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*The miraculous healing of Saint
Peregrinus, who developed
varicose veins and leg ulcers
from long standing: an angel
applied a good compression
bandage.
(This happened more than 700
years before compression
treatment of venous leg ulcers
had been proven to be effective
by modern principles of
evidence based medicine.)
(Lesachtal, Carinthia, Austria)*



H. Partsch
(Editor)

**Evidence based
compression therapy**

VASA

Zeitschrift für Gefäßkrankheiten
Journal of Vascular Diseases

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Evidence based compression therapy

An Initiative of the International Union of
Phlebology (IUP)
under the presidency of H. Partsch

San Diego, CA, (USA) August 27, 2003

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Evidence based compression-therapy

An Initiative of the International Union of Phlebology (IUP)

Abstract

Background

The use of compression therapy is mainly based on tradition and experience. Randomized controlled trials demonstrating clinical effects in different indications are rare or non-existing.

A clear proof of effectiveness for different compression devices endorsed by evidence based medicine will be a prerequisite for reimbursement by health budgets in the near future.

Against this background a group of experts has discussed and approved the following position document under the auspices of the International Union of Phlebology.

Indications for compression therapy in phlebology and lymphology are mainly:

1. Chronic venous disorders (CEAP C0-C6) (1)
2. Acute venous diseases
3. Lymphoedema.

The following 3 questions are discussed for every single indication:

- What is done? (Current practice and rationale)
- What do we know? (Level of recommendation based on present knowledge)
- What do we need to know? (Proposals for randomized controlled trials on compression therapy)

I) Introduction

Randomized controlled trials (RCT's) and systematic reviews

Only *randomized controlled trials (RCT's)* and *systematic reviews* concerning compression bandages and compression stockings are considered. Intermittent pneumatic compression should be evaluated in a future consensus meeting.

A *randomized controlled study* is one in which there are two groups, one treatment group and one control group. The treatment group receives the treatment under investigation, and the control group receives either no treatment or some standard default treatment. Patients are randomly assigned to all groups.

A *systematic review* is a comprehensive survey of a topic in which all of the primary studies of the highest level of evidence have been systematically identified, appraised and summarized according to an explicit and reproducible methodology.

Levels of recommendation

The available randomized controlled trials on compression therapy were evaluated by the expert group based on the following definitions (Table 1).

Basic requirements for future RCT's on compression

Research priority

Indications for compression therapy labelled with B or C or showing no evidence at all should receive special attention in future trials (see Appendix I, page 36).

Table 1: Levels of Scientific Proof and Strength of Recommendations (2)

Recommendation	Levels of Evidence/ Criteria	Interpretation (Meaning)
Grad A	<ul style="list-style-type: none"> – several randomised controlled trials with $\alpha < 0.05$ and $(1-\beta > 0,9)$ – valid meta-analysis 	<ul style="list-style-type: none"> – Large RCT's, – metaanalysis of homogenous results
Grade B	<ul style="list-style-type: none"> – randomized controlled trials with $\alpha < 0.05$ and $(1-\beta < 0,9)$ – one RCT with $\alpha < 0.05$ and $(1-\beta > 0,9)$ 	<ul style="list-style-type: none"> – randomized RCT's in smaller populations, one RCT only
Grade C	<ul style="list-style-type: none"> – non-randomized controlled trials, – cohort studies, – retrospective studies, – case series 	<ul style="list-style-type: none"> – observational studies – consensus reached among members of the authors of guideline (C*)

Material

In future studies the declaration of fibre content, extensibility in longitudinal and transverse direction and of stiffness (hysteresis-curve) is desirable.

Varying extensibility of compression material has a different influence on resting and working pressure and several layers are changing the elastic properties of the bandage.

Pressure

Table 2 shows the recommendations of the European CEN commission regarding compression classes of stockings (3).

Table 2: Compression hosiery, European compression classes (CEN Nr. ENV 12718)

Compression class	Compression at the ankle (mm Hg)
Ccl A light	10–14
Ccl I mild	15–21
Ccl II moderate	23–32
Ccl III strong	34–46
Ccl IV very strong	49 and higher

The exerted pressure at b-level should be given in mmHg and the method of pressure determination should be quoted. Compression classes vary considerably between different countries (Fig. 1).

Compression classes have also been proposed for bandages (Table 3).

Table 3: Compression levels of bandages according to the German (RAL-GZ) and the British regulations (BS 7505) (4)

Group RAL-GZ	Type BS 7505	Compression Level	mmHg British	mmHg German
1	3A	Light	< 20	18,4–21,2
2	3B	Light	21–30	25,1–32,1
3	3C	Moderate	31–40	36,4–46,5
4	3D	High	41–60	> 59

The pressure values given by the producers of medical compression stockings are measured by different methods (e.g. ITF, HOSY, HATRA). Several instruments are available for measuring the “in vivo”-pressure on the individual leg (5). However, clear recommendations how and where the pressure should be measured can not be given at the present time.

Several important points have to be considered (Table 4).

Pressure gradient

Higher compression values distally with a gradually pressure fall towards the proximal parts of a limb reflect an unproven phlebological dogma in most indications. The role of direct pressure over a venous ulcer has not been sufficiently investigated.

Duration of compression and compliance

The time of compression per day and the total wearing time has to be noted and patient’s compliance has to be ensured.

Table 4: Measurement of subbandage pressure depends on several aspects (Chr. Moffatt)

Pressure-sensors	Site of sensor Application	Method of Application	Position of limb
Large diameter sensors tend to report peak pressures	Sensor placed over soft tissue may cause lower pressures than when placed on a hard area	Factors affecting pressure	Pressures are higher when standing and significantly altered during walking
Inflexible sensors-artificially high readings due to lack of conformability		Figures of eight or spiral Number of layers Degree of overlap	

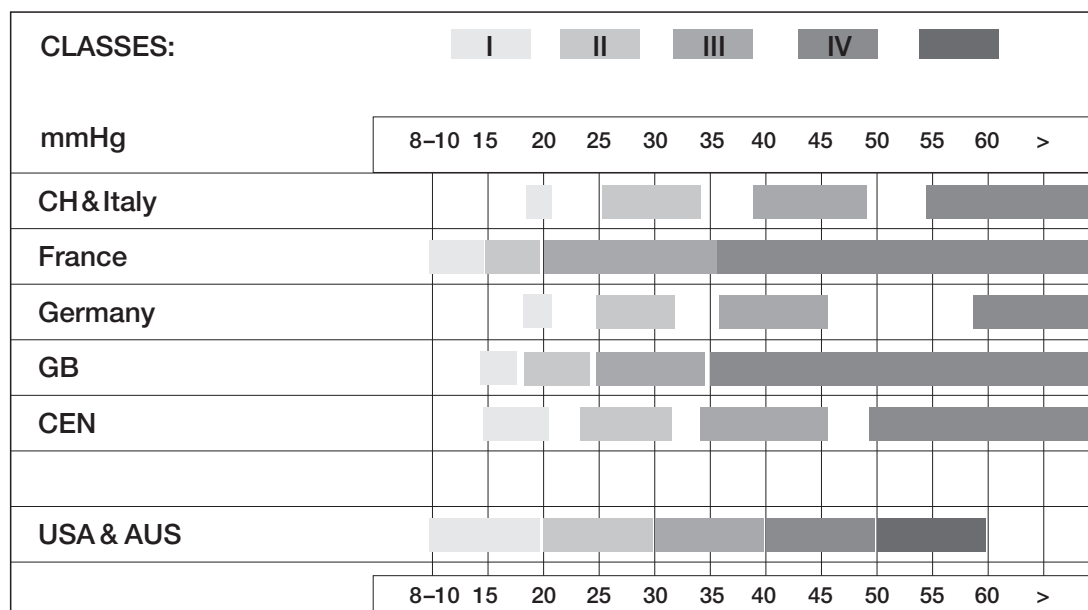


Fig. 1: Comparison of compression pressure at b-level (mmHg) and compression classes (I–IV) in different countries (A. Cornu-Thénard). In the European CEN concept a class A is proposed additionally (3).

Declaration of compression material by the producers

Compression class, exerted pressure at b-level in mm Hg and the method, which was used to measure the pressure should be indicated by the manufacturer.

Durability and costs

Durability, reusability and costs of the material should be noted.

Physical activity and walking ability of the patient

should be considered. The daily walking distance may be measured using a pedometer.

Main issues for all trials (Christine Moffatt)

- How do we classify compression? At the moment trials are performed using outdated criteria for describing bandage systems. All trials need to be undertaken following a careful classification of compression material.
- Cost-effectiveness and quality of life issues must be assessed in all trials undertaken in compression.
- We need to think about the inclusion and exclusion criteria for compression trials. Many trials recruit from specialist centres which are very different from patients from general populations.
- All compression systems should ideally be evaluated for their haemodynamic effect prior to compression trials.

What measurements can be done? (A.N. Nicolaidis) (6)

Table 5: Parameters which can be measured in future compression trials

• Pressure exerted	
• Effect on	
◦ Vein diameter	◦ Patency
◦ Hemodynamics	◦ Recanalisation
◦ Compliance	◦ Lipodermatosclerosis
◦ Edema	◦ Ulceration
◦ Microcirculation	◦ Symptoms
◦ Lymphatic drainage	◦ QOL

The influence of compression on the vein diameter can be measured by phlebography or by ultrasound.

Effects on hemodynamic function are summarized in Table 6.

Table 6: Methods to assess compression effects on venous hemodynamics

<i>Effect on Hemodynamic Function</i>	
• Velocity	
– Radio-isotopes	
– Duplex	
• Volume flow	
– Duplex	
• Total volume	
– Radioactive labelled red cells	
– Venous volume (APG)	
• Calf muscle pump	
– Ejection fraction (SGP, APG)	

• **Reflux**

- Duplex: anatomic extent
- Which veins, which length?
- Velocity and duration (-they depend on vein diameter and size of reservoir)
- LRR and PPG
- RT or RT90
- APG (tip- toeing or walking)
- VFI (reflux in ml/sec)
- RVF (direct proportional to AVP)

APG = air plethysmography
 SGP = strain gage plethysmography
 LRR = light reflux rheoprephy
 PPG = photoplethysmography
 RT = refilling index
 VFI = venous filling index
 RVF = residual volume fraction
 AVP = ambulatory venous pressure

- Potential effects of compression on venous compliance may be assessed from the pressure/volume relationship using simultaneous measurements of venous pressure and of volume (strain gauge plethysmography, air plethysmography).
- Effects on the lymphatic drainage can be demonstrated by lymphoscintigraphy, fluorescence microlymphangiography, indirect x-ray lymphography and intralymphatic pressure measurements.
- Changes of oedema can be measured using a tape, water displacement volumetry, ultrasound, or optoelectronic instruments.
- Different methods can be used to evaluate the influence of compression on the microcirculation: Laser Doppler fluxmetry to assess the veno-arteriolar reflex and vasomotor activity, transcutaneous oxygen tension and skin biopsy.

Table 7: demonstrates ways to assess the efficacy of compression after sclerotherapy.

Table 7: Assessment of patency of varicose veins after therapy

<i>Effect on Patency (e.g. Following compression sclerotherapy)</i>	
– Duplex	
– Extent of recanalization	
– Extent of flow (antegrade or reflux)	
– Number of incompetent perforating veins	
– APG	
– Ejection fraction (EF)	
– Venous volume (VV)	

- The effect of recanalisation of a vein, e.g. following treatment of deep vein thrombosis, can be evaluated by Duplex, measurement of outflow fraction by strain gauge or air plethysmography (APG), and quantitative assessment of refluxes by measuring venous filling index (ml/sec) using APG. Invasive pressure measurements are necessary for measuring the arm/foot differential or venous resistance.
- Lipodermatosclerotic skin changes on the lower leg can be assessed by measurement of skin thickness with high frequency ultrasound (e.g. 20 MHz), by the Durometer or a tissue compliance monitor.

The most important *clinical* parameters are:

- Symptoms on analogue scale
- CEAP classification
- Quality of life (QOL)

Clear parameters should be used for the assessment of ulcer healing (Table 8)

Table 8: Parameters for the assessment of ulcer healing
(Percentage area decrease per unit time is not a valid parameter)

Ulcer Healing

- Area-Planimetry
 - Area in qcm $\times \pi/4$ (ellipse)
 - Gilman method-healing rate per unit time with correction for ulcer size: $(A_b - A_a) / ((P_a + P_b)/2)(b - a)$
 - A is area of ulcer
 - P is its perimeter
 - a is the start and b is the end of the observation period
 - Time to complete healing
 - Initial healing rate
-

References (Methodology)

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II) Indications for Compression Therapy of the Extremities

1. Chronic venous disorders

1.1. Subjective symptoms without clinical signs (C 0, S)

Teleangiectases, reticular veins with symptoms (C 1, S)

(Subjective symptoms: e.g. heaviness and feeling of swollen legs in the evening)

What is done?

Frequently the following compression devices are used:

- Support hosiery (not accepted as a medical device and not listed in the CEN -regulation)
- Light compression stockings (CEN: class A)
- Class I stockings

Rationale for compression therapy (A. Cornu-Thénard)

Compression is well known to improve quality of life: from decreasing the intensity of symptoms to healing of venous ulcers.

However a relationship between venous symptoms (subjective complaints) and minor signs (C1) may be questioned. On the other hand, there is a strong presumption for such a relationship: Phlebologists and patients agree with this idea since a very long time. Discomfort, fatigue, aching and heaviness of the lower limbs are considered to be caused by venous pathology ("functional phlebopathy").

What do we know?

The following RCT's have been identified (see References A, page 18):

1.1.1.–1.1.3.

A critical analysis of these trials is given under: III) Evaluation of Randomized Controlled Trials, page 20–21.

Based on this analysis the "1.1. – indication for compression" can be labelled as **Grade B** (see Appendix I), page 36).

New RCT's in this indication are practically important.

What do we need to know?

Outcome parameters for future studies are summarized in Appendix II, page 37.

For the quantification of subjective symptoms visual analogue scales (VAS) and assessment of quality of life (QOL) is essential.

RCT's considering the following criteria are advisable:

Groups of comparison

A) One compression device, different study populations

B) Different compression devices, same study population

A) One compression device, different study populations

• Study population:

C 0,S: no visible clinical signs on the legs or C 1: small veins with a diameter less than 3 mm,

Subjective symptoms: heaviness, pain, feeling of swollen legs

• Control group:

C 0,A or C 1,A without subjective symptoms.

• Methods of compression:

Medical compression hosiery (class A), or class I stockings

• Follow-up

• Check symptoms after 2 weeks and 4 weeks

• Outcome measure:

Quality of life, Visual analogue scale for the subjective complaints. Patients satisfaction (Edinburgh scale).

"Physiological" leg swelling at the end of a day: volumetry in the morning and in the evening.

B) Different compression devices, same study population

• Study population:

C 0,S: no visible clinical signs on the legs or C 1,S: small, non palpable veins with a diameter less than 3 mm,

Subjective symptoms: heaviness, pain, feeling of swollen legs

• Methods of compression:

– Medical compression hosiery (class A, class I) (pressure to be determined on the leg!) (=Verum) versus

– Placebo stockings or support hosiery (pressure to be determined on the leg!)

• Follow-up

Check symptoms after 2 weeks and 4 weeks

• Outcome measure:

Quality of life, Visual analogue scale for the subjective complaints. Patients satisfaction (Edinburgh-scale!).

"Physiological" leg swelling at the end of a day: volumetry in the morning and in the evening.

Remark

There might be a correlation between subjective symptoms like heaviness and objective swelling during the course of a day. The volume increase of the lower leg compared to the morning ("vesperal oedema") could be a valuable objective parameter.

Experimental setup A) would be important to demonstrate that subjective symptoms do not need to correlate with clinical signs and that also individuals free of any venous pathology may profit from compression.

1.2. Small varicose veins (C1) after sclerotherapy or Laser treatment

What is done?

Various regimens exist:

- no compression at all,
- local compression only for 24 hours,
- compression stockings and bandages for up to 3 weeks.

Rationale for compression therapy (M. Goldman)

1. Decreases extent of thrombus formation

→ recanalisation ↓

→ inflammation ↓

→ teleangiectatic matting ↓

→ pigmentation ↓

2. Decreases post-treatment pain

3. Decreases post-treatment ankle edema.

What do we know?

The following RCT's have been identified (see References A, page 18):

1.2.1.–1.2.2.

A critical analysis of these trials is given under: III) Evaluation of Randomized Controlled Trials, page 21. Based on this analysis the "1.2. – indication for compression" can be labelled as **Grade B** (see Appendix I, page 36).

New RCT's in this indication are practically important.

What do we need to know?

Outcome parameters for future studies are summarized in Appendix II, page 37.

RCT's considering the following criteria are advisable:

- *Study population:*
C 1 patients after one session of sclerotherapy
- *Groups of comparison:*
 - Local compression (pad + tape) for 24 hours
 - Local compression + compression stocking class A, I, II
 - Tangential single plaster compression
 - Local compression + sustained bandage compression
 - One week versus 4 versus 6 weeks
- *Follow-up*
Weekly, up to 6 weeks, 6 months
- *Outcome measure:*
Standardized photographs before and after compression period, assessment by blinded observer?
Frequency of clot evacuation, complication rate, rate of pigmentation after 6 months
Patients satisfaction

1.3. Large varicose veins (C 2, A)

What is done?

Compression therapy is frequently recommended in patients with asymptomatic large varicose veins in order to prevent progression and complications.

Rationale for compression therapy (E. Rabe)

Prevention of progression into symptomatic stage C2, S or towards higher CEAP-classes. Prevention of complications.

Up to now there is no RCT indicating a positive impact of compression therapy on stage C2,A.

What do we know?

The following RCT has been identified (see References A, page 18):

1.3.1

A critical analysis of this trial is given under: III) Evaluation of Randomized Controlled Trials, page 22.

Based on this analysis the "1.3. – indication for compression" can be labelled as **Grade C** (see Appendix I, page 36).

New RCT's in this indication are practically important.

What do we need to know?

Outcome parameters for future studies are summarized in Appendix II, page 39.

RCT's considering the following criteria are advisable:

- *Study population:*
C 2 patients (localisation, calibre and extension of the varicose veins to be declared), asymptomatic without previous complications (phlebitis, bleeding),
Exclusion of venous drugs
- *Groups of comparison:*
 - no compression or Placebo-stockings
 - class A stockings
 - class I stockings
 - class II stockings (all knee length)
- *Follow-up*
for long observation periods (> 1 year)
(check compliance!)
- *Outcome measure:*
Standardized photographs before and after compression period (assessment by blinded observer is recommended).
Long term assessment (1–3 years) is essential.
Venous pumping function (plethysmography), reflux (APG)
Frequency of clinical progression and complications (phlebitis, ulceration),
Occurrence of subjective complaints, QOL (CIVIQ), patients satisfaction

Remark

Objective parameters (plethysmography, Duplex) may improve with the compression in situ but not any more after taking it off.

1.4. Large varicose veins, symptomatic (C 2, S)

What is done?

Compression therapy is recommended in patients with symptomatic large varicose veins in order to improve subjective complaints.

Rationale for compression therapy (J.P. Benigni)

Compression therapy is recommended in this indication:

- mainly to improve symptoms (heavy legs, pain, swelling, itching...)
- and to improve QOL
- to improve compliance for compression therapy (in case of use of class I)
- and secondarily to avoid complications (SVT, DVT) and clinical progression.

What do we know?

The following RCT has been identified (see References A, page 18):

1.4.1.

A critical analysis of these trials is given under: III Evaluation of Randomized Controlled Trials, page 22. Based on this analysis the "1.4. – indication for compression" can be labelled as **Grade C** (see Appendix I, page 36).

New RCT's in this indication are practically important.

What do we need to know?

Outcome parameters for future studies are summarized in Appendix II, page 37.

RCT's considering the following criteria are advisable:

- *Study population:*
C 2 patients (localisation, calibre and extension of the varicose veins to be discussed), with typical "venous symptoms" like heaviness, feeling of swelling, pain.
- *Groups of comparison:*
– no compression or Placebo-stockings, drugs?
– class A,
– class I,
– class II stockings
- *Follow-up*
Monthly, 1–3 months
- *Outcome measure:*
QOL (CIVIQ), visual analogue scale for subjective complaints, patients satisfaction
Frequency of clinical progression and complications (phlebitis, DVT, ulceration). Venous diameter (Duplex). Compliance > 80% duration of the trial, daily use > 6 hours.

Comment (Chr. Moffatt)

- *RCT in the prevention of ulceration in patients with either primary or secondary varicose veins.*
- *Randomised trial of vein surgery versus compression in ulcer prevention. (The current Medical Research Council trial in the UK looking at these issues has just been stopped due to lack of recruitment)*

1.5. Large varicose veins in pregnancy (C 2, A, S)

What is done?

Compression therapy is frequently recommended in patients with large varicose veins in pregnancy in order to improve subjective complaints and to prevent progression and complications.

Rationale for Compression therapy (AA Ramelet)

Pregnancy is a particular situation, in which varicose veins appear in a short period and may regress after delivery. Compression therapy is considered to be effective in reducing symptoms of venous disease and in preventing complications, as thrombo-embolic events. The interest of compression therapy in limiting the development of varicose veins is not established and has to be investigated.

What do we know?

The following RCT has been identified (see References A, page 18):

1.5.1

A critical analysis of this trial is given under: III Evaluation of Randomized Controlled Trials, page 23. Based on this analysis the "1.5. – indication for compression" can be labelled as **Grade B** (see Appendix I, page 36).

New RCT's in this indication are practically important.

What do we need to know?

Several studies devoted to venous haemodynamics during pregnancy and effects of CT on symptoms, venous reflux, low blood pressure or thrombo-embolism should be done. Outcome parameters for future studies are summarized in Appendix II, page 37.

RCT's considering the following criteria are advisable:

- *Study population:*
Pregnant women in the first trimester presenting with any kind of C 2 with or without subjective symptoms
- *Groups of comparison:*
– no compression or Placebo-stockings
– class A,
– class I
– class II stockings (panty hose)
- *Follow-up*
Monthly, – 3 months post partum
- *Outcome measure:*
Standardized photographs before and after compression period, assessment by blinded observer?
Frequency of clinical progression and complications (phlebitis),
Occurrence of subjective complaints, QOL, patients satisfaction
Venous diameter and reflux (Duplex) over LSV (junction and proximal to the knee), femoral vein, popliteal vein. Glucuronidase blood-level.

Remark

Pregnancy is an excellent model for observing the development of varicose veins in a relatively short time period and therefore for answering the question if compression is

able to prevent this process or to alleviate symptoms and complications rate. Then the interest of this condition is not only C2, but also prevention of C1,2,3 etc. Further studies should consider the length and strength of compression stockings.

1.6. Compression after varicose vein surgery for patients classified C2 to C6

What is done?

Compression therapy is routinely performed after surgery of large varicose veins.

There are two surveys on this subject (M. Perrin):

Menezes A. Compression élastique dans la chirurgie des varices primitives: réflexions auprès de 67 chirurgiens portugais. Phlebology 1992. John Libbey Eurotext Paris 1992: 83–86.

Results: Compression was prescribed respectively by 97.8 to 80.8% of Portuguese surgeon after primary varices surgery depending on the procedure performed: High ligation + stripping vs. other technique.

Duration, type of compression, complications are documented.

Perrin M. Résultats d'une enquête sur la pratique de la compression après chirurgie des varices (J Malad Vasc 2003; 5 in press).

Results: 208 French speaking surgeons answered out of 501 questioned in 2000.

Compression was prescribed by 96% of the responding surgeons.

Duration, type of compression, are documented.

79% prescribed postoperative compression by conviction politics rather than on the basis of validated studies (21%).

Rationale for compression therapy (M. Perrin)

The possible benefits of compression after surgery include prevention of superficial thrombophlebitis and DVT, improvement of wound healing, reduction of pain, bruising, hematoma, and improvement of the level of activity namely ambulation, and early return to work. These are short term benefits.

Prolonged use of compression might provide benefits that include decreased incidence of recurrent varicosities. The progression of chronic venous disease may also be impeded by the chronic use of compression. These ideas are conceptual, and supported only by few data.

What do we know?

The following RCT's have been identified (see References A, page 18):

1.6.1.–1.6.7

A critical analysis of these trials is given under: III) Evaluation of Randomized Controlled Trials, page 23. Based on this analysis the "1.6. – indication for compression" can be labelled as **Grade C** (see Appendix I, page 36).

New RCT's in this indication are practically important.

What do we need to know?

Outcome parameters for future studies are summarized in Appendix II, page 37.

Not necessary: RCT's comparing no compression versus compression (ethic problem)

Important

- 1) What kind of compression is recommended: bandages or stockings.
- 2) What kind of bandages: long stretch versus short stretch
- 3) What kind of stockings (Class I vs. II, Class I+I vs. Class II)
- 4) Duration of compression according to the CEAP classes

C2:1 week vs. 2 weeks, higher classes (C2, 3; C2, 4; C2,5) how long?

- 5) When primary deep vein reflux is associated, long-term compression is recommended, in order to prevent the evolution of the venous disease

Not necessary

Long term follow-up in order to know prevention of recurrence

RCT's with stratification are advisable:

- *Study populations*
C 2 , C3–C6. Use the C of CEAP in a descriptive manner, the A with the number allocated to S D and P
- *Anaesthesia* to be documented: general, spinal, truncal, local (tumescence or not)
- *Kind of surgery*
– GSV, SSV, NS
Crossotomy
Trunk stripping: complete, partial
endoluminal: invagination, eversion
exoluminal
Collateral(s) avulsion: site (thigh, lower leg)
number of incision or length resected

Radiofrequency and Endovenous Laser procedures might be included in these studies

- Groups of comparison:
 - class A
 - class I,
 - class II stockings (thigh length)
 - class I+I
 - compression bandages long-stretch versus short-stretch
- Cost
- Compression compliance to be documented
- Follow-up
Weekly – 2 or 4 weeks (early phase)
- Outcome measure:
Score for haematoma, complications, subjective complaints, VAS for pain, QOL, patients satisfaction compliance

Remarks (M. Perrin)

Studies should be divided in to 2 groups:

Group I: Short-term compression (up to 1 month)

Group II: Long-term compression

In this group patients have to be identified before surgery by the CEAP classification (**all items filled in a descriptive manner**) as the recommendations may be different according to the C, E, A and P classes.

Examples: A prospective randomized study (with and without long-term post operative compression) measuring different parameters is recommended in patients classed C2,3,4, EP, AS, PR before surgery or in patients classed C2, EP, AS+D, PR but not in patients quoted C2, EP, AS, PR.

1.7. Large varicose veins after sclerotherapy, endovenous Laser or Radiofrequency closure

What is done?

For many colleagues following the sclerotherapy schools of Sigg or Fegan ("compression-sclerotherapy") compression is indispensable after injecting large varicose veins. Most perform compression also after endovenous closing procedures.

Physiologic rationale for compression therapy (R. Weiss)

It is logical that the normal force generated within the venous system by muscle contraction would be additive with external applied pressure. Augmentation of the calf muscle pump occurs by external application of graduated compression. In ambulatory patients with superficial venous insufficiency, improvement can be demonstrated with graduated compression stockings with an ankle pressure of as little as 18 mmHg. After 90 days of elastic compression with a 30- to 40 mmHg graduated compression stocking, patients with cutaneous manifestations of venous stasis demonstrate noteworthy improvements in the structural pattern of dermal connective tissue. Compression reduces the edema which separates the skin and dermal tissues from direct contact with the superficial capillary network as this edema resides primarily in the papillary dermis.

Graduated compression hose therefore leads to normalized nutritional exchange and waste product removal. External "graduated" compression counterbalances the lost elasticity of the tissues to augment lymphatic flow. This flow is also expanded through an increase in hydrostatic pressure that prevents re-accumulation of edema. Compression, particularly inelastic, also decreases the size of deep muscular veins, thus increasing pressure within them and augmenting venous return.

These effects would be expected to reduce signs and symptoms of increased venous pressure as well as improve venous diameter by Duplex. Visible signs should also be noticeably decreased. Recurrence and incidence of complications should also be reduced.

What do we know?

The following RCT's have been identified (see References A, page 18):

1.7.1.-1.7.3.

A critical analysis of these trials is given under: III) Evaluation of Randomized Controlled Trials, page 25. Based on this analysis the "1.7. - indication for compression" can be labelled as **Grade B-C** (see Appendix I, page 36).

What do we need to know?

Outcome parameters for future studies are summarized in Appendix II, page 38.

RCT's considering the following criteria are advisable:

- Study population
 - C 2 patients after sclerotherapy, endovenous procedures (type of varicose veins, and technique to be stratified)
- Groups of comparison:
 - class A, class I, class II stockings (thigh length)
 - with and without padding
 - compression bandages; -excentric compression
- Follow-up
 - Weekly - 4 weeks, 6 months, 12 months
- Outcome measure:
 - Standardized photographs weekly intervals, assessment by blinded observer?
 - Duplex control to check the success (diameter, clot formation...), complications, subjective complaints, VAS for pain, QOL, patients satisfaction.

Remark

The importance of compression for occlusion of the veins is unknown (no compression= French sclerotherapy - school versus stocking compression (15 mmHg at thigh level) versus 40 mmHg (firm compression bandage)).

1.8. Venous oedema (C 3) (including postthrombotic oedema and oedema in angiodyplasias)

What is done?

Venous oedema is one of the most important indications for compression therapy.

Rationale for compression therapy (M. Jünger)

Edema causes impairment of cutaneous circulation, which results in reduction of nutritive capillaries and lack of supply with oxygen and nutrients. Patients complain about heavy legs, tension and pain of lower limbs. Compression by means of bandages and compression stockings reduce the increased volume of lower limbs, thereby improving quality of life.

What do we know?

The following RCT was identified (see References A, page 18):

1.8.1.

A critical analysis of this trial is given under: III) Evaluation of Randomized Controlled Trials, page 26.

Based on this analysis the "1.8. – indication for compression" can be labelled as **Grade B** (see Appendix I, page 36).

New RCT's in this indication are practically important

What do we need to know?

Outcome parameters for future studies are summarized in Appendix II, page 38.

RCT's considering the following criteria are advisable:

Study population

C 3 patients, in which reflux and/or obstruction of relevant vein segments are proved by Duplex and/or phlebography

- *Groups of comparison:*

- class A,
- class I
- class II stockings (thigh length)
- compression bandages
- material impregnated with drugs, e.g. zinc-cumarine bandages (E. Brizzio)

- *Follow-up*

Weekly – 4 weeks

Long term follow up to at least one year.

- *Outcome measure:*

Circumference above the ankles (smallest circumference) and at mid calf level (largest circumference),
 Volumetry (water displacement, optoelectronic, "Magical skin"[®] = digital camera+computer),
 Measurement of skin thickness (ultrasound B-scan), CT, NMR
 Subjective complaints, VAS for pain, QOL, patients satisfaction

Remark:

The phlebological dogma that oedema can be more effectively treated by bandages than by compression stockings should be proved or disproved by RCTs. Pressure measurements for fair comparison required!

1.9. Skin changes (eczema, pigmentation) (C 4a)*What is done?*

In these stages compression is not considered to be the most important component of treatment

Rationale for compression therapy (V. Wienert)

1. Eczema. A stasis dermatitis which is exclusively caused by venous hypertension. Elimination of venous hypertension by compression will heal the eczema. The skin changes are localized especially in the area of perforating veins and of ulcers. Contact dermatitis and bacterial eczema are less frequent conditions needing specific therapy.
2. Pigmentation, due to deposits of hemosiderin and melanin. Venous hypertension causes capillary wall lesions and an enhanced passage of red blood cells which are dismantled. Compression therapy leads to a reduction of venous and capillary hypertension and to a diminution of erythrocyte extravasation. Simultaneously reabsorption of hemosiderin and melanin is enhanced.

What do we know?

No RCT's available

Recommendation **Grade C*** (see Introduction) is only based on the agreement of the consensus experts. New RCT's in this indication are practically important.

What do we need to know?

Outcome parameters for future studies are summarized in Appendix II, page 38.

RCT's considering the following criteria are advisable:

- *Study population*

Patients with stasis dermatitis and/or pigmentation, in which reflux and/or obstruction of relevant vein segments are proved by Duplex and/or phlebography

- *Groups of comparison:*

- class A
- class I
- class II stockings (thigh length)
- compression bandages
- material impregnated with drugs, e.g. zinc-cumarine bandages
- (Supplementary indifferent local therapy, no corticosteroids!)

- *Follow-up*

Weekly – 6 weeks (eczema)

Monthly – 12–24 months (pigmentation)

- *Outcome measure:*

Standardized photographs, assessment by blinded observer?

Thermography, colorimetry

Subjective complaints, VAS for pain, QOL, patients satisfaction

1.10. Skin changes (lipodermatosclerosis, atrophie blanche) (C 4b)

What is done?

Compression is considered to be a very effective treatment modality to soften lipodermatosclerotic tissue and to transduce white atrophy areas into normal skin

Rationale of compression (M. Stacey)

Class III compression has been shown to reduce the area of lipodermatosclerosis in patients with healed venous ulcers. Accordingly it is also considered to improve areas of atrophie blanche and to reduce the oedema and induration in the leg associated with these conditions.

What do we know?

The following RCT have been identified (see References A, page 18):

1.10.1.

A critical analysis of this trial is given under: III Evaluation of Randomized Controlled Trials, page 26. Based on this analysis the "1.10. – indication for compression" can be labelled as **Grade B** (see Appendix I, page 36).

New RCT's in this indication are practically important.

What do we need to know?

Outcome parameters for future studies are summarized in Appendix II, page 38.

RCT's considering the following criteria could be advisable:

- *Study population*

Patients with stasis lipodermatosclerosis, in which reflux and/or obstruction of relevant vein segments are proved by Duplex and/or phlebography

- *Groups of comparison:*

- no compression
- class II
- class III stockings (calf length)
- surgery to superficial veins and/or incompetent perforating veins
- topical therapies that are considered to improve these changes
- intermittent pneumatic compression

- *Follow-up*

3,6,12,18,24 months

- *Outcome measure:*

Standardized photographs (digital camera with reference point and scale) or tracing of the affected area with subsequent calculation of area by planimetry- assessed by blinded observer

Rate of ulceration

Durometer, ultrasound B-scan (thickness and texture), CT, NMR

Subjective complaints, VAS for pain, QOL, patients satisfaction

Thermography, colorimetry

Capillaroscopy (atrophie blanche): e.g. count of capillary loops.

1.11. Healed ulcer (C 5)

What is done?

Compression is considered to be the most important modality to maintain an ulcer healed.

Rationale for compression therapy (M. Neumann)

Compression therapy is the cornerstone in the treatment of CVI, especially when treatment by surgery, sclerotherapy etc is not possible.

What do we know?

The following Systematic Cochrane Review has been identified:

1.11.1., additional RCT's: 1.11.2.–1.11.3. (see References A, page 18)

A critical analysis of this review is given under: III Evaluation of Randomized Controlled Trials, page 26.

Based on the available literature the "1.11. – indication for compression" can be labelled as Recommendation **Grade B** (see Appendix I, page 36).

New RCT's in this indication are practically important.

What do we need to know?

Outcome parameters for future studies are summarized in Appendix II, page 38.

RCT's considering the following criteria could be advisable:

- *Study population*

Patients with healed venous ulceration, in which reflux and/or obstruction of relevant vein segments are proved by Duplex and/or phlebography (Stratify for superficial, deep and superficial + deep incompetence)

Subgroups would be interesting: with/without varicose vein or perforator- surgery, sclerotherapy

- *Groups of comparison (CEN):*

- class A
- class I
- class II
- class III stockings (calf length)
- (addition of intermittent pneumatic compression?)

- *Follow-up*

Every 3 months up to 3 years

- *Outcome measure:*

Rate of ulcer-recurrence

Subjective complaints, VAS for pain, QOL, patients satisfaction

Patients compliance

Remarks (M. Neumann):

- Reflux in the v. poplitea is associated with bad prognosis
- 2 CEN Ccl II or III hosierys can have a different effect Effectiveness of compression therapy is proven for
 - Healing venous ulcers
 - Diminishing recurrence of venous ulcers
 - PTS

Additionally for active treatment:

- surgery
- sclerotherapy
- intravascular laser/ electrosurgery
- preventing DVT

What to do in the future: Recently healed ulcer recurrence trials:

- RCT: 1) Randomisation: with and without reflux v. poplitea
2) CEN-class III compression hosiery: with high,low stiffness index

Renew the hosiery every 6 months/follow up period: 3 years.

1.12. Active ulcer (C 6)

What is done?

Compression is considered to be the most important conservative treatment modality to heal venous ulcers. The classical phlebological recommendation are compression bandages but favourable results can also be achieved with compression stockings, at least for special cases.

Rationale for compression therapy (Chr Moffatt)

The rationale for compression therapy in the management of venous ulceration is proven haemodynamically and in randomised controlled trials of healing. Differentiation of the different systems in use requires more work in conjunction with an international classification of compression

What do we know?

The following Systematic Cochrane Review has been identified: 1.12.1

Additionally 13 randomized controlled trials (1.12.2.–1.12.9.) are listed under References A, page 18–19.

A critical analysis of the relevant studies is given under: III) Evaluation of Randomized Controlled Trials, page 27–29.

Based on the available literature the “1.12. – indication for compression” can be labelled as Recommendation **Grade A** (see Appendix I, page 36).

New RCT's in this indication are interesting.

What do we need to know?

While the evidence to support the use of high compression in ulcer healing is relatively robust, less is known about the many different materials and application techniques in use. Further discussion on the inclusion and exclusion criteria for the trials is necessary. The known risk factors such as ulcer duration, ulcer size and mobility etc. have profound effects on the healing rates achieved. Recruitment from specialist centres may result in different results from trials recruiting from general population. Stratification by site, ulcer duration and size, mobility and venous pathology are also useful. Compression trials must include a careful description of the materials used and complete standardisation of application technique. There is no universally agreed technique for bandage application. All trials should

incorporate quality of life assessment as this may be a useful discriminator between the symptom control of different systems of bandaging. While the emphasis has been on the evaluation of multi-layer systems, these vary greatly in complexity and performance. Further work is required to evaluate Unna boot, compression hosiery and varicose vein surgery in venous ulcer healing.

Trials comparing different application methods would be very useful in defining best practice.

Randomized trials in the treatment of mixed aetiology ulcers are almost non-existent with current recommendations based entirely on expert opinion of results from cohort studies. Definitions of mixed aetiology ulceration are required before such trials can be undertaken.

Outcome parameters for future studies are summarized in Appendix II page 38.

RCT's considering the following criteria could be advisable:

- *Study population*

Patients with active venous ulceration, in which reflux and/or obstruction of relevant vein segments are proved by Duplex and/or phlebography.

(Stratify for superficial, deep and superficial + deep incompetence, for size and duration of the ulcer.)

Subgroups would be interesting: with/without varicose vein or perforator surgery, sclerotherapy performed while the ulcer is active.

- *Groups of comparison:*

- class A
- class I
- class II
- class III stockings (calf length)
- compression bandages
- excentric compression
- material impregnated with drugs, e.g. zinc-cumarine bandages
- (-addition of intermittent pneumatic compression?)

- *Follow-up*

Weekly, up to 3–6 months

- *Outcome measure:*

Rate of ulcer-healing, healing-time.

Subjective complaints, VAS for pain, QOL (SF36 and disease specific), patients satisfaction (devised questionnaires and patients diaries).

Socioeconomy: Prospective collection of cost data required, e.g. dressing changes, materials, nurse time, other use of resources etc. These would be useful if we take a wider approach to cost effectiveness.

Remarks (Chr. Moffatt)

Most trials were done using compression bandages. An important question is to define subgroups of patients, in whom compression stockings may be indicated.

- Much more needs doing in identifying the risk factors for delayed healing in patient groups.
- Many trials recruit from specialist centres which are very

different from patients from general populations. We need to discuss stratification and whether this should include site, ulcer duration and size, mobility, venous pathology etc.

- Compression Systems: All trials need to be undertaken following a careful classification of compression material:
 - Unna boot versus multi-layer elastic with elastic single layer
 - Multi-layer compression versus high compression hosiery in ulcer healing
 - Trials comparing different application methods would be extremely useful in defining best practice e.g. Pütter technique, spinal versus figure of eight etc.
- Randomised trial of vein surgery versus compression in ulcer healing (recently published: see references A, 1.12.12 and 1.12.5.)

Mixed aetiology

- High versus low compression (elastic) in the treatment of mixed aetiology ulcers (definition needs agreeing)
- High compression versus intermittent pneumatic compression
- Short stretch versus multi-layer (reduced compression)

The outcomes of these trials are desperately needed in guiding practitioners in safe practice.

2. Acute venous disease

2.1. Prevention of venous thromboembolism

What is done?

Thromboprophylactic stockings are used as a routine during and after surgery, frequently also in bed – ridden medical and neurological patients, increasingly also in the risk situation of long sitting (travel thrombosis).

Hospital patients frequently receive also thromboprophylactic medication.

Rationale for compression therapy (J. Caprini)

Graduated compression stockings are effective in diminishing the risk of DVT in hospitalized patients. The combination of graduated compression stockings (GCS) and another method of prophylaxis is even more effective than GCS alone. There is insufficient data to recommend thigh vs. calf-length stockings as most of the trials were done with long-leg GCS.

What do we know?

The following Systematic Cochrane Review has been identified: 2.1.1. Long haul flight: 2.1.2.–2.1.3 (see References A page 19).

A critical analysis of this literature is given under: III) Evaluation of Randomized Controlled Trials, page 29–30.

Based on the available data the “2.1.1. – indication for compression” can be labelled as Recommendation **Grade A-B** (see Appendix I, page 38).

New RCT’s in this indication are practically important.

What do we need to know?

Outcome parameters for future studies are summarized in Appendix II, page 39.

RCT’s considering the following criteria are advisable:

- *Study population:*
 - Individuals with increased risk for VTE (dispositional or/and expositional)
- *Groups of comparison:*
 - no compression
 - compression stocking class A
 - class I
 - class II and compression bandages (CEAP classes C3–C6)
 - below knee versus thigh length
- *Follow-up*
 - Weekly, up to 3 weeks
- *Outcome measure:*
 - D-dimer, asymptomatic and symptomatic DVT (Duplex, phlebography), pulmonary embolism (V/Q-scan, spiral CT), superficial phlebitis (clinical assessment, Duplex), patients satisfaction.

2.2. Therapy of superficial phlebitis

What is done?

Compression therapy and walking exercises are the corner-stones of treatment.

Many centers use compression stockings. The classical phlebological therapy are compression bandages.

Rationale for compression therapy (H. Partsch)

Experience has taught us that firm compression applied to a segment of superficial thrombophlebitis leads to an immediate improvement of pain and to a fast regression of the inflammatory process.

What do we know?

No RCT’s available.

Recommendation **Grade C*** (see Introduction) is only based on the agreement of the consensus experts.

New RCT’s in this indication are practically important.

What do we need to know?

Outcome parameters for future studies are summarized in Appendix II, page 39.

RCT’s considering the following criteria are advisable:

- *Study population:*
 - Patients with superficial thrombophlebitis, Duplex to assess most proximal extension and exclude DVT
- *Groups of comparison:*
 - no compression
 - compression stocking class A
 - class I
 - class II
 - compression bandages
 - excentric compression
 - (stratify with/without additional LMWH, NSA, ASS)

- *Follow-up*
Weekly, up to 4 weeks
- *Outcome measure:*
Clinical scores,
Assessment of thrombus extension in superficial and/or deep veins by Duplex,
Occurrence of pulmonary emboli (repeat V/Q-scans)
Thermography
Pain assessment (VAS for dolor, rubor, calor, tumor), patients satisfaction

2.3. Early onset compression therapy of deep vein thrombosis (DVT)

What is done?

Compression therapy (CT) and walking exercises are getting more and more popular. Many centers use compression stockings. The classical phlebological therapy are compression bandages.

Rationale for compression therapy (W. Blättler)

CT – started immediately upon diagnosis alleviates pain and reduces oedema promptly, restores walking capability, allows to resume usual daily activities very soon, may speed up break-down of thrombi.

CT – started within the first few weeks after start of anti-coagulant therapy prevents the PTS 50% of patients with a first proximal DVT

What do we know?

The following RCT's are available (see References A, page 19):

2.3.1.–2.3.3.

A critical analysis of these trials is given under: III) Evaluation of Randomized Controlled Trials, page 31. Based on this analysis the “2.3. – indication for compression” can be labelled as **Grade B** (see Appendix I, page 36).

New RCT's in this indication are practically important.

What do we need to know?

Outcome parameters for future studies are summarized in Appendix II, page 41

RCT's considering the following criteria are advisable:

- *Study population:*
Patients with DVT proved by a visualizing method (Duplex, phlebography), treated conservatively. (Anticoagulation mandatory). Stratification idiopathic/secondary, acute/subacute, proximal/distal, first/recurrent).
- *Groups of comparison:*
no compression /-Placebo-stocking/-class II/-class III/-compression bandages/ CircAid/-below knee versus thigh length /day-long/ day and night.
Immediate compression as soon DVT is diagnosed vs. delayed start with compression.
- *Follow-up*
Depends on end-points. Weekly, up to 4 weeks
Check after 3 months, 1 year, 2 years
- Clinical signs reflecting CVI are present after 6 months in

most patients ultimately diagnosed with a PTS; however, as the clinical signs are not specific duplex scanning seems mandatory.

- *Outcome measure:*
Recurrence, death
Assessment of thrombus extension in deep veins by Duplex, reflux
Limb circumference, volumetry, CT, MRI,
Occurrence of pulmonary emboli (repeated V/Q-scans)
Occurrence of postthrombotic syndrome
Clinical scores, pain assessment (VAS, Lowenberg test), patients satisfaction
Parameters that may reflect eventual causes (inflammation, activation of coagulation, activation/inhibition of fibrinolysis, compartment pressure...)

Comments (Chr. Moffatt)

DVT(i) – Longitudinal follow up of patients with confirmed DVT within a general population to examine the relationship of DVT and ulcer formation

DVT(ii) – Randomised trial post DVT of high compression hosiery in ulcer prevention with longitudinal follow up

2.4. Prevention of postthrombotic syndrome (PTS)

What is done?

Compression therapy after deep vein thrombosis is inconsistently used with differences between medical disciplines and countries.

Rationale for compression therapy (H. Partsch)

Compression therapy is supposed to reduce pain and swelling after deep vein thrombosis, thereby preventing postthrombotic syndrome (CEAP: C3–C6, Es, Ad, Pr, o) In patients who present signs and symptoms of PTS compression may improve these findings (RCT's are available until now only for prevention, not for therapy of PTS)

What do we know?

The following RCT's have been identified (see References A, page 21):

2.4.1.–2.4.3.

A critical analysis of these trials is given under: III) Evaluation of Randomized Controlled Trials, page 32–33.

Based on this analysis the “2.4. – indication for compression” can be labelled as **Grade A** (see Appendix I, page 38).

New RCT's in this indication are practically important.

What do we need to know?

Outcome parameters for future studies are summarized in Appendix II, page 41.

RCT's considering the following criteria are advisable:

- *Study population:*
Patients after a first episode of proximal DVT proved by a visualizing method (Duplex, phlebography), (stratify for symptomatic/asymptomatic, localisation of throm-

bus, kind of therapy (conservative, fibrinolysis, thrombectomy), start of compression therapy, duration of anticoagulation).

Groups of comparison:

- no compression
- Placebo-stocking
- class II
- class III
- compression bandages
- below knee versus thigh length
- *Follow-up*
 Preferrably immediate compression starting in the acute phase of DVT, 3 months after DVT, check every 6 months, 1 year, 2 years
- *Outcome measure:*
 DVT-recurrence, death
 Assessment of thrombus extension in deep veins by Duplex, reflux
 Swelling: circumference of both legs, volumetry
 Pain assessment (VAS, Lowenberg test), patients satisfaction
 QOL, Clinical scores (Prandoni-Villalta-scale)

Remark

New RCTs should compare early start of compression vs delayed start. All available studies (2.4.1.–2.4.3.) start compression therapy only more than one week after DVT was diagnosed!

Longitudinal follow up of patients with confirmed DVT within a general population to examine the relationship of DVT and ulcer formation.

Randomised trial post DVT of high compression hosiery in ulcer prevention with longitudinal follow up.

3. Lymphoedema

3.1. Therapy of lymphoedema, lipoedema

What is done?

Compression therapy for lymphoedema is inconsistently used with differences between medical disciplines and countries.

Rationale for compression therapy (A. Cavezzi)

Compression therapy (bandage, stockings and sleeves) have some documented positive actions on lymphoedema:

- a) reduction of limb volume, through several mechanisms: increase of interstitial (transmural) pressure, increase of protein and fluid recovery in the lymphatic network, increase of lymphangion contractility, shift of fluids from affected to non (or hypo-)affected proximal areas of the limb,

b) improvement of musculo-vascular foot/calf pump,

c) protection of the skin (easily prone to infections etc.)

Multi-layer short-stretch bandaging is the favourite treatment over elastic stockings/sleeves in the intensive care phase. Compression/sleeves are mainly used for the maintenance phase (after R.Stemmer)

Finally the status of the patient (active-immobile etc.) is an important variable to be taken into consideration to fit the proper compression regimen.

What do we know?

The following RCT's have been identified (see References A, page 19):

3.1.1.–3.1.4. (No studies on lipoedema available)

A critical analysis of these trials is given under: III) Evaluation of Randomized Controlled Trials, page 33–35.

Based on this analysis the “3.1. – indication for compression” can be labelled as **Grade B–C** (see Appendix I, page 36).

New RCT's in this indication are practically important.

What do we need to know?

Outcome parameters for future studies are summarized in Appendix II, page 39.

RCT's considering the following criteria are advisable:

- *Study population:*
 Patients with primary or secondary lymphoedema of the extremities. Lipoedema (no studies)
- *Groups of comparison:*
 - no compression
 - class II
 - class III
 - compression bandages –

(Stratify for additional use of manual lymphatic drainage, intermittent pneumatic compression)

- *Follow-up*

Initially weekly,

Check every 3 months, up to 1 year

- *Outcome measure:*

Clinical scores, number and duration of dermatolymphangioadenitis (DLA)

VAS, QOL, patients satisfaction

Swelling: circumference extremities, volumetry (water displacement, optoelectronic devices). Photography. Pitting condition. Water displacement: bioimpedance, ultrasonography (echogenicity), CT, NMR, Durometer.

Lymphoscintigraphy, microlymphangiography, intralymphatic pressure measurement, indirect lymphography.

Comments (Chr. Moffatt):

The lymphoedema research is challenging. Should limb volume be the only outcome measure? I think not but would appreciate your thinking.

Randomised trials of multi-layer short stretch bandaging versus bandaging with MLD or simple massage.

Comparisons of different methods of bandage application e.g. padding versus upholstery.

References A)

Controlled Trials and Systematic Reviews

(in the order of indications)

1.1. Subjective symptoms without clinical signs (C 0, S)

Small varicose veins with symptoms (C 1, S)

- 1.1.1. Weiss RA, Duffy D. Clinical benefits of lightweight compression: reduction of venous-related symptoms by ready-to-wear lightweight gradient compression hosiery. *Derm Surg* 1999; 25: 701–04.
- 1.1.2. Vayssairat M, Ziani E, Houot B. Efficacité versus placebo de la contention classe 1 dans l'insuffisance veineuse chronique des membres inférieurs. *J Mal Vasc* 2000; 25: 256–62.
- 1.1.3. Benigni JP, Sadoun S, Allaert FA, Vin F. Etude comparative de l'efficacité des chaussettes de compression de classe 1 sur la symptomatologie de la maladie veineuse chronique débattente. *Phlébologie* 2003; 56: 117–25.

1.2. Small varicose veins (C1) after sclerotherapy or Laser treatment

- 1.2.1. Weiss RA, Sadick NS, Goldman MP, Weiss MA. Post-sclerotherapy compression: controlled comparative study of duration of compression and its effects on clinical outcome. *Dermatol Surg*. 1999; 25: 105–8.
- 1.2.2. Scurr JH, Coleridge-Smith P, Cutting P. Varicose veins: optimum compression following sclerotherapy. *Ann Roy Coll Surg Eng* 1985; 67: 109–11.

1.3. Large varicose veins (C 2, A)

- 1.3.1. Hartmann BR, Drews B, Kayser Th. Physical therapy improves venous hemodynamics in case of primary varicosity: Results of a controlled study. *Angiology* 1997; 48: 157–62.

1.4. Large varicose veins , symptomatic (C 2, S)

- 1.4.1. Anderson JH, Geraghty JG, Wilson YT, Murray GD, McArdle S, Anderson JR. Paroven and graduated compression hosiery for superficial venous insufficiency. *Phlebology* 1990; 5: 271–76.

1.5. Large varicose veins in pregnancy (C 2, A, S)

- 1.5.1. Thaler E, Huch R, Huch A, Zimmermann R. Compression stockings prophylaxis of emergent varicose veins in pregnancy: a prospective randomized controlled study. *Swiss Medical Weekly* 2001; 131: 659–62.

1.6. Large varicose veins after surgery

- 1.6.1. Shouler PJ, Runchman PC. Varicose veins: optimum compression after surgery and sclerotherapy. *Ann Roy Coll Surg Eng*. 1989; 71: 402–04.
- 1.6.2. Travers JP, Makin GS. Reduction of varicose vein recurrence by use of postoperative compression stockings. *Phlebology* 1994; 9: 104–109.
- 1.6.3. Rodrigus I, Bleyn J. For how long do we have to advise elastic support after varicose vein surgery? A prospective randomized study. *Phlebology*. 1991; 6: 95–98.
- 1.6.4. Bond R, Whyman MR, Wilkins DC, Walker AJ, Ashlez S. A Randomised Trial of Different Compression Dressings Following Varicose Vein Surgery. *Phlebology*. 1999; 14: 9–11.
- 1.6.5. Raraty MGT, Greaney MG, Blair SD. There is no Benefit from 6 weeks' postoperative Compression after Varicose Vein Surgery: A Prospective Randomised Trial. *Phlebology*. 1999; 14: 21–25.
- 1.6.6. Coleridge-Smith PD, Scurr JH, Robinson KP. Optimum methods of limb compression following varicose veins surgery. *Phlebology* 1987; 2: 165–72.
- 1.6.7. Travers JP, Rhodes JE. Postoperative limb compression in reduction of haemorrhage after varicose vein surgery. *Ann Roy Coll Surg Eng*. 1993; 75: 119–22.

1.7. Large varicose veins after sclerotherapy, endovenous Laser or Radiofrequency closure

- 1.7.1. Shouler PJ, Runchman PC. Varicose veins: optimum compression after surgery and sclerotherapy. *Ann Roy Coll Surg Eng*. 1989; 71: 402–04.
- 1.7.2. Scurr JH, Coleridge-Smith P, Cutting P. Varicose veins: optimum compression following sclerotherapy. *Ann Roy Coll Surg Eng*. 1985; 67: 109–11.
- 1.7.3. Stanley PRW, Bickerton DR, Campbell WB. Injection sclerotherapy for varicose veins- a comparison of materials for applying local compression. *Phlebology* 1991; 6: 37–39.

1.8. Venous oedema (C 3)

- 1.8.1. Diehm C, Trampisch HJ, Lange S, Schmidt C. Comparison of leg compression stocking and oral horse-chestnut seed extract therapy in patients with chronic venous insufficiency. *Lancet* 1996, 347: 292–94.

1.9. Skin changes (eczema, pigmentation) (C 4a) no RCT's available

1.10. Skin changes (lipodermatosclerosis, atrophie blanche) (C 4b)

- 1.10.1. Vandongen YK, Stacey MC. Graduated compression elastic stockings reduce lipodermatosclerosis and ulcer recurrence. *Phlebology* 2000; 15: 33–37.

1.11. Healed ulcer (C 5)

- 1.11.1. Nelson EA, Bell-Syer SEM, Cullum NA. Compression for preventing recurrence of venous ulcers (Cochrane Review). In: *The Cochrane Library*, Issue 2, 2003. Oxford: Update Software.
- 1.11.2. Franks PJ, Oldroyd MI, Dickson D, Sharp EJ, Moffatt CJ. Risk factors for leg ulcer recurrence: a randomised trial of two types of compression stockings. *Age Ageing* 1995; 24: 490–94.
- 1.11.3. Harper DJ, Nelson EA, Gibson B et al. A prospective randomised trial of class 2 and class 3 elastic compression in the prevention of venous ulceration. *Phlebology* '95, Negus D et al. *Phlebology* 1995; Suppl. 1; 872–73.

1.12. Active ulcer (C 6)

- 1.12.1. Cullum N, Nelson EA, Fletcher AW, Sheldon TA. Compression for venous leg ulcers (Cochrane Review). In: *The Cochrane Library*, Issue 1, 2003. Oxford: Update Software.
- 1.12.2. Meyer FJ, Burnand KG, Lagattolla NR, Eastham D. Randomized clinical trial comparing the efficacy of two bandaging regimens in the treatment of venous leg ulcers. *Br J Surg* 2002; 89: 40–44.
- 1.12.3. Partsch H, Damstra RJ, Tazelaar DJ, Schuller-Petrovic S, Velders AJ, de Rooij MJ, Sang RR, Quinlan D. Multicentre, randomised controlled trial of four-layer bandaging versus short-stretch bandaging in the treatment of venous leg ulcers. *Vasa*. 2001; 30:108–13.
- 1.12.4. Franks PJ, Oldroyd MI, Dickson D, Sharp EJ, Moffatt Chr. Risk factors for leg ulcer recurrence: A randomised trial of two types of compression stockings. *Age and Ageing* 1995; 24: 490–94.
- 1.12.5. Zamboni P, Cisno C, Marchetti F, Mazza P, Fogato L, Carandina S, de Palma M, Liboni A. Minimally invasive surgical management of primary venous ulcers vs. compression treatment: a randomized clinical trial. *Eur J Vasc Endovasc Surg* 2003; 25: 313–18.
- 1.12.6. Ukat A, König M, Vanscheidt W, Münter KC. Short-stretch versus multilayer compression for venous leg ulcers: a comparison of healing rates. *J Wound Care* 2003; 12: 139–43.
- 1.12.7. Moffatt CJ, McCullagh L et al. Randomised trial comparing four layer with two layer high compression bandaging in the management of chronic leg ulceration. *Wound Repair and Regeneration* 2003; 11: 166–171.

- 1.12.8. Moffatt CJ on behalf of the EXPECT trial. A multi-centre randomised trial comparing a Vari-stretch compression system with Profore. 13th Conference European Wound Management Association, Pisa, May 2003 (abstract).
- 1.12.9. Franks PJ, Moffatt CJ et al. Randomised trial comparing four layer with cohesive short stretch compression. 13th Conference European Wound Management Association, Pisa, May 2003 (Abstract).
- 1.12.10. Weiss RA, Weiss MA, Ford RW. Randomized comparative study of Cutinova foam and Allevyn with Jobst UlcerCare stockings for the treatment of venous stasis ulcers. *Phlebology* 1996; (1): 14–16.
- 1.12.11. Meyer FJ, McGuinness CL, Lagattolla NR, Eastham D, Burnand KG. Randomized clinical trial of three-layer paste and four-layer bandages for venous leg ulcers. *Br J Surg* 2003; 90: 934–4.
- 1.12.12. Guest M, Smith JJ, Tripuraneni G, Howard A, Madden P, Greenhalgh RM, Davies AH. Randomized clinical trial of varicose vein surgery with compression versus compression alone for the treatment of venous ulceration *Phlebology* 2003; 18: 130–136.
- 1.12.13. Koksall C, Bozkurt AK. Combination of hydrocolloid dressing and medical compression stocking versus Unna's boot for the treatment of venous leg ulcers *Swiss Med Weekly* 2003; 133: 364–68.
- 2.1. Prevention of venous thromboembolism**
- 2.1.1. Amaragiri SV, Lees TA. Elastic compression stockings for prevention of deep vein thrombosis. *The Cochrane Library*, Issue 2, 2003. Oxford: Update Software.
- 2.2. Prevention of flight thrombosis**
- 2.2.1. Scurr JH, Machin SJ, Bailey-King S, Mackie IJ, McDonald S, Coleridge Smith PD. Frequency and prevention of symptomless deep-vein thrombosis in long-haul flights: a randomised trial. *Lancet* 2001; 357: 1385–9.
- 2.2.2. Belcaro G, Cesarone MR, Shah SS, Nicolaidis AN, Geroulakos G, Ippolito E, Winford M, Lennox A, Pellegrini L, Brandolini R, Myers KA, Simeone E, Bavera P, Dugall M, Di Renzo A, Moia M. Prevention of edema, flight microangiopathy and venous thrombosis in long flights with elastic stockings. A randomized trial: The LONFLIT 4 Concorde Edema-SSL Study. *Angiology*. 2002; 53: 635–45.
- 2.2. Therapy of superficial phlebitis**
No RCT's comparing compression available
- 2.3. Early onset compression therapy of deep vein thrombosis (DVT)**
- 2.3.1. Blättler W, Borer M, Linder C, Bergan J. Outpatient and conventional treatment acute deep-vein thrombosis evaluated in a controlled single-center study. *Phlébologie* 1998; 51: 41–4.
- 2.3.2. 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.
- 2.3.3. Partsch H, 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: 861–9.
- 2.4. Prevention of postthrombotic syndrome (PTS)**
- 2.4.1. Brandjes D PM, Büller H, Hejboer H, Huisman MV, de Rijk M, Jagt H, ten Cate JW. Incidence of the postthrombotic syndrome and the effects of compression stockings in patients with proximal venous thrombosis. *Lancet* 1997; 349: 759–62.
- 2.4.2. Ginsberg JS, Hirsh J, Julian J, Van der Laande Vries M, Magier D, MacKinnon B, Gent M. Prevention and treatment of postphlebotic syndrome: results of a 3-part study. *Arch Intern Med* 2001; 161: 2105–9.
- 2.4.3. Prandoni P, Frulla M, Mosenza L, et al. Benefit of below-kee elastic compression stockings for prevention of the post-thrombotic syndrome in patients with proximal-vein thrombosis. A prospective controlled randomized study. *Pathophysiol Haemost Thromb* 2002; 32 (suppl.2) Abstr O136.
- 3.1. Therapy of lymphoedema, lipoedema**
- 3.1.1. Badger CM, Peacock IL, Mortimer P. A randomised controlled parallel group clinical trial comparing multilayer bandaging followed by hosiery versus hosiery alone in the treatment of patients with lymphoedema of the limb. *Cancer* 2000; 88: 2832–37.
- 3.1.2. Johansson K, Albertsson M, Ingvar C, Ekdahl C. Effects of compression bandaging with or without manual lymph drainage treatment in patients with postoperative arm lymphedema. *Lymphology* 1999 32: 103–10. Comment in: *Lymphology* 2000; 33: 69–70.
- 3.1.3. Bertelli G, Venturini M, Forno G, Macchiavello F, Dini D. Conservative treatment of postmastectomy lymphedema: A controlled, randomized trial. *Ann Oncology* 1991; 2: 575–7.
- 3.1.4. Andersen L, Höjris I, Erlandsen M, Andersen J. Treatment of breast-cancer-related lymphedema with or without manual lymphatic drainage. A randomised study. *Acta Oncologica* 2000; 39: 399–405.

III) Evaluation of the RCT's by the experts

Analysis of Randomized controlled trials or Systematic Reviews on compression therapy (see References A)

1.1. Subjective symptoms without clinical signs (C 0, S) Small varicose veins with symptoms (C 1, S) Reporter: A. Cornu-Thénard

1.1.1. Weiss RA, Duffy D. Clinical benefits of lightweight compression: reduction of venous-related symptoms by ready-to-wear lightweight gradient compression hosiery. *Derm Surg* 1999; 25: 701–04.

- *Types and number of participants*
19 flight attendants
- *Randomization correct?*
Yes: it is a prospective crossover trial
But one information is missing: 49 flight attendants have been included at the beginning of the study. Only 19 patients from 49 have participated: we don't know why? And who were the 20?
- *Types of intervention (e.g. bandage A versus stocking B)*
Only stockings: Ready-to-Wear Lightweight Compression (8–15 mmHg and 15–20 mmHg), before that: initial phase with no compression for 2 weeks
- *Follow up visits*
By answer to a questionnaire
- *Types of outcome measures*
Analysis of questionnaires: one before wearing compression, one after 8–15 mmHg, one after 15–20 mmHg
Modified Visual Analogue Scale
- *Conclusion of the authors*
Both, the 8–15 mmHg and the 15–20 mmHg ready-to-wear Compression stockings were very effective in improving venous symptoms ($p < 0.05$) compared to no compression.
- *Flaws of the trial*
19 patients only, only women, 39–54 years old, 9 have had Varicose Veins (C2) no proofs of the wearing
- *Recommendation level: B*

R. Weiss gave the following review of his own paper:
Clinical benefits of lightweight compression: reduction of venous-related symptoms by ready-to-wear lightweight gradient compression hosiery.
Weiss RA, Duffy D. *Dermatol Surg*. 1999; 25: 701–4.

Background: Medical-grade compression of class I (20–30 mmHg) and class II (30–40 mmHg) have been shown to be beneficial against venous hypertension or congestion. Relatively few studies address the effects of ready-to-wear (RTW) lightweight gradient compression pantyhose on venous symptoms. *Objective:* To perform a study comparing the effects of two different compression RTW lightweight gradient compression stockings (8–15 mmHg and 15–20 mmHg) on the venous symptoms of flight attendants. *Method:* A prospective crossover trial of symptom evaluation in 19 flight attendants was performed in which participants rated their symptoms on a visual analog scale. During the initial phase, participants wore no compression for 2 weeks. They then wore 8–15 mmHg and 15–20 mmHg gradient compression support hose while flying over a 4-week period. Symptoms before and after wearing the gradient compression stockings were compared and statistically analyzed.

Results: Wearing of 8–15 mmHg gradient hose resulted in statistically significant improvement of discomfort ($P < 0.01$).

Swelling, fatigue, aching, and tightness of the leg were all improved to a statistically significant degree ($P < 0.01$). For 15–20 mmHg gradient hosiery, symptoms were improved to a statistically significant or almost significant level. The difference between the 8–15 mmHg and 15–20 mmHg compression was not statistically significant.

- *Types and number of participants* – 19 flight attendants
- Randomization correct? yes
- *Types of intervention (e.g. bandage A versus stocking B)*
nothing versus 8–15 vs. 15–20mm
- *Follow up visits* 1
- *Types of outcome measures* – visual analog scale
Conclusion of the authors – Use of lightweight (low compression) RTW gradient compression hosiery is very effective in improving symptoms of discomfort ($P < 0.01$), swelling (almost $P < 0.05$), fatigue ($P < 0.05$), aching ($P < 0.01$), as well as leg tightness. Improvement of symptoms is statistically significant compared to no compression when hosiery was worn regularly during waking hours for 4 weeks.
- *Flaws of the trial:* Only patient assessment
- *Recommendation level: B*

Other paper:

Weiss RA, Weiss MA, Ford RW. Randomized comparative study of Cutinova foam and Allewyn with Jobst

UlcerCare stockings for the treatment of venous stasis ulcers. *Phlebology* 1996; 11: 14–16.
Demonstrated in 20 patients that with equal compression the topical dressing did not make a difference. Ulcers had no compression prior to entering the study.
Recommendation level B.

Reporter: A. Cornu-Thénard

1.1.2. Vayssairat M, Ziani E, Houot B. *Efficacité versus placebo de la contention classe I dans l'insuffisance veineuse chronique des membres inférieurs.* *J Mal Vasc* 2000; 25: 256–62.

- *Types and number of participants*
341 patients
- *Randomization correct?*
Yes: it is a prospective, randomised, double-blind (cross-over), placebo-controlled trial.
- *Types of intervention (e.g. bandage A versus stocking B)*
10–15 mmHg Compression Stockings vs. Placebo
- *Types of outcome measures*
Quality of life, symptom-index, volumetry, Visual Analogue Scales
- *Conclusion of the authors*
10–15 mmHg compression stockings show a statistically significant improvement of Quality of Live and a decrease of oedema ($p < 0.05$)
- *Flaws of the trial*
Only women, a large number of C2 and C3
- *Recommendation level: B*

Reporter: A. Cornu-Thénard

1.1.3. Benigni JP, Sadoun S, Allaert FA, Vin F. *Efficacy of Class I Elastic Compression Stockings in the Early Stages of Chronic Venous Disease: a comparative study* *International Angiology in press* 2003 (*Phlébologie* 2003; 56: 117–25)

- *Types and number of participants*
125 females
- *Randomization correct?*
Yes: double-blind with cross-over study
- *Types of intervention (e.g. bandage A versus stocking B)*
10–15 mmHg compression stockings, versus 6 mmHg compression stockings (placebo-stockings)

- *Follow up visits*
Control after 15 days (symptoms)
One month (symptoms and QOL)
- *Types of outcome measures*
improvement of global pain by visual analogue scale and improvement of each symptom by visual analogue scale. Quality of Life by visual analogue scale, PPG.
- *Conclusion of the authors*
significant improvement in the symptomatology of early-stage chronic venous disease, i.e., in the relief of global painful discomfort as well as in quality-of-life criteria
- *Flaws of the trial*
Only women; C1+C3, C3 = malleolar edema in the afternoon; 11% lost
- *Recommendation level: B*

1.2. Small varicose veins (C1) after sclerotherapy or Laser treatment

Reporter: M. Goldman

1.2.1. Weiss RA, Sadick NS, Goldman MP, Weiss MA. *Post-sclerotherapy compression: controlled comparative study of duration of compression and its effects on clinical outcome.* *Dermatol Surg.* 1999; 25: 105–8

- *Types and number of participants*
40 patients with teleangiectasia and reticular veins only
- *Randomization correct?*
Yes
- *Types of intervention (e.g. bandage A versus stocking B)*
20–30 mmHg graduated compression stocking for 0, 3d, 7d, 21 d
- *Follow up visits*
1, 2, 6, 12, 24 week evaluation
- *Types of outcome measures*
Improvement, bruising, teleangiectatic matting, edema, hyperpigmentation, deterioration
- *Conclusion of the authors*
Statistically significant improvement in pigmentation + vein resolution with compression stockings
- *Flaws of the trial*
0
- *Recommendation level: B*

Reporter: M. Goldman

1.2.2. Scurr JH, Coleridge-Smith P, Cutting P. *Varicose veins: optimum compression following sclerotherapy*. *Ann Roy Coll Surg Eng* 1985; 67: 109–11

- *Types and number of participants*
Patients without GSV incompetence at SFJ and high-thigh perforators with varicose veins, 42 patients total
- *Randomization correct?*
yes
- *Types of intervention (e.g. bandage A versus stocking B)*
35–40 mm Hg graduated stockings vs. Elastocrepe/Elastoplast bandage (alternate legs) after sclerotherapy for 7–28 days (mean 16–18 days)
- *Follow up visits*
3 weeks and 6 weeks after sclerotherapy
- *Types of outcome measures*
2 separate “blinded” doctors
- *Conclusion of the authors*
Stockings have a higher success rate than bandages
Stockings had less thrombosis than bandages
Stockings had less pigmentation than bandages
Stockings had less superficial venous thrombosis than bandages
- *Flaws of the trial*
No measure of compression level under bandages or stockings at various location of the leg.
Lack of uniformity in time of compression
- *Recommendation level: B*

1.3. Large varicose veins (C 2, A)**Reporter: E. Rabe**

1.3.1. Hartmann BR, Drews B, Kayser Th. *Physical therapy improves venous hemodynamics in case of primary varicosity: Results of a controlled study*. *Angiology* 1997; 48: 157–62

- *Types and number of participants*
24 patients with varicose veins in both lower limbs, increased venous capacity and reduced venous filling time with symptoms
- *Randomization correct?*
No information
- *Types of intervention (e.g. bandage A versus stocking B)*
A) standardized exercises twice a week for 60 minutes under supervision and once daily 15 min without supervision + 30 mmHg elastic stocking during exercise
B) no treatment superficial venous thrombosis

- *Types of outcome measures*
Reduction of venous capacity and increase in venous filling time and reduction of symptoms in the treatment group
- *Conclusion of the authors*
Standardized exercise improves function and symptoms in varicose vein patients.
- *Flaws of the trial*
No long term results, concerning progression of the disease, small number of patients
- *Recommendation level: C*

1.4. Large varicose veins, symptomatic (C 2, S)**Reporter: J.-P Benigni**

1.4.1 Anderson JH, Geraghty JG, Wilson YT, Murray GD, McArdle S, Anderson JR. *Paroven and graduated compression hosiery for superficial venous insufficiency*. *Phlebology* 1990; 5: 271–76

- *Types and number of participants*
72 patients from a waiting list for venous surgery
- *Randomization correct?*
Yes after the choice of patients: randomization by group of 12
- *Types of intervention (e.g. bandage A versus stocking B)*
Sigvaris 503 (30–40 mm Hg at the ankle) vs. Paroven (a venotropic drug) vs. placebo vs. Paroven + Sigvaris
- *Follow up visits*
4 weeks
- *Types of outcome measures*
Visual analogue scales for:
– Pain,
– Heaviness,
– Itch,
– Swelling
– Night cramps,
– Cosmetic.
- *Conclusion of the authors*
No statistically significant differences following any of the four treatments. Drug + stocking better than either treatment on its own.
- *Flaws of the trial*
– Number of patients,
– Lack of wash out between the different periods of the cross over,
– No assessment with visual analogue scores before each different treatment
- *Recommendation level: C*

1.5. Varicose veins (C2) in pregnancy

Reporter: AA Ramelet

1.5.1. Thaler E, Huch R, Huch A, Zimmermann R. Compression stockings prophylaxis of emergent varicose veins in pregnancy: a prospective randomised controlled study. *Swiss Medical Weekly* 2001; 131: 659–62

- *Types and number of participants*
42 female patients, with uncomplicated pregnancies < 12 weeks at outset of study
- *Randomisation correct?*
yes
- *Types of intervention*
3 groups (no stocking control group; class I stocking on one leg and class II on the other; idem but legs reversed)
- *Follow up visits*
2 during pregnancy (2nd, 3rd trimester), 2 after delivery (a7 and a42–56)
- *Types of outcome measures*
Primary: emergence of varicose veins, Doppler evidence of LSV reflux > 2s
Secondary: leg symptoms (pain, discomfort, cramps)
- *Conclusion of the authors*
“Compression stockings may be ineffective in preventing superficial spider nevi, side-branch or reticular varices, but they alleviate leg symptoms in pregnancy and lower the incidence of long saphenous vein reflux at the sapheno-femoral junction. If the later effect were to be associated with a lower incidence of long saphenous varices, compression stockings could make an important contribution to the prevention of varicose changes in pregnancy.”
- *Flaws of the trial*
Very limited number of patients, no CEAP classification, poor definition of type of stocking
- *Recommendation level: B*

1.6. Large varicose veins after surgery

Reporter: M. Perrin

1.6.1. Shouler PJ, Runchman PC. Varicose veins: optimum compression after surgery and sclerotherapy. *Ann Roy Coll Surg Eng.* 1989; 71: 402–04

Summary: Prospective randomised study. Post operative compression stockings (6 weeks) comparing high compression (40 mmHg, 51 patients) versus low compression (15 mmHg, 48 patients). The 2 groups were comparable for age, sex, surgical procedures and number of stab avulsions. Both type of compression were equally effective in

controlling bruising and superficial thrombophlebitis, but low compression proved to be more comfortable (35.3% vs. 29.2%. $P = 0.52$) and less expensive.

Type and number of participants: 99 in total: 51 versus 48
Randomization correct? YES

Type of intervention: High compression stockings (40 mm Hg) versus low compression stockings (15 mmHg)

Follow-up visits: one at 6 weeks

Type of outcome measures: compliance, comfort, superficial thrombophlebitis and cost

Conclusion of the authors: Both were equally effective in controlling bruising and superficial thrombophlebitis, but low compression proved to be more comfortable (35.3% vs. 29.2%. $P = 0.52$) and less expensive.

Flaws of the trial: C-class before surgery not mentioned. No information on post operative pain and convalescence duration. More important the compression duration is unusually long (38 days).

Recommendation level: C

Reporter: M. Perrin

1.6.2. Travers JP, Makin GS. Reduction of varicose vein recurrence by use of postoperative compression stockings. *Phlebology* 1994; 9: 104–07

Summary: Prospective randomised trial. 1-year follow-up comparing recurrence (REVAS) in patients with ($n = 33$) vs. without ($n = 36$) post operative compression stockings. Most patients agreed that wearing of compression stockings decreased leg aching and limb tiredness compared to the control group (not clear). Most patients still regarded the stockings as unfashionable. The stockings fitted well for the first 6 months of use, after which only 57% were satisfied with the fit (not clear).

Despite an early, relatively high non compliance rate, compression reduced REVAS. REVAS was respectively 6% vs. 71% at 6 months and 12% vs. 61% at 1 year in the stockings group and in the control group ($p < 0.01$).

Bias: 39% of patients allocated stockings were either lost to follow-up or abandoned their use after 3 months. No information on clinical classes, etiology and anatomy before surgery.

Type and number of participants: 69 in total: 33 versus 36
Randomization correct: YES

Type of intervention: compression stockings class II, thigh length with waist attachment (Medi) 12 months (6 months each) versus no compression (control group)

Follow-up visits: at 3, 6, 9, 12 months

Type of outcome measures: compliance, comfort and fashion, pain, fatigue and varices recurrence (clinical and instrumental: hand-held Doppler)

Flaws of the trial: 39% of patients allocated stockings were either lost to follow-up or abandoned their use after 3 months. No information on clinical classes, etiology and anatomy before surgery

Recommendation level: C

Reporter: M. Perrin

1.6.3. *Rodrigus I, Bleyen J. For how long do we have to advise elastic support after varicose vein surgery? A prospective randomized study. Phlebology. 1991; 6: 95–98*

Analysis: Prospective randomized trial, comparing results in 257 lower limbs at 2 months (*objective i.e. signs:* hematoma, pigmentation, induration, remaining varicose veins and spider veins; *subjective:* heaviness, pain, edema, bad cosmetic result, bad compression compliance, bad general appreciation) according to the duration of postoperative compression; 1 week, 3 weeks and 6 weeks. There was no difference from wearing an elastic support (p: NS) for 1, 3 or 6 weeks after surgery unless there was preoperative edema or CVI. Conclusion: 1 week compression is recommended

Types and number of participants: Elastic bandage: 1 week (all patients = 287) then Tubegauze? (Tubigrip; Seton) for 3 weeks (87 patients) or 6 weeks (89 patients). Patients with severe venous insufficiency(?), ulcer, superficial thrombophlebitis and minimal surgery (high ligation, isolated stab avulsion) were excluded

Follow-up visits: 2 months

Types of outcome measures: Scores for objective signs: hematoma, pigmentation, induration, remaining varicose veins and spider veins; *subjective:* heaviness, pain, edema, bad cosmetic result, bad compression compliance, bad general appreciation.

Conclusion of the authors: There was no difference from wearing an elastic support (p: NS) for 1, 3 or 6 weeks after surgery unless there was preoperative edema or CVI. 1 week compression is recommended

Flaws of the trial: There was no information on how scoring was evaluated.

Recommendation level: C

Reporter: M. Perrin

1.6.4. *Bond R, Whyman MR, Wilkins DC, Walker AJ, Ashley S. A randomised trial of different compression dressings following varicose vein surgery. Phlebology 1999; 14: 9–11*

Summary: Prospective randomised study. 3 types of postoperative compression (1 week) were compared: TED antiembolism stockings, Panelast self adhesive elasticated bandages and Medi Plus class stockings. Comfort and mobility were assessed by a questionnaire. There was a significant reduction of mobility experienced by patients wearing Panelast bandages compared with the 2 other dressings (p < 0.05). However, there were no significant differences between the dressings with regard to the degree of postoperative pain experienced, and in all other respects the dressing were equally tolerated.

Conclusion is that the choice of compression depends on the personal preference of surgeons as well as financial considerations

Types and number of patients: Bilateral varicose veins treated by HL+ GSV trunk stripping+ tributaries stab avul-

sion: 42 patients, 84 lower limbs. Active ulceration, REVAS were excluded.

Randomization correct: YES

Types of intervention: 3 types of postoperative compression worn 1 week were compared (TED antiembolism stockings: 10-12 mm Hg, Panelast self adhesive elasticated bandages: 30-38 mm Hg and Medi Plus class stockings: 30-40 mm Hg)

Follow-up visits: Daily pain scores recorded by the patient for 7 days.

Types of outcomes measures: Pain score, rating of the best dressing type. Cost

Flaws of the trial: Only pain score and costs were compared

Recommendation level: C

Reporter: M. Perrin

1.6.5. *Raraty MGT, Greaney MG, Blair SD. There is no Benefit from 6 weeks postoperative Compression after Varicose Vein Surgery: A Prospective Randomized Trial. Phlebology. 1999; 14: 21–25*

Summary: Prospective randomised study. Postoperative compression comparing Panelast Acryl adhesive short bandages (64 lower limbs) worn 1 week versus TED embolic stockings worn 6 weeks (67 lower limbs). Age and sex distribution were similar. Six items (symptoms and signs) were recorded and registered. Pain and activity were assessed on a linear analogue scale every day the first week. A further assessment was arranged at 6 weeks and any symptoms of aching, itching, swelling, discomfort or numbness were recorded. Postoperatively there was significant more bleeding in the TED group and a larger area of bruising (p < 0.02). However this did not correlate with any difference in discomfort or activity in the 2 groups. There was no statistical difference in the symptoms reported after the first week. Both groups returned to full activities and work after similar periods

Conclusion: there was no benefit in wearing compression for more than 1 week

Bias: duration of compression was different in the 2 groups. No information on clinical classes

Types and number of patients: Primary varicose veins treated by high ligation (HL) + GSV trunk stripping+ tributaries stab avulsion: 105 patients; 131 lower limbs.

Randomization correct: YES

Types of intervention: Postoperative compression comparing Panelast Acryl adhesive short bandages (64 lower limbs) worn 1 week versus TED embolic stockings worn 6 weeks (67 lower limbs.)

Follow-up visits: 1 week and 7 weeks after surgery

Types of outcomes measures: Pain, and activity scores (linear analogue scale every day the first week.), bleeding, extent of bruising, and groin wounds, were assessed. A further assessment was arranged at 6 weeks and any symptoms of aching, itching, swelling, discomfort or numbness were recorded.

Recommendation level: C

Reporter: M. Perrin

1.6.6. Coleridge-Smith PD, Scurr JH, Robinson KP. Optimum methods of limb compression following varicose veins surgery. *Phlebology* 1987; 2: 165–72

Summary: Prospective randomised study. Postoperative compression including crepe (13 patients), elastocrepe (10 patients) and stockings producing 30 mmHg at the ankle (11 patients). Pressures exerted by the bandages and stockings were measured during the 24 h following surgery. Initially the bandages exerted greater pressure than the stockings. However, the bandaging techniques lost 13–38% of their compression in the first hour and 29–48% in 24h compared with 3–5% for the compression stocking
Conclusion: the stockings provided a more constant compression with maintained graduation compared with the bandages.

Bias: Is there a correlation between the pressure exerted and the clinical benefits in this group of patients.

Types and number of patients: Varicose veins treated by HL+GSV trunk stripping+tributaries stab avulsion: 34 patients.

Randomization correct: YES

Types of intervention: Postoperative compression comparing crepe (13 patients), elastocrepe (10 patients) and stockings producing 30 mmHg at the ankle (11 patients).

Follow-up visits: Continuous evaluation 24 hrs after operation

Types of outcomes measures: Pressure measurement

Flaws of the trial: From a clinical point of view the correlation between the pressure exerted and the clinical benefits has never been validated in the immediate postoperative period

Recommendation level: C

Reporter: M. Perrin

1.6.7. Travers JP, Rhodes JE. Postoperative limb compression in reduction of haemorrhage after varicose vein surgery. *Ann Roy Coll Surg Eng* 1993; 75: 119–122

Summary: Prospective randomized study comparing importance of bleeding in varicose vein surgery according to compression modality. 10 patients allocated for bilateral high ligation and stripping. One leg received a high -compression short-stretch adhesive bandage (Panelast) and the second one non-adhesive crevic crepe. The compression was applied before stripping. Bleeding was measured by using 99m Tc-labelled red blood cells.

Conclusion: Bleeding was significantly reduced in the Panelast group.

Bias: small group

Types and number of patients: Bilateral varicose veins treated by high ligation + GSV trunk stripping: 10 patients 20 lower limbs

Randomization correct: YES

Types of intervention: One leg received a high -compression short-stretch adhesive bandage (Panelast) and the second one non-adhesive crevic crepe (control group). The compression was applied before stripping. Panelast was kept in place 6 days and crepe bandaging one day.

Follow-up visits: Bleeding evaluation in the recovery room
Types of outcomes measures: Postoperative bleeding was measured by using 99m Tc-labelled red blood cells

Conclusion of the authors: Adequate compression bandaging decrease subcutaneous haematoma formation after stripping of varicose veins

Flaws of the trial: Bleeding is not haematoma. Small group

Recommendation level: C

1.7. Varicose veins (C2) after sclerotherapy, endovenous procedures

1.7.1. Shouler PJ, Runchman PC. Varicose veins: optimum compression after surgery and sclerotherapy. *Ann Roy Coll Surg Eng*. 1989; 71: 402–04:

See 1.6.1 (M. Perrin)

1.7.2. Scurr JH, Coleridge-Smith P, Cutting P. Varicose veins: optimum compression following sclerotherapy. *Ann Roy Coll Surg Eng*. 1985; 67: 109–11

See 1.2.2. (M. Goldman)

Reporter: R. Weiss

1.7.3. Stanley PRW, Bickerton DR, Campbell WB. Injection sclerotherapy for varicose veins- a comparison of materials for applying local compression. *Phlebology* 1991; 6: 37–39

- **Types and number of participants:** 102
- **Randomization correct?** not described
- **Types of intervention (e.g. bandage A versus stocking B)**
Rectangular adhesive Molefoam 7 mm thick versus traditional Sorbo rubber pads
Both groups: 2 layers of Elastocrepe, one layer of elastoplast, covered with Tubigrip
- **Follow up visits**
2, 6 weeks, 3 months, 6 months after 4–5 injections per patient
- **Types of outcome measures**
1) veins disappeared, no further injection needed,
2) local reactions
- **Conclusion of the authors**
> 90% successful results in both groups (adequate compression in both groups)
Molefoam more comfortable, easier to use
- **Flaws of the trial**
Pressure of bandage?
Comparison only made for local pads after sclerotherapy
Weak outcome parameters
- **Recommendation level:** C

1.8. Venous oedema (C 3)

Reporter: M. Jünger

1.8.1. Diehm C, Trampisch HJ, Lange S, Schmidt C. Comparison of leg compression stocking and oral horse-chestnut seed extract therapy in patients with chronic venous insufficiency. *Lancet* 1996, 347: 292–94

- Types and number of participants
240 (194 women) with chronic venous insufficiency
- Randomization correct?
yes
- Types of intervention (e.g. bandage A versus stocking B)
Stockings class II versus horse-chestnut seed extract (50 mg Aescin twice daily)
- Follow up visits
12 weeks study duration
randomised to either compression, HCSE, or placebo (2:2:1)
- Types of outcome measures
Water displacement plethysmography
- Conclusion of the authors
– decrease by 53.6 ml with HCSE
– decreased by 56,5 ml with stocking compared to placebo after 12 weeks
HCSE offers an alternative to compression therapy
- Flaws of the trial
Treatment with oedema-preventive drugs are accepted by 67% of patients. Volume decrease in the range of 50 ml corresponds to a mean reduction in calf circumference of 2–3 mm in 12 weeks! Compression treatment improves venous hemodynamics (reduction of venous reflux, ambulatory venous hypertension and of capillary hypertension), which is not shown for drug treatment.
- Recommendation level: B

1.10. Skin changes (lipodermatosclerosis, atrophie blanche) (C 4b)

Reporter: H. Partsch

1.10.1. Vandongen YK, Stacey MC. Graduated compression elastic stockings reduce lipodermatosclerosis and ulcer recurrence. *Phlebology* 2000; 15: 33–37

- Types and number of participants
153 patients with venous ulcers that had healed 2 weeks previously
- Randomization correct?
Yes (closed envelopes)
- Types of intervention (e.g. bandage A versus stocking B)

- a) Venosan 2003 below knee stocking (35–45 mmHg) (n = 72) versus
- b) no stocking (n = 81)

- Follow up visits
– Measurements at beginning, after 6 and 12 months
– Ulcer recurrence 2 years
- Types of outcome measures
Area of LDS (skin marker, polyethylene sheet, planimetry), variation coefficient 37%
Recurrent ulcers
- Conclusion of the authors
LDS area significantly reduced by stockings
Recurrence after 6 months: 15/72 stockings, 37/72 no stockings
- Recommendation level: B

1.11. C5 Healed ulcer

Reporter: M. Neumann

1.11.1. Nelson EA, Bell-Syer SEM, Cullum NA.

Compression for preventing recurrence of venous ulcers (Cochrane Review). In: The Cochrane Library, Issue 2, 2003. Oxford: Update Software.

1.11.2. Franks PJ, Oldroyd MI, Dickson D, Sharp EJ, Mofatt CJ. Risk factors for leg ulcer recurrence: a randomised trial of two types of compression stockings. *Age Ageing* 1995; 24: 490–94

1.11.3. Harper DJ, Nelson EA, Gibson B et al. A prospective randomised trial of class 2 and class 3 elastic compression in the prevention of venous ulceration. *Phlebology* '95, Negus D et al. *Phlebology* 1995; Suppl. 1; 872–73

- Types and number of participants
300+166 (Harper and Franks)
- Randomization correct?
yes
- Types of intervention (e.g. bandage A versus stocking B)
UK-ccl III versus II (Harper)
UK-ccl II versus II (Medi vs Scholl) (Franks)
- Follow up visits
Up to a) 60 months
b) 10 months
- Types of outcome measures
Recurrent ulcers
- Conclusion of the authors
No compression is associated with recurrence
Recurrence rate low with Ccl III stockings
- Flaws of the trials
No characteristics of the used stockings,

too short follow up,
no comparison with no compression.

Final conclusion: No trials are available comparing compression with no compression. Recurrence rate may be lower with high pressure hosiery than with medium compression hosiery. Therefore patients should be offered the strongest compression with which they can comply.

Recommendation level: B

1.12. Active ulcer (C 6)

Reporter: Chr. Moffatt

1.12.1. Cullum N, Nelson EA, Fletcher AW, Sheldon TA. *Compression for venous leg ulcers (Cochrane Review) in the Cochrane Library, Issue 1, 2003. Oxford: Update Software*

Objective of the review

The objective of this systematic review was to assess the clinical and cost effectiveness of compression therapy (bandaging and stockings) in the treatment of venous leg ulcers. Specific questions included:

1. Does the application of compression therapy aid venous ulcer healing?
2. What is the optimum level of compression?
3. Which compression system is the most clinically effective?
4. Which system is most cost-effective?

Types and numbers of participants

Trials evaluating either compression bandaging or stockings in venous ulcer treatment were selected for this systematic review with no restriction on language. The primary endpoint chosen was complete ulcer healing. Searches of 19 databases, hand searching of conference material and use of bandage manufacturers was undertaken. Data extraction was verified by two independent reviewers.

Twenty two trials reporting 24 comparisons were identified. The relative risk with 95% confidence intervals were calculated for each category and are summarised below.

Types and numbers of participants

	Compression	Controls	(Relative Risk)	(95% CI)
Charles	19/27	6/23	2.70	(1.30–5.60)
Erikson	9/17	7/17	1.29	(0.62–2.65)
Kikta	21/30	15/39	1.82	(1.15–2.89)
Rubin	18/19	7/17	2.30	(1.29–4.10)
Sikes	17/21	15/21	1.13	(0.81–1.59)
Taylor	12/18	4/18	3.00	(1.19–7.56)

Comment

In this category the combined relative risk is not calculated. The variation in relative risk between trials may be due to a number of factors, particularly the application technique

and use of materials. The conclusion drawn is that compression therapy is beneficial in ulcer healing compared to no compression. Stacey has reported that approximately 20% of patients heal within three months without compression raising an important question. However compression would appear to offer up to a three fold increased chance of healing compared to no compression.

Elastic high compression versus inelastic (multi-layer compression)

Types and number of participants

Compression	Control	(Relative Risk)	(CI)
77/134	52/137	1.54	1.19–1.99

Comment

This review suggests that elastic compression (multi-layer) is beneficial in ulcer healing compared to inelastic. However this issue is complex. For example, the choice of inelastic material used in Callum's trial was less than optimal and the product used has now been withdrawn. Serious issues must be raised concerning the true comparability of different systems which are simplistically described as elastic or inelastic. The recent EWMA position document on compression therapy highlights the uselessness of such terms.

Multi-layer high compression systems versus single layer systems

Compression	Control	(Relative Risk)	(CI)
82/139	59/141	1.41	1.12–1.77

Comment

Multi-layer compression was found to aid healing better than single layer compression. Since this meta-analysis was performed a number of major trials have been completed which should be included within this category. A major limitation of this review which is frequently described as the gold standard is how out-of-date it has now become. In addition to new trials, further developments in the development of textiles challenge us to properly define and evaluate the systems in use.

Multi-layer high compression versus inelastic compression

Types and numbers of participants

Compression	Control	(Relative Risk)	(CI)
17/32	18/32	1.10	0.78–1.55

Comment

Multi-layer elastic compression was found to slightly favour inelastic regimes. This category of bandaging is particularly problematic due to the lack of standardisation of inelastic compression systems. Traditional elastic systems have been relatively well standardised for material and application. Inelastic systems vary widely in application of underpadding and numbers of layers. Variations in spiral, figure of eight, Pütter- technique may all influence out-

come. The review fails to identify important factors within the description of the bandaging system such as the application of a coherent, elastic compression bandage within the control group of Scrivens trial.

Four layer versus other multi-layer high compression systems

Types and numbers of participants

Compression	Controls	(Relative Risk)	(CI)
99/142	98/143	1.02	0.87–1.18

This review of elastic multi-layer systems reveals their similarity in outcome. This probably reflects the common parameters used in the replication of the Charing Cross system into products such as Profore, Ultra 4, Robinson etc. Most classic multi-layer systems include 3 or 4 layers. However clinicians frequently also cite high compression single layer elastic bandages as multi-layer systems when applied over padding. This highlights again the challenge of correct classification. Trials such as McCollum's were designed to be equivalence trials and the relative risk of 0.96 reveals this has been achieved.

Compression stockings versus compression bandaging

Types and numbers of participants

Stockings	Inelastic	(Relative Risk)	(CI)
Hendricks 10/14	7/10	1.02	0.60–1.72
Horakova 21/25	13/25	1.62	1.07–2.44

This category reveals little useful information. The inelastic control varied with both trials and it is therefore impossible to define the true value of stockings from this review. Cornwall within cohort studies in the mid eighties reported healing rates of 12 weeks in excess of 60%. The true potential of self treatment with hosiery remains to be examined.

Problems associated with the systematic review and trials cited within it

1. Requires updating with new, rigorous trials recently reported
2. The criteria set for randomisation by the reviewers was rarely achieved. Blinded treatment is an impossibility within these studies. Many studies simply failed to report their randomisation process.
3. *Types of intervention*

While the intervention groups are plausible, failure to examine issues such as application technique, materials and use of padding and dressings, limit the use of these conclusions. The delay in updating fails to take account of new compression devices emerging using new elastomeric technology.

Conclusions of the authors

1. Compression increases ulcer healing compared with no compression.

2. Multi-layered systems are more effective than single layered systems.
3. High compression is more effective than low compression.
4. No clear differences in effectiveness of different types of compression.

Comment

Cost-effectiveness was rarely examined within the trials cited. Re-definition of compression systems would be useful for further reviews. The quality of many trials was poor with low sample size and varying outcomes. Weeks to complete ulcer healing varied between authors. Lack of demographic and mobility data adds to the confusion. Well known risk factors such as duration, ulcer size and mobility of the patient groups are often not reported. The trials were also undertaken in a variety of settings from specialised clinics to community care. This raises issues of the representation of the patients and the skills of the practitioner in these settings. In some areas the introduction of a new bandage system into a clinical area which has been used to one method could contribute to a preference to what is familiar and a time lag in becoming skilled in the new method. It is widely acknowledged that the sub-bandage pressures achieved beneath bandages with different application is very varied and often not reproducible. We cannot therefore state that the compression has always been used in its optimum way.

The overall recommendation for the use of compression therapy is A

However, much further analysis of the many different systems in use must be carried out before differentiation is clear. A major flaw in the review is the failure to include quality of life or symptom changes as a primary endpoint.

Further trials recently completed

Moffatt CJ, McCullagh L et al. Randomised trial comparing four layer with two layer high compression bandaging in the management of chronic leg ulceration. Wound Repair and Regeneration 2003; 11: 166–171

109 patients randomised to either four layer bandage or a single layer bandage (Surepress) applied over padding. Application technique standardised. Analysis revealed that after 24 weeks a total of 71 (56%) of ulcers had healed. The healing rate in the four layer was 47/57 (82%) and in the single layer 24/52 (46%) ($p < 0.001$). Withdrawal and adverse events were similar.

Moffatt CJ on behalf of the EXPECT trial. A multi-centre randomised trial comparing a Vari-stretch compression system with Profore. 13th Conference European Wound Management Association, Pisa, May 2003 (abstract)

300 patients recruited from 5 countries, 24 sites, standardised application methods with modification of application to the new system during the trial. Comparable healing rates 67/69% at 24 weeks achieved on life table

analysis. Withdrawal rates were higher in the new system due to leg pain.

Franks PJ, Moffatt CJ et al. Randomised trial comparing four layer with cohesive short stretch compression. 13th Conference European Wound Management Association, Pisa, May 2003 (Abstract)

156 patients within a multi-centre trial were randomised to the original four layer system or a cohesive short stretch multilayer system. After 24 weeks in total 71% of patients had healed. Healing in the 4 layer group of 51/74 (69%) was achieved compared to 60/82 (73%) in the short stretch. There was no statistical difference in outcome with an adjusted rate ratio of 0.93.

1.12.2. Meyer FJ, Burnand KG, Lagattolla NR, Eastham D. Randomized clinical trial comparing the efficacy of two bandaging regimens in the treatment of venous leg ulcers. *Br J Surg* 2002; 89: 40–44

Reporter: H. Partsch

- *Types and number of participants*

112 ulcer patients, ulcers stratified into 3 size categories: small 0,25–2,5 sqcm, medium 2,5–25 sqcm, large >25–100 sqcm (max. length × width)
Venous pathology proved by Duplex, PPG, phlebography

- *Randomization correct? Yes*

- *Types of intervention (e.g. bandage A versus stocking B)*
3 layers were used in both groups A/B
1) Zink-impregnated paste bandage over the ulcer
2A) 57 patients Tensopress (“elastic”)
2B) 55 patients Elastocrepe (“inelastic”)
3) Tensoshape cotton-elastic tubular retaining bandage over the top to prevent slippage

- *Follow up visits*
Ulcer healed or after 26 weeks

- *Types of outcome measures*
Complete healing, photograph taken to confirm healing by a third party
Kaplan Meier plots

- *Conclusion of the authors*
After 26 weeks 58% healed by Tensopress, 62% by Elastocrepe (n.s.)
“no significant improvement in venous ulcer healing using higher compression elastic bandages”

- *Flaws of the trial*
Inelastic material (zinc paste) as the basis used in both arms
“Higher compression pressure” of Tensopress not measured

Recommendation level: B

1.12.10. Weiss RA, Weiss MA, Ford RW. Randomized comparative study of Cutinova foam and Allevyn with Jobst UlcerCare stockings for the treatment of venous stasis ulcers. *Phlebology* 1996; (1): 14–16.

Reporter: R. Weiss

Demonstrated in 20 patients that with equal compression the topical dressing did not make a difference. Ulcers had no compression prior to entering the study.

Recommendation level: B

2.1. Prevention of venous thromboembolism

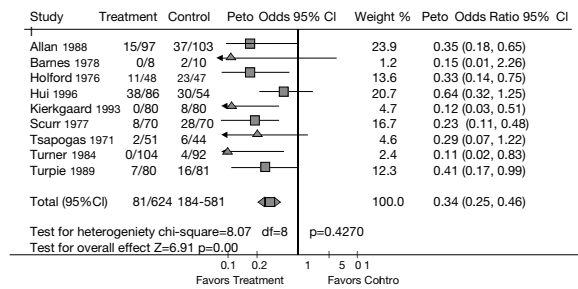
Reporter: J. Caprini

2.1.1. Amaragiri SV, Lees TA. Elastic compression stockings for prevention of deep vein thrombosis. *The Cochrane Library, Issue 2, 2003. Oxford: Update Software*

- *Types and number of participants*
9 randomised control studies (RCTs) GCS alone: placebo 581; GCS group 624
7 RCTs GCS Plus another method: placebo 505; treatment 501 (GCS = Graduated compression stocking).
- *Randomization correct? Yes*
- *Types of intervention (e.g. bandage A versus stocking B)*
a) stockings (GCS) vs Placebo
b) stockings (GCS) + other method vs Placebo
- *Types of outcome measures*
DVT (I 125 fibrinogen)
a) Placebo 154/581 (27%) DVT
GCS 81/624 (13%) DVT OR 0,34
b) Placebo 74/505 (15%)
GCS + other method 10/501 (2%) OR 0,24 (see Figures below)
- *Conclusion of the authors*
Compression stockings are effective in diminishing the risk of DVT in hospitalised patients. On a background of another method of prophylaxis they are even more effective than GCS alone.
- *Flaws of the trial*
Insufficient data to evaluate thigh vs calf stockings
No venography
Trials too small
- *Recommendation level: A-B*

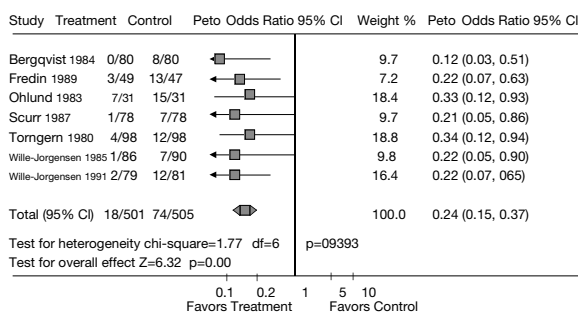
Elastic Compression Stockings for the Prevention of DVT

With and Without compression Stockings



Elastic Compression Stockings for the Prevention of DVT

With and Without Stockings on a Background of Additional Antithrombotic Measures



Remark: “Elastic compression stockings” in this review refer to thromboprophylactic stockings exerting a pressure on the distal lower leg around 15 mm Hg.

2.2 Prevention of flight thrombosis

2.2.1. Scurr JH, Machin SJ, Bailey-King S, Mackie IJ, McDonald S, Coleridge Smith PD. Frequency and prevention of symptomless deep-vein thrombosis in long-haul flights: a randomised trial. *Lancet* 2001; 357: 1385–9

Reporter: J. Caprini

- *Types and number of participants*
200
- *Randomization correct?* Yes
- *Types of intervention (e.g. bandage A versus stocking B)*
Calf length stocking 20-30 mmHg vs control
- *Follow up visits*
Post flight
- *Types of outcome measures*
Duplex scan
- *Conclusion of the authors*
Stockings prevent asymptomatic small calf clots

- *Flaws of the trial*
Need larger trial

• *Recommendation level:* B

This is a small pilot study, which showed that 20–30 mmHg hose protected this population from asymptomatic or clinical DVT. Four superficial thromboses were seen and were actually attributed to the stocking. This study is a pilot and needs to be repeated in a larger population on a multicenter basis. Until that time the conclusions in this study can only be viewed as preliminary.

2.2.2. Belcaro G, Cesarone MR, Shah SS, Nicolaidis AN, Geroulakos G, Ippolito E, Winford M, Lennox A, Pellegrini L, Brandolini R, Myers KA, Simeone E, Bavera P, Dugall M, Di Renzo A, Moia M. Prevention of edema, flight microangiopathy and venous thrombosis in long flights with elastic stockings. A randomized trial: The LONFLIT 4 Concorde Edema-SSL Study. *Angiology*. 2002; 53(6): 635–45.

Reporter: H. Partsch

- *Types and number of participants*
Part I (7–8 h flight): 179
Part II (11–12 h flight): 142, low-medium risk for VTE
- *Randomization correct?*
Not described
- *Types of intervention (e.g. bandage A versus stocking B)*
Stockings AD Scholl 14–17 mmHg versus no stockings
- *Follow up visits*
Before and after flight
- *Types of outcome measures*
Compression sonography Duplex
Edema score (Edema test, ankle circumference, volume, subjective swelling, discomfort -VAS)
- *Conclusion of the authors*
Part I: stocking-group: TVT: 0/179, edema score 2,16
No stockings: TVT: 4/179+ 2 Phlebitis, edema score 6,14
Part II: stocking-group: TVT: 0/142, edema score 2,56
No stockings: TVT: 3/143+ 3 Phlebitis, edema score 8,08
All DVT: popliteal, asymptomatic
- *Flaws of the trial*
Methodological details missing.
- *Recommendation level:* B

Overview on the LONFLIT studies

(Slides kindly disposed by G. Belcaro)

LONFLIT

- Six LONFLIT studies have been published or are in publication
- A global analysis of data, including subjects comparable for characteristics (sex, age, body-mass index and flight characteristics) was performed to evaluate the frequency of DVT in a large population sample including 4922 subjects (age range 25–69; M/F = 43%/57%)
- Subjects were divided in high, moderate and low risk for DVT and pulmonary embolism (PE) according to the ACCP guidelines for DVT
- IUA consensus

Results

- Global analysis indicate the incidence of venous clots detected after the flights. On average 3,35% of subjects had a clot after flying and most subjects (93,66%) had a variable range of lower limb edema.
- A separate epidemiological evaluation, based on questionnaires, on 8448 passengers, indicates that 54% of subjects flying between 7 and 12 hours (age range 25–75) can be considered at low-risk, 35% at moderate risk and 11% at high risk.
- The possible incidence of DVT could be extrapolated to a number between 2 and 3% for the general population.

Analysis

- Our analysis excluded younger subjects (< 25) or subjects older than 75 who constitute a significant number of passengers. Considering that some 20 000 000 travellers may travel every year for 10 hours the problem should be considered with attention.
- The evaluation of PE, often occurring hours/days after the flights require a more complex, long term study. The common finding of a small (< 1cm) vein clot, which may be spontaneously lysed in hours, in most subjects (as observed in the LONFLIT 4 study) is an interesting observation of doubtful clinical value.

LONFLIT-total results table

Risk Level	Number	Lost	DVT%	Number	EDEMA
Low	1476	58	1.35	20	88%
Moderate	1787	61	2.5	45	93%
High	1659	54	5.9	98	100%
Total	4922	173	3.25	163	93.66%

Compression studies: 1220 subjects randomised; 51% treated with compression

- 100 flyers x 12 hours/flight= 1200 hours
- 4-6% with a clot
- One clot for 48-72 hours of flight without compression
- Compression: 1 clot /288-344 hours of flight

Evidence in medicine

- Found only when profitable
- Big trials big profits
- Compression associated to limited profits

- Double-blind trials not possible
- Size, level of compression, other variables, difficult to control
- No standards

Level of compression

- Right compression = vein at the same size for hours, avoiding pooling, dilatation and DVT
- Compression < 25 mmHg
Results = 95% same size or 20% lower after 10 hours of flight

2.3. Early onset compression therapy of deep vein thrombosis (DVT)

Reporter: W. Blättler

2.3.1. Blättler W, Borer M, Linder C, Bergan J. Outpatient and conventional treatment of acute deep-vein thrombosis evaluated in a controlled single-center study. *Phlébologie* 1998; 51: 41–4

- *Types and number of participants*
Acute DVT, 28 patients
- *Randomization correct?*
yes
- *Types of intervention (e.g. bandage A versus stocking B)*
Stockings AD Sigvaris 504 + ambulation versus no compression therapie (CT) + bed rest
- *Follow up visits*
Daily for 7 days; days 10, 14, 28, 90
- *Types of outcome measures*
Pain score, clinical score; repeat lung scan; 2 repeat venograms
- *Conclusion of the authors*
Subjective and objective clinical benefit of stockings + ambulation
Same rate of PE
Tendency toward improved venograms
- *Flaws of the trial*
Too few patients
- *Recommendation level: B*

2.3.2. 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

Reporter: W. Blättler

- *Types and number of participants*
Acute DVT, 129 patients

- *Randomization correct?*
Yes; with stratification for DVT extension
- *Types of intervention (e.g. bandage A versus stocking B)*
Porelast bandages + walking versus no CT + bed rest
- *Follow up visits*
Daily for 4 days, 90 days
- *Types of outcome measures*
Pain score, leg circumference; repeat lung scan; telephone interview
- *Conclusion of the authors*
Not more PE with bandages + ambulation than with no CT + bedrest
(less pain with bandage + walking)
- *Flaws of the trial*
Only 4 days of study treatment
- *Recommendation level: B*

2.3.3. Partsch H, 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: 861–9.

Reporter: W. Blättler

- *Types and number of participants*
Proximal DVT; 45 patients
- *Randomization correct?*
Yes; small sample of eligible patients
- *Types of intervention (e.g. bandage A versus stocking B)*
Fischer bandages + walking versus stocking AG Sigvaris 503 + walking versus no CT + bed rest
- *Follow up visits*
Daily for 9 days
- *Types of outcome measures*
Subjective (VAS, QOL) and objective clinical; Compression ultrasound (CUS); repeat lung scans
- *Conclusion of the authors*
CT + walking is better than bed rest (all parameters, CUS data based on few patients)
No difference between bandages and stockings
Same rate PE
- *Flaws of the trial*
Too few patients, short observation period
- *Recommendation level B*

2.4. Prevention of postthrombotic syndrome (PTS)

Reporter: H. Partsch

2.4.1. Brandjes D PM, Büller H, Hejboer H, Huisman MV, de Rijk M, Jagt H, ten Cate JW. Incidence of the postthrombotic syndrome and the effects of compression stockings in patients with proximal venous thrombosis. *Lancet* 1997; 349: 759–62.

- *Types and number of participants:*
first episode venogram-proven proximal DVT
96 stockings vs. 98 no stockings
- *Randomization correct?*
sealed envelope technique
- *Types of intervention (e.g. bandage A versus stocking B)*
Knee length custom made, 40 mmHg, applied 2–3 weeks after DVT, replaced every 6 months. Minimal wearing time: 2 years, then patients could chose

All: heparin in hospital > 5 days, coumadin for 3 months

- *Follow up visits*
For 2 years every 3 months, thereafter every 6 months for over 5 years
Independent research nurse assessed compliance using a 4 point scale:
Wearing stocking always, usually (> 80% of time), sporadically, never
- *Types of outcome measures*
 1. Recurrence of DVT (phlebography, fibrinogen test, ultrasound)
 2. Scoring system for signs and symptoms
– PTS by definition only 6 months after DVT
Independent observers
- *Conclusion of the authors*
No difference in recurrence rate (14,6% stocking vs 13,3% control group)
PTS rate reduced to 50% by stocking
(mild PTS 20% vs 47%), severe PTS 11% vs 23%)
- *Flaws of the trial*
Start with compression only after 2–3 weeks
- *Recommendation level: A*

2.4.2. Ginsberg JS, Hirsh J, Julian J, Van der Laande Vries M, Magier D, MacKinnon B, Gent M. Prevention and treatment of postphlebotic syndrome: results of a 3-part study. *Arch Intern Med* 2001; 161: 2105–9

Reporter: H. Partsch

- *Types and number of participants:*
1 year after first episode objectively confirmed proximal DVT, PTS= pain and swelling
Study 1: 120 asymptomatic patients, normal PPG, Doppler (> 50% had asymptomatic DVT)
Study 2: Asymptomatic patients, pathological PPG, Doppler: 24 stockings/23 placebo stocking
Study 3: Symptomatic PTS: 18 stockings/17 placebo stockings
- *Randomization correct?*
yes, pre-randomization stratification for calf symptoms
- *Types of intervention (e.g. bandage A versus stocking B)*
Study 1: no stocking
Study 2: 20–30 mmHg stocking/“Placebo stocking” (1–2 sizes too large)
Study 3: 30–40 mmHg stocking (75% below knee) /Placebo stocking
- *Follow up visits*
Study 1: every 6 months for treatment failures, mean duration 55 months
Study 2: every 6 months for treatment failures, mean duration 55–59 months
Study 3: every 3 months for treatment failures, mean duration 22–28 months
- *Types of outcome measures*
“Treatment failure” assessed by questionnaire:
Only in Study 1: interviewer was not instructed that patients were not using stockings
- *Conclusion of the authors*
Treatment failures: Study 1: 5%
Study 2: 0% stocking/4,3% placebo stocking n.s.
Study 3: 61,1% stockings/58,8% placebo stockings n.s.
- *Flaws of the trial*
Low numbers (study 3: 18 stockings vs. 17 placebo stockings), cases with asymptomatic DVT included, “Placebo” stockings have too high pressure

Recommendation level: B

2.4.3. Prandoni P, Frulla M, Mosena L, et al. Benefit of below-knee elastic compression stockings for prevention of the post-thrombotic syndrome in patients with proximal-vein thrombosis. A prospective controlled randomized study. *Pathophysiol Haemost Thromb* 2002; 32 (suppl. 2) Abstr O136

Reporter: H. Partsch

- *Types and number of participants*
180 with first episode proximal DVT
- *Types of intervention (e.g. bandage A versus stocking B)*
40 mmHg stockings versus no stockings
- *Follow up visits*
2 years
- *Types of outcome measures*
Villalta scores
- *Conclusion of the authors*
50% PTS: no stocking
24,6% PTS: stocking group
PTS becomes manifest in the first 2 years
- *Flaws of the trial*
Only abstract published
- *Recommendation level: A*

2.5. Lymphoedema, Lipoedema

Reporter: A. Cavezzi

3.1.1. Badger CM, Peacock IL, Mortimer P. A randomised controlled parallel group clinical trial comparing multilayer bandaging followed by hosiery versus hosiery alone in the treatment of patients with lymphoedema of the limb. *Cancer* 2000; 88: 2832–37

- *Types and number of participants*
83 patients with primary or secondary lymphoedema of lower or upper limbs:
- *Randomization correct?*
yes
- *Types of intervention (e.g. bandage A versus stocking B):*
bandage followed by stocking/sleeves versus stocking/sleeves only
- *Follow up visits*
at 19 days, 7, 12, 24 weeks
- *Types of outcome measures*
Volume measurement:
a) optoelectronic device (Perometer TM),
b) circumferences and derived volume calculation in the affected limb and by means of confrontation between the two limbs

- *Conclusion of the authors*
multilayer bandage followed by hosiery (stockings or sleeves) gives a greater (15.8% difference) and more durable limb volume reduction in lymphedema patients, when confronted to hosiery alone
- *Flaws of the trial:*
a) quite “personal” a bandage was used and b) part of the patients with bandaging + hosiery were hospitalised in the first days (one week?) of the treatment; on the contrary all the patients on hosiery alone were managed on an outpatient basis. Inpatient management could condition a better lifestyle from the patients.
- *Recommendation level:* B
although it is evident from everybody’s experience that bandage plus hosiery is better than hosiery alone.

3.1.2. Johansson K, Albertsson M, Ingvar C, Ekdahl C. Effects of compression bandaging with or without manual lymph drainage treatment in patients with postoperative arm lymphedema. *Lymphology* 1999 Sep; 32(3): 103–10 Comment in: *Lymphology* 2000; 33: 69–70

Reporter: A. Cavezzi

- *Types and number of participants:*
38 female arm lymphoedema patients
- *Randomization correct?*
Quite correct, as the authors state (patients were allocated consecutively, not completely randomly)
- *Types of intervention (e.g. bandage A versus stocking B):*
first 14 days all the patients bandage
subsequent 7 days half of the patients bandage only, and the second half bandage plus manual lymphatic drainage (MLD)
- *Follow up visits:*
every 2–3 days arm volume measurement, at day 0 and day 21 VAS test
- *Types of outcome measures:*
arm volume (absolute and percentage reduction in confrontation with the other arm) through water displacement procedure, Visual analogue scale for symptoms, body weight
- *Conclusion of the authors:*
a) Low stretch bandaging is very effective in reducing volume and symptoms in post-mastectomy arm lymphoedema, especially in the first 2 weeks (in agreement with other published articles),
b) Additional manual lymphatic drainage helps to achieve a further improvement in volume reduction, especially in terms of percentage reduction (less as absolute measures); similarly MLD contributes to an improvement of symptoms. especially of pain

- *Flaws of the trial:*
a) little number of enrolled patients
b) suboptimal method of randomisation
c) 5 days of MLD seem to be a very short treatment, and furthermore MLD introduction after 2 weeks of bandaging, decreases MLD positive properties
d) the authors do not specify which kind of bandage is used (although they generically refer to a german language publication...)
- *Recommendation level:* B

3.1.3. Bertelli G, Venturini M, Forno G, Macchiavello F, Dini D. Conservative treatment of postmastectomy lymphedema: A controlled, randomized trial. *Ann Oncology* 1991; 2: 575–78

Reporter: H. Partsch

- *Types and number of participants*
74 postmastectomy lymphoedema
- *Randomization correct?*
not described
- *Types of intervention (e.g. bandage A versus stocking B)*
Elastic sleeves not custom made (Sigvaris 503) every day vs.
The same + additional electrically stimulated lymphatic drainage (2 cycles of 2 weeks, 5 weeks in between, daily 10–30 minutes stimulation)
- *Follow up visits*
2 months, 6 months
- *Types of outcome measures*
“delta” = difference of arm circumference diseased-healthy arm (exclusion: < 10 cm > 20 cm)
Reduction of oedema in “Delta cm”
% of patients showing a reduction > 25%
- *Conclusion of the authors*
17% reduction of circumference in both groups, no significant difference
- *Flaws of the trial*
Compression in both groups
- *Recommendation level:* C

3.1.4. Andersen L, Höjris I, Erlandsen M, Andersen J. Treatment of breast-cancer-related lymphedema with or without manual lymphatic drainage. A randomised study. *Acta Oncologica* 2000; 39: 399–405

Reporter: H. Partsch

- *Types and number of participants*
42 postmastectomy lymphoedema
- *Randomization correct?*
not described
- *Types of intervention (e.g. bandage A versus stocking B)*
Custom made sleeve and glove garments 32–40 mmHg Beiersdorf every day vs
The same + additional MLD 8× in 2 weeks + daily self massage
- *Follow up visits*
1, 3, 6, 9, 12 months

- *Types of outcome measures*
 1. Change of volume of the ipsilateral arm compared with the contralateral arm
 2. Subjective symptom score (7 points: discomfort, heaviness, pain, tightness, aching, function, mobility)
- *Conclusion of the authors*
MLD does not -at least in the early stage- improve treatment outcome.
- *Flaws of the trial*
Compression in both groups
No detailed description on volume measurement
- *Recommendation level: C*

Appendix I

Indications for Compression Therapy and Levels of Recommendations Based on RCT's and Systematic Reviews (Ref = References A)

Indication	Ref	Comparison	Bandage	Class A 10–14	I 15–21	II 23–32	III 34–46 (mmHg)
C0S, C1 S	1.1.1.	0/8–15/15–20		B	B		
	1.1.2.	10–15/6 (Placebo)		B			
	1.1.3.	10–15/6 (Placebo)		B			
C1 Sclero	1.2.1.	0/3/7/21 days				(B ¹)	
	1.2.2.	35–40/Bandage					B
C2A	1.3.1.	30+ physical therapy/0				C ²	
C2S	1.4.1.	30–40/drug/0					(C ³)
C2 Pregnancy	1.5.1.	0/I/II			B	B	
C2 Surgery	1.6.1.	40/15			C		C
	1.6.2.	II/0				C	
	1.6.3.	Band.1/3/6 wks	(C ¹)				
	1.6.4.	Band/10–12/30–40	(C ⁴)	(C ⁴)			(C ⁴)
	1.6.5.	Band/10–15	C				
	1.6.6.	Band/30				C	
	1.6.7.	Band/Band	C ⁵				
C2 Sclero	1.7.1.	= 1.6.1.			C		C
	1.7.2.	= 1.2.2.					B
	1.7.3.	Local pads	(C ⁶)				
C3	1.8.1.	II/drug				B ⁷	
C4b (LDS)	1.10.1.	II/0				B	
C5	1.11.1*	multiple			B	B	B
C6	1.12.1*	multiple	A			B	
DVT Prevention	2.1.1.*	multiple		A–B	A–B		
flight	2.2.1.	20/0			B		
	2.2.2.	14–17/0		B			
DVT Therapy	2.3.1.	34–46/0					B
	2.3.2.	Band/0	B				
	2.3.3.	Band/II/0	B			B	
PTS Prevention	2.4.1.	III/0					A
	2.4.2.	20–40/"Placebo"			(B ⁸)	(B ⁸)	
	2.4.3.	III/0					A
Lymphoedema	3.1.1.	Band/stock class?	B				
	3.1.2.	Band/Band+MLD	(B ⁹)				
	3.1.3.	II/II+electrostim.				(C ¹⁰)	
	3.1.4.	III/III+MLD					(C ¹¹)

* = Cochrane reviews

Comparison: numbers = mmHg of stockings, I–III = compression classes, Band. = bandages

"/" = versus, e.g. "Band/0" = Bandage compared versus no compression

Stocking classes A, I, II, III: mmHg according to CEN A,B,C = Level of Recommendation

¹ variable duration of the same compression compared

² compression + physical therapy compared with no therapy

³ stocking + drug better than either treatment on its own

⁴ comparison between 3 types of compression for one week: no difference of pain level

⁵ Panelast less bleeding than non-adhesive crepe

⁶ comparison of different pads under the same bandage

⁷ no significant difference between drug and stocking

⁸ "Placebo" stocking = 1–2 sizes too large stocking, no significant differences

⁹ both groups had bandages, MLD+bandage is more effective than bandage alone

¹⁰ both groups had stockings, additional electrostimulation: no benefit

¹¹ both groups had sleeves, MLD does not add benefit

(MLD= manual lymph drainage)

Appendix II

Outcome Parameters for Future Trials on Compression Therapy

1.1.–3.1. refer to the indications in the document, C1–C6 to the clinical stages of the CEAP classification

	1.1. symptoms	1.2. C1 sclero	1.3. C2 A	1.4. C2 S	1.5. C2 pregn.	1.6. C2 surg
<i>Clinical signs</i>						
Suppression/worsening of signs		Y	Y	Y	Y	
Reduction/progression of C-class			Y	Y	Y	
Visibility		Y	Y	Y	Y	
Swelling, consistency	Y	Y				
Skin changes (area, color, skin consistency)		Y	Y		Y	
Signs of inflammation		Y	Y		Y	
Incidence of complications		Y	Y	Y	Y	Y
Recurrence		Y				Y
<i>Subjective symptoms</i>						
Pain	Y	Y	Y	Y	Y	Y
Heaviness	Y	Y	Y	Y	Y	Y
Feeling of swelling	Y	Y	Y	Y	Y	Y
Cramps	Y	Y	Y	Y	Y	Y
Itching	Y	Y	Y	Y	Y	Y
Cosmetic appearance	Y	Y	Y	Y	Y	Y
Patient's satisfaction	Y	Y	Y	Y	Y	Y
QOL	Y	Y	Y	Y	Y	Y
Recurrence	Y	Y		Y		Y
<i>Objective findings</i>						
<i>Venous Morphology</i>						
Duplex		Y	Y	Y	Y	
Venous diameter/area	Y	Y	(y)	Y	Y	
Venous wall thickness	Y	Y			Y	
Venous occlusion (clot)	Y	Y				
Phlebography						
MRI					?	
Phleboscans						
<i>Venous Function</i>						
Duplex	Y			Y	Y	
Reflux time	Y		(y)	Y	Y	
Velocity	Y				Y	
Plethysmography	Y			Y	Y	
Capacitance	Y		Y		Y	
Outflow	Y				Y	
Pumping function	Y		Y		Y	
Filtration	?				Y	
Phlebodynamometry	?				(Y)	
Pumping function						
Limb volume	Y				Y	
Skin thickness	Y				Y	
Water content	Y				Y	
Lymphoscintigraphy						
Indirect lymphography						
Skin temperature	Y					
Skin perfusion	Y					
<i>Socioeconomy</i>						
Cost-effectiveness	Y		Y	Y	Y	Y
Absence of work	Y			Y	Y	Y
Duration of convalescence	Y					Y
<i>Compression therapy</i>						
Duration of use	Y	Y	Y	Y	Y	Y
Compliance	Y	Y	Y	Y	Y	Y
Activity	Y		Y	Y	Y	Y
Objective side effects	Y		Y	Y	Y	
Subjective side effects	Y		Y	Y	Y	

	1.7. C2 sclero	1.8. C3	1.9. C4a	1.10. C4b	1.11. C5	1.12. C6
<i>Clinical signs</i>						
Suppression/worsening of signs	Y		Y	Y	Y	Y
Reduction/progression of C-class	Y	Y	Y	Y		Y
Visibility		Y	Y	Y		
Swelling, consistency	Y	Y		Y	Y	Y
Skin changes (area, color, skin consistency)	Y	Y		Y		Y
Signs of inflammation	Y			Y	Y	
Incidence of complications	Y			Y	Y	Y
Recurrence	Y	Y		Y	Y	Y
<i>Subjective symptoms</i>						
Pain	Y	Y			Y	Y
Heaviness	Y	Y		Y	Y	Y
Feeling of swelling	Y	Y		Y	Y	Y
Cramps	Y	Y		Y		Y
Itching	Y	Y	Y	Y		Y
Cosmetic appearance	Y			Y		
Patient's satisfaction	Y	Y	Y	Y	Y	Y
QOL	Y			Y	Y	Y
Recurrence	Y			Y	Y	Y
<i>Objective findings</i>						
<i>Venous Morphology</i>						
Duplex	Y	Y		Y	Y	see Table 8
Venous diameter/area						
Venous wall thickness	Y					
Venous occlusion (clot)	Y		Y		Y	
Phlebography			Y			
MRI		Y		Y		
Phleboscans						
<i>Venous Function</i>						
Duplex				Y		Y
Reflux time						Y
Velocity						Y
Plethysmography						Y
Capacitance						
Outflow						
Pumping function				Y	Y	Y
Filtration		Y				
Phlebodynamometry						
Pumping function					Resistance	
Limb volume		Y		Y	Y	
Skin thickness				Y		
Water content		Y		Y		
Lymphoscintigraphy				Y		
Indirect lymphography				Y		
Skin temperature			Y	Y		
Skin perfusion				Y		
<i>Socioeconomy</i>						
Cost-effectiveness		Y		Y	Y	Y
Absence of work				Y	Y	Y
Duration of convalescence				Y	Y	Y
<i>Compression therapy</i>						
Duration of use		Y	Y	Y	Y	Y
Compliance		Y		Y	Y	Y
Activity		Y		Y	Y	Y
Objective side effects		Y		Y	Y	Y
Subjective side effects		Y		Y	Y	Y

	2.1. DVT Prev.	2.2. Phlebitis	2.3. DVT Ther	2.4. PTS Prev.	3.1.1. Lymphoed.
<i>Clinical signs</i>					
Suppression/worsening of signs		Y	Y	Y	Y
Reduction/progression of C-class				Y	
Visibility					Y
Swelling, consistency			Y	Y	Y
Skin changes (area, color, skin consistency)			Y		Y
Signs of inflammation		Y		Y	Y
Incidence of complications		Y		Y	Y
Recurrence	Y	Y	Y	Y	
<i>Subjective symptoms</i>					
Pain	Y	Y	Y	Y	
Heaviness	Y	Y		Y	Y
Feeling of swelling	Y	Y		Y	Y
Cramps	Y	Y		Y	
Itching		Y		Y	
Cosmetic appearance					Y
Patient's satisfaction	Y	Y	Y	Y	Y
QOL		Y	Y	Y	Y
Recurrence	Y	Y	Y	Y	
<i>Objective findings</i>					
<i>Venous Morphology</i>					
Duplex	Y	Y	Y	Y	Y
Venous diameter/area			Y		
Venous wall thickness					
Venous occlusion (clot)	Y	Y	Y	Y	
Phlebography			Y	Y	
MRI			(Y)	Y	
Phleboscans					
<i>Venous Function</i>					
Duplex			Y	Y	
Reflux time				Y	
Velocity				Y	
Plethysmography				Y	
Capacitance	Y			Y	
Outflow	Y		Y	Y	
Pumping function			Y	Y	
Filtration					
Phlebodynamometry				Y	
Pumping function				Y	
Limb volume	Y		Y	Y	Y
Skin thickness					Y
Water content	Y			Y	Y
Lymphoscintigraphy				Y	Y
Indirect lymphography					Y
Skin temperature					
Skin perfusion				Y	
<i>Socioeconomy</i>					
Cost-effectiveness	Y	Y	Y	Y	Y
Absence of work	Y	Y	Y	Y	Y
Duration of convalescence	Y	Y	Y	Y	
<i>Compression therapy</i>					
Duration of use	Y	Y	Y	Y	Y
Compliance	Y	Y	Y	Y	Y
Activity	Y	Y	Y	Y	Y
Objective side effects	Y	Y	Y	Y	Y
Subjective side effects	Y	Y	Y	Y	Y