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# Varicose tributary treatment as a single procedure may avoid saphenous ablation: an evidence review and prediction checklist

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**Abstract**

Growing evidence suggests that, in selected varicose vein patients, isolated tributary treatment (by phlebectomy, sclerotherapy, laser or disconnection) may avoid the sacrifice of the great saphenous vein, thereby simplifying varicose vein management and preserving saphenous capital. Patient selection relies primarily on detailed ultrasound assessment of venous haemodynamic, with particular attention to the Sapheno-Femoral Junction (SFJ), and re-entry perforators evaluated using the Reflux Elimination Test (RET). A structured checklist to predict surgical success may assist surgeons and support shared decision-making with patients by integrating anatomical, hemodynamic, clinical, and technical factors.

**Key words:** phlebectomy, tributary varices, saphenous sparing, CHIVA, ASVAL.

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## Introduction

Attention to tributary elimination is generally activated after the reflux in the Great Saphenous Vein (GSV) has been solved, independently of the method employed. Varicosities may be treated by concomitant or staged intervention,[1-10] usually by phlebectomy.[11] The main alternative is sclerotherapy, particularly since the introduction of foam, which provides more effective sclerosing action.[1,12,13]

Tributary disconnection (ligation or sectioning of the varix from the saphenous trunk) advocated by proponents of the more conservative CHIVA (Conservative Hemodynamic of Venous Insufficiency Ambulatory cure) strategy, may allow varicose regression by eliminating reflux-related hypertension transmitted from the Great Saphenous Vein (GSV), provided that drainage through a re-entry perforator is preserved. Flush tributary separation from the GSV stem is needed to avoid recurrence in the residual stump.[14]

Tributary Laser ablation utilizing slim radial fibers has recently gained widespread acceptance in the Japanese experience, supported by guideline endorsement and national training systems, suggesting that it may complement some limitations of stab avulsion.[15]

With few exceptions, there is strong evidence that both procedures - concomitant or staged -achieve similar good clinical results at one year,[9,10] so the debate is not based on "which choice gives better results", but, in reality, on "what is more convenient" for operators, patients, and insurance.[16]

### *Isolated tributary treatment*

Varicosities ablation may be performed as the only procedure needed when a reflux feeding point is isolated or not identified (29.3%), or fed by pelvic escapes; in recurrent varices after successful saphenous ablation (as in "staged" phlebectomy); in varices of the Anterior Accessory Saphenous Vein (AASV) (in this case the GSV is involved only at the junction).[17]

But more interestingly, varicosities ablation may be the only procedure, more frequently by phlebectomy, even if the reflux originates from the incompetent GSV. Subsequent recovery of

venous wall tone and valvular competence was clinically observed already by Fegan's school[18] and Hobbs[19] after variceal sclerotherapy, in analogy with the frequent puerperal regression of varicosities arising during pregnancy.[9] Muller, the promoter of Ambulatory Phlebectomy (AP), could experience anecdotally the same event. The advent of the Ultrasound venous exploration era, favoured by Franceschi's publications, base for the CHIVA strategy, could demonstrate the haemodynamic behaviour of the saphenous vein in different stages of pathology and treatments.[20]

## Materials and Methods

Relevant publications on the tributary-first/only treatment of varices were reviewed in light of the evolving understanding of the underlying pathophysiology, with inclusion limited to studies describing some evolution of the tributary-first/only approach, rather than performing a systematic review.

### *Development of conceptual understanding*

In 2001, Zamboni *et al.* published a "revolutionary" paper[21] demonstrating that in most of the varicose cases, the simple disconnection (by section and ligation) of the tributary from the refluxing saphenous trunk could eliminate the reflux in the same saphenous vein without any direct intervention. The elimination of the pressure gradient was the haemodynamic explanation of this effect. The cases involved were those presenting one or more re-entry perforators connected to the tributaries (58%); in this anatomic setting, the closure of the tributary by a finger's compression stops the reflux in the GSV (positive Reflux Elimination Test, RET+); in analogy, the tributary disconnection, similarly to a phlebectomy or a sclerotherapy, would have the same consequence. Patients with a negative RET having a perforator centred on the saphenous trunk - would not stop the reflux at the tributary interruption.[21]

In 2003, Escribano studied this same non-invasive tactic, with a longer follow-up (3 years), and found that reflux reappeared in about 90% of the cases, due to the successive activation of a re-entry

through a perforator centred on the GSV trunk, needing a junction interruption. Of great interest is the observation of an average diameter reduction of the GSV from 6.6 to 3.9 mm at 36 months from surgery.[22]

In 2009, Pittaluga *et al*. published the possibility of isolated phlebectomy with GSV preservation, calling this procedure ASVAL (Ambulatory Selective Varices Ablation Under Local Anaesthesia), based on the hypothesis of a so-called ascending or multifocal development of varicose disease starting from the distal superficial venous network.[23]

At 4 years follow up of 280 lower limbs,[24] in 66.3%, reflux was not significant, and reduced to <50% in 90.7% of the cases with a constant reduction of the GSV calibre. These were selected patients: the saphenous confluence was continent more often, its diameter was smaller, and the saphenous reflux was less often complete compared to the selected surgical patient's cohort; furthermore, the mean age was younger, the proportion of women was greater, the mean Body Mass Index (BMI) was lower, the CEAP C4 to C6 class was less frequent, the mean varicose reservoir was smaller.

A successive analysis on 1010 operated lower limbs[25] showed a flat survival curve with a frequency of 30% of persistent GSV reflux assessed since the first postoperative control with a very slight evolution during the follow-up (from 30.4% at one year to 34.6% at five years), but interestingly, freedom from varicose recurrence (99.8% at one year; 87% at 5 years), was more frequent than the GSV reflux absence cases (66.6% at one year; 66.6% at 5 years) indicating that reflux presence may be clinically non-significant, possibly due to the decrease of the GSV diameter lead to a reduction of the volume of the reflux.

Results at 10 years (average duration of follow-up, 59.8 months) showed an absence of saphenous reflux at 24, 60, 84, and 120 months in 71%, 69.7%, 68.5%, and 64.4% of the cases, respectively.[26,27]

In 2010, Zamboni *et al*.[28] suggested that a positive RET (found in 58% of cases), associated with SFJ competence (found in 63.1% of cases), could be the basis for a duplex protocol able to identify

the varicose patients (about half of the cases) who could benefit from a simplified procedure avoiding SFJ interruption. This gave the haemodynamic explanation of the previous papers' observations. In fact, terminal valve may be competent in a very high number of varicose cases according to literature evidence (33% Abu-Own [29]; 40% Pieri[30]; 55% Cappelli[31]; 56% Somjen[32]; 62♂ -71♀ Baldazzi[33]).

Biemans *et al*. (2014) studied the effect of a single phlebectomy of tributaries at the medial thigh on the saphenous reflux.[34] At one year, 50% of GSV had reflux abolished. Interestingly, these authors suggested a Phlebectomy Reflux Elimination Success Test (PREST) by a prediction score chart to evaluate individual probability for success, where C2, reflux in one segment (<10 cm), small GSV diameter (<5 mm), longer incompetent tributary (>30 cm), and positive RET are favourable factors.

Simple ambulatory phlebectomy (SAP - 227 pz) versus endothermal ablation of the GSV and/or anterior accessory saphenous vein with concomitant phlebectomy (TAP - 237 pz), at 1-year follow-up, was compared in a 2023 randomized study on 464 patients.[35] While quality of life showed no difference between the two procedures, at 9 months, of the 227 SAP patients, 58 (26%) needed additional truncal treatment; no selection criteria were applied.

Following the SAPTAP experience, the authors tried to create a predictor model for selecting patients more suitable for isolated phlebectomy.[36] The study was based on the analysis of 225 SAP patients, of whom 167 (74.2%), after one year, did not need additional ablation of the saphenous trunk. The success predictors for saphenous sparing were: tributary length, presence of SFJ reflux, and diameter of the saphenous trunk. Interestingly, tributary length was directly proportional to success prediction in contrast to the common sense. On the contrary, SFJ incompetence and saphenous diameter appear to be correlated, likely sharing the same clinical significance. Waiving the RET test - emphasized by the authors as being technically challenging for operators - could represents the main limitation of this model.

The evolution of Type III shunts, the CHIVA name for RET+ cases, after tributary disconnection, has been studied by Cappelli *et al*., on 318 cases with a mean follow-up of 8.5 years.[37] Reflux

reappeared in 77% of the cases. Interestingly, these authors analysed, above all, the pre-operative anterograde flow till the SFJ, particularly in the competent segment during muscle contraction, using the Vasculab manoeuvre,[38] ideal to activate the peripheral pumps. Patients with anterograde flow (144) had better results (55%) than those (174) without anterograde flow (95%), possibly due to avoiding the causal inflammatory process by the maintenance of an adequate shear stress. In conclusion, the pre-operative GSV anterograde flow, female sex and lower CEAP C scores prevented the reappearance of the GSV reflux, with up to 45% of cases not needing a further procedure (Table 1).

***About ASVAL/CHIVA 2 first step, two tactics for tributaries exclusion from the saphenous trunk***

Isolated phlebectomy, according to Muller's 1956 proposal, was popularized by Pittaluga as the ASVAL technique.[23-27] Alternatively, an isolated tributary varicosities treatment, known as "tributaries disconnection" (from the saphenous trunk), is a fundamental part of the CHIVA method, aiming to exclude from the saphenous refluxing trunk the retrograde flow directed to the re-entry perforators.[28] According to the strictest rules of purists, the disconnection entails the preservation of the corresponding varicose network, which the re-entry perforator, devoid of GSV retrograde diastolic flow, will drain. Only a few centimetres of the tributary, the most dilated and proximal to the saphenous stem, could be sacrificed, preserving the superficial tissue drainage.[39] When the re-entry perforator(s) is centred on the tributary (like in about 60% of the cases), the reflux in the saphenous vein will be abolished, due to the gradient elimination (RET positive).[28] This procedure is called "first step CHIVA 2"; in the follow-up, if the reflux reappears, a possible SFJ interruption may be indicated (second step). Conversely, if the perforator is centred on the saphenous stem, the reflux will persist, although reduced (RET negative).[40] Although phlebectomy and disconnection produce similar hemodynamic effects, leaving the varicose network intact may facilitate recurrence, as new flow pathways can quickly bypass the ligation point and re-establish the original hemodynamic pattern.[41]

ASVAL and the first step of CHIVA 2 are essentially the same procedure.[42] In both techniques, reflux elimination at one year is achieved in approximately 60% of cases. The hemodynamic explanation for the disappearance of GSV reflux after tributary exclusion lies in the elimination of the pressure gradient between the source and the drainage point of the retrograde flow. Although the saphenous vein is no longer refluxing, it does not become fully competent (the Valsalva manoeuvre remains positive), as there is no distal outflow pathway for the blood.

As the saphenous flow becomes centripetal again and diastolic backflow ceases, the saphenous wall begins to recover. This explains why, when the SFJ is competent, the outcome of tributary exclusion is more favourable.[28] Similarly, when the terminal valves are present but only partially functional, a reduction in vein's diameter may help restore valvular function.

Reflux recurrence occurs due to the activation of a new perforator, either along the saphenous tract or via a pre-existing tributary that becomes incompetent, or through a "jump" of the previous interruption.

Phlebectomy and sclerotherapy of reticular and spider varicose veins - provided the saphenous trunk is preserved - are both compatible with these conservative method.[41] Reflux recurrence will generally (though not always) require an additional procedure: in ASVAL, this typically involves saphenous vein elimination, while in CHIVA it may require crossotomy with preservation of the saphenous vein.[35] In some favourable cases (limited varices and mild symptoms), a further phlebectomy or disconnection may help postpone the recurrence of GSV reflux.[41]

***Success prediction checklist***

Based on the available evidence in the reported literature, a theoretical checklist for predicting surgical success could help guide surgeons and support patients in making informed decisions by considering anatomical, hemodynamic, clinical, and technical factors (Table 2). The maximal score being 13, ≥8 favourable points suggest that isolated phlebectomy is likely effective and durable; 5-7

balanced; ≤4 predict a less effective and long-lasting durable outcome. Opposite sign (-) score suggests for a not favourable indication.

**Discussion**

There is evidence that a "tributary-first" approach could represent an alternative strategy to the initial GSV ablation that is currently the standard of care - potentially overturning the established order of treatment.[27] What initially appeared as an anecdotal intuition regarding the benefits of great saphenous vein preservation was progressively explained and validated through the expanding capabilities of duplex ultrasound. These developments were predominantly explored by CHIVA practitioners, who played a pivotal role in introducing a new hemodynamic paradigm in the management of varicose vein disease. ASVAL approach, more easily practicable than CHIVA, has been frequently adopted in alternative in saphenous sparing strategy.[43] Both methods are reported in American Venous Forum guidelines with a rate of recommendation 2 (weak), and quality of evidence B (moderate).[17]

Starting from the bottom (varices) rather than from the top (GSV), in selected cases - possibly guided by an indication's checklist - offers several advantages: simplifies the treatment procedure by avoiding the use of technological devices such as laser, Radiofrequency (RF), or High-Intensity Focused Ultrasound (HIFU). It may also reduce costs for both patients and insurers, as the procedure can be performed in an office-based setting without the need for specialized equipment.[35] Furthermore, preserves venous capital, particularly the saphenous trunk, allowing it to remain available for future use if necessary.[44-45] Another potential advantage is its ability to channel recurrences, thereby reducing the risk of anarchic venous spread.[46] The technique also helps maintain the drainage capacity of the lower limb, preserving physiological venous function.[47] In addition, it has been shown to reduce the calibre of the great saphenous vein, which may contribute to the restoration of venous competence or facilitate the elimination of reflux when required.[22,24,25,35,47]

Patients asking to get rid of varices appreciate direct varices treatment, such as GSV-sparing approaches, when the advantages are explained, particularly the possibility of preserving the GSV for future bypass use.

The most consistent drawback to the 'tributary-first' approach stems from both the lack of involvement by device companies and entrenched cultural and academic traditions favouring GSV ablation. While the latter could evolve over time, financial concerns are likely to be more resistant to change. The suggested checklist, derived from success indicators progressively identified by various authors, remains at present a theoretical proposal that warrants evaluation in future studies.

**Conclusions**

Varicose tributary elimination as an isolated procedure - leaving the GSV intact, even if incompetent - may be sufficient to treat a large proportion of cases, as suggested by several studies in the phlebology literature. The evolving understanding of the underlying pathophysiology provides the rationale for this seemingly counterintuitive surgical approach. A predictive checklist for treatment success could assist both surgeons and patients in deciding whether to adopt this conservative strategy.

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**Table 1.** Relevant publications on the tributary-first/only treatment of varices which were reviewed in light of the evolving understanding of the underlying pathophysiology, with inclusion limited to studies describing some evolution of the tributary-first/only approach.

| | | |
|---|---|---|
| Zamboni | 2001 | reflux elimination by simple disconnection + RET |
| Escribano | 2003 | at 3 years 90% reflux; SV diameter reduction |
| Pittaluga | 2009 | ASVAL-isolated phlebectomy preserve GSV |
| Pittaluga | 2009 | at 4 years in favourable cases 66,3% reflux non-significant |
| Zamboni | 2010 | positive RET+SPJ competence identifies positive result (50%of cases) |
| Biemans | 2014 | PREST: prediction score for reflux abolition by phlebectomy |
| Pittaluga | 2015 | freedom of VV recurrence at 5 years 87%: SV diameter reduction |
| Pittaluga | 2017 | at 10 years 64% reflux absence |
| Scheerders | 2023 | at 1-year truncal treatment limited in 26% after phlebectomy |
| Scheerders | 2024 | success predictors: tributary length, SFJ competence, GSV diameter |
| Cappelli | 2024 | pre-op. antegrade flow, female sex, lower CEAP score 45% success |

RET, Reflux Elimination Test; SV, Saphenous Vein; ASVAL, Ambulatory Selective Varices Ablation Under Local Anaesthesia; GSV, Great Saphenous Vein; SPJ, Sapheno-Popliteal Junction; PREST, Phlebectomy Reflux Elimination Success Test; VV, Varicose Veins; SFJ, Sapheno-Femoral Junction

**Table 2.** Isolated Tributary Treatment (ITP) success prediction checklist: ≥8 Favourable ITP, isolated treatment likely effective and durable; 5-7, balanced; ≤4 Favourable ITP, predicted for less effective and long-lasting durable outcome; the same for calculating Not Favourable ITP, "0" score for intermediate situations of diameters, tributary length, age, Body Mass Index (BMI).

| **Anatomical/hemodynamic factors** | **Favourable for ITP** | **Not favourable for ITP** |
|---|---|---|
| | **(+1)** | **(-1)** |
| SFJ competence | Competent terminal valve | Incompetent SFJ |
| GSV diameter | ≤5 mm | ≥6 mm |
| Reflux segment length | Short (<10 cm)/segmental | Long/diffuse |
| RET (Reflux Elimination Test) | Positive (reflux stops on tributary compression) | Negative (reflux persists) |
| Tributary characteristics | Long (<30cm) dominant tributary | Multiple diffuse tributaries |
| Pre-operative anterograde flow | Present | Absent |
| **Clinical & demographic factors** | **Favourable for ITP (+1)** | **Not favourable for ITP (-1)** |
| CEAP class | C2-C3 | C4-C6 |
| Age | <60 years | >70 years |
| BMI | <25 | >30 |
| Symptoms | Mild/moderate, cosmetic | Severe, trophic |
| **Technical/practical considerations** | **Favourable for ITP (+1)** | **Not favourable for ITP (-1)** |
| Ultrasound evidence | Tributary reflux feeding limited area | GSV trunk reflux dominates |
| Operator experience | Familiar with CHIVA/ASVAL principles | Conventional ablation practice |

| | | |
|---|---|---|
| Patient preference | Prefers conservative or minimal intervention | Prefers definitive single procedure |

RET, Reflux Elimination Test; ASVAL, Ambulatory Selective Varices Ablation Under Local Anaesthesia; GSV, Great Saphenous Vein; SFJ, Sapheno-Femoral Junction; CHIVA, Conservative Hemodynamic of Venous Insufficiency Ambulatory cure