Fluorescent microscopy of biological tissues of the dead with the different levels of blood loss

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ABSTRACT

The results of laser autofluorescence microscopy of the distribution of the intensity of the multidimensional laser autofluorescence (MLA) microscopy of polycrystalline structures of biological tissue preparations are presented. The data of a statistical analysis of the distribution of the magnitude of the intensity of MLA networks of biological crystals of histological sections of tissues of the spleen with the parenchymal morphological structure of the dead are presented.

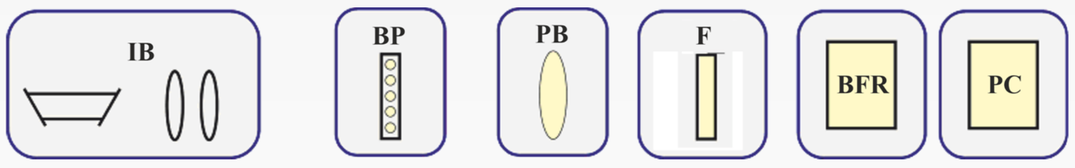

Figure 1. Functional block diagram of multidimensional spectrally selective laser autofluorescence microscopy.

The illumination block **IB** consisting of a laser and a collimator ensures the formation of a polarized parallel laser beam of 2 mm in diameter and wavelength of 405 nm, which excites the intrinsic fluorescence of the fluorophores of biological preparations. The object block is a microscopic table with a two-coordinate movement on which the biological preparation **BP** is attached. The projection block **PB**, which with the help of the micro-lens (4×) ensures the formation of a self-fluorescence microscopic image of a biological preparation **BP** excited by a laser beam in the plane of the digital camera. The block of spectral filtration of, which includes the interference light filters **F** for the spectral selection of the excited self-fluorescence polychromatic radiation of an ensemble of **BP** fluorophores. Block of photoelectron registration **BFR** of microscopic fluorescent images of biological preparations **BP**, provides the formation of the coordinate digital distribution of the intensity value in the computer interface. The data processing block using a personal computer **PC** provides a calculation of the magnitude of the statistical moments of the 1st to 4th orders characterizing the intensity distribution of the spectrally selective autofluorescence of biological preparations **BP**.

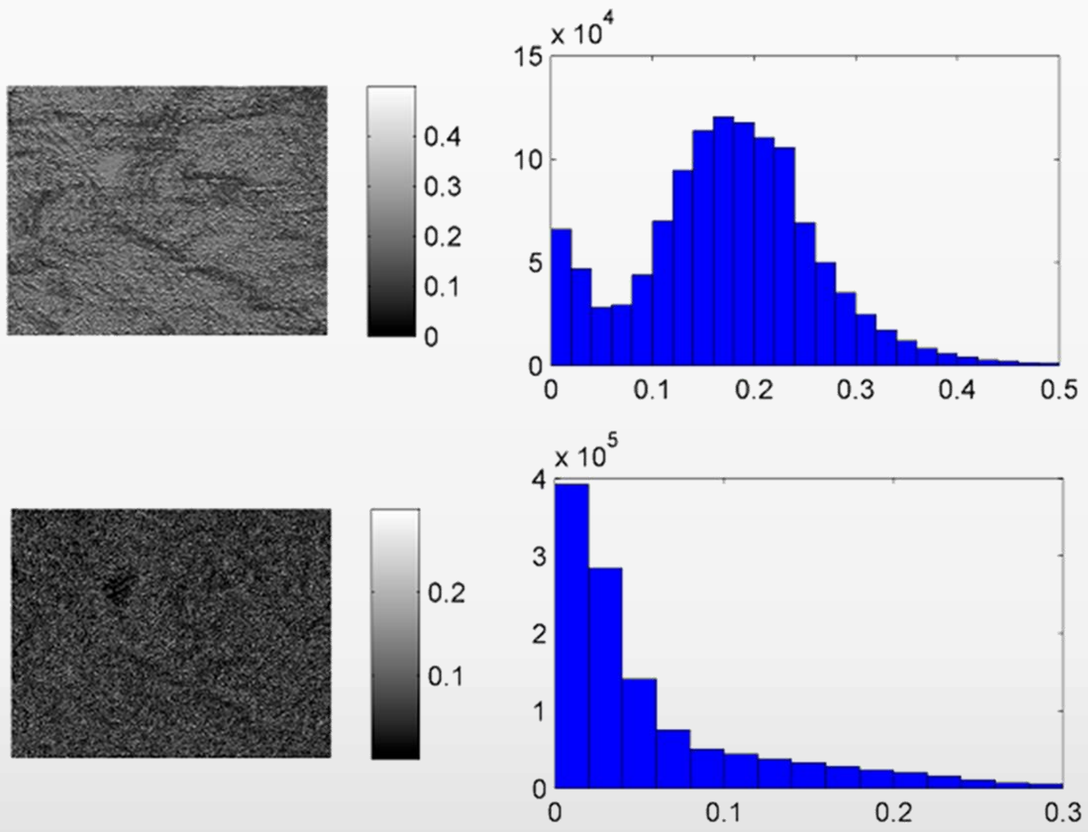

Figure 2. Maps and histograms of distributions of the autofluorescence intensity values of histological sections of the spleen of the control and research groups the dead.

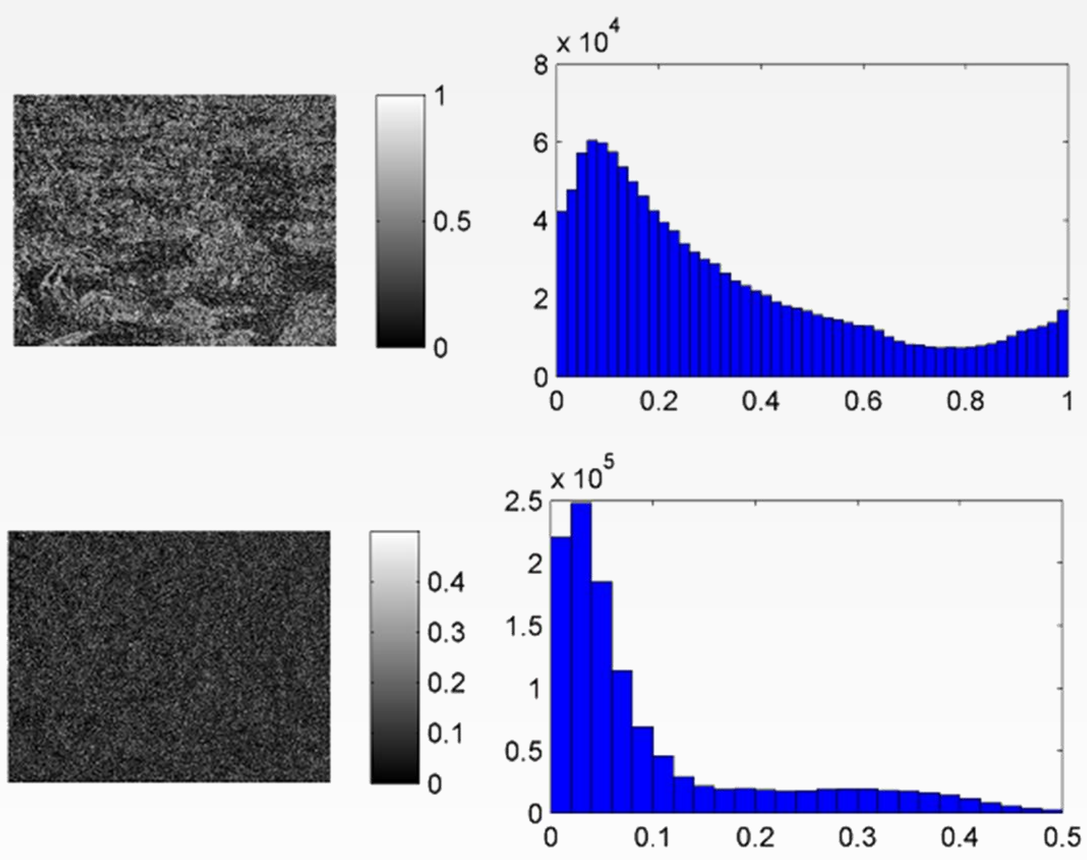

Figure 3. Maps and histograms of distributions of the value of autofluorescence intensity of histological sections of the kidney of the control and experimental groups of the dead.

Table 1. Accuracy of determining the volume of blood loss in the spleen.

Blood loss, mm^3	500±100 mm^3	1000±100 mm^3	1500±100 mm^3	2000±100 mm^3	2500±100 mm^3
Average, SM_1	84	86	86	84	84
Dispersion, SM_2	94	94	92	92	90
Asymmetry, SM_3	96	94	94	92	90
Kurtosis, SM_4	92	92	92	90	88

Table 2. Accuracy in determining the amount of blood loss in the kidney.

Blood loss, mm^3	500±100 mm^3	1000±100 mm^3	1500±100 mm^3	2000±100 mm^3	2500±100 mm^3
Average, SM_1	96	96	96	94	94
Dispersion, SM_2	96	96	94	92	92
Asymmetry, SM_3	84	86	86	86	84
Kurtosis, SM_4	94	94	92	90	90

CONCLUSIONS

1. A set of maps and histograms of random fluorescence intensity distributions of blood corpuscles of the polycrystalline component of histological sections of parenchymal biological tissues of the spleen of the deceased with varying degrees of blood loss were studied using spectral-selective laser autofluorescence microscopy.
2. The dynamics of changes in the magnitude of the statistical moments of the 1st – 4th orders, characterizing the distribution of MLA histological sections of parenchymal (spleen) tissues of the deceased with different blood loss (ΔV = 0 mm^3 ÷ 2500 mm^3), was studied.
3. The magnitudes and ranges of the accuracy of the method of spectral-selective laser autofluorescent microscopy of biological preparations of the spleen are determined as $SM_2 \leftrightarrow$ 90% ÷ 94% and $SM_3 \leftrightarrow$ 92% ÷ 96% and $SM_4 \leftrightarrow$ 88% ÷ 92%.