer and epidermal thickness of about 6 viable epidermal cell layers (H&E × 250).

FIG 6. Involved skin from dorsal forearm: There is a regular acanthotic epidermis with elongated club-shaped rete pegs. There is absent granular cell layer and parakeratosis. Suprapapillary thinning is seen above tortuous dilated capillaries and mixed inflammatory dermal infiltrate (H&E × 100).

FIG 7. Skin biopsy showing collection of leukocytes present in the upper epidermis. Parakeratosis is also seen (H&E × 250).

FIG 8. Skin biopsy taken from involved skin of right forearm 2 weeks after intralosomal triamcinolone acetonide. Suprapapillary thinning remains, but there has been marked reduction of the epidermal acanthosis and length of the rete pegs (H&E × 250).

were dilated and tortuous, particularly in the papillary dermis. There was a significant mixed inflammatory white blood cell exudate present. Some of these inflammatory cells were seen above the capillary loops and also scattered in the epidermis. The epidermis above the capillary loops showed marked supra papillary thinning (Fig 6). There were prominent and more frequent cells in mitosis in the involved epidermis than in the noninvolved epidermis.

A skin biopsy taken from an area of involved skin 2 weeks following the intralosomal triamcinolone acetonide showed a marked reduction of acanthosis with reduction of inflammatory infiltrate and return of the epidermal granular cell layer (Fig 8).

A 4-mm skin biopsy from the involved facial skin was frozen and sectioned with anti IgG, anti IgA, anti IgM and anti C-3 and examined directly for immunofluorescence. These studies were negative, suggesting that an immune disorder was not present.

DISCUSSION

The clinical and dermatopathological abnormalities in this rhesus monkey strongly resemble the features that are seen in human psoriasis vulgaris. These changes may be summarized in this animal as those of erythematous scaling plaques most obvious on the limbs but also present on the scalp and face. In addition, there was diffuse scaling and erythema of the palmar and plantar skin with the presence of hyperkeratosis beneath the nails.

Histopathologically the changes described were compatible with those seen with psoriasis vulgaris. These changes may be listed as (1) Regular acanthosis with "club" shaped rete pegs. (2) Supra papillary epidermal thinning. (3) Parakeratosis and reduction or absence of granular cell layer. (4) Dilated and tortuous papillary dermal capillary loops. (5) Mixed dermal inflammatory infiltrate. (6) Foci of inflammatory cells in upper epidermis.

The response of the involved skin of this monkey to intralosomal triamcinolone acetonide is of interest and warrants more detailed study. There was a significant reduction of erythema and scaling at the injected site after 2 weeks that became abnormal again after 5 weeks.

It may be possible to study further the progressive effects of local treatment of this monkey's abnormal epidermis with the treatment modalities available.

The monkey has been otherwise well; in particular, there has been no weight loss or gastrointestinal disturbance such as diarrhea. There are several deficiency syndromes that may be associated with scaling skin and psoriasiform changes, and although this animal is the only affected animal in a colony fed a standard laboratory primate diet, we have excluded the presence of essential fatty acid deficiency, vitamin A deficiency, vitamin B6 deficiency, vitamin A and carotene deficiency. Direct immunofluorescence was also negative. Human antisera were used and it is possible that anti IgG, IgM, IgA may not cross react with monkey tissue. However, human anti C-3 cross reacts with canine skin and it is highly probable therefore that
it would in the rhesus monkey (A.R. Ahmed, personal communication).

In summary, this is a preliminary report of the clinical and dermatopathological abnormalities present in a female rhesus monkey that are similar to the human disease psoriasis vulgaris. The basic pathogenesis of psoriasis vulgaris is unknown. Over the last 16 yr, the epidermal proliferation of psoriatic skin has been studied in detail using radioactive tracers and precursors of nucleic acids. Rothberg, Crouse, and Lee [6], using C14 labeled leucine found an epidermal turnover time of 28 days in normal skin and only 4 days in psoriasis. Weinstein and Van Scott [7] using tritiated thymidine found a turnover time of normal viable epidermis of 14 days compared with 2 days in psoriatic skin. Therefore, there is epidermal hyperproliferation and rapid turnover of the epidermal cells in psoriasis.

It is proposed to study, in greater detail, abnormalities which may be present in the skin of this animal. In this study, we have not attempted to measure the mitotic rate, but we have studies in progress on the skin of this animal and skin of normal female rhesus monkeys of similar age which will investigate different epidermal parameters including epidermal mitotic index, epidermal labeling indices following tritiated thymidine injection and autoradiography. Epidermal cell cycle times will be investigated. It is also planned to study polyamine, cyclic nucleotide, prostaglandin and lipid metabolism in the epidermis of this animal.

In addition, attempts will be made to breed from the animal in the hope that offspring may be born and may develop similar cutaneous problems. It is suggested that careful examination of primates may reveal further cases similar to psoriasis vulgaris.

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REFERENCES