

Stomach cancer diagnostics—new insights on stages of tumor growth

April 21 2016

Diagnosis of gastric cancer in the early stages is difficult because of the lack of simple and cheap methods of inspection and specific markers of gastric cancer while the symptoms of the disease are vague and tend to overlap with other common and benign conditions. Better tumor characterization and more individualized treatment planning can be expected only with the implementation of better diagnostic tools combined with advances in molecular and genetic analysis.

Despite the reduction in incidence, stomach (gastric) cancer (SC) is still the second-most frequent cause of cancer-related death worldwide. According to the Russian national statistics, 38,318 new SC cases were diagnosed in 2011, most of them during the final disease stages III-IV. In Ukraine in 2013, SC took the second and third places in cancer-related mortalities for men and women, correspondingly, though in the hierarchy of tumor diseases, it is only the fourth for men and the eighth for women.

High levels of reactive oxygen (ROS) and nitrogen (RNS) species can lead to the destruction of the extracellular matrix, facilitating [tumor progression](#). ROS can activate matrix metalloproteinases (MMP), damage DNA and RNA. Therefore, the levels of MMP, ROS and RNS can serve as additional prognostic markers and for the estimation of the effectiveness of tumor therapy.

The effects of [nitric oxide](#) (NO) and superoxide anion radicals in the enhanced permeability and retention (EPR) effect for the tumor-

selective delivery of macromolecular agents (nanomedicines) are reported and used.

MMP-2 and MMP-9, also known as gelatinase A and gelatinase B, belong to a zinc-dependent family of endopeptidases implicated in a variety of physiological processes as well as in pathological conditions. They are considered to be the major MMPs involved in invasion and metastasis of cancer.

In other words, at the presence of distant metastasis, the tumor tissue is characterized by high values of NO levels and superoxide generation rates, but by the low activities of MMP-2.

Researchers of Kazan Federal University and the National Academy of Sciences of Ukraine found correlations between the superoxide and nitric oxide generation rates, levels of active forms of MMP-2 and MMP-9 in tumor and adjoining tissues between each other and with the disease stages for [gastric cancer](#) patients.

The [tumor cells](#) are characterized by the re-programmed mitochondrial metabolism, the high level of cells hypoxia, defective redox system, and unbalanced concentrations of molecules that determine the aggressive phenotype of the tumor. It is apparent that the proliferation, migration and the tumor invasion correlate with the disease progress.

Measuring the redox state of [tumor](#) tissue (among them the superoxide generation rate, NO level, activity of MMP-2 and MMP-9) can be used as a supplementary objective tool in diagnostics. Moreover, the effectiveness of the anticancer therapy can be additionally controlled in this way.

More information: Anatoly P. Burlaka et al, Stomach Cancer: Interconnection between the Redox State, Activity of MMP-2, MMP-9

and Stage of Tumor Growth, *Cancer Microenvironment* (2016). [DOI: 10.1007/s12307-016-0182-5](https://doi.org/10.1007/s12307-016-0182-5)

Provided by Kazan Federal University

Citation: Stomach cancer diagnostics—new insights on stages of tumor growth (2016, April 21) retrieved 24 April 2024 from <https://medicalxpress.com/news/2016-04-stomach-cancer-diagnosticsnew-insights-stages.html>

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