

rate and temperature in a hermetically sealed implanted system. All leads feature solid state pressure tipped sensors, eliminating slow frequency response, head pressure and animal movement noise which are associated with fluid filled catheters.

Conclusions: All mentioned above parameters can be estimated in already made chemical animal models of Cardiovascular or Neurodegenerative diseases. Animal models of adult-onset neurodegenerative diseases have enhanced the understanding of the molecular pathogenesis of Alzheimer's disease, Parkinson's disease, frontotemporal dementia, and amyotrophic lateral sclerosis. In parallel with physiological parameters estimation. Nevertheless, our understanding of these disorders and the development of mechanistically designed therapeutics can still benefit from more rigorous use of the models and from generation of animals that more faithfully recapitulate human disease. Here we review the current state of rodent models for Alzheimer's disease, Parkinson's disease, fronto-temporal dementia, and amyotrophic lateral sclerosis. We discuss the limitations and utility of current models, issues regarding translatability, and future directions for developing animal models of these human disorders.

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Multicentric study on patient doses in diagnostic and interventional cardiology in Bulgaria and patient follow up: Preliminary results

A. Zagorska^a, D. Ivanova^{b,c}, D. Kostova-Lefterova^{d,e}, F. Simeonov^f, V. Gelev^g, I. Jeleva^g, N. Rifai^h, N. Stoyanov^h, K. Romanova^c, D. Vassilev^d, V. Ivanov^d

^aAcibadem City Clinic, Sofia, Bulgaria

^bUniversity Multiprofile Hospital for Active Treatment "Saint Ekaterina", Sofia, Bulgaria

^cMilitary Medical Academy, Sofia, Bulgaria

^dUniversity Multiprofile Hospital for Active Treatment "Aleksandrovsk", Sofia, Bulgaria

^eNational Cardiology Hospital, Sofia, Bulgaria

^fNational Centre of Radiobiology and Radiation Protection, Sofia, Bulgaria

^gAcibadem City Clinic, Tokuda Hospital, Sofia, Bulgaria

^hUniversity Multiprofile Hospital for Active Treatment "Saint Anna", Sofia, Bulgaria

Introduction: New National Diagnostic Reference Levels (NDRL) were established in Bulgaria in 2018, in terms of kerma-area product, P_{KA} , for coronary angiography (CA), 4600 cGy.cm², and for percutaneous coronary intervention (PCI), 13600 cGy.cm².

Purpose: The purpose of this study was to: (1) determine typical P_{KA} values for CA and PCI procedure in the biggest cardiology departments; (2) compare with NDRL and (3) investigate the number of patients exceeding the proposed trigger levels for radiation-induced effects.

Materials and methods: Seven interventional cardiology departments were included in the study, with eleven different angiography systems. Data for P_{KA} , cumulative dose (CD) and fluoroscopy time (FT) values was recorded.

Results and discussion: The typical P_{KA} values for CA procedures for four of the angiography systems are higher than NDRL with a factor 1.05–1.46. The typical P_{KA} value for one of the systems is 0.3 times lower than NDRL, but the typical FT value is 1.96 times higher, which could be associated with poor image quality.

The analysis of the results for the PCI procedures show that NDRLs are exceeded by a factor of 1.02–1.56 (P_{KA}) for three of the units and 1.17–1.86 (FT) for five of them.

The percentage of patients exceeding at least one trigger level for radiation-induced effects varies between 1–13 % for the different angiography systems. Follow-up program is successful implemented in one hospital, still in progress in four and not performed in one of the surveyed hospitals.

Conclusions: Additional survey should be performed to investigate the equipment performance and the cardiology practice in the departments with typical P_{KA} and FT values exceeding the NDRLs. No radiation-induced effects have been reported among the patients exceeding the trigger levels. Individual patient follow-up approach should be used, depending on the type or combination of exceeded trigger levels.

Key words: NDRLs, Radiation-induced effects, Interventional cardiology.

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Comparative study of patient doses on four CT scanners

Simona Avramova-Cholakova, Eugenia Kulama

Imperial College Healthcare NHS Trust, London, UK

Purpose: The purpose of this study is to determine typical patient doses from four CT scanners in two hospitals and to compare the CT protocols most commonly used.

Materials and methods: The 4 scanners were the same model SOMATOM Definition AS+ (Siemens) with automatic tube voltage selection and tube current modulation, three of them with iterative reconstruction (SAFIRE). Patient data were retrospectively retrieved from PACS with automated dose tracking software Radimetrics (Bayer) for a 6 month period and thirteen types of examinations were considered. Descriptive statistics data were calculated for CTDI_{vol} and DLP on each scanner and for each examination type. Since information on patient weight wasn't available, all data below the 5th and above the 95th percentiles were removed and statistical parameters were recalculated, as recommended by ICRP (Report 135). Mean values were compared with the national diagnostic reference levels (NDRL) for consistency with the methodology used, but median values were chosen as typical doses for each examination type as more representative.

Results: Data were analyzed for a total of 13,485 patients. Even though the protocols were supposed to be identical on all scanners (apart from the one without iterative reconstruction), several differences were found between them. This was most probably due to erroneous data input. All doses were below NDRLs except for Chest HR on one of the scanners. Some of the examinations were related to significant dose differences, most dramatic for Urogram, for which the median ratio was up to 2.5 between scanners.

Conclusions: Additional optimization of the CT examinations is needed with the initial step of standardisation of the protocols used. Data retrieval and analysis is planned for the third hospital in the Trust with three CT scanners. Local DRLs for the Trust will also be calculated.

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Patient exposures from three different modalities on one mammography unit

Simona Avramova-Cholakova, Eugenia Kulama

Imperial College Healthcare NHS Trust, London, UK

Purpose: The purpose of this study is to estimate and compare mean glandular patient doses (MGD) from the three imaging tech-

nologies available on one mammography unit: full field digital mammography (FFDM), digital breast tomosynthesis (DBT) and contrast-enhanced spectral mammography (CESM).

Materials and methods: The study was performed on a Senographe Essential/SenoClaire/SenoBright (GE Healthcare) system. The methods recommended in the EUREF protocol were used. Patient data were retrospectively retrieved from PACS with dose tracking software Radimetrics (Bayer). Radiation output and half value layer were measured with X2 (Raysafe) instrument with appropriate calibrations for the spectra used. Incident air kerma (IAK) for patients and PMMA phantom (thicknesses from 20 up to 70 mm with additional spacers) was calculated from the measured data. Mean glandular dose (MGD) was calculated from IAK by applying relevant conversion coefficients.

Results: Data for 74 patients, 296 exposures (FFDM), 82 patients, 172 exposures (DBT), and 43 patients, 148 exposures (CESM) were collected and analysed. MGD varied from 0.87 mGy (FFDM), 1.01 mGy (DBT), 1.82 mGy (CESM) for 20 mm PMMA with 1 mm spacer, up to 2.36 mGy (FFDM), 2.77 mGy (DBT), 3.48 mGy (CESM) for 70 mm PMMA with 20 mm spacer respectively. Mean value of MGD \pm standard deviation for the whole patient samples was 1.75 ± 0.72 mGy (FFDM), 1.87 ± 0.65 mGy (DBT), 2.54 ± 0.79 mGy (low energy component of CESM), and 3.16 ± 0.99 mGy (CESM, both energies). MGD from the low energy component of CESM was about 45% higher than MGD from FFDM. MGD from the total CESM exposure taking into account both low and high energy components was 80% and 69% higher than MGD from FFDM and DBT respectively.

Conclusions: Doses from FFDM and DBT are comparable, while from CESM are significantly higher. However, this is considered justified since CESM is used for symptomatic patients.

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Comparative evaluation of physical breast phantoms dedicated for mammography studies

Firgan Feradov, Stoyko Marinov, Zhivko Bliznakov, Kristina Bliznakova

Laboratory of Computer Simulations in Medicine, Technical University of Varna, Bulgaria

Introduction: In the presented paper we provide an evaluation of the properties of physical breast phantoms dedicated to x-ray breast imaging and study. The use of physical phantoms is a widely used approach for evaluation of new breast imaging techniques, control and calibration of imaging equipment and patient dose estimation.

Materials and Methods: The examined phantoms are created through combination of different components, which simulate different elements of the female breast (glandular tree, adipose compartments and skin), and manufactured using various materials (polylactic acid (PLA), Gray resin and Clear resin) and two different methods (fused deposition modelling and stereolithography). The phantoms are evaluated using statistical parameters – namely skewness, kurtosis, fractal analysis, power spectrum analysis (PSA), gray-level co-occurrence matrix contrast and energy, which are compared with the values obtained from real mammograms.

Results: The analysis of images from seven physical phantoms demonstrated that each material has different degrees of resemblance to real breast tissues. The phantoms that achieved results closest to these from real images consisted of PLA, clear resin and glycerol. In particular, the difference between the parameters of the real images and the phantom images is in the range of up to 30% for the best performing materials. Skewness was the parameter where highest differences between real and phantom images were observed.

Conclusions: The performed comparative evaluation shows that images, created using the manufactured phantoms have characteristics similar to the real mammograms.

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The endotoxin influence on the deformability of red blood cells. (in vitro)

I. Djenev

Medical University, Faculty of Medicine, Department Medical Physics and Biophysics, Sofia, Bulgaria

Experiments with endotoxin is an interesting direction for medical applications. It is known that certain abnormalities in the micro-circulation in endotoxin shock are related to a reduction of the surface electrical charge and the deformability of red blood cells. The intravascular coagulation of blood cells or “sludge phenomenon” has been observed in endotoxin and other types of shock. To gain a more comprehensive insight into the effect of endotoxin on erythrocyte membranes an assessment was made of the light dispersion in electric field by erythrocyte suspension. Its adoption enables to investigate better the dynamics of endotoxin interaction with erythrocyte membranes, changes in deformability and the like.

In the latter case the biphasic effect became manifest at the very beginning. It was rather marked in the first minute, while ten minutes later it was no longer noted. The development of intravascular coagulation in shock is related to a lower deformability of the cell membranes.

A decrease of deformability has been established, although only qualitatively. The electro-optical method enables to estimate the quantitative alterations in deformability. From the values of the disorientation time for five of the samples was measured, a 37 percent average reduction of deformability was obtained. It is further more presumed that deformability modification is proportional to the change in relaxation time of disarrangement. This is a mean value of measurements performed during the first minute, when the changes in electro-optical effect are most significant. The reduction of deformability in individual subjects varies in the 30–50 percent range.

Key words: Electro-optical technique, Deformability of red blood cells, Endotoxin shock.

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Comparative study of Lanthanum halide scintillation detectors

Desislava Ivanova^{a,b}, Stefan Lalkovski^c, Zhulietta Toneva^c, Velko Rangelov^a

^a Military Medical Academy, Scientific Laboratory of Radiation Protection and Radiobiology, Sofia, Bulgaria

^b University Hospital “Saint Ekaterina”, Department of Radiology, Sofia, Bulgaria

^c Sofia University “Saint Kliment Ohridski”, Faculty of Physics, Department of Nuclear Engineering, Sofia, Bulgaria

Introduction: Gamma ray and X-ray detectors are constructed and developed at the Faculty of Physics, Sofia University. They are extensively tested for future use in nuclear physics, astrophysics and nuclear medicine. The aim of this investigation is to perform a comparative study of two scintillation detectors based on Lanthanum halide scintillators - LaBr₃:Ce and CeBr₃. The study is ongoing. Preliminary results will be presented.