CLAUDE FRANCESCHI
Prefaces Jean-Michel CORMIER - Giuseppe ZANNINI

THEORY AND PRACTICE OF THE CONSERVATIVE HAEMODYNAMIC CURE OF INCOMPETENT AND VARICOSE VEINS IN AMBULATORY PATIENTS

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Translation: John EVANS

ÉDITIONS DE L'ARMANÇON

ENGLISH COPY

1993

FROM

FRENCH TEX BOOK

1988

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Remerciements,

Je remercie tous ceux qui, par leur intérêt ou leur scepticisme à l'endroit de la cure CATIVA lors de mes premières publications, m'ont décidé à écrire cette lettre. Je n'oublie pas que Jean Marc Fichelle s'est généreusement prêté à la mise en place de la méthode, ni François Luizy, ni Martine Jardin, ni Josette Le Noenff, ni Jean Marc Massoni, ni Michel Medon, ni Paolo Carbone, ni Philippe Blanche Maison dont les conseils et le soutien dans mes premiers pas vers CATIVA m'ont été si précieux.

Je me souviens de Neige, si proche pendant ce mois d'août 88.

ISBN 2-906594-28-8

Préface

varices. Problème banal. Indications parfaitement codifiées. Traitées depuis 40 ans par une intervention logique, le stripping qui supprime le tronc saphènien incontinent, avec scléroses complémentaires. Les résultats sont satisfaisants mais existent des échecs liés à des variations anatomiques méconnues (dédoublements), et des récidives malgré l'absence de malfaçons techniques. Aucune autre stratégie n'est proposée : un dogme établi ne se discute pas.

À savoir l'échographie ; le doppler apporte de meilleures précisions que la clinique, l'échotomographie permet une carte géographique précise des veines incontinentes. Mais parallèlement il n'est pas possible de ne pas s'intéresser à l'hémodynamique normale et pathologique du système veineux des membres inférieurs pour comprendre le mécanisme créant le fait pathologique, et le traiter.

ceci conduit à revoir les règles intangibles du stripping.

Avec la même rigueur qu'il avait déployée dans l'étude des sténoses carotidiennes par une corrélation radiologique et chirurgicale, Claude Franceschi propose, en se basant sur une analyse hémodynamique, une nouvelle approche du traitement des varices.

Au lecteur de juger des bases théoriques exposées et d'apprécier l'intérêt du CHIVA qui a fait ses preuves avec deux ans de recul.

Léonard de Vinci, Dali avaient déjà utilisé calligraphie et dessins pour transmettre leur message ; Cl. Franceschi n'hésite pas à faire de même dans le domaine médical.

Ne pas admettre le principe d'autorité et oser sortir des traditions établies n'est-il pas source de progrès !

J. Pozmes

Prologue

J'ai cherché dans cette longue lettre à livrer les résultats actuels de mon expérience et de mes réflexions sur la maladie variqueuse.

J'invite le lecteur à me suivre dans les chemins qui m'ont conduit à proposer une attitude thérapeutique que j'ai appelée cure CHIVA, dans le but de la définir le plus complètement possible au moyen d'un style court.

Bièvre-lès-Semur
Août 88.

INTRODUCTION

The aim of the conservative and haemodynamic cure of incompetent and varicose veins in ambulatory patients (CHIVA) is to preserve the superficial venous capital and to treat lower limb varicose veins.I have based it upon a haemodynamic analysis performed with anatomic and functional investigations followed by light surgical procedures in ambulatory patients.

The CHIVA method will be exposed in two optics. The first is based on a strategy, related to an accurate haemodynamic, anatomic and functional analysis of the deep and superficial venous dysfunction leading to correct therapeutic decisions. This strategy is univocal in its principle, but varies in practical situations, according to the particularities of each patient because of the multiform features of the disease.

The second optic is tactical. It concerns the practical means of carrying out the strategical decisions.

Conservative:

With the exception of support stockings, medication and hydrotherapy, most methods of treating varices suppress part or all of the venous circulation. The superficial venous network of the legs may be required for arterial revascularisation. The CHIVA technique preserves at the least the main venous vessels by creating haemodynamic conditions which prevent stasis, venous hypertension and veno-venous shunts so that the diameter and walls of the veins tend to return to normal. The new haemodynamic conditions also account for the stabilisation of the varicose disease as the collateral vessels and unaffected veins do not support the overload of blood caused by the ablation of main collectors.

Haemodynamic cure:

The CHIVA method is based on haemodynamic considerations. The working hypothesis is that the constitutional or acquired parietal abnormalities of the varicose veins only become manifest because of the special haemodynamic conditions in the superficial veins of the leg. In consequence, a change in these conditions should result in the regression or suppression of the pathological manifestations of this disease even if the primary cause is parietal.

Insuficiency (venous):

The CHIVA method addresses not only varicose disease in the strict sense of the term, but also the problem of rectilinear superficial veins of normal calibre which also play a role in general superficial venous insufficiency by their dysfunctioning valves.(*)

Ambulatory patients:

The CHIVA method is performed on ambulatory patients under local anaesthesia. The first phase comprises very acccurate anatomical and functional venous mapping by clinical and echo-doppler ultrasonographic examination. The second phase, surgery under local anaesthetic, consists of making one to eight small, aesthetic skin incisions for venous access and disconnection. Other complementary procedures may be required after the first post-operative month.

(*) Superficial veins with valvular incompetence due to agenesis, dystrophy or lack of coaptation, whether or not they are large or small, rectilinear or sinuous.

1/ PHYSIOLOGICAL FOUNDATIONS OF THE CHIVA THEORY.

HAEMODYNAMIC APPROACH (*)

**The histological and biological approach will only be mentioned and not treated in depth.*

Peripheral venous pressure is one of the determinants of the size of the superficial and deep veins, and is related to the parietal compliance.

- The principal factor in peripheral venous pressure is the hydrostatic pressure, the value of which depends on the laws of gravity and which changes with posture.

This phenomenon can be demonstrated by simple clinical examination:

- When the patient is standing, the calibre of the distal superficial veins is maximal. It decreases when the patient lies down and the vein collapses when the legs are raised above the level of the heart, confirming the importance of gravity and hydrostatic pressure in the variations of the size of the superficial veins of the legs.
- If the patient has varicose veins, the phenomenon is quite striking because of the contrast in the diameter of the varicose vein when the patient is standing compared with the venous collapse when the legs are raised.

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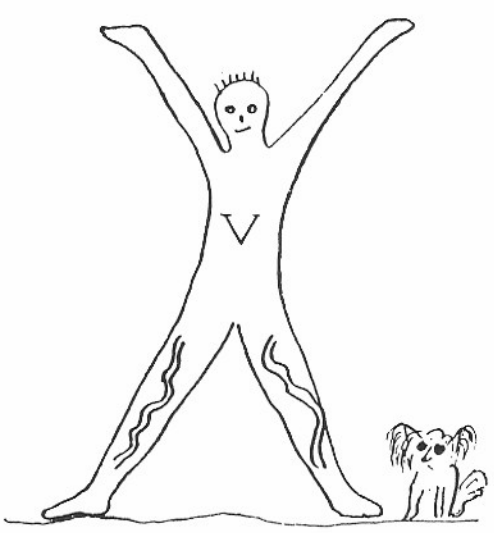
A FEW PRELEMINARY CONCLUSIONS MAY BE DRAWN FROM THESE SIMPLE OBSERVATIONS:

- The upright position (high hydrostatic pressure) is NECESSARY but NOT in itself SUFFICIENT to produce varicose veins (fig. A).
- Lifting the legs (low or negative hydrostatic pressure) is SUFFICIENT to suppress the varicose dilatation (fig. B).
- Abnormalities of the venous wall are NECESSARY but NOT in themselves SUFFICIENT to cause varicose veins (fig. B).
- Normal venous walls are SUFFICIENT to prevent varicose dilatation (fig. C).



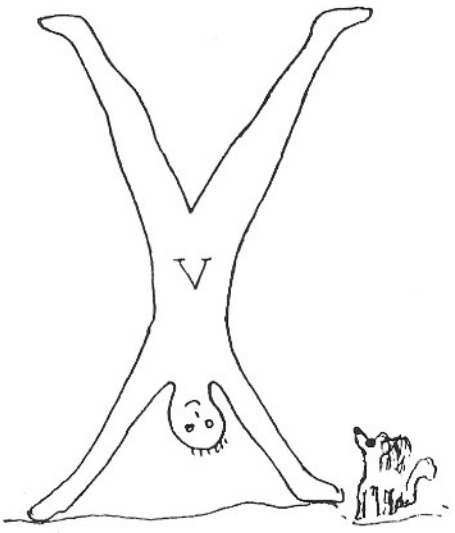


Fig. A Fig. B

V= Varicose patient : PARIETAL AND VALVULAR DISEASE

Therefore it is necessary to treat effectively either the venous wall or the hydrostatic pressure to reduce varicose dilatation.

The CHIVA method acts by reducing the hydrostatic pressure to reproduce conditions favorising venous collapse when the patient is standing up, varicose veins

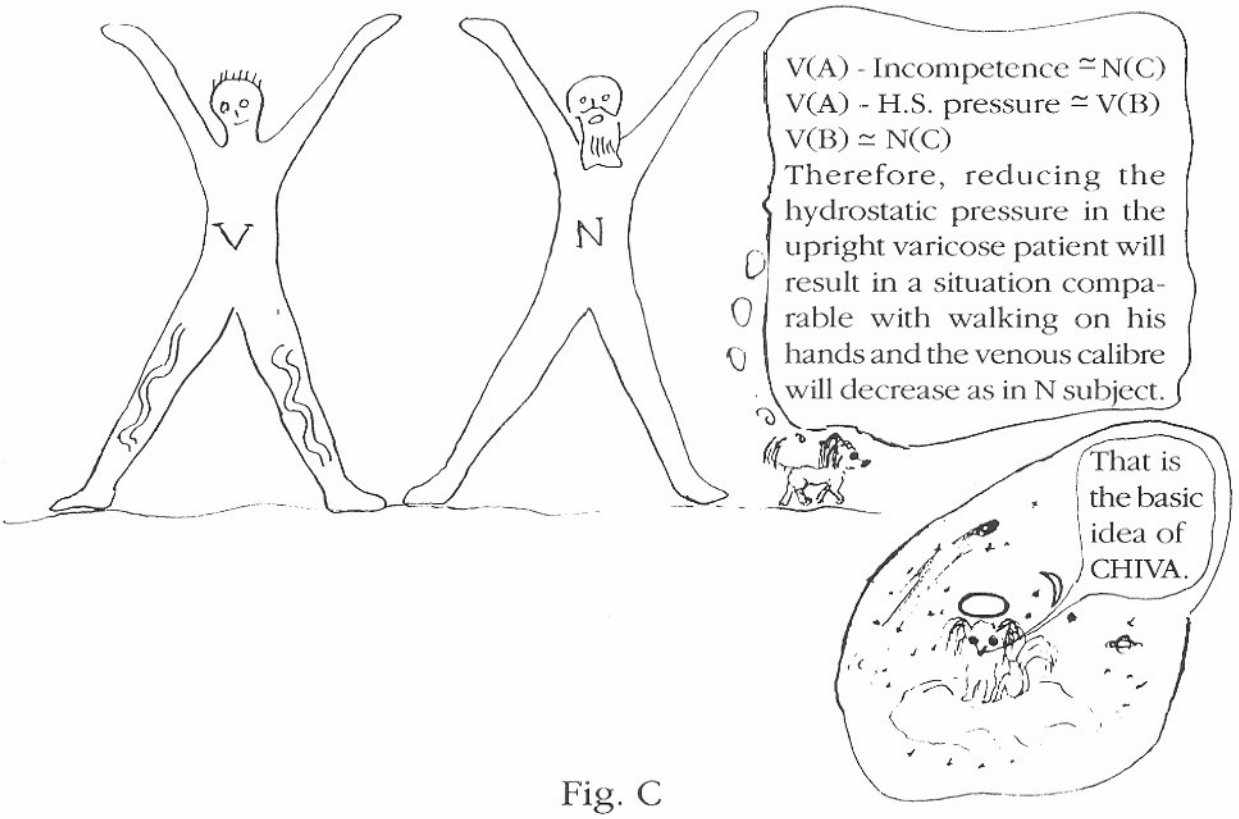


Fig. C
N=Normal subject: NORMAL VALVES.

behaving as if the legs had been raised. The treatment will not only reduce the size of the veins but also correct associated abnormalities (oedema, heaviness, pain,trophic abnormalities) related either to the excess pressure in constitutional or acquired deficiencies of compensatory systems against the mechanical aggression resulting from the upright posture, even though the latter be normal. In addition to control of the baro-trauma by the direct action on the hydrostatic pressure, the effects of supportive stockings and drugs on the vessel walls are potentialised.

Veno-venous shunts.

The second important principle of the CHIVA method reposes on veno-venous (V.V.) shunts. Clinical examination is not sufficiently reliable for assessing shunts. This is why Doppler ultrasonography is so important by demonstrating the physiopathological abnormalities of varicose veins. The disorganisation of venous flow secondary to the functional abnormality of the venous valves, results in closed-circuits (BASSI) in which the blood goes "round and round" between the superficial and deep systems (or between superficial veins themselves), so aggravating the volume overload and accumulating hypoxic and "toxic" blood.
Because V.V. shunts result in inefficient deep valvulo-muscular pump action on superficial blood draining INTERRUPTION OF THESE VICIOUS CIRCLES IS, WITH THE REDUCTION OF THE HYDROSTATIC PRESSURE AND DRAINING VEINS CONSERVATION, THE ESSENTIAL OF THE CHIVA METHOD.

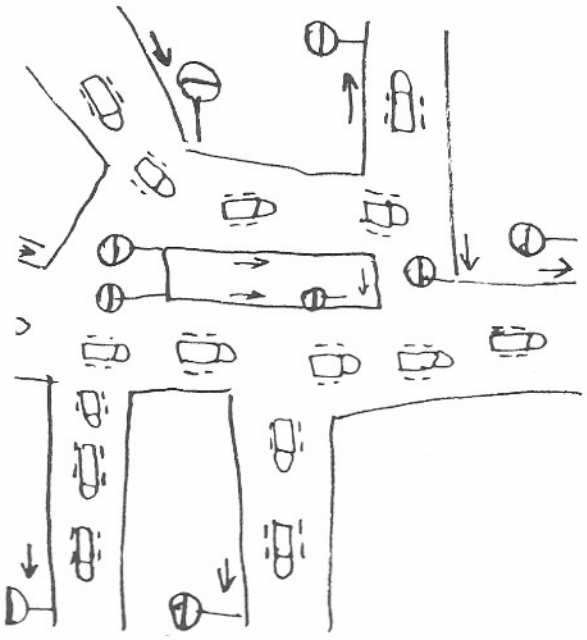


Fig. C

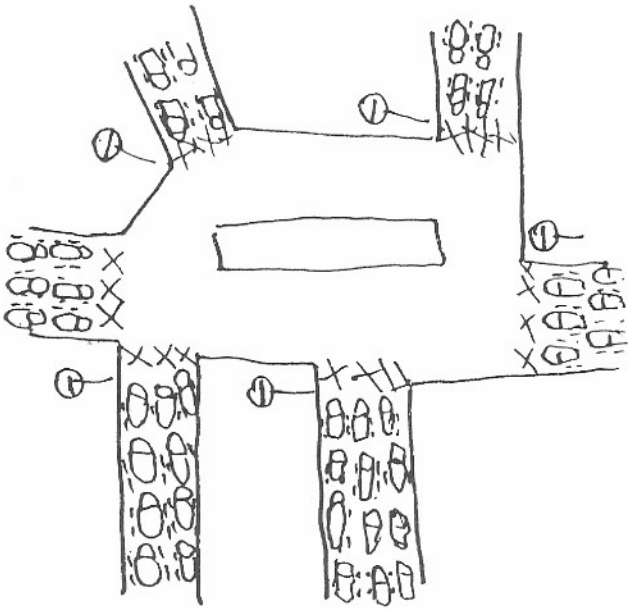


Fig. B

Fig. A

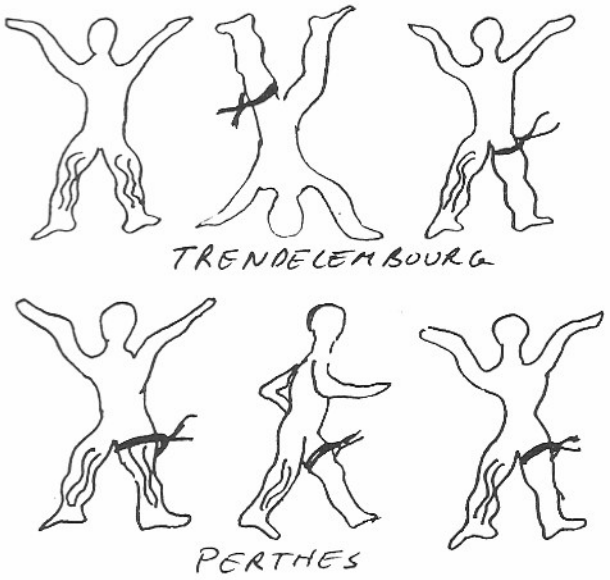
Suppressing a road junction in a town because it is always blocked (Fig.A) results in displacement and/or aggravation of the traffic problem (Fig.B). Organising the traffic flow without interrupting circulation, suppresses the traffic jam and improves the road conditions (Fig.C).This is the solution that the CHIVA method proposes in V.V. shunts.

The valvulo-muscular pump.

As we will see, prolonged immobility in the upright position is incompatible with the normal haemo-dynamic function of maintaining physiological venous pressure and cardiac return. Muscular activity, especially walking,is necessary to activate the "valvulo-muscular pump" consisting of the valved deep veins massaged by the contraction of surrounding muscles.
The beneficial effects of the CHIVA on the superficial venous circulation depend on the functional integrity of this deep valvulo-muscular pump.

Conclusion: The CHIVA method, reducing the hydrostatic pressure, disconnecting the veno-venous shunts and preserving the draining superficial network, can only be completely beneficial in ambulatory patients with a functional deep valvulo-muscular pump. These criteria are respected in the vast majority of patients with superficial venous incompetence. Many patients, especially with trophic changes, have a predominant superficial insufficiency and deep venous incompetence. In these cases, if superficial veins do not supply a deep venous occlusion, CHIVA method will be beneficial, even if incomplete.

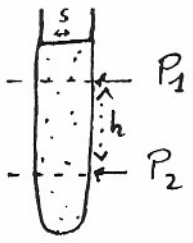
In fact, TRENDELENBOURG and PERTHES said it all. The former, by interrupting the hydrostatic pressure in the recumbent position, showed that the varicose veins filled slowly in the upright position. PERTHES, by interrupting the same column of blood in the upright position, showed that walking tended to reduce the size of the varicose veins, thereby demonstrating the action of the deep valvulo-muscular pump. However, the efficacy of the tourniquets and the accuracy of their sites of application limited the development of these significant manoeuvres. The CHIVA method is only a logical prolongation of these clinical observations.



II/ HYDROSTATIC PRESSURE AND ITS PHYSIOPATHOLOGICAL CONSEQUENCES ON THE VEINS.

HYDROSTATIC PRESSURE: DEFINITION

In a liquid in equilibrium, the difference of pressure between two points is numerically equal to the weight of a column of liquid with a given surface area and a height equal to the difference in level between the two points.



Specific weight = weight per unit volume

P = Pressure

h = height between the two points of measurement

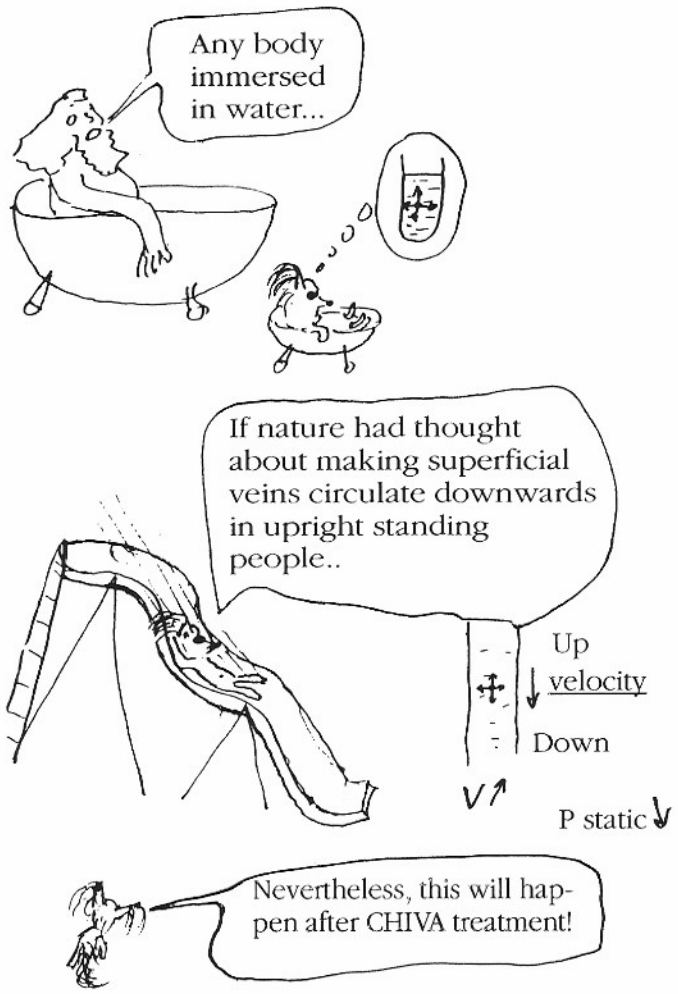
S = area unit

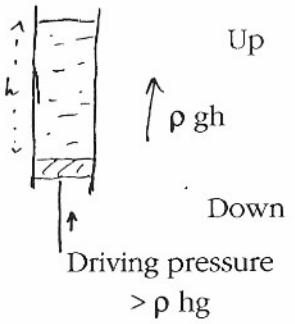
$P_2 - P_1$ = S x h x Specific weight

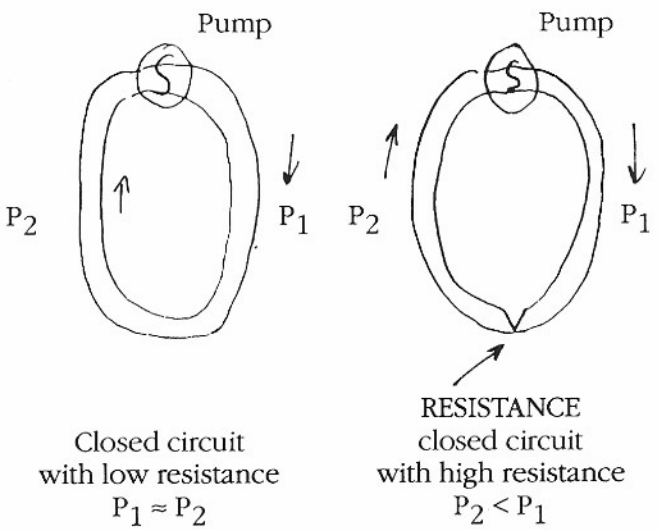
$P_2 > P_1$

Specific weights:

- Water = 1g/ml
- Mercury = 13,6g/ml
- Blood ≃ 1g/ml







Hydrostatic pressure is a concept which applies to liquids in equilibrium (static). At a given point, it exerts the same force in all directions. The pressure exerted on the containing walls is therefore equal to the vertical pressure at the same level. We call the pressure exerted on the wall, the parietal pressure, which is equal to the hydrostatic pressure.

If the liquid is placed in motion by its own weight by opening the bottom of the container, the hydrostatic principle, by definition, is not applicable as such. The liquid then obeys HYDRODYNAMIC principles. The law of conservation of energy states that the energy required for the motion must come from somewhere. In this example, the parietal pressure has to give up some of its potential energy, so that the greater the speed of motion, the less will be the parietal pressure (elevated legs, CHIVA). If on the other hand, the liquid is displaced upwards, it will require a force greater than the hydrostatic pressure (driving pressure gradient). The parietal pressure, related to the hydrostatic pressure, will be unchanged. If the liquid circulates in a closed circuit, even in the vertical position, the upward and downward moving columns equilibrate, so that the force required to circulate the liquid may be negligeable, except in cases where there are resistances between the two columns. The force required must then be greater than that due to the resistance. This is the case of the human circulation.

A/ IN THE STANDING IMMOBILE SUBJECT

When a person has been standing immobile for a certain period of time, the venous blood may be considered to be in equlibrium.

The pressure measured at the ankle in the superficial and deep veins, irrespective of the competence of the venous valves, is of the order of

90 mm of mercury

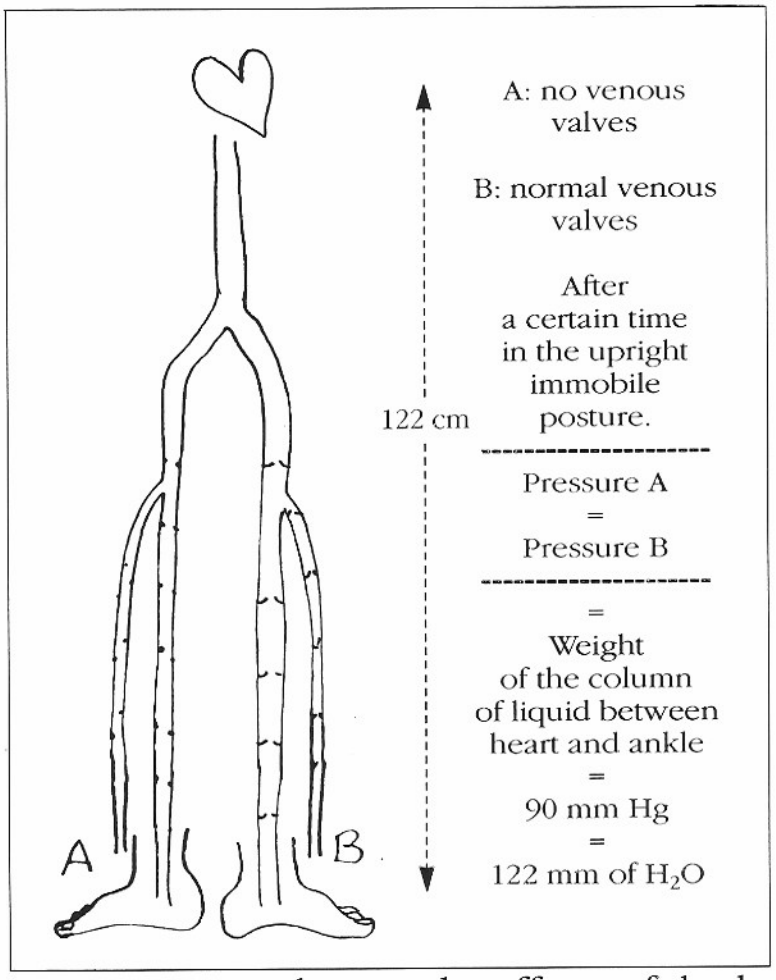
or

122 cm of water,

which corresponds to the distance between the heart and the ankle.

In the immobile posture, this pressure cannot be controlled (partitioned) even in normal subjects by the valvular system.

a) The hydrostatic pressure and its effects in standing immobile subjetcs



What are the effects of the hydrostatic pressure under these conditions?

– The pressure is greater as the distance from the heart to the ankle increases.

– The pressure is applied to the visco-elastic venous wall:

– supple, elastic, viscous,

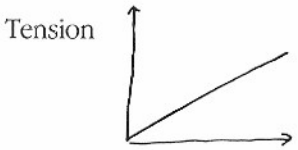
which results in progressive dilatation due to the force of tension, which itself increases with an increase in radius (T = PressurexRadius).

Therefore, veins under constant pressure will tend to dilate and this tendency increases as the veins dilate (vicious circle) but with a certain inertia and latency (VISCO).

– Under these conditions:
– The <u>venous volume increases</u> causing an intravenous "haemorrhage" which may suddenly reduce venous return to the heart: SYNCOPE.

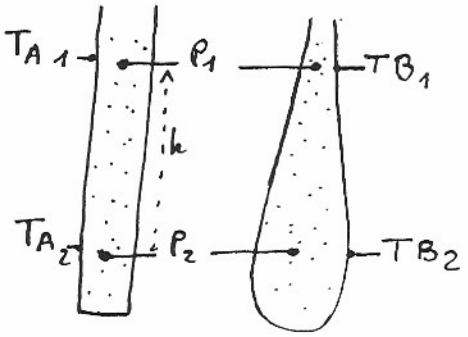
T = tension
= pressure x radius
= P.r
If nothing opposes the force of tension it increases with the radius.

– <u>The venous distension causes functional valvular incompetence so that the weight of the column of liquid is transmitted distally</u>. This explains why there is <u>no difference in distal pressure</u> between <u>healthy subjects</u> and those with <u>varicose veins</u> when standing immobile.



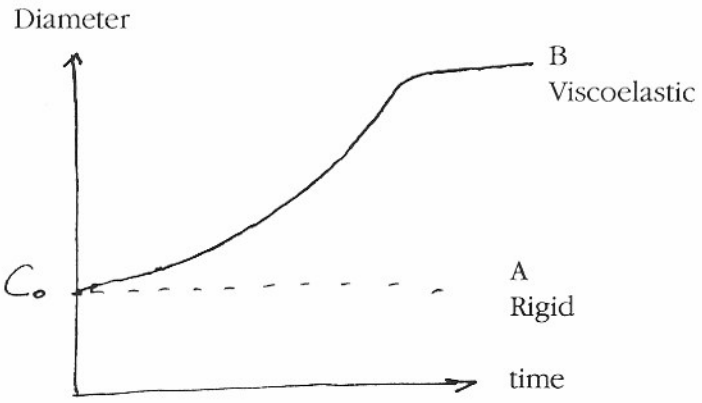
AVALVULAR VEIN

FUNCTIONAL INCOMPETENCE
under high and constant hydrostatic pressure



A B

A = Rigid container
B = Viscoelastic container
$P_1 < P_2$
T = Parietal tension
$P_2 - P_1 = \rho gh$
ρ = density
h = height
g = gravity in m/s²
$TA_1 > TB_1$
$TA_2 < TB_2$
P_1 in A = P_1 in B
P_2 in A = P_2 in B



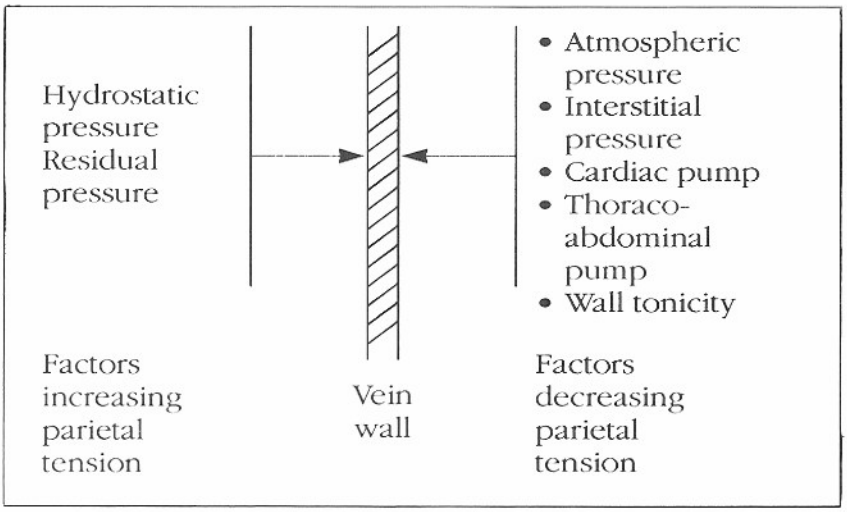
At a constant P_2, same initial diameter C_o when subjected to pressure at t_o.

– Therefore it is quite obvious that:

PROLONGED IMMOBILITY
IN THE UPRIGHT POSITION
IS INTOLERABLE

creating FUNCTIONAL VENOUS INCOMPETENCE
IN HEALTHY AND
PATHOLOGICAL SUBJECTS

This incompetence develops sooner and is more severe when physiological mechanisms which counteract venous hypertension are less effective.
The clinical consequences are:
– heaviness, pain and other leg symptoms
– oedema and trophic abnormalities
– venous turgescence
– syncope
– development of varicose veins
in many people exposed to this posture by their professional occupations.



b) Factors which counteract the effects of hydrostatic pressure in the upright immobile position.

PH = Hydrostatic pressure = $\rho_1 g h_1$
PR = Residual pressure =
PAT = Atmospheric pressure = $\rho_2 g h_2$
PT = Interstitial pressure
PC = Cardiac pump
PTA = Thoraco-abdominal pump
PT = Parietal tonicity

(PR) = Arterial pressure transmitted to the venous sector minus the pressure dissipated by arteriolar and capillary resistance
=
Arterial pressure-(Flow x arteriolo-capillary resistances)
Therefore PR
increases with fall
in arteriolar and capillary resistances (vasodilatation, opening of arteriolo-venular shunts).

(PH)
=
Hydrostatic pressure
=
122 cm of water at the ankle
=
$\mu 1gh1$

μ_1 = specific gravity of blood = 1mg/ml
g = gravity acceleration = 9,8 m/s²
h1 = height of the column of blood above measuring point.

(PAT)
=

μ_2 = specific gravity of air variable with temperature
H_2 = air column height which decreases with altitude.

Atmospheric pressure = $\mu_2 g h_2$ = 10 atmospheres = 1013 millibars at sea level and O°c = weight of a 76 cm column of mercury with a surface area of 1 cm² or of a 10 m column of water with a 1 cm² base.

Interstitial pressure.The pressure in the interstitial tissues and cells.

Thoraco-abdominal pump. The volumes of the thoracic and abdominal cavities change during the respiratory cycle, very much like cardiac systole and diastole, and this alters venous pressures in the same way as cardiac pump.

Parietal tonicity. This factor is responsible for active and passive mechanical resistance to the forces of tension which tend to distend the venous wall. This venous tone must be greater, under conditions of constant pressure, when the diameter of the vein is increased (T=P.r).

Passive mechanical resistance depends on the rigidity of the components of the vessel walls. Active resistance is related to vasomotricity.

Cardiac pump. Dilatation of the right ventricle is associated with a fall in right ventricle pressure. The pressures in the venous system tend to equilibrate by the movement of a quantity of venous blood towards the right ventricle. Therefore, during each diastole, the cardiac pump is responsible for a fall in mean venous pressure and the venous system would be emptied of all its blood, and for the continuous supply in flow and pressure by the arterial system through the arteriolar-capillary bed.

From all these seemingly unrelated factors, one unifying concept can be deduced:

THE TRANSPARIETAL PRESSURE: **TPP**

$$TPP = PH(*) + PR(*) - PT - PAT$$

This is the resultant force which exerts a real pressure on the venous wall.

*This is not all the residual pressure, only the parietal component (BERNOUILLI).This factor decreases with the velocity of blood flow. It is equal to PR when the velocity is zero. Also, the hydrostatic pressure, as previously defined, is only totally converted to parietal pressure at equilibrium, if at zero velocity. When the blood flows this PH is partially due to parietal pressure (principle of conservation of energy).

Therefore parietal pressure (PP)

=

$$PH + PR - 1/2\ mv^2$$

and

$$TPP = PP - PT - PAT(*)$$

Note that in upright immobile position, the velocity of venous flow is so small that the factor 1/2mv″ can be neglected.

*By convention, measured pressures are real pressure - atmospheric pressure.

Due to the importance of PH in the upright position, the TPP is positive and greater than the counteracting forces (PT and PAT) so that only the TP remains to prevent excessive venous distension. As we have previously stated, the upright immobile position is unbearable even in normal subjects.

– Oncotique pressure (OP) and the different metabolic pumps regulate the distribution of liquids in the capillary beds. The OP counteracts the tendency of liquids to leave the capillaries and enter the interstitial tissues. It is proportional to the plasma concentration of large molecules. It acts indirectly on the venous pressure by the distribution of fluid in the intra and extravascular compartments, and on the volumes, or more precisely, the blood mass. Therefore, at constant venous pressure, the OP is responsible for the exit and reentry of fluid in the venous compartment.

The pathogenic effects of the hydrostatic pressure in the prolonged upright immobile position:

- venous distension
- stasis
- oedema

are aggravated by the physiological and pathological factors which affect the parameters which we have just analysed.

These factors are the traditional risk factors for venous insufficiency.

Physiological circumstances

Heat:

- Increases the residual pressure and therefore the TPP by arteriolo-capillary vasodilatation and the increased arterio-venous shunting.
- Increases the diameter of the veins and thereby the parietal tension by reflex vaso-dilatation.

Decreased atmospheric pressure:

- Increases the TPP, therefore the parietal tension (altitude, low atmospheric pressure, plane).

Carrying heavy loads:

- Increases the TPP in the lower limbs by increasing intra-thoracic and intra-abdominal pressures.

Female genital activity:

- Decreases venous tone by hormonal impregnation, thereby increasing the diameter and parietal tension.
- increases intra-abdominal and pelvic pressures during pregnancy, accentuating the effects of the female hormones.

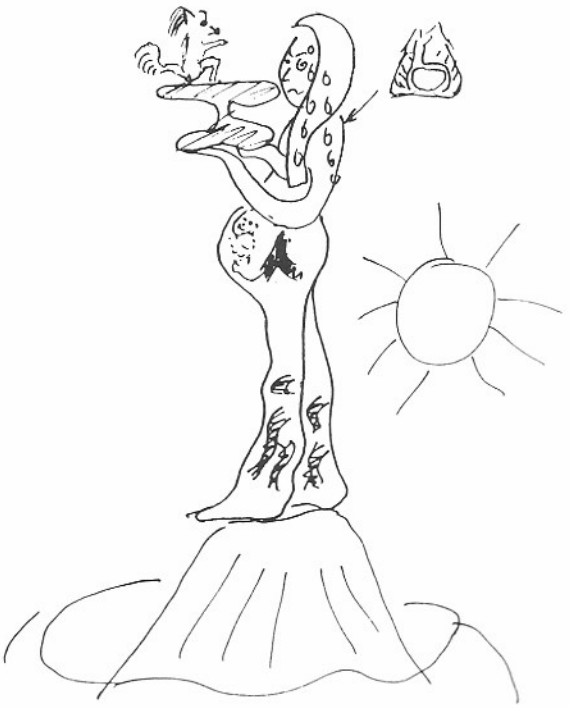
To summarise: the ideal pathogenic conditions for venous insfficiency are present in women who are

- Upright
- Immobile
- Exposed to heat
- At high altitude
- Pregnant
- Carrying heavy loads and aggravated by constitutional abnormalities of venous wall and vice versa.

Pathological circumstances:

- Problems related to heat exchange
  - excessive response of vascular thermoregulation to heat.
- Obstacles between the heart and the lower limbs
  - decreased efficacy of the cardiac and thoraco-abdominal pumps: venous thrombosis especially.
- Cardiac pump dysfunction
  - Tricuspid regurgitation, right ventricular failure and congestive cardiac failure.
- Thoraco-abdominal pump dysfunction
  - Abnormal thoraco-pulmonary compliance, poor diaphragmatic movement, abnormal abdominal wall muscular tone.
- Blood biochemical changes
  - Fall in oncotique pressure and/or changes in osmolarity (electrolytes, proteins, etc).
- Congenital or acquired abnormalities of the venous wall causing excessive compliance and/or loss of vasomotricity.

– Fistulous angiodysplasias which increase residual pressure.



To summarise: The ideal pathogenic and pathological conditions for venous insufficiency are present in women who are

- Upright
- Immobile
- At high altitude
- Pregnant
- Carrying heavy loads

and who, in addition, have

- Excessive responses to external heat
- Deep venous thrombosis
- Right heart or congestive cardiac failure
- Pulmonary fibrosis
- Reduced thoracic respiratory movements and phrenic nerve paralysis
- Nephrotic syndrome
- Abnormalities of the venous walls due to collagen, elastin or smooth muscle disease.

BUT

If they lie down with their legs in the air?

– Despite the interaction of all these physiological and pathological conditions:

– The veins will collapse
– Stasis will disappear
– Oedema will regress

BY
ONLY CHANGING
THE HYDROSTATIC
PRESSURE
thereby considerably
reducing
TPP

– But,who, except for Madame RECAMIER and the ROIS FAINEANTS, would enjoy living lying down with their legs in the air ?

– Therefore we can suggest:
– <u>Increasing the parietal tone directly:</u> drugs, miracle etc without modifying the TPP

– <u>Increasing counteracting pressures</u>
and reducing the TPP: anti-G suits or more simply by <u>support stockings</u>, <u>the first and only logical, real and durable therapeutic intervention</u> in lower limb venous insufficiency, not only in patient with varicose veins but also in healthy subjects exposed to the previously described risk factors.

– But it is also possible to create haemodynamic conditions which tend to reproduce the advantages of venous circulation when lying down in persons in the upright position. This is the object of the CHIVA method.If this goal is partially achieved, the efficacy of venotonic drugs and support stockings will clearly be improved.

– But haven't we just demonstrated that the prolonged immobility in upright posture is intolerable? Even if support stockings make it more bearable?
– However, man is a two-legged animal who has adapted to the prolonged upright posture by walking.

B/ IN THE WALKING UPRIGHT POSITION

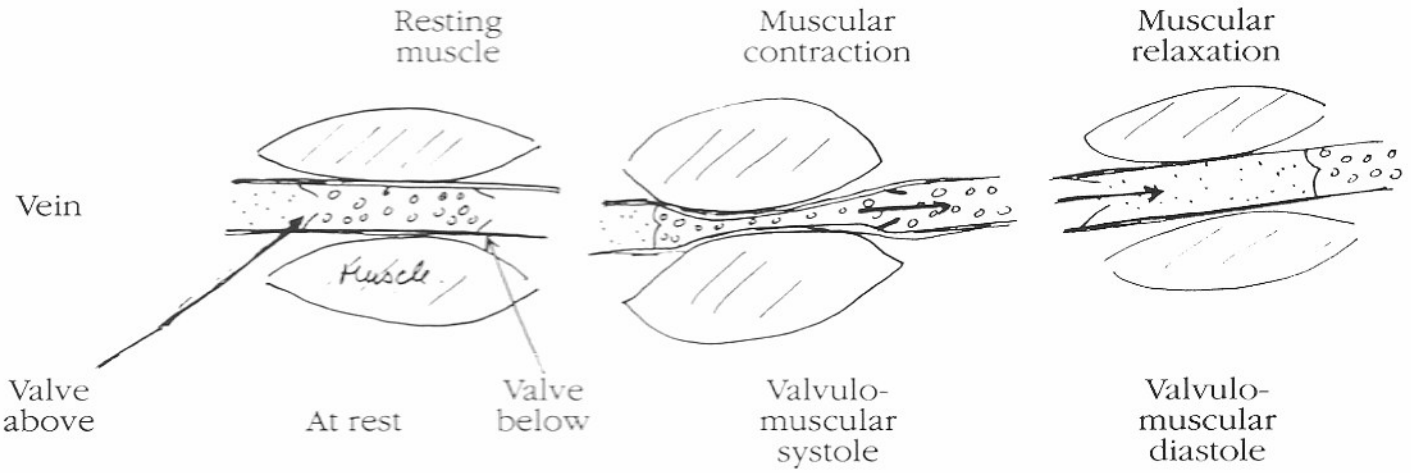
The ankle pressure in normal, walking subjects is less than 90 mmHg, less than the pressure recorded in the same person in the prolonged, upright immobile position.
In pathological cases, the pressure at the ankle is not reduced by walking and it may even increase.
Therefore, there are physiological ways of reducing the hydrostatic pressure on walking.
This must be a very powerful mechanism.

IT IS CALLED THE VALVULO-MUSCULAR PUMP(*)

(*) The pump of LEJARS (sole of LEJARS) will not be described in detail because, though active, it plays a minor role. At each step the veins in the sole of the foot are compressed by the weight of the body (plantar sole) forcing the blood upwards towards the main collecting veins.

a) The valvulo-muscular pump and the deep venous system

THE VALVULO-MUSCULAR PUMP

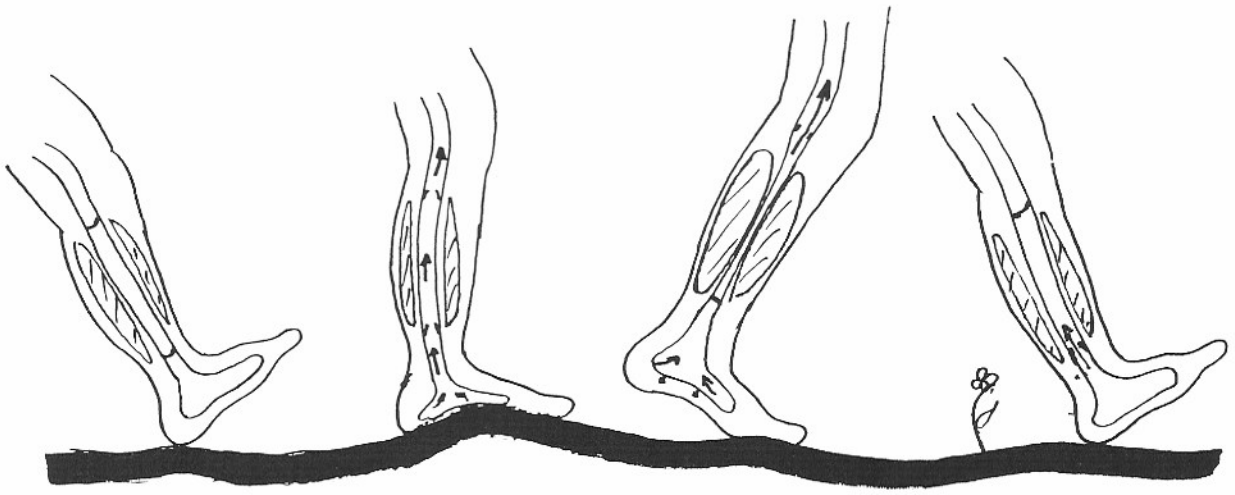


At each step, the muscles of the leg contract and empty the deep veins by compression (valvulo-muscular systole).

The direction of flow (the pump of Lejars and the valvulo-muscular pump act synergistically but at slightly different moments, the former before the later) from the foot towards the heart, is determined by the higher pressures presents distally and also by the valvular function which, by closure, prevents reflux and so ensures that blood flows towards the heart.

When the weight is taken off the leg (plantar diastole *) and the muscles relax the pressure on the deep veins

* this explains why we cannot completly neglect the LEJARS sole.



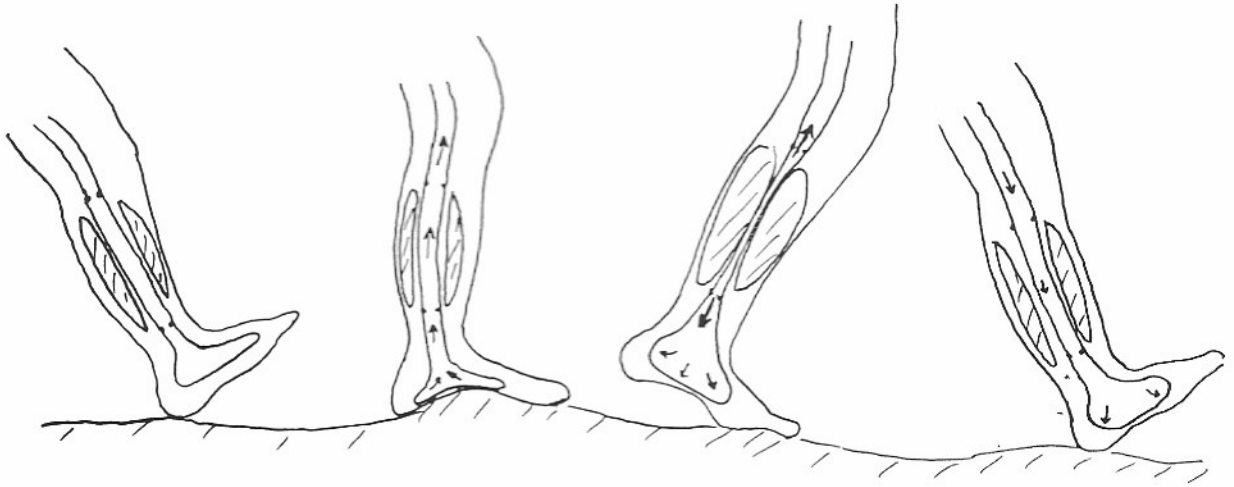
PLANTAR SYSTOLE | PLANTAR DIASTOLE

MUSCULAR SYSTOLE | MUSCULAR DIASTOLE

COMPETENT DEEP VENOUS SYSTEM

valvulo-muscular diastole), the relative depression between the valves results in valve closure which prevents venous reflux and opens more cranially situated valves,allowing the blood to flow towards the heart.

In the absence of a continent valvular system, the blood flows both towards and away of the heart in systole, resulting in the creation of a centrifugal pressure wave (hydrostatic pressure increased by the force of the muscle pump). In diastole the reflux of the hydrostatic column is almost total.



PLANTAR SYSTOLE

PLANTAR DIASTOLE

MUSCULAR SYSTOLE

MUSCULAR DIASTOLE

DEEP VENOUS INCOMPETENCE

This explains why the distal pressures decrease in healthy subjects during walking.
The valvulo-muscular system which is virtually ineffective in the prolonged upright immobile position becomes very important on walking.
Walking can improve the critical situation of upright immobility only if the valvulo-muscular pump is intact. The pressure decreases.
Walking can only aggravate the critical situation of upright immobility in patients with incompetent valvulo-muscular pump. The pressure increases (*).

Conditions of valvulo-muscular dysfunction:

– MUSCULAR DISEASE
- Paralysis
- Amyotrophies

– and/or

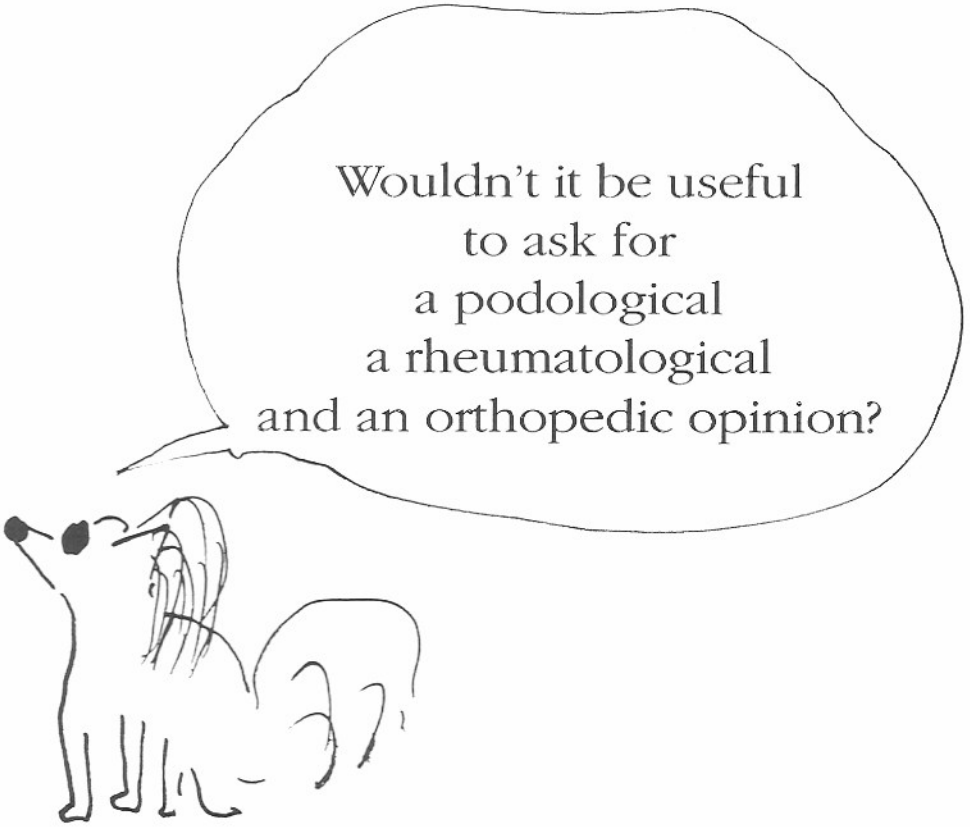
– VALVULAR DISEASE
- Valvular absence
- Valvular destruction
- Fonctionnal incompetence due to extreme venous dilatation.

Because the V.M. pump is a real functionnal unit.

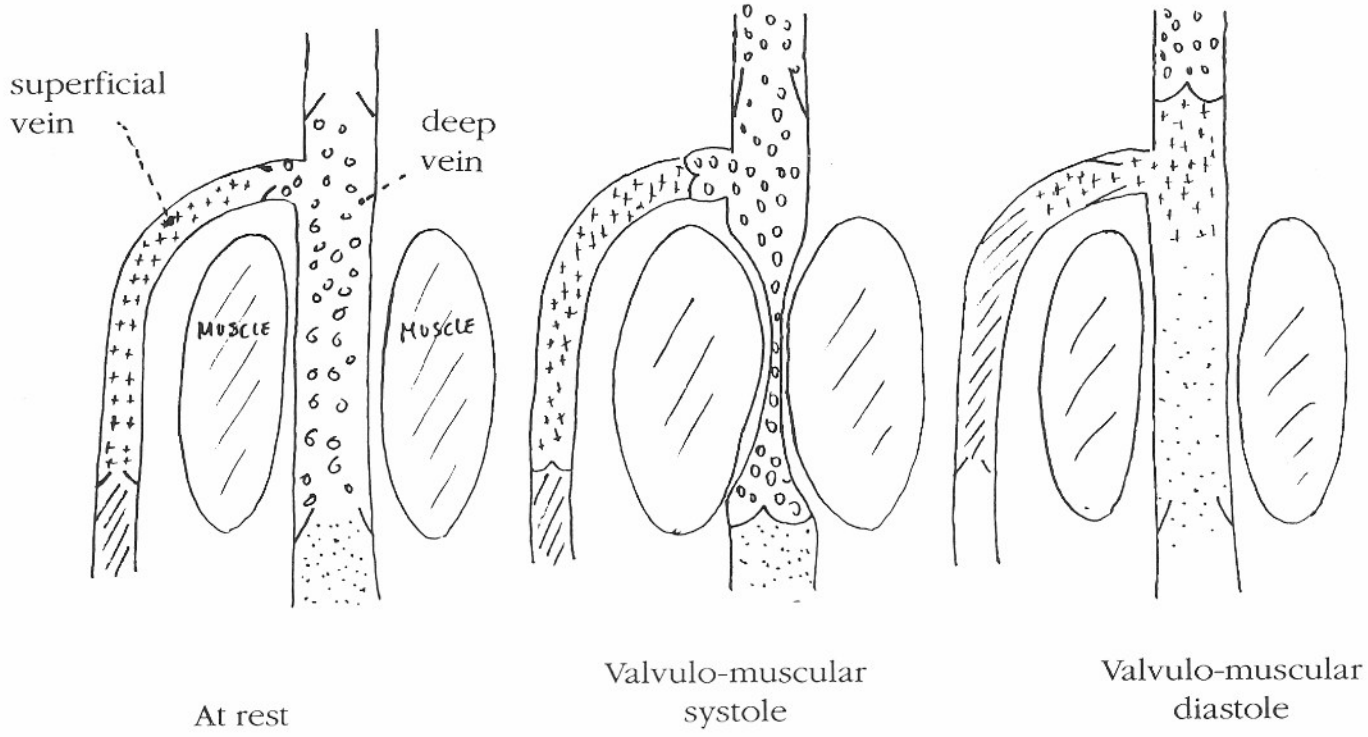
(*) The improvement in some physical symptoms of venous insfficiency on walking does not contradict this statement. Although, walking increases blood flow and reduces the stasis responsible for the symptoms, it also increases the parietal trauma by increasing the distal pressure pulse wave.

Measures to counter dysfunction
of the valvulo-muscular and plantar pumps

– MUSCULAR DYSFUNCTION
  - Support stockings, postures,physiotherapy
– VALVULAR DYSFUNCTION
  - Valvular reconstruction
  - Support stockings (increased distal counter-pressures)
– PLANTAR DYSFUNCTION
  - Footwear with a good sole-plantar fit.



b) The valvulo-muscular pump and the superficial veins



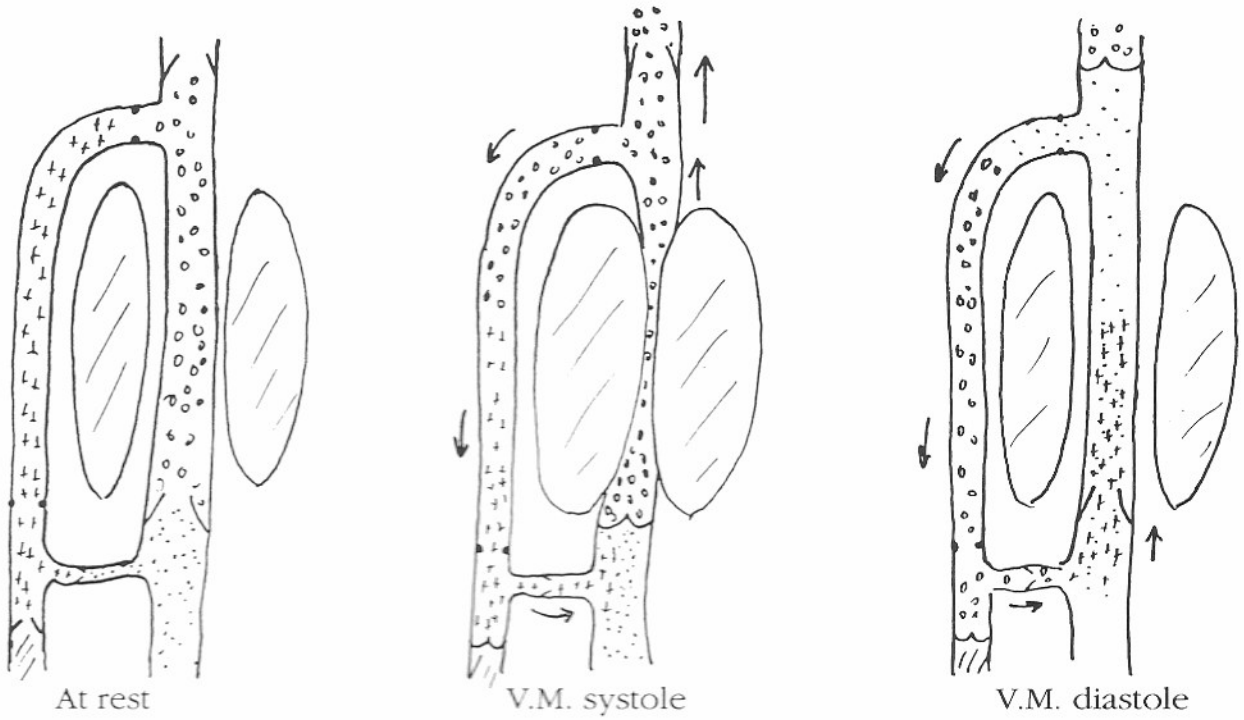
– This diagram shows that:

- The valvulo-muscular pump makes the blood flow towards the heart in the <u>deep veins</u>:
  - During <u>systole</u> and <u>diastole</u>

  and in the <u>superficial veins</u>:
  - During <u>diastole alone</u>

<u>Providing the superficial and deep veins are competent</u>.

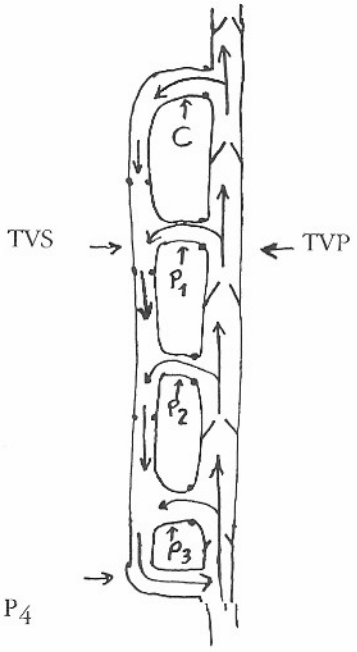
When the V.M. pump works normally and the superficial veins are incompetent



There is a haemodynamic disorder: VENO-VENOUS SHUNTS **(V.V.S.)**

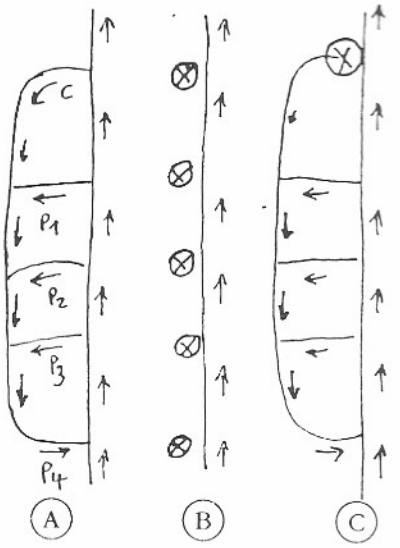
- Not only in the pathological superficial veins
  - increased pressure during V.M. systole with an increase of flow
  - reflux during V.M. diastole with even higher flow rates
- But also in the continent superficial venous system distal to the diseased segment which is unable to empty properly because of high proximal pressures during V.M systole and diastole.
- and even in the deep venous system which has to accept the volume and pressure overload, creating a vicious circle of pressure and volume overload with hypoxic and toxic venous blood.

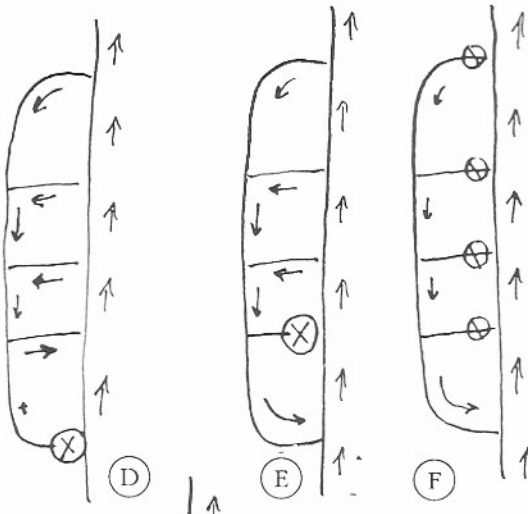
The complexity of the V.V.S depends on the anatomic location of the continent and incontinent communications between the superficial and deep venous systems, but the same physical principle applies.

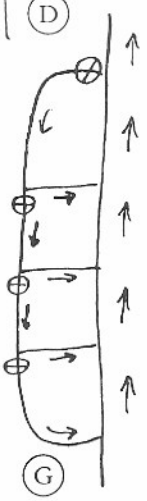


C = Incontinent saphenous ostium
TVS = Incontinent superficial veins
P_1, P_2, P_3 = Incontinent perforating veins with reflux
P_4 = Reentrant, continent or incontinent perforating vein
TVP = Continent deep venous system

In upright position







This diagram shows a system of V.V.S between the superficial and deep venous system in which the blood refluxes through saphenous ostium and three distal perforating veins (P_1,P_2,P_3) from the deep to the superficial system and then reenters the deep venous system again through a more distally situated perforating veins.

(A) Diagram of blood flow

How can this complex V.V.S. system be suppressed?

Solution (B):

- total destruction of saphenous ostium, saphenous trunk, and perforating veins:
- ablative procedure
- superficial blood drainage compromission
- lymphatic superficial drainage compromission
- possible venous draft compromission
- possible recurrences

Solution (C):

- simple ligature or section of the saphenous ostium
- suppresses only 1 of the 3 feeders of the V.V.S.

Solution (D):

- ligation or suppression of the reentrant perforating vein P4
- this only displaces the site of reentry to the next perforating vein (P3) without resolving the problem.

Solution (E):

- ligation or section of an intermediary perforating vein
- slightly reduces the reflux but does not resolve the problem.

Solution (F):

- ligation or suppression of the saphenous ostium and the perforating veins
- suppresses the V.V.S but a long column of blood with high hydrostatic pressure (saphenous ostium to ankle) remains, the superficial blood drainage is compromised (superficial vein thrombosis) and the recurrence risk is high.

Solution (G): CHIVA

Interruption by ligation-section of the saphenous ostium, ligation-section immediatly under the perforating refluxing veins P_1,P_2,P_3

- suppresses the V.V.S
- fractionates the column of hydrostatic pressure
- preserves the venous axes : better drainage and possible drafts.
- P_1,P_2,P_3 become REENTRANT perforating veins.

C/ THE VALVULO-MUSCULAR PUMP AND HYDROSTATIC PRESSURE IN THE UPRIGHT POSITION, IMMOBILE AND WALKING

Interaction of the deep and superficial venous systems.

a) Healthy subject.

– Upright immobile position:

- As previously shown, the forces counteracting the hydrostatic pressure are rapidly overcome and in the absence of muscular contraction, the valvular system is unable to fractionate the column of pressure and becomes redundant (*).

– Upright and walking:

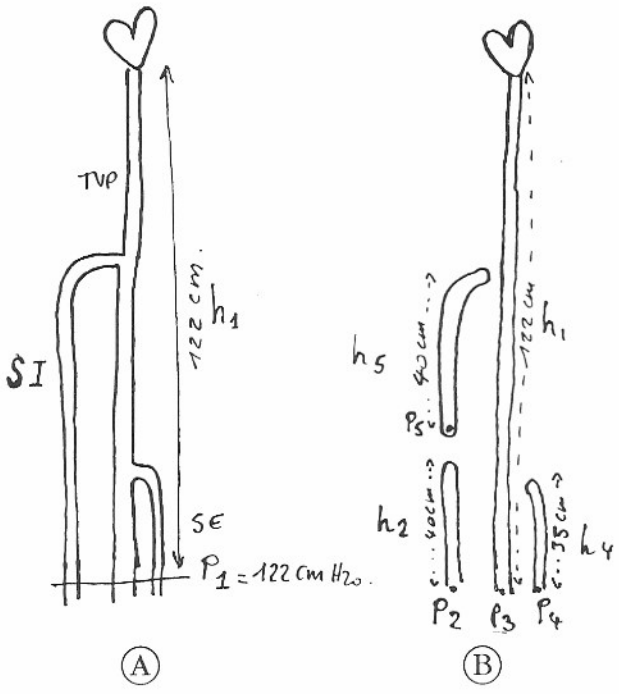
- The functional valvular system contributes to the valvulo-muscular pump and is active during muscular relaxation and contraction on the deep venous system, but only during muscular relaxation on the superficial venous system.

(*) This justifies the use of prophylactic support stockings (decreased transparietal pressure, reduced stasis and tension by compression) and venotonic agents in normal subjects with high risk of venous insufficiency.

b) In patients with pathologic venous systems.

– Upright immobile position

- As previously demonstrated, the venous pressure is not greater in the pathological than in the healthy subject, but the forces which normally counteract the hydrostatic pressure, especially the parietal tone, are partially or totally absent, which results in venous dilatation, increased parietal tension and stasis. On the other hand, the V.V.S system is not more active in this posture in pathological subjects than in healthy subjects.
- What can be done with regards to these pathological superficial veins, given that in the upright immobile position, the quality of the deep venous system is relatively unimportant?



– Here again, supportive stockings and venotonic agents are helpful, but:

– <u>Why not potentialise this treatment by fractionating the column of pressure</u>?

– <u>CHIVA</u>?

SI = incompetent, dilated great saphenous vein

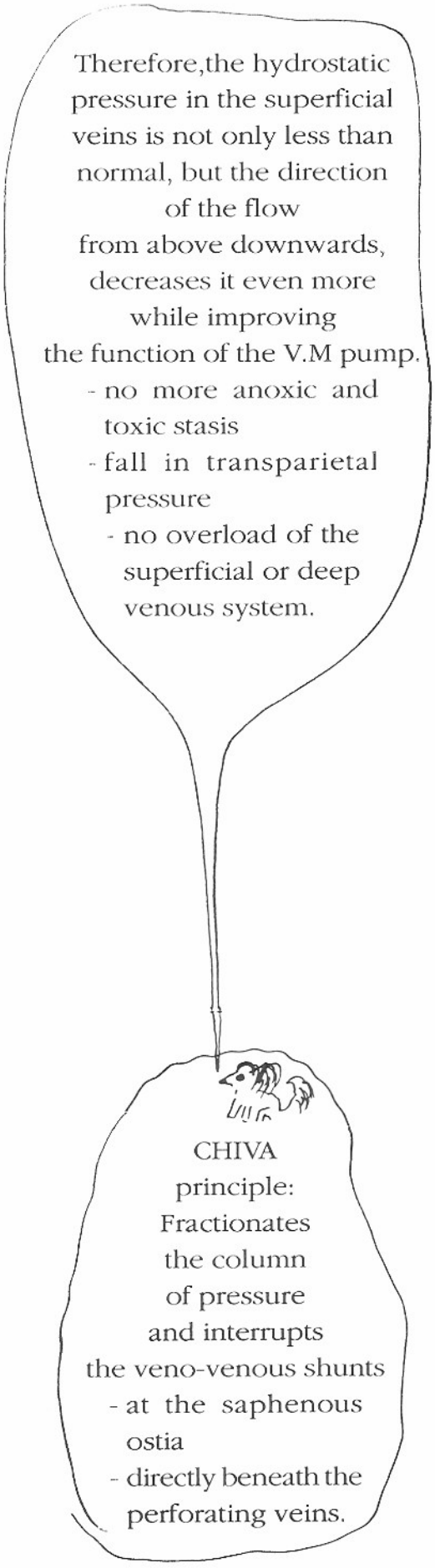
SE = incompetent dilated external saphenous vein

TVP = deep venous system (competent or incompetent).

In diagram (A), the hydrostatic pressure at the ankle is P1 =122 cm H2O or 90 mmHg in the saphenous and deep venous systems = height of the column of liquid between the heart-ankle.

In diagram (B), the column of blood has been divided at the level of the saphenous ostium and the knee.
The maximal hydrostatic pressure in each segment is therefore equal to the weight of the liquid remaining in each segment. This is true providing there is no residual communication between the superficial and deep venous systems, but this is not clinically valid because the perforating veins provide a communication through which the different pressures equilibrate.
Nevertheless, a significant benefit is obtained with respect to the hydrostatic pressure during a latent period (*), which may be quite long before the equilibrium is obtained (short periods of upright immobility).
Therefore this is an advantage compared with the situation before fractionating the column of blood.
In addition, it will be seen that slight muscular contraction, even in the static position, causes a fall in hydrostatic pressure by action of the deep valvular pump.

(*) parietal viscoelasticity

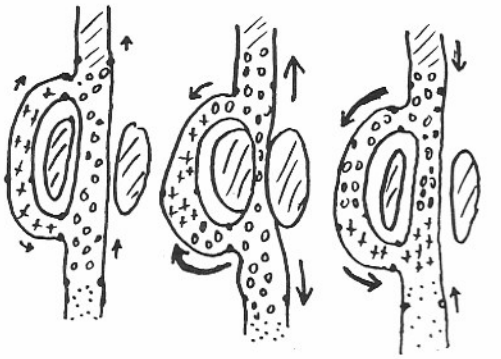


On walking

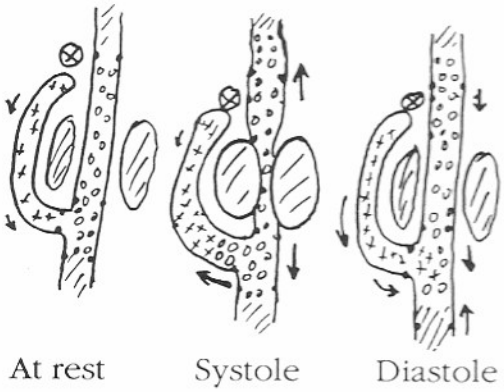
– With a normal deep venous system
  - In addition to the factors related to the upright immobile posture, the pathological effect of the V.V.S are observed (increase load in pressure and flow both in the superficial and deep systems, "venous claudication") with its cortege of symptoms related to the stasis, hypoxia, and accumulation of toxic wastes.

Walking is therefore a good preventive measure but it may aggravate pathological systems (the increased flow reduces stasis, but increases the parietal baro-trauma).

Logical management consists of supportive stockings and so-called "detoxifying" medications.
Non-conservative methods and sclero therapy requires detailled critical analysis which will be developped later on.



Ⓐ Total absence of deep and superficial valves.



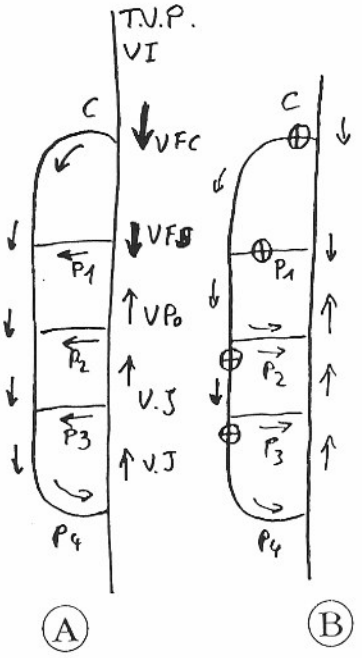
Ⓑ ⊗ CHIVA interruption of the hydrostatic pressure and shunt effect in case Ⓐ.

– <u>With a pathological deep venous system</u>

- <u>If there are no valves at all in the deep venous system</u>, the V.M pump cannot function and pressure waves will build up proximally and distally during systole with transmission of the hydrostatic pressure head to both the deep and superficial systems (which are already incontinent)

The CHIVA method associated with support stockings is a logical, though incomplete solution to the problem, suppressing the volume overload due to proximal-to-distal reflux (from the deep to the superficial veins), decreasing the hydrostatic pressure, decreasing the trans parietal pressure but not preventing the proximal-to-distal reflux (deep to superficial veins) adequately or the peaks of excessive pressure.

The ideal complementary procedure would be to revalve the deep venous system, so returning to the previous example: Aspirating V.M. pump.

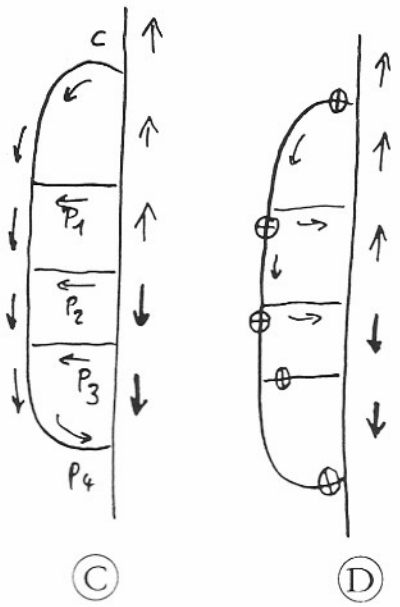


P_1 P_2 P_3 : Refluxing perforating veins
P_4 : Reentrant perforating vein
C : Incontinent saphenous vein
VI : Iliac vein
VFC : Common femoral vein
VFS : Superficial femoral vein
VPo : Popliteal vein
VJ : Calf and sural veins

– If the deep venous system is partially valved:
The dysfunction and overload will be most marked in the segment without valves.
One could propose to suppress the veno-venous shunts, fractionate the pressure column and assure reentry only via perforating veins communicating with a continent segment of the deep venous system surrounded by muscle.

The CHIVA solution (B) would be: interruption of the saphenous ostium at the junction with the common femoral vein and interruption immediately beneath the perforating veins P_2 and P_3. Ligation-section of the perforating vein P1, which would be suppressed.

For example, in example (A) with deep venous incontinence limited to the iliac, common and superficial femoral veins, and normal continence of the popliteal and calf veins and with superficial venous incontinence of the saphenous ostium, of the great saphenous vein, the perforating vein of DODD, the perforating veins of the leg with reentry via a large perforating vein of COCKETT.



Another example, situation Ⓒ;
The saphenous vein is under the same conditions as in situation Ⓐ but the deep venous system is different as only the deep calf veins are incontinent.

The CHIVA solution Ⓓ
- interruption of the saphenous trunk at its junction with the common femoral vein (ostium) and interruption just below the perforating veins P1 P2.
- ligation of the perforating veins P3 and P4 which would be suppressed, the intermediary segment of the saphenous vein would then thrombose or drain through a perforating vein.

We can close this chapter with a summary of the therapeutic principles of the CHIVA method as derived from physiopathologic concepts:

- FRACTIONATE THE COLUMN OF PRESSURE
- INTERRUPT VENO-VENOUS SHUNTS
- CONSERVE ALL REENTRANT PERFORATING VEINS DRAINING INTO A CONTINENT DEEP VENOUS SEGMENT.

BUT: to avoid overloading collateral veins, thrombosis in the drained veins, varicosities at the point of interruption the reentrant perforating vein must be large enough to cope with the volume of shunted superficial blood.

D/ GENERAL AND SPECIAL CHARACTERISTICS OF THE SUPERFICIAL VENOUS CIRCULATION IN THE LEGS

1/ General characteristics

Similarly to the deep venous circulation, the superficial venous system is characterised by:

a) Its haemodynamics

– The circulation is cardiopetal: flows from the periphery towards the heart.
– Flow depends on:
  - the pressure gradient between the foot and the heart generated by the cardiac pump, the thoraco-abdominal pump, the residual pressure and the valvulo-muscular pump.
– Flow, volume and pressures are affected by postural changes which depend on the laws of the gravity (hydrostatic pressure).
– The visco elasticity of the venous walls confers on the veins a high compliance and therefore a capacity to increase their diameter.

b) Its metabolic effects:

- Evacuation of toxic metabolites to organs of waste disposal and/or excretion (lungs, kidneys, skin)
- Transfer and exchange of substances between organs (hormones, proteins, lipids, carbohydrates, etc)

– Effect of distribution of fluids in the body: intracellular, interstitial, and intravascular compartments.
– Effects on thermoregulation.
– Effects on cardiac performance, especially by the constitution of reserve volume of blood.

It is obvious that the physiological functions of the venous circulation depend on the haemodynamic conditions. These relations and the physiopathological consequences of superficial venous insufficiency will be explained later.

c) Anatomo-physiological structures:

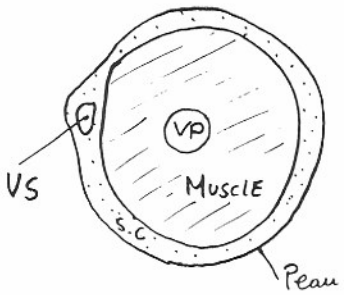
– Macroscopic: A convergent venous system from the venous micro circulation to the great collecting veins
– Microscopic: A histological structure of the venous wall containing different proportions of endothelial cells, collagen elastin, smooth muscle and adventitia according to the site and size of the vein, responsible for variable, but always high degre of compliance and for venous vasomotricity.
– Valves of variable number and topography.

2/ Haemodynamic features specific to the superficial venous system.

The anatomy of the superficial veins explains some of their characteristics.

a) Their superficial situation:

- The major part of the main saphenous trunks (network R2) are under the aponeurosis, but all the collaterals (network R3 and R4) are above, directely under the skin. Therefore, the collaterals are submitted to a globally higher transparietal pressure (because of the low interstitial pressure of the subcutaneous tissues) than the main saphenous trunks and the deep veins which are surrounded by aponeurosis and muscles.
- So, they maintain a normal calibre essentially by their parietal tone (structural and vaso-motor). This explains why they tend to dilate more than the others (low atmospheric pressure, heat,upright immobile position).
- So explaining why external elastic support, by reducing the transparietal pressure, may stabilize the progression of the disease or why the efficacy of venotonic drugs depends on good control of transparietal pressure (CHIVA and/or elastic support when the disease is clinically apparent).

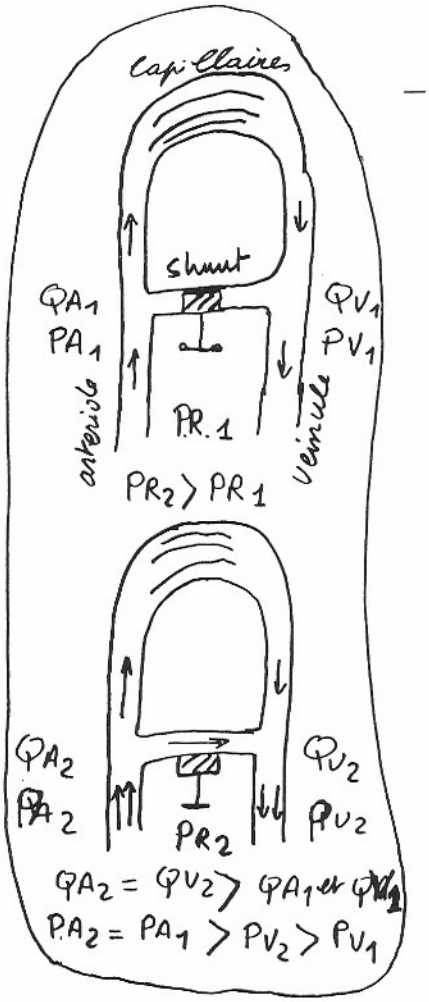


VP = Deep vein
SC = Subcutaneous tissue
VS = Superficial vein

Venous wall:

- ELASTIN
- COLLAGEN
- SMOOTH MUSCLE

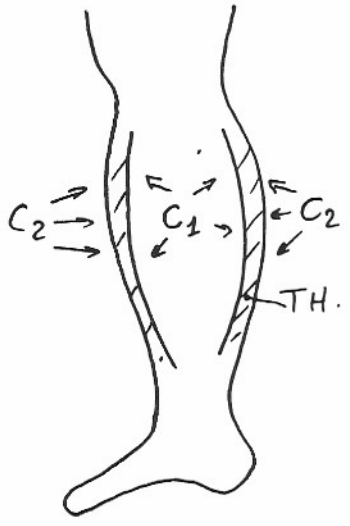
IN
VARIABLE
PROPORTIONS.



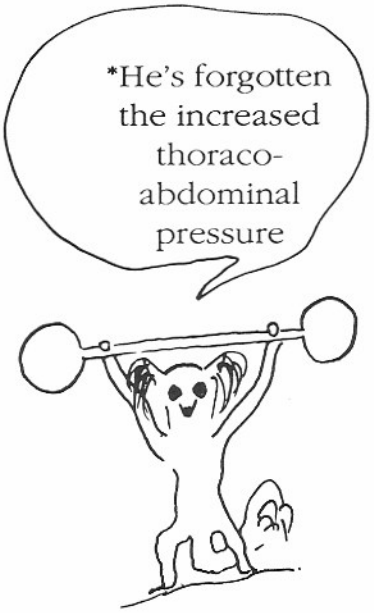
– Participating in thermoregulation, flow in the superficial venous system increases in order to increase heat loss. This increases the residual pressure by arteriolo-capillary dilatation and opening of arteriolo-venular shunts while the parietal smooth muscle reflex becomes less effective, explaining the undesirable effects of heat especially in high risk subjects.This phenomenon merits two asides.

The first concerns athletes. The high incidence of varicose veins in athletes may be at least partially explained by increased flow for thermoregulation (endogenic heat) (*) and participation to high flow of venous return on exercise.

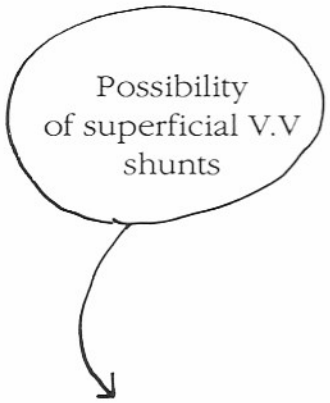
The second concerns thermoregulation and epidemiological aspects of varicose disease itself. It is possible that some factors of thermal dysregulation may explain the high frequency of varicose veins in some races and some countries excessive thermoregulation



C_1 : endogenic heath
C_2 : exogenic heath
TH : cutaneous thermoregulation



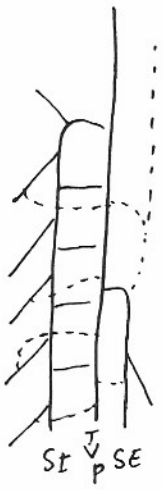
favorised by certain modes of life and fashions (covering up the legs, wearing shoes and socks, central heating : features of life in so called "developed countries") is more pathogenic in subjects predisposed to varicose disease. These factors may even counteract the beneficial effects of external elastic support, a source of heat. The beneficial prophylactic effects of wearing appropriate light clothing and shoes should be considered. Another approach is to find a therapy for controlling local thermoregulation mechanisms in the legs.



b) These veins, which are much more variable in number and topography than the deep veins, communicate between themselves like a vast network.

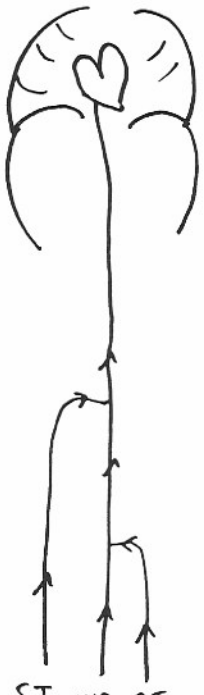
Orderly blood flow towards the deep venous system depends on the valvular system and the orientation of the pressure gradient.

Venous network with flow directed by the valvular system



SI : Internal saphenous
SE : External saphenous
TVP : deep venous system
—— : Commonest trajectories
..... : Less common trajectories

The variability in the quality of the venous walls and the inconstancy of the valvular apparatus exposes the superficial vein to dysfunction.
In addition, the communications with the deep venous system are also variable (saphenous ostia and perforating veins).



Cardiac and thoraco-abdominal pumps

Finally, they do not drain directly into the right atrium but into the deep venous system and depend on the prevailing haemodynamic conditions there in.
– The deep veins (the valvulo-muscular pump) protect the superficial system from the hydrostatic pressure and in addition, the superficial veins benefit from the suction of the cardiac and thoraco-abdominal pumps.
Disease of the deep veins is therefore very often followed by problems of superficial venous circulation.

c) These concepts explain the utility of a systematic anatomo-functional classification of the superficial venous system of the lower limbs and its connections with the deep venous system. It helps understand the physiopathology and deduce the logical therapeutic consequences of the CHIVA method.

ANATOMO-FUNCTIONAL CLASSIFICATION OF THE VEINS OF THE LOWER LIMBS

1) THE VENOUS NETWORKS

(R_1): **The primary network:**
This segment includes all the deep veins; it determines the quality of the pump

(R_2): **The secondary venous network:**
This segment comprises the main superficial venous collectors: internal and external saphenous trunks which have higher parietal tone than the afferent branches and communicate with R_1 by the saphenous ostia and perforating veins.

(R_3): **The tertiary venous network:**
This segment comprises the direct branches of the R_2 segment and therefore drain into R_1 either indirectly R_1-R_2 or directly by special perforating veins.

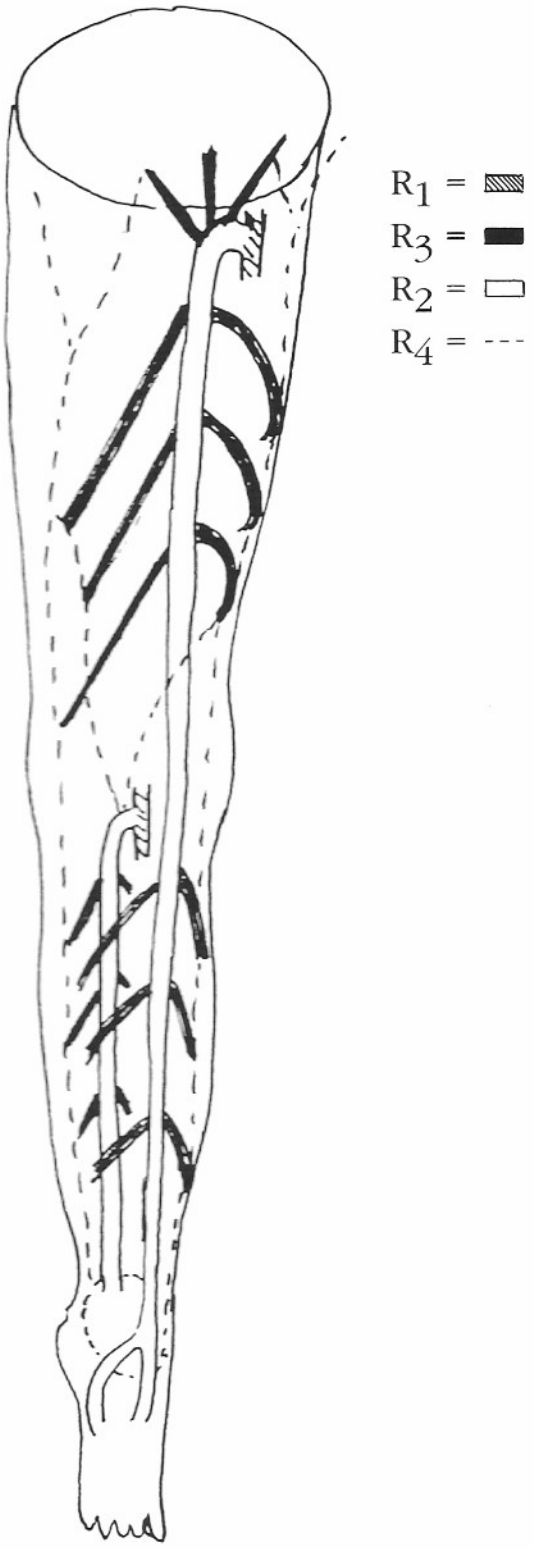
(R_4): **The quaternary venous network:**
This comprises all communications between the veins in segment R_2 and/or segment R_3 (for an example, the vein of GIACOMINI between the internal saphenous (R_2) and external saphenous trunks.

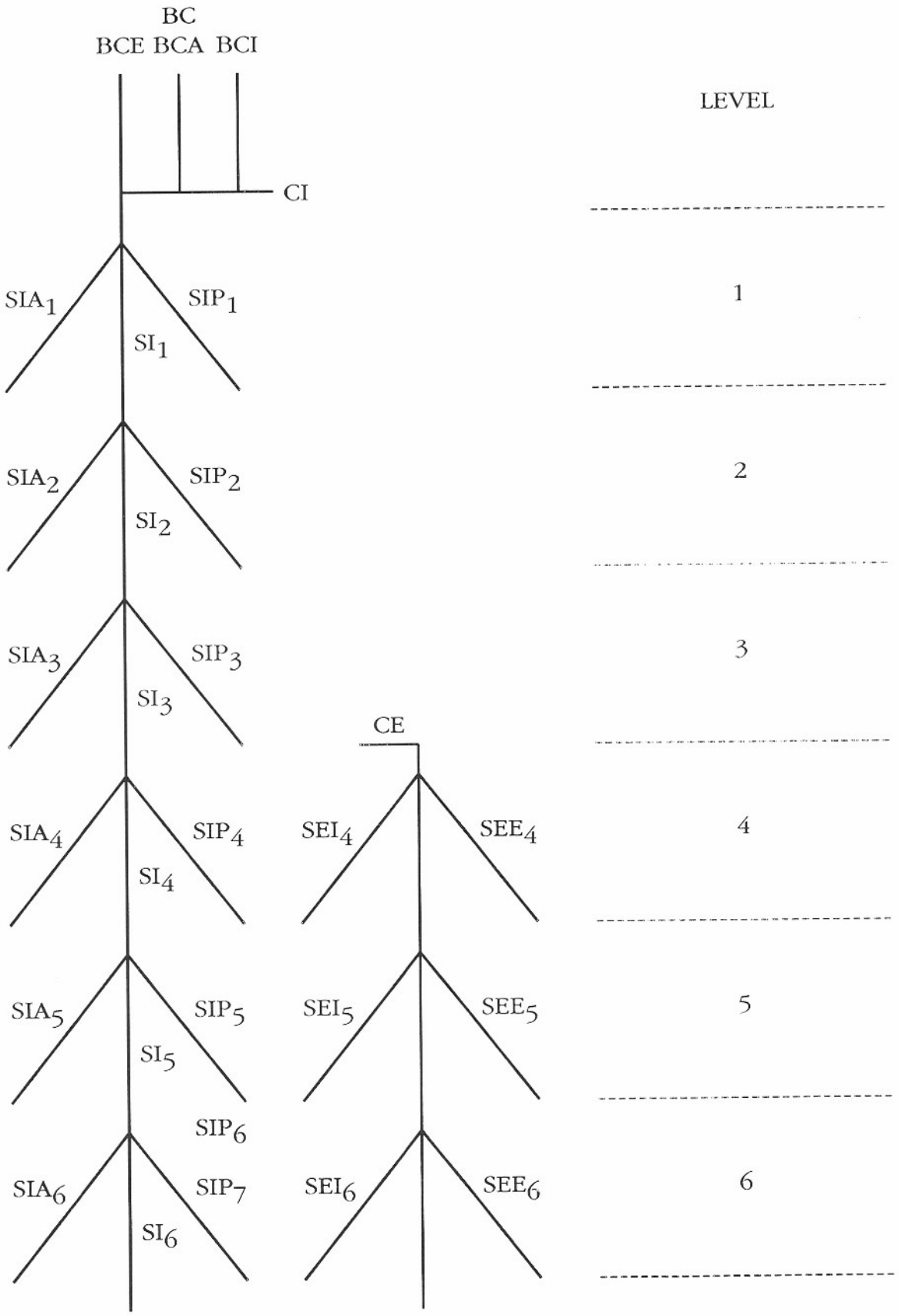
2/ CODING THE VEINS

– The veins may be coded as follows:

ANATOMY

– Level : 1, 2, 3, 4, 5, 6
  1: upper 1/3 of thigh
  2: middle 1/3 of thigh
  3: lower 1/3 of thigh
  4: upper 1/3 of calf
  5: midlle 1/3 of calf
  6: lower 1/3 of calf
– Site: A, P, I, E
  A= anterior
  P= posterior
  I= internal
  E= external
– Atypical veins and branches: QA
– Communicating branches: Q
– Communications: ⟶
– Crosses:
  CI: internal saphenous crosse
  CE: external saphenous crosse
  BC: branch of the crosse
  SI: internal saphenous trunk
  SE: external saphenous trunk
– Number:
  - O: absence
  - U: single
  - D: double
    DI: doubled internal branch
    DE: doubled external branch
– R_1, R_2, R_3, R_4
  - Primary, secondary, tertiary, quaternary veous networks.
– PE: perforating veins
  SC: sub-cutaneous
  SA: sub-aponevrotic
  IM: intra-muscular
– H, B, M: high, mid, low
  - Ø: diamater
    - Ø1: small
    - Ø2: medium
    - Ø3: large
– Trajectory: R= rectilinear, S= sinuous.


R1 =
R3 =
R2 =
R4 =


BC
BCE BCA BCI
CI
LEVEL
SIA1
SIP1
SI1
1
SIA2
SIP2
SI2
2
SIA3
SIP3
SI3
3
CE
SIA4
SIP4
SI4
SEI4
SEE4
4
SIA5
SIP5
SI5
SEI5
SEE5
5
SIP6
SIA6
SIP7
SI6
SEI6
SEE6
6

HAEMODYNAMIC

T= occlusion

Io= continent

I1= short reflux (incontinence without reentry)

I2= prolonged reflux

PE ⊖= refluxing perforating vein

PE ⊕= reentrant perforating vein.

This code anables a precise and rapid anatomo-functional description of the venous system.

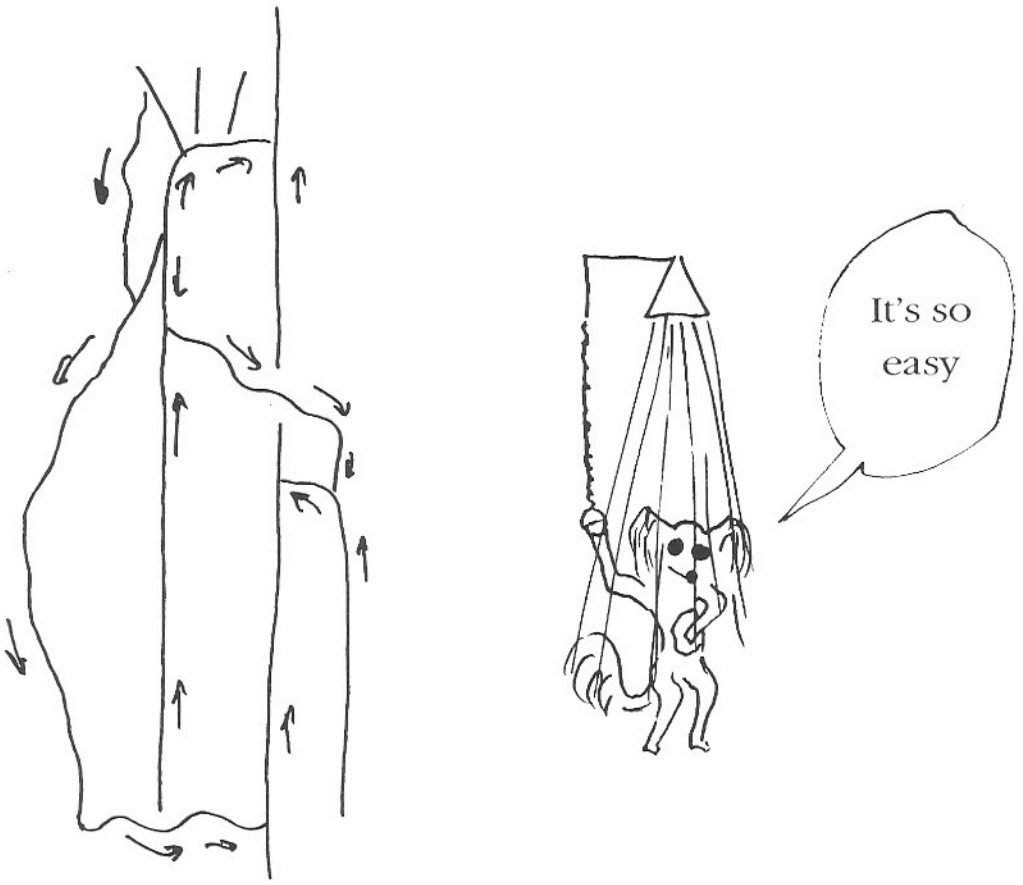
This code is easily adapted to computer programing (Text and graphism).

EXAMPLE

$$BCE \rightarrow (QA)_1\, I_2\, \emptyset_1 \rightarrow SIA_1\, I_2\, S\emptyset_3 \rightarrow (QA)E567\, I_2\, S\emptyset_3 \rightarrow PE \oplus_6 \emptyset_3$$

$$\downarrow$$

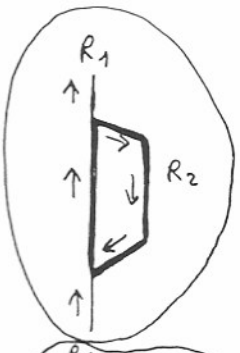
$$SIP_1\, I_2\, \emptyset_2 \rightarrow Q \rightarrow CEI_0.$$



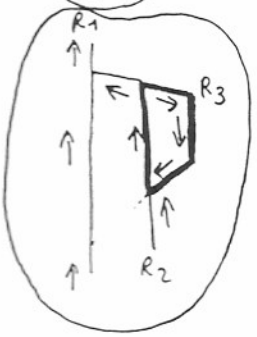
Topographic, morphological and haemodynamic coding.

Classification according to anatomo-functional characteristics.

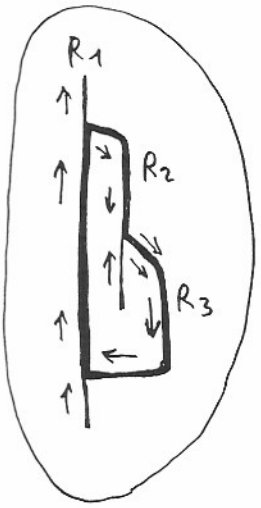
TYPE I: $R_1 \rightleftarrows R_2$



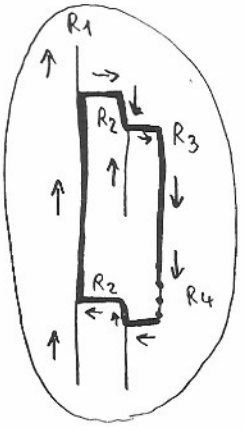
TYPE II: $R_2 \rightleftarrows R_3$



TYPE III: $R_1 \rightarrow R_2 \rightarrow R_3 \rightarrow R_1$

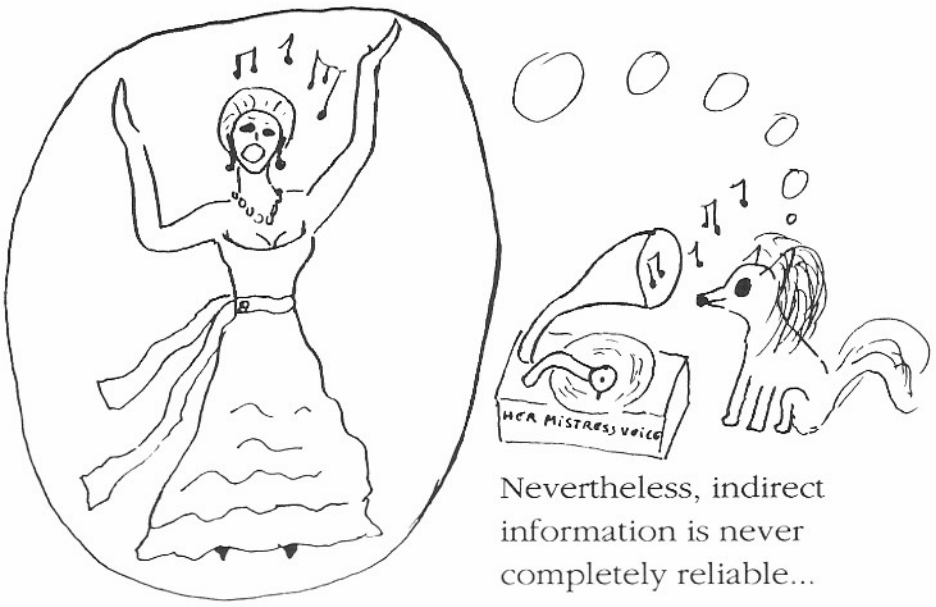


TYPE IV: $R_1 \rightarrow R_2 \rightarrow R_3 \rightarrow R_4 \rightarrow R_2 \rightarrow R_1$



Practical value of this classification

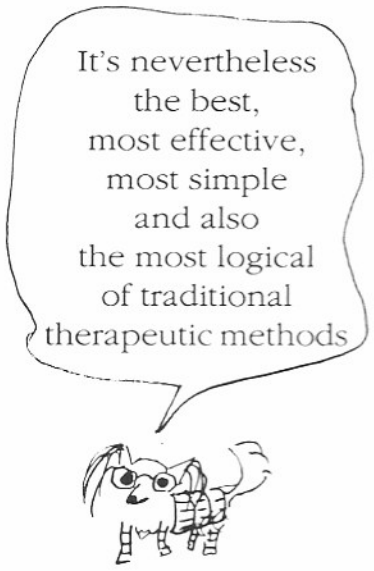
– Improvement of communication between practitioners
– Establishes simple rules for carrying out the CHIVA method:
  - Preserve completely the R_1 and R_2 networks
  - Preserve as much as possible the R_3 network
  - Suppress active segments of the R_4 network
  - Establish reentry in continent segments of the R_1 network
  - Labels the veins according to their topography and hemodynamics



Nevertheless, indirect information is never completely reliable...

E/ CRITICAL ANALYSIS OF THE MAIN THERAPEUTIC METHODS EXCEPT THE CHIVA IN THE LIGHT OF THE PREVIOUSLY DESCRIBED PHYSIOPATHOLOGICAL PRINCIPLES.

a) Conservative methods



Elastic support:

- The major advantage of the support stockings is that it reduces transparietal pressures and thereby the venous dilatation and oedema.
- Its major limitations are the poor control of V.V shunts, the undesirable increase in temperature locally and the fact that many patients find them unconfortable.

Venotonic drugs:

- These drugs are most useful in the early stages of venous insufficiency.
- Their action is very limited in advanced stages (patent venous incompetence) and they are only of value in association with other therapeutic methods.

Do biological parameters of disease of the venous wall necessarily indicate the presence of primary disease of the venous wall or are they the result of physical and chemical aggression due to increased pressure, stasis and hypoxia?

Ligations

– They have lost most of their credibility because of the variability of the end result: partial correction, progressive recurrences.

  However, the method itself is partially due to the technique of ligations (tactic)(*).But, failure is more usually due to inadequate anatomo-functional analysis of the haemodynamics in each case (strategy).

  Some sporadic successes may be attributed to luck when a ligation is performed at the appropriate anatomical site without its beneficial effects being compromised by an other ligation placed at an inappropriate site. This aspect of treatment of varicose veins will become clear to the reader later on when we explain the CHIVA technique in detail and when the author will try to explain the risks that occur from not respecting strategic guidelines.

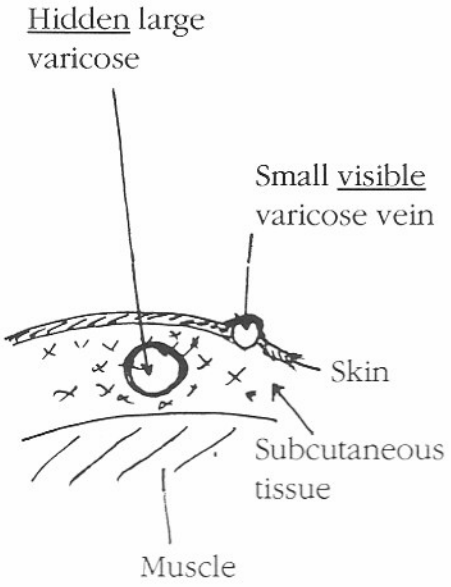
(*)As a matter of fact, a simple ligation of a vein may be either incompletely occlusive, or become ineffective after a certain period of time because of recanalisation (resorption or reject of the thread).

It's like fighting indians: it only requires a single shot to wound the chief for the whole tribe to retreat. On the other hand, you can kill as many braves as you like, but if you don't wound their chief, you won't stop the battle - quite the contrary. The Yankees had to be good strategists to understand this principle. In case of defeat, it was not the tactical means (gunshot or ligation) which were in question but the strategic principle which failed to recognise either the chief or the customs of the Indian tribe.

b) Destructive methods

Partial or radical by an endoluminal approach (chemical sclerosis, cryosclerosis, etc) or by surgical ablation (all forms of stripping)

– The "advantage" of the method is obvious : alone or in association, these methods suppress the "diseased" veins often sacrificing "healthy" veins at the same time, and in any case suppressing function with the dysfunction.



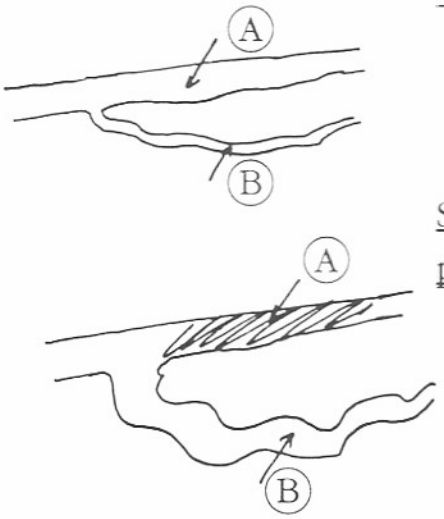
– The limitations of these methods are the inconstancy of their immediate results, the number of recurrences (sometimes explosive) either in situ (sclerosis) or at a distance (stripping or sclerosis) for the following reasons:

The superficial venous system is a network.

– Suppressing a visible varicose vein (A) results in the venous drainage being shunted to another small vein (B), hidden in the subcutaneous tissues. This vein will then be overloaded and become pathological.

– The fact that sometimes there are no "visible" varicose veins after these destructive methods does not mean that there are none left (pre-existing or secondary and masked by the thickness of subcutaneous tissues).

– Paradoxically, but only apparently, the greater the main collecting veins that are destroyed, the higher the risk of atypical neo-varicose formation.



Sclerosing methods do not always permanently interrupt the venous flow.

(*) The argument that the quality of these veins is not good enough for use as grafts in patients with venous insufficiency is false and goes against practical and anatomical realities. How many stripped veins in varicose patient are used for arterio-venous shunts in patients referred for dialysis? How many coronary or peripheral patent venous auto-grafts are performed in patients affected by varicose veins? The saphenous main trunks are usually rectilinear when incompetent because under the aponevrosis, and very often competent especially along the calf in varicose patients. Let them live!

THESE PROCEDURES ARE NOT CONSERVATIVE

- They reduce the venous capital by suppressing vessels, decreasing the subject's potential for venous auto-grafts (*) which are so important in vascular surgery. This is the main reason for preserving the R_2 network at all costs (the internal saphenous trunk is the best venous material).
- The superficial venous system is necessary for an efficient drainage of superficial tissues and skin.
- In addition, venous stripping results in lymphatic damage, aggravating the trophic condition.

Destroying drainage pathways favorises recurrence by the collateral effect due to increased residual pressure because of increase of resistance in micro-circulatory draining.

F/ THERAPEUTIC PRINCIPLES OF THE CHIVA METHOD BASED ON PHYSIOLOGICAL ARGUMENTS AND CLINICAL RESULTS

1°) PRESERVE THE SECONDARY R_2 NETWORK.

- Especially trunk of the internal saphenous vein.
- That of the external saphenous vein even if a less important collector and not as useful for grafts(*).
- Which implies that any intervention on these venous axes should not cause thrombosis:
  -loss of capital.
  -source of recurrence and evolutivity.

(*) Poor material for surgeons.

2°) PRESERVE THE TERTIARY R_3 NETWORK.

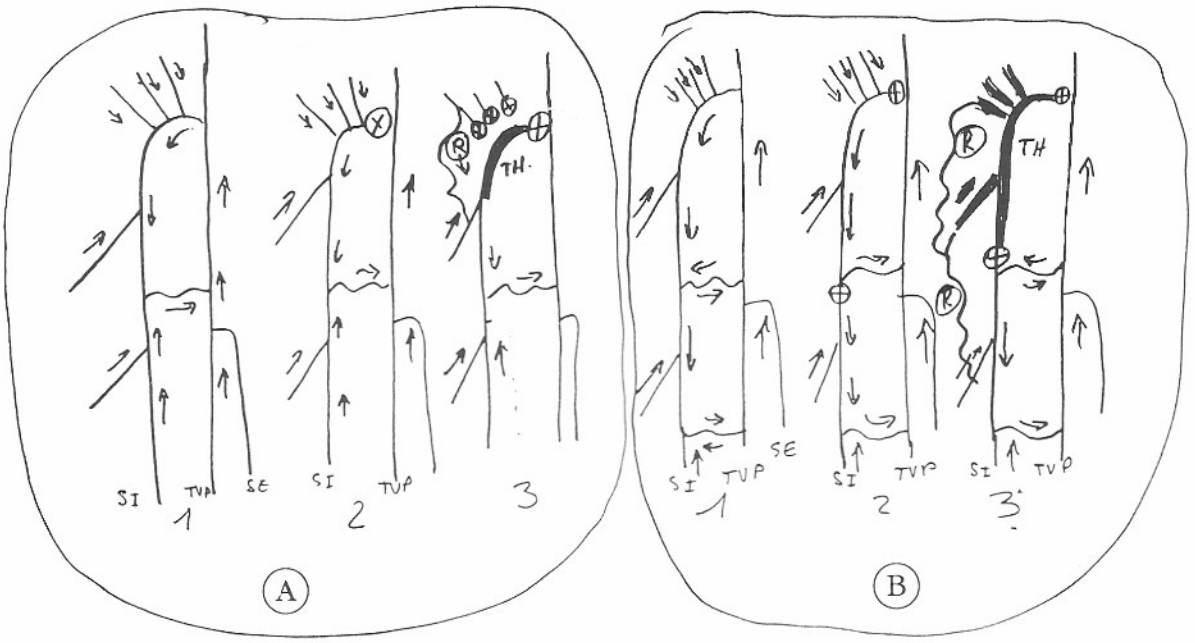
- All continent branches especially those descending to the crosse of the internal saphenous vein.
- The majority of incontinent branches, even all them, providing that the procedures to be carried out do not cause them to thrombosis.
- In cases in which an immediate esthetic result is sought (impatient patient and susceptible practitioner), an R_3 branch may be destroyed. However, with time, the preserved vessel would have returned to normal after CHIVA and destruction may result in replacement by spots and varicosities.

3°) INTERRUPT THE PRESSURE COLUMN ONLY ON THE INCONTINENT AXES

– Incompetent crosses
  - Groin and popliteal fossa, whilst respecting the descending branches.
– Incontinent axes
  - Internal saphenous vein slightly above or below the knee, as far as the middle of the calf, just underneath a perforating vein (continent or incontinent).
– If the branches of the internal saphenous crosse are not respected, if a reentrant perforating vein is not respected (continent or incontinent), the segments interrupted will thrombose.

Here are two examples

– If the reentrant perforating vein is not large enough to ensure adequate drainage, the segment will thrombose and/or will be overloaded and result in varicosities.



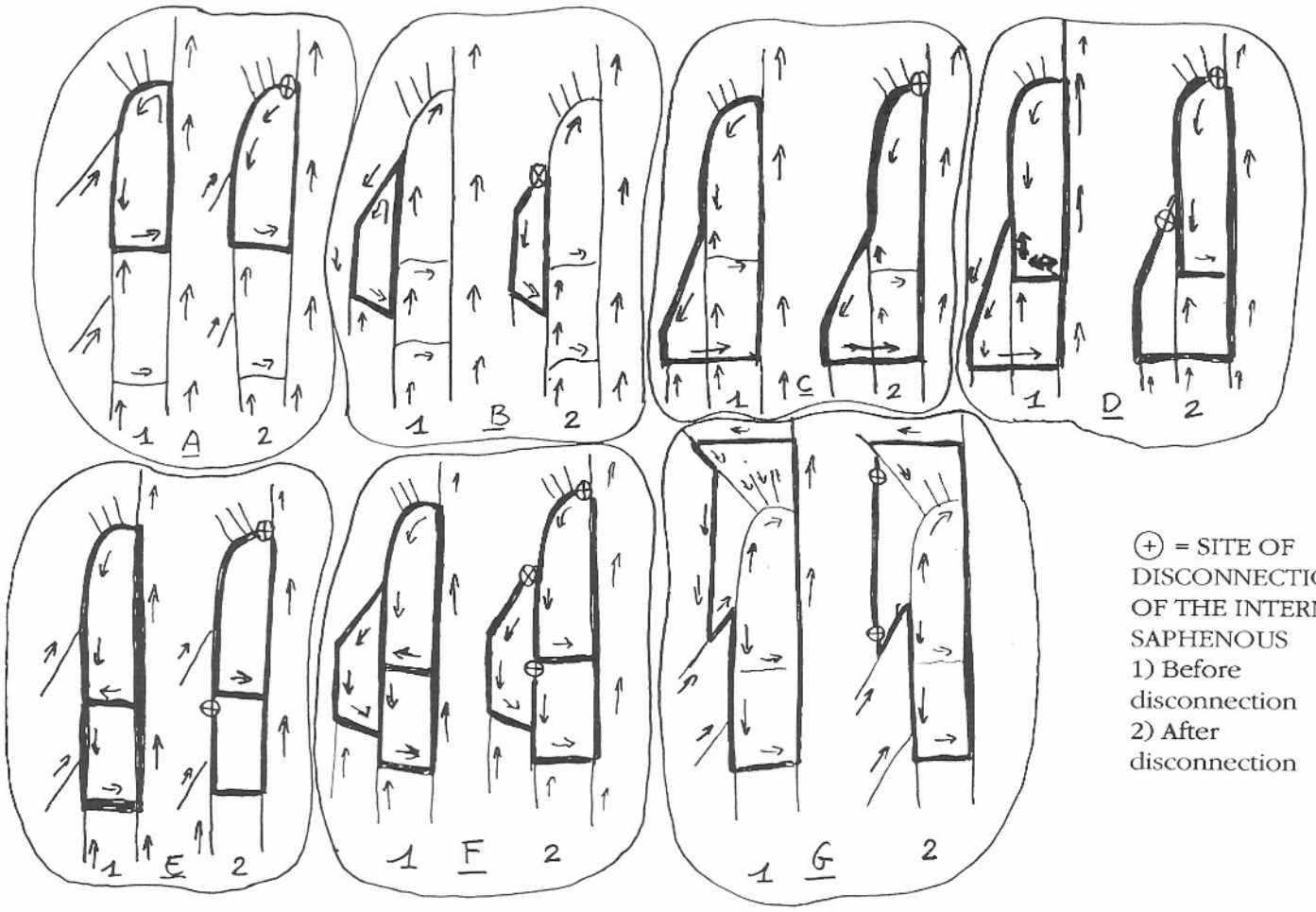
(A) :1) Before interruption of the I.S crosse
2) After interruption of the crosse according to CHIVA
3) After interruption of the crosse and its branches
TH = Thrombosis
R = Recurrences

(B) :1) Before the interruption of the I.S crosse and under the perforating vein of the knee
2) After a proper CHIVA
3) After correct interruption of the crosse but incorrect interruption of the perforating vein (above the junction)
- Thrombosis of the proximal segment.
- Varix remaining distally if the perforating vein is incompetent.

4°) DECONNECT THE VENO-VENOUS SHUNTS.

A: SHUNT TYPE **I**
B: SHUNT TYPE **II**
C: SHUNT TYPE **III**
D: MIXED SHUNT
TYPE **I** + TYPE **III**
E: MULTILEVELED SHUNTS
TYPE **I** + TYPE **I**
F: MIXED MULTILEVELED SHUNTS
TYPE **I** + TYPE **I** + TYPE **II**
G: SHUNT TYPE **IV**

- at the incontinent crosses
- immediatly beneath the refluxing perforating vein, so transforming them into perforating veins
- at incontinent quaternary segments (Type IV)
- at the junction of incontinent branches of the R_3 network with the secondary network (Type III)
- ensure that the primary R_1 systeme is continent where reentrant veins have been created
- ensure that conditions of thrombosis have been avoided.



⊕ = SITE OF DISCONNECTION OF THE INTERNAL SAPHENOUS
1) Before disconnection
2) After disconnection

5°) SUPPRESSION OF INCONTINENT QUATERNARY R_4 VEINS.

– by interrupting the veins at both ends, so suppressing all feeders and evacuating vessels (see diagrams G_1 and G_2 on the previous page).

THE CHIVA PRINCIPLES
- NTERRUPTION OF THE COLUMN OF PRESSURE
- DISCONNECTION OF THE V.V SHUNTS
- SUPPRESION OF INCONTINENT R4 VEINS

MAY BE ACHIEVED IN A SINGLE PROCEDURE

The preceding diagrams illustrating disconnection of V.V. shunts show in fact that, in most cases, these procedures correspond to an interruption of the column of pressure. The sites of interruption are limited to a maximum of 1, 2 or 3 levels, covering, at least partially, the rules of disconnection.
In practice, the anatomical sites of disconnection may vary from 1 to 5 (maximum). Similarly, the sites of R4 suppression vary in general from 2 to 4. Therefore, even in the most complex of cases, the number of operative sites does not exceed 9.

STRATEGIC PRINCIPLES OF THE CHIVA METHOD
EXAMPLE OF COMPLEX CASE

$B_1 \rightarrow b_4 \rightarrow P_2$ = type III shunt

① section-ligation or ligated clip (SL or CL)
- interupts the pressure column at groin and disconnects the B_1-b_4 shunt

$B_2 \rightarrow b_4$ = multileveled type II shunt

② SL
- interupts the pressure column at the knee and disconnects the upper type II shunt

⑤ SL
- disconnects the lower type II shunt (spoliting up the pressure column)

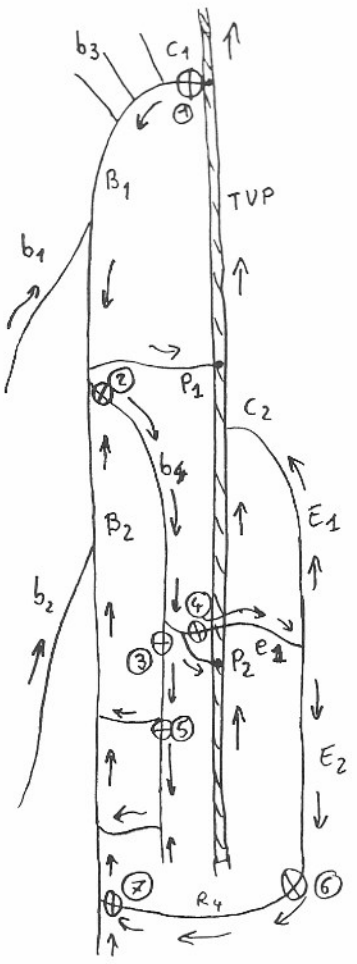
$P_2 \rightarrow b_4$ = Type I shunt

③ SL creating a reentry at P_2

$P_2 \rightarrow e_1 \rightarrow E_2$ = Type I shunt

④ SL interupting the shunt and pressure column

$e_1 \rightarrow E_2 \rightarrow R_4 \rightarrow B_2$ = Type IV shunt section-exclusion from ⑦ to ⑥



⊕ = operating sites ① to ⑦

C_1 = INCONTINENT internal saphenous crosse

C_2 = CONTINENT external saphenous crosse

B_1 = INCONTINENT internal saphenous trunk of the thigh (R_2)

B_2 = CONTINENT internal saphenous trunk of the lower leg (R_2)

b_1 = CONTINENT internal saphenous branch of the thigh (R_3)

b_2 = CONTINENT internal saphenous branch of the lower leg (R_3)

b_3 = descending branches of the internal saphenous crosse

b_4 = INCONTINENT internal saphenous branch of the lower leg

E_1 = CONTINENT segment of the external saphenous trunk

E_2 = INCONTINENT segment of the external saphenous trunk

P_1 = CONTINENT perforating vein of the thigh

P_2 = INCONTINENT perforating vein of the calf

RESULTS OF THE CHIVA METHOD

With a thorough understanding of the haemodynamics and physiopathology of the venous circulation of the legs, which requires a certain intellectual effort, essential for mastering the technique, apprentices of the CHIVA method will see that the theoretical results are confirmed in practice as described below, in a standing patient:

The blood flows from above to below in the veins treated:

- at low pressure
  - fractioned H.S pressure
- at normal flow volume
  - suppression of V.V shunts
- at high flow velocity
  - pressure gradient
    - residual pressure
    - hydrostatic pressure acting on the column of blood in synergy.

Which is comparable to the situation before treatment when the patient elevated the legs above the level of the heart.

POTENTIALISED EFFECT BY WALKING WHICH DECREASES VARICOSE DIAMETRE :ASPIRATION BY THE V.V. PUMP.

SO THAT THE RESULTS EXPECTED OF THE CHIVA TECHNIQUE SHOULD BE VISIBLE BEFORE THE OPERATION IF THE PATIENT IS MADE TO LIE DOWN WITH THE LEGS ELEVATED.

All that disappears or improves in this posture should be obtained by the CHIVA.

AFTER THE OPERATION,THESE RESULTS SHOULD BE APPARENT

– IMMEDIATELY

– In the upright immobile position, the venous dilatation though still visible, is much improved.
– The veins should disappear on walking or after 3 or 4 elevations on the tips of the toes (*).

– WITH TIME
– Walking will help the regression of dilated veins so that they become invisible even in the upright immobile position.
– There should be no recurrences on the treated vessels
– There should be no progression of the varicose disease on untreated vessels (healthy) which should benefit indirectly from the fractionated pressure column and reduction of volume overload related to V.V. shunts.
– There should be an improvement of the veins which were healthy before the CHIVA, but which the technique has not directly affected (**).

(*) If persistant, one or more V.V shunts have not been disconnected. If more dilated, one or more reentrant perforating veins has been interrupted either above or at the level of the junction with the varicose vein.

(**) Cure limited to the venous trunks of the thigh, respecting continent trunks of the lower leg. In some cases, one of these "healthy" trunks may dilate (especially the anterior branch) if the reentrant perforating placed above is too small to drain the descending flow adequately).

THESE RESULTS SHOULD IMPROVE WITH TIME AND BE POTENTIALISED BY CLASSICAL PREVENTIVE METHODS.

– VENOTONIC DRUGS
– SLIGHT,INTERMITTENT ELASTIC SUPPORT
– HYGIENIC PRINCIPLES
- avoidance of heat { central heating / clothing / shoes
- avoidance of prolonged immobility in the upright position.

THE CHIVA METHOD SHOULD MODIFY THE PHYSIOLOGICAL CONDITIONS OF FLOW DIRECTION AND TRANSMISSION OF HYDROSTATIC PRESSURE IN A BENEFICIAL WAY COMPARABLE WITH MOTHER NATURE'S OWN PROJECT. THE MECHANISMS COUNTERACTING THE EFFECTS OF THE GRAVITY IN THE UPRIGHT POSITION MAY BECOME EFFECTIVE, EVEN WHEN INITIALLY DEFICIENT AS OBSERVED SPONTANEOUSLY WHEN LYING DOWN WITH THE LEGS ELEVATED.

III/ INVESTIGATIONS REQUIRED BEFORE CARRYING OUT CHIVA STRATEGY.

A/ CLINICAL EXAMINATION.

– In addition to careful history taking to evaluate the patient's symptoms and previous medical conditions which will not be discussed in detail here,the varicose veins visible in the upright position and on walking, trophic abnormalities and oedema will be observed on inspection. The patient then lies down with the legs elevated in order to ensure that the veins collapse (detection of pulsatile varices of cardiac or fistulous origin) and to obtain some idea of the eventual result of the CHIVA method,if feasable and correctly performed. The PERTHES and TRENDELENBOURG (*) manoeuvres are not essential nor does percussion of the veins provide any useful information.

(*) These manoeuvres are excellent in theory, but the inconstancy of correct compression by tourniquets makes for unreliable results in practice (false negatives).

B/ ULTRASONIC EXAMINATION

a) First of all, the deep venous system is carefully examined from the leg to the inferior cava, using the DOPPLER TECHNIQUE, when possible this should be associated with ECHOTOMGRAPHY (*) in order to avoid any unpleasant surprises after treatment of the superficial venous insufficiency. Any obstruction or incompetence must be noted as this will be very important when elaborating the CHIVA strategy.

(*) We shall not describe the details of these tried and established techniques.

b) The arterial system is examined by the same techniques, not only to diagnose any fistulous angiodysplasia but also to detect any obstructive arterial disease which may later require venous by-pass grafting, reinforcing, if need be, the interest of conservative attitude to the treatment of the superficial venous insufficiency.

C/ Examination of the superficial venous system DOPPLER AND ECHOTOMOGRAPHY

This is carried on in two or three stages

– First of all, a general impression is obtained whilst examining the deep venous system in the upright position, localising segments of reflux by VALSALVA manoeuvre, muscular contraction, manual compression and decompression of the internal and external saphenous veins and the main vessels of the secondary network.

– At the end of the investigation and depending on the clinical context, the patient's wishes and psychology, the state of the deep venous and arterial systems and the localisation of the superficial varicose veins, a decision can be taken as to the indications for a CHIVA.

– The second and third stages are performed only when the indications for a CHIVA have been retained. Second stage: preoperative examination of one leg. Third stage: preoperative examination of the other leg if required.

These stages of examination are not performed together because they take time and because operation of one leg before the other is better suited to ambulatory treatment.

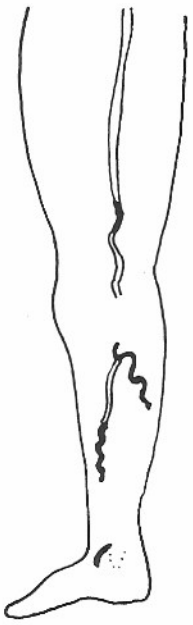
COMPLETE PREOPERATIVE
INVESTIGATION
WITH SKIN MARKING
OF THE AFFECTED LEG.

PATIENT POSITION

– Upright, on mobile but stable platform with a safety bannister.

– The patient can turn around
– The platform can be moved near to the ultrasonographs

The patient and the physician must be confortable because the investigation is long and difficult.



blue
red

dotted red
perforating veins
direction of flow

MARKING

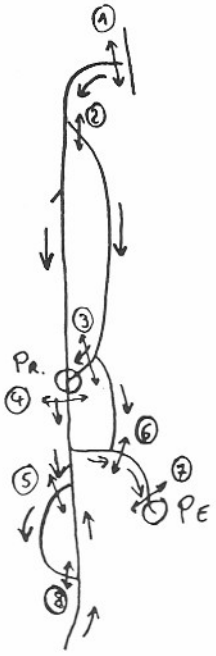
The main difficulty in practice is the ultrasonic transmission gel between the ultrasound probe and the skin which makes drawing difficult. Therefore, we recommend the following procedure.

1 – Marking by sight in BLUE before ultrasonic examination all visible veins (varicose or not) followed by marking in RED all veins palpable but invisible.

2 – Marking the veins only detected by ultrasonic examination with RED dotted lines (the dots are easier to draw in the presence of ultrasonic gel). After wiping the gel off, these dotted lines can be joined up. The visible perforating veins are marked by BLACK circles.

3 – Then, using the continuous wave Doppler, the venous axes are examined whilst performing manual compressions, VALSALVA manoeuvre and muscular contractions to demonstrate the reflux (indicated by Black arrows parallel to the venous axes being examined).

3 – Incontinent perforating veins and those invisible previously are marked with BLUE cercles.



EXAMPLE
1 SL o CL
2 SL
3 SL
4 LS
5 SL o exclusion
5 ⟶ 8 optional
6 SL o exclusion
6 ⟶ 7 optional

4 – The BLUE circles are then checked by Duplex Pulsed Doppler to localise perforating veins

5 – A simplified diagram of the marking is drawn on paper on which the sites of operation are decided and then indicated with the skin crayon on the patient's leg.

6 – The patient is asked not to wash the leg until after the CHIVA marking has been performed.

7 – Care must be taken not to erase marking during the preoperative shaving and preparation.

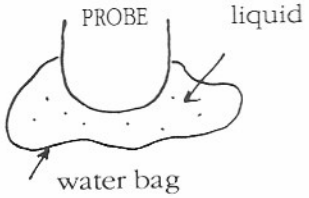
ECHO TECHNIQUE

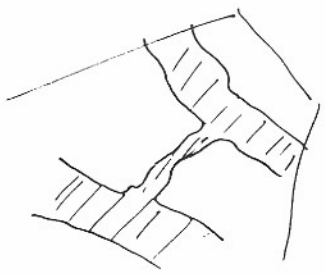
– High frequency ultrasound transducer
- 7, 10, 13 MHZ

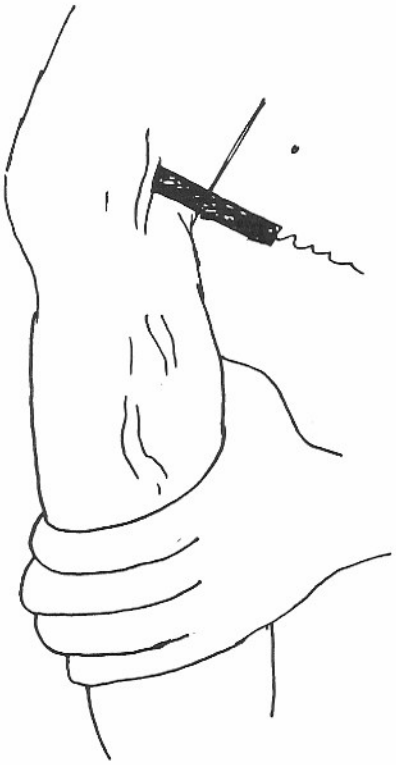
– SOFT-WALLED liquid-filled bag in order not to compress the veins.

– THE ORDER OF EXAMINATION IS AS FOLLOWS
- INTERNAL SAPHENOUS TRUNK (R_2)
- from its distal malleolar extremity to its junction with the femoral vein, noting the size and any special feature of the sapheno-femoral junction, taking care not to mistake saphenous trunk (always anatomically sub or intra aponeurotic) with a saphenous collateral branch (supra-aponeurotic) and vice-versa.
- EACH VISIBLE INTERNAL SAPHENOUS BRANCH (R_3)
- ANY VISIBLE COMMUNICATING VEINS (R_4) between branches and trunks.
- AT THE SAME TIME,ALL THE VISIBLE PERFORATING VEINS MUST ALSO BE RECORDED (In practice, visible perforating veins are not always incompetent, but they are always visible when refluxing).

(*) 7 MHz may be the best compromise







– External saphenous vein : same procedure as for internal saphenous vein.

CONTINUOUS WAVE DOPPLER TECHNIQUE

- Frequency 8 MHZ
- Distal manual compression and release, VALSALVA's manoeuvre, muscular contraction:

Flow towards the heart during compression and contraction.

Reflux:

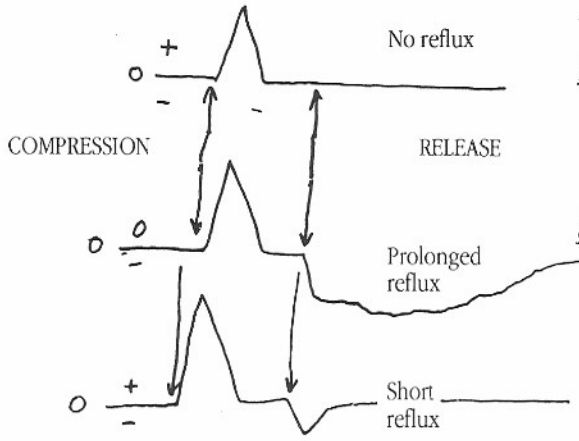
- No reflux if vein is continent
- Reflux if the vein is incontinent

Prolonged reflux

- large shunt
- or large reentry

Short reflux

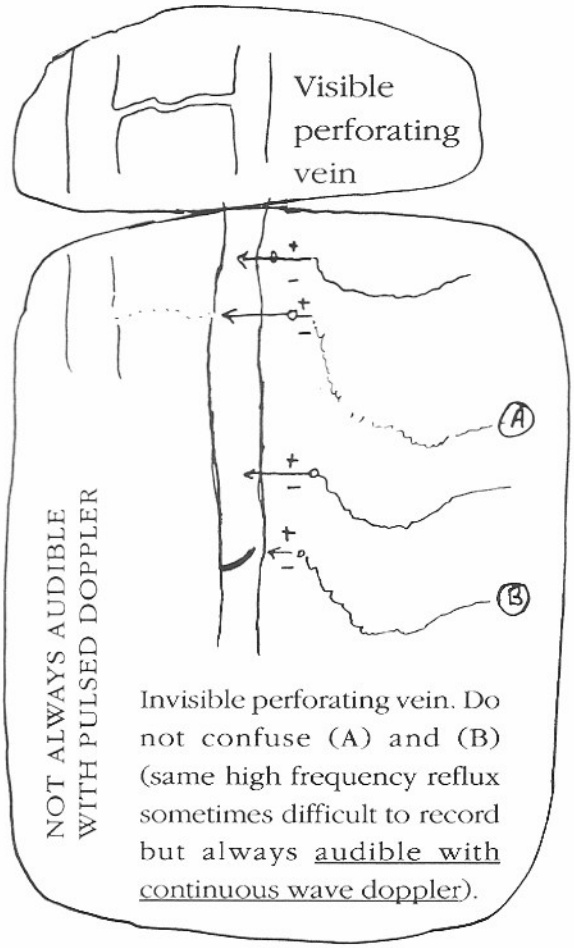
- check by repeating the manoevures with longer compression, more powerful contractions and VALSALVA's.
- persistant short lasting reflux indicates a venous incompetence without significant reentry.



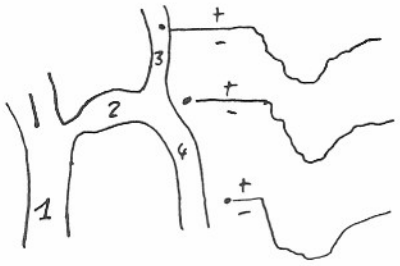
(*) Many continent perforating veins are too small to be visible and flow is too small to be recorded.

Perforating veins (*)

- When visible by US imaging, they are too large to be continent.
- Doppler examination only serves to confirm this fact.



Invisible perforating vein. Do not confuse (A) and (B) (same high frequency reflux sometimes difficult to record but always audible with continuous wave doppler).



1. Popliteal vein
2. External saphenous crosse
3. Vein of GIACOMINI
4. External saphenous trunk

Difficult to determine whether reflux in (4) comes from (3) and (2) (limitation of continuous wave Doppler but easily differentiated with pulsed wave Doppler).

- However, an <u>incontinent perforating vein does not necessarily imply reflux</u>, especially when reentering.
- <u>When it is impossible to image</u> the perforating vein by echo, the only way of locating them is by Doppler and then only when they are refluent.
- The cardinal sign is high velocity reflux on the venous axis (A) even though in some cases it may be due to a narrow escape from a large but incompletely occlusive valve. Effective compresion with the Echo probe above the site of reflux should allow distinction between an incompetent refluent perforating vein and valvular incompetence responsible of that reflux (B). In this situation, Duplex Pulsed Doppler Echo can be very useful, but, as will be shown later, it does have its limitations.

<u>Continuous wave Doppler limitation</u>: absence of depth resolution.

TECHNIQUE OF DUPLEX ECHO

– Pulsed Doppler frequency 5 to 7.5 MHZ
– Doppler cursor in the B mode echo image
– Advantages:
  Good spatial resolution
– Limitations:
  - Beam line angle limited
  - May miss a very high velocity jet especially if of low intensity (*).

(*) physical limits of PRF.

– IN PRACTICE:

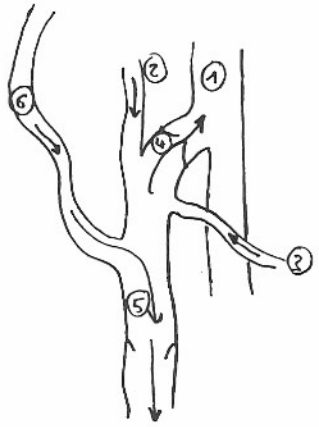
The Duplex technique is useful for

– sorting out certain situations:

- Equivocal reflux of perforating veins with continuous wave Doppler(*)
- Superposing blood flow difficult to assess with continuous wave Doppler (**)

– on the other hand,very high velocity, low intensity reflux especially of the valves of the saphenous crosses may be missed by pulsed but not with continuous Doppler. Therefore, absence of reflux cannot be confirmed by Duplex Pulsed Wave Doppler alone, only presence. That is the reason why "continent veins" on pulsed doppler examination must be checked with Continuous Wave Doppler. If reflux is detected on C.W.D, it is really present even if undetected by P.W.D. (common at the saphenous crosse).

(**) It is not easy with continuous wave Doppler alone without B mode to recognise reflux in (6) without confusion with reflux in (4) (continent in the diagram)



(*) see preceding page

1 Commmon femoral vein
2 Descending branch of the crosse
3 Ascending branch of the crosse
4 Continent segment of the internal saphenous vein
5 Incontinent segment of the internal saphenous vein
6 Descending branch feeding the segmental incontinence. This branch is often a pudendal or perineal vein in women during and after pregnancy, transmitting a deep pelvic reflux, obvious cause of most recurrence after traditional and perfect stripping

A DUPLEX CONTINUOUS WAVE DOPPLER PROBE IS THEREFORE VERY USEFUL.

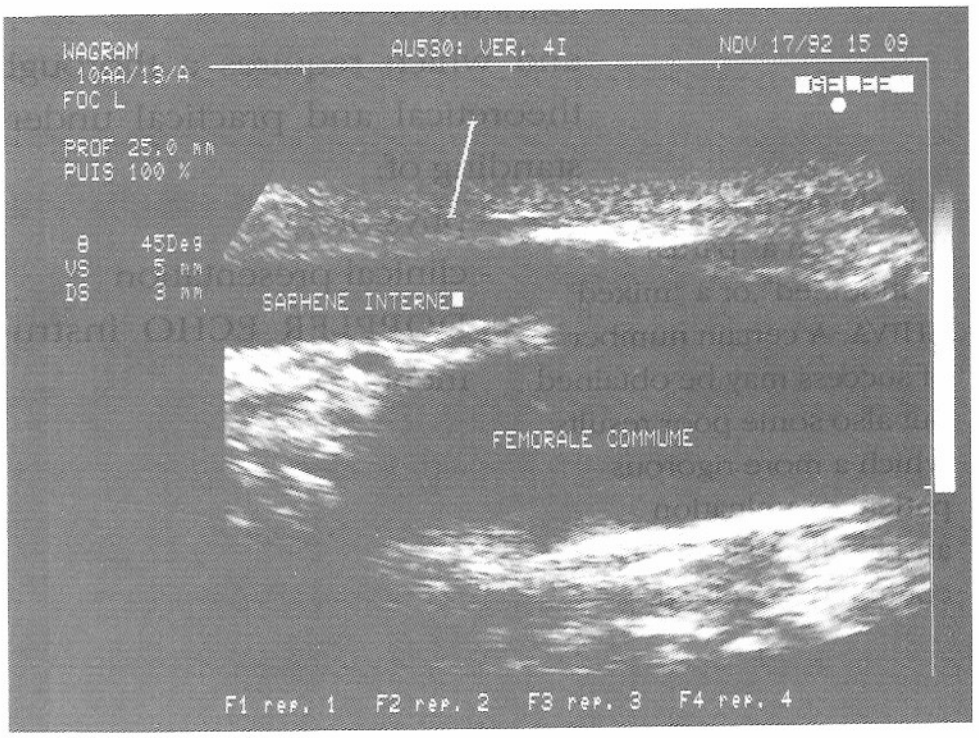
At the end of this investigation which is

- Time consuming
- Difficult
- and which requires a thorough theoretical and practical understanding of:
  - physiology
  - clinical presentation
  - DOPPLER ECHO instrumentation

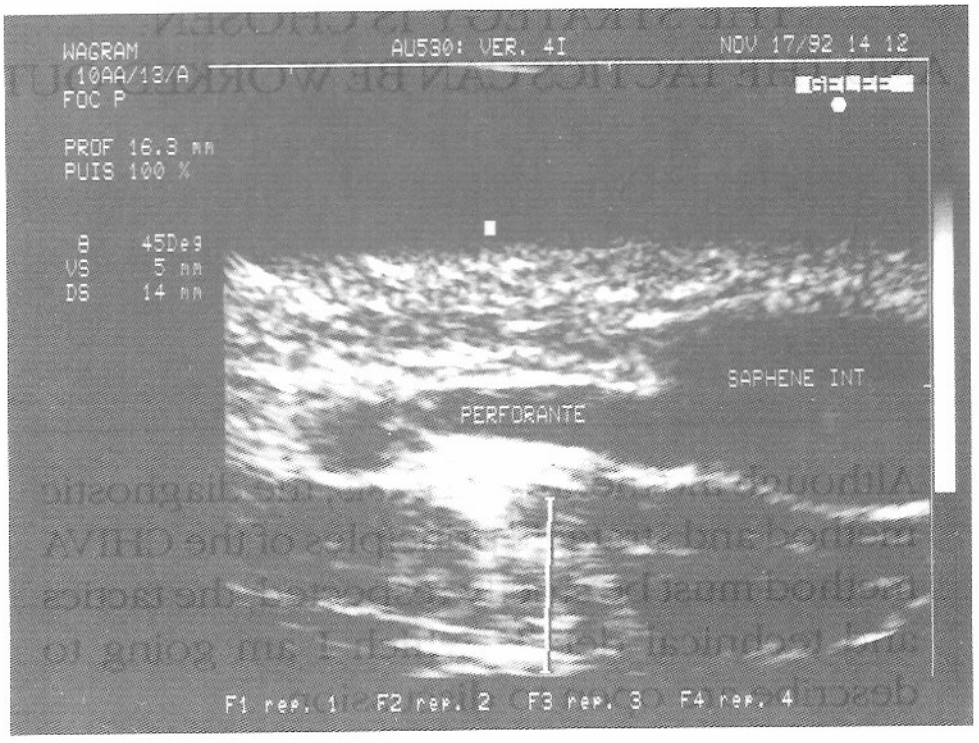
It is always possible to perform a "partial", a "modified",or a "mixed" CHIVA. A certain number of success may be obtained but also some poor results which a more rigorous patient examination and intellectual effort could have avoided.

THE STRATEGY IS CHOSEN AND THE TACTICS CAN BE WORKED OUT

Although the theoretical basis, the diagnostic method and strategic principles of the CHIVA method must be strictly respected, the tactics and technical details which I am going to describe are open to discussion.



The high emission frequencies
of mechanical sector scanners (10 and 13 Mhz in this example)
enable visualisation of small calibre perforating veins (1-2 mm)
the venous walls and valves.



Here is a good example of tactics:

- Depressing the keys on the piano does not necessarily produce music.
- Ligature "on sight" of the leg veins is not the CHIVA method.
- Marking technique of CHIVA without CHIVA strategy is confusing piano technique and sonata.
- Playing the piano keys in an order designated by the composer makes music.
- Ligation of the veins after marking and mapping according to CHIVA theory is the CHIVA method.

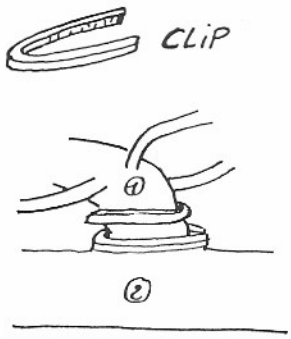
IV/ CHIVA TACTICS

These tactics must conform to the strategic objectives of the CHIVA method and the requirements of ambulatory therapy. They concern the procedures performed at sites determined by the strategist and indicated on the skin with a skin crayon.

NOT ONLY THE STRATEGY, BUT THE TACTICS ALSO NEED SPECIFIC SURGICAL PROCEDURES TO AVOID CUTANEOUS ESTHETIC DISAPPOINTMENT, SHORT OR LONG TERM VARICOSE RECURRENCES BY RECANALISATION OF THE INTERRUPTIONS AND SAPHENOUS THROMBOSIS.

A/ THE PROCEDURES

a) Interruption and disconnection.

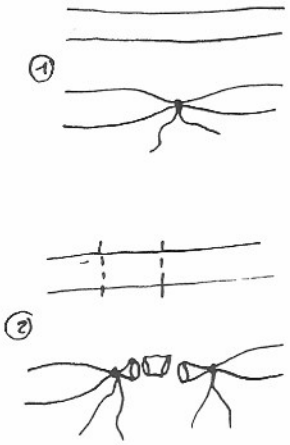


1 Internal saphenous crosse with branches respected
2 Common femoral vein

1– CLIPS:

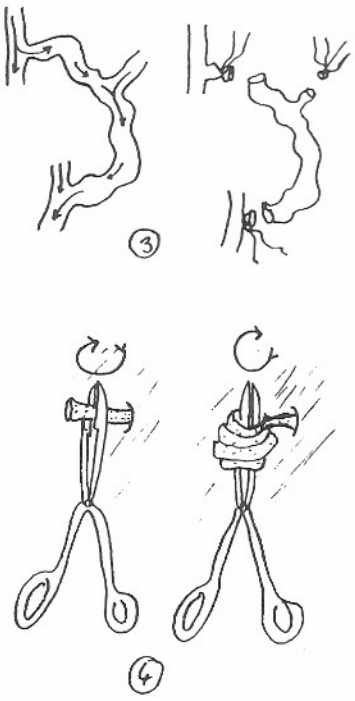
Easy to use but must be closed correctly (by a transfixed knot), to produce effective and lasting occlusion. Two or three clips may be required at the same site. They have to be reserved for the internal saphenous crosse and positioned precisely at the junction with the common femoral vein.

If possible, it is best to avoid using clips in thin people as they may bulge under the skin. Patients with high risk of sepsis are also poor candidates for these prostheses.



2– SECTION-LIGATION (S.L)

Simple ligation (1) is quick and easy but the risk of recanalisation is too high. A 1 or 2 cm resection between two ligatures is the procedure of choice (2). It is obvious that the suture must not be absorbable.



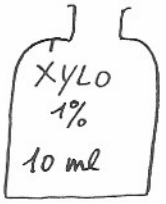
3– EXCLUSION (E.X)

This consists in ligating the feeding and draining vessels with section of the vein on the segment to be excluded (which should not bleed when the feeding veins have been ligated), so avoiding thrombosis of he excluded segment (3). Some or all of the excluded veins may be withdrawn by rolling them up on a forceps. In any case, a correctly excluded segment, which is not ablated, will rapidly be resorbed.

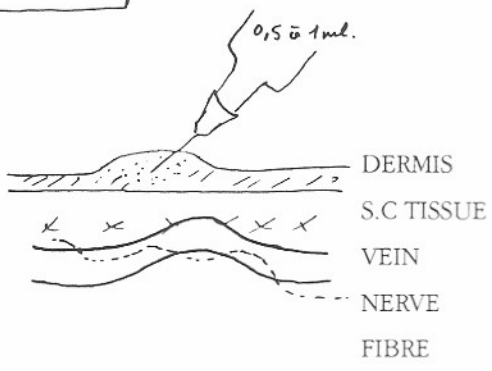
b) Surgical details (with the exception of the saphenous crosse)

(*) without erasing the skin markings

VENOUS INTERRUPTIONS CANNOT BE CORRECTLY PERFORMED IN SCLERO-INFLAMMATORY SITES. THEREFORE, THESE SITES WILL BE OPERATED ONLY WHEN IMPROVED BY PREVIOUS INTERRUPTIONS IN HEALTHY CUTANEOUS SITES.



AFTER SHAVING AND DISINFECTING THE SKIN(*)



1– LOCAL ANESTHESIA

Use 1 p.cent lignocaine <u>without</u> adrenaline

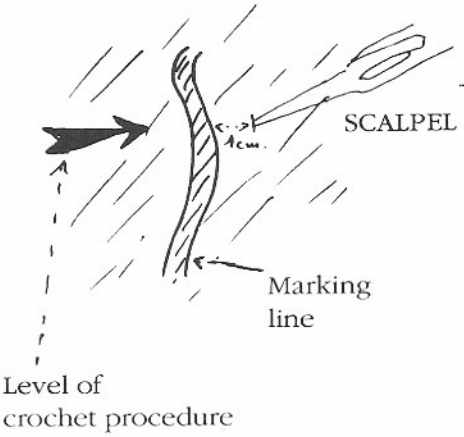
-Bleeding indicates an incomplete procedure. Therefore, this valuable sign must not be masked by the use of adrenaline.

Hypodermic needle

<u>Infiltrate the dermis only</u>: papule

– <u>Avoid anesthetising the vein and the surrounding nerve fibres</u>.

THE CHARACTERISTIC SHARP PAIN CAUSED BY CONTACT OF THE SURGICAL INSTRUMENT WITH THE NERVE FIBRES PREVENTS BLIND SECTION OF ANAESTHETIC OR PARESTHETIC STRUCTURES

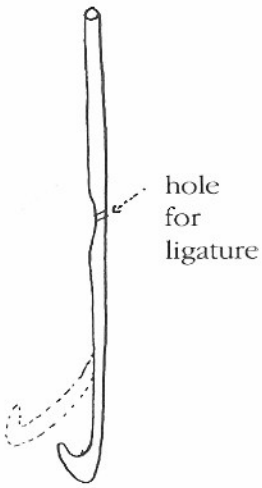


– Introducing the crochet

- 1 to 2 mm large superficial skin incision with a N°11 ophthalmic scalpel, respecting the subcutaneous layer.
- 1 cm away from the vein to be exposed

Never just over the vein because:

- There is a risk of injury of the vein and bleeding.
- Even if the vein is not injured, difficulties arise because the operator will not know which side of the incision to look for the vein.



Lace crochet
Curved point
Ligature hole pierced

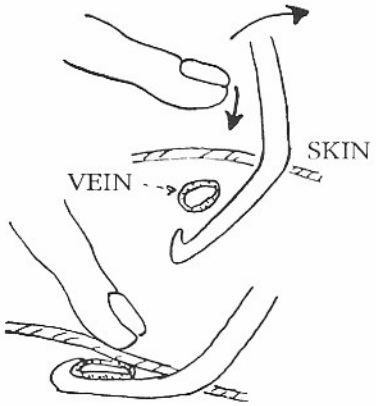
– The crochet.

It should be:

- small: small incision
- blunt: not traumatic
- effective

Commercially available surgical crochets and instruments designed personally seem less practical than the simple and inexpensive lace crochets in stainless steel (made in Great Britain) (1.75 - 3 mm series) which are perfectly adapted for this task. They only need to be bent to form a distal curve and pierced to form a hole for the ligature.

– Crochet technique



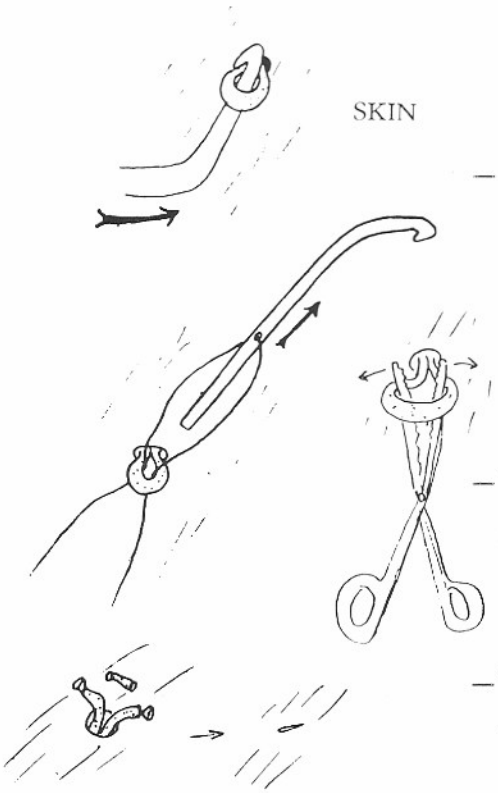
– The color of the skin marking indicates the depth at which the vein is located (also shown on the skin mapping report).

– Dissection can be performed with the blunt end of the crochet.

– The crochet is introduced obliquely under the vein and then extracted by a levering movement.

– When the vein is exposed it is clamped with two forceps either side of the crochet.

– The crochet is passed under the vein to pull the ligations into position.



– The absence of pain indicates that the superficial nervous fibres have been respected. Any visible nervous tissue is dissected away from the vein.

– The vein is ligated and sectioned / and / or excluded.

– The remaining structures are replaced under the skin.

3– WOUND CLOSING:
Often unnecessary. sometimes limited to an adhesive dressing (which may be responsible for epidermical reactions).

4– DRUGS AND LIGHT ELASTIC COMPRESSION.

c/ Surgical approach to the saphenous crosses.

1– INTERNAL SAPHENOUS VEIN:

- Light local anesthesia, without adrenaline
- Classical approach
- Clip (*) or section between two ligations
- At the junction with the common femoral vein
- RESPECTING THE COLLATERAL VESSELS

(*) avoid the use of clips in thin subjects and in infected patients (inflammation and/or lymphadenopathy)

2– EXTERNAL SAPHENOUS VEIN:

The external saphenous vein crosse poses special problems.

- Variable position
  - -high
  - -low
  - -deep
  - -superficial
- Variable anatomy
  - - common trunk with gastrocnemous veins
  - - draining into the popliteal, superficial femoral, deep femoral or even sciatic vein, sometimes after an intramuscular trajectory.

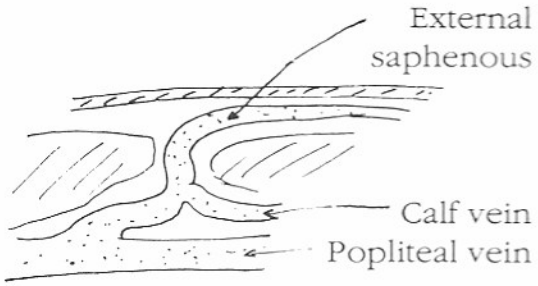
– <u>TENDENCY TO CAUSE POSTOPERATIVE THROMBOSIS OF THE NEIGHBOURING DEEP VEINS</u> (calf and popliteal) (*)

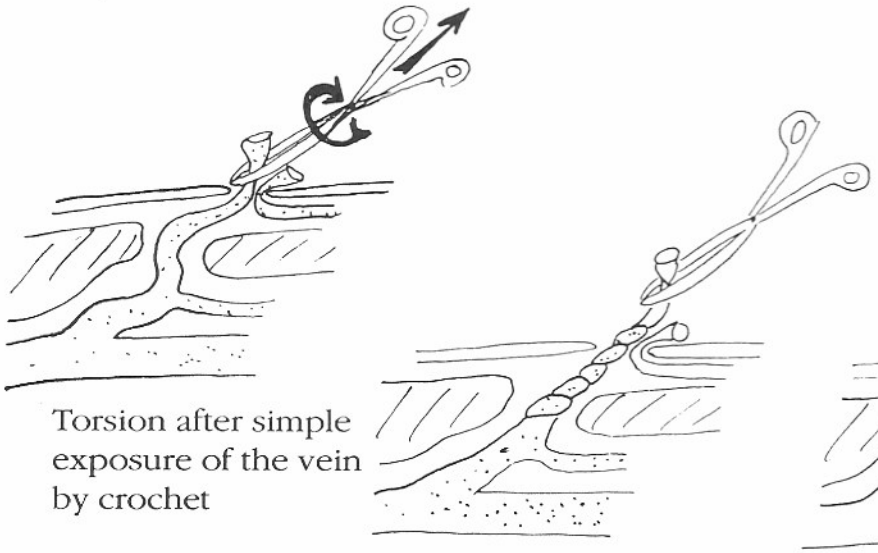
– This is the reason why I recommend adoption of the least aggressive technique when operating on the external saphenous vein:

– Simple crocheting whenever possible

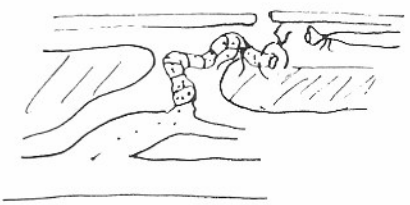
- Superficial or partially superficial trajectory
- Ligature and fixed torsion of the proximal (upper) extremity.
- Effective anticoagulation for the 10 postoperative days with calcium heparin.

(*) often asymptomatic or paucisymptomatic and masked by the usual discomfort after stripping, these thromboses are often ignored. THEY ARE VERY COMMON as demonstrated by systematic postoperative Echo-Doppler ultrasonography.





Torsion after simple exposure of the vein by crochet



Ligature and reintegration after suturing the stump to the aponevrosis

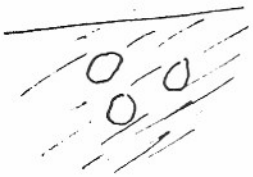
B/ PREOPERATIVE MANAGEMENT.

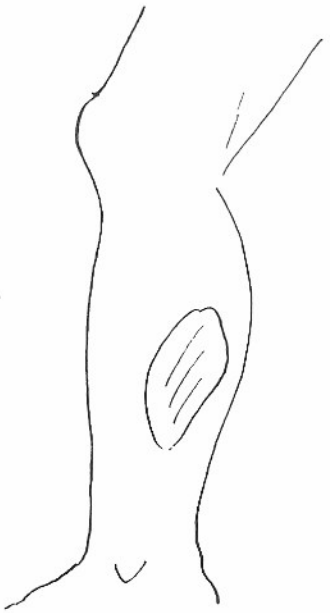
GENERAL

– For two weeks before surgery use
  - mild support stockings
  - Venotonic drugs and pay special attention to
  - Hygiene of the feet
– Low molecular weight heparin the evening before surgery which should be performed after an overnight fast.
– Neuroleptic anesthesia depending on the patients psychological profile.

SPECIAL PRECAUTIONS

– In patient with trophic changes (even without ulceration) and/or chronic infection of the feet
  Over same period:
  - strong or normal support stockings
  - antibiotic therapy
  - general and local antiinflammatory agents
  - local or general disinfiltrating agents in patients with sclero-inflammatory plaques





IN FACT: These regions tend to bleed (arteriolo-venous shunts and fragile venous vessels which cannot be easily dissected). Therefore, skin incisions must be performed in healthy zones. The sclero-inflammatory plaque may well regress after the initial CHIVA and allow a complementary procedure at a later date.

C/ POSTOPERATIVE MANAGEMENT.

GENERAL

Low molecular weight heparin for 6 days but only in patients with:

- Very large varicose veins
- Risk of deep venous thrombosis

Mild support stockings

WALKING AND NORMAL ACTIVITIES ENCOURAGED IMMEDIATELY AFTER THE CHIVA.

After the 6th day, mild support elastic stockings only during sporting activities or prolonged immobility in the upright position (*).

(*) Very large varicose veins will benefit from a longer period of external support (3-6 weeks) so as to avoid thrombosis.

SPECIAL:

The preoperative management of patients with trophic skin abnormalities, ulcerated and/or infected, should be continued for 15 days and associated with the general measures described above. If the external saphenous vein has been treated, I recommend that anticoagulants are prescribed at therapeutic doses for 10 days with external support stockings, and Echo-Doppler U.S control the 4th and 7th days.

D/ POSTOPERATIVE FOLLOW-UP.

GENERAL

Clinical and U.S examination on the 10th postoperative day.

– Detection of deep and superficial venous thrombosis.
– Diagnosis of persistant V.V shunt.

(*)BLOOD FLOWS FROM ABOVE DOWNWARDS in the treated vessels at high velocity without any appreciable reflux below-above during manual compressions and muscular contraction, or reflux above-below during the VALSALVA's manoeuvre.

(*) I was going to forget

(*)On only one foot, extension is produced not by contracting the calf but by elevating the thigh.

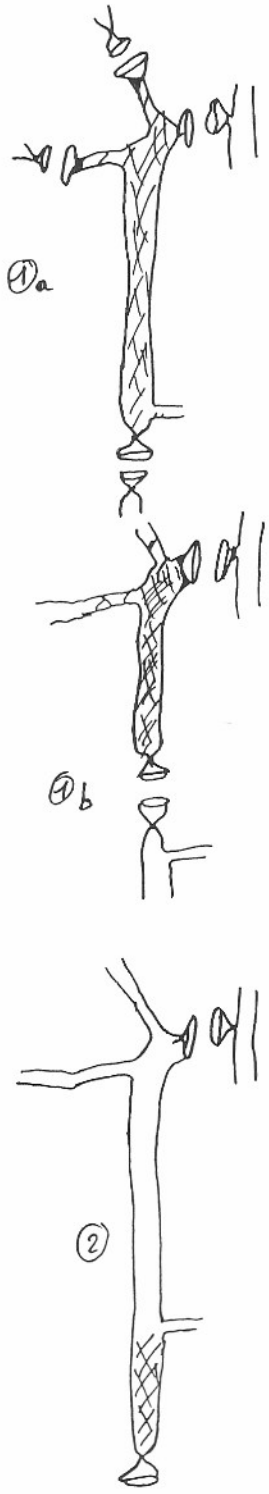
A PERSISTANT SHUNT CAN BE DIAGNOSED CLINICALLY IN MOST CASES.

THE VEIN IS VISIBLE AND DILATED AND DOES NOT COLLAPSE WHEN THE PATIENT WALKS OR STANDS UP AND DOWN ON BOTH FEET ON THE TIPS OF THE TOES (*)

COMPLEMENTARY TREATMENT WITH ONE OR TWO SMALL INCISIONS CAN BE UNDERTAKEN DURING THE CONSULTATION

IF THE VEIN COLLAPSES,IT WILL DISAPPEAR SPONTANEOUSLY WITHIN FEW WEEKS

A QUATERNARY NETWORK WHICH HAS BEEN INCOMPLETELY EXCLUDED MAY BE OCCLUDED BY REOPERATION OR SCLEROSED IN THE SAME WAY (BUT ONLY THE QUATERNARY VEINS !
SUPERFICIAL VENOUS THROMBOSIS USUALLY RESPONDS TO MEDICAL THERAPY ALONE.



(3) Large varicose veins after CHIVA decrease progressively in size within days or weeks according to the parietal tone. However, but during this period, the flow being relatively low for the size of the vein, there is a risk of thrombosis which can be avoided with elastic support.

SPECIAL

- If the external saphenous vein has been operated (especially at the crosse):
- Look for deep venous thrombosis at the 4th and 7th postoperative days.

COMPLICATIONS

- Superficial venous thrombosis
- This is due to poor technique (absence of or poor reentry vein and/or absence of afferent branches, $(1)^a$ and $(1)^b$ or to the presence of inflammation (chronic infection inadequately treated before and after operation).
- It may be due to a long cul-de-sac (2) (ligation-section too far below the reentrant vein) or ligation-section too close or above the reentrant vein (1).
- It may be due to inadequate support stockings (3).
- WHEN YOU ARE UNSURE OF THE REENTRANT PERFORATING VEIN (PRESENCE? CORRECT DRAINING POSSIBILITIES?) ITS BEST TO LEAVE IT ALONE DURING THE FIRST CHIVA ATTEMPT. ON THE 10TH POSTOPERATIVE DAY THE PROBLEM CAN BE REEXAMINED (easily performed as the excessive reflux above the vein has generally regressed) and an immediate complementary procedure considered.

E/ SPECIAL BUT FREQUENT PROBLEMS.

1/ ESTHETIC APPEARANCES OF THE THIGH

a) Large and visible saphenous vein.

– In a large number of cases, there is a bifurcation of the saphenous trunk at variable levels of the thigh, into the real anatomic saphenous trunk (sub or intra aponeurotic (The sign of the "eye" in echo imaging (BAILLY)) which may be hypoplasic and/or continent and into a superficial, supra-aponeurotic collateral vein parallel to the former, but incontinent, large and unaesthetic. The size of this branch decreases after interruption of the crosse, but not as much or as rapidly as the patient would wish.

– The absence of reentrant and visible perforating veins at this bifurcation added to the absence or continence of the real saphenous trunk below, do not theoritically permit the interruption of this collateral at the bifurcation. In practice, one may propose this interruption in any case, either interrupting it at the same time as the crosse (TYPE I+II CHIVA), or in a second procedure (CHIVA II). In this case, he waits until the reentry is improved before interrupting the crosse. CHIVA II is performed only when the distance between the crosse and the bifurcation is short and the crosse is not very dilated. This is because of the risk of thrombosis of the open crosse with extension to the common femoral vein or pulmonary embolism.

b) Varicose Anterior branch of the thigh.

– This "ugly" varicose vein may be due to an isolated incompetence of this vein in spite of the competence of all the saphenous network. Multilevel interruptions (at the crosse, under each perforating vein, at the largest of the two branches of each bifurcation) and patience (weeks, months) are sufficient and satisfactory. Hastiness in obtaining an aesthetic result (stripping, sclerosing) will bring disillusion after a period of immediate satisfaction.

2/ GIANT VARICOSE SAPHENOUS VEIN

Do not hesitate : Just interrupt the crosse in a first stage. Complete the CHIVA procedure one month later.

3/ EXTERNAL SAPHENOUS RECURRENCE

– In order to avoid postoperative deep venous thrombosis and lymphatic damage occurring after radical crossectomy, just ap-

proach the crosse as superficially as possible. Then, perform a generous section-ligation just beneath the feeding or draining upper branch (GIACOMINI). The proximal crosse will be washed out by this branch and reduce the risk of thrombosis. However, the risk of recurrence should not be neglected, but it will happen without cavernoma formation and will be easy to reoperate. Do not regret not having performed a drastic stripping, because you have avoided worse venous damage (deep thrombosis, lymphatic oedema, paresthesia, recurrent and complex cavernoma difficult to reoperate).

4/ PREGNANCY AND PERINEAL VEINS

– Most varicose veins are caused by or with perineal veins, refluxing from the deep pelvic veins, obviously more frequent in women after or during pregnancy. The perineal veins must be respected, even when reflux is observed from the deep system (during VALSALVA's manoeuvre) if the patient is pregnant or wishes future pregnancy. Interruption will result in a more complex reccurence. They should be respected in the absence of deep venous reflux. They should be interrupted when reflux from deep venous system is observed over one year after pregnancy and in women who do not want further pregnancies.

5/ HOW TO AVOID SPOTS AND MICRO-VARICOSITIES AT THE SITES OF INTERRUPTION

– Just respect the rules of CHIVA strategy. Do not interrupt above a poor perforating vein (go lower, under the following one), at the level or above any perforating vein. Use only thin, non-absorbable sutures. Avoid operating women while they are taking intensive hormone therapy, while they are pregnant or shortly therapy after (less than one year).

6/ HOW TO AVOID PARESTHESIA

– Keep away from the external saphenous vein at the lower third of the calf and the real saphena of the lower leg (sub aponevrotic). If one has to incise at these sites, it has to be performed very carefully as previously described (surgical technique).

The CHIVA technique is

CONSERVATIVE

and performed in

AMBULATORY PATIENTS

THEREFORE

IT IS BETTER PRACTICE TO ACCEPT AN INCOMPLETE RESULT AT THE FIRST ATTEMPT,

AND AVOID THE COMPLICATIONS (BENIGN) WHICH RESULT IN THE LOSS OF A SUPERFICIAL VEIN BY THROMBOSIS AND/OR THE RISK OF AGGRAVATION OF THE VENOUS INSUFFICIENCY (VICARIANCE).

– BECAUSE IT IS CHILD'S PLAY TO COMPLETE A CHIVA AFTER THE 10TH DAY IN 5 MINUTES DURING THE FOLLOW UP EXAMINATION.
You only need to advise the patient that during the follow-up it may be necssary to perform a minor complementary procedure, it being prudent to be parsimonious in the number of ligations-sections during the first CHIVA.

V/ INDICATIONS OF THE CHIVA METHOD

- All cases of superficial venous insufficiency in which there are no contraindications.
- All classical surgical indications are also indications for the CHIVA method, from the small limited venous incompetence to the full-blown varicose veins with trophic skin changes.
- The objectives themselves define the limitation of the method:
  - recurrences after traditionnal stripping
    - the conservative character of the CHIVA method cannot be fulfilled in this case because the most important superficial venous network (R2) has already been removed.
    - the haemodynamic cure of the varices can however be envisaged according to the previously described principles.
  - Varices associated with total deep venous incontinence
    - the haemodynamic principle of the CHIVA method can only be partially respected (valvulo-muscular pump ineffective).
    - the consevative objective, however, can be attained.
  - Varices before a planned pregnancy: partial contraindications only limited to the perineal veins (as previously described).

VARICOSE AND OBSTRUCTIVE ARTERIAL DISEASE

- CHIVA will respect and improve the superficial venous capital in a patient who is a potential candidate for arterial bypass surgery with a venous graft.

– CONTRAINDICATIONS:

When the conditions for performing a CHIVA are absent

– No true venous incompetence
  - veins visible through the skin but continent(*)
– When the doctor performing the investigation and/or operator is not fully familiar with the technique
– Inflammation and infection which should be treated by medically beforehand.
– Varicose veins with fistulous angiodysplasia.
– Deep or superficial acute venous thrombosis.
– Pregnancy

(*) In the XVIIIth century, women of society used to underline their blue veins to show off the white colour of their skin.

IN ALL CASES

A CHIVA

IS THE LOGICAL TREATMENT OF CHOICE FOR SUPERFICIAL VENOUS INSUFFICIENCY AND VARICOSE VEINS, BECAUSE IT IS:

– RELATIVELY NON AGGRESSIVE
– RELATIVELY ECONOMICAL
– DOES NOT PREVENT THE USE OF CLASSICAL METHODS, SHOULD THE RESULTS BE UNSATISFACTORY
– LOSES SOME OF ITS ADVANTAGES WHEN PERFORMED AFTER STRIPPING OR REPEATED VENOUS SCLEROSIS.

The strength of a theory depends on the coherence of the underlying working hypothesis and the results of preliminary experimentation should confirm it. The accumulation of proof is redundant and is not particularily useful for validating the theory. This euristic philosophy has been the inspiration of the greatest and most economical scientific advances. In the absence of an adequate theoretical basis, another different and much more costly method consists of multiplying the experimentation, submitting the results for statistical analysis to identify the factors which may eventually be useful for the elaboration of the theory...

VI/ IMMEDIATE AND LONG TERM RESULTS

Are there any large scale trials with 5 years follow-up of the classical methods?

The results of the hundred CHIVA procedures performed over 2 years period have been good with no long term complications:

- 2 recurrences caused by ineffective clips
- complete anatomic and haemodynamic result up to now.

Only a few patients have required a complementary procedure on the 10th day (at the beginning of the experience).

3 patients developed benign segmental superficial thrombosis which regressed rapidly (but which could have been avoided).

One patient developed a deep popliteal vein thrombosis on the 7th postoperative day (deep surgical approach of the crosse, at the junction with the popliteal vein without adequate anticoagulation).

Two patients developed limited and asymptomatic calf thrombosis (common trunk with the external saphenous crosse).

(*) Progressive aesthetic and functional improvement after CHIVA procedure is a strong argument in favor of the validity of the underlying theorical principles : suppression of a dominant causative mechanism results in progressive cure of venous disease.

AESTHETIC RESULTS

- Regression of trophic skin abnormalities and ulcerations.
- Improvement in the peripheral cyanosis of the ankle and feet.

DILATED VARICES REGRESS TOTALLY WITHIN A FEW WEEKS WITHOUT OCCLUSION (*).

VII/ PRACTICAL QUESTIONS: TROUBLE SHOOTING.

A/ What are the limits of conservation?

– The whole of the R_2 network must be preserved at all costs

– Some of the R_3 network can be destroyed when an immediate aesthetic result is essential, limited to part of the thigh and external region of the leg or to LEONARDO's vein for example, providing the rules of reentry are respected.

Atypical, excentric varicose veins, independant of the saphenous axes detected at Doppler mapping, can be totally excluded without betraying any of the CHIVA principles. These veins can be classified as a R_4 network.

B/ When there are one or more incompetent perforating veins on the internal saphenous vein, especially **in the thigh**,

ligation-section just below each junction will preserve the venous axis but it will be fractionated in small segments which are too short for eventual bypass grafts

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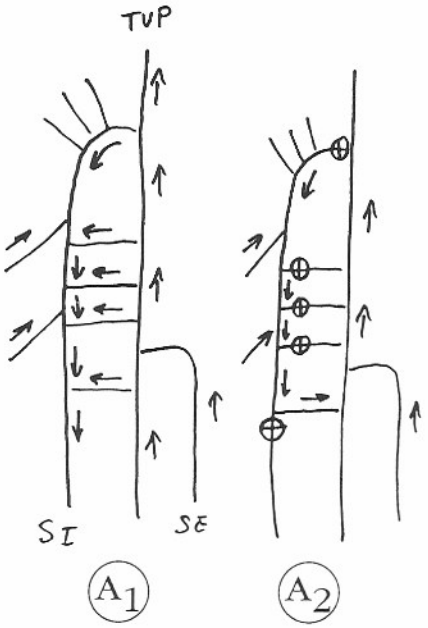
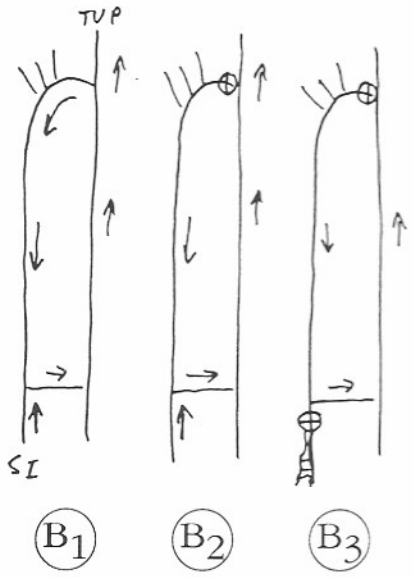


(especially femoro-popliteal) (A1) can be avoided?

It is possible to ligation and divide all intermediary incompetent perforating veins, provided there is a point of reentry to the deep venous system (A2).



C/ Is it essential to ligate and divide under a reentrant perforating vein if the underlying vein is continent when one wishes to fractionate the pressure column? (B1)

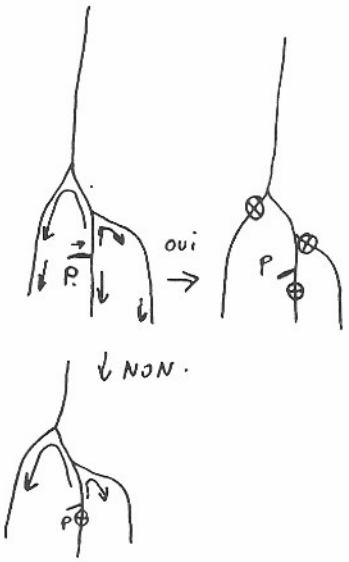
- No, because normal valve function is sufficient (B2)
- In addition, interrupting the vein at this level risks a thrombosis or dilatation of this previously normal vein (B3)

D/ It is always necessary to interrupt the internal saphenous crosse?

– No, only when it is incompetent.

E/ What are the commonest situations in practice?

– The fact that some cases are more common should not blind the operator to the more unusual and rare cases. The strategic and tactical CHIVA protocol of examination enables the diagnosis of every clinical problem with the same facility.
– The concept of statistical incidence can, however, help gain some time in achieving one's objective. Nevertheless, the operator must remain vigilant in order not to miss an unusual anatomical variation, masked by an apparently "classical" presentation.
– Beware especially of reflux in the perineal veins, gluteal and posterior veins of the thigh, whether or not the saphenous vein is continent.



F/ Is interruption just below a perforating vein an unequivocal gest?

– No. Interruption may be performed on 1 or several branches without risk of inefficacy.
– Here is a common example at the trifurcation of the internal saphenous vein of leg. The 3 incontinent branches have the same perforating "feeders". All three branches should be interrupted as shown in the diagram.

G/ Why do most varicose ulcers occur over the malleoli and the anterior tibial region?

– This is the most dependant part of the body and, therefore, where the hydrostatic pressure is greatest.

– Why not over the heel, the plantar surface of the foot or over the toes?

– Because these areas are protected from the pressure shock waves associated with incontinent tibial or peroneal veins.

– Why then do varicose ulcers do not occur over the calf opposite the perforating vein which communicates with an incontinent calf vein?

– I suggest a third hypothesis: the site of skin ulceration is related to the absence of underlying muscle tissue and is therefore particulary at risk of poor oxygenation (precarious arterial supply), stasis, hypoxia, pressure, accumulation of waste products, at the lowest point on a veno-venous shunt lead to necrosis and infection which is difficult to reverse. This could account for the reactional hyperaemia around the

ulcer and also perhaps for so-called white atrophy (*). This only implies respecting the reentrant perforating vein (even very dilated) (the veins of COCKETT are mainly reentrant perforating veins in our experience) in order to assure the evacuation of the cutaneous venous circulation, providing the hydrostatic pressure is reduced and the veno-venous shunts disconnected. This explain spectacular results of the CHIVA procedure in varicose ulcers, without operating the usual enormous perforating vein underlying.

(*) This would also explain the greater skin fragility in patients with associated obstructive arterial disease (mixed ulcer).

BIBLIOGRAPHY

The history of phlebology dates back to antiquity and features an innumerable number of publications. Not having been able to read all this literature, my own ignorance of some of the most important scientific articles is, therefore, more than probable. I wish to present my excuses to these authors and in order not to offend anyone, I suggest that the reader who wishes further information consults the international bibliography,where all are cited. However, I cannot resist the temptation of recalling the names of those whose euristic approach to the problem of venous insufficiency has particularily influenced my thinking: Trendelenbourg, Perthes, Bassi, Van Houtte, Tournay, Burton, Cockett.

INDICE

Achevé d'imprimer sur les presses
de l'imprimerie Darantiere
à Dijon-Quetigny en février 1993

Dépôt légal : 1er trimestre 1993
Numéro d'imprimeur : 093-081