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High LET photons from integration of HIFU with Radiotherapy

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By adding High Intensity Focused Ultrasound (HIFU or FUS) to Radiotherapy (RT), a totally new weapon (FUS/RT) against cancer is created. This new therapy possesses the benefits of each of the two modalities, but is more than a simple addition of the two. In fact the hyperthermia field and cavitation effects (sonoporation), generated by FUS are potent enhancers of the effects of the ionizing radiation, and enable a significant radiation dose reduction and a totally different spatial distribution. In fact HIFU ablation can be restricted to a reduced part of the tumor, in principle to just the hypoxic region, which is relatively insensitive to ionizing radiation and may be located in the most central part of the tumor. It is probable that the survival of hypoxic cells plays a major role in local recurrence and treatment failure. Having destroyed the hypoxic region with HIFU, X-radiation can be delivered selectively to the well oxygenated, annular-shaped volume surrounding the central (hypoxic) region, which consists of tumor clonogens amongst healthy tissue. The lower dose level and the reduced irradiation volume will reduce the probability of side effects (sequelae) of the radiation treatment. In addition, FUS facilitates mediated drug delivery, eventually in combination with radiation. This combination of therapies, that can be administered to the patient in a short time period, may open a new horizon in patient-tailored, 'Medical' Oncology.

Biography

Giovanni Borasi took a degree in Theoretical Physics in 1967, with first class honors. Specialized in Medical Physics, in 1985 he moved from Milan to Reggio Emilia. Retired since 2007, he was involved in the project of a new Tomosynthesis unit (3 International Patents). In the same year he became consultant of the University of Milano Bicocca and subsequently of the Italian National Research Council. The project of a new device integrating HIFU into a standard LINAC for combined treatments, was developed. He has published more than 80 papers in highly rated journals and in 2013 became "Honorary Member" of the Italian Medical Physics Association.

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