Graduated compression stockings as prophylaxis for flight-related venous thrombosis: systematic literature review

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CRD summary
The authors of this review concluded that medium compression pressure, below-knee graduated compression stockings are effective in preventing flight-related deep vein thrombosis, but not superficial venous thrombosis, in low-medium- or high-risk participants. These conclusions were drawn from a well-conducted review of the evidence.

Authors' objectives
To evaluate the effectiveness of graduated compression stockings (GCS) as prophylaxis for flight-related thrombosis in the general population.

Searching
PubMed (MEDLINE), EMBASE: Drugs and Pharmacology, CINAHL, Current Contents, ISI Web of Science, and the Cochrane Library (Issue 1,2004) were searched for relevant studies published in Chinese or English; the search terms were reported. In addition, references or citations of retrieved papers were examined to identify additional studies, and handsearches of relevant journals and searches of trial registries (e.g. the UK National Research Register) were undertaken. Unpublished trials were sought through electronic databases such as Dissertation Abstracts and trial registries such as Current Controlled Trials. Manufacturers of stockings were also contacted for any additional trials.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs) with at least one intervention and one control group evaluating the effectiveness of GCS for travelling were eligible for inclusion in the review.

Specific interventions included in the review
Studies evaluating any type of GCS for air travel in a healthy population were eligible for inclusion. Controls receiving no prophylaxis or another method, such as aspirin or low molecular weight heparin, were eligible for inclusion. GCS in the included studies were below-knee length. Pressure ranged from 17 to 30 mmHg at the ankle and from 14 to 20 mmHg below the knee.

Studies including air-flight, non-hospitalised participants were eligible for inclusion. Inclusion was not limited by gender, age, risk for deep vein thrombosis (DVT) or presence of any pre-existing illness. The included studies specifically evaluated GCS in participants with a low-medium or high risk of DVT.

Participants included in the review
Studies including air-flight, no-hospitalized participants were eligible for inclusion in the review. Inclusion was not limited by sex, age, risk for DVT (deep vein thrombosis) or presence of any pre-existing illness. The included studies specifically evaluated GCS in participants with low-medium or high risk of DVT.

Outcomes assessed in the review
Studies measuring thrombosis, including DVT and superficial venous thrombosis (SVT), using ultrasound scan were eligible for inclusion. The secondary outcomes were oedema, subjective feelings such as discomfort or pain, and acceptability or tolerability.

How were decisions on the relevance of primary studies made?
Decisions about the inclusion or exclusion of primary studies were made after discussion between two reviewers.
Assessment of study quality
Study validity was assessed according to the following criteria: inclusion and exclusion criteria, use of a sample size calculation, baseline comparability of the groups, masked or blinded outcome assessment, and use of intention-to-treat analysis. The validity assessment was performed and double-checked by both authors, with any disagreements resolved through discussion.

Data extraction
The data extraction was performed and double-checked by both authors. Key characteristics of the included studies were extracted onto a standardised form. The relative risk (RR), with 95% confidence interval (CI), was calculated for each included study for the incidence of DVT and SVT.

Methods of synthesis
How were the studies combined?
RRs derived from the primary studies were pooled in a weighted fixed-effect meta-analysis.

How were differences between studies investigated?
Statistical heterogeneity was assessed using the chi-squared test. Subgroup analyses were conducted for baseline risk of DVT and intention-to-treat analysis.

Results of the review
Nine RCTs (n=2,484) were included in the review.

Randomisation methods were not reported for the included RCTs, and none of these trials used blinding.

All 9 RCTs evaluated the incidence of DVT, though three were excluded from the meta-analysis since they had no incidence of DVT in either groups. GCS were more effective than no GCS in preventing DVT in the remaining 6 trials (RR 0.08, 95% CI: 0.03, 0.23, p<0.00001).

Eight studies (n=1,651) evaluated the incidence of SVT. Four RCTs reporting no incidence of SVT in either group were excluded from the meta-analysis. GCS were more effective than no GCS in preventing SVT in 3 of the 4 remaining trials (overall RR 0.67, 95% CI: 0.24, 1.87, p=0.4).

Intention-to-treat analysis of participants lost to follow-up or diagnosed with DVT or SVT (8 RCTs, n=1,772) favoured GCS over no GCS (RR 0.53, 95% CI: 0.39, 0.72, p<0.0001).

GCS were more effective than no GCS in preventing DVT in 2 RCTs of participants at high risk of DVT (RR 0.08, 95% CI: 0.02, 0.34, p=0.0006).

GCS were more effective than no GCS in preventing DVT in 3 RCTs of participants at low-medium risk of DVT (RR 0.14, 95% CI: 0.03, 0.79, p=0.03).

Authors’ conclusions
Medium compression pressure, below-knee graduated compression stockings appear effective in preventing flight-related DVT, but not SVT, in low-medium- or high-risk participants.

CRD commentary
The question for this review was well-defined in terms of the participants, interventions, outcomes and study design. Attempts were made to identify all relevant published and unpublished trials through a variety of sources, though there was the possibility that studies published in languages other than Chinese or English might have been overlooked. Validity was assessed using appropriate criteria and attempts were made to minimise errors and bias throughout the review process. The selected primary studies were described in adequate detail and the methods used to synthesise the
data from these studies were appropriate. In summary, this was a well-conducted review and the authors' conclusions appear reliable.

**Implications of the review for practice and research**

*Practice:* The authors stated that GCS should be used to protect against flight-related thrombosis, but higher compression pressure is only indicated for participants at high risk of DVT. They also stated that it is essential to have GCS that are sized and fitted correctly, and that high-risk participants for DVT should be advised to use GCS along with other preventive measures.

*Research:* The authors stated that "Given lower occurrences of DVT and SVT after flights, studies with larger numbers of participants are needed to detect the effect size. The decision on the number of participants should be based on a prior sample size calculation. Prolonged observation periods might be necessary to evaluate the occurrence of delayed DVT or SVT and pulmonary embolism. Repeated measurements may be valuable". They also stated the need to study the optimal compression pressure of GCS to be used by airline passengers and to evaluate the prophylaxis of GCS in comparison with other prophylactic measures such as antithrombotic medication.

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**Other publications of related interest**


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