Effect of a Lymphocyte-Derived Pro-Inflammatory Factor on Carrageenan Pleurisy in the Rat

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Abstract

An intravenous injection of a lymphocyte pro-inflammatory factor (LpIF), obtained from rat spleen, restored diminished fluid and cellular responses in carrageenan pleurisy in leucopenic animals. A similar filtrate of bone marrow cells had no restorative properties. Previous results from elsewhere indicated a single pro-inflammatory activity on the fluid component of inflammation. We propose that LpIF has a more significant effect by influencing both components of inflammation and suggest that the discrepancy may be due to the different models used.

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Although not present in large numbers at acute inflammatory foci, evidence exists which implicates a role for lymphocytes in the development of acute (non-immune) inflammation. Firstly, Turk et al. [1968] demonstrated a decreased acute response in rats treated with anti-lymphocyte sera. Also, Stevens and Willoughby [1969] proposed a possible correlation between the anti-inflammatory activity of certain immuno-suppressants and their ability to lower the circulating lymphocyte count.

More recently, Garcia Leme et al. [1976] have shown that lymphocytes (and their products) from rat spleen have the ability to restore diminished acute inflammatory responses in leucopenic animals. This inflammatory modulator, termed 'lymphocyte pro-inflammatory factor' (LpIF), has been shown to be more associated with fluid exudation than with leucocyte emigration [Bechara et al., 1976]. We have investigated the effect of LpIF on the carrageenan pleurisy [Velo et al., 1973] and present evidence that this factor has a more significant effect than was originally proposed.

Male Wistar rats (200–250 g) were rendered leucopenic using methotrexate (Nordic) – 3 doses of 2.5 mg/kg at 24-hour intervals. Effectiveness of treatment was assessed by carrying out blood leucocyte counts (blood sample taken from tail and counted using a Coulter D Counter) before treatment and 3 days after the final dose. Only healthy animals showing a 50% reduction in leucocyte count were used. Figure 1

shows that leucopenia reduces the number of cells entering the pleural cavity during a 4-hour carrageenan pleurisy (A-carrageenan, Marine Colloids) when compared with that of non-leucopenic controls (less than 1 % lymphocytes). It can also be seen that the response is restored to 80% of control levels when animals are injected, just prior to initiation of pleurisy, with a

filtrate of spleen cells prepared in Medium 199 (Flow) as described by Garcia Leme et al. [1976]; the filtrate obtained was from 60×10^6 viable spleen lymphocytes (the approximate number of cells required to restore the lymphopenia). A similar amount of bone marrow cell filtrate was used as control – the cells being obtained by the method of Pelletier et al. [1978] and converted to filtrate by subsequent sonication at 15,000 cps for 30 s followed by passage through a 0.45- μ m Millipore filter – and was ineffective. The effect of these different treatments on exudate volume is presented in figure 2 and shows a profile similar to that of the cellular response. The results shown in figures 1 and 2 are the means $\pm$ SEM of groups of 5 or 6 animals (statistical analysis was by Student's t test).

Garcia Leme [1981] has produced strong evidence that lymphocytes, independent of previous sensitisation, release pro-inflammatory factor(s) needed for adequate host response to injury. Previously, Bechara et al. [1976], using histological techniques have shown that this lymphocyte factor interferes with events leading to fluid exudation with no effect on the cellular response. Inflammation in the pleural cavity lends

190

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200

160

120

40 -

*p < 0.01

well as the fluid. The discrepancy between these results and those of Bechara et al. [1976] may be explained on the grounds of the different models used -these authors may have missed the effects on the cellular component because cellular infiltration in the rat paw oedema model is difficult to quantify. Furthermore, different results may be obtained with different strains of rat [Harris and West, 1963].

To conclude, the present results suggest that lymphocytes or their products are important for the full expression of both fluid exudation and polymorph invasion in an acute inflammatory lesion.

Groups

Fig. 1. The effect of different treatments on the number of leucocytes present in the pleural cavity of rats 4 h after initiation of the pleurisy with 0.1 ml of 1% carrageenan. Group I represents non-leucopenic animals which received 0.5 ml of Medium 199 intravenously just prior to pleurisy; group II was as group I except that animals were leucopenic; group III animals were leucopenic and received 0.5 ml of spleen cell filtrate intravenously prior to pleurisy; group IV was as group III except that 0.5 ml of bone marrow filtrate was administered. Statistically significant differences between group II and group III are illustrated.

fp < 0.05

07

0.6

0.5

0.A

0.3 E i 0.2

D

O

φ 0.1 -

$\frac{7}{8}$

-α

D

uj 0

Groups

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Fig. 2. The effect of different treatments on the exudate volume present in the pleural cavity after a 4-hour carrageenan inflammation. Groups are as in figure 1. Statistically significant differences between group II and group III are shown.

itself more readily to quantification, both the fluid exudate and cell number being easily measured [Capasso et al., 1975]. Using this model, the data presented show that LpIF is active on the cellular response as