ORIGINAL ARTICLE

Evaluation of great saphenous vein occlusion rate and clinical outcome in patients undergoing laser thermal ablation with a 1470-nm bare fiber laser with low linea nergy density

Avaliação da taxa de obliteração da veia safena magna e da evolução clínica de pa a termoablação com laser 1470 nm, fibra linear e baixa densidade de energia endovenosa linear

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Abstract

Background: Water-specific 1470-nm lasers enable vein ablation at lower energy densities and with fewer side effects because they target interstitial water in the vessel wall. **Objectives:** To determine great saphenous vein (GSV) occlusion rate after thermal ablation with 1470-nm laser using 7W power and to evaluate clinical outcomes and complications. **Method:** Nineteen patients (31 GSVs) underwent thermal ablation. Follow-up duplex scanning, clinical evaluation using the Venous Clinical Severity Score (VCSS), and evaluation of proce ns were performed at 3-5 days after the procedure and at 30 and 180 days. **Results:** Mean patient age was 46 years and 17 of the patients were female (89.47%). Of 31 limbs treated, 2 limbs were clinical class C2, 19 were C3, 9 were C4, and 1 limb was C5 according to the Clinical-Etiology-Anatomy-Pathophysiology (CEAP) classification. Mean linear endovenous energy density was 33.53 J/cm. The GSV occlusion rate was 93.5% immediately after treatment, 100% at 3-5 days and 100% at 30 days after treatment and 87.1% 180 days after treatment. There was a significant reduction in VCSS at all time points. **Conclusions:** The data from this study support the possibility that the incidence of complications can be reduced without significantly affecting the clinical outcomes, by using lower energy density. However, this appears to be at the cost of reduced efficacy in terms of GSV occlusion rates.

Keywords: ablation techniques; laser therapy; varicose veins.

Resumo

Contexto: O laser de diodo 1470 nm, com comprimento de onda específico para água, tendo como alvo a água intersticial da parede venosa, poderia causar ablação venosa a densidades de energia menores e com menos efeitos colaterais. **Objetivos:** Determinar a taxa de obliteração da veia safena magna (VSM) após termoablação com laser 1470 nm utilizando 7 W de potência e avaliar a evolução clínica e as complicações. **Métodos:** Dezenove pacientes (31 VSMs) foram submetidos a termoablação e reexaminados através de ecodoppler, avaliação clínica utilizando o Venous Clinical Severity Score (VCSS) e avaliação das complicações do procedimento entre 3 e 5 dias e aos 30 e 180 dias de pós-operatório. **Resultados:** A média de idade dos pacientes foi de 46 anos; 17 eram mulheres (89,47%). De acordo com a classificação de Clinical-Etiology-Anatomy-Physiopathology (CEAP), 2 dos 31 membros tratados eram C2, 19 eram C3, 9 eram C4 e 1 membro era C5. A de endovenosa média foi de 33,53 J/cm. A taxa de obliteração da VSM foi de 93,5% no pós-operatório imediato, de 100% entre 3 e 5 dias e aos 30 dias, e de 87,1% aos 180 dias. Houve uma redução significativa dos valores de VCSS em todos os momentos de avaliação. **Conclusões:** Os dados deste estudo apoiam a possibilidade de que, utilizando baixa densidade de energia, podemos reduzir a incidência de complicações sem afetar significativamente o resultado clínico. No entanto, isso parece ocorrer às custas da diminuição da eficácia em termos de taxa de obliteração da VSM.

Palavras-chave: técnicas de ablação; terapia a laser; varizes.

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EVLA.[9,10] However, use of higher LEED significantly increases the incidence of paresthesia. It therefore seems appropriate to use LEED below 100 J/cm in future trials.

The efficacy of energy delivered at different ranges of energy density has also been evaluated. Timperman et al.[11] conducted a study using 810-nm and 940-nm laser treatment and reported a significant difference in energy delivery between the "success" and "failure" groups (63.4 J/cm vs. 46.6 J/cm, p<0.0001). They also concluded that there was no significant difference in outcomes between patients treated with different wavelengths.[11]

Bueno et al.[12] published a case series report showing that use of 1470-nm laser is a good method for treating saphenous veins, with results similar to those obtained with 980-nm laser treatment, but with lower energy densities and power.

Park et al.[13] concluded that EVLA conducted using a1470-nm laser and low energy (LEED of 80 J/cm or lower) is an effective, safe, and technically successful option for the treatment of incompetent saphenous veins. In the current study, use of low-energy parameters with a mean LEED of 33 J/cm resulted in a GSV occlusion rate of 87.1% after 6 months.

Because recanalization can also occur after high-energy EVLA of saphenous veins, energy is probably not the only problem. If recanalization occurs, the ablated GSV may have incompetent collateral veins in the distal part of the reflux segment. If incompetent collateral veins are visualized preoperatively using duplex scanning, they should be removed by phlebectomy during the same procedure, thus preventing some cases of recanalization. In the current study, phlebectomy of incompetent collateral veins was performed concomitantly with EVLA of the saphenous vein to minimize recanalization rates related to this factor.

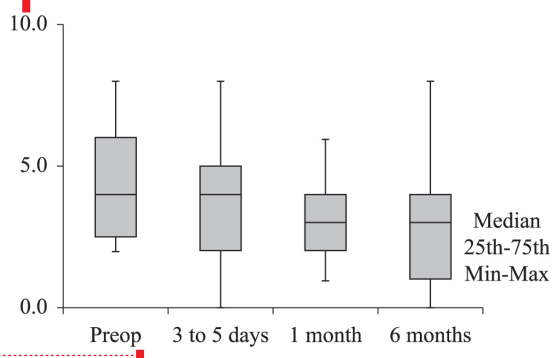

Figure 4. Venous Clinical Severity Scores (VCSS) over time.

Table 2. Pairwise comparison of GSV diameters measured at the SFJ, thigh, and knee at different time points.

Time points compared	SFJ	Thigh	Knee
Preop × 3-5 days	0.330	0.902	0.476
Preop × 1 month	0.386	0.110	0.091
Preop × 6 months	0.001	<0.001	0.001
3-5 days × 1 month	0.068	0.140	0.017
3-5 days × 6 months	<0.001	<0.001	<0.001
1 month × 6 months	0.014	<0.001	0.091

GSV: great saphenous vein; SFJ: saphenofemoral junction.

Table 3. Length of ablated GSV versus occlusion rate at 6 months.

Occlusion at 6 months	Length of ablated GSV						p-value*
	n	Mean	Median	Minimum	Maximum	SD	
No	4	35	35	30	40	5.8	0.237
Yes	27	31	28	15	50	9.8	

GSV: great saphenous vein; SD: standard deviation. *Nonparametric Mann-Whitney; p<0.05.

Table 4. Procedure-related complications.

Variable	No		Yes		Total
	n	%	n	%	
DVT – 3-5 days	31	100.0%	0	0.0%	31
DVT – 1 month	31	100.0%	0	0.0%	31
DVT – 6 months	31	100.0%	0	0.0%	31
Phlebitis – 3-5 days	31	100.0%	0	0.0%	31
Phlebitis – 1 month	30	96.8%	1	3.2%	31
Phlebitis – 6 months	31	100.0%	0	0.0%	31
Paresthesia – 3-5 days	28	90.3%	3	9.7%	31
Paresthesia – 1 month	29	93.5%	2	6.5%	31
Paresthesia – 6 months	31	100.0%	0	0.0%	31

DVT: deep vein thrombosis.

first month in two patients, but by 6 months symptoms had resolved in all patients.

One limitation of this study is the lack of long-term follow-up. However, the mean follow-up of 6 months is consistent with that reported in previous studies.[20] Min et al.[21] reported that most failures in their study occurred within the first 3 months of follow-up, and all had occurred by 9 months. It therefore seems reasonable to assume that most failures that occurred in our study would have been detected within our follow-up period. Furthermore, a relatively small number of failures were observed in our sample, thereby precluding a multivariate analysis. Nevertheless, we only used nonparametric statistical tests, which are suitable for evaluation of variables that are not normally distributed or when the sample size is small. The sample size (31 cases) was considered adequate, and nonparametric methods were adopted mainly because the data did not fit the normal distribution. An additional factor to be considered is that, when significant differences are detected for a particular sample, we can conclude that the sample size is sufficient to support the results (differences) obtained in the analysis.

CONCLUSION

The thermal ablation therapy investigated in this study, using a 1470-nm water-specific laser, allowed ablation at lower laser fluence, leading to a reduction in the energy required for successful treatment. Our data support the possibility that, by using low energy density, the incidence of complications can be reduced without significantly affecting the clinical outcomes in the whole study group. However, this appears to be at the cost of reduced efficacy in terms of GSV occlusion rates.

5,5 mm
4,5 mm
2,5 mm
4 mm

Cronos Pro Bold
11 pt/ 13 pt - C0 M0 Y0 K100

Cronos Pro Regular
8 pt/ 9,6 pt - C0 M0 Y0 K100

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