

Connective Tissue Research Laboratory (Director: G. Asboe-Hansen),
University Institute of Medical Anatomy, Copenhagen, Denmark.

BASOPHIL LEUCOCYTES AND HISTAMINE¹

By

A.-W. A. BOSEILA²

INTRODUCTION

Although morphogenetically independent, the tissue mast cells and the basophil leucocytes have some morphological similarities, and have been claimed to be functionally related (Asboe-Hansen & Kaalund-Jørgensen 1956, Boseila 1958 a, b, c). The tissue mast cell is rich in histamine (Riley & West 1953) and so is the basophil leucocyte (Graham et al. 1955). The number of basophils in rabbit blood has been found to decrease significantly following an injection of the histamine releaser compound 48/80 (Boseila 1958 a). A similar effect in the cockerel was reported by Hunt & Hunt (1958). The aim of the present investigation was to study the influence of histamine and antihistamines on the count of basophil leucocytes in rabbit blood.

MATERIAL AND METHODS

Male albino rabbits weighing 1500-2500 g were used. The animals were kept separately and were not used until they became accustomed to handling. Histamine chloride in doses of 0.2 mg/kg was injected intravenously in five rabbits and

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² On leave from the Histology Department, Faculty of Medicine, Cairo University, Egypt.

0.3 mg/kg in 20 rabbits. Pyribenzamine (Ciba, Basle) as well as mepyramine, in doses of 1 mg/kg, were also injected intravenously in two groups of five rabbits each. All injections were performed slowly in one of the marginal ear veins at about 9 a.m.

Blood samples were obtained from the ear veins immediately before the injection as well as after 2, 4, 6 and 24 hours. The blood was diluted 1:10 with Moore & James (1953) toluidine blue diluting fluid as modified by Boseila (1958 a). Fuchs-Rosenthal chambers were filled for simultaneous basophil and total white cell counting. Control counts were carried out on the *same* animals on the preceding day, after injection of corresponding volumes of sterile saline solution.

RESULTS

Following an injection of histamine chloride, 0.3 mg/kg, an increase in the number of circulating basophils was observed in 20 rabbits reaching a maximum ($P < 0.001$) within 4 hours (Fig. 1). With the 0.2 mg/kg dose no significant effect could be noted. Neither mepyramine nor pyribenzamine produced a detectable change in the basophil count.

DISCUSSION

A correlation between the histamine content and the count of basophils in normal blood of different species can be seen from Table 1. In experimental (Code & Mitchell 1957) as well as in pathological (Rorsman 1958) basopenia, a corresponding low level in blood histamine has been reported. In pathological basophilia, such as in chronic myeloid leukemia and in liver cirrhosis, a high histamine content may be encountered in the blood (Graham et al. 1955, Mitchell et al. 1954). Graham and coworkers (1955), using microchemical methods, reported that half of the histamine content of normal human blood is located in the basophil leucocytes.

Following administration of the histamine releaser compound 48/80 in the rabbit the number of circulating basophils

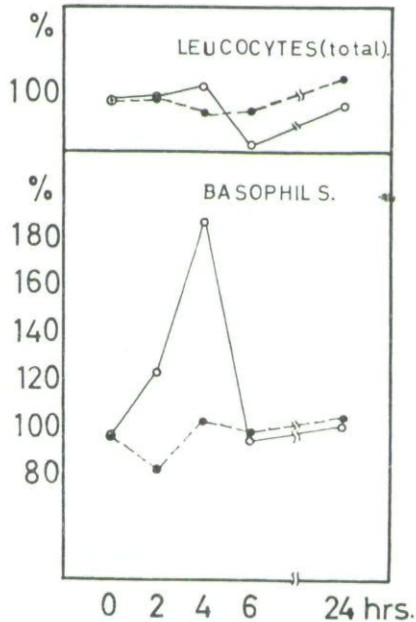


Fig. 1.

Effect of intravenous injection of histamine (0.3 mg/kg) in 20 rabbits, on the counts of basophils and all white cells in rabbit blood. (o—o: mean counts after histamine injection, ●-----●: means counts after saline injection).

increases within two hours. After this, there is a decrease which may be due either to a direct action on the cells causing release of the metachromatic granules, or to a migration of blood basophils to the tissues, or to both factors (Boseila 1958 a). Histamine, on the other hand, entails a more prolonged increase, reaching a maximum at four hours (Fig. 1). The rise is explained as a response to a strong call on the basophil reservoirs; and the secondary decrease may be due to a migration of basophils to the tissues, which are oedematous because of an increased capillary permeability induced by the histamine. Increased tissue water entails a release from the tissue mast cells of water-binding mucopolysaccharides of the hyaluronic acid type converting the water into a gelatinous "ground substance" (Asboe-Hansen & Wegelius 1956). In

TABLE 1
Histamine content in 1 ml blood (from Silvea, 1955) and leukocyte and platelet counts in 1 μ l blood (from Albritton, 1953) in man and some laboratory animals.

	Histamine		Leucocytes								Platelets	
	1 ^g base/ml	%	Total		Neutrophils		Eosinophils		Basophils		count ($\times 1000$)	%
			count	%	count	%	count	%	count	%		
Man	0.047	100*	7400	100	4000	100	200	100	40	100	325	100
Dog	0.020	42	8200	110	4400	110	600	300	85	212	460	141
Cat	0.035	75	9500	128	4500	115	850	425	20	50	422	130
Rat	0.047	100	14000	190	3100	77	300	150	100	250	750	230
Guinea-pig ..	0.120	256	10000	135	4200	105	400	200	70	175	780	240
Rabbit	3.400**	7200	9000	121	4100	102	180	90	450	1125	530	163

* All blood values in man are considered 100 to which the values from the other animals are related in %.

** Of the rabbit histamine value, 2.500 μ g are found in the platelets and 0.900 μ g are in the leucocytes.

the rabbit, possessing few tissue mast cells, the task of furnishing mucopolysaccharide material for such emergencies might be taken care of by the functionally related basophil leucocytes ("blood mast cells") (Boseila 1959 b). A migration of basophils to oedematous ovarian tissue has recently been observed in the rabbit as a response to coitus or injection of gonadotrophic hormone (Zachariae, Asboe-Hansen & Boseila 1958, Boseila 1959 a).

SUMMARY

Intravenous injection of histamine in a dose of 0.3 mg/kg in rabbits produced a significant increase in the number of circulating basophil granulocytes within 2 hours, reaching its maximum in 4 hours.

The suggestion of basophil leucocyte migration from the circulation to the tissues as reflected by a rapid fall in the basophil count, is discussed in relation to the possible roles of mast cells and basophils in oedema organization.

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