Non-pharmacological management of orthostatic hypotension after spinal cord injury: a critical review of the literature
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CRD summary
The authors concluded that there was inconclusive evidence about compression and pressure, upper body exercise and biofeedback for controlling orthostatic hypotension during rehabilitation in spinal cord injury; functional electrical stimulation of the legs showed the most promise. Limitations in the review methods and reporting of study quality undermined the reliability of the findings about functional electrical stimulation.

Authors' objectives
To evaluate the effects of non-pharmacological management of orthostatic hypotension during rehabilitation in people with spinal cord injury.

Searching
MEDLINE via PubMed, EMBASE and Cochrane Central Register of Controlled Trials were searched from inception to April 2007 for English-language studies. Search terms were not reported. Reference lists were screened.

Study selection
Case studies, parallel-group trials and cross-over studies (randomised or quasi-randomised) that evaluated non-pharmacological management of orthostatic hypotension during an orthostatic challenge in patients with spinal cord injury were eligible for inclusion. Patients could be of any age or gender with any duration of time since spinal cord injury and any level or completeness of spinal cord injury. Studies that assessed modifications of diet were excluded. Studies had to assess systolic blood pressure under controlled and intervention conditions. The review also assessed diastolic blood pressure, patient perception and heart rate.

The included studies evaluated compression and pressure applied to the abdomen and/or legs, upper body exercise, functional electrical stimulation applied to the legs and biofeedback. Patients ranged in age from 29 to 41 years. Most patients were male (95%) and most had cervical lesions; others had thoracic lesions. Where reported, studies included patients in the acute post-injury phase (three to nine weeks) and chronic phase (77 months to 12 years). Most studies provided the orthostatic challenges using head-up tilting.

One reviewer selected studies.

Assessment of study quality
One reviewer assessed validity using the Downs and Black checklist.

Data extraction
Where possible, systolic blood pressure and diastolic blood pressure and heart rate were extracted for control and intervention conditions.

The authors stated neither how data were extracted for the review nor how many reviewers performed the data extraction.

Methods of synthesis
The studies were grouped by type of intervention and combined in narrative synthesis. Some differences between studies were discussed in the review.

Results of the review
Thirteen studies were included (n=138). Sample size ranged from one to 27. Study designs were not clearly reported.
Compression and pressure to the abdomen and/or legs: Three studies (n=12 to 27). Two studies reported an increase in systolic blood pressure and one study reported attenuation of diastolic blood pressure, but not systolic blood pressure, with use of gait harness while sitting. Two studies reported no change in heart rate between intervention and control conditions.

Functional electrical stimulation applied to the legs: Six studies (n=5 to 16). The authors stated in the discussion that these studies included two randomised controlled trials. Five studies reported some attenuation of systolic blood pressure under intervention conditions. One study reported an increase in systolic blood pressure during both intervention and control conditions. Four studies reported no change or a decrease in heart rate in intervention compared to control conditions and two reported an increase.

Upper body exercise: Two studies (n=10 and 12). One study reported a significant attenuation of the fall in systolic blood pressure 24 hours after maximal arm cranking exercise. One study reported a fall in blood pressure associated with upper arm exercise compared with control.

Biofeedback: Two studies (n=1 and 2). Both case studies reported attenuation of fall in systolic blood pressure associated with biofeedback.

Authors' conclusions
There was inconclusive evidence about compression and pressure, upper body exercise and biofeedback for controlling orthostatic hypotension during orthostatic challenge in patients with spinal cord injury. Functional electrical stimulation of the legs showed the most promise.

CRD commentary
The review question was clearly stated. Inclusion criteria for intervention, participants and study design were broad. Several relevant sources were searched. No attempts were made to minimise publication and language biases, so some relevant studies may have been missed. Methods were not used to minimise reviewer error and bias during the selection of studies or assessment of validity; these limitations were acknowledged by the authors. Methods used to extract data were not described, so it was unknown whether efforts were made to reduce reviewer errors and bias. The authors stated that they assessed validity using a specified checklist, but did not report results from this assessment and so results from these studies and any synthesis may not be reliable. In view of the diversity among studies, a narrative synthesis with studies grouped by type of intervention was appropriate, although the synthesis took no account of study quality. The authors’ conclusions about the inconclusive evidence reflected the limited evidence presented. Evidence about functional electrical stimulation was based on a modest number of small studies of unknown quality. In addition, limitations in review methods undermined the reliability of the findings.

Implications of the review for practice and research
Practice: The authors stated that the use of functional electrical stimulation in clinical situations could not be recommended until further research was conducted in representative samples.

Research: The authors did not state any implications for research.

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