Late Pulmonary Response in Guinea Pigs after Ascaris Challenge

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Many asthmatic patients show biphasic pulmonary response, consisting of immediate and late bronchoconstriction after allergen challenge (Hargreave et al. 1974). It has been suggested that the late pulmonary response has some clinical features similar to those of naturally occurring asthmatic attack. There are some papers concerning the pathophysiology as well as pathogenesis of the late response. To our knowledge, two animal models of the late response have been proposed: the sheep (Abraham et al. 1983) and rabbit (Shampain et al. 1982). Guinea pigs have often been used for study of bronchial asthma because of their bronchial hyperresponsiveness to various stimuli. However, there have been no reports on the late pulmonary response in guinea pigs. Accordingly, in this study we examined whether guinea pigs have a late pulmonary response or not.

Eight male albino guinea pigs of Hartley strain (400 to 600 g) were immunized by injection of a mixture (1 ml) of 2 mg Ascaris suum extract (Greer Diagnostics, Lenoir, NC, USA) and 10 mg aluminium hydroxide, intraperitoneally and subcutaneously. On the 14th day after the 1st immunization, a 2nd immunization was performed in the same way as the 1st one. One week after the 2nd immunization, all of the guinea pigs were challenged with inhalation of Ascaris suum aerosol generated by an ultrasonic nebulizer. Respiratory resistance (Rrs) was measured by the oscillation method, according to the principles described by Mead (1960). On the day of the challenge, guinea pigs had 1: 63 to 1: 256 serum titer as measured by homologous passive cutaneous reaction of anaphylaxis. Five of eight immunized guinea pigs responded to the aerosol challenge with a biphasic response. One of the remaining three showed the immediate response only and the two did not respond at all. Percent increase of Rrs in guinea pigs with a biphasic response was 237±80% (mean±s.d.) at the immediate response and 241±81% at the late response.
Fig. 1 shows the time course of Rrs change in a typical experiment over 6 hr after aerosol challenge with *Ascaris suum*. Upon exposure to the allergen, Rrs began to increase. One hour later, Rrs had returned to the control level. However, it increased again between the 4th and 6th hr following the challenge. This biphasic pulmonary response resembles closely that of asthmatics reported.

Histological study (Fig. 2) shows a narrowing of the bronchial lumen and digitating of the epithelium into the bronchial lumen due to contraction of the bronchial smooth muscle. In addition, peribronchial edema and neutrophil-rich mucous in bronchial lumen were observed.

The cytological study of bronchoalveolar lavage fluid indicated that neutrophils had markedly increased (31.9 ± 7.5%, mean ± S.D.) at the late pulmonary response compared with the control (2.9 ± 1.2%).

As described above, we showed that guinea pigs immunized with *Ascaris suum* had a biphasic pulmonary response after aerosol challenge. The late response model of this animal may be a useful tool in studies of the late pulmonary response of bronchial asthma.

References