
Abstract
Background: Hemorrhagic shock is a leading cause of death following severe trauma, and platelet transfusions are frequently necessary to achieve hemostasis. Platelets, however, require special storage conditions, and storage time has been associated with loss of platelet quality. We hypothesized that standard storage conditions have a deleterious effect on platelet mitochondrial function and platelet activation. Materials and methods: Platelet donations were collected from healthy donors (n = 5) and stored in gas-permeable collection bags according to American Association of Blood Bank recommendations. Platelet units were sampled from day of collection (day 0) until day 7. High-resolution respirometry was used to assess baseline mitochondrial respiration, maximal oxygen utilization, and individual mitochondrial complex-dependent respiration. Fluorescence-activated cell sorting was performed to analyze mitochondrial content, mitochondrial reactive oxygen species, the expression of P-selectin (both before and after challenge with thrombin receptor-activating peptide), and apoptosis. Data were analyzed using analysis of variance and Pearson correlation (P < 0.05 significant). Results: Mitochondrial respiration decreased significantly in platelets stored longer than 2 d (P < 0.05). Platelets also demonstrated a persistent decrease in response to stimulation with thrombin receptor-activating peptide by the third day of storage (P < 0.05) as well as an increase in mitochondrial reactive oxygen species and apoptosis (P < 0.05). Mitochondrial respiration significantly correlated with platelet capacity to activate (r = 0.8, P < 0.05). Conclusions: Platelet mitochondrial respiratory function and activation response decrease significantly in platelets stored for 3 d or more. Because platelet transfusions almost universally occur between the third and fifth day of storage, our findings may have significant clinical importance and warrant further in vivo analysis. © 2013 Elsevier Inc. All rights reserved.

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High-resolution respirometry; Mitochondrial respiratory capacity; Platelet activation; Resuscitation; Systemic organ

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