

Acute Effects of Intermittent Pneumatic Compression on Popliteal Artery Blood Flow

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Objectives: To investigate the immediate effects of intermittent pneumatic foot and calf compression (IPFCC) on popliteal artery blood flow in symptom-free volunteers and to determine the reproducibility of color flow duplex imaging in the popliteal artery.

Design: Cohort study.

Setting: A university associated tertiary care hospital.

Patients: Forty lower limbs of 30 volunteers without symptoms or noteworthy risk factors of peripheral vascular disease.

Interventions: Popliteal artery blood flow was measured in the sitting position before, during, and after the application of IPFCC using color flow duplex imaging. The interobserver, intraobserver, and between occasion within-subject variability of the popliteal artery blood flow were evaluated in 5 symptom-free volunteers who had at least 5 color flow duplex imaging measurements taken at each of the above time points on 3 different days.

Main Outcome Measures: The arterial diameter, peak systolic, end diastolic, and reverse-flow velocities were measured, as well as the duration of forward flow during diastole before, during, and after IPFCC. The same variables were measured in 5 separate volunteers by 3 different observers, on 3 separate days, at 3 separate times to determine reproducibility.

Results: Including all types of variability, the popliteal artery blood flow varied from 8% to 39% with a mean value of 19%. Since the diameter of the artery was obtained with less than 5% variability, the time average mean velocity was responsible for the high variation in flow. During application of the IPFCC, the popliteal artery blood flow increased significantly in all subjects ($P<.001$). The mean increase in the flow was 2.4 times the baseline values. The diameter of the arteries remained unchanged while the time average velocity increased significantly ($P<.001$). This velocity increase was due to marked elevation in the peak systolic and end diastolic velocities and diminution of the reverse-flow component, as well as a prolongation of the forward flow during diastole. After cessation of the pump, flow returned to baseline levels ($P=.41$).

Conclusions: Ultrasound-derived popliteal artery blood flow measurements show moderate variability. The application of IPFCC greatly enhances popliteal artery blood flow. The flow increase is due to a dramatic drop in the peripheral vascular resistance as the peak systolic and end diastolic flow velocities increase and the reverse-flow component diminishes. Its role in the treatment of lower extremity occlusive arterial disease needs to be determined.

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