

Advancing Precision Oncology: The Role of Cancer Stem Cells in Thyroid Cancer Treatment

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DESCRIPTION

Precision oncology, which focusses on customizing medicines based on the unique characteristics of each patient and their tumour, represents a paradigm change in the treatment of cancer. The knowledge of Cancer Stem Cells (CSCs), a group of cells within tumours with special qualities including the ability to self-renew and differentiate, is essential to this strategy. Targeting these CSCs has become a viable tactic in the context of thyroid cancer in order to enhance treatment results and overcome resistance to traditional medicines. The significance of cancer stem cells in thyroid cancer is examined in this article, along with how developments in precision oncology are influencing therapy options in the future.

Thyroid cancer is a highly prevalent endocrine cancer, exhibiting several histological forms such as papillary, follicular, medullary and anaplastic thyroid carcinoma. Although most thyroid tumours have a good prognosis, especially the differentiated varieties (follicular and papillary), there are major obstacles due to the emergence of aggressive forms and treatment-resistant instances. For instance, anaplastic thyroid carcinoma has a bad prognosis since it is extremely aggressive and frequently resistant to standard treatments. Surgical intervention, hormone replacement therapy and radioactive iodine therapy are often used in the treatment of thyroid cancer. However, treatment results may become more complicated if cancer stem cells are present in the tumour microenvironment. It is believed that CSCs have a role in the development, spread, metastasis and recurrence of tumours, as well as in their resistance to radiation and chemotherapy. Thus, it is essential to comprehend the biology of thyroid cancer stem cells in order to create tailored treatments that can enhance patient outcomes. The unique traits that set cancer stem cells apart from other types of tumour cells. They may develop into multiple cell types present inside the tumour and have the capacity to self-renew, which allows them to produce new tumour cells continuously. Because of this dual ability, CSCs provide a challenge to traditional treatments as they may both contribute to tumour heterogeneity and maintain tumour development. Subsets of stem-like cells that exhibit

certain markers including Aldehyde Dehydrogenase (ALDH), CD44 and CD133 have been found in thyroid cancer cases. Tumour aggression and treatment resistance are thought to be significantly influenced by these CSCs. Stem cells from thyroid cancer, for instance, have been demonstrated in tests to be resistant to radiation and chemotherapy, which can result in tumour recurrence following first treatment. To improve the effectiveness of current treatments and achieve long-term remission, it is therefore imperative to target these cells.

Targeting cancer stem cells in thyroid cancer

Targeting cancer stem cells in the treatment of thyroid cancer has become more feasible because to developments in precision oncology. To successfully eradicate CSCs while protecting normal cells and minimizing negative effects, a number of approaches are being investigated. Certain signaling pathways, such the Wnt, Notch and Hedgehog pathways are frequently essential to the survival and growth of cancer stem cells. Preclinical research has indicated that inhibitors that target these pathways are promising. To lower the population of stem cells and increase the susceptibility of thyroid cancer cells to traditional treatments, for example, the use of Wnt pathway inhibitors has been investigated.

Targeting CSCs with immune-based therapy is an area of ongoing study, as these medicines are becoming more popular in the fight against cancer. The ability of tactics like immune checkpoint inhibitors and CAR-T cell therapy to specifically target and eradicate thyroid cancer stem cells is being investigated. Through the activation of the immune system, these treatments may offer a more successful means of eliminating tumour populations that are resistant to current treatments. Novel approaches to target cancer stem cells with therapeutic drugs are provided by nanotechnology. Chemotherapeutic drugs can be delivered more effectively to the tumor's stem cell population by use of nanoparticles that are able to target CSC markers. In addition to increasing therapeutic efficacy, this focused strategy reduces toxicity to healthy tissues. Combining new drugs that target cancer stem

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cells with established medicines is another intriguing approach. For example, using chemotherapy and drugs that target CSCs together may improve treatment outcomes and lower the risk of recurrence. This strategy is especially important in cases with anaplastic thyroid carcinoma, when traditional treatments frequently don't work.

CONCLUSION

Targeting cancer stem cells in precision oncology has significant potential for improving treatment results for thyroid cancer.

Researchers can create tailored medicines that address the issues of treatment resistance and tumour recurrence by learning about the special characteristics and behaviours of thyroid cancer stem cells. Future thyroid cancer therapy may move towards more individualized and efficient methods that improve patient survival and quality of life as continuing research reveals the complexity of cancer stem cells. In the end, the fight against thyroid cancer has advanced significantly with the incorporation of cancer stem cell research into precision oncology approaches.