Effects of GSH and VEGF on Angiogenesis

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Angiogenesis is the process of forming new blood vessels from pre-existing ones and is essential for many functions such as wound healing, embryonic development, and repair. However, angiogenesis has been identified to play a major role in the progression of inflammation and the proliferation of cancer. Vascular Endothelial Growth Factor (VEGF), in particular, can bind to and activate its receptors (VEGFR-1 or VEGFR-2), promoting angiogenesis, vascular permeability, and cell migration. Because of this, researchers have designed angiogenesis inhibitors, that target the VEGF/VEGFR system, to block the formation of new blood vessels in cancer cells in order to halt the growth of primary tumors. Glutathione (GSH) is an antioxidant that is responsible for blocking damage commonly caused by reactive oxygen species (ROS) and oxidative stress. The hypothesis is that increased levels of GSH in the cell will result in an increase in Angiogenesis because lower levels of Glutathione-related enzymes, such as γ-glutamylcysteine ligase (GCL) and γ-glutamyl-transpeptidase (GGT), will push cancer cells to have a lower concentration of free radicals. Chemotherapy drugs such as Cisplatin, Doxorubicin, and Methotrexate were used to observe the behavior of G-292 and SAOS-2 cells. L-Buthionine-Sulfoximine (BSO) was also used in the experiments. Results from ELISA assays suggest that as the concentrations for Doxorubicin and BSO increased, the osteosarcoma cells began to express significantly more VEGF ($p < 0.05$ and $p < 0.001$). Previous studies have indicated that BSO depletes GSH and Doxorubicin increases the amount of GST, thus decreased levels of GSH led to an increase in Angiogenesis.