VENOUS GAS EMBOLI AND AMBULATION AT 4.3 PSIA
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INTRODUCTION: Ambulation imparts compressive and decompressive forces into the lower
body, potentially creating quasi-stable micronuclei that influence the outcome of hypobaric
depressurizations. Hypotheses: ambulation before the conclusion of a denitrogenation
(prebreath) protocol at 14.7 psia is not sufficient to increase the incidence of venous gas emboli
(VGE) at 4.3 psia but is sufficient if performed after tissues become supersaturated with nitrogen
at 4.3 psia. METHODS: VGE results from 45 subjects that performed exercise prebreath without
ambulation before or during a 4-hr exposure to 4.3 psia (Phase II control) are compared to 21
subjects that performed the same prebreath but ambulated before and during the hypobaric
exposure (Phase II-1) and to 30 subjects that only ambulated before the hypobaric exposure
(Phase II-3). VGE in the pulmonary artery were detected at about 16 min intervals using
precordial Doppler ultrasound (2.5 mHz) and assigned a Spencer 0–IV grade. The highest grade
assigned during the exposure is one metric, and Grade III or IV were combined as “high VGE
grade”. We used Fisher’s exact directional $\chi^2$ for VGE counts, evaluated survival curves for onset
of high VGE grade using non-parametric Kaplan-Meier, and used logistic regression (LR).
RESULTS: The incidence of high VGE grade for Phase II-1 (57%) was greater than Phase II (17%, $P = 0.001$) and Phase II-3 (16%, $P = 0.002$). Mean onset times for high VGE grade were similar for
control (105 ± 72 min SD), II-1 (104 ± 55), and II-3 (102 ± 24) conditions. Differences among the
three Kaplan-Meier survival curves were significant from log-rank tests ($P \leq 0.001$), but not just
between II and II-3 ($P > 0.85$). Age and ambulation status from LR were needed to describe the
probability of high VGE grade. DISCUSSION: VGE are increased by mild ambulation conducted
under a supersaturated state (Phase II-1 vs II-3); however, no increase in VGE was observed with
mild ambulation during the undersaturated state alone (Phase II control vs II-3).

Learning Objectives:
1. Lower body exercise is a consideration for hypobaric decompression sickness and bubble
formation.