STUDY OF SKIN CONTAMINATION WITH RADIOACTIVE SUBSTANCES (PART 2)

—INFLUENCE OF pH—

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We studied the influence of pH, using ^{131}I solution, as for a skin contamination and obtained the following results: 1) in regard to alkalinity, the skin surface contamination was large and in regard to acidity, the contamination in skin surface was less than in skin deep part. 2) the internal contamination in acidity was larger than in alkalinity.

INTRODUCTION

We carried out the role of horny layer or skin as for the skin contamination of ^{131}I solution with hairless mouse and obtained the results that there was a difference in the permeance of ^{131}I solution between normal skin with horny layer and skin without horny layer. At this paper, we studied that the influence of pH of ^{131}I solution to the skin contamination.

METHOD AND RESULTS

Experimental animal was hairless mouse (5-week-old) that was used as

follow: the skin was isolated from the back skin of hairless mouse and ^{131}I was dripped on the isolated skin. For observing the internal permeability of ^{131}I solution, the radioactivity passed through the skin was counted with a circulation system of physiologic saline (Yano et al., 1977).

The circulation system consisted of the table that put the isolated skin on, pump, pyrostat and well type counter. The physiologic saline kept at 37°C in pyrostat was moved by pump and circulated between the table and a glass tube inside well counter. The pump was adjusted to keep the physiologic saline flow constant. The table that put the

skin on and the glass tube were closed up tightly by gum packing to prevent over flow.

The physiologic saline was circulated on the back surface of the isolated skin and then turn into the glass tube inside well counter and activity of saline was counted with well counter. The counts (cpm) meant the dosis of ^{131}I passed through the skin.

The permeance dosis was estimated in both cases of skin with and without horny layer and in case that pH of ^{131}I solution was changed into pH 5, 7 and 8.

The horny layer was removed by means of applying adhesive tape to horny layer 20 times.

The permeance dosis was shown in Table 1.

TABLE 1

Relationship between skin condition and pH

	pH 5	pH 7	pH 8
Skin with horny layer	$9.5 \pm 6.9\%$	$7.1 \pm 4.7\%$	$1.7 \pm 1.6\%$
Skin washed by alcohol	—	$5.7 \pm 1.8\%$	—
Skin without horny layer	$78.2 \pm 3.7\%$	$58.8 \pm 14.4\%$	$51.9 \pm 22.3\%$
Damaged skin without horny layer by sand paper	—	$69.6 \pm 19.4\%$	—

In the case of skin with horny layer, the permeance rate was $9.5 \pm 6.9\%$ in pH 5, $7.1 \pm 4.7\%$ in pH 7 and $1.7 \pm 1.6\%$ in pH 8 respectively.

The permeance rate of ^{131}I solution with pH 8 was decreased to 1/5 of pH 7.

In the case of skin without horny layer, the permeance rate was $78.2 \pm 3.7\%$ in pH 5, $58.8 \pm 14.4\%$ in pH 7 and $51.9 \pm 22.3\%$ in pH 8 respectively.

The permeance of ^{131}I solution with acidity was higher than with alkalinity in both cases of the skin with and without horny layer.

In damaged skin without horny layer by sand paper, the permeance rate of ^{131}I solution was $69.6 \pm 19.4\%$ in pH 7, which was increased in the comparison with none damaged skin. This findings showed that the more the skin was damaged, the more the internal contamination was increased.

Washing the skin with alcohol, the permeance rate was $5.7 \pm 1.8\%$ in pH 7 on the decrease because alcohol removed the wax of the skin surface and made skin dry.

^{131}I was dripped on the isolated skin and then adhesive tape was applied on the skin 20 times to remove horny layer.

And ^{131}I activity attached in each adhesive tape was counted.

The frequency of application of adhesive tape was taken on horizontal line and activity was taken on perpendicular line (Fig. 1).

From Fig. 1, it was found that in the surface of horny layer, the activity in alkalinity was higher than in acidity in the deep part of horny layer, that is, with the increase of the frequency, the activity in acidity became higher than in alkalinity.

Amounts of radioactivity of 20 sheets

Fig. 1 Variety of counts (%) inside horny layer due to changing pH.

of adhesive tapes meant amounts of ^{131}I remained in horny layer.

The remainder that was subtracted amounts of activity of adhesive tape from the administered dosis of ^{131}I meant the penetrate dosis in the internal tissue (Fig. 1).

From Fig. 2, it was found that the penetrated dosis in acidity was regardless of the existence of horny layer, higher than in alkalinity.

DISCUSSION

The internal contamination in the case that pH of ^{131}I solution was changed into pH 5, 7 and 8 showed in Table 1. The internal contamination was larger in acidity regardless of the existence of horny layer.

On the other hand, the contamination within the skin was as followed, that is, the activity of 1st time adhesive tape that represented the skin surface contamination was higher in alkalinity.

Fig. 2 Relationship between the permeance dosis (%) and pH in the cases with and without horny layer.

On and after 5 times, the activity was contrawise higher in acidity which meant the contamination in the deep parts of skin was larger in acidity.

These findings seemed to be caused that acidity solution showed the large contamination in the internal tissue.

And acidity solution was easily penetrated into subcutaneous tissue and blood activity was higher even in the case of normal skin. From this view, we assumed that the acidity solution was easy transited into blood flow.

About pH of radioisotope solution and the internal contamination, there was Wadachi's report (1963). In the experience with ^{90}Sr and ^{90}Y , Wadachi observed that the change of pH and contact time of radioisotope with skin affected the skin surface contamination and it was resulted that in the case of more than pH 4, surface contamination was increased and the surface contamination got maximum in pH 10. In the experience with ^{32}P , the surface contamination got maximum in pH 4 or 5. In regard to alkalinity, the surface contamination in alkalinity was more larger than in acidity.

These findings was found on our experience too, that is, skin surface contamination was larger in pH 8 than in pH 5.

Tashiro (1966) reported that in anode substance, the skin surface contamination

was larger in acidity, in cathode substance, the surface contamination was larger in alkalinity than acidity.

^{131}I was anode and the surface contamination was larger in alkalinity and the deep part of skin contamination was larger in acidity.

The amounts of the surface contamination and the internal contamination was depended on whether it was acidity or alkalinity.

In handling radioactive substances, we should be paid attention whether it was acidity or alkalinity for prevention of the internal contamination.

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