LS.2.P079
Age-related changes in structural complexity of liver tissue architecture: light microscopy fractal analysis

I. Pantic[1], M. Basailovic[2], J. Paunovic[2], S. Pantic[3], M. Perovic[4], M. Trajkovic[5], D. Djuricic[6], M. Pesut[5]

[1]University of Belgrade, Faculty of Medicine, Institute of Medical Physiology, Belgrade, Yugoslavia
[2]University of Belgrade, Faculty of Medicine, Belgrade, Serbia
[3]University of Belgrade, Faculty of Medicine, Institute of Histology, Belgrade, Serbia
[4]Hospital Center "Narodni Front", Belgrade, Serbia
[5]Clinical Hospital Center "Dr. Dragisa Misović", Belgrade, Serbia
[6]Health Center Savski Venac, Belgrade, Serbia

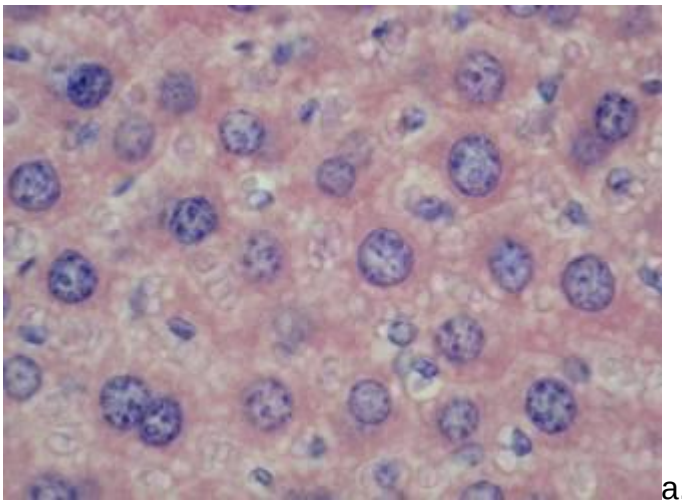
milos.basailovic@live.mfub.rs
Keywords: Structure, Hepatic, Aging

Recent studies have determined that structural complexity of various tissues and organs may change during postnatal development and aging [1, 2]. In this study, on a mouse experimental model, we demonstrate the age-related reduction of liver tissue architecture complexity evaluated by fractal dimension.

The study was performed on the total of 64 male albino mice divided into 8 different age groups (n=8): newborns (0 days old), 10 days, 20 days, 30 days, 120 days, 210 days, 300 and 390 days old. Liver tissue was stained with conventional hematoxylin/eosin, and DNA-binding toluidine blue dyes (Figure 1). Liver lobuli were visualized with Olympus BX41 light microscope, and digital micrographs were created with Olympus C-5060 Wide Zoom digital camera instrument. After micrograph binarization, for each animal, average values of tissue fractal dimension and lacunarity were calculated using the National Institutes of Health (NIH) ImageJ software package, as previously described [1]. Parameters of tissue texture were also measured by applying Grey level co-occurrence matrix (GLCM) method on 8-bit micrographs [3].

Results indicate that during postnatal development liver tissue fractal dimension decreases while lacunarity increases. Statistically highly significant trends ($p<0.01$) were detected for both parameters. GLCM textural parameters on the other hand remained unchanged ($p>0.05$). These findings are in accordance with previous studies that suggested complexity reduction in biological structures during aging. This is also one of the first studies to apply methods of fractal and textural analysis in evaluation of liver cytoarchitecture.

1. I. Pantic, G. Basta-Jovanovic, V. Starcevic, J. Paunovic , S. Suzic, Z. Kojic and S. Pantic. Nephrology. 18 (2013), p. 117-124.
2. A. Warren, S. Chaberek, K. Ostrowski, V. C. Cogger, S. N. Hilmer, R. S. McCuskey, R. Fraser and D. G. Le Couteur. Microcirculation 15 (2008), p. 191-202.
3. I. Pantic, S. Pantic and G. Basta-Jovanovic. Microsc Microanal. 18 (2012), p. 470-5.


a.)

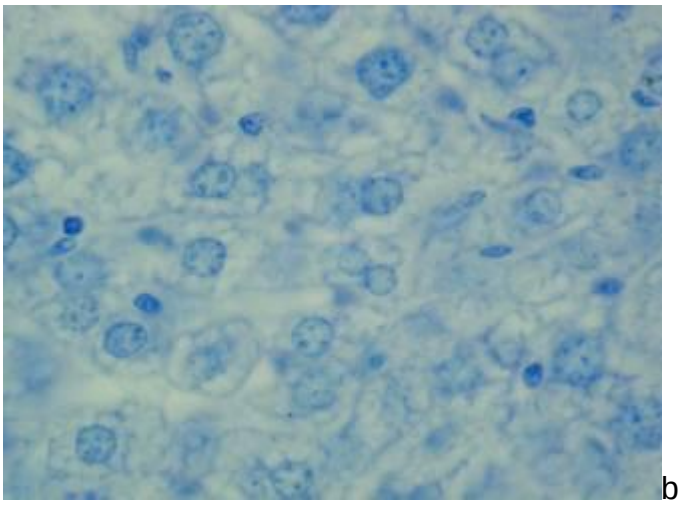

b.)

Figure 1. Digital micrographs (magnification 1000x) of the liver tissue stained with conventional hematoxylin/eosin (A), and DNA-binding toluidine blue (B) dyes