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Feasibility and transport of packed red blood cells into Special Forces operational conditions.

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BACKGROUND: Transfusing packed red blood cells (PRBCs) into Special Forces may provide a survival advantage from hemorrhage-induced battlefield injuries; however, the effect of the unique operational stressors on RBC integrity is not known.

METHODS: Pooled PRBCs (20 U) (7 days old), stored in Golden Hour containers, were exposed to the following simulated operational stressors: High-Altitude Low-Opening parachute descent from 30,000 ft, followed by a simulated soldier presence patrol in a climatic chamber set to 48 °C and 9% humidity for 12 hours (test). Biochemical (pH, lactate, potassium, and adenosine triphosphate) and biomechanical (percent hemolysis, deformability, and morphology) were measured to determine the integrity of PRBCs.

RESULTS: The simulated parachute descent significantly raised pH ($p = 0.025$) and potassium ($p = 0.014$) levels compared with the control; however, this was not clinically significant. Lactate (mmol/L) and adenosine triphosphate levels (μmol/g Hgb) were unaffected ($p > 0.05$). Potassium and pH levels increased with time but not significantly compared with controls. Lactate levels were unaffected with time. Mechanical agitation of PRBCs from the simulated soldier presence patrol did not significantly affect the biochemical ($p \geq 0.08$) or biomechanical ($p \geq 0.33$) parameters compared with control. Hemolysis was found to be less than 0.8% at the end of 12 hours. No significant difference in RBC morphology and RBC deformability were noted.

CONCLUSION: Carrying PRBCs into the austere Special Forces environment is feasible as biochemical and biomechanical markers of RBC stress remain within published transfusion safety parameters when PRBCs were stored in new cold technology containers for 12 hours at 48°C during a simulated Special Forces operation.