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Environmental Mobilization Of Hematopoetic Stem Cells With Exercise, Compression, And Cooling

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Abstract:

Hematopoetic stem cells (HSC) have recently been studied to improve healing and rehabilitation from musculoskeletal injury. HSC are currently collected using invasive bone marrow aspiration and peripheral harvest after pharmaceutical mobilization. Animal studies show environmental stresses including heat, hypoxia, and cold mobilize HSC. HSC have also been mobilized to peripheral circulation (PC) with exercise. We hypothesized that the combination of environmental stress and exercise can mobilize HSC to PC. Mechanisms for environmental mobilization will aid in understanding healing and rehabilitation mechanisms and may provide a more convenient method to harvest HSC. **PURPOSE:** To determine if the combination of compression and cooling during exercise can mobilize HSC in PC. **METHODS:** Ten healthy, active males (height $1.78 \pm .06$ m, weight 85.1 ± 13.3 kg, age 30.4 ± 4.7 y) completed a 20-min exercise protocol on the Vasper™ recumbent cross trainer. The protocol entailed a 7-min warm up and 6 sprints alternating between 30s and 60s in duration with 90s recoveries. Compression cuffs were placed around the upper arms and thighs and inflated to 40 and 65 mmHg, respectively. Subjects sat on a cooling pad and wore a cooling vest to decrease body temperature. Blood samples were collected via forearm vein access prior to exercise and at 20 (T20), 30, 60, 90, 120, 150, 180 min and 24h post exercise. A complete blood count with differential and flow cytometry was performed on each sample. A linear mixed model analysis was used to evaluate differences in each variable. **RESULTS:** A spike in white blood cell (WBC) count was seen between baseline and T20 ($M_{diff} = 1.740$, $SE = .48$, $p = .004$). The WBC differential revealed a decrease in neutrophils ($M_{diff} = 4.13$, $SE = 1.52$, $p = .015$) and eosinophils ($M_{diff} = .42$, $SE = .13$, $p = .009$), and an increase in lymphocytes ($M_{diff} = 4.51$, $SE = 1.62$, $p = .014$) from baseline to T20, with no change in basophils,

monocytes, or immature granulocytes. Flow cytometry indicated an increase in CD34(+), a cell surface marker for HSC, from baseline to T20 ($M_{diff} = 1.25$, $SE = .48$, $p = .028$) with no change in the viability of the WBCs. **CONCLUSION:** The Vasper™ consistently mobilizes HSC to PC when used to a high level of exertion. Further study is required to determine if these cells can be consistently harvested from PC after mobilization.

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Author Disclosure Information:

A.W. Anz: None.**Category (Complete):** 1200. Exercise is Medicine- focuses on the impact of physical activity on health and the prevention and treatment of disease and disability in clinical settings.**Keyword (Complete):** stem cells ; musculoskeletal injury ; peripheral circulation**Unlabeled/ Investigational Products (Complete):**

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