

EFFECT OF THE THYMUS ON HEMATOPOIETIC STEM CELLS AND ON THEIR POWERS OF SELF-SUPPORT

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It was shown by cloning hematopoietic cells in the spleen of irradiated mice that thymectomy on adult animals has no significant effect either on the number of hematopoietic stem cells or on their self-supporting ability.

KEY WORDS: hematopoietic stem cell; colony-forming unit; thymectomy.

Work has recently been published in which attempts have been made to determine the influence of the thymus on hematopoietic stem cells (HSC). These investigations have been carried out both on neonatally thymectomized mice [1, 6] and on thymectomized adult mice [2, 3, 5]. Information in the literature on the number of HSC in the bone marrow of adult thymectomized mice, determined by both endocolonization and axocolonization methods, is contradictory [2, 3, 5].

The object of this investigation was to study the effect of removal of the thymus in adult mice on certain characteristics of HSC, namely their number (by the exocolonization test) and the ability of HSC of thymectomized mice to support themselves.

EXPERIMENTAL METHOD

Female CBA and (C57BL × CBA)F₁ mice were used.

Thymectomy was performed on the donor mice at the age of 8-10 weeks [4]. The mice were used in the experiments at different times (from 30 days to 10 months) after thymectomy. Completeness of removal of the thymus was verified when the bone marrow was taken. The recipients were irradiated on the IPK ¹³⁷Cs-source in a dose of 1300 rad and with a dose rate of 21.5 rad/min.

The number of exogenous colony-forming units (exo-CFU) was determined by cloning in the spleen [7]. The test suspensions were injected in a dose of 4 · 10⁴ bone marrow cells into irradiated recipients. The

TABLE 1. Effect of Thymectomy on Adult Mice on Number of Colony-Forming Cells in Bone Marrow

Expt. No.	Time elapsing after operation on donors of bone marrow, months	Number of femoral bone marrow cells of mice (× 10 ⁶)		CFU/10 ⁴ cells (M ± m)		CFU per femur (M ± m)	
		undergoing mock thymectomy	thymectomized	undergoing mock thymectomy	thymectomized	undergoing mock thymectomy	thymectomized
1	1,0	14,6	14,5	7,4±0,8	9,0±1,2	2701±297	3083±401
2	1,5	20,0	16,6	4,1±0,9	9,3±0,9*	2050±451	3859±347*
3	2,5	12,0	12,5	6,3±0,6	13,0±1,4*	1890±180	3900±429*
4	4,5	14,0	11,0	9,3±0,6	12,7±2,6	3237±207	3492±723
5	4,5	14,0	11,0	8,0±1,0	13,5±1,2*	2800±350	3712±334
6	5,0	12,8	15,0	6,2±1,8	10,7±1,5*	1984±575	4012±562*
7	5,0	20,5	20,3	16,3±1,5	9,2±1,8†	8350±777	4669±934†
8	5,0	19,5	24,0	16,5±1,4	12,3±1,5	8044±724	7411±889
9	5,0	—	21,0	16,9±1,0	8,6±1,0†	—	4515±542
10	5,0	18,0	21,7	8,1±2,0	12,7±1,0*	3645±912	6890±630*
11	5,0	17,1	23,0	6,3±2,0	13,9±1,3*	2693±862	7993±719*
12	10,0	15,6	19,8	12,0±1,2	12,0±1,4	4680±468	5940±713

*Increase in CFU compared with control significant.

†Decrease in CFU compared with control significant.

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TABLE 2. Effect of Thymectomy on Adult Mice on Power of Self-Support of HSC

Expt. No.	Number of colonies per spleen in primary recipients (9 days after injection of $4 \cdot 10^4$ bone marrow cells ($M \pm m$))		Number of CFU per colony in secondary recipients ($M \pm m$)	
	mice undergoing mock thymectomy	thymectomized mice	mice undergoing mock thymectomy	thymectomized mice
1	$6,2 \pm 1,8$	$10,7 \pm 1,5$	$8,6 \pm 1,05$	$5,2 \pm 1,35^*$
2	$16,3 \pm 1,5$	$9,2 \pm 1,8$	$6,8 \pm 0,11$	$5,4 \pm 0,60^*$
3	$16,5 \pm 1,4$	$12,3 \pm 1,8$	$4,2 \pm 0,11$	$3,7 \pm 0,45^*$
4	$16,9 \pm 1,0$	$8,6 \pm 1,0$	$2,2 \pm 0,20$	$6,3 \pm 0,35$

*Differences from control not significant.

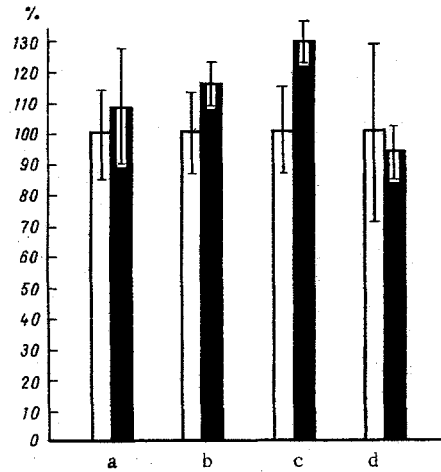


Fig. 1. Number of HSC and their power of self support in intact and thymectomized mice. Abscissa: a) number of cells in femoral marrow; b) number of CFU/10⁴ cells; c) number of CFU per femur; d) number of CFU per 9-day colony in secondary recipient. Ordinate, percentage of control. Shaded columns represent thymectomized, unshaded columns intact mice.

number of colonies in the spleen was counted on the 8th day after transplantation of the bone marrow suspension.

To determine the power of self-support of the HSC the number of CFU was determined in 9-day colonies of primary recipients, retransplanted into secondary irradiated recipients in a dose of 2 colonies per mouse. These experiments were carried out 5 months after thymectomy on the donors.

In all experiments the groups of recipients consisted of 10-15 mice, the mean survival rate of which was 80-85%.

EXPERIMENTAL RESULTS

The number of HSC in the bone marrow of mice undergoing mock thymectomy and true thymectomy is shown in Table 1. In six of 12 experiments a significant increase was found in the number of CFU in the bone marrow of the thymectomized mice compared with the bone marrow of mice undergoing the mock operation. In the remaining experiments there was either no difference (experiments Nos. 1, 4, 8, 12) or the number of CFU was greater in the bone marrow of mice undergoing mock thymectomy (experiments Nos. 7 and 9). The number of CFU did not correlate with the time elapsing after thymectomy on the donors.

Generally none of the experiments revealed differences in the number of CFU in the bone marrow of mock-thymectomized and thymectomized mice. This is demonstrated more clearly in Fig. 1 which graphically depicts the amount of HSC in the bone marrow of thymectomized mice expressed in percent of the control (the index of bone marrow of mock-thymectomized mice). Apparently, according to all three parameters (the number of cells in the hip, the number of CFU per 10^4 cells, and the number of CFU per hip), there were no reliable differences between the bone marrow of these and other animals.

The results of the study of the self-supporting ability of the HSC are given in Table 2. They show (Table 2, Fig. 1) no significant difference in the ability of HSC of the thymectomized mice and mice undergoing the mock operation to support themselves.

Thymectomy on adult mice thus has no significant effect either on the number of HSC or on their ability to support themselves, at least so far as CBA mice and (C57BL \times CBA) F_1 hybrids are concerned.

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