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STRONTIUM SULFIDE DEPILATION OF RAT SKIN AND THE EFFECT OF LANOLIN ON DEPILATED SKIN

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USNRDL-345

U.S. NAVAL RADIOLOGICAL DEFENSE LABORATORY
SAN FRANCISCO 24, CALIFORNIA

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SECURITY

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USNRDL-345
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San Francisco 24, California

17 March 1952

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DATE ISSUED: 9 May 1952

ABSTRACT USNRDL-345

A method is described for the depilation of rat skin making use of strontium sulfide paste followed by lanolin application. Histologic and gross observations of the depilated area for a 10 day period, both with and without lanolin application, are described. Ten days following depilation the skin protected with lanolin application was essentially normal while hair growth at this time was very slight. Without lanolin application the depilated areas became encrusted and remained so for 7 to 8 days.

INTRODUCTION

Studies initiated in this Laboratory on the effects of radiant thermal energy upon the skin of rats have required the availability of large numbers of rats with areas free of all but a minimal quantity of hair stubble. It was necessary that essentially no histological or biochemical injury be done to the skin in the depilated area. Because of the number of animals involved, the method had to be rapid.

The problem of preparing the skin of small laboratory animals for physiological or biochemical studies has received attention from many workers and numerous techniques have been devised. Clipping, razor and electric shaving, stripping with adhesive tape and chemical depilation have been used. Certain disadvantages are associated with each of these techniques.

From the initial studies in this Laboratory, a chemical depilation with strontium sulfide seemed most promising. It was found that treatment of the depilated surface with lanolin prevents the roughening and serous encrustation that otherwise follows the use of this depilatory. Clipping was found to cause only slight damage to the skin but it produced an inadequately depilated surface. Careful electric or razor shaving yielded a surface nearly free of grossly visible hair but after a day or two numerous serous crusts appeared on the surface. Adhesive tape stripping was obviously unsatisfactory since gross skin damage, including many small areas of bleeding, was seen immediately after depilation.

The age of the rat at depilation was found to bear a critical relationship to the completeness of depilation. Animals younger than about 45 days, or older than 60 days, did not provide a satisfactory preparation. Rats less than 45 days of age had a spotty surface with scattered areas of unremoved fine hairs; those older than 60 days had a heavy bristle which frequently was not completely removed.

METHODS USNRDL-345

The following depilation technique was evolved. Female Sprague-Dawley rats (50 to 60 days old) were lightly anesthetized with nembutal and a thick paste of a commercial strontium sulfide depilatory applied to one or both flank and hip areas. After 4 to 5 minutes, the paste was washed off with a stream of cool water. The area was then rinsed with 0.1 per cent acetic acid and finally with more cool water. The lanolin was softened by warming and then applied liberally to the depilated area at 1 hour, 2 days and 4 days after depilation.

To evaluate the tissue injury produced by depilation and the part played by lanolin in its prevention, the following study was undertaken.

Forty-two rats were clipped and depilated as described. To a group of 21 of these animals, lanolin was applied at 1 hour, 2 days and 4 days after depilation. No lanolin was applied to the remaining group of 21. Immediately after depilation and at 1, 2, 4, 7, 8 and 10 days, three animals from each group were sacrificed and the depilated area removed for histological study.

A control group of three animals was clipped but no other treatment was given. These animals were sacrificed immediately and skin specimens removed from the clipped area for histologic study.

All specimens were fixed in Bouin's solution, imbedded, sectioned at 7 micra and stained with hematoxylin and eosin.

RESULTS USNRDL-345

The gross changes seen in the depilated area are described in Table 1 (next page).

Histologically, the skin was considered in three layers. In the clipped controls, the outermost layer, the stratum corneum, had a superficial, spongy appearing component and a deeper, compact eosinophilic portion. The stratum Malpighii, the cellular portion of the epidermis, was normally about two cells in thickness. The deeper cells were roughly cuboidal with

TABLE 1

GROSS SKIN CHANGES RESULTING FROM APPLICATION OF LANOLIN TO CLIPPED AND DEPILATED (SrS) RAT SKIN

Time after Depilation (days)	Gross Changes	
	Lanolin Treatment	No Treatment
Immediate	Hair absent	Hair absent
1	No change	No change
2	No change	Multiple, tiny, serous crusts
4	No change	Larger crusts
7	No change	Crusts drop off
8	No change	Crusts drop off
10	Very slight hair growth	Very slight hair growth

ovoid to round nuclei; those more superficial were flat, had no distinguishable nuclei and contained variable amounts of a dark staining granular substance. The remainder of the skin, the dermis, was composed of a loose, eosinophilic, connective tissue matrix dotted with hair follicles and sebaceous glands. A very few small blood vessels were recognizable in the superficial layers of the dermis. The base of the hair follicles and some larger blood vessels were seen in the deeper dermis.

Clipped and Depilated Rat Skin

Immediately after depilation, the spongy portion of the stratum corneum was absent. The hair shafts were not present above the surface of the skin and, in the upper half of the dermis, were shriveled and dark staining. Neither increased vascularization nor other evidence of inflammation was present.

One Day. Of the stratum corneum only the compact base layer remained and this was easily detached from the stratum Malpighii. Cells of the stratum Malpighii were swollen and pale staining and the entire stratum separated readily from the dermis. The superficial levels of the dermis were highly vascular.

Two Days. The superficial cells of the stratum Malpighii exhibited a

marked increase in black staining granules and the deeper cells showed swelling, vacuolization and chromatin clumping. The dermis was highly vascular.

Four Days. There were numerous small areas where the epidermis was absent and replaced by pockets of pus cells. A few polymorphonuclear cells appeared in the dermis. The remaining stratum Malpighii was 3-5 times normal thickness and stratified. The basal cells were roughly cuboidal while the more superficial ones were first polygonal and then flattened.

Seven and Eight Days. Only a few pus cells were present in the corneum. The stratum Malpighii was still stratified, but it was only 2-3 times normal thickness. Beginning regrowth of hair shafts was evident near the surface of the dermis.

Ten Days. The spongy layer of the corneum in general appeared essentially normal. The stratum Malpighii was about twice normal thickness and the cells above the basal layer were flattened, had lost most of their nuclei and contained a large amount of the black staining substance. The vessels of the superficial dermis were considerably less prominent than at 7 and 8 days. The new hair shafts had penetrated the surface of the stratum corneum.

Clipped, Depilated and Lanolin Treated Rat Skin

One Day after Depilation. The spongy layer of corneum was absent and the stratum Malpighii separated easily from the dermis; otherwise, the skin appeared normal.

Two Days. Essentially normal.

Four Days. Normal except for slight thickening of the stratum Malpighii in a few small areas.

Seven Days. A moderate increase in black staining material was seen. There was a slight thickening, in a few areas, of the stratum Malpighii. The hair shafts had reached the stratum corneum.

Ten Days. The skin was normal except for an increase in the black staining material and a slight thickening of the stratum Malpighii.

DISCUSSION

As a result of the described method of clipping and depilating rat skin, without use of lanolin, several changes in the skin occurred. Initially there was a removal of the hair shafts to a point below the epidermis and a loss of the superficial spongy appearing layer of the stratum corneum. After 48 hours a serous crust appeared on the surface and a mild inflammatory reaction was present in the epidermis and upper dermis. By 10 days the inflammatory reaction had essentially disappeared; however, the epidermis remained twice normal thickness and contained a considerable excess of a black staining granular material. At 10 days the new growth of hair shafts had penetrated the surface of the epidermis.

When lanolin applications were used during the first 4 days after depilation, the secondary serous exudation and inflammation did not occur. At 7 to 10 days a slight increase in thickness and pigmentation of the Malpighian layer was present but to a lesser extent than when no lanolin was used. It is possible that these changes might have been prevented by continuing the lanolin applications beyond 4 days.

The delay in appearance of the inflammatory reaction in the non-lanolin treated skins suggests that the reaction may have been the result of exposure of the skin to drying and other external factors rather than a later result of depilation.

SUMMARY

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A method for the preparation of rat skin essentially free of hair has been developed. The histologic changes following the application of strontium sulfide to the skin, with and without subsequent lanolin application, have been described.

Approved by:

M. C. Fishler
Head, Biological and Medical Sciences Division

For the Scientific Director

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