Sex-associated differences in physical ability in patients with sickle cell disease

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Résumé

Introduction

Sickle cell disease (SCD) is a genetic disorder leading to the production of abnormal haemoglobin (HbS). Deoxygenated HbS may polymerize, causing sickling of the red blood cell (RBC) and haemolysis. Patients are subjected to severe anaemia, endothelial dysfunction and often hypoxaemia. Because oxygen transport is seriously compromised, patients' physical ability is strongly reduced compared to healthy subjects. To date, no study investigated sex specificities in physical ability impairment in SCD. This question is of interest because women, with higher anaemia (lower HbS content), nitric oxide bioavailability, vasoreactivity and foetal haemoglobin (Gladwin et al., 2003), may display lower repercussions of SCD on their physical ability than men. Therefore, the aim of this study was to evaluate the sex-associated differences in physical ability in SCD patients.

Methods

Thirty-three SCD patients (18 males and 15 females) were studied. They were subjected to i) a blood sampling to measure haemoglobin level, HbS and HbF percentages (HbS% and HbF%) and viscosity, ii) a submaximal exercise test to measure physical ability markers such as oxygen uptake at the lactate thresholds 1 and 2 expressed in percentage of theoretical values (LT1%TheorValue and LT2%TheorValue, respectively) (Myers et al., 2017), and iii) a

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muscle biopsy (vastus lateralis) to analyse the microvascular network, muscle fibre size and energetic enzyme activities.

Results

LT1%TheorValue was higher in females than in males (p=0.020) (a tendency was noticed for LT2 TheorValue, p=0.098). Women also had lower muscle fibre perimeter (p=0.025). No significant sex-associated differences were noticed on the microvascular network, enzyme activities and blood characteristics excepted for haemoglobin level (p=0.012). In females (but not in males), LT2%TheorValue correlated with haemoglobin level ($p< 0.001$, r=0.770), HbS% (p=0.004, r=-0.720) and viscosity (p=0.033, r=0.552) on the one hand, and with capillary cross-sectional area (p=0.003, r=0.729), perimeter (p=0.001, r=0.766), diameter (p=0.007, r=0.683) and length of contact capillary-fibre over fibre perimeter ratio (p=0.001, r=0.779). In males (but not in females), LT2%TheorValue was associated with capillary density (p=0.005, r=0.628) and number of capillaries in contact with one fibre (p=0.018, r=0.558).

Discussion

Physical ability (in percentage of predicted value) has been found to be lower in males than females. In females, physical ability seems to be influenced by blood parameters (haemoglobin level, HbS% and viscosity) and morphologic characteristics of capillaries (diameter, perimeter, area), whereas in males, physical ability was associated with microvasculature density. Even if the implicated physiological mechanisms remain to be explored, SCD repercussions on physical ability 1) differs between men and women with SCD, and ii) does not seem to be limited by/associated to the same parameters.