

A radiobiology experiment on Breast cancer cell line using Laser Driven electron Accelerators

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First radiobiological experience at ILIL with electron beams generated by a 2TW laser system.

Summary

Laser-driven electron accelerators (LDA) based on the Laser Wakefield Acceleration process has entered a mature phase to be considered as alternative devices to conventional radiofrequency linear accelerators used in medical applications. Before entering the medical practice, however, deep studies of the radiobiological effects of such short bunches as the ones produced by laser-driven accelerators have to be performed. The studies here reported were carried out at the Intense Laser Irradiation Laboratory (ILIL) of the INO- CNR in Pisa, using a 2TW laser system.

Tumorigenic MCF7 Breast Cancer cell line have undergone to LDA treatment and to conventional electron beams, in order to compare the dose effect between the two sources of ionizing radiation on cell surviving capacity, tested by clonogenic assays. The dosimetry calculation permitted to reveal the precise doses released by LDA, which were those described in the table 1 below. Then, table 1 show the percentage of cell surviving fractions observed in the two experiments. As it is show, LDA resulted much more efficacious in cell killing than conventional electron beam at all the doses compared.

Furthermore, fitting the data in a linear-quadratic model, our data from conventional electron beam radiation well fit the model, being the experimental α and β : 0,21 and 0,028 respectively, not so far from those reported in literature (0,38 and 0,026) (1). Instead, in the case of LDA, the mathematical model do not well describes our data.

Future experiments are needed to well understand the effect of extremely high dose rate released by LDA, even if preliminary data seem very promising.

Table 1

D (Gy)	EBRT SF %	LDA SF%
1,79	65 %	19 %
3,18	47 %	17 %
4,42	35 %	7,3 %
5,37	28 %	6,2 %
6,91	19 %	4, 1 %
7,35	17 %	2,9 %

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