Spectropolarimetry differential diagnosis of adenocarcinoma and squamous cell cervix carcinoma

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INTRODUCTION

Early diagnosis of pathological processes of endometrium and cervix is an urgent problem in gynecology, which requires new non-standard approaches. Most gynecological diseases, including endometrium, are combined with the pathology of the cervix. In addition, due to the availability of cytological and histological studies, the cervix is a convenient model for studying various pathological conditions, not only endo- and exotservix, but also endometrium. Physiological and pathological changes associated with age, menstrual cycle, pregnancy, and menopause are observed both from the multilayered flat epithelium of exotservix, prismatic epithelium of the cervical canal and endometrium

The purpose of the study was to determine the histochemical and laser criteria for diagnosis of background, precancerous and endometrial cancer by the state of the cervical canal wall.

This purpose improve the diagnosis of CC by introducing laser polarimetry and spectro-polarization research methods.

METHODS

For experimental testing of the developed model representations and conducted computer modeling of virtual polarization properties of biological primitives presented in the form of spherical and cylindrical lenses, as objects of experimental research such group of samples was chosen: the histological smear, and scraping slices of different types of tissues of the cervix rights. Morphologically histological sections were received using a freezing microtome. Geometric thick slices of muscle tissue samples of all types ranged from 25 to 100 microns.

This method is based on measuring[6-8] the absorption oriented system (particles, molecules) linearly polarized light, resulting to judge the orientation properties of the object of study. In the study of linear dichroism oriented sample is irradiated with light, polarized in two perpendicular directions: parallel and perpendicular to the axis orientation of the sample.

The research of the very sample on spherical photometer showed that the value of Δ for almost all λ close to zero, except for the value λ = 350 nm, for which Δ = 0,010 at τ_{mid}=0,888. According to these λ maxima correspond to the spectral dependence Δ. This means that the spherical diffuse scattering photometer for samples at small values of Δ detect it almost impossible since it is impossible to consider diffusely reflected radiation, which, in addition to the missed stream is recorded as a spherical photometer. These are much larger value τ_{mid} obtained on spherical photometer, which caused not only directed missed stream, and also takes into account the diffuse scattered radiation.

SPECTRAL DIAGNOSTICS OF STAGE OF CANCER CHANGES IN EDOMETRIUM

The results of the study of tissues using native smears (epithelial tissue) in the normal squamous cell carcinoma and adenocarcinoma presented in a tabular data and graphs in the wavelength range 320-640 nm in Fig. 3 - 4. These data showed that the value of the linear dichroism is insignificant in all investigated spectral range λ = 320-640 nm for normal tissue in the range 0,015-0,1% and certain patterns of change in the spectrum is not observed.

RESULTS

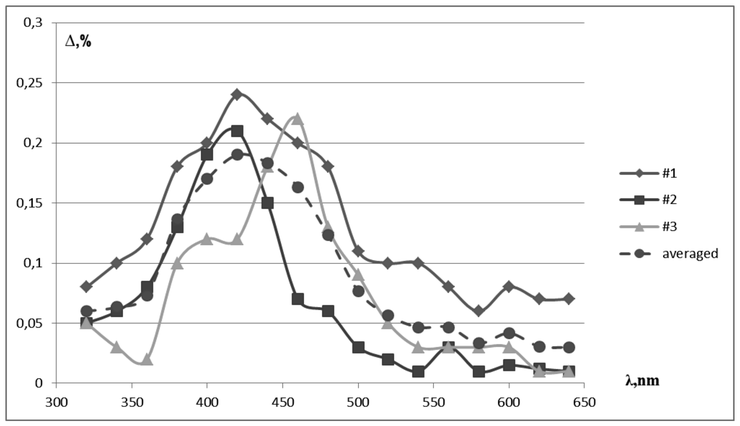

Figure 1. The spectral dependence of the linear dichroism of the native smear from the endometrium

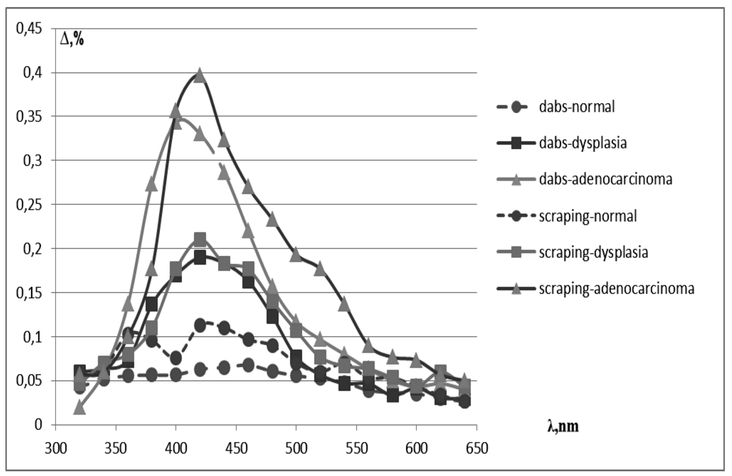

Figure 2. The spectral dependence of linear dichroism for all groups of samples investigated (summary data averaged values)

The comparison of the results with the preliminary test results for samples of animals makes it possible to introduce differentiation criteria spectropolarimetric precancerous condition and the stage cancer formation in the spectral band of 400-410 nm, which in our opinion could be considered as "spectral fingerprint" of cancer (cancer formation) in biotissues considering absorbtion-anisotropic properties of tissues.

In the analyzed process several endogenous fluorophores in diagnostic actual region of the spectrum (390-410 nm) can be accentuated, namely porphyrins, lipopigments, flavin group, collagen and elastin. The main role in tumors in pathological tissue absorption anisotropic structure plays a porphyrin group.

The research results from a malignant tumor tissues have shown that in the λ <320 nm and at λ> 740-800 nm linear dichroism is practically absent; Δ maximum value s attributable to λ = 420 nm; while in contrast with only mucus they are much larger and are in the range of 15 to 42% depending on the characteristics of research.

Diagnostic portion of the spectrum in the range 390-410 nm to implement the differential diagnosis of benign tumors and adenocarcinomas of biological tissues with important diagnostically relevant ranges of values of linear dichroism changes at each stage of cancer process is established:

- for the low differentiated dysplasia - Δnd = 0,05 ÷ 0,1;
- for highly differentiated dysplasia - Δvd = 0,1 ÷ 0,22;
- for the different stages of adenocarcinoma - Δac = 0,25 ÷ 0,45.

The established criteria of differentiation optical anisotropy cuts and scraping gynecological tissues fields in various stages of human cancer formation found the basis of the experimental method of differential diagnosis stage of cancer formation in biotissues.

The resulting values of linear dichroism within the selected spectral range 400-410 nm are shown in Fig. 6.

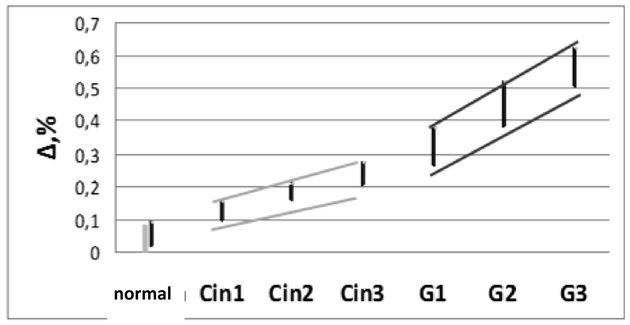

Figure 3 Criteria for differentiation of optical anisotropy for endometrium.

CONCLUSIONS

1. The given data on the state of connective tissue in the endocervix can distinguish three differential prognostic possibilities: 1) prediction of the condition of the connective tissue of the endocervix of the normal endometrium without the possibility of differentiating the phases of the ovarian cycle; 2) prediction of the endocervix endotracheal connective tissue state of the endometrium as a separate process; 3) prediction for the condition of the connective tissue of the endocervix of the processes of expressed proliferation of the typical (glandular hyperplasia and glandular polyps) or atypical (adenocarcinoma) glandular first endometrial epithelial differentiation without the possibility of these processes among them.
2. The stroke-scrape of the epithelium of the cervical canal (endocervix) allows the condition of the connective tissue to diagnose the processes of pronounced proliferation of the typical (hyperplasia, polyp) and atypical (adenocarcinoma) epithelium of the endometrium without the possibility of differentiating these processes among themselves.
3. Parameters of linear dichroism in cervical cancer can reliably (p=0.001) differentiate between normal, adenocarcinoma and squamous cell carcinoma (native smear with squamous cell carcinoma - 0.94±0.21, with adenocarcinoma 0.343±0.04; cervix - 0,212±0,014, with adenocarcinoma - 0,396±0,081).
4. The method of spectropolarimetry allows to accurately accurately distinguish the normal epithelium of the cervix from cancer of the cervix, and the parameters of linear dichroism during the spectropolarization study, reliably (p=0,001) differentiate between normal, adenocarcinoma and flat cell cancer of the cervix.

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