

Modelling of tumour hypoxia - relationship to treatment response

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Hypoxia is an important factor that influences the outcome of radiotherapy through the radioresistance it confers to the affected cells and their malignant selection. Many methods have been proposed to investigate tumour oxygenation as it should be taken into consideration for decisions regarding the treatment strategy. Among these, an interesting method to evaluate hypoxia and its impact on treatment response is theoretical modelling. Thus, tissue oxygenation can be calculated starting from complex vascular arrangements and taking into consideration the oxygen diffusion into the tissue and its consumption at the cells. The results of the simulations could be used for modelling the tumour response to treatment or for investigating the efficiency of other measurements methods. This presentation reviews important aspects that have been highlighted through the theoretical modelling of tissue oxygenation and in particular the relationship to vascular parameters. It also deals with the estimation of the efficiency of various measurement methods and the relationship between results obtained from different techniques. Particular attention has been given to resolution, averaging and other factors that may lead to systematic deviations of the measurement results. The role of the metabolic properties of the cells with decreased oxygenation was also taken into consideration for predictions of treatment outcome for full fractionated treatments. The findings stress the importance of incorporating hypoxia information into the biological modelling of tumour response for making clinical decisions. They also highlight the usefulness of theoretical simulation for evaluating the efficiency of strategies aimed to overcome the effects of tumour hypoxia.