Ten conclusions after ten years’ experience in radical endovenous laser therapy of lower extremity varicose veins

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OBJECTIVE: The paper is aimed to show our experience with endovenous surgical treatment of superficial venous insufficiency of the lower limbs.

SUBJECTS AND METHODS: We have been performing the radical endovenous laser therapy in the treatment of the chronic venous insufficiency of the great and the small saphenous veins with the device Cerelas D 15, (Biolitec Inc.) since 2004. The 980 nm wavelength was used until the end 2007, and the 1470 nm wavelength has been used from 2008 to date. All patients underwent the procedure under the conditions of the aseptic operation theatre, with the choice of different types of anesthesia, endolaser therapy, the procedures should be performed in conditions of the aseptic operation theatre, with the choice of different types of anesthesia, crossectomy, instrumental removal of varices, in special cases. We believe, that the more radical treatment is performed initially, the longer lasting effect may be expected, of course in synergy with the complete care of the insufficient venous system.

RESULTS: 445 (53.6%) patients were examined within 1 to 8 years after the procedure. The partial recanalisations in the main veins were observed in 7 (6.5%) patients, with the 980 nm device, and in 29 (8.5%) patients with 1470 nm device, respectively. The complete recanalisation in the main veins was observed in 3 (2.8%) patients with 980 nm device and in 8 (2.3%) patients with 1470 nm device, respectively. All patients with total recanalisation have been reoperated. The recurrence in the groin was found in 3 (2.8%) cases with 980 nm device and in 19 (5.5%) with 1470 nm device, respectively. The recurrence in the popliteal area was found in 1 (0.9%) with 980 nm device and in 5 (1.46%) with 1470 nm device, respectively. The immediate complications after the surgery were: longer lasting paresthesia in 12 (2.67%), skin burn of mild degree in 7 (1.56%), deep venous phlebothrombosis in 1 (22%) patient.

CONCLUSION: A vast majority of our patients was satisfied with the endolaser therapy provided for their varices. The benefit of radical treatment may be summarised as follows: better postoperative comfort and immediate cosmetic effect, significantly shorter work incapacity, faster achievement of full socioeconomic activity. The administration of the cold physiological saline solution close to the laser fiber is a great advantage, in present time. We believe, that if we offer the radical treatment of lower extremity varices via endolaser therapy, the procedures should be performed in conditions of the aseptic operation theatre, with the choice of different types of anesthesia, crossectomy, instrumental removal of varices, in special cases. We believe, that the more radical treatment is performed initially, the longer lasting effect may be expected, of course in synergy with the complete care of the insufficient venous system.

Key Words: Varicose veins of lower limbs; Experience in endovenous laser surgery – 10 years.
the patient pulls the stocking on the operated leg only during a day time. Work capability is mostly reached on the fifth day following the procedure and it depends on the extent of the venous impairment and on the character of the work (Table 1).

**TABLE 1**
The overview and characteristics of our group

<table>
<thead>
<tr>
<th>Variables</th>
<th>C-0</th>
<th>C-1</th>
<th>C-2</th>
<th>C-3</th>
<th>C-4</th>
<th>C-5</th>
<th>C-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of ELVeS</td>
<td>835</td>
<td>32</td>
<td>147</td>
<td>270</td>
<td>215</td>
<td>111</td>
<td>96</td>
</tr>
<tr>
<td>The average age</td>
<td>44 y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELVeS on the great saphenous vein</td>
<td>724</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELVeS on the small saphenous vein</td>
<td>103</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELVeS on the vena saphena accesoria</td>
<td>77</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELVeS bilaterally</td>
<td>102</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 2**
The severity of the venous impairment – CEAP classification

<table>
<thead>
<tr>
<th>Variables</th>
<th>Number of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-0 no varices, C-1 spider veins, C-2 truncal veins, C-3 venous edema, C-4 lipodermatosclerosis, C-5 healed varicose ulcer, C-6 not completely healed varicose ulcer (Table 2).</td>
<td></td>
</tr>
<tr>
<td>Within 1 to 5 years after the procedure we examined 448 (53.6%) our patients. All patients with total recanalisations have been reoperated, the others have been treated ambulatory (Table 3).</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 3**
The results of surgeries 448 followed up patients

<table>
<thead>
<tr>
<th>Variables</th>
<th>Partial recanalisation in the main veins</th>
<th>Total recanalisation in the main veins</th>
<th>Recurrence in the groin</th>
<th>Recurrence in the popliteal area</th>
</tr>
</thead>
<tbody>
<tr>
<td>107 pts. 980 nm</td>
<td>7 (6.5%)</td>
<td>3 (2.8%)</td>
<td>3 (2.8%)</td>
<td>1 (0.9%)</td>
</tr>
<tr>
<td>341 pts 1470 nm</td>
<td>29 (8.8%)</td>
<td>8 (2.3%)</td>
<td>19 (5.5%)</td>
<td>5 (1.46%)</td>
</tr>
</tbody>
</table>

**TABLE 4**
The summary of complications

<table>
<thead>
<tr>
<th>Variables</th>
<th>Number of patients, (%, (no, nm))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-term lasting paresthesias</td>
<td>12, (2.67), (6-980 nm, 6-1470 nm)</td>
</tr>
<tr>
<td>Skin burns of a minor degree</td>
<td>7, (1.56), (3-980 nm, 4-1470 nm)</td>
</tr>
<tr>
<td>Deep phlebitis</td>
<td>1, (0.3), (980 nm)</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td>0</td>
</tr>
</tbody>
</table>

**DISCUSSION**

The color Doppler ultrasound examination is a part of the basic diagnostic vascular testing in a patient with lower limb varices and it should be optimally performed by a physician trained and experienced in endovascular treatment of insufficiency of the superficial venous system of lower limbs. The examination relatively exactly helps determining the current situation of magistral veins in both legs, the extent of their dilatation in different levels and potential existence of reflux, the examination of valves, collateral branches, perforators and the deep venous system as well as the state of the arterial supply of limbs (Table 4).

According to our opinion, the optimal place of treatment in the planned radical procedures should be the aseptic operating room, due to a large variability of venous impairment. The patient may be provided with not only different methods of anesthesia that are suitable for the given procedure but also with different ways of the extension of the basic procedure, i.e., the removal of magistral veins, so called – crossectomy, the preparation in the popliteal region, minipheleectomy, etc., in such a place. All these conditions are met in the one day surgery departments (1-11).

As for the assement of used medical devices, the 1470 nm wavelength device was significantly superior to the 980 nm wavelength device (12-15). The optimal power output was 122 W with the beam energy around 80 J/cm. This experience is consistent with other authors (6,7,16-20). It is proved that the 1470 nm wavelength of the laser beam is more powerful in destroying the wall of dilated veins; therefore it is more suitable to have the vein partially evacuated. Also, this wavelength is very probably more effective when assessing the postoperative 10-year follow up (20). The shaped tip of the laser fibre, that gets in touch with the wall of the vein, is also significant. Peroperatively administered cold normal saline around the laser fiber also acts positively both by the pressure against the vein and by a local cooling (21). However, it seems, that the additional increase of the wavelength of laser devices not be more effective, according to several studies. The 1950 nm wavelength is more effective only in tiny veins with the inner diameter of approximately 1 mm (19).

Besides the technical equipment of the working place the management of the procedure itself is predominantly important in terms of the therapeutical effect. We believe that the laser closure of the entire length of the dilated great or small vein is necessary. As for the proximal closure of the great saphenous vein together with its branches in the so called crossectomy, we have been performing it selectively since 2008. In any case we perform it, consistently with other authors, in situations when it is not possible to penetrate the fiber to the saphenofemoral junction retrogradely, in extreme dilatation, or reflux; and in the insufficiency of valves; the magistral vein and its branches in order to present the so called – neovascularization – and the recurrence of varices in groin, and in anatomically unclear situations (9). Some authors report that such a neovascularization occurs more often after simple ablation with endo-laser method in groin (3). It must be said that this complication was not observed in our group who passed the crossectomy. It is reported in the literature that the recurrence of varices in groin occurs also after high ligature and the stripping method, but that it was supposedly caused by another factors (5). We believe that the crossectomy and /or the high ligature, were not performed lege artis in these cases. The development of the deep phlebitis after the surgery may be promoted by other factors –older age, an increased diameter of the great saphenous vein – around 1.5 cm, obesity, minipheleectomy, etc. (10,21,22). The local phlebitis spontaneously dissolves according to the follow up ultrasound examinations performed 4 weeks after the procedure. However, it is evident that in the insufficient valve in the saphenofemoral junction and in the increased diameter of the great saphenous vein, crossectomy is an effective prevention of both the thrombosis reported in up to 3,2%, and of other complications as well. Also, only the peroperative ligature of the saphenous vein may prevent the recently seen complication. The displacing of the broken tip of the laser catheter into the deep venous system (2,14). The cons of crossectomy are the future scars in the groin, certain prolongation of the procedure, and predominantly the unsuitability for the out-patient setting. In some cases also the professional orientation of the department may disapprove the crossectomy. The fact is that the health institutions specialized in surgery and vascular procedures have recently preferred certain form of the high ligature of the saphenous vein – for example with Deschamps needle or with other devices (16,23).

When assessing our five-year outcomes of the endo-laser procedures we evaluated positively the the simultaneous treatment of impaired branches of magistral veins by minipheleectomy. Other authors have recently joined this opinion (4). We still prefer this procedure together with a simultaneous treatment of impaired branches of magistral veins, so called – crossectomy, the preparation in the popliteal region, minipheleectomy, etc., in such a place. All these conditions are met in the one day surgery departments (1-11).
dilated collateral branches before the radical procedure to be the optimal method (18).

Despite the extremity low occurrence of phlebothrombosis in our patients we have recently administered the LHMW heparin as a standard prevention of the thromboembolic disease in the day of the procedure and during the next three days in accordance with other authors (10,19). The wearing of high elastic socks with 40 mmHg compression during 2 weeks (the first week permanently and the second week only during the day) is sufficient for the after treatment according to our experience. Other authors report similar date (8).

CONCLUSIONS

We can draw ten conclusions from the above discussion:

1. The indication for ELVeS of magistral veins and their branches must be established after the clinical and the ultrasound Doppler examination. This examination exactly determines the extent of their impairment, dilatation, reflux in magistral veins and their branches, deep veins patency and arterial system patency. This enables to determine the extent of the surgery for the individual patient.

2. ELVeS should be performed at Surgery, Angiosurgery or Phlebology Departments respectively, where the procedure can be modified or extended, for example with crossectomy, ligature, instrumental resection of branches, etc.

3. We believe that the standard approach to the ELVeS procedure is that it should be performed under aseptic conditions in the operating theatre with multiple choices of analgesia, as well as with the possibility of one day hospitalization. The outpatient setting often limits the extent of the radical treatment.

4. The specialization of the physician shouldn’t limit the primary procedure. The extent of the procedure should be determined after the basic examination, if and where the crossectomy, ligature, modified „pinhole” crossectomy, instrumental removal of too coiled branch, foam sclerotherapy, etc., is to be performed – lege artis.

5. The nature of the disease itself predicts, that the chronic venous insufficiency is a long term, sometimes even life long burden for the patients. It is determined genetically, professionally – static load, constitutionally – overweight, hormonally – contraception, and by bad habits – smoking, etc. The primary extent of the procedure is the key factor of the treatment in reducing the recurrence of the disease.

6. Long term prevention of the recurrence of the disease including patients’ follow up is also very important. This is the only way to reduce late complications and recurrences, eg. in the extreme static load, sports, travelling, etc.

7. While some authors emphasize also the established role and comeback of stripping and cryostripping surgical procedures, after the basic examination, if and where the crossectomy, ligature, instrumental removal of too coiled branch, foam sclerotherapy, etc., is to be performed – lege artis.

8. Concurrent price evaluation of the individual therapeutic methods is and will be very important, also when compared to the traditional stripping method.

9. Nowadays, no method of the radical treatment of the insufficiency of the superficial venous system can be considered obsolete for the above mentioned reasons. Recently, the combined procedures have been used more and more.

10. We believe, that the future of the radical endo-laser closure of the insufficient superficial venous system of the lower limbs, lies in a further improvement and a wide use of fibers and laser energy with a wavelength around 1500 nm and with possibility of a simultaneous percutaneous treatment of intracutaneous spider veins. Or even higher wavelength may be used. Further technical development is very likely in this area, as well as the e-stim-blishment of internationally recommended standards of the treatment. At present time we recommend using 1470 nm wavelength device.

CONFLICT OF INTERESTS

The authors declare that they have not conflict of interest in connection with emergence of and that the article was not published in any other journals.

REFERENCES


