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Porphyrins for tumor destruction in photodynamic therapy

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Photodynamic therapy (PDT) using porphyrin derivatives is a new approach to cancer treatment. The method has been investigated extensively, as an adjunctive treatment in the neuro-oncological field. It is based on the selective accumulation of a photosensitizer in malignant tissue with low systemic toxicity. Subsequent laser activation induces photo-oxidation of different biological targets followed by selective tumor destruction via vascular and direct cellular mechanism. The purpose of this review is to summarize the current available data on human brain tumors treated photodynamically in the presence of different porphyrin derivatives: 5, 10, 15, 20-tetra-phenyl-porphyrin (TPP), 5, 10, 15, 20-tetra-naphthyl-porphyrin (TNP), 5, 10, 15, 20-tetra-sulphonato-phenyl-porphyrin (TSPP), 5, 10, 15, 20-tetra-sulphonato-naphthyl-porphyrin (TSNP). The phototherapy of tumor produces a cytotoxic effect on the vascular network that results in cessation of blood circulation and subsequent necrosis of the tissue. The effect of PDT on the microvasculature of the brain tumor cells in the first few hours after treatment was studied by electron microscopy. The red light led to a rapid necrosis of tumor which was not the result of the direct killing of tumor cells, but destruction of tumor microvasculature. It has been shown that the vascular damage expressed by a decreased blood flow stasis are immediate and major consequences of the photodynamic treatment with photodynamic systems introduced in these experiments. The first observable signs of the destruction occur in the collagen fibers and other connective tissue elements located in the subendothelial zone of the tumor capillary wall. The altered permeability and transport through the endothelial cell layer resulting from erythrocyte swelling and increased intraluminal pressure may be another keys feature in the photodynamic destruction. From the recorded micrograms before and after the PDT-treatment of the brain culture tissue, the disappearance of the tumoral zone from the studied cellular mass was observed. Since the vasculature is the site the most affected by PDT, the inhibition of the mitogenic stimulation of the human blood lymphocytes by the dyes photosensitization was also took into account, knowing that the porphyrins are better incorporated into granulocytes than into lymphocytes provided from the human blood cells. The effect of PDT on the tumor microvasculature in the first hours after treatment, demonstrated that the most efficient drug being TNP in DMSO: water (0.05 % -99.5 %) as solvent.