

GENINATTI CRICHA-1: Quantification of Boron distribution by magnetic resonance imaging (MRI)

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BNCT is a promising option for the treatment of metastasis disseminated, for example, in the thoracic cavity that cannot be treated by methods requiring a precise localization, such as surgery or conventional radiotherapy. Therefore, the measurement of local boron concentration is crucial to determine the optimal neutron irradiation time, to calculate the delivered radiation dose and to evaluate the toxicity of the treatment by determining differences in boron concentration between tumour and healthy tissues.

Thanks to its superb spatial resolution, low toxicity and non invasivity, Magnetic Resonance Imaging (MRI) appears to be the most appropriate technique to tackle this task. Moreover, the signal intensity enhancement generated by MRI contrast agents is quantitatively proportional to their concentration and it can be exploited to obtain a precise measurement of their concentration. Thus different dual BNCT/MRI agents have been proposed in the literature containing in the same molecule (AT101) or in the same nanoparticle (liposomes, PLGA, LDL particles) both MRI Gd based contrast agents and boron carriers. The obtained results are a typical example in which a highly selective therapy takes advantages from imaging to improve its efficacy. Imaging-guided BNCT is, therefore, an important modality because one can access key information as to whether the concentration threshold of 10B atoms at the diseased cells has been reached from the signal enhancement generated by the Gd complex. The use of nanoparticles with a high payload of NCT and MRI imaging agents appears to be the route to achieving considerable improvement in the NCT technique, thus shortening the irradiation times and allowing non invasive measurements of B atoms in vivo. Finally, the further advantage is the possibility to exploit the possible synergistic action of the two ^{10}B and ^{157}Gd NC agents.