

# Compression Bulletin 39

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This study investigated, in elderly people, the wearing comfort of knee-length compression stockings with an interface pressure of 18–21 mmHg compared to compression stockings with an interface pressure of 23–32 mmHg. Furthermore, the correlation between symptoms and foot deformities, rheumatism and arthritis were analyzed.

**High tolerance of progressive elastic compression in peripheral arterial disease**

The aim of this study was to evaluate the short-term tolerance and effects of elastic progressive compression stockings on peripheral arterial vascularization in patients suffering claudication (impairment in walking, or pain, discomfort, numbness, or tiredness in the legs during walking or standing) due to peripheral arterial disease with associated mild venous insufficiency.

**Effect of lower leg compression during caesarean section on post-spinal hypotension and neonatal hemodynamic parameters: nonrandomized controlled clinical trial**

Post-spinal hypotension (PSH) is the most common complication following spinal anesthesia; its incidence ranges from 60% to 70%. PSH is a serious problem that can lead to maternal complications such as loss of consciousness, aspiration, and death if not efficiently managed. The aim of this study was therefore to determine the effect of lower leg compression during caesarean section (CS) on post-spinal hypotension (PSH) and neonatal hemodynamic parameters.

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## Better wearing comfort of knee-length elastic compression stockings with an interface pressure of 18–21 mmHg compared to 23–32 mmHg in elderly people after a one day trial – Influence on foot deformities, rheumatism and arthritis

*Clinical Hemorheology and Microcirculation (2019), 145-156*

### Aim

Although the efficacy of compression therapy through knee-length compression stockings with an interface pressure of 18–21 mmHg for leg edemas has been confirmed by many studies, 91 % of patients are still treated with a higher interface pressure. As patient compliance is essential, this study investigated the wearing comfort of knee-length compression stockings with an interface pressure of 18–21 mmHg compared to compression stockings with an interface pressure of 23–32 mmHg. Furthermore, the correlation between symptoms and foot deformities, rheumatism and arthritis were analyzed.

### Methods

In this prospective open randomized monocentric study 19 patients (age  $\geq 65$ , movement restrictions and symptomatic leg edema) received knee-length compression stockings with an interface pressure of 18–21 mmHg (stocking type 1) and 23–32 mmHg (stocking type 2), both from the same compression stocking company Juzo (Juzo Dynamic<sup>®</sup>), Bauerfeind (VenoTrain<sup>®</sup> soft), Sigvaris (Sigvaris comfort<sup>®</sup>) or Medi (Mediven comfort<sup>®</sup>). On two consecutive days each of the two compression stocking types were worn for at least 8 hours. The primary outcome was the wearing comfort of knee-length compression stockings with an interface pressure of 18–21 mmHg (stocking type 1, Ccl 1) and compression stockings with an interface pressure of 23–32 mmHg

(stocking type 2, Ccl 2). Secondary outcomes included their influence on foot deformity, rheumatism and arthritis, as well as the assessment of clinical symptoms and adverse events. Both stocking types were assessed subjectively, and skin changes were recorded.

### Results

A significantly ( $p$ -value  $< 0.001$ ) subjective improvement of the symptoms and complaints based on leg edema was reported with the knee-length compression stockings. Overall, the knee-length compression stockings with an interface pressure of 18–21 mmHg (stocking type 1, Ccl 1) significantly outperformed the knee-length compression stockings with a higher interface pressure of 23–32 mmHg (stocking type 2, Ccl 2) (significance level  $p \leq 0.05$ ) in terms of wearing comfort ( $p = 0.045$ ). In addition, the stocking type 2 was significantly too large amongst women in the front foot area ( $p = 0.044$ ). The most common side effects were constrictions on the proximal lower leg (stocking type 1 = 73,7% (14/19); stocking type 2 = 78,9% (15/19)). Subjects with arthritis ( $p = 0.006$ ), hallux valgus ( $p = 0.034$ ) and/or digitus flexus ( $p = 0.021$ ) found the socking type 1 significantly more comfortable.

### Conclusions

The knee-length compression stockings with an interface pressure of 18–21 mmHg (Ccl 1) should be preferred to 23–32 mmHg (Ccl 2) because of the easier donning and the higher wearing comfort. There-

fore, to achieve optimal patient compliance it is recommended to prescribe knee-length compression stockings with an interface pressure of 18–21 mmHg, especially if the following criteria are met: age  $\geq 65$  years, female sex, arthritis, digitus flexus (claw toe) or hallux valgus.

### Comments of the Editors

This is an admirable attempt to disprove the old dogma that there is no “medical compression” in a pressure range lower than 20 mmHg. This is achieved by translating subjective complaints of patients into visual analogue scales and to evaluate these data by statistical methods. One can easily imagine how difficult and problematic this may be; especially in cohort of elderly patients, suffering from a mixture of complaints; making a differentiation between an intended treatment effect and an unwanted side effect to characterize treatment comfort difficult. The results support those publications which showed that the easiness of donning is the most important factor for positive feelings regarding compression, a point which had not specifically been assessed in this study.

However, the study helps to provide realistic and feasible compression therapy to many patients who benefit from this treatment modality. Stockings in a pressure range of lower than 20 mmHg are not only indicated for thromboprophylaxis but should be prescribed more often also in edema-patients who are unable or unwilling to wear stronger stockings.

Couzan S, Pouget JF, Le Hello C, Chapelle C, Laporte S, Mismetti P

## High tolerance of progressive elastic compression in peripheral arterial disease

*Vasa (2019), 48, 413–417*

### Aim

The elastic compression which is used in chronic venous insufficiency is an elastic degressive compression (= higher compression at the ankle than at the calf). According to the recommendations, this elastic degressive compression cannot be used in peripheral arterial disease (PAD) when ankle brachial index (ABI) is lower than 0.60 or higher than 1.40 because of the risk of increasing peripheral arterial insufficiency.

Conversely, elastic progressive compression produces a higher compression at the calf than at the ankle. Theoretically, this could induce a better venous return flow by increasing muscle calf function while walking without increasing peripheral arterial insufficiency. The aim of this study was to evaluate the short-term tolerance and effects of elastic progressive compression stockings on peripheral arterial vascularization in patients suffering claudication (impairment in walking, or pain, discomfort, numbness, or tiredness in the legs during walking or standing) due to peripheral arterial disease with associated mild venous insufficiency.

### Methods

This study is a monocentric, prospective and descriptive open pilot study. Patients (n = 18) had stress arterial claudication due to a peripheral arterial disease with an ABI between 0.6 - 0.75 and a mild associated chronic venous insufficiency (CEAP C1s-C4). All the patients

had a venous insufficiency for a mean period of  $16.5 \pm 11.2$  years. The majority of the patients were classified in CEAP C2s and C3 classes (class 2: 16.7%, class C2s: 27.8%, class C3: 44.4%, class C4: 5.6% and class C4s: 5.6%). All the patients wore progressive compression stockings for 15 consecutive days (ankle:  $8 \pm 2$  mmHg; calf:  $18 \pm 2$  mmHg).

Tolerance of the progressive compression by day 15 was evaluated by a composite primary criteria associating “no decrease > 15% of ankle brachial index (ABI) on each side”, “no decrease > 15% of toe brachial index (TBI) on each side”, “no decrease > 25% of the number of active plantar flexions performed while standing”. ABI was calculated for each lower limb by dividing the mean of 3 measures performed in the 3 arteries at the ankle by the maximal brachial arterial pressure. TBI was calculated by dividing the mean of at least 2 stabilized measures by the maximal brachial arterial pressure. For each patient, the measures were performed by the same medical doctor. Tolerance was considered high if no component of the composite primary criteria was present and low if at least one of the components was present.

Secondary criteria evaluated by day 15 assessed arterial vascularisation (ABI, TBI, number of active standing plantar flexions, maximal walking distance estimated by a constant load Strandness test, clinical signs of PAD [claudication,

feeling of cold feet or paresthesias of feet during effort]) and clinical signs of venous insufficiency (feeling of heavy legs, pain of lower limbs quantified by a visual analogical graduated scale (0 to 10), telangiectasia, reticular and non-reticular varicoses, oedema, and skin modifications [pigmentation, stasis dermatitis, hypodermatitis]).

### Results

Eighteen patients were included between February 2015 and October 2015. The ratio of men to women was 77.8% / 22.2%. Mean age of the patients was  $77.3 \pm 7.5$  years, BMI was  $24.5 \pm 2.3$  kg/m<sup>2</sup>, and 11.1% of patients had a sedentary lifestyle. No patient was diabetic. As a daily treatment, 66.7% had an antiplatelet agent, 27.8% an anticoagulant, 66.7% a renin-angiotensin blocker and 16.7% a  $\beta$ -blocker. All the patients had a PAD for a mean period of  $13.1 \pm 8$  years. All of them had muscle pains or arterial claudication, 27.8% leg myalgias and 16.7% a perception of leg coldness or paresthesias while walking.

At inclusion, the mean low ABI was  $0.60 \pm 0.04$  and the mean high ABI was  $0.77 \pm 0.18$ . The mean low TBI was  $0.32 \pm 0.09$  and the mean high TBI was  $0.46 \pm 0.15$ . The mean number of active standing plantar flexions was  $33.0 \pm 5.0$ . Poor tolerance occurred in no patient. By day 30, no patient had worsening of their arterial and venous symptoms. No serious and non-serious adverse events occurred during the

study. Putting on of the compression stockings was considered easy for all the patients.

## Conclusions

We tested progressive compression stockings in patients with a PAD associated with a venous insufficiency. Our hypothesis was that lower pressure at ankle would not deteriorate peripheral arterial vascularisation and higher pressure at calf would increase blood drawing from the microvessels. Our study showed a high tolerance of progressive compression in patients with symptomatic arterial occlusive disease. We chose a composite primary criteria with components evaluating peripheral arterial vascularisation including microcirculation (TBI) and effort function (active plantar flexions while standing). Secondary criteria included the components of the composite primary criteria and also standardised walking distance and functional signs of venous insufficiency. We showed that the tolerance of progressive compression was excellent based on the primary criteria (no decreasing of ABI, TBI and active plantar flexions) and secondary criteria (walking distance evaluated by a Strandness test, functional signs of venous insufficiency evaluated with an analogical scale). As already

published, the putting on of progressive compression was considered easy in all patients. This data is encouraging and allows to continue to evaluate progressive compression in PAD with a bigger number of patients and a longer testing period.

## Comments of the Editors

Compression therapy in patients with critical ischemia (systolic ankle pressure < 50 mmHg, ABPI < 0.5) is a clear contraindication for compression therapy. As we know today compression therapy with mild pressure is not a contraindication but even a good indication in mixed arterial-venous disease with an ABPI > 0.5, mainly due to edema reduction and partly due to the improvement of venous drainage. Using inelastic bandages in mixed, arterial-venous ulcers, applied with a pressure of 20mmHg, an increase of the ejection fraction of the venous pump by 70% was reported. Pressures of 40 mmHg even doubled the ejection fraction and improved the arterial blood flow parameters significantly. (Mosti G, Iabichella ML, Partsch H. Compression therapy in mixed ulcers increases venous output and arterial perfusion. *J Vasc Surg.* 2012;55(1):122–128.)

In the paper of Couzan et al. stockings exerting a pressure of 18±2 mmHg at the calf and 8±2 mmHg at the ankle neither decreased systolic ankle pressure and toe pressure nor did they have a negative influence on walking distance. Unfortunately, no comparison was done in the same patients with usual low pressure degressive graduated stockings or with inelastic bandages, so that possible advantages of progressive stockings in this indication are still a matter of speculation.

However, since it had been demonstrated that higher pressure over the calf is more effective concerning an improvement of the venous pump compared to conventional graduated compression stockings in patients with venous insufficiency, this concept is certainly also important for patients with additional arterial occlusions. The optimal pressure of such stockings needs to be defined by future studies. (Mosti G, Partsch H. Improvement of venous pumping function by double progressive compression stockings: higher pressure over the calf is more important than a graduated pressure profile. *Eur J Vasc Endovasc Surg.* 2014;47(5):545–549).

Wafaa Taha Ebrahim Elgzar, Hanan Ebrahim Said, Heba Abdelfatah Ebrahim

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## Effect of lower leg compression during caesarean section on post-spinal hypotension and neonatal hemodynamic parameters: nonrandomized controlled clinical trial

*International Journal of Nursing Sciences 6 (2019) 252e258*

### **Aim**

The incidence of caesarean section (CS) is incredibly increasing worldwide in general and in Egypt in particular. Local anesthesia (including spinal and epidural) is preferred over general anesthesia in case of emergency caesarean section, fetal distress, some chronic maternal diseases, and difficult intubation. Post-spinal hypotension (PSH) is the most common complication following spinal anesthesia; its incidence ranges from 60% to 70%. PSH is a serious problem that can lead to maternal complications such as loss of consciousness, aspiration, and death if not efficiently managed. Fetus complications range from low Apgar score in mild PSH to fetal hypoxia, distress, fetal acidosis, and brain damage due to severe hypoxia reflected on umbilical PH samples. The mechanism of PSH is complex and multi-factorial. Two major factors are acknowledged. The first is systemic decrease in blood

vessel vascular resistance after spinal block due to sympathetic inhibition. The second is compression of gravid uterus in the inferior vena cava against the vertebral bone, resulting in reduction of venous return to the heart. These two factors are usually compensated by increased heart rate (HR) and cardiac output. However, in a relatively high dose of spinal block, this compensatory action is blocked, secondary to inhibition of cardio accelerator fibers leading to systemic hypotension. The placenta blood supply is pressure dependent; consequently, in case of PSH, the utero-placental blood supply is decreased by around 16% to 20%, leading to serious fetal complications.

The aim of this study was therefore to determine the effect of lower leg compression during caesarean section (CS) on post-spinal hypotension (PSH) and neonatal hemodynamic parameters.

### **Methods**

A total of 120 women giving birth and undergoing elective caesarean section with spinal anaesthesia were recruited for this non-randomized, controlled clinical trial conducted in the caesarean delivery unit of the National Medical institute, Damanshour, Egypt. The researchers developed three tools for data collection: sociodemographic data and reproductive history interview schedule, electronic monitoring of maternal hemodynamic parameters, and neonatal hemodynamic assessment sheet. The interventional group was treated with a long elastic stocking with an ankle pressure of 20-30mmHg, applied on both legs during caesarean section. The control group received the same care without the elastic compression stockings.

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## Results

The majority of study participants were in the age range of 21-35 years and the most common reason for the elective caesarean section was "having a previous one". No differences were seen in baseline values like BMI, gestational age, number of gravidities, etc. between the active and the control group.

Maternal systolic blood pressure, diastolic blood pressure, and mean arterial blood pressure were significantly higher in the intervention group throughout the entire operation period except in the last 5 to 15 min of the caesarean section. Heart rate was significantly lower in the intervention group. Only 13.3% of the intervention group took ephedrine, a medication and stimulant that is often used to prevent low blood pressure during spinal anaesthesia, compared with 45% of the control group. Nausea and vomiting were statistically significant higher in the control group.

Apgar score was higher among neonates of intervention group compared with the control group at 1 minute but improved at 5 minutes in both groups. Neonatal respiratory acidosis was significantly higher in the control group than in the intervention group. A very small, but not statistically significant proportion of the control group was admitted to the ICU compared with none in the intervention group.

A statistically significant difference in all neonate blood gas parameters (arterial pH, pCO<sub>2</sub>, HCO<sub>3</sub> and venous pH, pO<sub>2</sub>, HCO<sub>3</sub>), except arterial pO<sub>2</sub> and venous pCO<sub>2</sub> were seen between the two study groups.

## Conclusions

The current study showed that lower leg compression can effectively reduce PSH and neonatal acidosis. Wearing compression stockings during the caesarean section led to a lower incidence of PSH and to better neonatal hemodynamic parameters.

The authors recommend that lower leg compression should be included in spinal anaesthesia care protocols during elective caesarean section.

## Comments of the Editors

In this nonrandomized controlled clinical trial, the authors could show that wearing compression stockings during cesarean delivery has a significantly positive effect on blood pressure, heart rate, need for antihypotensive drugs and even on the Apgar score of the neonates. Post-spinal hypotension (PSH) as the most common complication with an incidence of 60-70% following spinal

anesthesia during cesarean section may be accompanied by nausea and vomiting and is a risk factor for low Apgar scores in neonates caused by hypoxia. The beneficial effect of compression stockings on low blood pressure is well known<sup>1,2</sup>. Many of our colleagues are wearing compression stockings during standing in the operating room to avoid hypotension. Mendoza and all could show beneficial effects of compression to in avoiding nausea and vomiting during early pregnancy<sup>3</sup>. The results of this study should motivate pregnant women to wear compression stockings not only during pregnancy but also during delivery and during cesarean section. This simple method may help to prevent serious problems in mothers and neonates.

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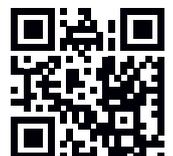
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