Summary:

Background: Simultaneous collection of several blood components from a single donor is enabled through multicomponent apheresis (MCA). The use of multiple components from the same donor decreases the possibility of transfusion induced alloimunisation and reduces the risk of infection. Not all aspects of this approach are fully understood.

Aims of this prospective study were: 1) to follow both immediate and long-term effects of multicomponent apheresis on donor health; 2) to investigate quality parameters of blood components, markers of cells activation and apoptosis (annexin V, sP-selectin) and 3) to specify more precisely selection criteria for these donors and to propose schedule for their long-term follow-up.

Method: We completed 225 collections in 52 donors on two devices (Haemonetics MCS+: 98 double erythrocytaphereses, 52 thrombocytaphereses plus plasma, 5 double thrombocytaphereses, Trima Accel: 36 thrombocytaphereses plus plasma, 28 thrombo-erythrocytaphereses). The effect of MCA on donors was followed: the changes of Hb and Hct values, platelet counts, level of annexin V a sP – selectin, values of iron, transferin, ferritin, sTfR and qTfRi, total protein, albumin and immunoglobulin A, G, M. Products were measured for: the content of Hb/platelets, leukocyte contamination on the day of preparation; the markers of cells damage and activation at the start and the end of expiration (red blood cells concentrates: kalium, lactate, LDH, pH and annexin V, platelet concentrates: pH, LDH, lactate, annexin V, sP-selectin). The results were compared with the same parameters in whole blood donors and products stemming from their respective donations. Statistical significance was shown when p-value was $< 0,05$.

Results: MCA has neither immediate nor long-term adverse effects on blood donor health. Blood cells returned back to donors display no markers of activation (no significant changes in the levels of annexin V and sP-selectin were observed). No significant changes in the level of plasma iron, ferritin, total protein, albumin and immunoglobulins were found during 2 years period of blood donors observation. The decrease of iron stores in several donors of double erythrocytaphereses was found. The plasma level of ferritin > 40ug/L is recommended for repeated double erythrocytapheresis donors. Inclusion criteria for selection of optimal donor for both particular cell separator and particular protocol were postulated by this study. The quality of blood components is high and independent of inclusion parameters of donors. Blood cells are neither activated nor damaged by apheresis. There are no significant differences in tested quality parameters between transfusion products obtained by different apheresis devices. The technology of apheresis is not influencing activation and apoptosis of cells in blood components. The components from a single donor are targeted especially at polytransfused patients. The above mentioned method proves to be economically effective under the condition of correct choice of apheresis products combinations.

Conclusions: Multicomponent apheresis is a safe alternative to blood donation for obtaining multiple blood component while preserving high quality. Blood cells are neither activated nor damaged by apheresis. Further knowledge in apoptosis and activation of donor blood cells and cells in blood components remains an issue for the future