CHIVA method for the treatment of varicose veins

Review information

Review number: 1671

Authors

Sergi Bellmunt-Montoya[1], Jose Maria Escribano[2], Jaume Dilme[1], Maria José Martinez-Zapata[3]

[1]Angiology, Vascular and Endovascular Surgery, Hospital de la Santa Creu i Sant Pau, IBB Sant Pau, Barcelona, Spain
[2]Angiology, Vascular and Endovascular Surgery, Hospital Universitario Vall d'Hebron, Barcelona, Spain
[3]Iberoamerican Cochrane Centre. Universitat Autònoma de Barcelona. Institute of Biomedical Research Sant Pau (IIB Sant Pau), Barcelona, CIBER Epidemiología y Salud Pública (CIBERESP), Spain, Barcelona, Spain

Citation example: Bellmunt-Montoya S, Escribano JM, Dilme J, Martinez-Zapata MJ. CHIVA method for the treatment of varicose veins. Cochrane Database of Systematic Reviews 2012 , Issue 2 . Art. No.: CD009648. DOI: 10.1002/14651858.CD009648 .

Contact person

Sergi Bellmunt-Montoya

Vascular Surgeon
Angiology, Vascular and Endovascular Surgery
Hospital de la Santa Creu i Sant Pau, IBB Sant Pau
Sant Quinti No. 89
Barcelona
08041
Spain

E-mail: sbellmunt@santpau.cat

Dates

Assessed as Up-to-date:	22 December 2012
Date of Search:	6 November 2012
Next Stage Expected:	31 January 2013
Protocol First Published:	Issue 2 , 2012
Review First Published:	Not specified
Last Citation Issue:	Issue 2 , 2012

What's new

Date	Event	Description

History

Date	Event	Description

Abstract

Background

Many different surgical approaches are available to treat varicose veins secondary to chronic venous insufficiency. Ambulatory conservative haemodynamic correction of venous insufficiency (CHIVA) is one of the least invasive techniques and is based on venous hemodynamics with preservation of the superficial venous system.

Objectives

To compare the efficacy and safety of the CHIVA method with other therapeutic alternatives to treat varicose veins.

Search methods

The Cochrane Peripheral Vascular Diseases Group Trials searched the Specialised Register (November 2012), CENTRAL (2012, Issue 10) and clinical trials databases. The authors searched Pubmed and EMBASE (December 2012). There was no language restriction. We contacted authors to obtain more information when necessary.

Selection criteria

We included randomized controlled trials (RCTs) that compared the CHIVA method versus other treatments. Studies were selected and evaluated by two independent reviewers. A reviewer extracted data and performed the quantitative analysis.

Data collection and analysis

We calculated the relative risk (RR), mean difference (MD), the number of patients needed to treat for an additional beneficial

outcome (NNTB), and the number needed to treat for an additional harmful outcome (NNTH), using a 95% confidence interval (CI). The statistical program used was Review Manager 5.1.0.

Main results

Four clinical trials from among 434 publications were included with a total of 796 patients (70.5% women). Three RCTs compared the CHIVA method with vein stripping, and one RCT compared the CHIVA method with compression dressings in patients with venous ulcers. Methodological quality of the studies included in this review was low to moderate. The risk of overall bias of the studies was high because the participants and the outcome assessors were not blinded to the interventions. The primary endpoint, clinical recurrences, showed favourable results for the CHIVA method group compared to stripping (n = 721; RR 0.63; 95% CI 0.51 to 0.78; I^2 = 0%, NNTB 6; 95% CI 4 to 11) and compression dressings (n = 47; RR 0.23; 95% CI 0.06 to 0.96; NNTB 3; 95%CI 2 to 17). Only one study reported quality of life and results significantly favoured the CHIVA method.

The vein stripping group had a higher risk of side effects than the CHIVA group; specifically, the RR for bruising was 0.63 (95% CI 0.53 to 0.76; NNTH 4; 95% CI 3 to 6) and the RR for nerve damage was 0.05 (95%CI 0.01 to 0.38; I^2 = 0%; NNTH 12; 95% CI 9 to 20). There were no differences between groups regarding the incidence of limb infection or superficial vein thrombosis.

Authors' conclusions

The CHIVA method reduces recurrences of varicose veins and produces fewer side effects than vein stripping. However, studies are needed to confirm these conclusions since they are based on clinical trials with a high risk of bias.

Plain language summary

CHIVA method for the treatment of varicose veins

Chronic venous insufficiency (CVI) is a disorder in which veins have difficulty to drive blood to the heart. It can cause varicose veins, skin ulcers, and superficial or deep vein thrombosis in the legs. The CHIVA method is a minimally invasive surgical technique to treat varicose veins. This review evaluated the effectiveness and safety of the CHIVA method in CVI and included four randomised clinical trials with a total of 796 participants. The results showed that the CHIVA method reduced recurrences of varicose veins and produced less bruising and nerve damage than vein stripping. However, studies are needed to confirm these conclusions since they are based on clinical trials with methodological limitations.

Background

Description of the condition

Venous insufficiency is the inability of veins to drive blood to the heart in response to tissue drainage, thermoregulation, and hemodynamic reserve. It may involve the venous wall and valve system, posture, the muscle pump, or respiratory and venule-capillary bed factors. When referring to the syndrome of chronic venous insufficiency (CVI), all the characteristic signs and symptoms must be addressed. The most common symptoms are pain, fatigue, heaviness, warmth and swelling of the leg, all of which are more intense when standing and under environmental conditions of heat and humidity (Vanhouette 1997). The most common signs are varicose veins, reticular veins, edema, skin changes, and ulcers.

CVI is a chronic disease of multicausal origin with a slow evolution. CVI complications, such as ulcers, superficial or deep vein thrombosis and skin complications, often appear years or even decades after the onset of symptoms (Kurz 1999). The prevalence of CVI in the general population depends on the outcome considered. It has been estimated that the prevalence of trunk varicose veins ranges from 30% to 40% in the general population (Lee 2003) and that 15% of females and 9% of males have reflux confined to the superficial venous system (Allan 2000). According to Carpentier 2004, varicose veins can be detected in up to 50% of women in the general population.

The introduction of duplex scanning in the study of CVI has allowed in vivo knowledge of venous hemodynamics (Franceschi 1997). In addition to allowing the completion of a morphological study, this exploration allows mapping of the hemodynamics of the venous system, providing precise information on any changes or abnormalities (Cavezzi 2007; Coleridge-Smith 2006; Labropoulos 2005; Labropoulos 2001; Nicolaides 2000).

Treatment of CVI depends on the state of development of the disease (Agus 2001). There are several therapeutic options that can be used in combination to treat this disease. These therapies cannot cure the disease but can improve symptoms and prevent complications. Treatments for CVI include hygienic and postural measures such as elevation of the legs or walking around to keep the muscle pump working, compression therapy (Nelson 2000; Nelson 2011; O'Meara 2009), topical treatment (Aziz 2011; Cullum 2010; Jull 2008; Kranke 2004; O'Meara 2010; Palfreyman 2006), drug therapy (Martinez-Zapata 2005; O'Meara 2010), sclerotherapy (Tisi 2006), laser therapy (Flemming 1999), radiofrequency ablation (Nesbitt 2011) and surgery (Rigby 2004).

Surgical treatment for varicose veins dates back to the early 20th century when Keller described removal of the saphenous vein through a metal loop in 1905 and endoluminal stripping in 1906. Two years later Babcock first used a vein-extractor similar to that used today (Lofgren 1977). In 1966, Muller's ambulatory phlebectomy was described (Muller 1966). However, based on the available literature, treatment that involves these techniques cannot totally prevent varicose vein recurrence (Blomgren 2004; Perrin 2000; Winterborn 2004, Labropoulos 2005) or the remodelling of the venous network of subcutaneous tissue (Juan 2002). Surgery that removes saphenous veins is generally associated with varicosities or telangiectasias, and sometimes leads to a clinical cosmetic outcome that could be poorer than before surgery. These inconveniences are difficult

to justify in patients with clinical grade C2 of Clinical picture, Etiology, Anatomic distribution and Pathophysiology (CEAP) classification (Porter 1995) (Table 1).

Description of the intervention

In 1988, Franceschi described a procedure for the treatment of CVI based on venous hemodynamic with preservation of the superficial venous system. Francheschi called this procedure ambulatory conservative haemodynamic correction of venous insufficiency (CHIVA) (Franceschi 1988).

CHIVA is a strategy that can be performed via open surgery or via endovascular procedures such as laser, radiofrequency or sclerotherapy. It is based on the modification of the hemodynamics of the venous system to eliminate varicose dilatations and to preserve the saphenous vein. This theory is supported by findings showing that CHIVA decreased the diameter of the saphenous vein (1.6 to 2.6 mm) and the femoral vein (0.4 to 0.7 mm) (Escribano 2003; Mendoza 2011).

How the intervention might work

Regarding the venous hemodynamics, primary varicose veins are characterized by a retrograde circuit or a venous-venous shunt (Goren 1996). This circuit consists of a retrograde proximal reflux point (escape point) from which blood from the deep venous system is discharged into the superficial venous system, usually the saphenous veins. The hydrostatic pressure column, between the escape point and the point of re-entry into the deep venous system, generally comprises the saphenous vein and the perforating re-entry vein. This point of venous retrograde re-entry circuit drains back into the deep venous system.

The aim of the CHIVA treatment is to decrease the hydrostatic column pressure to disrupt venous-venous shunts without removing the saphenous vein and the venous drainage of the superficial tissues of the limb. The CHIVA method is a minimally invasive surgery procedure, usually performed under local anaesthesia, based on the findings of a careful analysis of the hemodynamic superficial venous network by duplex ultrasound. The principles underlying the CHIVA method are fragmentation of the venous pressure column, disconnection of venous-venous shunts, preservation of the re-entry perforators, and abolition of undrained superficial varicose veins. Fragmentation of the venous pressure column and disconnection of venous-venous shunts is generally implemented by open surgery, but can also be performed by sclerotherapy, laser, or radiofrequency.

Why it is important to do this review

CHIVA is one of the most widely used methods in several countries and is one of the few strategies that treat varicose veins without seeking their destruction.

Objectives

To evaluate the efficacy and safety of the CHIVA method compared with other procedures to treat varicose veins.

Methods

Criteria for considering studies for this review

Types of studies

Randomized controlled trials (RCTs).

Types of participants

Males and females over 18 years of age with CVI at clinical stage C2-C6 of the CEAP classification.

Types of interventions

RCTs that assess the CHIVA method compared with other procedures to treat varicose veins, such as drugs, sclerotherapy, compressive dressings and other surgical methods.

Types of outcome measures

Primary outcomes

Recurrence of varicose veins, defined as the appearance of new varicose veins after a minimum follow-up of one year.

Secondary outcomes

1. Re-treatment, defined as patients' need for a new intervention due to persistent varicose veins or new varicose veins in the same leg and the same area.

2. Clinical or aesthetic changes after a minimum follow-up of one month after the intervention, assessed by the following:

- Objective signs:
  - free from reflux, as defined by reverse flow from the deep venous system to the superficial venous system, and checked by duplex ultrasound;
  - edema, measured by the dichotomous variable edema and the continuous variables 'ankle perimeter circumference' and 'volume of the leg';
  - skin manifestations such as venous ulcers and trophic alterations, which may include telangiectasia (small red points on the skin caused by permanently opened tiny blood vessels), reticular veins (dilated veins which show as a net-like pattern on the skin), varicose veins (permanently dilated veins), or lipodermatosclerosis (a hardening of the skin which

may gain a red or brown pigmentation and is accompanied by wasting of the subcutaneous fat).

- Subjective symptoms:
  - pain;
  - cramps;
  - restless legs;
  - itching;
  - feeling of heaviness in the legs;
  - swelling;
  - paresthesias (abnormal sensations, such as prickling, burning, tingling).
- Global assessment measures:
  - disease-specific quality of life (QoL) scales (e.g. CVIIQ or Veines-QoL) or satisfaction of participants, or both.

3. Side effects

Side effects include hematoma, infection, superficial or deep venous thrombosis, lung embolism and nerve injury.

Search methods for identification of studies

There was no language restriction.

Electronic searches

The Cochrane Peripheral Vascular Diseases Group Trials Search Co-ordinator (TSC) searched the Specialised Register (last searched November 2012) and the Cochrane Central Register of Controlled Trials (CENTRAL) 2012, Issue 10, part of *The Cochrane Library*, www.thecochranelibrary.com. See Appendix 1 for details of the search strategy used to search CENTRAL. The Specialised Register is maintained by the TSC and is constructed from weekly electronic searches of MEDLINE, EMBASE, CINAHL, AMED, and through handsearching relevant journals. The full list of the databases, journals and conference proceedings which have been searched, as well as the search strategies used are described in the Specialised Register section of the Cochrane Peripheral Vascular Diseases Group module in *The Cochrane Library* (www.thecochranelibrary.com).

The following trial databases were searched by the TSC for details of ongoing and unpublished studies (November 2012) using the terms c.h.i.v.a or chiva;

World Health Organization International Clinical Trials Registry http://apps.who.int/trialsearch/

ClinicalTrials.gov (http://clinicaltrials.gov/)

Current Controlled Trials (http://www.controlled-trials.com/)

Nederlands Trials Register (http://www.trialregister.nl/trialreg/admin/rctsearch.asp)

In addition the authors searched EMBASE (Ovid plattform; last searched December 2012) and Pubmed (last searched December 2012) using the search strategies Appendix 2 and Appendix 3.

Searching other resources

We scrutinized reference lists of identified RCTs, systematic reviews and meta-analyses to find further trials. We contacted trial authors for additional information.

Data collection and analysis

Selection of studies

Two review authors (SB and MJM) independently assessed the eligibility of the studies identified in the search. In case of disagreements, a third author independently evaluated the study and discussed it with the rest of the team. We classified eligible studies as included or excluded. It was not necessary for a third review author to look at disagreements.

Data extraction and management

Two review authors (SB and MJM) collected data independently on a previously tested standardized form. Data included methodological quality, characteristics of study participants, characteristics of the intervention and control groups, and outcome characteristics of each group of participants. One review author (MJM) entered the data into Review Manager 5.1 and performed the appropriate analyses.

Assessment of risk of bias in included studies

Two review authors (SB and MJM) assessed the quality of the studies, examining the randomization method (sequence generation and allocation concealment). They also assessed the blinding of participants and investigators (caregivers and outcome assessors), the completeness of outcome data and the percentage of patients lost to follow-up.

Once this information was gathered, the authors classified each study into low, unclear or high risk of bias, based on the criteria specified in the Cochrane Handbook for Systematic Reviews of Interventions (Higgins 2011).

We also specified whether the studies calculated the sample size needed and whether they included an intention-to-treat (ITT) analysis.

Measures of treatment effect

For each study, we considered relative risk (RR) for dichotomous variables, and mean differences (MDs) for continuous variables. If the continuous variables in the studies were measured using different scales, we calculated the standardized mean difference (SMD). We also calculated the number needed to treat for an additional beneficial outcome (NNTB) and the number needed to treat for an additional harmful outcome (NNTH).

Unit of analysis issues

The unit of analysis was the individual participant.

Dealing with missing data

We contacted authors to obtain additional information.

The main analysis was an 'available case analysis', analysing data as provided in the individual studies.

Assessment of heterogeneity

We examined the characteristics of each study to determine clinical heterogeneity. We deemed an I^2 statistic greater than 50% as substantial heterogeneity. We also studied the sources of heterogeneity.

Assessment of reporting biases

We did not perform a funnel plot to assess reporting bias because we included fewer than ten studies.

Data synthesis

We estimated the global effect for each variable through a meta-analysis. We applied the statistical method of Mantel-Haenszel for dichotomous measures and the inverse variance for continuous measures, using a fixed-effect model. When I^2 was greater than 50%, we used a random-effects model. If heterogeneity was greater than 75%, we did not pool the results. We performed all statistical analyses using Review Manager 5.1. We calculated the number needed to treat to obtain a benefit (NNTB) and the number needed to treat to produce harm (NNTH), and the corresponding 95% confidence interval (CI).

Subgroup analysis and investigation of heterogeneity

We considered two sources of clinical heterogeneity to plan subgroup analysis if necessary:

1) Type of procedure used to implement the CHIVA method: open surgery, sclerotherapy, laser, radiofrequency and any other.

2) Type of comparison assessed: CHIVA versus drugs, compression dressings and other techniques

Sensitivity analysis

We conducted a sensitivity analysis to assess the strength of the results and to explain possible heterogeneity between the studies. The data was re-analysed by analysing data by intention to treat, and imputing data using the worst case scenario, that is, imputing missing values for participants who withdrew or were lost to follow-up as negative events. We did not conduct a sensitivity analyses by comparing any unpublished studies with published studies and by comparing studies with high risk of bias with those having low risk of bias due to lack of suitable data.

Results

Description of studies

See Figure 1.

Results of the search

The search identified 434 citations. After considering titles and abstracts, 15 potentially relevant papers were retrieved in full text. Finally, after reading the full text, we included ten papers reporting four randomised controlled trials. Three studies compared CHIVA with the stripping technique (Carandina 2008; Iborra-Ortega 2006; Pares 2010) and one compared CHIVA with the use of compression dressings (Zamboni 2003). We excluded the remaining five studies (Figure 1).

We contacted three authors because more information was needed and to clarify doubts regarding missing data (Iborra-Ortega 2006; Pares 2010; Zamboni 2003).

Included studies

Four included randomized clinical trials recruited a total of 796 patients (70.5% women) (Carandina 2008; Iborra-Ortega 2006; Pares 2010; Zamboni 2003) . The age of patients ranged from 47 to 63 years.

All patients had chronic venous insufficiency and a clinical stage of the CEAP classification between 2 and 6. The study of Iborra-Ortega 2006 included only patients with CEAP 2, whereas the study of Zamboni 2003 included only patients with venous ulcers, CEAP 6. Follow-up of patients also varied between studies, with a minimum of three years (Zamboni 2003) and a maximum of 10 years (Carandina 2008). Three studies compared CHIVA method with stripping (Carandina 2008; Iborra-Ortega 2006; Pares 2010) and one study compared CHIVA with compression dressings (Zamboni 2003). In all inlcuded studies the CHIVA method was implemented by open surgery.

Except for Pares 2010 study, no studies specified sample size calculation.

The funding sources was public in three studies (Iborra-Ortega 2006; Pares 2010; Zamboni 2003) , and not specified in the

other (Carandina 2008).

Excluded studies

In total we excluded five studies. Four controlled studies were excluded because they were not randomized (Maeso 2001; Solis 2009; Zamboni 1995; Zamboni 1998). One study was excluded because it was not controlled (Zamboni 1996).

Risk of bias in included studies

Overall, methodological quality of the studies included in this review was low to moderate (Summary of findings table 1). The risk of bias was generally high, mainly because the interventions were not masked to participants and outcome assessors (Figure 2; Figure 3).

Allocation (selection bias)

All studies adequately explained how the randomization sequence was generated. Only two of the four studies specified allocation concealment (Carandina 2008; Iborra-Ortega 2006). We contacted the other two authors (Pares 2010; Zamboni 2003) and they provided this information. Three studies specified that allocation was done by phone (Iborra-Ortega 2006; Pares 2010; Zamboni 2003). The Carandina 2008 study explained that allocation was blinded to the treating physicians, but did not state how the blinding was done.

Blinding (performance bias and detection bias)

Studies could not be blinded because the specific anatomical changes produced by the intervention were easily recognizable by a specialist. In one study, the Carandina 2008 study, the clinical results were evaluated by independent assessors in an attempt to compensate for this bias,

Incomplete outcome data (attrition bias)

The percentage of patients lost to follow up was less than 10% in both groups in three of the studies (Iborra-Ortega 2006; Pares 2010; Zamboni 2003) and in the intervention group in the Carandina 2008 study. However, in the conventional surgery group of the Carandina 2008 study the percentage of losses was 28%.

Selective reporting (reporting bias)

In the study of Zamboni 2003, it is not clear if recurrence data were based on ultrasound or clinical parameters. Data about ulcer healing time was incomplete and was not included in this review.

Effects of interventions

Comparison of vein stripping versus the CHIVA method

We identified three randomized trials that compared vein stripping versus CHIVA (Carandina 2008; Iborra-Ortega 2006; Pares 2010). The results of the analysis were as follows:

Primary outcome

Recurrence of varicose veins

These three studies included a total of 721 patients. The pooled result was significant and favoured the CHIVA method (RR 0.63; 95% CI 0.51 to 0.78; I^2 = 0%; NNTB 6, 95%CI 4 to 10) (Figure 4).

The sensitivity analysis comparing published studies versus non-published was not performed because all three studies were published. We did not analyse sensitivity based on the level of risk of bias because all studies had a high risk of bias. The interventions were not masked in any of the three studies.

The sensitivity analysis by intention-to-treat included 751 participants and did not change the way of the results (pooled RR 0.60; 95% CI 0.50 to 0.73; I^2 = 44%).

Secondary outcomes

Re-treatment

Only the Iborra-Ortega 2006 study reported data about re-interventions after a five-year follow-up. Five patients in each treatment group underwent re-intervention (RR 0.96; 95% CI 0.30 to 3.11).

Clinical or aesthetic changes

- Objective signs:

1. "Free from reflux", checked by echo-doppler: Two studies provided information on this variable (Carandina 2008; Pares 2010). They had a combined total of 625 patients but their data were not pooled due to the high heterogeneity (I^2 = 76%). However, in both studies the results significantly favoured the CHIVA method.
2. The outcome "Edema" was not reported in the included studies
3. "Aesthetic improvement reported by the patient" was reported in the Iborra-Ortega 2006 study as a dichotomous outcome. There were no significant differences between the interventions at five-year follow-up (RR 1.03; 95% CI 0.90 to 1.18). In the Carandina 2008 study with 124 patients "Aesthetic improvement reported by the patient" was described as a continuous outcome. There were no significant differences between the interventions at ten-year follow up (MD -0.16; 95% CI -2.66 to 2.34). "Aesthetic improvement reported by the investigator" was reported in the Iborra-Ortega 2006 study as a dichotomous outcome. There were no significant differences between the interventions at five-year follow up (RR

1.12; 95% CI 0.85 to 1.48).

- Subjective symptoms:

None of the three studies specifically measured subjective symptoms. Related outcomes were:

1. Iborra-Ortega 2006 and Pares 2010 reported the outcome "Cure or no clinical symptoms" in a total of 601 patients. The pooling data were significant favouring CHIVA method (RR 1.73, 95% CI 1.36 to 2.19; I^2 = 0%).
2. Iborra-Ortega 2006 and Pares 2010 assessed the outcome "Clinical improvement" in a total of 601 patients. The pooling data were not significant (RR 0.93, 95% CI 0.71 to 1.21; I^2 = 0%).

- Global assessment measures:

None of the included trials provided information on quality of life or participant satisfaction.

Side effects

Iborra-Ortega 2006 and Pares 2010 provided information in a total of 601 participants (Figure 5). Analyses by specific side effect were the following:

Pares 2010 included information on "Bruises". The CHIVA method reduced the number of patients with bruises compared to stripping (RR 0.63; 95% CI 0.53 to 0.76; NNTH 4; 95% CI 3 to 6). This study also reported information on "Limb infection", without significant differences between groups (RR 1.33; 95% CI 0. 38 to 4.66).

Iborra-Ortega 2006 and Pares 2010 included information on "Superficial vein thrombosis". The pooled result was not significant (RR 2.23; 95% CI 0.60 to 8.33; I^2 = 42%). The same two studies reported data on "Nerve damage". The pooled result was significant and favoured the CHIVA method (RR 0.05; 95% CI 0.01 to 0.38; I^2 = 0%; NNTH 12; 95% CI 9 to 20).

Comparison of compression dressing versus the CHIVA method

One randomized clinical trial included only patients with venous ulcers. This study compared compression with the CHIVA method in 47 patients (Zamboni 2003). The unit of analysis was the ulcer and not the individual but the data were analysed because, except for one patient, all participants had only one ulcer. The result of the outcome "Recurrence of venous ulcer" significantly favoured the CHIVA method (RR 0.23; 95% CI 0.06to 0.96; NNTH 3; 95% CI 2 to 17). The outcome "Cure of venous ulcer" showed no significant differences (RR 1.04; 95% CI 0.93 to 1.17).

The Zamboni 2003 study assessed "Quality of life" measured by the SF-36 questionnaire, but there were not numerical data in the paper. The authors concluded that CHIVA method improved significantly the quality of life after a three-year follow up.

Subgroup analysis

All four included studies implemented the CHIVA method by open surgery. Therefore we did not perform a subgroup analysis according to the procedure used to implement the CHIVA method.

Discussion

Summary of main results

This systematic review included four randomized clinical trials. All included studies assessed the CHIVA method implemented by open surgery. Three of the four trials compared the CHIVA method with the vein stripping for varicose veins, and one compared the CHIVA method with compression for venous ulcers. The results showed that the CHIVA method reduced recurrence of varicose veins compared to other methods. However, no differences in clinical improvement or cosmetic results, as perceived by patients and investigators, were detected between groups. Quality of life was only assessed in the Zamboni 2006 study and favoured the CHIVA method.

Regarding adverse effects, the CHIVA method showed a lower percentage of bruising and nerve injuries than vein stripping. The risk-benefit balance therefore favoured the CHIVA method over vein stripping.

Overall completeness and applicability of evidence

We have included all relevant studies that assessed CHIVA method for varicose veins in adults. The studies were conducted in Italy and Spain, where the CHIVA method is frequently used (Milone 2011). However, new publications show this method is implemented in other countries (Chan 2011; Mendoza 2011; Mowatt-Larssen 2012).

All participants had venous reflux and the severity of the chronic venous disease was variable, from aesthetic alterations to leg ulcers. Three studies compared the CHIVA method implemented by open surgery with vein stripping and only one clinical trial with few patients compared the CHIVA method implemented by open surgery with compression for venous ulcers. No studies comparing the CHIVA method with other surgical approaches such as sclerotherapy, laser, or radiofrequency were identified. Evidence therefore is limited to the comparison of CHIVA method implemented by open surgery versus stripping and compression.

All studies included the primary outcome 'recurrence'. The time of follow-up, from three to 10 years, was enough to adequately assess recurrence and adverse effects.

Quality of the evidence

Overall, methodological quality of the studies included in this review was low to moderate. The global risk of bias was high because participants and investigators were not blinded to interventions. Blinded assessment is not possible in clinical trials that assess vein surgery because the intervention has characteristic anatomical consequences.

Potential biases in the review process

The methodological process of our review was rigorous. The search strategy was thorough without language restrictions. We contacted the main authors of included studies for further information. All trials included in the review were funded either by public organisations or non-profit institutions. No conflicts of interest were declared.

Agreements and disagreements with other studies or reviews

Although one narrative review on the CHIVA method has been published (Mendoza 2008), we found no record of any review with pooled results. Mendoza 2008 included randomised and non-randomised clinical trials. The conclusions were that CHIVA method improved subjective and objective outcomes better or equal to stripping, had lower rate of recurrence and cost.

Authors' conclusions

Implications for practice

- The CHIVA method is more effective than stripping as it reduces clinical recurrence of varicose veins and venous ulcers. It is also safer than stripping as it produces less neuronal injury and bruising. Evidence to date only includes application of the CHIVA method with open surgery compared with varicose vein stripping.

Implications for research

- Randomized clinical trials are needed to corroborate the findings reported in this review as they are based on few studies with a high risk of bias. Quality of life should be included as an outcome of interest. It could also be of interest to compare the CHIVA method with surgical approaches other than open surgery.

Acknowledgements

The authors would like to acknowledge the contribution of the Trials Search Coordinator (Karen Welch) for running searches, managing editor (Marlene Stewart), and peer referees, editors of the PVD Group for their comments on the protocol and review and Carolyn Newey for their help in editing the manuscript.

Contributions of authors

Conceiving the review: SB, JME
Designing the review: SB, MJM
Co-ordinating the review: MJM
Designing electronic search strategy: Cochrane PVD Group editorial base
Screening search results: SB, MJM
Obtaining copies of trials: SB, MJM
Appraising quality of papers: SB, MJM
Abstracting data from papers: SB, MJM
Data management for the review: MJM
Entering data into RevMan: MJM
Analysis of data: MJM
Interpretation of data: all authors
Writing the review: MJM, SB , JME
Draft the final review: all authors
Guarantor for the review: SB, MJM

Declarations of interest

None known

Differences between protocol and review

The name of the primary outcome "Recurrence of varicosity" has been changed for "Recurrence of varicose veins" . Varicosity and *varicose veins* have the same meaning, but varicose veins is used often.

Published notes

Characteristics of studies

Characteristics of included studies

Carandina 2008

Methods	Design: Randomized controlled trial. Number of participant centres: 1. Setting: Hospital. Country: Italy. Unit of randomization: patient. Unit of analysis: patient. Follow-up: Patients were reviewed postoperatively at 1, 6, 12 months, and subsequently, after 3 years and 10 years.
Participants	Participants: 150 (75 surgery and 75 CHIVA). Sex. 33 men and 91 women Age (mean): 48-50 years. Inclusion criteria: primary chronic venous insufficiency with no history of surgery or sclerotherapy, presence of saphenofemoral reflux and incompetence of the saphenous trunk, presence of a competent deep venous system, at least one re-entry perforator located in the trunk of the saphenous and one or more veins and incompetent tributaries of the great saphenous vein. Exclusion criteria: patients 70 years old or older, patients with deficiency of the calf muscle pump, or unable to walk, diabetic patients with autoimmune diseases, malignancies, severe kidney disease, liver disease, cardio-respiratory disease, patients with previous history of deep vein thrombosis.
Interventions	1) Stripping procedure: sapheno-femoral ligation, great saphenous vein stripping from groin to knee, multiple phlebectomies of the tributaries and subfascial ligation of thigh perforating veins 2) CHIVA: saphenofemoral ligation, disconnection from the great saphenous vein of the varicose tributaries and their avulsion through cosmetic incisions. Postoperative management: CHIVA patients wore class 2 medical compression stockings above the knee for three weeks. Limbs which had been treated by saphenous stripping were bandaged to minimise bruising. Bandages were replaced with class 2 medical compression stockings above the knee after 1-3 days and then worn for 14 days. Patients were usually discharged from hospital on the day of surgery.
Outcomes	Primary outcome: recurrence of varicose veins at 10 years of follow-up. Recurrence was defined as a class C or D of the Hobbs' score and the presence of reflux on duplex ultrasonography with a demonstrate escape point. Secondary outcome: Functional or cosmetic results. Both clinical and ultrasound examinations were performed at each visit. Clinical assessment of surgical results: All limbs were examined by three independent assessors who had not been involved in previous surgical decision making and operative procedures. They assigned a score to each limb according to the method reported by Hobbs. Subsequently, patients were further analysed by duplex scanning using a standard methodology. Functional and cosmetic results were self-assessed by the patients at the time of the last examination in hospital. Assessment of recurrences: were considered varicose veins recurrence if ÷ 1) The remaining or newly formed varicose veins with diameter > 5 mm and the presence of incompetent main trunks and perforator (Hobbs' score C and D). 2) The presence of reflux on duplex ultrasonography with a demonstrable escape point and change of venous network
Notes	Sample size was specified in methods.

Risk of bias table

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "Study randomisation was by a computer-generated randomisation list of the 150 patients, structured in balanced blocks of 4 patients and blinded to the treating physicians. The allocated treatment was disclosed shortly before surgical treatment and patients were treated with saphenous stripping or CHIVA, 75 patients by each technique" Comment: Study randomisation was by a computer-generated randomisation list, structured in balanced blocks.
Allocation concealment (selection bias)	Low risk	Quote: "Study randomisation was by a computer-generated randomisation list of the 150 patients, structured in balanced blocks of 4 patients and blinded to the treating physicians. The allocated treatment was disclosed shortly before surgical treatment and patients were treated with saphenous stripping or CHIVA, 75 patients by each technique" Comment: Allocation was blinded to the treating physicians. The allocated treatment was disclosed shortly before surgical treatment
Blinding of participants and personnel (performance bias) All outcomes (participants)	Unclear risk	It is not specified if the patient was blinded.
Blinding of participants and personnel (performance bias) All outcomes (personnel)	High risk	The surgeon that applied the intervention was unblinded.
Blinding of outcome assessment (detection bias)	Low risk	Quote: "At the time of scoring the surgical outcome the assessors were unaware of the procedure each patient". Comment: The assessor was blinded.
Incomplete outcome data (attrition bias)	Low risk	There were 26 (17.3%) patients lost in ten years of follow-up, without differences between groups. The reasons of losses were not specified.
Selective reporting (reporting bias)	Low risk	The results of all outcomes pre-specified in the methods of the trial report were presented. The trial protocol was not requested from the authors.

Iborra-Ortega 2006

Methods	Design: Randomized controlled trial. Number of participant centres: 1. Setting: Hospital. Country: Spain. Unit of randomization: patient. Unit of analysis: patient. Follow-up: first week after surgery, 1, 3, 6 and thereafter annually until 5 years.
Participants	Participants:100 (49 stripping and 51 CHIVA) Sex. both sexes: 62 women and 38 men. Age: 49 (range 26 to 69) years. Inclusion criteria: presence of symptomatic varicose veins with saphenous involvement and / or perforating, or not symptomatic but, varicose veins with a big size and potential risk of complications (varicophlebitis or bleeding). Exclusion criteria: patients with alterations in the deep venous system, with a history of venous thrombosis, with previous treatment (surgery or sclerotherapy), morbidly obese patients or older than 70 years.
Interventions	1) CHIVA: according to the cartographic map, different strategies were applied: CHIVA 1 (superficial venous drainage system with a single surgical procedure), CHIVA 2 (requires two possible surgical steps to ensure the drainege of the system) and CHIVA 1+2 (with a single surgical procedure, the superficial system is not drained and therefore represents a conservative but not hemodynamic treatment). 2) Vein stripping
Outcomes	Primary endpoint: rate of complications and, clinical and hemodynamic outcomes. Secondary outcomes: type of anesthesia, surgical time, level of activity after one week of the intervention, time off work and cosmetic results at one and six months and annually, number of reoperations performed during the follow-up. Assessment: the week after surgery when the stitches were removed , at the first, third and sixth postoperative months, and annually thereafter to complete 5 years of follow-up. Assessment of recurrences: “Finally, a patient was considered cured when he was clinically asymptomatic or was better, he was pleased with the aesthetic results and the objective assessment of varicosities was not visible or they were of a diameter less than 5 mm.” “Thus, patients not included in this characterization would be considered as disease recurrence”
Notes	Grants from Fundació August Pi i Sunyer (Hospital Universitari de Bellvitge) and SEACV (Sociedad Española de Angiología y Cirugía Vascular). Sample size not stated.

Risk of bias table

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Quote: "The patients were randomized with the software Excel of Window " Comment: We assume that the generation of random sequence was perfomed by computer.
Allocation concealment (selection bias)	Low risk	Quote: "the patients were allocated by phone" Comment: There was allocation concealment because the investigator did not know the random sequence.
Blinding of participants and personnel (performance bias) All outcomes (participants)	High risk	The participants knew the intervention assigned.
Blinding of participants and personnel (performance bias) All outcomes (personnel)	High risk	The personnel knew the intervention assigned to the patient.
Blinding of outcome assessment (detection bias)	High risk	There was no blinding of outcome assessors.
Incomplete outcome data (attrition bias)	Low risk	The lossess were minimal 4% at 5-year follow-up (two patients in each group).
Selective reporting (reporting bias)	Low risk	The results of all outcomes pre-specified in the methods of the trial report were presented. The trial protocol was not requested from the authors.

Pares 2010

Methods	Design: Randomized controlled trial. Number of participant centres: 1. Setting: Hospital. Country: Spain. Unit of randomization: patient. Unit of analysis: patient. Follow-up: immediate postsurgery and 3, 6, 12, 24, 36, 48, and 60 months after surgery
Participants	Participants: 501 patients (156 striping with clinical marking, 159 stripping with duplex marking, 160 CHIVA) Sex. 147 men and 354 women Age: 48 to 50 years (SD 12) Inclusion criteria: patients diagnosed with varicose veins by a vascular surgeon in the outpatient clinic and according to the criteria of the CEAP classification of venous insufficiency. Exclusion criteria: patients with congenital venous disease, varicose veins secondary to previous thrombosis, postthrombotic side effects, sclerotherapy, recurrent varicose veins, associated systemic diseases or any patient who does not agree to participate in the study, who refuse surgery, which cannot participate in long-term monitoring or women who had been pregnant for less than 6 months.

Interventions	1) Group CHIVA: Disconnection of the point reflux and preservation of the superficial venous system drainage. Points of venous reflux were closed by ligation and division reflux of the saphenofemoral junction (preserving draining veins tributaries), ligation and division of the saphenopopliteal union (preserving the Giacomini vein drainage) or subfascial closure of perforating veins, preservation of the incompetent segments of great saphenous vein and / or short saphenous vein, removal of secondary reflux points originating the varicose vein, the preservation of re-entry points (perforating vein), and phlebectomy of collateral veins with improper drainage. Physical and Doppler ultrasound examination to identify incompetent segments. A map was produced and printed with venous images, points of reflux, the diameter of the saphenous vein and superficial and reentry points. These documents were the baseline for comparison in follow-up. 2) Stripping with clinic marking: Remove the incompetent superficial venous system. Before surgery, the surgeon decided which segments were incompetent to be removed. The decision was based on physical examination, identification of incompetent segments and points of reentry. The surgical procedure consisted of the closing of the points of reflux, by ligation and division of the saphenofemoral junction, tributaries veins in the groin or ligation and division of the safenopopliteal union or subfascial closure of perforating veins, and removal of all the great saphenous vein and / or superficial venous system or phlebectomy. 3) Stripping with duplex marking: Remove the incompetent superficial venous system. Surgical strategy was based on the closing of the points of reflux by ligation and division of the saphenofemoral junction in the groin, or ligation of tributary veins and division of the union or saphenopopliteal subfascial closure, of perforating veins , removal of only the incompetent segment of great saphenous vein and / or the superficial venous system, phlebectomy of varicose veins and closing points of reentry. The physical examination and Doppler ultrasound were used to identify incompetent segments. Authors carried out a map of varicose veins and ultrasound images were stored. Points of reflux were marked, also the diameter of the great saphenous vein and minor saphenous vein and reentry points. These documents were the baseline for comparison in follow-up. Postoperative management: pressure bandage from the groin to the foot for 48 hours, then elastic stockings for 4 weeks. Analgesic and antithrombotic prophylaxis treatment were common to all patients.
Outcomes	Primary endpoint: Recurrence rate of varicosity (using Hobbs` Classification). Secondary outcomes: Ultrasonographic recurrence of varicose veins, descriptive baseline characteristics, type of anesthesia, days of convalescence, clinical cure, clinical improvement, and complications (deep vein thrombosis, pulmonary thromboembolism, death, bruises, subcutaneous inguinal hemorrhage, neuralgia of the saphenous nerve, wound infection and phlebitis). Postsurgical complications were evaluated at 8 days postintervention Clinical follow-up and duplex ultrasonography with venous mapping were at 3, 6, 12, 24, 36, 48, and 60 months after surgery
Notes	Authors were contacted to obtain information on the randomization process. Funding: Institute of Health Carlos III, Ministry of Health (Spanish Ministry of Health) and Consumption, by 2 research grant FIS 94/5365 and FIS 97/0694 (Spain), and a research grant from the Non-Invasive Vascular Diagnosis Area of the Spanish Society for Angiology and Vascular Surgery and Endovascular (Spanish Society of Angiology and Vascular Surgery), 2003 The sample size was specified in the methods.

Risk of bias table

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	The publication does not specify the method of generating the randomization sequence. We contacted the authors who explained that the method of sequence generation was centralized and independent of the clinicians: randomisation generated by computer in blocks of 6.
Allocation concealment (selection bias)	Low risk	The publication does not specify the method of allocation concealment. We contacted the authors who explained that the allocation was centralized by telephone and independent of the clinicians.
Blinding of participants and personnel (performance bias) All outcomes (participants)	High risk	Quote: "This was a randomized, open-label controlled trial" Comment: It was an open study.
Blinding of participants and personnel (performance bias) All outcomes (personnel)	High risk	Quote: "This was a randomized, open-label controlled trial" Comment: It was an open study.
Blinding of outcome assessment (detection bias)	High risk	Quote: "This was a randomized, open-label controlled trial" Comment: It was an open study.
Incomplete outcome data (attrition bias)	Low risk	The losses were minimal: 15 (3%) patients.
Selective reporting (reporting bias)	Low risk	The results of all outcomes prespecified in the methods of the trial report were presented. The trial protocol was not requested from the authors.

Zamboni 2003

Methods	Design: Randomized controlled trial. Number of participant centres: 1. Setting: Hospital. Country: Italy. Unit of randomization: patient. Unit of analysis: ulcer and patient. Follow-up: twice a year for 3 years.
Participants	Participants: 45 patients. Ulcers: 47 ulcers (21 patients, with 23 ulcers, treated with CHIVA; 24 patients, with 24 ulcers, treated with compression). Sex. 18 men and 27 women. Age (mean): 63 years. Inclusion criteria: patients with venous ulcer. Exclusion criteria: 80 years old or older, inability to walk, ulcers less than 2 cm^2 or greater than 12 cm^2, diabetes, peripheral arterial disease or an ankle brachial index <0.9, secondary or congenital venous disease (history of deep venous thrombosis and / or ultrasound evidence of deep venous obstruction or reflux, congenital angiodysplasia).
Interventions	1) CHIVA group: operations were performed under local anesthesia and Doppler ultrasound. Depending on the location of the re-entry of the perforator were 2 different minimally invasive techniques: a) The opening is located on the main venous trunk (type I cases) b) The opening was located in the venous branches (type III cases) Cases of type I: the operation included high ligation of the venous sapheno femoral or popliteal union completed by ligation and division of the venous saphenous trunk and insufficient branches. The result was the creation of a drainage flow down into the venous saphenous trunk re-entering the deep circulation through perforators. Cases of type III: the operation involved ligation and disconnection of the venous saphenous trunk insufficient branches. The process could contain a second step consisted of high ligation. Patients began to walk an hour after the operation with the ulcer protected with a bandage and with half elastic compression at the ankle. Patients were discharged after 3 hours and were visited 2 times per week the first week and then every week until the ulcer healed. 2) Compression group: treated with foam dressing, zinc oxide and an inelastic bandage applied from foot to the knee. Antibiotics were used selectively according to sensitivities. The dressing was changed every 3-5 days the first month and then every 7 days. Once ulcers healed, elastic stockings were prescribed. In the case of recurrence, the dressing protocol was repeated. Monitoring: Patients in both groups were reviewed clinically, completed the questionnaire on quality of life (SF-36), and underwent a Doppler ultrasound and plethysmography twice a year for 3 years.
Outcomes	Primary outcome: healing rate, recurrence rate Secondary variables: ulcerated area, quality of life (SF-36 questionnaire)
Notes	Authors were contacted to obtain information on the randomization process. Sample size was calculated. Grant funding "Venous Ulcers: TISSUE AND GROWTH FACTORS HAEMODYNAMICS of the Italian Ministry of the University and Scientific and Technological Research (MURST). "

Risk of bias table

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	The first author was contacted by e-mail. His response was " The study was preceded by a computer-generated randomisation list, structured in balanced blocks of 4 patients and prepared by the local dept. of mathematics, of course blinded to the treating physicians. Once the patient was included in the study the physician called the secretary of the department, who communicated him/her the arm. I hope this clear." Comment: the generation of random sequence was blinded.
Allocation concealment (selection bias)	Low risk	The first author was contacted by e-mail. His response was " The study was preceded by a computer-generated randomisation list, structured in balanced blocks of 4 patients and prepared by the local dept. of mathematics, of course blinded to the treating physicians. Once the patient was included in the study the physician called the secretary of the department, who communicated him/her the arm." Comment: there was allocation concealment.
Blinding of participants and personnel (performance bias) All outcomes (participants)	High risk	It was an open study
Blinding of participants and personnel (performance bias) All outcomes (personnel)	High risk	It was an open study
Blinding of outcome assessment (detection bias)	High risk	It was an open study
Incomplete outcome data (attrition bias)	Low risk	No losses to follow-up (3 years).
Selective reporting (reporting bias)	Unclear risk	The results of quality of life are missing at the paper. It is not clear if data of recurrence was based in ultrasounds or clinical parameters. There are insufficient data about the time to heal the ulcer to include in the analysis of the review.

Footnotes

Characteristics of excluded studies

Maeso 2001

Reason for exclusion	Controlled trial, not randomised, case-review study.

Solis 2009

Reason for exclusion	Prospective, controlled trial, not randomised.

Zamboni 1995

Reason for exclusion	Prospective, controlled trial, not randomised.

Zamboni 1996

Reason for exclusion	Prospective, non controlled clinical trial.

Zamboni 1998

Reason for exclusion	Prospective, controlled trial, not randomised.

Footnotes

Characteristics of studies awaiting classification

Footnotes

Characteristics of ongoing studies

Footnotes

Summary of findings tables

1 Summary of findings

CHIVA compared with stripping for varicose veins						
Patient or population: adults with varicose veins **Settings: hospital** **Intervention: CHIVA** **Comparison: stripping**						
Outcomes	**Illustrative comparative risks* (95% CI)**		**Relative effect (95% CI)**	**No of Participants (studies)**	**Quality of the evidence (GRADE)**	**Comments**
	Assumed risk	**Corresponding risk**				
	stripping	**CHIVA**				
Recurrence of varicose veins [follow-up 60 months - 10 years]	**Low risk population**		**RR 0.63** (0.51 to 0.78)	721 (3 studies)	⊕⊕⊕⊖ **moderate**	The studies were open: patients and assessors knew the intervention
	471 per 1000	**297 per 1000** (240 to [368)				
	Medium risk population					
	383 per 1000	**241 per 1000** (195 to 299)				
Side effects - Bruises [follow-up; 60 months]	**Low risk population**		**RR 0.63** (0.53 to 0.76)	501 (1 study)	⊕⊕⊕⊖ **moderate**	The studies were open: patients and assessors knew the intervention
	719 per 1000	**453 per 1000** (381 to 546)				
	Medium risk population					
	719 per 1000	**453 per 1000** (381 to 546)				
Side effects - Limb infection [follow-up: 60 months]	**Low risk population**		**RR 1.33** (0.38 to 4.66)	501 (1 study)	⊕⊕⊖⊖ **low**	The studies were open: patients and assessors knew the intervention. There was imprecision due to low number of events.
	18 per 1000	**24 per 1000** (7 to 84)				
	Medium risk population					
	18 per 1000	**24 per 1000** (7 to 84)				
Side effects - Superficial vein trombosis [follow-up: 60 months - 5 years]	**Low risk population**		**RR 2.23** (0.6 to 8.33)	601 (2 studies)	⊕⊕⊖⊖ **low**	The studies were open: patients and assessors knew the intervention. There was imprecision due to low number of events.
	10 per 1000	**22 per 1000** (6 to 83)				
	Medium risk population					
	6 per 1000	**13 per 1000** (4 to 50)				
Side effects - Nerve damage [follow-up: 60 momths - 5 years]	**Low risk population**		**RR 0.05** (0.01 to 0.38)	601 (2 studies)	⊕⊕⊕⊖ **moderate**	The studies were open: patients and assessors knew the intervention. There was imprecision due to low number of events. CHIVA method is unlikely that causes nerve damage. We have upgraded the quality of evidence for large effect.
	68 per 1000	**3 per 1000** (1 to 26)				
	Medium risk population					
	135 per 1000	**7 per 1000** (1 to 51)				

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI). **CI:** Confidence interval; **RR:** Risk Ratio;-
GRADE Working Group grades of evidence **High quality:** Further research is very unlikely to change our confidence in the estimate of effect. **Moderate quality:** Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate. **Low quality:** Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate. **Very low quality:** We are very uncertain about the estimate.

Footnotes

Additional tables

1 CEAP Clinical Classification (C)

Class	Clinical Indication
0	No visible or palpable signs of venous disease
1	Telangiectases or reticular veins
2	Varicose veins
3	Edema
4	Skin changes ascribed to venous disease (e.g., pigmentation, venous eczema, lipodermatosclerosis)
5	Skin changes as defined here with healed ulceration
6	Skin changes as defined here with active ulceration

Footnotes

References to studies

Included studies

Carandina 2008

Carandina S, Mari C, De Palma M, Marcellino MG, Cisno C, Legnaro A, et al. Varicose vein stripping vs haemodynamic correction (CHIVA): a long term randomised trial. European Journal of Vascular and Endovascular Surgery 2008;35(2):230-7.

Carandina S, Mari C, De Palma M, Marcellino MG, Legnaro A, Liboni A, et al. Stripping vs haemodynamic correction (CHIVA): A long term randomised trial. Phlebology 2006;21(3):151.

Iborra-Ortega 2006

Iborra E, Linares P, Hernández E, Vila R, Cairols MA. Clinical and random study comparing two surgical techniques for varicose veins treatment: immediate results [Estudio cínico y aleatorio que compara dos técnicas quirúrgicas para el tratamiento de las varices: resultados inmedatos]. Angiologia 2000;6:253-8.

Iborra E, Vila R, Barjau E, Cairols MA. Surgical treatment of varicose veins: Comparative study between two different techniques. Phlebology 2006;21(3):152.

Iborra E. Comparative clinical study: CHIVA vs phlebectomy [Ensayo clínico comparativo: Fleboextracción versus CHIVA]. Anales de Cirugía Cardíaca y Vascular 2006;12(2):109.

Iborra-Ortega E, Barjau-Urrea E, Vila-Coll R, Ballon-Carazas H, Cairols-Castellote MA. Comparative study of two surgical techniques in the treatment of varicose veins of the lower extremities: results after five years of follow up [Estudio comparativo de dos técnicas quirúrgicas en el tratamiento de las varices de las extremidades inferiores: resultados tras cinco años de seguimiento]. Angiología 2006;58(6):459-68.

Pares 2010

Parés JO, Juan J, Tellez R, Mata A, Moreno C, Quer FX, et al. Varicose vein surgery: stripping versus the CHIVA method: A randomized controlled trial. Annals of Surgery 2010;251(4):624-31.

Pares JO, Juan J, Tellez R, Mata A, Moreno C, Quer FX, et al. Varicose vein surgery: Stripping versus the CHIVA method: A randomized controlled trial. Vasomed 2011;23(2):98.

Pares O, Juan J, Moreno C, Tellez R, Codony I, Mata A, Quer X, Roca J. Randomized clinical trial on surgical techniques for the treatment of varicose veins in legs: non-conservative treatment compared with a conservative one. Five years follow-up. Phlebology 2008;23(5):243.

Zamboni 2003

Zamboni P, Cisno C, Marchetti F, Mazza P, Fogato L, Carandina S, et al. Minimally invasive surgical management of primary venous ulcers vs. compression treatment: a randomized clinical trial. European Journal of Vascular and Endovascular Surgery 2003;25(4):313-8.

Excluded studies

Maeso 2001

Maeso J, Juan J, Escribano J, Allegue NM, Di Matteo A, Gonzalez E, et al. Comparison of clinical outcome of stripping and CHIVA for treatment of varicose veins in the lower extremities. Annals of Vascular Surgery 2001;15(6):661-5.

Solis 2009

Solís JV, Ribé L, Portero JL, Rio J. Stripping Saphenectomy, CHIVA and Laser ablation for the treatment of the saphenous vein insufficiency. Ambulatory Surgery 2009;15(1):11-4.

Zamboni 1995

Zamboni P, Marcellino MG, Feo CV, Pisano L, Vasquez G, Bertasi M, et al. Alternative saphenous vein sparing surgery for future grafting. Panminerva Medica 1995;37(4):190-7.

Zamboni 1996

Zamboni P, Feo CV, Marcellino MG, Vasquez G, Mari C. Haemodynamic correction of varicose veins (CHIVA): An effective treatment? Phlebology 1996;11(3):98-101.

Zamboni 1998

Zamboni P, Marcellino MG, Cappelli M, Feo CV, Bresadola V, Vasquez G, et al. Saphenous vein sparing surgery: principles, techniques and results. Journal of Cardiovascular Surgery 1998;39(2):151-62.

Studies awaiting classification

Ongoing studies

Other references

Additional references

Agus 2001

Agus GB, Allegra C, Arpaia G, Botta G, Cataldi A, Gasbarro V, et al. Guidelines for the diagnosis and treatment of chronic venous insufficiency. International Angiology 2001;20(1):2-37.

Allan 2000

Allan PL, Bradbury AW, Evans CJ, Lee AJ, Vaughan Ruckley C, Fowkes FG. Patterns of reflux and severity of varicose veins in the general population - Edinburgh Vein Study. European Journal of Vascular and Endovascular Surgery 2000;20(5):470-7.

Aziz 2011

Aziz Z, Cullum NA, Flemming K. Electromagnetic therapy for treating venous leg ulcers. Cochrane Database of Systematic Reviews 2011, Issue 3. Art. No.: CD002933 DOI: 10.1002/14651858.CD002933.pub4.

Blomgren 2004

Blomgren L, Johansson G, Dahlberg-Akerman A, Norén A, Brundin C, Nordström E, et al. Recurrent varicose veins: Incidence, risk factors and groin anatomy. European Journal of Vascular and Endovascular Surgery 2004;27(3):269-74.

Carpentier 2004

Carpentier PH, Maricq HR, Biro C, Ponçot-Makinen CO, Franco A. Prevalence, risk factors, and clinical patterns of chronic venous disorders of lower limbs: A population-based study in France. Journal of Vascular Surgery 2004;40(4):650-9.

Cavezzi 2007

Cavezzi A, Labropoulos N, Partsch H, Ricci S, Caggiati A, Myers K, et al. Duplex ultrasound investigation of the veins in chronic venous disease of the lower limbs. UIP consensus document. Part II. Anatomy. Vasa 2007;36(1):62-71.

Chan 2011

Chan CY, Chen TC, Hsieh YK, Huang JH. Retrospective comparison of clinical outcomes between endovenous laser and saphenous vein-sparing surgery for treatment of varicose veins. World Journal of Surgery 2011;35(7):1679-86.

Coleridge-Smith 2006

Coleridge-Smith P, Labropoulos N, Partsch H, Myers K, Nicolaides A, Cavezzi A. Duplex ultrasound investigation of the veins in chronic venous disease of the lower limbs. UIP consensus document. Part I. Basic principles. European Journal of Vascular and Endovascular Surgery 2006 ;31(1):83-92.

Cullum 2010

Cullum NA, Al-Kurdi D, Bell-Syer SEM. Therapeutic ultrasound for venous leg ulcers. Cochrane Database of Systematic Reviews 2010, Issue 6. Art. No.: CD001180 DOI: 10.1002/14651858.CD001180.pub3.

Escribano 2003

Escribano JM, Juan J, Bofill R, Maeso J, Rodríguez-Mori A, Matas M. Durability of reflux-elimination by a minimal invasive CHIVA procedure on patients with varicose veins. A 3-year prospective case study. European Journal of Vascular and Endovascular Surgery 2003;25(2):159-63.

Flemming 1999

Flemming K, Cullum NA. Laser therapy for venous leg ulcers. Cochrane Database of Systematic Reviews 1999, Issue 1. Art. No.: CD001182 DOI: 10.1002/14651858.CD001182.

Franceschi 1988

Franceschi C. Theorie et pratique de la cure: conservatrice et hemodynamique de l'insuffisance veineuse en ambulatoire. Precy-sous-Thil. France: Editions de l'Armançon, 1988.

Franceschi 1997

Franceschi C. Measures and interpretation of venous flow in stress tests. Manual compression and Parana manoeuver. Dynamic reflux index and Psatakis index [Mesures et interprétation des flux veineux lors des manoevres de stimulation. Compressions manuelles et manoeuvre de Paranà. Indice dynamique de reflux (IDR) et indice de Psatakis]. Journal des Maladies Vasculaires 1997;22(2):96-136, (3Ref) pp 91-5.

Goren 1996

Goren G, Yellin AE. Hemodynamic principles of varicose vein therapy. Dermatologic Surgery 1996;22(7):657-62.

Higgins 2011

Higgins JPT, Green S, editors. Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [updated March 2011] The Cochrane Collaboration, 2011. Available from www.cochrane-handbook.org.

Hobbs 1974

Hobbs JT. Surgery and sclerotherapy in the treatment of varicose veins. A random trial. Archives of Surgery 1974;109:793–96..

Juan 2002

Juan J, Escribano JM, Maeso J. Hemodynamic after stripping of varicose vein [Hämodynamik des Varizenrezidivs nach Strippingoperation]. In: 18 Jahreskongress 2002 der Deutschen Gessellschaft für GefäBchirurgie – Gesellschaft für vaskuläre und endovaskuläre Chirurgie. Würzburg (Germany). 2002.

Jull 2008

Jull AB, Rodgers A, Walker N. Honey as a topical treatment for wounds. Cochrane Database of Systematic Reviews 2008, Issue 4. Art. No.: CD005083 DOI: 10.1002/14651858.CD005083.pub2.

Kranke 2004

Kranke P, Bennett MH, Debus SE, Roeckl-Wiedmann I, Schnabel A. Hyperbaric oxygen therapy for chronic wounds. Cochrane Database of Systematic Reviews 2004, Issue 1. Art. No.: CD004123 DOI: 10.1002/14651858.CD004123.pub2.

Kurz 1999

Kurz X, Kahn SR, Abenhaim L, Clement D, Norgren L, Baccaglini U, et al. Chronic venous disorders of the leg: epidemiology, outcomes, diagnosis and management. Summary of an evidence-based report of the VEINES task force. Venous Insufficiency Epidemiologic and Economic Studies. International Angiology 1999;18(2):83-102.

Labropoulos 2001

Labropoulos N, Tiongson J, Pryor L, Tassiopoulos AK, Kang SS, Mansour MA, et al. Nonsaphenous superficial vein reflux. Journal of Vascular Surgery 2001;34(5):872-7.

Labropoulos 2005

Labropoulos N, León L, Kwon S, Tassiopoulos A, González-Fajardo JA, Kang SS, et al. Study of the venous reflux progresión. Journal of Vascular Surgery 2005;41(2):291-5.

Lee 2003

Lee AJ, Evans CJ, Allan PL, Ruckley CV, Fowkes FG. Lifestyle factors and the risk of varicose veins: Edinburgh Vein Study. Journal of Clinical Epidemiology 2003;56(2):171-9.

Lofgren 1977

Lofgren EP. The operative treatment of varicose veins. In: Rutherford RB, editors(s). Vascular surgery. Philadelphia: WB Saunders, 1977:1169-75.

Martinez-Zapata 2005

Martinez-Zapata MJ, Bonfill Cosp X, Moreno RM, Vargas E, Capellà D. Phlebotonics for venous insufficiency. Cochrane Database of Systematic Reviews 2005, Issue 3. Art. No.: CD003229 DOI: 10.1002/14651858.CD003229.pub2.

Mendoza 2008

Mendoza E. CHIVA 1988-2008: Review of studies on the CHIVA method and its development in different countries. Gefasschirurgie 2008;13(4):249-56.

Mendoza 2011

Mendoza E, Berger V, Zollmann C, Bomhoff M, Amsler F. Diameter-reduction of the great saphenous vein and common femoral vein after CHIVA. Phlebologie 2011;40(2):73–8.

Milone 2011

Milone M, Salvatore G, Maietta P, Sosa Fernandez LM, Milone F. Recurrent varicose veins of the lower limbs after surgery. Role of surgical technique (stripping vs. CHIVA) and surgeon's experience. Il Giornale di chirurgia 2011;32(11-12):460-3.

Mowatt-Larssen 2012

Mowatt-Larssen E, Shortell CK. Treatment of primary varicose veins has changed with the Introduction of new techniques. Seminars in Vascular Surgery 2012;25(1):18-24.

Muller 1966

Muller R. Treatment of varicose veins by ambulatory phlebectomy [Traitement des varices par phlébectomie ambulatoire]. Phlebologie 1966;19(4):277-9.

Nelson 2000

Nelson EA, Bell-Syer SEM, Cullum NA, Webster J. Compression for preventing recurrence of venous ulcers. Cochrane Database of Systematic Reviews 2000, Issue 4. Art. No.: CD002303 DOI: 10.1002/14651858.CD002303.

Nelson 2011

Nelson EA, Mani R, Thomas K, Vowden K. Intermittent pneumatic compression for treating venous leg ulcers. Cochrane Database of Systematic Reviews 2011, Issue 2. Art. No.: CD001899 DOI: 10.1002/14651858.CD001899.pub3.

Nesbitt 2011

Nesbitt C, Eifell RK, Coyne P, Badri H, Bhattacharya V, Stansby G. Endovenous ablation (radiofrequency and laser) and foam sclerotherapy versus conventional surgery for great saphenous vein varices. Cochrane Database of Systematic Reviews 2011, Issue 10. Art. No.: CD005624 DOI: 10.1002/14651858.CD005624.pub2.

Nicolaides 2000

Nicolaides AN; Cardiovascular Disease Educational and Research Trust; European Society of Vascular Surgery; The International Angiology Scientific Activity Congress Organization; International Union of Angiology; Union Internationale de Phlebologie at the Abbaye des Vaux de Cernay. Investigation of chronic venous insufficiency. A consensus statement. Circulation 2000;102(20):E126-63.

O'Meara 2009

O'Meara S, Cullum NA, Nelson EA. Compression for venous leg ulcers. Cochrane Database of Systematic Reviews 2009, Issue 1. Art. No.: CD000265 DOI: 10.1002/14651858.CD000265.pub2.

O'Meara 2010

O'Meara S, Al-Kurdi D, Ologun Y, Ovington LG. Antibiotics and antiseptics for venous leg ulcers. Cochrane Database of Systematic Reviews 2010, Issue 1. Art. No.: CD003557 DOI: 10.1002/14651858.CD003557.pub3.

Palfreyman 2006

Palfreyman SSJ, Nelson EA, Lochiel R, Michaels JA. Dressings for healing venous leg ulcers. Cochrane Database of Systematic Reviews 2006, Issue 3. Art. No.: CD001103 DOI: 10.1002/14651858.CD001103.pub2.

Perrin 2000

Perrin MR, Guex JJ, Ruckley CV, de Palma RG, Royle JP, Eklof B, et al. Recurrent varices after surgery (REVAS), a consensus document. REVAS Group. Cardiovascular Surgery 2000;8(4):233-45.

Porter 1995

Porter JM, Moneta GL. Reporting standards in venous disease: an update. International Consensus Committee on Chronic Venous Disease. Journal of Vascular Surgery 1995;21(4):635–45.

Rigby 2004

Rigby KA, Palfreyman SSJ, Beverley C, Michaels JA. Surgery versus sclerotherapy for the treatment of varicose veins. Cochrane Database of Systematic Reviews 2004, Issue 4. Art. No.: CD004980 DOI: 10.1002/14651858.CD004980.

Tisi 2006

Tisi PV, Beverley C, Rees A. Injection sclerotherapy for varicose veins. Cochrane Database of Systematic Reviews 2006,

Issue 4. Art. No.: CD001732 DOI: 10.1002/14651858.CD001732.pub2.

Vanhouette 1997

Vanhoutte PM, Corcaud S, de Montrion C. Venous disease: from pathophysiology to quality of life. Angiology 1997;48(7):559-67.

Winterborn 2004

Winterborn RJ, Foy C, Earnshaw JJ. Causes of varicose vein recurrence: late results of a randomized controlled trial of stripping the long saphenous vein. Journal of Vascular Surgery 2004;40(4):634-9.

Other published versions of this review

Classification pending references

Data and analyses

1 CHIVA versus Stripping

Outcome or Subgroup	Studies	Participants	Statistical Method	Effect Estimate
1.1 Recurrence of varicose veins	3	721	Risk Ratio(M-H, Fixed, 95% CI)	0.63[0.51, 0.78]
1.2 Re-treatment	1		Risk Ratio(M-H, Fixed, 95% CI)	No totals
1.3 Free from reflux	2		Risk Ratio(M-H, Random, 95% CI)	Subtotals only
1.4 Aestetic improvement assessed by the patient	1		Risk Ratio(M-H, Fixed, 95% CI)	No totals
1.5 Aestetic improvement assessed by the patient	1		Mean Difference(IV, Fixed, 95% CI)	No totals
1.6 Aestetic improvement assessed by the investigator	1		Risk Ratio(M-H, Fixed, 95% CI)	No totals
1.7 Cure or no clinical symptoms	2	601	Risk Ratio(M-H, Fixed, 95% CI)	1.73[1.36, 2.19]
1.8 Clinical improvement	2	601	Risk Ratio(M-H, Fixed, 95% CI)	0.93[0.71, 1.21]
1.9 Side effects	2		Risk Ratio(M-H, Fixed, 95% CI)	Subtotals only
1.9.1 Bruises	1	501	Risk Ratio(M-H, Fixed, 95% CI)	0.63[0.53, 0.76]
1.9.2 Limb infection	1	501	Risk Ratio(M-H, Fixed, 95% CI)	1.33[0.38, 4.66]
1.9.3 Superficial vein trombosis	2	601	Risk Ratio(M-H, Fixed, 95% CI)	2.23[0.60, 8.33]
1.9.4 Nerve damage	2	601	Risk Ratio(M-H, Fixed, 95% CI)	0.05[0.01, 0.38]
1.10 Recurrence of varicose veins. Sensitivity analysis.	3	751	Risk Ratio(M-H, Fixed, 95% CI)	0.60[0.50, 0.73]
1.10.1 Intention to treat	3	751	Risk Ratio(M-H, Fixed, 95% CI)	0.60[0.50, 0.73]

2 CHIVA versus Compression dressing

Outcome or Subgroup	Studies	Participants	Statistical Method	Effect Estimate
2.1 Recurrence of venous ulcer	1		Risk Ratio(M-H, Fixed, 95% CI)	No totals
2.2 Cure of venous ulcer	1		Risk Ratio(M-H, Fixed, 95% CI)	No totals

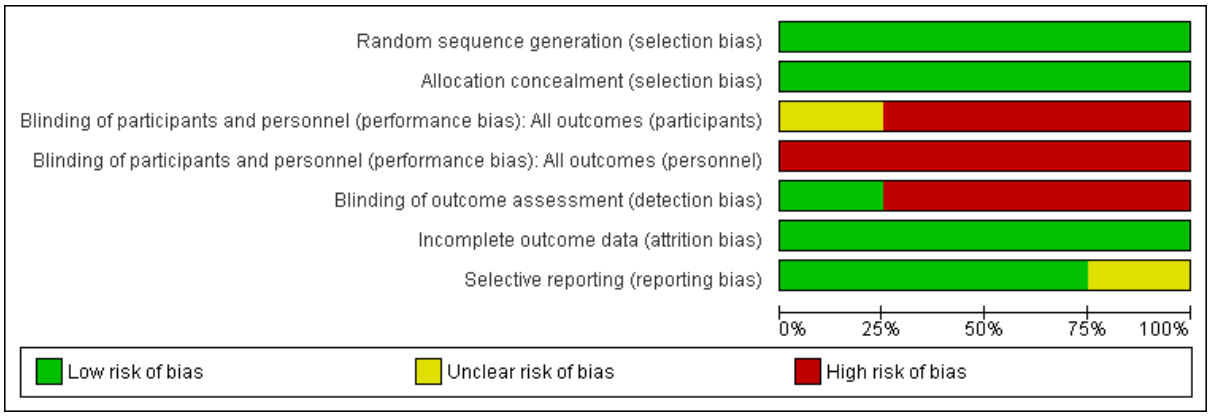
Figures

Figure 1

Caption

Study flow diagram.

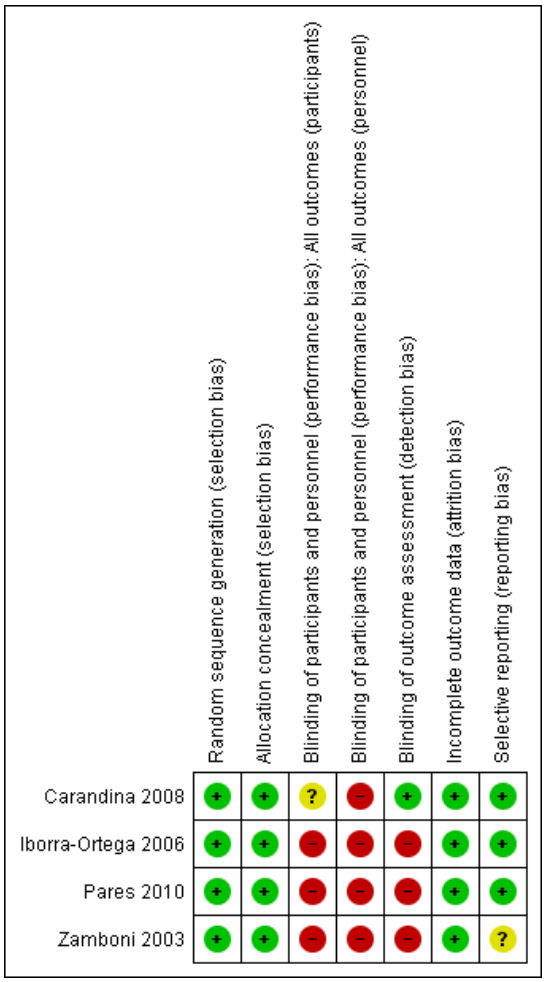
Figure 2



Caption

Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.

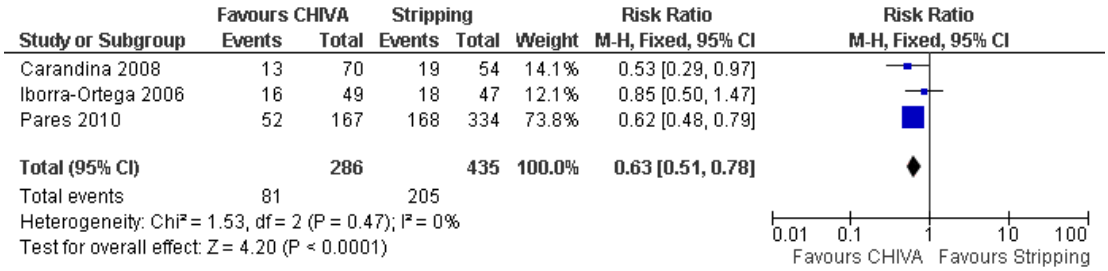
Figure 3



Caption

Risk of bias summary: review authors' judgements about each risk of bias item for each included study.

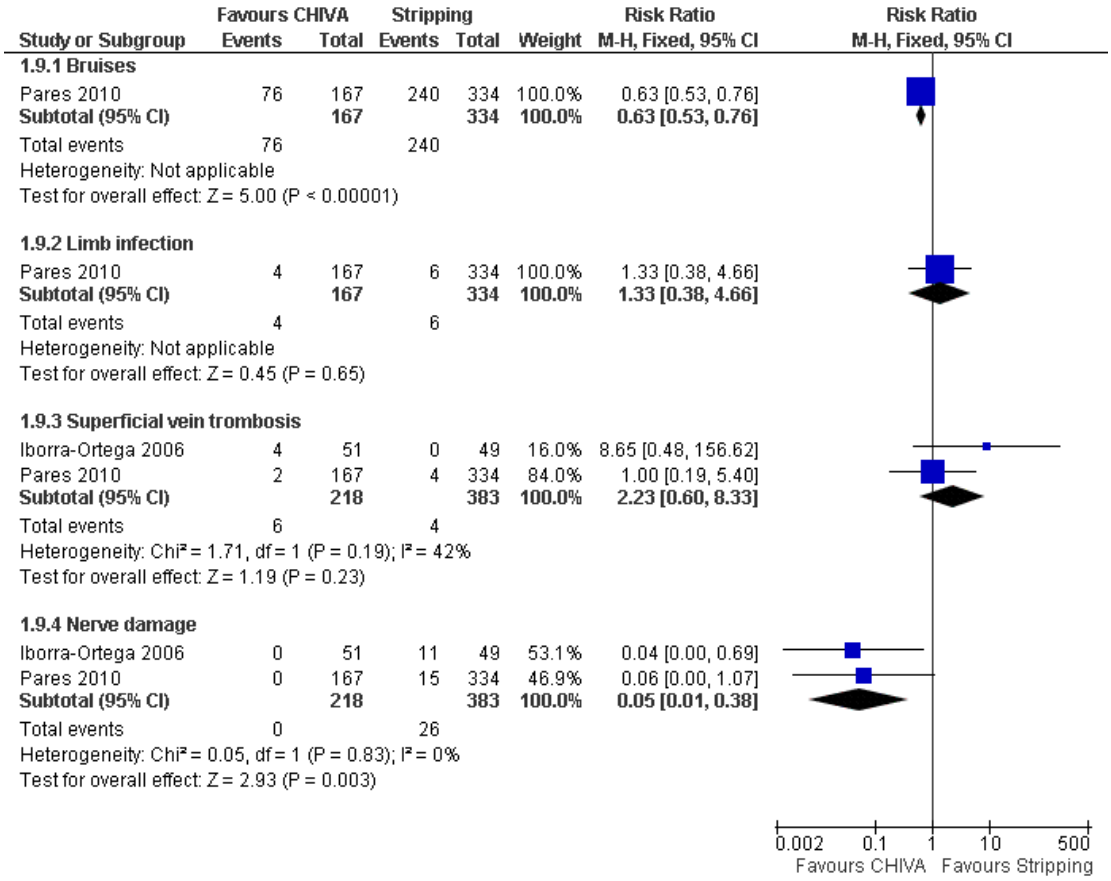
Figure 4 (Analysis 1.1)



Caption

Forest plot of comparison: 1 CHIVA vs Stripping, outcome: 1.1 Recurrence of varicose veins.

Figure 5 (Analysis 1.9)



Caption

Forest plot of comparison: 1 CHIVA versus Stripping, outcome: 1.9 Side effects.

Sources of support

Internal sources

- Iberoamerican Cochrane Center, Spain

External sources

- Chief Scientist Office, Scottish Government Health Directorates, Scottish Government, UK
  The PVD Group editorial base is supported by the Chief Scientist Office.
- Associazione "Umanizazione" della Chirurgia, Italy
  This organization is a not-for-profit organization that promotes formative and scientific sessions (scientific meetings, workshops etc.) principally in relation to venous hemodynamics of the lower limbs. This organization partially finances this review because it has an interest in the independent assessment of the CHIVA method but it does not have influence on the review process.

Feedback

Appendices

1 CENTRAL search strategy

#1	MeSH descriptor: [Varicose Veins] explode all trees	742
#2	(varicos* near/3 (vein* or veno*))	766
#3	(tortu* near/3 (vein* or veno*))	14
#4	(incomp* near/3 (vein* or veno* or saphenous or valv*))	133
#5	(insuffic* near/3 (vein* or veno* or saphenous))	706
#6	((saphenous or vein* or veno*) near/3 reflux)	99
#7	MeSH descriptor: [Saphenous Vein] this term only and with qualifiers: [Surgery - SU]	349
#8	GSV	78
#9	MeSH descriptor: [Venous Insufficiency] explode all trees	341
#10	(#1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9)	1877
#11	(CHIVA or C.H.I.V.A):ti,ab,kw	9
#12	MeSH descriptor: [Ambulatory Surgical Procedures] this term only	1384
#13	MeSH descriptor: [Surgical Procedures, Minimally Invasive] this term only	718
#14	MeSH descriptor: [Vascular Surgical Procedures] this term only	619
#15	MeSH descriptor: [Hemodynamics] explode all trees	39923
#16	haemodynamic or hemodynamic:ti,ab,kw	10987
#17	(ambulat*):ti,ab,kw	12674
#18	#11 or #12 or #13 or #14 or #15 or #16 or #17	55898
#19	#10 and #18 in Trials (Word variations have been searched)	282

2 Authors' EMBASE search strategy

#1	exp varicosis/	46688
#2	varicose vein*.mp.	8645
#3	varice*.mp	46202
#4	1 or 2 or 3	71685
#5	CHIVA.mp	123
#6	Conservative Hemodynamic Management of Varicose Vein*.mp	3
#7	Conservative Hemodynamic Management.mp.	4
#7	hemodynamic correction.mp	84
#9	5 or 6 or 7 or 8	202
#10	4 and 9	87

3 Authors' Pubmed search strategy

#1	"Varicose Veins"[Mesh]	14337
#2	varicose vein*[tw]	12772
#3	varice*[tw]	28511
#4	((#1) OR #2) OR #3	42070
#5	CHIVA[tw]	50
#6	Conservative Haemodynamic Management of Varicose Vein*[tw]	7
#7	Conservative Hemodynamic Management of Varicose Vein*[tw]	7
#7	Conservative Hemodynamic Management[tw]	3
#9	Conservative Haemodynamic Management[tw]	0
#10	hemodynamic correction[tw]	56
#11	haemodynamic correction[tw]	9
#12	((((((#5) OR #6) OR #7) OR #8) OR #9) OR #10) OR #11	110
#13	(#4) AND #12	43

4 Glossary

CHIVA: Conservative Hemodynamics Insufficiency Venous Ambulatory method to treat chronic venous Insufficiency

Hobbs' Classification and scores (Hobbs 1974):

- Class A (score 1): no visible and palpable varicose veins;
- Class B (score 2): a few visible and palpable varicose veins with diameter < 5 mm;
- Class C (score 3): remaining or newly formed varicose veins with diameter > 5 mm;
- Class D (score 4): incompetent main trunks and perforator.