Mechanical thromboprophylaxis in critically ill patients: a systematic review and meta-analysis

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CRD summary
The authors concluded that there was little evidence about the effects of compression and pneumatic devices for thromboprophylaxis in critically ill patients, and the place of mechanical devices in these patients is unknown. There were limitations to the review but, overall, the review was well-conducted and the authors' conclusions reflect the limited identified evidence.

Authors' objectives
To evaluate the effects of compression and pneumatic devices for thromboprophylaxis in critically ill patients.

Searching
PubMed, the Cochrane Library, National Guideline Clearinghouse, and databases of the Agency for Healthcare Research and Quality and the Joanna Briggs Institute were searched from 1990 to present; the search terms were reported. No language restrictions were applied to the search but only abstracts of non-English language reports were included. In addition, the reference lists of published studies were screened.

Study selection
Randomised controlled trials (RCTs) and observational studies that evaluated compression and pneumatic devices for thromboprophylaxis in intensive care patients were eligible for inclusion. Studies of intensive care patients, such as trauma, surgical, medical and coronary patients, were included; studies that did not identify the subgroups of intensive care patients included were excluded. Surveys of compression devices were also eligible but, since they did not involve evaluation of the interventions, the results are not reported in this abstract.

The included RCTs evaluated graduated compression stockings and pneumatic, intermittent pneumatic and sequential compression devices. Comparisons included another compression device, no compression device, foot pump and low molecular weight heparin. The RCTs included trauma patients and patients aged over 70 years with a myocardial infarction. All but one RCT assessed deep venous thrombosis; one study only assessed compliance. The RCTs assessed outcomes using a variety of methods (e.g. plethysmography, fibrinogen uptake test and Doppler sonography). Other outcomes included pulmonary embolism, mortality and venous volume.

All included observational studies were prospective. They evaluated different types of prophylaxis, all of which included some form of pneumatic or compression device. The studies included medical, surgical/medical and trauma patients. Most of the observational studies assessed rates of deep vein thrombosis, pulmonary embolism or venous thromboembolism.

Two reviewers independently selected the studies.

Assessment of study quality
Validity was assessed by considering the potential for selection bias (sample, sample size, response rates), performance bias (intervention), detection bias (diagnostic tests used to assess outcome and actual outcomes measured) and attrition bias.

Two reviewers independently assessed validity, with any discrepancies resolved through consensus.

Data extraction
For each study, the numbers and percentages of patients with the outcomes of interest were presented for each treatment group, together with the level of statistical significance of the difference between treatment groups.
Two reviewers independently extracted the data, with any discrepancies resolved through consensus.

**Methods of synthesis**
The studies were grouped by study design and characteristics described. Pooled risk ratios (RRs) with 95% confidence intervals (CIs) were calculated using data from RCTs with comparable populations, controls and outcomes, using random-effects and fixed-effect models. Publication bias was assessed for RCTs using a funnel plot.

**Results of the review**
Twenty-one studies were included, of which five were RCTs (n=811) and thirteen were prospective observational studies (n=3,324).

**RCTs.**
In one study, the outcome assessor was blinded. Only two RCTs were comparable and used the same control intervention. There was no significant difference in the incidence of deep venous thrombosis between intermittent pneumatic compression devices and low molecular weight heparin (random-effects RR 2.37, 95% CI: 0.57, 9.90; two studies, n=562). The results were similar when using a fixed-effect model. The funnel plot was symmetrical and provided no evidence of publication bias.

**Observational studies.**
The incidence of deep vein thrombosis in intensive care patients ranged from 11 to 56% when no treatment was used, from 7.4 to 40% when pharmacological prophylaxis was used, and from 0 to 33% when mechanical prophylaxis was used. Two studies reported incidences of 13% and 31%, respectively, when both pharmacological and mechanical prophylaxis were used. The authors stated that the observational studies were difficult to interpret because of methodological problems.

**Authors' conclusions**
There was little evidence about the effects of compression and pneumatic devices for thromboprophylaxis in critically ill patients. The place of mechanical devices in these patients is unknown.

**CRD commentary**
The review question was stated clearly although inclusion criteria for the study design and outcomes were broad. Several relevant sources were searched but only limited attempts were made to minimise language bias (for non-English language publications, only information in abstracts was included). No attempts were made to locate unpublished studies and the assessment of publication bias, using a funnel plot of RCTs, was of limited value given the small number of studies. Appropriate methods were used to minimise reviewer error and bias during the review process. Validity was reported as having been assessed but, for RCTs, only blinding was reported. It appears appropriate to focus on evidence from RCTs and to only pool data from comparable RCTs. There were limitations to the review but, overall, it was well-conducted and the authors’ conclusions reflect the limited identified evidence.

**Implications of the review for practice and research**
Practice: The authors stated that until further evidence is available, thromboprophylaxis in critically ill patients will be guided by recommendations (see Other Publications of Related Interest).

Research: The authors stated that future studies need to determine if there is any advantage to be gained by adding compression and pneumatic devices to mainstream pharmacological thromboprophylaxis regimens; large-scale multisite trials may be required. It would be helpful if future studies used similar methods to measure the outcomes.

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