Airway Microbiota as a Modulator of Lung Cancer

Recent research on cancer-associated microbial communities has elucidated the interplay between bacteria, immune cells, and tumor cells; the bacterial pathways involved in the induction of carcinogenesis; and their clinical significance. Although accumulating evidence shows that a dysbiotic condition is associated with lung carcinogenesis, the underlying mechanisms remain unclear. Microorganisms possibly trigger tumor initiation and progression, presumably via the production of bacterial toxins and other pro-inflammatory factors. The purpose of this review is to discuss the basic role of the airway microbiome in carcinogenesis and the underlying molecular mechanisms, with the aim of developing anticancer strategies involving the airway microbiota. In addition, the mechanisms via which the microbiome acts as a modulator of immunotherapies in lung cancer are summarized.

The human microbiome consists of more than 1000 species of bacteria inhabiting the human body, including the skin, oral cavity, nasal cavity, stomach, small intestine, large intestine, urinary tract, and vagina (hundreds of trillions of bacteria in number). Among them, the intestinal microbiome contains approximately 40 trillion bacteria, which exceeds the total number of human cells, and plays important roles in nutrient and energy consumption of the host. The human host and the intestinal microbiome are in a symbiotic relationship, which is mutually beneficial for maintaining homeostasis. Intestinal bacteria metabolize substances that cannot usually be metabolized by the host to produce energy for self-maintenance, while the host uses these metabolites for its life activities. These bacteria also protect the host from invading foreign substances and pathogenic microorganisms. Loss of this homeostasis leads to the development of various diseases, including cancer. Currently, the roles of the intestinal and other microbiomes in malignant tumors are being actively investigated, and studies regarding their involvement in carcinogenesis and their application in cancer treatment and prevention are underway.

In particular, the intestinal microbiome has been shown to modify antitumor immune activity and play an important role in regulating response and resistance to immunotherapy in malignant tumors.

Recent studies have revealed the presence of the microbiome in the lower respiratory tract; however, its association with the development and metastasis of lung cancer remains unclear. At the same time, advancements in gene analysis techniques have enabled analysis of the lower airway microbiome using 16S ribosomal RNA (rRNA) gene sequencing and metagenomic analysis, and the microbiome populations that may be involved in the development of lung cancer have been identified. These microbiomes may...
potentially act as novel diagnostic and therapeutic biomarkers, which may facilitate the development of personalized medicine.[13] This review outlines the current knowledge regarding the role of the lower airway microbiome in carcinogenesis.

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Keywords

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