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Review

Stem cells and brain cancer

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Received 15 February 2005; revised 8 March 2005. Available online 14 April 2005.

Abstract

One of the most devastating CNS pathologies is brain cancer. The undifferentiated character of brain tumor cells and recent reports of cancer stem cells prompt questions regarding the involvement of normal stem/progenitor cells in brain tumor biology, their potential contribution to the tumor itself, and whether they are the cause or the consequence of tumor initiation and progression. The cancer stem cell model proposes a clonally derived brain tumor arising from a cancer stem cell. This tumor cell-of-origin originates from a stem/progenitor or more differentiated cell via acquisition of oncogenic mutations that dysregulate or allow reacquisition of self-renewal mechanisms. The tumor cells differentiate unidirectionally from the cancer stem cell in a way parallel to normal development. However, several properties of brain tumors add complexity to this model. For example, the apparent lineage and differentiation status of tumor cells are significantly affected by signaling abnormalities that are causally related to formation of the tumor. In addition, these tumors recruit normal CNS stem and progenitor cells to the tumor mass leading to the possibility of a heterogeneous and polyclonal cell population. It is likely that a complete description of the role of stem cells in brain tumors will be more complex than our current models.

Keywords: Brain cancer; Stem cell; Cell-of-origin; Cancer stem cell; Tumor clonality; Recruitment into the tumor; Tumor cell differentiation state

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