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A new approach to cancer stem cells

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Cancer Stem Cells (CSCs) or tumor–initiating cells constitute a small fraction of tumor cells that have the ability to self–renew, differentiate into different cell lineages, and have a high tumorigenic ability in various tissues and organs of the body compared to other stem cells. Cancer stem cells reside in specific microenvironments known as CNMs. CNMs of CSCs are composed of different types of cells that maintain the survival and improve the characteristics of CSCs. In this review, the characteristics of CSCs, methods for their isolation and detection, the two–way communication between CSCs and CNMs have been investigated. Also, important signaling pathways of stem cells including Hedgehog, Wnt, Notch, and Hippo, which are commonly altered in CSCs and play a supportive role for CSCs, and the therapeutic targets of these pathways that play a role in eliminating CSCs and treating cancer have been investigated.[1-27]

Recent studies have shown the presence of cancer stem cells in various leukemias and tumor tissues. Cancer stem cells, like other stem cells, have the ability to self–renew and differentiate, and in addition, they also have the ability to induce tumorigenesis. This group of cells plays an important role in the process of invasion and metastasis of tumor cells. Many studies have been conducted to discover specific markers and different phenotypes of cancer stem cells, which are of particular importance in identifying and isolating this group of cells. It is believed that the characteristics of cancer stem cells, such as their tumorigenic potential, are largely related to their specific signaling pathways such as Wnt, b–catenin, and Hedgehog. The tumor microenvironment, microRNAs, and their regulatory factors are also important factors involved in regulating the function of cancer stem cells. The present review study examined the biology of cancer stem cells, specific signaling pathways, and the role of microRNAs in controlling the function of this group of cells in order to provide new therapeutic methods.[28-55]

Cancer stem cells are a rare collection of cells in a tumor mass that are resistant to chemotherapy and have the properties of self–renewal, proliferation, and differentiation to other tumor cells. To eliminate tumor stem cells, several therapeutic methods are used, including: 1) Targeting cells using antitumor agents such as monoclonal antibodies, small molecules, engineered viruses, or activated immune cells, which are usually all designed against surface markers (CD133, CD44, CD24) or adhesion molecules and extracellular matrix. 2) Stopping the activity of cancer stem cells by blocking intracellular signaling pathways (Jack–STAT, Wnt, AKT, BMP, FGF) that play a role in their self–renewal activity and also in maintaining their stemness, or, like PTEN, tumor suppressor factors that play an important role in the development and homeostasis of most organs in the body. 3) Sensitizing CSCs to drugs by blocking ABC membrane transporters, the presence of these transporters increases drug resistance in CSCs. 4) Differentiating CSCs using MicroRNA or epigenetic changes that reduce their metastasis, tumorigenesis and invasion. Conclusion: A combination of treatments that target both tumor mass and CSCs is necessary to reduce cancer mortality.[56-59]

In recent years, significant progress has been made in stem cells, which hold promise for new therapeutic approaches to intractable diseases. These cells, which are present in all multicellular organisms, have the ability to divide and transform into highly specialized cells and are also capable of replacing lost and damaged cells. The self–renewal and differentiation properties of these cells promise a bright future in the fields of regenerative medicine, cell therapy, and pharmaceutical research. Modern technologies not only provide an unlimited source of autologous stem cells, but also enable the use of non–autologous cells. Of course, the therapeutic use of stem cells is accompanied by numerous limitations and obstacles, and therefore further research is necessary to understand their biology. In this article, the basic concepts, applications and limitations of use, and the prospects for the future use of stem cells are reviewed.[60-66]

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Conflicts of interest

The author declares that there is no conflicts of interest.

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