

Abstract

Introduction The vitreoretinal (VR) interface of the eye is a dynamically evolving environment which significantly influences and indicates the course of macular disorders. The main topic of the presented paper is research on the VR interface in relation to surgery on diabetic macular edema (ME), partial macular defects (PMD) and idiopathic macular holes (IMH).

Aims The aims of the research were to find out new knowledge about specific characteristics of and changes in the VR interface in eyes with diabetic ME, PMD and IMH, namely with main attention focused on the internal limiting membrane (ILM) of the retina and the epimacular membrane (EMM).

Methods Histopathologic and morphometric analyses were carried out on samples of the ILM of the retina and the EMM which were taken during pars plana vitrectomy (PPV) of eyes of sets of patients with diabetic ME, PMD and IMH. The analytic results were statistically evaluated and interpreted in relation to clinical factors and anatomical results of the PPV.

Results Treatment of diabetic ME with removal of the ILM resulted in improved visual acuity (VA), at minimum 2 lines on the ETDRS table, in 51.8% surgically treated eyes and remained the same in 33.9% of eyes. A comparison study confirmed that PPV with preserving of the ILM achieved a long-term improvement of VA in 39.1% of eyes and remained the same in 28.3% of eyes. Ultrastructural histopathologic examination of all surgically taken samples from eyes with diabetic ME confirmed presence of the ILM. Macrophages and fibroblasts were rarely found on the vitreous side of the ILM, and isolated circular structures corresponding to the internal parts of Müller cells were identified on the uneven retinal side. It was statistically confirmed that the thickness of the ILM depends not only on the age, duration of diabetes mellitus (DM) and gender of patients, but also on long-term compensation of DM. Biochemical analysis of vitreous confirmed higher concentrations of uric acid and glucose. OCT/SLO examinations proved that the thickness of the retina in the macula is one of the prediction factors which can indicate declining VA. In eyes with non-removal of the ILM, a significantly negative (decreasing) dependence between central macular thickness and VA was statistically confirmed.

PMD treatment achieved an improvement of VA in 38.9% eyes and stabilization of 44.7% eyes; in 2 eyes, lamellar macular hole (LMH) was not closed and developed all the way through to become a macular hole. Biomicroscopy and/or OCT/SLO confirmed 16 eyes (88.9%) with healed LMH or macular pseudofenestra and restored foveolar outline. Histopathologic examination of ILM tissue confirmed fibroblasts, collagenous tissue,

extracellular matrix and macrophages in one or more layers of the vitreal surface of the ILM. Morphometry of the ILM confirmed an increasing of the thickness to $3.98 \pm 0.86\mu\text{m}$.

PPV with surgically removed ILM is an effective method of treatment of IMH. Final VA was improved in 22 eyes (66.7%) and unchanged in 6 eyes (18.2%). Morphometric analysis showed a significant increasing of the thickness of the ILM in all 33 eyes with a mean thickness of the ILM being $3.27 \pm 0.86 \mu\text{m}$.

Conclusions Interpretation and correlation of clinical and experimental knowledge about VR interface during surgical treatment of selected types of macular disorders confirmed that morphological features and increasing thickness of the ILM of the retina are significant indicators of the disorder of anatomical structure and functional effect of VR interface of the eye. Equivalent findings were also documented by the morphology of the retina in macula. Complex research of the VR interface contributes to the effectiveness of both surgical treatment and the evaluation of its success, and to better knowledge of the pathogenesis of macular disorders.

Keywords: vitreoretinal interface, internal limiting membrane, macular disorders