Effects of intermittent pneumatic compression of the calf and thigh on arterial calf inflow: A study of normals, claudicants, and grafted arteriopaths

Konstantinos T. Delis, MD, PhD, Marc J.W. Husmann, MD, Nick J. Cheshire, MD, FRCS, and Andrew N Nicolaides, MS, FRCS
Imperial College School of Medicine, St Mary's Hospital, London, UK

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Background. Recent data indicate that intermittent pneumatic compression (IPC) of the foot may offer benefits in patients with intermittent claudication exceeding those of standard medications approved by the Food and Drug Administration. IPC of the foot (IPC_{foot}) and calf (IPC_{calf}) increases flow velocity in infrainguinal arterial bypass grafts and thus may prevent arterial thrombosis. Our aim was to evaluate the acute effects of IPC of the thigh (IPC_{thigh}), IPC_{calf}, and IPC of the thigh and calf ($IPC_{calf+thigh}$) in healthy controls, claudicants, and arteriopaths who have undergone infrainguinal bypass grafting for critical or subcritical limb ischemia.

Methods. Sixteen limbs of normals (group A), 17 limbs of claudicants (group B), and 16 limbs of arteriopaths (group C) who had undergone infrainguinal autologous revascularization were studied. Blood flow was measured in the limbs of normals and claudicants in the popliteal artery and in the grafts of revascularized limbs by using duplex ultrasonography. Mean velocity (mV), peak systolic velocity, end diastolic velocity (EDV), pulsatility index (PI), and volume flow (Q) were measured in the sitting position at rest and within 10 seconds from the delivery of IPC_{thigh}, IPC_{calf}, and $IPC_{calf+thigh,}$ IPC was delivered at maximum inflation and deflation pressures of 120mmHg and 0 mmHg, respectively; inflation and deflation times of 4 and 16 seconds, respectively; and a proximal inflate delay of 1 second (calf compression preceding that of thigh).

Results. In all 3 groups with all IPC modes, the Q, mV, and EDV increased while PI decreased ($P < .05$). IPC_{thigh} was less effective than IPC_{calf}, but still increased in Q (by 114%, 57%, and 59.8% in groups A, B, C, respectively) and EDV, while decreasing PI in all 3 groups ($P < .05$). $IPC_{calf+thigh}$ was the most efficient mode, generating an increase in the median Q of 424% in controls, 229% in claudicants, and 317% in grafted arteriopaths. The addition of IPC_{thigh} to IPC_{calf} increased the mV and Q in group A ($P \leq .044$); then mV, Q and EDV in group B ($P \leq .03$), and mV and PI by 24% and –27% in group C, respectively.

Conclusions. IPC applied to the thigh, either alone or in combination with IPC_{calf}, generates native arterial and infrainguinal autologous graft flow enhancement. The paucity of conservative methods available for lower limb blood flow augmentation may allow IPC of the lower limb to emerge as a reliable, noninvasive therapeutic option, amelioration claudication and assisting infrainguinal bypass graft flow. IPC_{thigh} adds to the armamentarium of currently known IPC options (foot or calf) promoting its applicability and efficacy.