

ABSTRACT

Colorectal cancer is one of the most common cancers and a global health problem. Approximately 8,000 new cases are diagnosed annually in the Czech Republic and about half of them die from this malignancy, with 20 % patients being under 60 years of age. It is still true that the greatest hope for successful treatment and management of the disease is given to patients by early diagnosis of cancer.

There is still a remarkably high proportion of detection of colorectal cancer in the advanced stage, which is mainly due to the absence of reliable and sensitive clinical methods. The still unfavorable epidemiological situation is a clear challenge to further strengthen all activities aimed at active prevention and early diagnosis. Colorectal cancer is the best preventable disease of the gastrointestinal tract, it lasts for several years, when an invasive lesion gradually develops through a precursor lesion. This offers a sufficiently long diagnostic window, Therefore, attention is currently being focused to find affordable, sensitive and minimally invasive techniques that can provide early, simple, rapid, inexpensive and reliable diagnosis of this disease and could thus support or replace conventional diagnostic methods in the future.

In our work, we focused on the use of completely new diagnostic approaches. Molecular spectroscopy is one of the promising methods that meet the above requirements; Raman and infrared spectroscopy have made significant developments in the diagnosis of tumours. They can be used to examine biological samples at the molecular level and thus observe the biochemical processes that occur during pathology. The methods of advanced chiroptical spectroscopy – electronic circular dichroism and Raman optical activity – also represent great potential. Their sensitivity to the spatial structure of biomolecules provides a unique opportunity to monitor changes in the structure of proteins and other chiral molecules. By applying these techniques in the examination of blood samples and colon tissue (under *ex vivo* and *in vivo* conditions) we have tried to perform sensitive biochemical analysis and by comparing the results of healthy individuals and patients with colorectal cancer we have detected characteristic spectral markers that reflect malignancy. By evaluating the spectra by statistical methods, a division of patients and controls was achieved, where the most reliable results were provided by a combination of all the above techniques. Thus, spectroscopic methods have the potential to become complementary or even alternative methods for the clinical diagnosis of colorectal cancer based on the analysis of plasma and colon tissue.

Key words: colorectal cancer, diagnostics, prevention, spectroscopic methods, *in vivo* and *ex vivo* analysis