Knee versus thigh length graduated compression stockings for prevention of deep venous thrombosis: a systematic review

CRD summary
This review evaluated the effectiveness of knee-length elastic stockings for the prevention of deep vein thrombosis in different populations. The authors concluded that knee-length stockings are effective in reducing risk in hospitalised and long haul flight populations. Differences between the included studies, and other limitations, mean that the reliability of these conclusions is unclear.

Authors' objectives
To determine the effectiveness of knee-length elastic stockings for the prevention of deep vein thrombosis (DVT) in hospitalised patients and high-risk long distance air travellers.

Searching
MEDLINE, EMBASE, CINAHL, and the Cochrane Library were searched from January 1976 to June 2005; the search terms were reported. Searches using references from original articles were also undertaken.

Study selection
Study designs of evaluations included in the review
Randomised, controlled, prospective clinical trials were eligible for inclusion.

Specific interventions included in the review
Studies comparing knee-length and thigh-length compression stockings for the prevention of DVT were eligible for inclusion.

Participants included in the review
Studies including airline passengers or hospitalised patients undergoing orthopaedic, abdominal, urological, gynaecological, ear nose and throat (ENT), neurosurgical and gastrointestinal procedures were eligible for inclusion. The included studies identified long haul flight patients, and hospitalised patients undergoing general surgery, orthopaedic procedures (hip and knee replacement), breast surgery, oncology, ENT, urology, vascular, neurosurgery and gastrointestinal surgery.

Outcomes assessed in the review
Studies measuring the incidence of DVT in either above or below knee deep veins were eligible for inclusion. Studies used fibrinogen uptake scan, venography or duplex ultrasonography to diagnose DVT.

How were decisions on the relevance of primary studies made?
The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
To be included in the review, the interpretation of diagnostic tests in primary studies had to be blinded, with each positive test evaluated independently by two radiologists. No other details were reported.

Data extraction
Data on diagnostic test used to detect DVT, population and outcomes were extracted. The odds ratio (OR) with 95% confidence intervals (CIs) for DVT occurrence was calculated for each study. The authors did not state how many reviewers performed the data extraction.

Methods of synthesis
How were the studies combined?
ORs were pooled using a random-effects or fixed-effect model in the presence or absence of heterogeneity, respectively. Publication bias was not assessed.

How were differences between studies investigated?
The chi-squared test was used to assess statistical heterogeneity. Clinical heterogeneity was investigated using meta-regression to identify the benefits of knee-length stockings in the different populations. A sensitivity analysis was also carried out to account for trials (n=4) reporting no incidence of DVT in one of the treatment groups.

Results of the review
Fourteen randomised clinical trials (n=3,074: 1,478 (reported as 1,568) assigned knee-length stockings, 1,596 (reported as 1,696) assigned thigh-length or no stockings) were included in the review.

Three trials reported no occurrences of DVT and were not included in the pooled results. The remaining trials indicated significantly fewer occurrences of DVT in patients using knee-length stockings, compared with patients using thigh-length or no stockings: the OR (random-effects) was 0.35 (95% CI: 0.13, 0.97, p=0.043). The inclusion of studies reporting no DVT events in either treatment arm gave an OR (random-effects) of 0.42 (95% CI: 0.18, 0.98, p=0.046).

The subgroup analysis reported a significant difference between knee- and thigh-length stockings in 6 of the 9 long haul passenger trials (OR 0.08, 95% CI: 0.03, 0.22, p<0.001); there was no evidence of statistical heterogeneity. By contrast, there was no significant difference in hospitalised populations (random-effects OR 1.01, 95% CI: 0.35, 2.90, p=0.99) and significant heterogeneity was reported.

The meta-regression analysis indicated a significant effect for type of population, with knee-length stockings being more effective in long haul passengers than in hospitalised patients (OR 0.14, 95% CI: 0.04, 0.57).

Cost information
The authors reported a saving of £5 per pair of knee-length graduated compression stockings, which equates to a saving of approximately £1.2 million per annum for hospitals with 250,000 patients.

Authors' conclusions
Knee-length graduated compression stockings can significantly reduce the risk of DVT in hospitalised and long haul flight populations, and may be beneficial in terms of patient compliance and reduced costs.

CRD commentary
The review question was clear and appropriate inclusion criteria were reported for the participants, interventions, outcomes and study designs. Attempts were made to identify all relevant published literature by searching several electronic databases and other appropriate sources. However, there was no apparent search for unpublished material and no tests for publication bias were carried out, which means it is possible that potentially relevant papers were missed. The processes used to select the studies and extract the data were not reported, thus the potential for reviewer error and bias cannot be ruled out. In addition, the limited validity assessment and study details may affect the reliability of the included studies and the conclusions drawn from the data synthesis.

Despite some analysis of heterogeneity, the pooling of trials with no events or small numbers of events might not have been appropriate, and sample sizes were small with the majority of participants being long haul passengers. In addition, the subgroup analysis identified no significant difference for stocking type in hospitalised patients, which does not reflect the authors’ conclusions. The article also contained inconsistencies in the reported total number of participants and the depiction of risk differences rather than ORs in some forest plots. Given such limitations, the reliability of the authors' conclusions is unclear.

Implications of the review for practice and research
Practice: The authors stated that the review provided some evidence for the use of knee-length stockings in hospital practice. However, conclusions about the efficacy of knee-length stockings are limited by the use of other forms of thrombosis treatment, which confounded the results.

Research: The authors stated that larger multicentre randomised controlled trials should be carried out on hospitalised patients to determine the effectiveness of knee-length graduated compression stockings in comparison with thigh-length stockings.

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