Biophysics, Poster

OPTICAL DIAGNOSTICS OF BILE DUCT TISSUES STATE WITH TUMOR COMPRESSION

Ksenia Kandurova, Orel State University, Russia
Victor Dremin, Orel State University, Russia
Evgeny Zherebtsov, Orel State University named after I.S. Turgenev, Russia; Aston University, UK
Elena Potapova, Orel State University, Russia
Andrey Dunaev, Orel State University, Russia
Andrian Mamoshin, Orel State University, Russia; Orel Regional Clinical Hospital, Russia
Alexander Alyanov, Orel State University, Russia; Orel Regional Clinical Hospital, Russia
Vadim Muradyan, Orel Regional Clinical Hospital, Russia

ABSTRACT

Currently, visualization and analysis of malignant, inflamed and necrotic tissues remain one of the urgent problems of biophotonics applications for surgery. In particular, this is significant in diagnosing the causes of obstructive jaundice. The most common origin of this syndrome is pancreatic cancer. Obstructive jaundice can also be caused by benign tumors, cicatrical changes, chronic pancreatitis, bile duct stones, etc. Early diagnosis of these pathologies with biopsy is a difficult task in this area, which affects the duration and effectiveness of the treatment process. In this regard, the problem of searching for new diagnostic methods and approaches that allow for increasing the accuracy of diagnosis of malignant tumors in abdominal organs remains relevant.

One of the rapidly developing areas of research is optical non-invasive methods for medicine. In particular, the use of optical methods in minimally invasive abdominal surgery can increase the prevalence and effectiveness of these interventions in clinical practice by providing additional diagnostic information for surgeon intraoperatively.

The most widely used methods often called "optical biopsy" include spectroscopic ones (fluorescence spectroscopy and diffuse reflectance spectroscopy) and of imaging ones (hyperspectral imaging and laser speckle contrast imaging). These methods allow evaluating metabolic processes in tissues, chromophores content, blood filling and oxygenation.

The aim of this work is to study the parameters of fluorescence of malignant tissue of common bile duct in obstructive jaundice patients under minimally invasive interventions.

The study involved 20 patients in the surgical department of Orel Regional Clinical Hospital aged of 67±2 years with mechanical jaundice. The studies were approved by Ethics committee Orel State University (record of the meeting №10 of 16.11.2017). The methods used fluorescence spectroscopy (FS) at excitation wavelengths of 365 nm and 450 nm for assessing metabolic activity by registering the fluorescence of NADH and FAD coenzymes. Laser Doppler

flowmetry (LDF) was used as well for assessing blood perfusion of tissues. These methods were implemented in a specially designed fiber optic set up, the most units of it were developed jointly with SPE “LAZMA” Ltd (Moscow, Russia). Fluorescence spectra and LDF signals were recorded at areas of common bile duct blocked by the tumor and at unblocked zones during diagnostic and therapeutic minimally invasive interventions under ultrasound and X-ray control.

Despite the considerable variability of the obtained data (especially LDF signals), in a number of cases, an increase 1.5-3 times of raw and normalized fluorescence intensity at tumor areas was observed. A decrease of the LDF signal and its oscillations was observed as well. The presence of blood and other substances, as well as anatomical features, influenced the registered data.

Generally, the obtained data showed the possibility and greater prospect for applying optical diagnostic methods to minimally invasive surgery of the common bile duct. The preliminary research allowed assessing the sensitivity of used methods for malignant tissues investigation. A number of affecting factors were observed that require further research to address a number of issues affecting registered spectra and signals, one of which is compensation of influencing factors, for example, blood perfusion by using additional methods.

The multimodal approach combining several optical diagnostic methods seems promising for further research. It is proposed to extend a number of methods by adding various spectroscopic and imaging techniques. The multimodal approach will allow obtaining various types of diagnostic information needed to optimize the treatment process. Moreover, at the initial stages of the research, a combination of optical biopsy and traditional biopsy followed by histological and cytological examination will allow applying biopsy as a reference for optical methods for more accurate interpretation and development of diagnostic criteria.

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