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Optical dosimetry and photokinetic simulations for the analysis of indocyanine green during photodynamic therapy in the pig thoracic cage with 808 nm

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It is of interest in biomedical optics to describe the light propagation through biological tissues to allow the development of diagnostic and therapeutic photonic techniques. (1) For external illumination of the thoracic cage is relevant to determine the behavior of light attenuation from the skin surface until lungs. Since the volume of this region is large, a model concerning the light propagation is needed to extract dosimetry parameters as the irradiance, fluence and exposure time. (2) A two custom-made prototype panel of 200 diode lasers each was used to perform the experimental assays. Each one presents a mean irradiance of 78 $\pm$ 10 mW/cm^2 and centered wavelength at 808 nm. The emission wavelength, irradiance stability and temperature increase for the panel were correctly characterized.The respiration is important when considering the optical properties of the lung, since a ventilated lung does not have the same properties of a collapsed one. (3) Then for the assays, an in vivo experiment was performed in a 34 kg pig. The pig was in the prone position and the panels were placed in contact to the back. The irradiance measurements were made with an isotropic fiber that was conducted with the help of a bronchoscope in different lobes of the lung. With the value of irradiance in different regions of the lung, a simulation of the bleaching of the photosensitizer was performed using the parameters of indocyanine green diluted in PBS and PDT bleaching macroscopic model. The values achieved were of 15% of the emitted irradiance and from those values the PDT dose was calculated. These results suggest that an external illumination of the thoracic cage with NIR light effectively pass through the thoracic wall and achieve fluence levels above the ones described for lung photodynamic inactivation.

Palavras-chave: Lungs. Dosimetry. Laser.

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