Diagnostic and minisurgical treatment of chronic venous insufficiency

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In the treatment of chronic venous insufficiency (CVI) it is very important to make an appropriate diagnosis, to measure and localise the haemodynamic failure before starting treatment. We do not want to mention all the diagnostic procedures, just the Phlebodynamometry and the Functional Doppler test.

To achieve good therapeutic results it is not always necessary to use difficult and expensive diagnostic and therapeutic procedures. Is is more important, especially among patients with CVI, to have a method which is as atraumatic as possible. These patients have vulnerable tissue and edemas, so a radical procedure could damage the tissue and as a result the edema will be worse than before.

Diagnostic

Phlebodynamometry according to Várady

Varicose veins are not only an anatomical problem but also a haemodynamical one. With the patient in a standing position large varicose veins are visible which disappear when the leg is elevated because the venous pressure drops.

This method makes possible a judgement about the haemodynamic situation, the transporting capability of the according veins and of the valve function.

Measured are the hydrostatic pressure P_1, then the pressure under maximal strain P_2, the pressure under strain and occlusion $P2_{Occl}$ and finally the time for regain of the filling of the veins t_0.

As is well-known the most important parameter here is the pressure drop $\Delta P = P_1 - P_2$ which can be determined very accurately (**figure 1**).

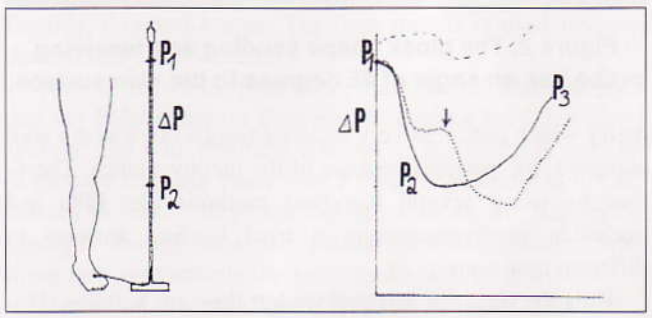

Figure 1. The most important parameter is the pressure drop. $\Delta P = P_1 - P_2$.

The regain of the filling of the veins is also important but it comes only in second place behind the pressure drop.

The functional Doppler test with flat probe

For many years phlebologic diagnosis has been unthinkable of without the Doppler probe. Generally the pen probe is used which is permanently installed on most devices. The test is performed on the resting patient. With this method among others the insufficiency of the venous valves is demonstrated, perforating veins are localised and a deep venous thrombosis is diagnosed with more or less certainty. For these applications the pen probe is sufficient, which is placed upon the skin in at an angle of 45^0 while the patient is lying down or standing upright. If the patient moves then the probe cannot be held in the correct position and so valid results are not achieved unless it is a static test.

Especially in recent years functional testing methods have become more important, primarily blood phlebodynamo-

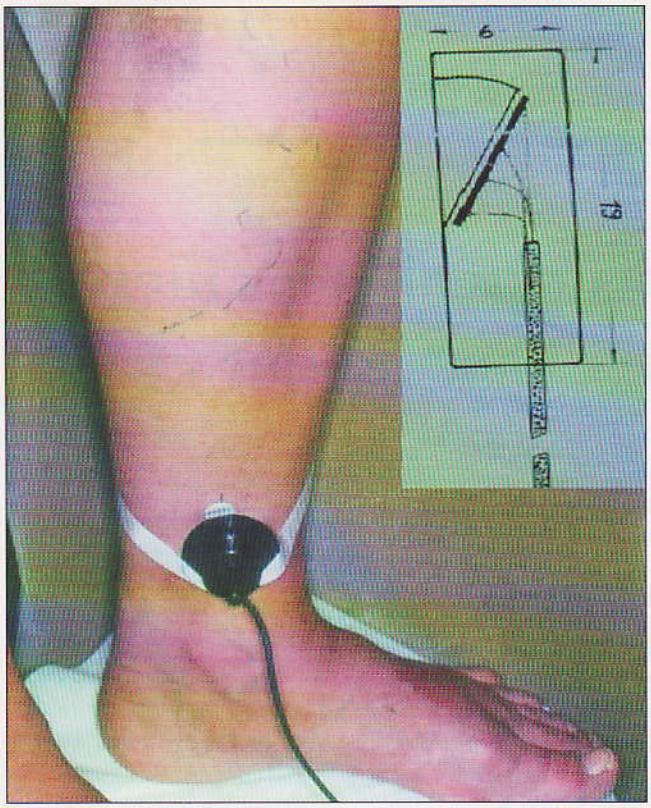

Figure 2. The block shape sending and receiving probe has an angle of 45 degrees to the skin surface.

metry which produces very accurate results but was not well accepted by patients because of the inconvenience. Therefore by using several bloodless methods like PPG and occlusion plethysmography it tried to find answers to different questions.

Thus the tests are less precise but they are painless. However before purchasing expensive instruments it should be considered whether testing can be extended using the instruments already available.

Description of the probe: the probe has a block shape. The sending and receiving unit is located inside at an angle of 45 degrees to the skin surface (**figure 2**).

What are the answers the test can give?

On one side there is the formulation of the question of PPG and on other side that of phlebodynamometry. An answer to both is given by the dynamic Doppler test because it combines the method of the ordinary Doppler probe with the results of phlebodynamometry an exercise programme.

Phlebodynamometry is mentioned here as far as comparison with the Doppler test makes it necessary. It gives the same results but with a bloodless technique: with phlebodynamometry the pressure is determined, based on the flow velocity.

The procedure is similar to the bloody venous pressure test: the first measurement is made on the motionless patient. Then the patient bends his knees several times until the pressure does not drop any further, i.e. the curve does not change any more. Now the occlusion test follows where the

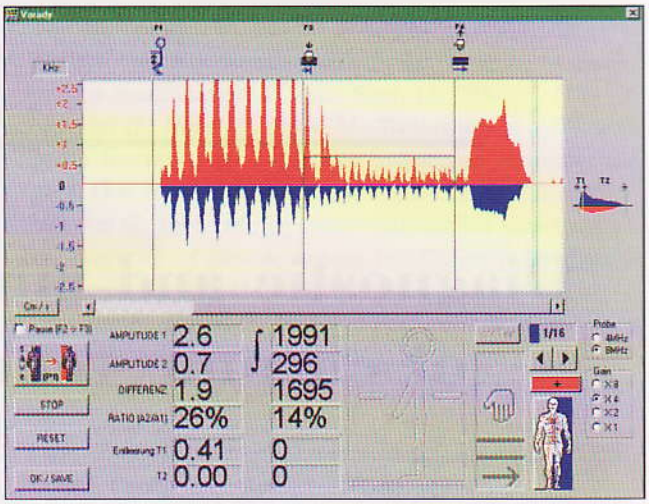

Figure 3. Functional Doppler curve of extensive varicosis with valve insufficiency.

vein is shut off by finger pressure or with a special cuff. This gives P_{2Occl} (pressure under maximum strain and occlusion). After this the filling regain curve is drawn with the patient standing still. This makes the same conclusions possible as with PPG + phlebodynamometry as well as giving more information.

The result is the following: you get more information than with PPG and phlebodynamometry but with a bloodness test. For the last few years we have been using a computer programme which gives more information and makes calculations automatically.

The description and interpretation of a sample curve: extensive varicosis with valve insufficiency (**figure 3**).

Phase 1. The curve shows respiration-synchronous movement of the blood with low velocity caused by large calibre veins with valve insufficiency producing a counter-pressure.

Phase 2. It can be observed how through the effect of the muscular pump the stasis is reduced, indicated by a large increase in the flow velocity. The substantial amplitude indicates a large amount of regurgitated bloodflow.

Phase 3. This shows the situation during the occlusion test: the blood is drained through the deep venous system. Because the v. saphena magna and the varicose veins are shut off the amount of regurgigated bloodflow has diminished substantially (low amplitude).

Phase 4. The last part of the test can be observed: while the patient is standing still the blood flows back into the varicose veins at high velocity, which shows that these were extensively emptied before. If the patient is standing and the occlusion persists the perforating venous valves can be tested.

Basic parameters

Pumping performance. Amount of blood (ml) over a period of time (integral of blood velocity over period of time = area under the curve).

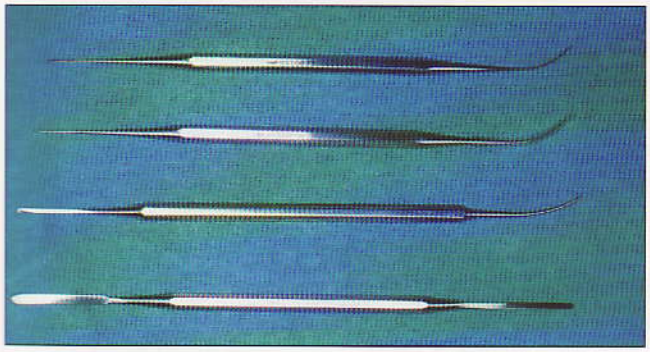

Figure 4. The Phlebextractor has two ends: one is a hook and the other one is spatula.

Pumping power. Amount of decrease of drained blood volume (the ascending curve = changing of the blood velocity).

Healthy leg. Normal blood volume, which is drained quickly. Refilling minor and slow (small amplitude and minor slope of the curve).

Large caliber varicose veins with free deep vein. Large blood volume with little change during strain. Indication of oscillating blood.

Occlusion test: drain through the deep vein.

a/ Fast drop of the amplitude.

b/ Small area under the curve.

Refilling quick with large blood volume.

Acute deep venous thrombosis clinically typical. The leg is swollen, there is only a little blood present which is not drained during movement, thus venous pressure is even increased.

Therapy

Besides the basic compression therapy it is necessary to remove insufficient varicose veins to decrease the hemodynamic failure.

The majority of patients suffering from varicose veins are women, and this implies that not only medical but also cosmetic aspects have to be considered in therapy. Often stripping is combined with fairly large and numerous cuts to extract branches. In many cases scars after traditional surgery are more annoying for the patient than the varicose veins before. Besides this many develop edema because of the destruction of lymphatic vessels. Therefore it is of the greatest importance to have a method in mind which includes both aspects.

Many had throught of removing varicose veins through micro-incisions. Using more or less appropriate small hooks they tried to extract varicose veins without considering that veins are fixed in their surrounding tissue. Therefore neither the technique nor the instruments used were suitable to get any further with this problem. About twenty years ago I developed a method for which the German company Aesculap provides the necessary instrumentation. It is the first method based on surgical principles together with matching surgical instruments, the Phlebextractor and the Phlebodissector, by which modern minisurgery of varicose veins could be established.

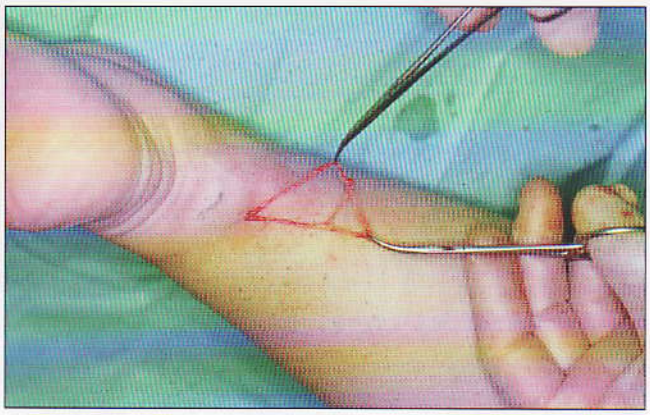

Figure 5. Long varicose vein section can be removed from a tiny incision.

Materials and methods

Instruments (**figure 4**). The Phlebextractor has two ends: one is a hook and the other is a spatula. This is really two instruments in one with different functions, so it is not necessary to switch very often. The spatula is firm, arced and not flexible. We use different Phlebextractors for all kinds of situations, as there are large calibre varicose veins, reticular veins and spider veins.

The Phlebodissector has spatulas on both ends which are flexible, thin and longer. The firm spatula is used first and the flexible one thereafter.

The big difference from other methods and instruments is that my Phlebextractor does not have just a hook but also a spatula, and with this new concept or method it is possible to prepare varicose veins over a long range and it is not necessary to make a large number of incisions. So, besides the specially shaped hook the spatula is most important. With these new instruments the best results will be achieved.

Method of surgery (**figure 5**). Tiny incisions 3 to 5 mm) are made with a special micro scalpel with which no big cuts can be made accidently. By using the spatula-end of the Phlebextractor veins are loosened in each direction. After this the instrument is turned around, and with the other end (the hook) the vein is pulled out. With your fingers you can imprint the skin in order to find and feel the vein more easily. The hook is pressed against the fingertip, locating the vein between them. So the vein is found easily and no nerve can be hurt because this would be noticed instantly.

The loosened vein is grasped with the mini-Mosquito forceps. Under continuous pulling with the mini-Mosquito the vein is prepared further with the help of the spatula. The tip of the spatula must point towards the skin. You must be able to feel the tip, in order not to hurt anything. Having pulled out the vein a second incision is made 5 to 15 cm from the first incision. The location depends on how far the vein can be prepared. This consideration distinguishes minisurgery from other methods. Now the other end of the vein is loosened and the whole vein section can be removed. A cutaneous suture is rarely necessary.

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