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Effects of light fractionation and different fluence rates on photodynamic therapy with 5-aminolaevulinic acid *in vivo*

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Abstract:

To improve efficacy of photodynamic therapy (PDT) with intravenously administered 5-aminolaevulinic acid (ALA) fractionating the light dose or reducing the light intensity may be a possibility. Therefore, Syrian Golden hamsters were fitted with dorsal skinfold chambers containing an amelanotic melanoma ($n = 26$). PDT was performed (100 mW cm^{-2} , 100 J cm^{-2} , continuously or fractionated, and 25 mW cm^{-2} , 100 J cm^{-2} ; continuously or fractionated) using an incoherent light source following i.v. application of ALA. Following fractionated irradiation, the light was paused after 20 J cm^{-2} for 15 min. Prior to and up to 24 h after PDT tissue, pO_2 was measured using luminescence lifetime imaging. The efficacy was evaluated by measuring the tumour volume of amelanotic melano cells grown subcutaneously in the back of Syrian Golden hamsters ($n = 36$). Only high-dose PDT resulted in a significant decrease of pO_2 . Irrespective of the mode of irradiation only high-dose PDT induced complete remission of all tumours (13 out of 13). It could be shown that low-dose PDT failed to induce a significant decrease of pO_2 . No significant effect of fractionated irradiation was shown regarding the therapeutic efficacy 28 days after PDT. Thus performing a fractionated PDT with ALA or reducing the light intensity seems not to be successful in clinical PDT according to the present data.

Key-words: Amelanotic melanoma, protoporphyrin IX, Oxygen, Microcirculation, Tumour