Reduction of Circulating Tumor Cells by Induction of Apoptosis via a TRAIL-Functionalized, Nanostructured Shunt Device

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This study focused on advancing research in the capture of colon circulating tumor cells (CTCs), by engineering an implantable shunt device that will reduce metastatic burden by inducing apoptosis (programmed cell death) in CTCs. The shunt device was functionalized by a coating of the apoptosis-inducing molecule TRAIL and nanostructured via the use of halloysite nanotubes. The protein E-selectin, immobilized on the inner surface of the MicroRenathane shunt tubing, causes the cancer cells to adhere and roll on the surface. Through the cell rolling process, the surface of the cell is brought into repeated close contact with TRAIL. A colon cancer cell line designated COLO205 derived from a 70 year old male with Dukes' stage D colon cancer was used for these experiments. Multiple trials were carried out to determine the effect of the halloysite nanotube coating on the viability of the processed cells. Each trial included a control, which was untreated with the TRAIL molecule and demonstrated the highest viability of processed cancer cells. The majority of the trials demonstrated that the addition of halloysite nanotubes altered the death rates of early apoptotic, late apoptotic, and necrotic cells thus proving that the experimental shunt device achieved the induction of apoptosis. This innovative design for a shunt device in capturing CTCs to aid in the reduction of metastatic burden could be used in conjunction with other chemotherapeutic colon cancer treatments to increase effectiveness.

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