# THE EFFECTS OF ACUTE AND CHRONIC STRESS ON ERYTHROCYTE DYNAMIC IN COMBINATION WITH β– ADRENERGIC RECEPTORS BLOCKADE IN RATS

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**Key words**: propranolol, acute stress, chronic stress, peripheral blood erythrocyte

**Abstract**: 3 consecutive days propranolol hydrochloride administration (5 mg/kg b.w., subcutaneous injections) under acute and chronic stress conditions causes changes of peripheral erythrocyte distribution in rats. The effects of acute stress and its combination with β-adrenergic receptor blockade on erythrocyte dynamic were more pregnant beside the effects of chronic stress and its combination with β-adrenergic receptor blockade, respectively. β-adrenergic mechanisms were shown to be involved in regulation of erythrocyte dynamic in acute and chronic stress response.

## INTRODUCTION

Adrenergic compounds are extremely important factors in neuroendocrinal regulation of the function of the immune system in the norm and in the case of different pathological conditions. With such processes like stress, the adrenergic mechanisms may play a key role in the changes of the immune system (Khlusov et al., 1993; Spengler et al., 1994), in the redistribution of T lymphocytes (Zimin et al., 1985) and in the regulation of medullar hemopoiesis (Goldberg et al., 1991). Concurrently, β- and α-adrenoreceptors are expressed on the cells of the immune system and on the erythrocyte system. The aim of this work was to study changes in the erythrocyte dynamic under acute and chronic stress in combination with the β-adrenergic receptor blockade in rats.

## MATERIAL AND METHODS

Male Wistar rats weighing 200g ± 25g at the beginning of experiments were used. They were fed and allowed to drink water ad libitum.

The rats of the first two groups were treated with propranolol hydrochloride (5 mg/kd b.w., subcutaneous injections) and were subjected to an acute stress (intermittent session of footshock; 0,5 mA, during 60s (5s shock, 5s pause)) after 1 and 3 days from the moment of the propranolol administration. Control groups were subjected to the same conditions and were treated with saline solution.

The rats of the third group were treated with propranolol hydrochloride (5 mg/kd b.w., subcutaneous injections) and were subjected to an chronic stress (intermittent session of footshock; 0,5 mA, during 60s (5s shock, 5s pause)) during of 3 consecutive days from the moment of the propranolol administration. Control group were subjected to the same conditions without the propranolol administration and were treated with saline solution.

Four days after the drug administration, rats were killed by decapitation. We used a Coulter Counter Beckman for determination of total number of erythrocytes, hematocrit (HCT) and hemoglobin (HB).

Statistical analysis

Results were expressed as mean ± S.E.M. The results were analyzed statistically by means of the Student’s “t” test. $p<0.05$ was taken as the criterion for significance.

## RESULTS AND DISCUSSIONS

1. Effects of acute and chronic stress and β-adrenoreceptor blockade on the erythrocyte dynamic

The experimental data are shown in Fig 1. The total number of erythrocyte decrease significantly in the control group after 3 days under the acute stress influence, as well as in the control group under the chronic stress influence. In the groups treated with propranolol the total number of erythrocyte increase significantly only after 3 days under the acute stress influence, and decrease in the chronic stress condition.

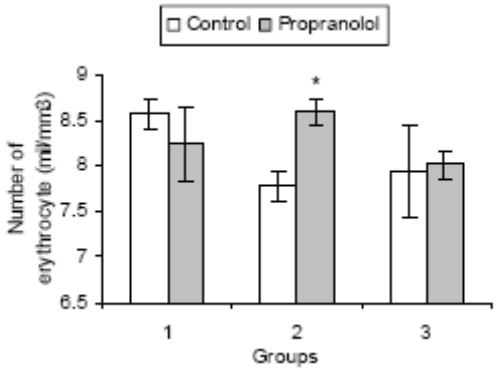


Fig 1. Changes of the total number of erythrocyte after 1 and 3 days of propranolol administration under acute (groups 1, 2) and chronic (group 3) stress. Values are means ± SEM (n = 6 per group). *p<0.05 vs. Control.

2. Effects of acute and chronic stress and β-adrenoreceptor blockade on the hemoglobin (HGB) quantity.

The experimental data are shown in Fig 2. Propranolol treatment enhances the quantity of hemoglobin after 3 days under acute stress exposure (groups 2). Acute stress exposure after 1 day of propranolol treatment induced no significant variation of hemoglobin quantity (groups 1). The same effect was observed under 3 consecutive days chronic stress exposure in groups 3 treated with propranolol.

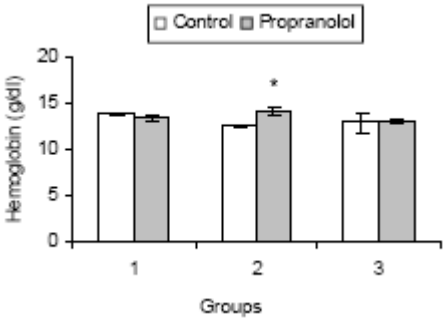


Fig 2. Hemoglobin quantity after 1 (groups1), 3 (group2) of acute stress exposure and 3 consecutive days (groups 3) of chronic stress exposure in combination with β-adrenoreceptor blockade. Values are means ± SEM (n = 6 per group). *p<0.05 vs. Control

3. Effects of acute and chronic stress and β-adrenoreceptor blockade on hematocrit (Ht) values.

The experimental data are shown in Fig 3. Acute stress exposure after 3 days of propranolol treatment induced a significant variation on the hematocrit value. Acute stress exposure after 1 day of propranolol treatment and chronic stress exposure after 3 days of propranolol treatment induced no significant variation on the hematocrit value.

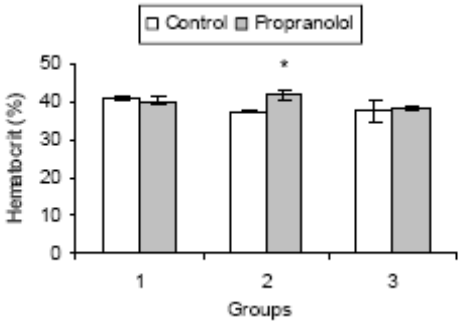


Fig 3. Variation of hematocrit value after 1 (groups1), 3 (groups 2) of acute stress exposure and 3 consecutive days (groups 3) of chronic stress exposure in combination with β-adrenoreceptor blockade. Values are means ± SEM (n = 6 per group). *p<0.05 vs. Control

Our results showed that adrenergic receptor blockade with propranolol enhances the total number of erythrocyte, the quantity of hemoglobin and the hematocrit under acute stress influences and a no significant influences under chronic stress conditions. These data confirmed those from the literature concerning the influence of blockade of β-adrenoreceptors and acute and chronic stress on medullar hemopoiesis (Goldberg et al., 1991; Shilov et al., 2001).

Adrenergic compounds are extremely important factors in neuroendocrinal regulation of the function of the immune system in the norm and in the case of different pathological conditions. With such processes like stress, the adrenergic mechanisms may play a key role in the changes of the immune system (Khlusov et al., 1993; Spengler et al., 1994), in the redistribution of T lymphocytes (Zimin et al., 1985) and in the regulation of medullar hemopoiesis (Goldberg et al., 1991). Concurrently, β- and α-adrenoreceptors are expressed on the cells of the immune system and on the erythrocyte system that indicate the important role of β-adrenoreceptor mechanisms in the regulation of erythrocyte dynamic.

## CONCLUSIONS

On the whole the obtained data indicate the important role of β-adrenoreceptor mechanisms in the regulation of erythrocyte dynamic.

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