Scurvy and Anaphylactic Shock

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This study was designed to re-examine the importance of ascorbic acid in anaphylaxis in guinea-pigs. After sensitization with egg albumen, the animals were exposed to antigen aerosol and their sensitivity to anaphylactic shock measured as the mean collapse time (Herxheimer, 1952). They were then placed on an ascorbic acid-deficient diet and the sensitivity again measured. This decreased from the end of the second week so that by the fourth week they were insensitive. This result was in contrast to that obtained when guinea-pigs were exposed to a histamine aerosol while on an ascorbic acid-deficient diet. In this case, control mean collapse times were maintained until the end of the fourth week, after which insensitivity developed quickly.

Ascorbic acid (100 to 200 mg/kg), administered just before sensitized guinea-pigs were exposed to antigen aerosol, gave marked protection against anaphylactic shock. This effect appeared to be partly due to a reduction of histamine sensitivity, as these doses of ascorbic acid reduced the bronchoconstriction induced by intravenous histamine. The protective influence was not affected by reserpine, pronethalol or pempidine treatment.

The effect of ascorbic acid on histamine metabolism was then examined in an attempt to explain these findings. When guinea-pigs were placed on a scorbutic diet, there was first an increased production of urinary free histamine and an increased conversion of histidine to histamine after an oral load of histidine, but later, in terminal scurvy, both urinary free histamine and the conversion of histidine were greatly reduced. Administration of ascorbic acid reduced the formation of histidine to histamine in both scorbutic and control animals. The in vitro activities of histidine decarboxylase and histaminase from scorbutic animals were similar to those from

44 Dawson/West, Scurvy and Anaphylactic Shock

control animals, and added ascorbic acid did not change either activity.

It appears that ascorbic acid is essential for complete sensitization of guinea-pigs to antigen and for the maintenance of the degree of sensitivity to antigen. It is also of interest that the response of guinea-pigs to endogenous histamine (released during the anaphylactic reaction) is different from that to exogenous histamine (given as an aerosol).

In rats, ascorbic acid, administered concomitantly with non-effective doses of mepyramine, gave complete protection against anaphylactic shock, although alone it only slightly reduced the mortality rate.

Reference

Herxheimer, H.: Repeatable 'microshocks' of constant strength in guinea-pig anaphylaxis. J. Physiol., Lond. 117: 251-255 (1952).