MOH BULLETIN #40

Special Edition

Risks and contraindications of medical compression treatment – a critical reappraisal. An international consensus statement.

Consensus group:

Eberhard Rabe[1], Hugo Partsch[2], Nick Morrison[3], Mark Meissner[4], Giovanni Mosti[5], Christopher Lattimer[6], Patrick Carpentier[7], Sylvain Gaillard[8], Michael Jünger[9], Tomasz Urbanek[10], Jürg Hafner[11], Malay Patel[12], Stephanie Wu[13], Joseph Caprini[14], Fedor Lurie[15] and Tobias Hirsch[16].

Article open access link:
https://journals.sagepub.com/doi/pdf/10.1177/0268355520909066

Author information: See page 7.

Objective
Medical compression (MC) therapy is used for non-invasive treatment of venous and lymphatic diseases. MC therapy-associated adverse events and contraindications have been reported, although some contraindications are theoretically based. This consensus statement reviews the available literature and provides recommendations on medical compression therapy risks and contraindications.

Method
A systematic literature search of medical compression therapy publications reporting adverse events up until November 2017 was performed. Papers on intermittent pneumatic compression were excluded from the analysis. A consensus panel comprising 15 international experts critically reviewed the publications and consented recommendations.

Results
62 publications reporting adverse events of medical compression therapy were identified. The consensus panel issued 21 recommendations on medical compression therapy contraindications and adverse risk mitigation, in addition to reviewing medical compression therapy use in borderline indications. The most frequently reported non-severe medical compression therapy-associated adverse events included skin irritation, discomfort and pain. Very rare but severe adverse events, including soft tissue and nerve injury were included.

Conclusion
This consensus statement summarises published medical compression therapy-associated adverse events and contraindications, and provides guidance on medical compression therapy. Severe medical compression therapy-associated events are very rarely encountered if compression is used correctly and contraindications are considered.

Flow diagram of the relevant literature identified

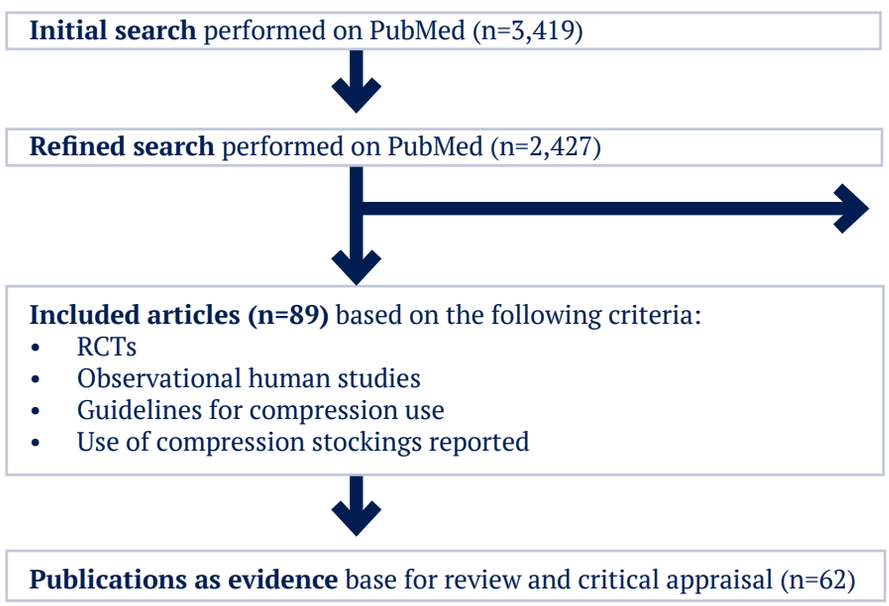

Figure 1: Preferred Reporting Items for Systematic reviews and Meta-Analyses flow diagram of relevant literature identified.
RCT: randomised controlled trial.

Primary search terms & cross-matching terms

Primary search terms:
'compression bandages', 'medical compression stockings', 'graduated elastic compression', 'adjustable compression', 'thromboprophylactic stockings', 'TPS'.

Cross-matching terms:
'complications', 'adverse events', 'contraindications', 'side effects', 'risks'.

Results: general statement

1 We recommend that every patient receiving compression therapy should be screened for conditions that increase the risk of complications, and every compression device should be checked for appropriate fit and application. Contraindications for compression treatment must be considered to limit the risk of side effects.

Results: Risks and complications of compression therapy

Skin irritation

2 We recommend using adequate skin care to prevent skin irritation in patients with sensitive skin.

Allergic skin reactions

3 To prevent allergic skin reactions due to compression devices, we suggest avoiding potentially allergenic substances and dyes in compression materials.

Discomfort & pain

4 In patients with discomfort and/or pain below compression garments, we recommend checking the correct indication pressure level, material, fitting or bandage techniques as well as the correct donning and doffing.

Forefoot edema / lymphedema

5 In patients with, or in those developing, forefoot or toe edema when wearing compression, we suggest considering forefoot and toe bandaging or forefoot and toe compression pieces in addition to leg compression with a foot piece.

Bacterial & fungal infections

6 In patients with bacterial or fungal infection beneath the compression device, we recommend considering treatment with topical antiseptics or topical anti-microbiological medication. In patients with systemic symptoms (fever, chills), erysipelas or cellulitis, we recommend that systemic treatment should be given. In other cases of systemic symptoms and severe local wound and tissue infection, the decision on further treatment, including also MC, should be individualized on the basis of the local and general patient condition evaluation.

7 If the compression application or material is suspected to contribute to the infection (e.g. lateral pressure on toes with interdigital maceration), we suggest a modification of compression.

Mechanical tissue & nerve damage

8 We suggest considering that, according to the Law of Laplace, the local pressure below the compression material may be higher than expected at bony and tendinous prominences such as above ankles, the tibia, the fibular head or above tendons such as the Achilles tendon, and to check those locations for skin lesions due to pressure.

9 To prevent tissue damage or necrosis and nerve damage in regions with a small radius, we suggest protecting these regions (tendons, nerves and bones) from inappropriate high pressure, particularly in patients with sensitive skin, by:

- Decreasing the local pressure by inserting soft padding material
- Using low overall pressure
- Taking appropriate circumference measurements so that the compression devices fit properly.

Soft tissue damage & necrosis

10 We suggest specific precaution (padding, special care of fit, low pressure) and close controls at the initial stages of compression therapy in patients with polyneuropathy and elderly patients with frail, atrophic skin (dermatoporosis).

Nerve damage

11 We suggest considering that pressure-induced nerve damage may occur at specific points of the leg (e.g. fibular head) mainly in cases with excessive local compression pressure, e.g. due to ill-fitting MCS, TPS or CB. Numbness and nerve palsy may occur. We suggest preventing high or continuous local pressure in regions with a risk of nerve compression as well as correct sizing and application of compression. Patients at higher risk for nerve damage (e.g. patients with diabetes, patients with neuropathy) should be treated with special caution to prevent nerve damage.

12 Peripheral arterial occlusive disease (PAOD)

We recommend checking the arterial circulation status before any kind of compression therapy is initiated. If foot pulse and/or ankle pulse is weak or not palpable, ABPI should be measured and calculated prior to initiating MC therapy.

13 Severe PAOD (systolic ankle pressure <60mmHg, toe pressure <30mmHg) is a contraindication against compression therapy with MCS. In CB, the applied pressure and the elasticity of the material are important. This contraindication does not apply to IPC and to patients with non-critical leg ischaemia treated with inelastic material applied with low resting pressure.

14 In every patient with impaired perfusion of the lower limb (ABI >0.9), the clinical effect of the MCS on leg blood supply should be carefully monitored. If the situation is not recognized, there is a possibility of developing non-healing skin breaks even under low pressure MCS.

Results: Risks & complications of compression therapy

Bypass surgery or stenting

15 After bypass surgery with improved peripheral arterial pressures, MC treatment may be performed if there is no direct compression effect on the bypass itself. We suggest avoiding the compression of epifascial bypass conduits. As for all patients with chronic leg ischemia, the recommendations regarding the use of MC treatment should be followed (see recommendations 12-14).

Venous thromboembolism

16 Because of a tourniquet effect, improper compression can cause local SVT, especially in combination with prolonged sitting (long-haul flights). To prevent thromboembolic complications, we recommend avoiding a tourniquet effect and strangulation by inappropriate application of MCS, TPS and bandages.

Cardiac insufficiency

17 We recommend against applying compression in severe cases of cardiac insufficiency (NYHA IV). We also suggest against routine applications of MCS in NYHA III cases. When needed, careful use of compression therapy in this patient group may be considered if there is a strict indication, with clinical and hemodynamic monitoring. In less severe cases, cautious increase of compression pressure only leads to very short phases of increased cardiac load and may lead to a substantial reduction of peripheral edema.

Results: Borderline indications

Deep & superficial vein thrombosis

18 We recommend considering that, in contrast to previous concepts, compression is not contraindicated in acute thrombotic events, but results in favourable clinical outcomes when applied with caution. In the hands of experts, proper compression leads to an immediate improvement of pain and edema.

Edema in different pathological conditions

In patients with heart failure, diabetes, mixed pathology CVI or lymphedema and/or PAOD and after arterial bypass surgery or stenting, the use of compression to treat edema is not a contraindication but must be carefully considered.

Inflammatory diseases & infections

19 We suggest additional compression in purpura due to leucocytoclastic vasculitis and in leg erysipelas or cellulitis, to reduce inflammation, pain and edema. In infectious inflammation, we suggest compression only in combination with antibacterial treatment.

20 Special precautions have to be taken if MC treatment is considered in patients with “borderline indications”. Treatment decisions should be taken on a case-by-case basis and under consideration of a careful benefit-risk assessment. In case of a favourable assessment, we suggest the use of low-pressure compression, the use of modified-compression strategies (compression materials) and the use of padding to reduce pressure peaks.

Results: Contraindications

21 We recommend considering the following contraindications for sustained compression with TPS, ACW, MCS and elastic CB:

- In patients with severe PAOD with any of the following: ABPI < 0.6; ankle pressure <60mmHg; toe pressure <30mmHg; transcutaneous oxygen pressure <20mmHg.
- Suspected compression of an existing epifascial arterial bypass.
- Severe cardiac insufficiency (NYHA IV).
- Routine application of MC in NYHA III without strict indication, and clinical and hemodynamic monitoring.
- Confirmed allergy to compression material.
- Severe diabetic neuropathy with sensory loss or microangiopathy with the risk of skin necrosis (this may not apply to inelastic compression exerting low levels of sustained compression pressure (modified compression)).

Consensus Conclusion

Severe adverse events due to compression treatment, such as skin necrosis, nerve damage or thromboembolic events are rarely encountered if compression is correctly used and contraindications are considered.

Discomfort, dry skin and itching are the most frequently reported adverse events related to compression use. To prevent skin irritations in patients with sensitive skin, we propose the use of applicable skin care.

Conclusion & comments of the editors

Compression therapy is a very effective treatment modality, frequently applied by staff members or patients without deeper insight or special skills, which increases the rate of side effects. Also, several reviews report compression therapy ”contraindications” that are based on theoretical assumptions, but are rarely proven by clinical data.

Thanks to both an extensive literature review and to a broad selection of medical experts in the field of compression therapy who strongly contributed through their personal experience, our group was able to reduce the list of strict contraindications to only a few situations. We commented on risky conditions and how to avoid side effects. In addition, we defined some conditions, formerly being listed as contraindications, for which even beneficial effects have been reported, as “borderline indications", emphasizing that there are conditions in which proper compression therapy causes more benefit than harm (examples: edema reduction and increase of nutritional flow in diabetic feet, mixed arterial-venous ulcers, erysipelas). It is to the merit of our sponsor SIGVARIS GROUP that we succeeded in bringing together this outstanding faculty.

At this occasion we thank the sponsor and our faculty for their enthusiastic cooperation and hope that this consensus will be useful for everyone involved in compression therapy.

Hugo Partsch & Eberhard Rabe

Abbreviations

ABI Ankle brachial index; **ABPI** Ankle brachial pressure index; **ACW** Adjustable compression wraps; **CB** Compression bandages; **CT** Compression therapy; **DVT** Deep vein thrombosis; **EPD** Erosive pustular dermatosis; **IPC** Intermittent pneumatic compression; **MC** Medical compression; **MCS** Medical compression stockings; **PAOD** Peripheral arterial occlusive disease; PU Pulmonary embolism; **RCT** Randomized controlled trial; **SVT** Superficial vein thrombosis; **TPS** Thromboprophylactic stockings; **VLU** Venous leg ulcer

References

1. Mosti G, Iabichella ML and Partsch H. Compression therapy in mixed ulcers increases venous output and arterial perfusion. J Vasc Surg 2012; 55: 122–128.
2. Dennis M, Cranswick G and Deary A. Thigh-length versus below-knee stockings for deep venous thrombosis prophylaxis after stroke: a randomized trial. Ann Intern Med 2010; 153: 553–562.
3. Reich-Schupke S, Feldhaus F, Altmeyer P, et al. Efficacy and comfort of medical compression stockings with low and moderate pressure six weeks after vein surgery. Phlebology 2014; 29: 358–366.
4. Harrison MB, Vandenkerkhof EG, Hopman WM, et al. The Canadian Bandaging Trial: evidence-informed leg ulcer care and the effectiveness of two compression technologies. BMC Nurs 2011; 10: 20.
5. Mizuno J and In-Nami H. Allergic contact dermatitis to synthetic rubber, neoprene in compression stockings [In Japanese]. Masui 2011; 60: 104–106.
6. Valesky EM, Kaufmann R and Meissner M. Contact allergy to compression stockings: is this possible? Phlebologie 2014; 43: 140–143.
7. Lattimer CR, Azzam M, Kalodiki E, et al. Compression stockings significantly improve hemodynamic performance in post-thrombotic syndrome irrespective of class or length. J Vasc Surg 2013; 58: 158–165.
8. Boris M, Weindorf S and Lasinski BB. The risk of genital edema after external pump compression for lower limb lymphedema. Lymphology 1998; 31: 15–20.
9. Hansson C, Faergemann J and Swanbeck G. Fungal infections occurring under bandages in leg ulcer patients. Acta Derm Venereol 1987; 67: 341–345.
10. Carliota AB, Kaya E, Turgut H, et al. Letter to the editor. Folliculitis associated with intermittant pneumatic compression. Yonsei Med J 2014; 55: 545–546.
11. O'Meara S, Al-Kurdi D, Ologun Y, et al. Antibiotics and antiseptics for venous leg ulcers. Cochrane Database Syst Rev 2014: CD003557.
12. Franks PJ, Barker J, Collier M, et al. Management of patients with venous leg ulcers: challenges and current best practice. J Wound Care 2016; 25: S1–S67.
13. O'Meara S, Cullum N, Nelson EA, et al. Compression for venous leg ulcers. Cochrane Database Syst Rev 2012; 11: CD000265.
14. Elder DM and Greer KE. Venous disease: how to heal and prevent chronic leg ulcers. Geriatrics 1995; 50: 30–36.
15. Dawn G, Loney M, Zamiri M, et al. Erosive pustular dermatosis of the leg associated with compression bandaging and fungal infection. Br J Dermatol 2003; 148: 489–492.
16. Thompson CB, Wiemken TL and Brown TS. Effect of postoperative dressing on excisions performed on the leg: a comparison between zinc oxide compression dressings versus standard wound care. Dermatol Surg 2017; 43: 1379–1384.
17. Jaccard Y, Singer E, Degischer S, et al. Effect of silver-threads-containing compression stockings on the cutaneous microcirculation: a double-blind, randomized cross-over study. Clin HemorheolMicrocirc 2007; 36: 65–73.
18. Basford JR. The Law of Laplace and its relevance to contemporary medicine and rehabilitation. Arch Phys Med Rehabil 2002; 83: 1165–1170.
19. Crawford F, Welch K, Andras A, et al. Ankle brachial index for the diagnosis of lower limb peripheral arterial disease. Cochrane Database Syst Rev 2016; 9: CD010680.
20. Heath DI, Kent SJ, Johns DL, et al. Arterial thrombosis associated with graduated pressure antiembolic stockings. Br Med J (Clin Res Ed) 1987; 295: 580.
21. Merrett ND and Hanel KC. Ischaemic complications of graduated compression stockings in the treatment of deep venous thrombosis. Postgrad Med J 1993; 69: 232–234.
22. Creton D. La chirurgie des varices. Complications cutan_ee dues a` la compression par doubles collants postopératoires [In French]. Phlebologie 1998; 51: 363–364.
23. Ong JC, Chan FC and McCann J. Pressure ulcers of the popliteal fossae caused by thromboembolic deterrent stockings (TEDS). Ir J Med Sci 2011; 180: 601–602.
24. Callam MJ, Ruckley CV, Dale JJ, et al. Hazards of compression treatment of the leg: an estimate from Scottish surgeons. Br Med J (Clin Res Ed) 1987; 295: 1382.
25. Dennis M, Sandercock PA, Reid J, et al. Effectiveness of thigh-length graduated compression stockings to reduce the risk of deep vein thrombosis after stroke (CLOTS trial 1): a multicentre, randomised controlled trial. Lancet 2009; 373: 1958–1965.
26. Chan CL, Meyer FJ, Hay RJ, et al. Toe ulceration associated with compression bandaging: observational study. BMJ 2001; 323: 1099.
27. McIlhone S, Ukra H, Karim A, et al. Soft tissue injury to the sole of the foot secondary to a retained AV impulse foot pump. Foot Ankle Surg 2012; 18: 216–217.
28. Anand A. Complications associated with intermittent pneumatic compression devices. Anesthesiology 2000; 93: 1556–1557.
29. Parra RO, Farber R and Feigl A. Pressure necrosis from intermittent-pneumatic-compression stockings. N Engl J Med 1989; 321: 1615.
30. Werbel GB and Shybut GT. Acute compartment syndrome caused by a malfunctioning pneumatic compression boot. A case report. J Bone Joint Surg Am 1986; 68: 1445–1446.
31. Usmani N, Baxter KF and Sheehan-Dare R. Partially reversible common peroneal nerve palsy secondary to compression with four-layer bandaging in a chronic case of venous leg ulceration. Br J Dermatol 2004; 150: 1224–1225.
32. Fukuda H. Bilateral peroneal nerve palsy caused by intermittent pneumatic compression. Intern Med 2006; 45: 93–94.
33. McGrory BJ and Burke DW. Peroneal nerve palsy following intermittent sequential pneumatic compression. Orthopedics 2000; 23: 1103–1105.
34. Hirate H, Sobue K, Tsuda T, et al. Peripheral nerve injury caused by misuse of elastic stockings. Anaesth Intensive Care 2007; 35: 306–307.
35. Kim JH, Kim WI, Kim JY, et al. Peroneal nerve palsy after compression stockings application. Saudi J Anaesth 2016; 10: 462–464.
36. Güzelküçük, Skempes D and Kumnerddee W. Common peroneal nerve palsy caused by compression stockings after surgery. Am J Phys Med Rehabil 2014; 93: 609–611.
37. O'Brien C and Eltigani T. Common peroneal nerve palsy as a possible sequelae of poorly fitting below-knee thromboembolic deterrent stockings (TEDS). Ann Plastic Surg 2006; 57: 356–357.
38. Blättler W and Partsch H. Leg compression and ambulation is better than bed rest for the treatment of acute deep venous thrombosis. Int Angiol 2003; 22: 393–400.

References (continued)

39. Partsch H and Blättler W. Compression and walking versus bed rest in the treatment of proximal deep venous thrombosis with low molecular weight heparin. J Vasc Surg 2000; 32: 861–869.
40. Partsch H. The role of leg compression in the treatment of deep vein thrombosis. Phlebology 2014; 29: 66–70.
41. Ten Cate-Hoek AJ, Amin EE, Bouman AC, et al. Individualised versus standard duration of elastic compression therapy for prevention of post-thrombotic syndrome (IDEAL DVT): a multicentre, randomised, single-blind, allocation-concealed, non-inferiority trial. Lancet Haematol 2018; 5: e25–e33.
42. Partsch H. Therapy of deep vein thrombosis with low molecular weight heparin, leg compression and immediate ambulation. VASA 2001; 30: 195–204.
43. Scurr JH, Smith PD and Machin S. Deep vein thrombosis in airline passengers – the incidence of deep vein thrombosis and the efficacy of elastic compression stockings. Cardiovasc Surg 2001; 9: 159–161.
44. Jünger M, Partsch H, Kahle B, et al. Phlebologischer Kompressionsverband (PKV) – Leitlinie der Deutschen Gesellschaft für Phlebologie. Phlebologie 2009; 38: 168–171.
45. AWMF online. S3-Leitlinie Prophylaxe der ven€osen Thromboembolie (VTE), detail/ll/003-001.html (2010, accessed July 2019).
46. AWMF online. S2k Leitlinie Diagnostik und Therapie der Lymph€odeme AWMF Reg. -Nr. 058-001, ien/058-001l_S2k_Diagnostik_und_Therapie_der_Lymphoedeme_2017-05.pdf (2017, accessed July 2019).
47. Andriessen A, Apelqvist J, Mosti G, et al. Compression therapy for venous leg ulcers: risk factors for adverse events and complications, contraindications – a review of present guidelines. J Eur Acad Dermatol Venereol 2017; 31: 1562–1568.
48. Mostbeck A and Partsch H. Influence of dihydroergotamine and leg compression on the blood volume in different regions of the body [in German]. Med Klin 1978; 73: 801–806.
49. Lattimer CR, Kalodiki E, Azzam M, et al. Haemodynamic performance of low strength below knee graduated elastic compression stockings in health, venous disease, and lymphoedema. Eur J Vasc Endovasc Surg 2016; 52: 105–112.
50. Azevedo PS, Polegato BF, Minicucci MF, et al. Cardiac remodeling: concepts, clinical impact, pathophysiological mechanisms and pharmacologic treatment. Arq Bras Cardiol 2016; 106: 62–69.
51. Bain RJ, Tan LB, Murray RG, et al. Central haemodynamic changes during lower body positive pressure in patients with congestive cardiac failure. Cardiovasc Res 1989; 23: 833–837.
52. Dereppe H, Hoylaerts M, Renard M, et al. The effects of pressotherapy on cardiovascular hemodynamics [In French]. Rev Med Brux 1989; 10: 185–186.
53. Todd J, Austwick T, Berridge D, et al. B-type natriuretic peptide in lymphedema. Lymphology 2011; 44: 29–34.
54. The Criteria Committee of the New York Heart Association. Nomenclature and criteria for diagnosis of diseases of the heart and great vessels. Boston, MA: Little, Brown & Co, 1994, pp.253–256.
55. Galm O, Jansen-Genzel W, von Helden J, et al. Plasma human atrial natriuretic peptide under compression therapy in patients with chronic venous insufficiency with or without cardiac insufficiency. VASA 1996; 25: 48–53.
56. Wilputte F, Renard M and Venner JP. Hemodynamic response to multilayered bandages dressed on a lower limb of patients with heart failure. Eur J Lym 2005; XV: 1–4.
57. Leduc O, Crasset V, Leleu C, et al. Impact of manual lymphatic drainage on hemodynamic parameters in patients with heart failure and lower limb edema. Lymphology 2011; 44: 13–20.
58. Gorelik O, Almoznino-Sarafian D, Litvinov V, et al. Seating-induced postural hypotension is common in older patients with decompensated heart failure and may be prevented by lower limb compression bandaging. Gerontology 2009; 55: 138–144.
59. Boussuges A, Ayme K, Chaumet G, et al. Observational study of potential risk factors of immersion pulmonary edema in healthy divers: exercise intensity is the main contributor. Sports Med Open 2017; 3: 35.
60. Carter HH, Spence AL, Ainslie PN, et al. Differential impact of water immersion on arterial blood flow and shear stress in the carotid and brachial arteries of humans. Physiol Rep 2017; 5: pii: 5/10/e13285.
61. Bowering CK. Use of layered compression bandages in diabetic patients. Experience in patients with lower leg ulceration, peripheral edema, and features of venous and arterial disease. Adv Wound Care 1998; 11: 129–135.
62. Robertson BF, Thomson CH and Siddiqui H. Side effects of compression stockings: a case report. Br J Gen Pract 2014; 64: 316–317.
63. Aschwanden M, Labs KH, Engel H, et al. Acute deep vein thrombosis: early mobilization does not increase the frequency of pulmonary embolism. Thromb Haemost 2001; 85: 42–46.
64. Schellong SM, Schwarz T, Kropp J, et al. Bed rest in deep vein thrombosis and the incidence of scintigraphic pulmonary embolism. Thromb Haemost 1999; 82: 127–129.
65. Partsch H and Mostbeck A. Early diagnosis of deep venous thrombosis of the lower leg [In German]. Acta Med Austriaca 1979; 4: 159–160.
66. Verlato F, Zucchetta P, Prandoni P, et al. An unexpectedly high rate of pulmonary embolism in patients with superficial thrombophlebitis of the thigh. J Vasc Surg 1999; 30: 1113–1115.
67. Boehler K, Kittler H, Stolkovich S, et al. Therapeutic effect of compression stockings versus no compression on isolated superficial vein thrombosis of the legs: a randomized clinical trial. Eur J Vasc Endovasc Surg 2014; 48: 465–471.
68. Abu-Own A, Shami SK, Chittenden SJ, et al. Microangiopathy of the skin and the effect of leg compression in patients with chronic venous insufficiency. J Vasc Surg 1994; 19: 1074–1083.
69. Dini V. Compression in vasculitis. Veins and Lymphatics 2016; 5: 5981.
70. Roumen-Klappe EM, den Heijer M, van Rossum J, et al. Multilayer compression bandaging in the acute phase of deep-vein thrombosis has no effect on the development of the post-thrombotic syndrome. J Thromb Thrombolysis 2009; 27: 400–405.
71. Amin EE, Joore MA, Ten Cate H, et al. Clinical and economic impact of compression in the acute phase of deep vein thrombosis. J Thromb Haemost 2018; 16: 1555–1563.
72. Wu SC, Crews RT, Najafi B, et al. Safety and efficacy of mild compression (18–25mm Hg) therapy in patients with diabetes and lower extremity edema. J Diabetes Sci Technol 2012; 6: 641–647.
73. Wu SC, Crews RT, Skratsky M, et al. Control of lower extremity edema in patients with diabetes: double blind randomized controlled trial assessing the efficacy of mild compression diabetic socks. Diabetes Res Clin Pract 2017; 127: 35–43.
74. Bochmann RP, Seibel W, Haase E, et al. External compression increases forearm perfusion. J Appl Physiol (1985) 2005; 99: 2337–2344.
75. Mayrovitz HN and Macdonald JM. Medical compression: effects on pulsatile leg blood flow. Int Angiol 2010; 29: 436–441.
76. Fromy B, Legrand MS, Abraham P, et al. Effects of positive pressure on both femoral venous and arterial blood velocities and the cutaneous microcirculation of the forefoot. Cardiovasc Res 1997; 36: 372–376.
77. Humphreys ML, Stewart AH, Gohel MS, et al. Management of mixed arterial and venous leg ulcers. Br J Surg 2007; 94: 1104–1107.
78. Alizadeh-Ghavidel A, Ramezannejad P, Mirmesdagh Y, et al. Prevention of edema after coronary artery bypass graft surgery by compression stockings. Res Cardiovasc Med 2014; 3: e17463.
79. Belczak CE, Tyszka AL, Godoy JM, et al. Clinical complications of limb undergone harvesting of great saphenous vein for coronary artery bypass grafting using bridge technique. Rev Bras Cir Cardiovasc 2009; 24: 68–72.
80. Khoshgoftar Z, Ayat Esfahani F, Marzban M, et al. Comparison of compression stocking with elastic bandage in reducing postoperative edema in coronary artery bypass graft patient. J Vasc Nurs 2009; 27: 103–106.
81. Maleti O. Compression after vein harvesting for coronary bypass. Veins and Lymphatics 2016; 5: 5989.
82. te Slaa A, Dolmans DE, Ho GH, et al. Prospective randomized controlled trial to analyze the effects of intermittent pneumatic compression on edema following autologous femoropopliteal bypass surgery. World J Surg 2011; 35: 446–454.
83. Olszewski WL. Episodic dermatolymphangioadenitis (DLA) in patients with lymphedema of the lower extremities before and after administration of benzathine penicillin: a preliminary study. Lymphology 1996; 29: 126–131.
84. Maccio` A. Compression in dermato-lymphangio-adenits. Veins and Lymphatics 2016; 5: 5982.
85. Stalbow J. Preventing cellulitis in older people with persistent lower limb oedema. Br J Nurs 2004; 13: 725–732.
86. Bonnetblanc JM and B_edane C. Erysipelas: recognition and management. Am J Clin Dermatol 2003; 4: 157–163.
87. Villefrance M, Høgh A and Kristensen LH. Compression is important in erysipelas treatment [In Danish]. Ugeskr Laeger 2017; 179: pii: V04170284.
88. Ligi D, Croce L and Mannello F. Inflammation and compression: state of the art. Veins and Lymphatics 2016; 5: 5980.
89. European Commission. Consumer Goods – Pharmaceuticals: a guideline on summary of product characteristics (SmPC): section 4.8: undesirable effects, www.ema.europa.eu/en/documents/presentation/presentation-section-48-undesirable-effects_en.pdf (2009, accessed July 2019).

Author information

1. Department of Dermatology, University of Bonn, Bonn, Germany
2. Emeritus, Department of Dermatology, Medical University of Vienna, Vienna, Austria
3. Center for Vein Restoration, Mesa, AZ, USA
4. Department of Surgery, Harborview Medical Center, Seattle, WA, USA
5. Angiology Department, Clinica MD, Barbantini, Lucca, Italy
6. Josef Pflug Vascular Laboratory, West London Vascular and Interventional Centre, Ealing Hospital & Imperial College, London, UK
7. Centre de Recherche Universitaire de La Lechere, Equipe THEMAS, Universite Joseph Fourier, Grenoble, France
8. SIGVARIS Management AG, Winterthur, Switzerland
9. Department of Dermatology, University of Greifswald, Greifswald, Germany
10. Department of General Surgery, Vascular Surgery, Angiology and Phlebology, Medical University of Silesia, Katowice, Poland
11. Department of Dermatology, University Hospital of Zurich, Zurich, Switzerland
12. First Choice Vascular, Swastik Society, Ahmedabad, India
13. Department of Podiatric Surgery & Applied Biomechanics, Rosalind, Franklin University of Medicine and Science, North Chicago, IL, USA
14. Department of Vascular Surgery, The University of Chicago, Chicago, IL, USA
15. Department of Vascular Surgery, University of Michigan, Ann Arbor, MI, USA
16. Practice for Internal Medicine and Vascular Diseases, Halle, Germany

MOH BULLETIN

Published by

MOH by SIGVARIS GROUP
SIGVARIS Management AG
CH-8400 Winterthur
Tel. +41 52 265 00 00
www.sigvaris.com | www.medical-online-hub.com