The Torch
Vol. 2 (40)

Cancer causing microbes

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Microorganisms are present all around us and contribute to essential functions in the environment; however, there are various diseases associated with microorganisms as well. There is a huge population of microbes in the human body, known as the microbiome, which is not harmful but helps in facilitating different functions of the body through a symbiotic relationship. Additionally, there is a small population of microbes that are pathogenic in nature and can cause diseases that range from inflammatory bowel disease, Clostridioides difficile infection to colon cancer. An imbalance in the microbial composition, their metabolic activity or distribution known as dysbiosis could lead to these diseases. The human microbiome consists of many mutualistic, pathogenic, transient or residential microbes that are opportunistic and may induce cancer or may influence the course of established cancer. Microbes have the ability to induce cancer in the body by causing immunosuppression, producing DNA-damaging toxins and carcinogenic metabolites. Some of these cancer-inducing microbes include Helicobacter pylori, Fusobacterium nucleatum, Clostridium sp., Lactobacillus murinus, and Bacteroides sp. Additionally, the viruses that are part of our microbiome are known as viromes and include Epstein-Barr virus (herpes virus that causes inflammation of the throat lymphoid), human papillomavirus (induces mutations in cervical cells), hepatitis B virus and hepatitis C virus (causative agents of hepatocellular carcinomas).

Furthermore, human T-cell leukaemia virus-1 (HTLV) is involved in T cell leukaemia; human polyomaviruses, such as Merkel cell polyoma-virus (MCV) and simian virus 40 (SV40) are implicated in Merkel cell carcinoma (MCC) and mesothelioma. Merkel cell polyoma-virus (MCV) induces tumours in immunosuppressed individuals, leading to skin cancer. Carcinogenesis is induced in the body due to the release of a toxin called genotoxin that damages host DNA and can be very chronic and inflammatory in nature, triggering tumour growth. There are complex bacterial communities invading to colonise the mucus layer of the colonic mucosa which were identified to cause nearly all colorectal tumours proximal to the hepatic flexure. It was also determined that bacterial biofilms were associated with some epithelial layer changes which trigger carcinogenesis, being a contributor to a pro-oncogenic state. Microbes also become part of the microenvironment of aerodigestive tract malignancies; however, microbiota is not solely responsible for causing tumours as it is not directly associated with the tumour site. Microbes rather find a tumour’s oxygen tension or carbon sources permissive and take advantage of an underused nutritional niche. Hence, rigorous frameworks for interpreting tumour-associated microbiota data are essential.

Keywords: Carcinogenic microbes, Opportunistic microbiome, Cancer, Tumour inducing microbes, Microbiota, Viromes

Citation:
Ekankita Mishra. Cancer causing microbes. The Torch. 2021. 2(40). Available from:
https://www.styvalley.com/pub/magazines/torch/read/cancer-causing-microbes.