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Morphology of the Valve Sinus Wall in Essential Varicosity of the Great Saphenous Vein — TEM and SEM Investigations

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Venous hypertension alters the morphology of the valve sinus wall by damaging the specific arrangement model of endothelial cells, smooth muscle cells (SMC), elastic and collagen fibres as well. Besides the specificity of the structural modifications in SMC there is a process of transformation from a contractile into a synthetic-secretory phenotype. This explains in part the important functional changes observed in the SMC. The progression of the venous hypertension acts on the valvular cusp and the valvular complex and increases the development of the varicosis process.

Key words: vein, valves, varicosis, SEM, TEM.

Introduction

Nowadays the development of venous varicosity is explained by a series of hypotheses [1, 2, 3, 4, 6, 9]. According to the hemodynamic hypothesis, this development is due to the venous hypertension and venous stasis acting not only on the venous wall but also on the components of the valvular complex. The morphological changes occurring in the valve sinus wall during the progression of the varicosis process were observed in both transmission and scanning electron microscopy (TEM and SEM, respectively)

Material and Methods

The valve sinus wall of the great saphenous vein harvested from 28 patients was analyzed. They were operated on because of venous varicosity. The selected specimens were fixed in 4% glutaraldehyde in phosphate buffer at pH 7,4, post-fixed in 1% OsO_4, and dehydrated in ethanol of graded concentrations. The material for TEM was embedded in Durcupan. Semithin and ultrathin sections were prepared. The material for SEM was soaked in hexamethyldisilazane for 5 min and then air-dried. The preparations were gold-palladium coated and examined in a Jeol JSM-35 CF scanning electron microscope.

Results

The investigation of the sectional surface of the valve sinus wall by means of SEM demonstrates that the proximal part of the wall is cross-striated due to densely located transversal invaginations of the endothelial surface and the distal part possesses an undulating relief (Fig. 1). As observed in TEM examination the endothelial cell (EC) of morphologically inadequate valves sharply expresses congestion of the cellular matrix, changes in the micropinocytic vesiculation, enlargement of the vacuoles and increased number of Weibel-Palade bodies. In the tunica media, SMC are clearly individualized from the collagen of the connective tissue and can be assembled to form bundles. The transformation of the smooth muscle cells (SMC) from a contractile into a synthetic-secretory phenotype is demonstrated in the veins after progression of the varicosis process (Fig. 2). Ultrastructurally, the enlarged number of the cellular organelles designed for performance of an active synthetic-secretory function was well evidenced. In the morphologically inadequate valves one can observe not only a great variety of the fibrillar diameters but also an increased number of the atypical forms of the fibrils. The presence of atypical, giant fibrils is confirmed, too. Some of these fibrils are spirally screwy, however, the characteristic cross striation along the whole fibril remains intact. In some single fibrils the so-called 'crease-like' deformities as a sign of fibrillar overstretching can occur, too.

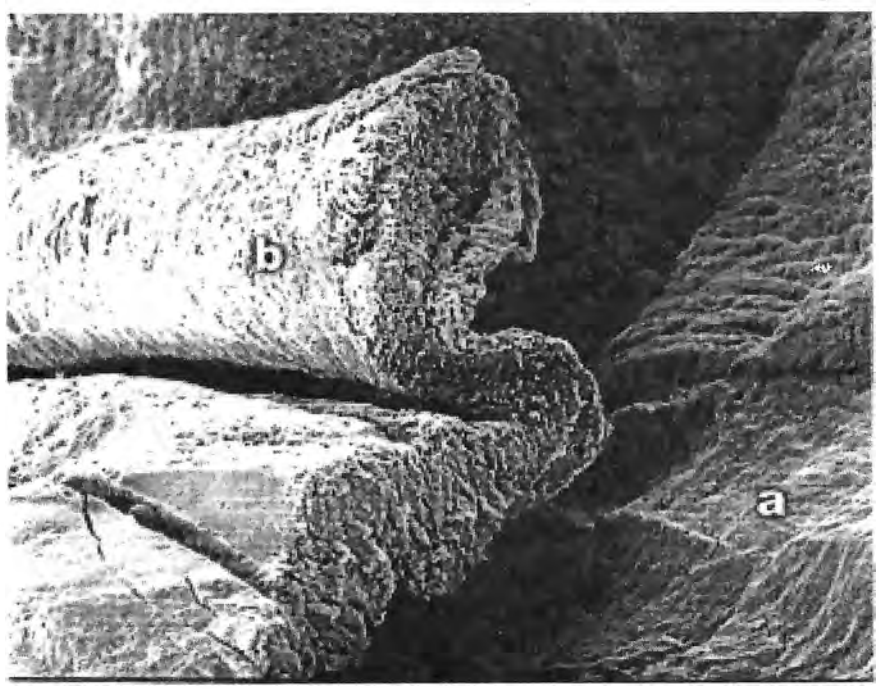

Fig. 1. Valve complex of a morphologically inadequate valve
a — valve sinus wall; b — valvular cusp (SEM, Magn. × 200)

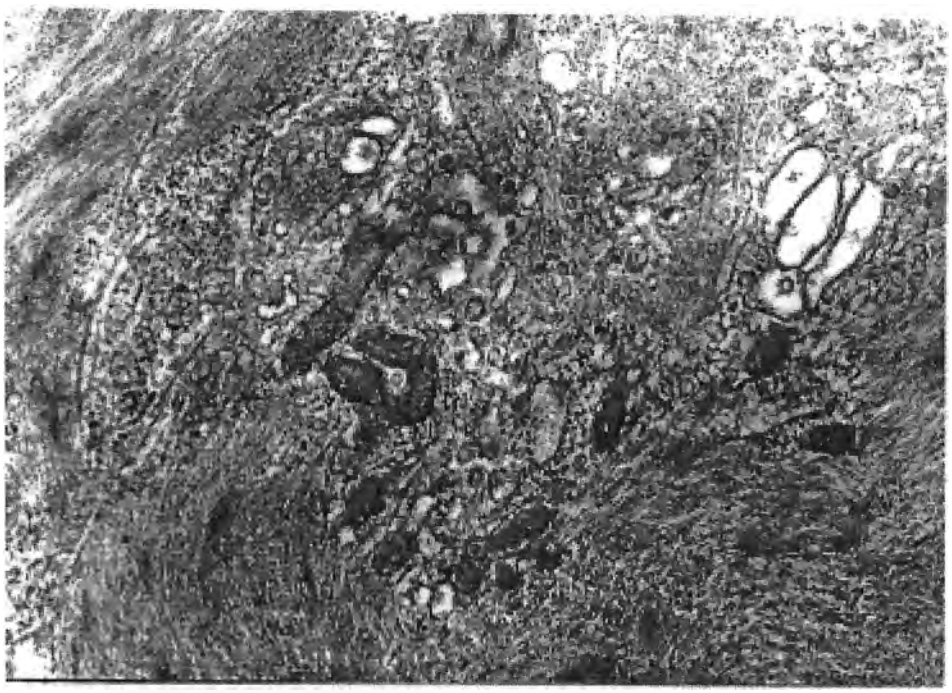

Fig. 2. Smooth muscle cells from the valve sinus wall of a morphologically inadequate valve (TEM, Magn. × 20 000)

Discussion

The presence of SMC of a synthetic-secretory phenotype is the first response of the wall to the venous hypertension. Remodelling of the wall is the next time-dependent process during its adaptation to the new conditions. The fibrosing of the wall and the presence of destructive changes in the SMC and extracellular matrix testify not only to the duration of the varicose process but also to the exhausted adaptation capacities towards the venous hypertension and hypoxia. Besides this investigation demonstrates that the established electron microscopic changes in the valve sinus wall correlate with our previous data [5, 7, 8] dealing with the morphological alterations occurring in the valve complex during the development of the varicose process.

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