Introduction: Current literature suggests that vascular components play a fundamental role in neurological diseases like Alzheimer’s disease (AD) (Kovacic and Fuster, 2012). One such component is erythrocytes (RBCs) that are highly deformable, which contributes to assisting blood flow in the microcirculation (Mohandas and Gallagher, 2008). Abnormalities in RBCs and their flow can contribute to AD by obstructing oxygen delivery to parts of the brain that are already in a compromised state. Closely linked to hematological pathology in AD are increased iron levels that may play an important role in the pathogenesis of the condition (Barnham and Bush, 2008). Increased iron levels cause oxidative stress, as they participate in oxygen-dependent free radical formation (Castellani et al., 2012). This free radical stress may have an impact on RBCs and may possibly cause extensive and accumulative damage to these cells, ultimately compromising their functioning. Aims: Determine if there is iron overload present in AD and if this has an effect on the structure of the RBCs. Methods: 25 AD patients and 40 healthy control individuals were studied and results from light microscopy, scanning electron microscopy, atomic force microscopy and confocal microscopy were correlated. Results: RBC ultrastructure showed a changed morphology in the presence of iron overload. These changes might impair the oxygen carrying capacity and compromise hemorheology of the RBCs, and additionally cause a strain on the already challenged brain function of these individuals. Conclusions: Iron overload are present in AD patients, this may cause the condition to progress faster than in AD individuals who do not have iron overload, particularly due to the additional hydroxyl radical load.

References:

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Fig. 1: Red blood cell (RBC) of a healthy individual with a typical discoid shape. Scale: 1μm

Fig. 2: Discoid shaped red blood cell from an Alzheimer's patient with normal serum ferritin levels. Scale: 1μm

Fig. 3: Irregular shaped red blood cells from Alzheimer's patient with increased serum ferritin levels. Scale: 1μm