Optimisation of radiation protection procedures in angiography system commisioning

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Introduction

Angiography or arteriography is an invasive diagnostic method for examining the inside of blood vessels in the human body, arteries, veins and chambers of the heart. The purpose of angiography is to determine the anatomy and degree of obstruction inside the arteries. It is performed by injecting a radio-opaque, hydro-soluble (liquid-soluble) contrast agent, through numerous special catheters made for this purpose. They are injected into the blood vessel, and then an image of the blood vessels is taken with an X-ray technique - fluoroscopy (digitally or on film). Taking into consideration, the imaging procedure is performed in the presence of an angio team, max radiation protection of the personnel is highly important. Because of that, the aim of this paper is to optimize the procedures for radiation protection in angiography system commissioning. It implies, calculation of the thickness of the protective walls in accordance with the frequency of operation and utilization of the surrounding rooms; control of the working parameters of the angiograph; staff training for proper handling and compliance with the ALARA principle; control with personal dosimeters and control of lead protective clothing.

Methods

New GE Innova 2000 angiograph is installed in Acibadem Sistina clinical hospital. Number of employees is 12, number of procedures are 20/week. Utilization of fluorography / fluoroscopy up to 1500 s/procedure. Operating voltage - 120 kV max, 60 kV аверare, 88 kV most often used. TLD personal dosimeters are with monthly readings. Lead protective clothing (skirts, vests, suits and thyroid collars) 60 pieces in total, with frequency of control once a year.

Results

Measured ambient dose equivalent (0.037mSv/h at the workplace fluoroscopy in the controlled zone and 0.18 mSv at the work desk) ensure safe working in the area analyzed here. The monthly readings of the personal dose equivalent, Hp(10), show values in the range of 0.1 - 1 mSv, which is far below the permissible limit for professionally engaged persons. Even more, the worker shifts are planned on a way, everyone has more or less same professional exposure. Protective clothing control shows 1 damage every second year. The damaged piece is evaluated and removed from service.

Conclusions

Optimisation of the radiation protection procedures is necessary during angiography system commissioning, in order to improve the work conditions in ionizing area. To be able to achieve the maximum possible radiation protection during a specific angiography procedure, each part of the control chain is equally important. The training of the staff to optimize the parameters that will give a sufficiently good image with the minimum exposure is extremely important for the radiation protection of the staff and of course the patient.

A new natural detector (Curcuma Longa L.) for photodynamic therapy (PDT) measurements with blue LED irradiations: Application of Convolutional Neural Networks (CNN) and Multilayer Perceptron (MLP)

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Introduction

The objective of this work was to apply for the first time methods used in Artificial Neural Networks (ANN) such as Convolutional Neural Networks (CNN) and Multilayer Perceptron (MLP) for prediction and classification in the photodynamic therapy measurements with blue LED irradiations and a new natural detector from Curcuma (*Curcuma Longa L.*).

Methods

Artificial neural networks present great potential for modeling complex nonlinear relationships between independent and dependent variables, which may be viable in modeling scientific research results from irradiations carried out with LEDs and evaluated by the technique of UV-Vis spectroscopy.

Results

The training + validation and training + testing phases were suitable for models that use ANN in their computational experiments, which corroborates the excellent results obtained for the reconstructions and classifications carried out by CNN and MLP. In the reconstruction, the results of CNN were better than those of MLP.

Conclusions

Therefore, as a final conclusion, ND samples can be used in photodynamic therapy measurements as natural dosimeters for quality control associated with spectra reconstruction and classification via convolutional neural networks and multilayer perceptron computational experiments.