Lipid-polymer nanoplatform enables X-ray triggerable photodynamic therapy for rectal cancer in an orthotopic mouse model

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Rectal cancer accounts for approximately 30% of colorectal cancers which is the 2nd most deadly cancer in Australia. A significant proportion of Stage III rectal cancer patients undergo chemo-radiotherapy to downsize the primary tumour and lymph node metastasis before surgery. Unfortunately, the side effect of this standard of care treatment is progressive late morbidity due to high doses in long-course radiotherapy and toxicity of chemodrugs used in chemo-radiotherapy. To improve the quality of life of rectal cancer patients, it is important to find a new and safe treatment method. Here we brought a new treatment method, X-ray triggerable photodynamic therapy (X-PDT), by combining existing clinical techniques used in cancer treatment and delivering via bespoke nanocarriers. In this strategy verteporfin (VP), a clinically approved photosensitizer, was directly activated by X-ray via lipid-polymer hybrid nanoplatform. The activated VP generates highly toxic reactive oxygen species, killing the cancer cells. With X-PDT, the tumour growth suppression was observed in an orthotopic mouse model bearing rectal cancer. Such tumour control is consistent with decreased cell viability, increased necrotic tumour tissue and reduced Ki-67 protein expression observed in the mouse group treated with X-PDT, compared with other treatment conditions. Our study establishes an effective strategy to treat rectal cancer in a more clinically relevant model, which offers prospects for clinical translation of this technology for deep seated cancers.