Editorial focus

Some thoughts before an epidemic of endoluminal varicose vein ablations

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In recent years endoluminal thermal ablation of varicose veins has become increasingly popular. The method accommodates tendencies towards less invasive procedures for both the patients' clinical benefit and economy. In parallel, the quality of long term results of standard varicose vein surgery came under investigation (4, 5). Thus, enthusiasm spread in hope to obtain at least as good results with catheter based interventions as with classic surgery.

Two main advantages of endovenous ablation have been emphasized:

- The procedure can be performed office-based under local analgesia and patients recover rapidly taking up their ordinary activities.
- Early reports claimed fewer side effects and less post-interventional pain.

As much promising were the first publications on short and midterm results of efficacy. Permanent target vein occlusion rates observed up to 4 years after treatment ranged from 76 to 100% (2, 9, 10, 12, 13, 16, 17). Long term results gathered in registries and data of ongoing randomized trials comparing surgery with various techniques of endovenous treatment will realize the expectations. Meanwhile, encouraged by the relative simplicity of the procedures and tempted by the industries propaganda more and more physicians started to use catheter directed varicose vein ablation. However, the fact that the new techniques have largely replaced surgery in many centres does not mean that the prophecies will indeed come true.

Damage to the varicose vein wall is inflicted by intermittently applied heat and/or electric current triggering a process which starts with tissue necrosis and ends with fibrosis and ultimately disappearance of the varicose vessel. A catheter with a heat-delivering tip is introduced under tumescent anaesthesia, placed close to the sapheno-femoral or sapheno-popliteal junction and slowly pulled back. Lasers act through very high temperatures, about 1000°C. Different wavelengths allow targeting different structures, at least in theory. But really better results, i.e. less pain and bruising with a similar primary occlusion rate, seem achievable only with the newest radial laser systems. A much lower temperature is generated by an electric current of radiofreqency. The more gentle technique requires staying power, as the catheter has to be pulled back with very low speed. The approach has undergone technical advancements. The system marketed under the brand Closurefast needs a much shorter time to complete the procedure.

Which heat is the best cook?

The temperature applied and the mode of heat generation seems to be fundamental for both efficacy and adverse local effects. Other apparent problems, such as the risk of deep vein thrombosis may be related to the concept of the endoluminal intervention and not to the used technique. At present, comparative safety data are not available. However, the rate of DVT seems to be in order of about 1% only, for both radiofrequency and laser ablations (1, 6, 10, 11, 14).

In this issue of *Phlebologie* and in an earlier volume, two research groups reported on their

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Phlebologie 2009; 38: 1–2
Received and accepted: December 23, 2008

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experience with a new mode of heat application (3, 7, 8, 18). An electric current of radiofrequency is sent through the vein wall using a bipolar catheter. The heat is generated right in the vessel wall while the probe itself remains unheated. The positioning of the catheter within the vein lumen is of less importance. The technique allows the control of the amount of heat produced as the electric conductivity decreases with the dehydration of the tissue. Conductivity can be measured and the signal used to modify the current. The articles show that the optimal dose of heat and the time of delivering it to the vein wall have not been firmly established yet. Too little heat and/or too short application may not lead to closure of the vein and/or to early recanalisation while higher temperature and longer application times may cause damage to perivenous tissues and jeopardize the potential benefit of the method. The phlebologist as a rope-dancer!

This brings me back to the primordial question: what is heat doing to which structure and at what temperature? I find no clear answers in literature on endovenous vein ablation but I recall my lessons on food and cooking. Heat has a drastic effect on muscle fibres. They start to shorten at 54°C and have shrunk as much as they can at about 77°C. Collagen in the connective tissue requires more extensive cooking in order to be converted into soft gelatine. The temperature at which the ordered structure of this protein collapses, is about 60°C in meat and 41°C in fish. Separation into individual molecules, the loose association called gelatine, occurs at about 100°C. Thus, cooking meat rarely results in tender meat but the unaffected connective tissue remains tough. Conversely, cooking meat thoroughly will result in gelatinized collagen but crumbly and mealy rather than firm and juicy meat. Thus, cooking meat implies a necessity of compromise.

What does this metaphor mean for varicose vein ablation?

Intended in the first place is shrinkage of the vessel lumen. If this is achieved all the processes following the thermal injury, e. g. denudation of the endothelial layer, thrombosis, inflammatory reaction, and fibrosis, are more confined. Therefore, moderate or even low temperatures should be used and applied for as long as ultrasound control shows maximal shrinkage of the wall. Only, in this case higher temperatures might be used to "cook" collagen fibres. The initial use of high temperature may cause denaturation of the delicate muscle proteins and elastic fibres and preclude contraction. The size of the lumen plays an important role, unless the heat is generated within the vessel wall – as with the bipolar radio-frequency system – and not transported through the blood present in the lumen. These deliberations may have an impact on selection of patients for endoluminal therapy. Varicose veins may not shrink as they may be devoid of a sufficient quantity of muscle fibres and/or the lumen may be too wide to permit a relevant reduction. Thus, in the presence of a large varicose vein allowance must be made for a large thrombus (or "sclerus" as some French phlebologists like to term it), probably requiring tailored compression therapy and a longer healing period – or the patient is recommended for classic surgery.

The ideal method?

The various and numerous reports published on endoluminal therapy of varicose veins show me that the ideal method to destroy the vein with a minimally invasive procedure and no relevant side effects is still to be discovered.

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Verantwortlicher wissenschaftlicher Schriftleiter dieser Rubrik: W. Blättler, Richterswil