



## Isolation and characterization of cancer stem cells from medulloblastoma

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**ABSTRACT.** Brain cancer stem cells are a subset of tumor cells present in several types of brain tumor that evade treatment regimens and are responsible for tumor recurrence. Recent reports on several tumors have suggested that Hoechst 33342 dye exclusion is a powerful technique for isolating cancer stem cell-like side population (SP) cells. In the present study, we attempted to isolate the SP cells from medulloblastoma, a malignant brain tumor in children. The tumor samples obtained were subjected to fluorescence-activated cell sorting analysis for SP cell isolation. Further, the SP cells were characterized by a sphere-formation assay and analyzed for expression of stem cell genes by reverse transcription-polymerase chain reaction (RT-PCR). Using flow cytometry, we isolated 2.9% of cancer stem-like SP cells from malignant medulloblastoma, which was reduced to 0.4% in the presence of verapamil, an inhibitor of ABC transporter. These SP cells undergo rapid proliferation and have a high tendency to form tumor spheres when compared with non-SP cells. Further, RT-PCR analysis revealed that the isolated SP cells have increased expression of neural stem cell markers such as nestin, Notch1, and the ABC transporter protein ABCG2. Therefore, our findings suggest that SP cells of medulloblastoma share the characteristics of cancer stem cells.

The increased expression of stem cell markers and ABCG2 protein may function collectively and be responsible for drug and apoptosis resistance, as well as tumor recurrence and invasion.

**Key words:** Cancer stem cells; Medulloblastoma; Side population; Multidrug resistance; Chemotherapy