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Perspective

Tumor Metabolism and Clinical Implementation of Metabolomics

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DESCRIPTION

Cancer progression may be characterized by metabolic reprogramming. Metabolomics analysis of multiple metabolic profiles is a potent and technically possible tool for tracking dynamic changes in tumor metabolism and response to treatment throughout the course of the disease. Numerous original studies have emphasized the use of metabolomics in various aspects of tumor metabolic reprogramming research to date. In this review, we outline how metabolomics approaches can aid in understanding the consequences of changes in the tumor microenvironment's metabolic profile on the three key metabolic pathways of malignancies. There are a variety of non-invasive bio fluids available that generate reliable and relevant clinical information on tumor metabolism in order to discover early biomarkers of tumor progression. Similarly, metabolomics can predict individual metabolic changes in response to malignancy treatments, as well as evaluate drug efficacy and track drug resistance. The isotope tracer technology can be used to research tumor metabolism by tracking metabolite activity in the body and deep metabolic pathways. The outline the varied application of metabolomics in cancer metabolic reprogramming in order to highlight its critical role in cancer development and treatment.

To meet the needs of uncontrolled multiplication, cancer cells' metabolism is dysregulated. This rewiring of cellular metabolism results in distinct metabolic phenotypes that can be exploited for earlier cancer detection, patient selection techniques for clinical trials, and/or as treatment response biomarkers. Changes in metabolism also result in distinct metabolic dependencies, which can be targeted in some situations using precision medicine and nutrition, including medications that selectively target metabolic enzymes. Cancer and cancer therapies can also modify metabolism at the whole-body level and interact with the metabolic effects of nutrition and exercise in complex ways, thereby affecting cancer outcomes and patient quality of life.

METABOLIC EFFECTS OF CANCER THERAPY

Cancer-induced systemic metabolic abnormalities, cancer treatment with surgery, radiation, systemic therapy, or hormone therapy generate both acute and long-term adverse effects that might influence metabolism. Not surprisingly, the majority of acute treatment-related toxicities impacting metabolism are caused by side effects involving the digestive system. Malnutrition and weight loss can occur as a result of nausea, vomiting, diarrhea, mucositis, and dysgeusia, all of which are frequent in patients undergoing treatment for head and neck and gastrointestinal cancers. In patients undergoing chemo radiotherapy for head and neck cancer, resting energy consumption initially reduces and then increases at the conclusion of treatment. It has been proposed that the higher energy expenditure at the end of therapy is due to stress from the cumulative effects of chemo radiotherapy.

CLINICAL IMPLEMENTATION OF METABOLOMICS

Although both untargeted and targeted metabolomics have enormous potential in biomarker discovery and hypothesis testing in the translational setting, several obstacles must be solved before metabolomics can be widely used in clinical research and practice. As previously stated, numerous complementary approaches are needed to cover the whole metabolome. This frequently necessitates the use of various instrumentation platforms, which are not always available in academic and clinical laboratories. Metabolomics strives to leverage on the metabolic signature of cancer to assess disease risk, detect cancer earlier, diagnose particular disease subgroups, and track treatment outcomes. In theory, metabolomics could aid in the rational selection of tailored medicines to meet cancer's metabolic needs.

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CONCLUSION

Metabolomics has the potential to have a large impact on core aspects of oncology, including as screening, diagnosis, and treatment. One of the difficulties with metabolomics is the large number and chemical complexity of metabolites. Plasma metabolite composition, for example, is a manifestation of liver, muscle, and other organ-level metabolism, nutritional intake, micro biome activity, and other variables. It is also critical to understand how metabolomics differs from other technologies.