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Tumor targeted, stealthy and degradable bismuth nanoparticles for enhanced X-ray radiation therapy of breast cancer

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ABSTRACT Nanoparticles of heavy elements can be used as radiosensitizers to enhance X-ray radiation therapy, but a major roadblock in translating nanoparticle radiosensitizers into clinical practice of cancer treatment is related to the non-degradable nature of the nanoparticles, which can cause accumulation inside body and long-term toxicity. This paper reports the use of a folate-inserted, red blood cell membrane-modified bismuth (i.e., F-RBC bismuth) nanoparticles in X-ray radiation therapy for breast cancer, where cell membrane coating provides long blood circulation time, folate acts as tumor targeting agent, X-ray and bismuth nanoparticles interaction generates more free radicals for cancer cells damage, and physiological condition helps dissolve bismuth nanoparticles after treatment. Significant tumor inhibition and improved survival ratio in mice was confirmed when F-RBC bismuth nanoparticles were used to sensitize X-ray radiation. *In vivo* bio-distribution and histological analysis indicated F-RBC bismuth nanoparticles were excreted from animal body after 15 days and no evident damage or inflammatory was observed in major organs. Cell membrane modification and dissolution of bismuth nanoparticles in body allow the fine tune of the circulation, radiation enhancement and body clearance in such a way that treatment effect can be maximized and long term toxicity can be minimized.