Influences of pneumatic compression on the cardiovascular system

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Abstract

In the study, venous flow velocities and venous refilling times (VRT) were measured to investigate the influences of pneumatic compression on the cardiovascular system. The venous flow velocities and VRTs of sixty-one healthy subjects were measured in the inguinal region before applying pneumatic compression by using Accuvix V10 (Medison, Republic of Korea). A cuff was placed around the lower limbs, and ~~the~~ pneumatic compression was applied by using DVT-2600 (DS MAREF, Republic of Korea). The maximum ~~of~~ venous velocity after applying pneumatic compression VRT was measured, and the mean venous velocity (MVV) before applying pneumatic compression was 26.92±9.77cm/s while the MVV after applying pneumatic compression was 21.3cm/s. The study result shows that the patients' venous flow velocities ~~was~~ increased by approximately forty-five percent. The mean VRT was 30.52±11.53 s.

Background

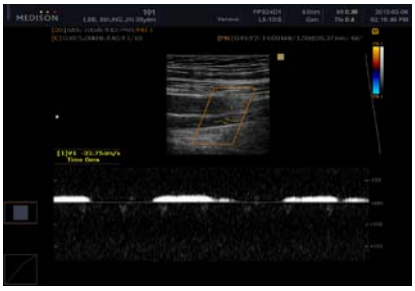
Deep Vein Thrombosis (DVT) is known to be a major cause of morbidity and mortality among hospitalized patients. It is a blood clot in a vein that can later block the vein, or when the thrombus breaks away from the blood vessel wall, it can cause vessel occlusion. The symptoms of deep vein thrombosis are pain and swelling in the affected leg, and increased temperature. Moreover, since it can be difficult to detect and diagnose DVT correctly, and because DVT cannot be distinguished easily from other common disease, it may lay dormant to cause problems in the future, if untreated. For this reason, it is extremely important for any patients in high risk groups for DVT to wear compression stockings or use intermittent pneumatic compression devices, in order to prevent the disease [1], [2].

Therefore, as a fundamental study for the prevention of DVT, this study measured the venous flow velocities and venous refilling times (VRT) of the subjects both before and after applying pneumatic compression, to find out the aspects of resulted changes in the cardiovascular system.

Methodology

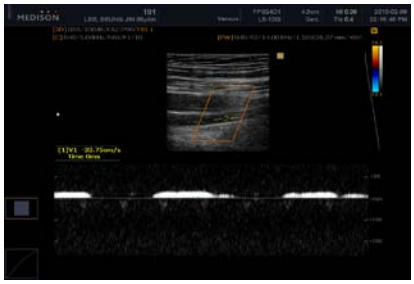
Sixty-one healthy male and female subjects whose mean age is 39.22±9.97 and who do not suffer from vascular diseases have participated in this study. They rested for ten minutes by lying down in a quiet and comfortable room, and used Accuvix V10 (Medison, Korea) to have their venous flow velocities measured from the venous vessels of the inguinal region before applying pneumatic compression. After that, they used DVT-2600 (DS MAREF, Korea), attached a cuff comprised of three chambers (one on a thigh, two on a calf), and then applied pneumatic compression for twenty minutes to their lower extremities from the thighs all the way down to the toes step by step. The pressure in each chamber was 40 mmHg, and it was applied every sixty seconds. All subjects had their venous flow velocities measured from the venous vessels of the inguinal region both before and after applying pneumatic compression (the same region from which their venous flow velocities were measured before applying pneumatic compression), and their venous refilling time was also measured simultaneously. The venous refilling time here refers to the time necessary for the vein to become suffused with blood after

applying pneumatic compression.



(a)

(b)



(C)

Figure 1. (a) The initially measured venous flow velocity (b) The venous flow velocity measured after applying pneumatic compression (c) The venous refilling time measured

Results and Discussion

The results obtained when measuring the venous flow velocities of sixty-one subjects before and after applying pneumatic compression show that the mean venous velocity (MVV) was 26.92±9.77cm/s, the velocity after applying pneumatic compression was 59.9±21.3cm/s, which indicates that the venous flow velocities increased by approximately forty-five percent compared with the level measured before applying IPC, and the mean VRT was 30.52±11.53 s.

Table 1. The changes in venous flow velocities and venous refilling times (VRT) before and after applying compression

Initial venous velocity (cm/s)	Venous velocity after Pneumatic Compression (cm/s)	increase rate (%)	Venous refilling time (s)
26.92±9.77	59.90±21.30	44.94	30.52±11.53

One of the planned future studies is a multi-centered randomized clinical trial which will be used for creating detailed and standardized guidelines regarding the duration of application, the number of applications, applying pressure, and compression methods, according to different purposes for using IPC to allow continuous studies.

References

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