

Delayed beneficial effect of a single short physical exercise conducted to the first ventilatory threshold on the red blood cell aggregate strength in patients with sickle cell anemia

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We investigated the effects of a single incremental exercise conducted to the first ventilatory threshold on the blood rheological properties of patients with sickle cell anemia and healthy subjects. Exercise did not change red blood cell deformability or aggregation properties. Two and 3 days after the exercise, the red blood cell aggregate strength of sickle cell patients was decreased below the baseline level whereas it remained unchanged in healthy subjects. The changes in the red blood cell aggregate properties of sickle cell patients were similar to the changes observed for platelets count in this group. This study suggests that a single moderate and short exercise may positively impact on the hemorheological properties of patients with sickle cell anemia.

**Key words:** Sickle cell anemia, hemorheology, exercise.

## INTRODUCTION

Although regular physical activity has been shown to reduce the morbidity and mortality from many chronic diseases, there is uncertainty as to whether patients with sickle cell anemia (SCA) should participate safely in a physical activity (3). The dilemma faced by health care professionals involved in SCA management is the level of physical activity (at work or in sport practice) they should recommend for their patients, in order to avoid potential complications (3). The presence of anemia is responsible for a reduction of oxygen delivery to tissues and faster transition from aerobic to anaerobic metabolism during exercise, which may stimulate the polymerization of hemoglobin S (HbS), lead to red blood cells (RBCs) sickling and promote painful microvascular occlusions. In addition, it has been reported that vigorous exercise in patients with SCA may lead to sporadic hemoglobinuria (6), massive splenic infarction (4) or a worsening (if present) of pulmonary hypertension (5). However it has been observed that exercise therapy consisting of moderate strength and endurance exercise of 10-30 min duration may contribute to a reduction in the length of hospitalization in SCA children with vaso-occlusive crises (1). Before the establishment of accurate exercise program in SCA, there is a need to test the exercise type that SCA patients could be able to sustain without any risks of vaso-occlusive and medical complication. The present study was conducted to test the effect of a short incremental exercise conducted to the first ventilatory threshold on several biomarkers of increased risk for vaso-occlusive events.

## MATERIALS AND METHODS

Eight patients with SCA ( $34 \pm 3.6$  yrs,  $61 \pm 4.5$  kg,  $172 \pm 2.9$  cm) and a control group of 14 subjects with normal HbA ( $36 \pm 2.1$  yrs,  $78 \pm 3.5$  kg,  $174 \pm 2.1$  cm) were enrolled in the present study. The two groups were submitted to a cycling incremental exercise test until they reached their first ventilatory threshold (SV1). Blood was sampled at rest (D-1; day preceding the exercise), at the end of exercise (D0), and 12 hours (D1), 36 hours (D2), 60 hours (D3) after the exercise bout. Hematological parameters were determined with an automatic hematological analyzer. Several hemorheological parameters were determined: red blood cell deformability by ektacytometry at several shear stresses and red blood cell aggregation

properties by back scattering technique. All measurements were done as recommended (2)

## RESULTS

Hemoglobin concentration and hematocrit were low in SCA patients. Resting red blood cell deformability and aggregation were reduced in SCA patients as compared with the control group. In contrast, platelet number and the strength of red blood cell aggregates were increased in the SCA group. Exercise did not change red blood cell deformability, whatever the shear stress applied, in any of the group. In contrast, the strength of red blood cell aggregates (figure 1) and platelet number decreased below baseline on D2 and D3 in SCA patients but remained unchanged in the control group. No clinical complication was observed during the 4 days of experiment.

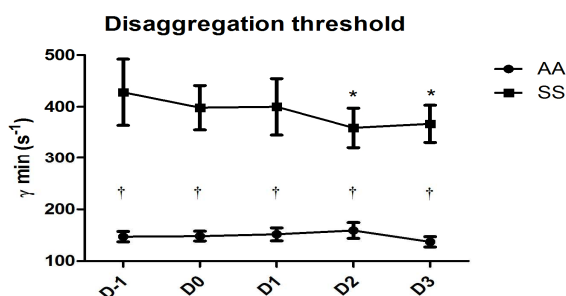


Figure 1: Effect of exercise on the strength of red blood cell aggregates (disaggregation threshold) in SCA patients (SS) and healthy subjects (AA)

## DISCUSSION

The present demonstrated that a short mild/moderate acute exercise does not further impair the rheological properties of red blood cells in SCA patients. We observed a beneficial delayed effect of this exercise on the red blood cell aggregation properties of the SCA group that could be the consequence of the decrease of platelets count at that time. SCA patients seem to be able to practice safely during such an effort.

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