Phases Of Lung Cancer

Lung Cancer is a malignant tumour characterized by uncontrolled cell growth in the tissues of the lungs. Hence, it is also known as Lung carcinoma, a type of primary cancer that develops from damaged epithelial cells that line the inner and outer surfaces of the body. This formation of cancerous cells from normal cells is known as carcinogenesis, which is a process characterized by three stages: Initiation, promotion and progression. This report focuses on the formation of lung cancer cells and the mutations of healthy cells through the process of carcinogenesis at a cellular and genetic level.

The Aspen Lung conference conducted comprehensive studies on lung cancer over 17 years. Through this, it is evident that the vast majority of cases of lung cancer (80-90%) is due to long-term tobacco smoking, as supported through cancer researcher Kanematsu Sugiura which discovered the “repeated painting with tobacco tar for from 90 to 500 days developed a squamous carcinoma at the site of application” (KANEMATSU SUGIURA, 2019). Whereas, the other 10-15% of cases occurs in individuals who are non-smokers. This is mainly due to other factors which include genetic factors, and environmental factors such as: exposure to radon gas, asbestos, second-hand smoke, and/or other forms of air pollution. (Miller and Keith, 2019)

The first phase of the development of malignant cells of the lungs is known as the initiation (transformation) stage. This is the stage where a normal cell transforms into malignant cell, due to the interaction between healthy cells and transforming agents such as as carcinogens, e.g Tobacco, Asbestos, etc. When the carcinogens interact with the genetic material such as nucleic acids (DNA and RNA) and proteins, lung cancer occurs as a result of the genetic mutation build up in the critical genes that are responsible for cell growth, division or repair of damaged DNA. These changes to critical genes evidently result in the cells to grow and divide uncontrollably to form a tumour. These changes are known as somatic mutations, meaning the altered genetic expression can be passed on, forming the proliferation of mutated of cells.

Somatic mutations occur in the genes: TP53, EGFR and KRAS, all in which are common to lung cancer. The TP53 gene provides instructions for making protein, called p53, that is located in the nucleus of the cell throughout the body and attaches directly to DNA (Zappa and Mousa, 2019). The role of the p53 protein is to regulate cell growth and division by monitoring damaged DNA. When the DNA becomes damaged, the p53 protein helps determine whether the DNA will be repaired, or whether the cell will undergo apoptosis (cell death). TP53 gene mutations result in the production of an altered p53 protein that cannot bind to DNA. The altered protein prevents the regulation of cell proliferation, further allowing DNA damage to accumulate in cells, as it is unable to trigger apoptosis in cells with mutated or damaged DNA. The accumulation of mutated cells may continue to divide in an uncontrolled way, leading to tumour growth. A mutation in the TP53 gene, can be genetically inherited from parent to offspring, this is known as Li- Fraumeni syndrome, which is a condition that makes a person more likely to develop one or more cancers in areas of the body such as the brain, spine, blood, lungs, breasts, etc.

Furthermore, the pharmaceutical research institute place an emphasis on the EGFR and KRAS genes that each provide instructions to make a protein known as K-ras which plays the essential role as the on and off switch in the cell membrane (Zappa and Mousa, 2019). When these

proteins are activated by binding to other molecules/substrates, the protein automatically relays signals from outside the cell to the cell's nucleus. These signals instruct the cell to grow and divide (proliferate). Furthermore, mutations in the EGFR or KRAS gene lead to the K-ras protein being constantly turned on (constitutively activated). (Herbst, Morgensztern and Boshoff, 2019) As a result, cells constantly receive signals to proliferate, leading to tumour formation.

The Initiation phase, is then followed on by the promotion (Activation) phase. This is significant as once the normal cells have been mutated, this is the stage where the transformed cells proliferate, as they are stimulated to grow and divide faster (Herbst, Morgensztern and Boshoff, 2019). Agents that cause the promotion of cancer cells is substances in the environment and promoters such as stress, alcohol, drugs, pesticides etc. These promoters do not cause cancer by themselves, however they allow a cell that has undergone initiation to become cancerous, as a cancer-prone cell need certain conditions to proliferate. Evidently, this stage is followed on by the final progression stage, where the cancerous cells proliferate into large tumours and can spread from the primary sight to other areas of the body, this process is known as metastasis. Thus, if not treated at a earlier stage the growth can spread beyond the lungs by the process of metastasis into nearby tissues, organs, nodes, and other parts of the body. (Zappa and Mousa, 2019).

In conclusion, through the use of comprehensive studies, scientific evidence highlights the significant advances that have been made towards the reduction of occupational health, with more emphasis on the scientific advancements in genetics as an influential factor in the identification and progression of lung cancer, thus targeting and identifying specific mutations with more precision.