

MORPHOLOGICAL CHANGES IN THE WALL OF GREAT SAPHENOUS VEIN AFTER RADIOFREQUENCY ABLATION

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ABSTRACT

Radiofrequency ablation (RFA) is a relatively new method for endoluminal thermal occlusion of the incompetent saphenous veins. The aim of the present study was to investigate microscopically the changes in the venous wall after routine RFA procedures. Short pieces (n=7) from the knee segment of the great saphenous vein were taken during RFA procedures. The removed vein segments were immersion fixed in 10% formalin and proceed to routine histology examination. Microscopically, the venous wall after RFA showed circular disintegration of the intimal layer. In addition, cylindrical medial lesions with disintegration and intercellular splits and gaps were observed. No transmural thermal lesions were seen. The present results highlight the mechanism of predetermined tissue damage after RFA procedures of the great saphenous vein.

Key words: *great saphenous vein, venous insufficiency, endovascular treatment, radiofrequency ablation*

INTRODUCTION

The venous insufficiency of the lower extremities is a common medical problem (4,5). Nearly half of the adult population may have some signs of minor venous disease (1). About one quarter of the population has lower extremity varicose veins (7), leading to a number of complications (5). In a large number of patients, the truncal veins of the leg, including the great saphenous vein (GSV) and small saphenous vein, are commonly affected (4).

Radiofrequency ablation (RFA) is a relatively new method for endoluminal thermal occlusion of

the incompetent saphenous veins – an alternative to surgical high ligation and stripping (9). The mechanism of RFA is to produce by intravenous catheter a predetermined amount of tissue damage to the vessel wall that result in an irreversible occlusion of the saphenous vein (9). This method has a proven efficacy but in the same time it can develop some complications (2,4,11).

The aim of the present study was to investigate microscopically the changes in the venous wall after routine RFA procedures.

MATERIAL AND METHODS

Short pieces (n=7) from the knee segment of the great saphenous vein were taken during routine RFA procedures performed at the Clinic of Vascular Surgery and Angiology of Military Medical Academy, Sofia. The closure system catheter (VNUS Medical Technologies, San Jose, USA) was used for RFA procedures. The removed vein segments were immediately immersion fixed in 10% formalin, stored for one week and proceed to routine histology examination. Parafin sections (7 µm thick) were

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stained with haematoxylin-eosin and orcein and examined under light microscopy.

RESULTS

After completion of the RFA procedures, the catheter tips were examined, but none had any carbonized deposits after treatment. Macroscopically, the vein segments showed no external signs of thermal damage in the surrounding layers. The vein walls were thickened and slightly contracted. A discoloration of the intimal surface was noted after longitudinal opening of some veins. Microscopically, on the H&E stained sections of the venous wall after RFA, circular disintegration of the intimal layer with loss of endothelium was observed (Fig. 1). In addition, cylindrical medial lesions with disintegration and intercellular splits and gaps were noted (Fig. 1). No transmural thermal lesions were seen. The orcein stain revealed presence of fewer elastic fibers in the area of internal elastic lamina, a finding consistent with the wall changes in varicose veins (3), but showing clear signs of disintegration (Fig. 2). The adventitia of the veins contained thick, frequently disintegrated elastic fibers (Fig. 2).

DISCUSSION

For many years, surgery has been the standard treatment for the varicose GSV – high ligation (crossotomy) at the saphenofemoral junction and following stripping and surgical removal of accessory varicose veins (11). Recently, to improve efficacy of the varicose vein treatment and also to reduce side effects, costs and postoperative pain, several minimally invasive techniques have been introduced including the ultrasound-guided foam sclerotherapy, endovenous laser therapy and RFA (4). With RFA, a special catheter is introduced into the vein through a skin puncture or with direct phlebectomy incision. Then the vein wall is exposed by the catheter tip to high-frequency alternating current that creates local heat up to 85°C-90°C (with the modern catheters up to 120°C).

The effect of the RFA on incompetent saphenous veins in human patients has been studied basically by means of ultrasound pre- and postprocedural evaluation (2,6,8). However, the morphological changes in the vein wall after RFA have been studied only in some animal models. In cow's foot model

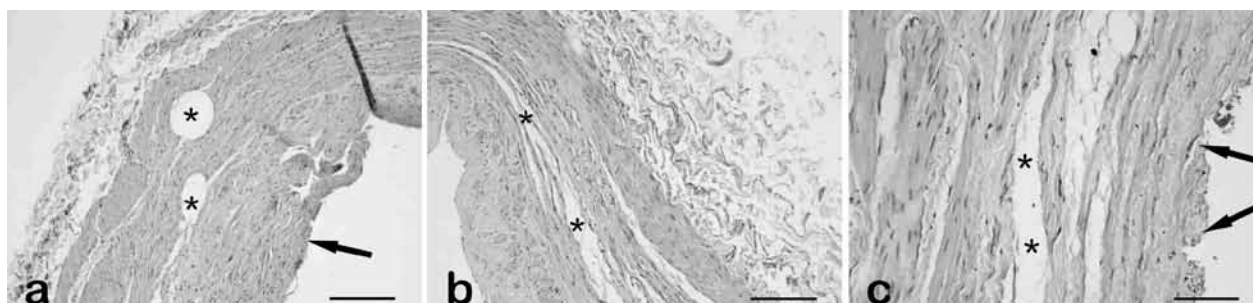


Fig. 1. Microphotographs of the H&E stained histologic cross sections of great saphenous ven after RFA procedures. Cylindrical medial lesions with disintegration and intercellular splits and gaps (asterisks). Disintegration of the intimal layer with loss of endothelium (arrows). Size bars: (a) and (b) – 200 μ m; (c) - 100 μ m

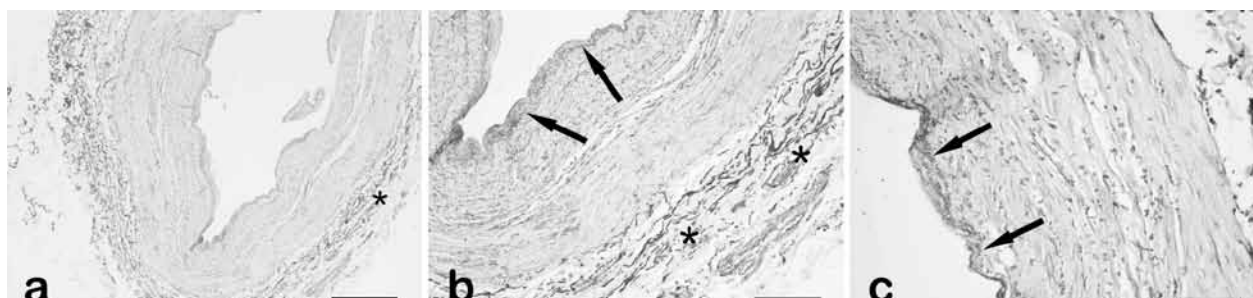


Fig. 2. Microphotographs of the orcein stained histologic cross sections of great saphenous ven after RFA procedures. Presence of fewer, frequently desintegrated elastic fibers in the area of internal elastic lamina (arrows). Thick, frequently disintegrated elastic fibers within the adventitia (asterisks). Size bars: (a) – 500 μ m; (b) – 200 μ m; (c) - 100 μ m

after RFA procedures, Schmedt et al. (9) found that at the site of direct contact with the catheter, the vein wall shows collagen shrinkage, denudation of the endothelium and reduction of the vein lumen. Later, with the same model, Schmedt et al. (10) demonstrated the ability of endoluminal optical coherence tomography to detect the immediate thermal alterations such as increased medial thickness and reduced vessel lumen diameter.

The morphological changes in the wall of the great saphenous vein after routine RFA procedures, found in our study, do not differ significantly from the findings reported by Schmedt et al. (9). One of the macroscopic differences established, was the different degree of vessel diameter reduction, being smaller in human veins compared to the animals. There is a simple explanation – all of the human veins were affected by pathological enlargement, while the animals' veins were not diseased.

CONCLUSION

The present results highlight the exact mechanism of predetermined tissue damage after RFA procedures of the GSV. As it seems, the tissue destruction is quite precise and if the procedure is done properly good curative results can be expected.

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