Enhanced Rabbit Skin Plasmin Activity by UV Irradiation

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Key Words

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Hijikata [1] reported increased plasmin (PL) activity of rabbit skin induced by UVB irradiation. In this study, we reexamined this fact and determined the action spectrum (AcSp) for skin swelling and PL activity by UV irradiation.

Four-week-old male New Zealand white rabbits were used. Rabbits were irradiated by fluorescent UVB lamp (Toshiba FL-20SE 30, 7.5 W/m²) or an irradiation mono-chromator (CRM-FM, Japan Spectroscopic Co., Tokyo). The degree of erythema was measured by a colorimeter (OFC-1001DP, Nippon Denshoku, Tokyo), and skin swelling was expressed in terms of skin thickness measured with dial thickness gage (Mitsutoyo, Tokyo). Irradiated skin (1×1cm) was homogenized and centrifuged at 30,000 g for 30 min. PL activity of this supernatant was measured using a synthetic fluorogenic peptide substrate, Boc-Val-Leu-Lys-MCA [2].

Elevated PL activity was detected 6 h after UVB irradiation at the dose of 1.5×10^3 J/m², equivalent to twice the minimal erythema dose, and reached a plateau after 24 h. It coincided well with the time course of skin swelling, while it did not with that of erythema.

Skin was irradiated with graded fluences in arithmetic progression of + 0.5 or + 1.0×10^3 J/m², such as 0, 0.5, 1.5, 2.5, 4.5 $\times 10^3$ J/m². PL activity measured 24 h after irradiation increased fluence-dependently. It reached a plateau at 1.5×10^3 J/m², which was $147 \pm 15\%$ of nonirradiated control.

Tranexamic acid (TA, 800 mg/kg), which was injected intraperitoneally 36, 24, and 12 h before and 0 and 12 h after irradiation, suppressed significantly both PL activity and skin swelling at 12–48 h after irradiation.

AcSp for PL production and skin swelling ranged from 260 to 310 nm with two peaks at 280 and 300 nm. In contrast AcSp for erythema differed from them.

This study clearly demonstrates that UV irradiation enhances tissue PL activity in the skin. This effect is fluence- and time-dependent. The peaks of AcSp for PL production were 280 and 300 nm. Takashima et al. [3] reported that a peak of AcSp for plasminogen activator production from keratinocyte is 260–270 nm. The peak at 280 nm seems to induce PL activity from epidermal keratinocyte, while the peak at 300 nm induces PL activity from keratinocyte and dermal

fibroblast. Several lines of evidence prove that PL mediates skin swelling in UV inflammation. Time course and AcSp for PL production correlated well with those for skin swelling, and both PL production and swelling were suppressed by TA treatment.

References

- Hijikata T: Fibrinolysis in sunburn reaction (Japanese). Jap J Dermatol 1973;83:347–360.
- Kato H, Adachi N, Ohno Y, et al: New fluorogenic peptide substrates for plasmin. J Biochem (Tokyo) 1980;88:183–190.
- Takashima A, Ichikawa K, Yasuda S, et al: Induction of plasminogen activator by UV light in mouse keratinocyte-derived cell line, Pam 212. Dermatologica 1989;179(suppl 1): 133.