

Photoluminescent Diagnostics of Destructive Diseases of the Abdominal Cavity Organs

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Abstract - Diagnostics of inflammatory-destructive diseases of the abdominal cavity organs is performed by the determined spectra of luminescence of venous blood plasma. The influence of devascularization of intestines on the intensity of their walls luminescence has been studied also. The intensity of intestine walls luminescence changed with the increase of the time of devascularization.

Keywords - biosubstance, photoluminescence, blood plasma, abdominal cavity organs.

I. INTRODUCTION

The opportune effective diagnostics of acute surgical diseases is one of extremely urgent and still unsolved problems of abdominal surgery. Creating a technique of diagnostics, which would be highly accurate, non-invasive, easy to perform and wouldn't demand much time and costs – appears to be an extremely urgent task. For this purpose we used optical properties of venous blood and optical properties the walls of cavernous digestive organs. Such investigations will help to solve one of the extremely urgent surgical problems – determining the viability of the intestines in the state of obstruction. [1].

II. METHOD OF INVESTIGATION

The optical quantum generator of comparatively low power that does not have any thermal influence on biosubstance are very suitable for biological investigations. In this case the use of lasers with variable wave-length of radiation enables to perform the investigation of the excitation and reaction spectra of the substance.

The luminescence of biotissue should be mentioned among the particular manifestations of the reaction of biological objects to monochromatic radiation. To perform the experimental task of investigation the effect of coherent monochromatic radiation on plasma, the photometric technique is used [2].

The biological objects is illuminated with monochromatic laser beam. The argon laser, which radiates at the wave-length of 458 nm with the power $200 \cdot 10^{-3}$ W is the source of monochromatic radiation. Thus, it produces the illumination $6 \cdot 10^{-6}$ W/m² of object in the quartz pan 3.01 mm thick. Laser radiation is scattered by object and regular component is focused on the monochromator's slot, behind which the light-filter is assembled. At the outlet from the monochromator the laser beam gets into photo receiver connected with a universal voltmeter, by means of which the initial parameters of the radiation are determined. The measurement error by intensity at this setting is 2-3%. The results are represented by the curves of photoluminescence spectrum distribution.

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The investigations of luminescence spectrum of venous blood plasma determined that the maxima suitable for diagnosing at the wave-lengths 475-477 nm are observed in the spectra. It was found out that the blood of patients with acute inflammatory-destructive diseases of abdominal cavity organs show the shift of fluorescence intensity maximum beginning with wave-length 474 nm. The intensity maximum shifts into the short-wave range with the exacerbation of inflammatory-destructive changes in abdominal cavity organs.

In the experiment with the white rats of the Vistar line we have performed with the same experimental technique. The obtained spectra represent the shift of the photoluminescence maxima for the devascularized intestine. Such a shift is appropriate for diagnostics of viability of intestines. So, for the wavelengths 469 and 493 nm there is a shift of the spectral distribution of the fluorescence intensity, which enables to diagnose the viability with great degree of reliability by the relation of the intensity at these wavelengths. In the majority of cases this relation for the live intestine makes the value less than unity, for the dead one – much more than unity. The average value of fluorescence intensity relation at the wavelengths 469 and 493 nm for the live intestine is 2.032, while for devascularized one – 4.868.

III. CONCLUSION

Thus, the photoluminescence maximum shift beginning with wave-length of 474 nm into short-wave range proves the presence of acute inflammatory-destructive diseases as well as the exacerbation of pathological process. Consequently, the use of photoluminescence of venous blood plasma provides the possibility of reliable high-frequency pre-surgical diagnostics of acute inflammatory-destructive surgical diseases of abdominal cavity organs.

It is determined that the intensity of intestine walls luminescence changed with the increase of the time of devascularization. While analysing the above mentioned differences we have found the typical changes of interrelation off luminescence intensity in the domain of the maxima, which reliably increased with the increase of the time of devascularization.

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