Acta Dermatovener (Stockholm) 56: 435–439, 1976

QUANTITATIVE AND QUALITATIVE CHANGES IN MAST CELLS IN THE SKIN OF NORMAL EGYPTIANS

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Abstract. 192 biopsies from normal individuals of either sex and in different age groups were studied for mast cell changes in different sites. It was found that mast cells increase in number with age up to puberty and then decline gradually. The highest count was found in the forearms, followed by the back, abdomen and lower limbs. Metachromasia, tissue basophilia and regularity of cells were most marked during puberty.

Key words: Mast cells

Mast cells develop from undifferentiated mononuclear mesenchymal cells in the perivascular area of connective tissue. It is well known that mast cells secrete many pharmacologically active substances such as histamine, heparin, hyaluronic acid and serotonin.

Reports on mast cell counts in human skin are very sparse. The most comprehensive study hitherto is that of Hellström & Holmgren (6) who made counts of mast cells per cu. mm. of skin from abdomen, calf and top of foot from human subjects at autopsy. Mast cells were found to decrease in number with advancing age in all the sites studied. However, the specimens were obtained in cases where death resulted from a variety of diseases and were in the form of thick (100 μm) frozen sections.

It was found of the utmost importance to study the mast cell population both qualitatively and quantitatively in normal Egyptians of different ages in an attempt to correlate our findings with others and to determine if there is any racial specificity.

MATERIALS AND METHODS

The material consisted of 192 autopsy cases—96 males and 96 females. All were road accident victims. Specimens were collected 2 hours after death. The mast cells were studied from the following four sites: skin from abdomen around the umbilicus, skin from back opposite the second lumbar vertebra, lower limb (L.L.) from extensor surface of mid right thigh and upper limb (U.L.) from extensor surface of the mid right forearm. The cases were sorted into different age groups ranging from 5 to 55 years (Table I).

Histological technique

The samples were fixed in a freshly prepared 4% solution of basic lead subacetate for one day, followed by washing

Table I. *The site, age and sex of cases studied*

Age group	Abdomen		Back		L.L.		U.L.	
	♂	♀	♂	♀	♂	♀	♂	♀
5	3	3	3	3	3	3	3	3
8	3	3	3	3	3	3	3	3
10	3	3	3	3	3	3	3	3
15	3	3	3	3	3	3	3	3
20	3	3	3	3	3	3	3	3
35	3	3	3	3	3	3	3	3
45	3	3	3	3	3	3	3	3
55	3	3	3	3	3	3	3	3
Total	24	24	24	24	24	24	24	24

Table II. *Mast cell count per sq. mm in normal males and females at different ages*

Site	Sex	Age (years) 5	8	10	15	20	35	45	55
Abdomen	♂	312	370	394	404	260	229	183	99
	♀	232	280	294	345	233	194	188	64
Back	♂	322	385	440	456	329	235	231	140
	♀	284	312	326	359	305	256	252	82
Lower limb	♂	175	211	216	243	174	107	95	63
	♀	192	215	234	274	196	181	175	57
Upper limb	♂	375	426	448	465	426	258	231	223
	♀	375	460	506	589	443	340	264	83

Table III. *Mast cell counts at different sites and their statistical significance in various age groupings*

Site	No. of samples	Mean count per mm^3. fresh skin	S.D.	Sites compared	Degree of sign.
Statistical significance at 5 years					
Abdomen	3	26 520	20.8	Abd. *v.* Back	−
				Abd. *v.* L.L.	+++
				Abd. *v.* U.L.	−−−
Back	3	27 370	38.1	Back *v.* L.L.	++
				Back *v.* U.L.	−
Lower limb	3	14 875	43.3	L.L. *v.* U.L.	+++
Upper limb	3	31 875	34.3		
Statistical significance at 8 years					
Abdomen	3	31 790	52	Abd. *v.* Back	−
				Abd. *v.* L.L.	+++
				Abd. *v.* U.L.	−
Back	3	32 385	69.3	Back *v.* L.L.	++
Lower limb	3	17 935	19.1	L.L. *v.* U.L.	+++
Upper limb	3	36 216	41.6	L.L. *v.* U.L.	+++
Statistical significance at 10 years					
Abdomen	3	33 490	51.1	Abd. *v.* Back	−
				Abd. *v.* L.L.	+++
				Abd. *v.* U.L.	−
Back	3	37 400	17.3	Back *v.* U.L.	+++
				Back *v.* U.L.	−
Lower limb	3	18 360	27.7	L.L. *v.* U.L.	++
Upper limb	3	38 080	90.1		
Statistical significance at 15 years					
Abdomen	3	34 378	9	Abd. *v.* Back	−
				Abd. *v.* L.L.	++++
				Abd. *v.* U.L.	−
Back	3	38 795	67	Back *v.* L.L.	+++
				Back *v.* U.L.	−
Lower limb	3	19 910	27.7	L.L. *v.* U.L.	+++
Upper limb	3	39 554	60.6		
Statistical significance at 20 years					
Abdomen	3	22 138	19	Abd. *v.* Back	−
				Abd. *v.* L.L.	+
				Abd. *v.* U.L.	+++
Back	3	27 965	20	Back *v.* L.L.	++
				Back *v.* U.L.	−
Lower limb	3	14 810	45	L.L. *v.* U.L.	+++
Upper limb	3	36 294	42		

Table III. (cont.)

Site	No. of samples	Mean count per mm³. fresh skin	S.D.	Sites compared	Degree of sign.
Statistical significance at 35 years					
Abdomen	3	19 502	50	Abd. *v.* Back	−
				Abd. *v.* L.L.	++
				Abd. *v.* U.L.	−
Back	3	19 975	26	Back *v.* L.L.	+++
				Back *v.* U.L.	−
Lower limb	3	9 059	12	L.L. *v.* U.L.	++++
Upper limb	3	26 969	16		
Statistical significance at 45 years					
Abdomen	3	15 522	30	Abd. *v.* Back	+++
				Abd. *v.* L.L.	+++
				Abd. *v.* U.L.	−
Back	3	19 715	33	Back *v.* L.L.	++++
				Back *v.* U.L.	−
Lower limb	3	8 113	16	L.L. *v.* U.L.	++++
Upper limb	3	19 646	33		
Statistical significance at 55 years					
Abdomen	3	8 420	13	Abd. *v.* Back	+
				Abd. *v.* L.L.	−−
				Abd. *v.* U.L.	+++
Back	3	11 904	17	Back *v.* L.L.	+++
				Back *v.* U.L.	+
Lower limb	3	7 935	23	L.L. *v.* U.L.	+++
Upper limb	3	18 966	40		

in running water for one day. The preparation was then prepared in the usual way and embedded in paraffin.

The sections (6 μm) were stained with 1% toluidine blue in 40% alcohol (to avoid basophilia around the cells) for half an hour.

The mast cell count per cu. mm. was calculated according to Flodérus formula (5).

$$X = n \frac{1000}{\alpha + D - 2H}$$

$$X = n \frac{1000}{6 + 5 - 1}$$

When 15% is regarded as the shrinkage

$X = n \times 85$.

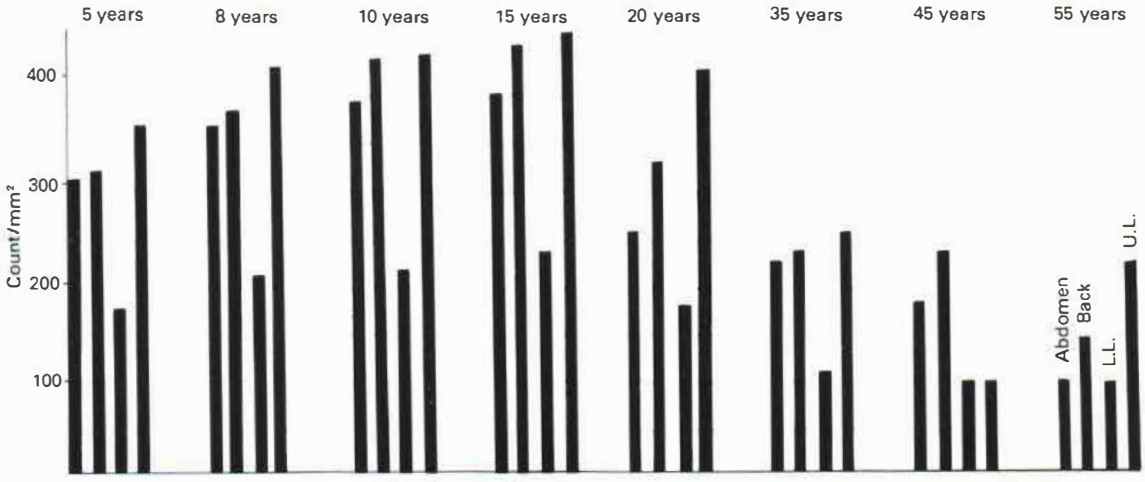

Fig. 1. Mast cell count per mm³ at different sites but within the same age group.

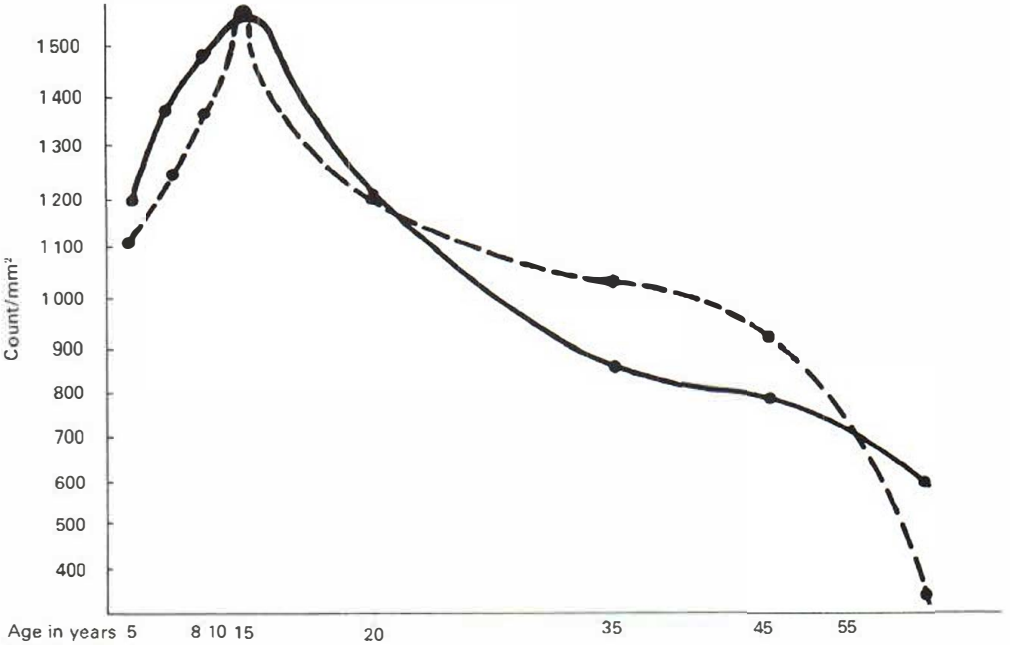

Fig. 2. Mast cell count in whole skin in both sexes at different ages. —, Male; - - -, female.

RESULTS

The results are shown in Tables II–III and Figs. 1–4.

DISCUSSION

The results obtained from this study proved that marked variations in mast cell count, granularity and metachromasia do exist during different periods of life and at different sites within the same age group. However, mast cell variation seems to be related to maturation of the connective tissue as well as to the distribution of the blood vessels (1, 3, 7). It was found that the mast cell count at all sites examined increased gradually with age until it

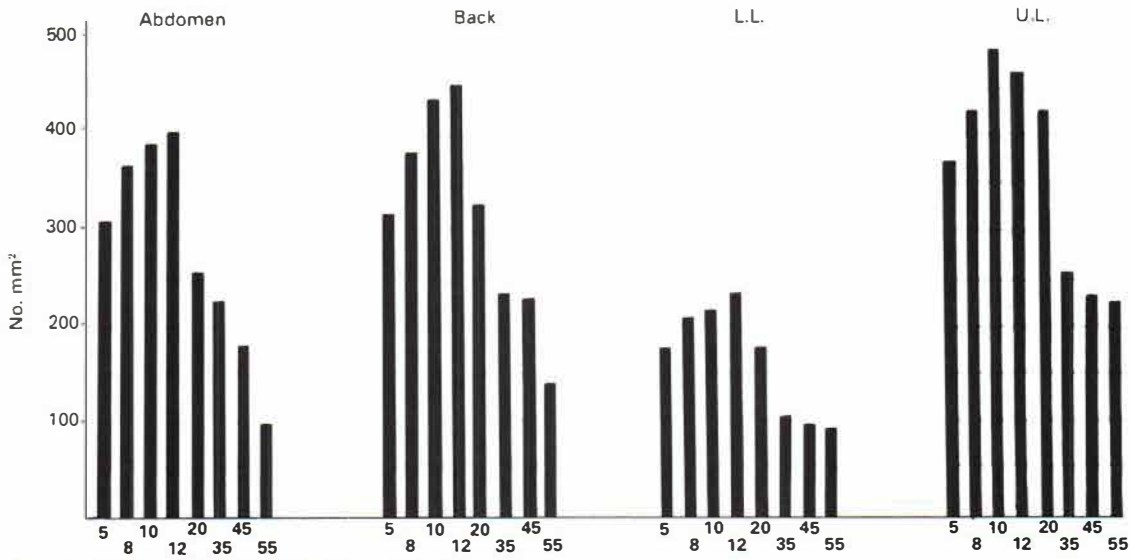

Fig. 3. Mast cell count per mm² at the same but in different age groups.

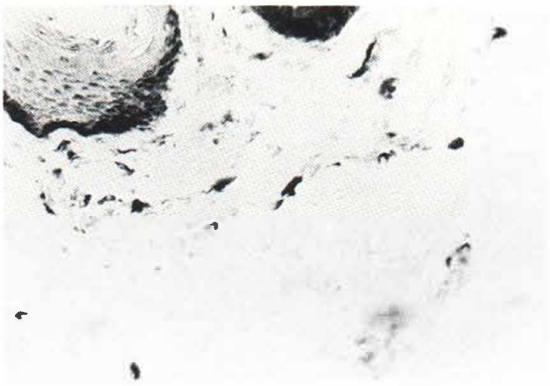

Fig. 4. Section of skin of upper limb, showing numerous mast cells full of granules in the upper dermis. × 145.

reached its maximum at 15 years (Table II, Fig. 2). This high mast cell count could be explained on the assumption that during this period of life maturation of connective tissue occurs. It has been assumed that mast cells increase in number with maturation of connective tissue (1). Moreover, the effect of growth hormone on mast cell activity should be considered. Growth hormone has been found to stimulate the activity of mast cells, including mucopolysaccharide production (4, 11). The count gradually decreased with age until the lowest count was detected at the age of 55 years (Table II). This decrease in mast cell population during old age may be attributed to the degenerative changes which are liable to occur in the connective tissue during this period of life. The decreased mast cell count in elderly individuals may explain their susceptibility to thrombosis, as mast cells are believed to disintegrate heparin (10).

Mikhail & Miller-Malinska (8) have reported that the mean value of mast cell count per cu. mm. in adult healthy human skin was 7225. The difference between our results and those of Mikhail may be due to racial specificity as most of our cases were of dark colour with thick skin.

The metachromasia of mast cell granules was bluish and bluish violet during childhood. At the age of 15 years the cells are large in size, regular in shape, granules violet in colour and are associated with marked tissue basophilia. During old age when the skin becomes fibrotic, the mast cells were found to be smaller in size, less granular, irregular in shape; their outline becomes hazy and appears ghost-like. The metachromasia was light bluish violet. The various colour changes of the granules in different ages may signify the presence of different sulphated forms of heparin which in turn may be related to maturation of the cell (2, 9). Sex variation has been considered but no marked differences were found and no real statistical significance (Table II, Fig. 3).

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Received May 26, 1975

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