Nanomedicine in Cancer Treatment

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Introduction

More than half of the populations over 65 years old suffer from a cancer disease. Tumor research, therefore, also seeks new and more efficient forms of therapy.

Since cytostatics have harmful effect on all cells in the human body, the concept of magnetic drug targeting offers an interesting alternative to conventional tumor therapy [1]. The concept has been described in the literature and tested on animal models. The intravasal availability of the ferrofluids and the magnetic sensitivity were critical. The particles must be large enough to be attracted by a magnetic field, and to migrate into the tumor in this way, in order to release their active substance there [2].

Materials and Methods

Animal studies

A magnetic field strength of 0.6 tesla was applied externally to the body [3]. Iron oxides [Fe₃O₄] were administered intravasally into a vein or artery (Figure 1). Cytostatics were bonded to the iron oxides [Fe₃O₄]. The animal studies were conducted with sarcomas such as rhabdomyosarcoma (Tables 1 and 2).

Results: It was demonstrated that mitoxantrone has a higher concentration in the tumor than the mitoxantrone concentration [2], in the peripheral blood (Table 3).

The results revealed that iron bonded cytostatics contributed towards a reduction in the volume of the tumor and encouraged for further experimental surgical studies (Table 4).

Human study

70-year old female patient with metastases mammary carcinoma on left, initial diagnosis in May 2008, has been detected. Further diagnosis was arterial hypertension and obesity (97 kg, 161 cm).

Results: The CT showed an exulcerated timorous mass approx. 10 cm

Figure 1: Extravasation of the nanoparticles in the tumor tissue.

Figure 2: 30.05.2008 metastasis of liver prior to treatment–arrow marks metastasis in the upper and lower liver, small node as the size of 14.9 cm³.

Figure 3: 04.07.2008 four weeks after treatment, reduction of all metastasis in the liver visible–more metastasis in right lobe shrank of 45% volume, to 8.0 cm³.
in diameter in the region of the left breast (500 ml). Table 5 shows the pathologically changed axillary lymph nodes of maximum 2.5 cm diameter and multiple metastases of maximum 5 cm diameter, in both lobes of the liver (Figure 2).

The exulceration at the breast stopped, so that an imputation of the breast had been successfully performed in 11/2008. The patient has responded well to the therapy. Her physical and mental condition is good and well tolerated, she felt well, and no complications or side effects occurred in the patient.

Conclusion
The animal study shows in the living organism, an effect of the magnetic field, concentrating on the iron particles. The case study on a human shows a reversible granulocytopenia, neither gastritis, nor alopecia or stomatitis. The data show partial metastatic reduction as per literature. Further patients were treated with the same dose; long-term results are being investigated. This therapy method is a possible option with relatively few side effects.

References