Functional Heterogeneity of Human Mast Cells

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Abstract

Mast cell heterogeneity in man is much less sharply defined than in the rodent but human cutaneous mast cells appear to be distinct in their histochemical properties, their reactivity to polycationic histamine liberators, and their relative lack of responsiveness to antiasthmatic chromones.

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The concept of mast cell heterogeneity is well established in the rodent where two distinct phenotypes, mucosal and connective tissue mast cells (MMC and CTMC) have been identified [1, 2]. The full extent to which this heterogeneity applies to the human is, however, still uncertain. To address this problem we have now isolated, by collagenase digestion [3], and characterized human mast cells from colonic mucosa and muscle, gastric mucosa, lung, skin, and uterus.

All of the cells stained with alcian blue but failed to counterstain with safranin O, except occasionally (ca. 3%) in the case of skin. Isolated mast cells from colonic and gastric mucosa, lung and uterus were predominantly sensitive to formalin fixation [1] whereas significant numbers of these cells from colonic muscle (ca. 30%) and particularly from skin (ca. 80%) were insensitive to this treatment.

Mast cells from all six locations, together with human basophil leucocytes, released histamine on treatment with anti-human IgE (table 1) and calcium ionophores (data not shown). However, the cutaneous cells were unique in responding to polycationic histamine liberators, such as compound 48/80 and basic neuropeptides, albeit rather weakly and at high concentrations. Representative data with substance P are shown in table 1. The remaining cells were essentially refractory to these agents, although isolated basophils did respond to polyarginine (data not shown).

In contrast, the antiasthmatic drug nedocromil sodium comparably inhibited histamine release induced by anti-IgE from the colonic, gastric, lung, and uterine cells but was significantly less active against the skin cells and basophil leucocytes (table 1). Similar results (not shown) were obtained with the prototype

Table 1. Functional properties of human mast cells

Source Histamine release (%) Inhibition of
induced by: immunologic histamine
release (%) by:

All values are means $\pm$ SEM for 4–7 experiments.

antiallergic compound disodium cromoglycate. Other agents such as β -adrenoceptor agonists and phospho-diesterase inhibitors showed less variation in their reactivity. Representative data with theophylline are shown in table 1.

The present study then shows that it is not possible topographically to define MMC and CTMC phenotypes in man. Instead, the cutaneous mast cell appears to be unique in its histochemical and functional properties. In addition, the present isolation of mast cells from the uterus and gastric mucosa may help to clarify the role of these cells in reproduction and the control of acid secretion, respectively.

240

Pearce/Boulos/Lau/Liu/Tainsh

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