CRD summary
The review found that, based on low quality evidence, available treatments for varicose veins appeared safe and surgery appeared effective long term. Less invasive treatments caused less periprocedural disability and pain but their effectiveness was supported only by short-term studies. These conclusions require some caution in interpretation due to large differences between the included studies.

Authors' objectives
To evaluate the benefits and harms of different treatments for varicose veins.

Searching
MEDLINE, EMBASE, Current Contents, Cochrane Central Register of Controlled Trials (CENTRAL), Web of Science, Scopus and Science Citation Index were searched to February 2008. There were no language restrictions. There was an ongoing check for new publications. Reference lists of included studies were inspected. Experts were consulted. The search strategy was available on request.

Study selection
Randomised controlled trials (RCTs) and cohort studies that compared treatments for varicose veins (surgery, sclerotherapy, percutaneous endovenous thermal interventions or conservative management with compression stockings) were eligible for inclusion. Studies were required to report varicose vein recurrence, patient satisfaction, aesthetics, return to work, pain and/or procedure-related complications (wound-related and/or systemic).

Participants in the included studies had a mean age of 49 years and 70% were women. Participant characteristics, interventions, comparisons and outcome measures varied widely between studies. In some studies sclerotherapy was restricted to participants with specific clinical characteristics. Clinical outcomes were measured by clinical encounter or record review. Patient satisfaction, pain and quality of life were measured by questionnaires. Many studies reported surrogate outcomes (such as ultrasound measurements) rather than clinical outcomes. Mean follow-up was 31 months (range three months to 10 years).

Two reviewers independently selected the studies. Disagreements were resolved by consensus or arbitration by a third reviewer.

Assessment of study quality
Items for validity assessment included randomisation, allocation concealment, blinding of outcome assessment, follow-up duration, losses to follow-up, baseline comparability of groups, adjustment for confounding, funding source and outcome ascertainment. The overall quality of evidence was graded from high to very low using the GRADE framework.

Two reviewers independently assessed study validity. Disagreements were resolved by consensus or arbitration by a third reviewer.

Data extraction
All data were dichotomous. Relative risks (RRs) with 95% confidence intervals (CIs) were extracted or calculated.

Two reviewers independently extracted data. Disagreements were resolved by consensus or arbitration by a third reviewer.

Methods of synthesis
Studies were combined to calculate pooled relative risks with 95% CIs using a random-effects model. Heterogeneity was assessed with I². Subgroup, sensitivity and meta-regression analyses were planned or undertaken to examine the effects of study quality, participant characteristics (such as gender), disease severity, follow-up duration and exclusion.
of short-term studies.

**Results of the review**

Thirty-nine studies were included (8,285 participants, range 28 to 733): 29 RCTs, one quasi-RCT and nine observational studies. The overall quality of evidence was rated as low to very low. Five RCTs were rated as having adequate allocation concealment (for four of these the only descriptor in the review was sealed envelopes). Two RCTs used blinded outcome assessment. Common limitations of observational studies included possible baseline differences, unblinded outcome assessment and losses to follow-up that were high or unreported and unequal between study arms. Outcome ascertainment was adequate in all studies. Most studies failed to report funding source. Seven were commercially funded.

Surgery was associated with a non-statistically significant reduced risk of varicosity recurrence compared to liquid sclerotherapy (RR 0.56, 95% CI 0.29 to 1.06; 10 studies). This difference was statistically significant when analysis was restricted to studies with at least two years' follow-up (RR 0.45, 95% CI 0.22 to 0.93; seven studies). Surgery was associated with a non-statistically significant reduced risk of varicosity recurrence when compared with all endoluminal therapies (laser, radiofrequency and foam) (RR 0.63, 95% CI 0.37 to 1.07; 16 studies). All three analyses had very high heterogeneity ($I^2 = 90\%$ to 93%).

Several studies reported that endoluminal therapies were associated with less procedure-related disability and pain than surgery. In general all treatments were well tolerated, although data on deep vein thrombosis and pulmonary embolism were sparse and poorly reported.

The review also reported comparisons of non-surgical therapies and the results of other subgroup analyses.

**Authors’ conclusions**

Based on low-quality evidence, available treatments for varicose veins appeared safe and surgery appeared effective long term. Less invasive treatments caused less periprocedural disability and pain, but their effectiveness was supported only by short-term studies.

**CRD commentary**

The objectives and inclusion criteria of the review were clear. Relevant sources were searched for studies in any language. It was unclear whether the search was restricted by publication status and potential for publication bias was not discussed. Steps were taken to minimise risks of reviewer bias and error by having more than one reviewer independently select studies, undertake validity assessment and extract data.

It was questionable whether it was appropriate to include the observational studies in meta-analysis alongside the RCTs due to the relatively poor quality of non-randomised designs. Appropriate methods were used to assess statistical heterogeneity, although high levels of heterogeneity were detected ($>90\%$) they were not explored specifically. The authors noted that the evidence was limited by low event rates, lack of long-term follow-up and use of surrogate outcomes and there was wide variation between the studies (such as interventions and participant characteristics). The authors acknowledged that the overall quality of the evidence was poor.

The authors’ conclusions require some caution in interpretation due to high levels of heterogeneity between the studies.

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

**Practice:** The authors stated that the clinical implications of the review were explained in the clinical practice guidelines of the Society for Vascular Surgery and the American Venous forum.

**Research:** The authors stated a need for RCTs to compare newer and less invasive therapies with standard surgical procedures for varicose veins. Studies should stratify participants by disease severity, be of long duration (over five years), assess patient-important outcomes, use standardised disease-specific outcomes tools and consider cost-effectiveness. Randomisation to clinician rather than treatment was recommended.

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