

Influence of Body Position and Venous Pooling On Aortic Blood Pressure and Wave Reflection in Young Adults

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Objective: Indices of wave reflection (Augmentation Index, AIx; Augmentation Index at 75 bpm, AIx@75) decrease during a passive head up tilt (HUT). We aimed to examine whether decreases in wave reflection during HUT were a result of venous pooling in the lower limbs, or change in body position (supine vs. 60° tilt).

Methods: 23 healthy, normotensive, young adults (12M/11F; 23±1yr) participated in 3 randomized orthostatic challenge conditions; 60° head up tilt (HUT), 60° HUT with rhythmic blood pressure cuff inflation on calves (75 mmHg) to minimize venous pooling, and lower body negative pressure (LBNP; -30 mmHg) to mimic HUT condition without change in body position. High fidelity radial artery pressure waveforms using applanation tonometry were taken at baseline (rest) and at 2:30 and 5:00 min during each challenge. Aortic blood pressure and wave reflection were analyzed from a synthesized aortic blood pressure waveform (SphygmoCor, AtCor Medical).

Results: Table 1 shows peripheral and central hemodynamics and pressures during each condition. AIx decreased during LBNP compared to baseline (P<0.01) and HUT conditions (P<0.05; Figure 1). Likewise, AIx@75 decreased across time points during LBNP (P<0.01); whereas, it increased slightly during HUT conditions (with and without cuff inflations) (P<0.05). Aside from diastolic pressures, there was no significant condition x time interactions for any of the other peripheral or central pressures.

Conclusion: In contrast to previous research, AIx did not decrease during HUT conditions; however, when standardized for heart rate, HUT (with and without cuff inflations) elicited slight increases in aortic wave reflection. Conversely, LBNP elicited large reductions in indices of aortic wave reflection. These data suggest that the change in aortic wave reflection in response to an orthostatic challenge is dependent on the specific test and possibly body position.

Table 1: Peripheral and Central Pressure and Hemodynamics

	Tilt			Tilt with Cuffs			LBNP			Condition	Time	Interaction
	BL	2:30	5:00	BL	2:30	5:00	BL	2:30	5:00			
HR (bpm)	58±2	74±2	74±3	58±2	71±2	68±3	59±2	71±3	72±3	0.47	<0.01	0.47
AIx@75 (%)	-8±2	-4±3*	-1±2*	-9±2	-7±2	-3±2*	-8±2	-18±2**†	-14±2**†	<0.01	<0.01	<0.01
BSP (mmHg)	116±2	107±2	106±2	115±2	108±2	106±2	115±2	111±2	109±2	0.28	<0.01	0.17
BDP (mmHg)	72±1	66±2*	66±2*	71±1	66±1*	66±2*	70±2	69±2	68±2	0.38	<0.01	0.01
MAP (mmHg)	85±1	79±2	79±2	84±1	79±1	78±1	83±2	80±1	79±2	0.59	<0.01	0.10
BPP (mmHg)	44±2	41±2	40±2	44±1	41±2	40±2	45±2	41±2	40±2	0.80	<0.01	0.80
ASP (mmHg)	99±2	92±2	91±2	99±2	92±1	91±2	98±2	94±2	92±2	0.59	<0.01	0.10
ADP (mmHg)	72±1	67±1*	67±2*	72±1	67±1*	67±2*	70±2	71±2†	70±2	0.27	<0.01	0.01
APP (mmHg)	27±1	24±1	24±1	27±1	24±1	24±1	28±1	23±1	23±1	0.73	<0.01	0.19
AP (mmHg)	0±1	-1±1	0±1	0±1	-1±1	0±1	0±1	-4±1**†	-3±1**†	<0.01	<0.01	0.01

BL, Baseline; HR, Heart Rate; AIx@75, Heart Rate Standardized Augmentation Index; BSP, Brachial Systolic Blood Pressure; BDP, Brachial Diastolic Blood Pressure; MAP, Mean Arterial Pressure; BPP, Brachial Pulse Pressure; ASP, Aortic Systolic Blood Pressure; ADP, Aortic Diastolic Blood Pressure; APP, Aortic Pulse Pressure; AP, Augmented Pressure; * P < 0.01 vs. Baseline; † P < 0.01 vs. HUT conditions

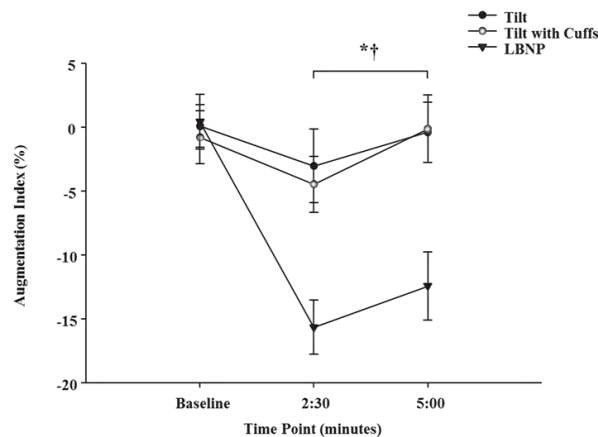


Figure 1: Augmentation Index during orthostatic challenges * P < 0.05 LBNP vs. Baseline; † P < 0.05 LBNP vs. HUT conditions