Gold nanoparticles as contrast agents for micro-CT imaging

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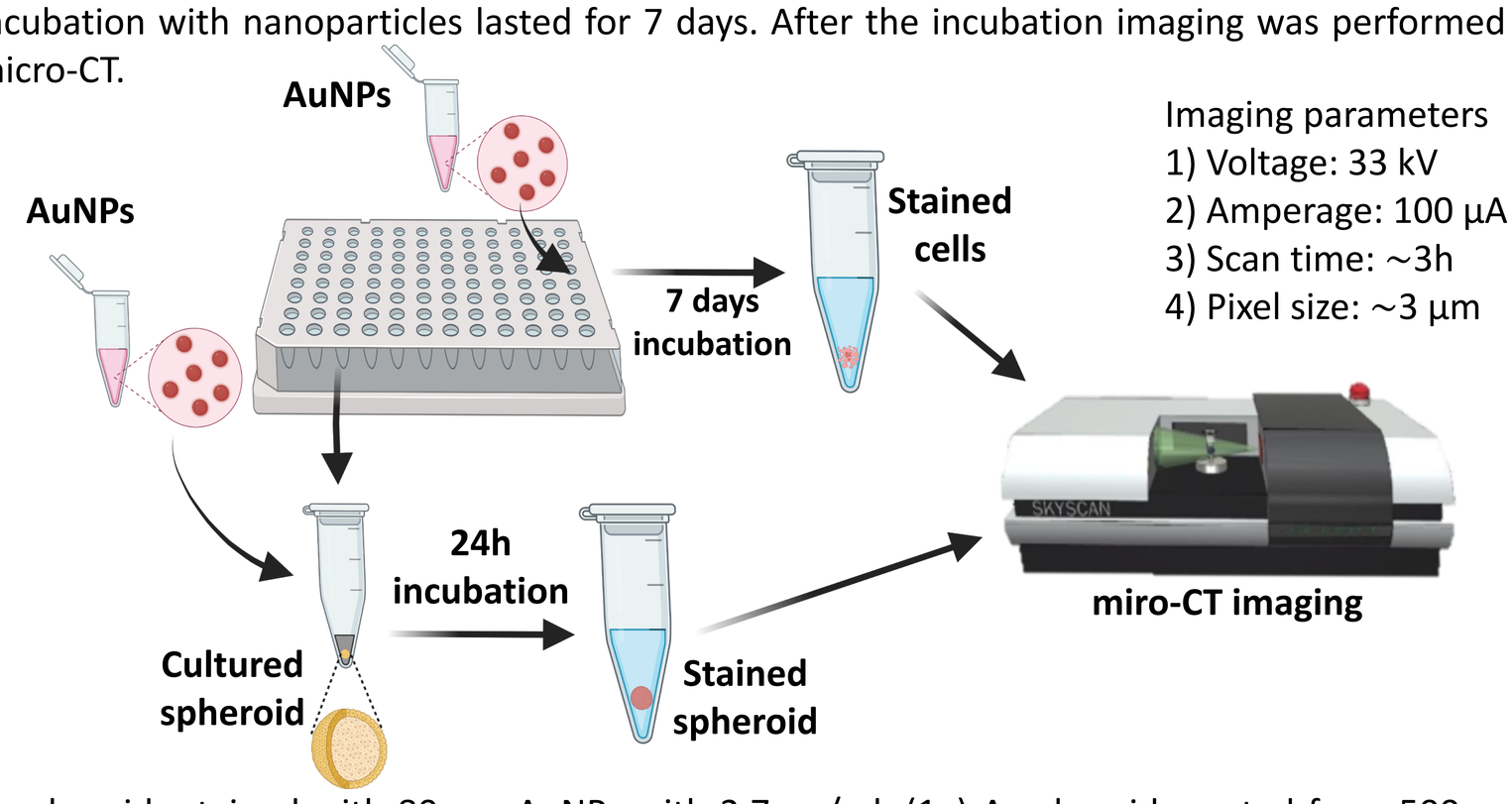
Introduction

3D cell cultures (spheroids) are intended to imitate the properties of the tumor tissue. Being able to image the tumor with high spatial resolution and at a very low concentration of contrasting agents would pave the way for future applications in the case of clinical imaging. In clinical routine Lugols solution is used. Our approach was to use gold nanoparticles (AuNPs) because of their biocompatibility. In our research microcomputed tomography (micro-CT) was used, together with the spheroid model. This study focused on the uptake and accumulation of AuNPs, which had the size of **80 nm.** The concentration of **2.7 µg/ml** was used throughout the whole experiment.

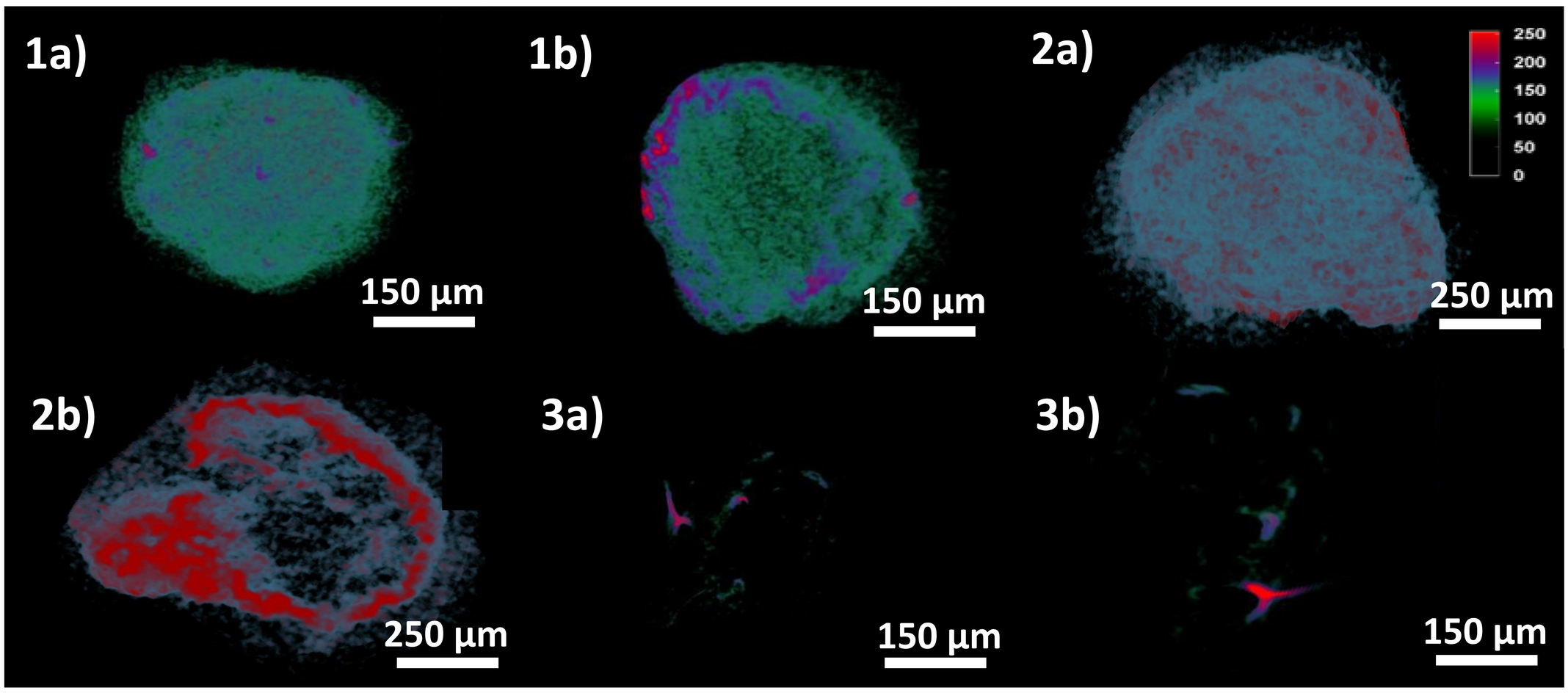
Methods

Spheroids were created using metastatic melanoma cell line (WM266-4) from 500 and 2000 cells. AuNPs were added to the spheroids on the 7th day of growth. The incubation lasted for 24h. In the case of the incubation in 2D culture (2000 cells) AuNPs were added from the beginning and the incubation with nanoparticles lasted for 7 days. After the incubation imaging was performed using micro-CT.



Results

Reconstructed images from micro-CT imaging of spheroids stained with 80 nm AuNPs with 2.7 µg/ml. (1a) A spheroid created from 500 cells, its cross section is shown at the figure (1b). (2a) Spheroid created from an initial number of 2000 cells and its cross section – (2a) . (3a) Cells stained with AuNPs added to the 2D cell from the beginning of the spheroid growth, the cross section of this image is shown in figure (3b). The color bar shown in the right-hand corner corresponds to the density in a given pixel (which corresponds with AuNPs accumulation).



Conclusions

The results show that, in case of spheroids, gold nanoparticles can be successfully used for micro-CT imaging even at very low concentrations. The reconstructed images suggest that AuNPs do not penetrate to the inside of the spheroids but rather accumulate in the outer layer – what can be seen in figures (1b) and (2b). As for the incubation with AuNPs with 2D cel culture, there was probably no spheroid formation. However, small aggregates of cells were observed and in this case AuNPs were distributed evenly throughout the created structure.

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