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Intraoperative radiotherapy with balloon-based electronic brachytherapy system – First Bulgarian experience in breast cancer patients

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Introduction: Xoft® Axxent® Electronic Brachytherapy (eBx®) System® is balloon-based technique for intraoperative radiotherapy (IORT) that uses a tungsten target to generate low energy X-ray beam (50 kV, tube current 0.3 mA and half-value layer of 0.5 mmAl). This system is available in 11 countries around Europe and the published data regarding its application is very limited. We report the first results of IORT with this system in Bulgaria.

Material and Methods: This is a prospective case series of 12 early breast cancer patients fulfilling the GEC- ESTRO low risk group criteria for partial breast irradiation and treated with IORT at Alexandrovska University Hospital, Sofia, Bulgaria. For intraoperative evaluation (IOE) of resection margins, rapid frozen section examination was performed. For IOE of sentinel node, marked with 99mTc-MIBI, the College of American Pathologists protocol was followed.

Results: The median values of patients, tumors and irradiation characteristics are as follows: age 59.5 (55–73); tumor size -14.5 mm (8–24); balloon applicator size −47.5 cc (30–70); time of irradiation - 12.75 min (8.38–18.02); skin dose – 7.5 Gy (6–10). In all patients distance from the skin was more than 7 mm (7–11). No radiation-induced skin reactions were observed and the cosmetic results were excellent. With median follow up of 15 months no recurrence was observed.

Conclusions: Four hospitals in Bulgaria have Axxent® eBx®. We report the results of the center with biggest experience with this system. The small number of patients treated is due to the additional expenses for payment of the applicator's price, which are not covered by the National Health Insurance Fund. The first Bulgarian results prove that this system is effective and convenient for patients, significantly shortening the irradiation time and is less aggressive to the skin. Longer follow up is necessary to confirm the low recurrence rate, comparable to other techniques.

Key words: Intraoperative radiotherapy, Early breast cancer, Axxent electronic brachytherapy

Animal models based on telemetry for investigation of mechanisms of neurological and cardiovascular diseases (in vivo)

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Introduction: The complexity and diversity of the animal organism goes beyond any in vitro systems, the use of animal model systems gives us the chance to investigate the molecular and cellular mechanisms of the disease, following the principles of medical ethics, and at the same time without losing natural regulation chemical and signal transduction pathways typical for in vivo systems.

Animal models are:

1. Models with chemically induced diseases.
2. Models with defined traumatism (cerebral artery ligation, induced thromboembolism).
3. Models with genetic modifications.

The best animal models of disease are almost similar in etiology (mechanism of development) and phenotype (signs and symptoms) to the human equivalent.

Material and methods: Animal models and Methods for Animal model monitoring

In our laboratory we use method for telemetrically evaluation of vital signs and parameters from conscious animals (Stellar Telemetry Ltd.)

Stellar Telemetry is the next generation of implantable telemetry technology – The system allows monitoring of unlimited animals with just one receiver thus allowing group housing, social interaction studies and monitoring of animals.

Animals are allowed to roam freely and interact in groups with no restriction in number.

The Stellar Telemetry system can be implanted into any animal from mice to swine with no additional items required. Finally an implantable telemetry system for research that performs with great efficiency.

Results and Discussion: The Stellar Telemetry system allow us to measure and collect vital signs.

Stellar Telemetry transmitters allow measurement of activity, pressure (P), electrocardiogram (ECG), electro-encephalogram (EEG), electromyography (EMG), electrooculography (EOG), heart

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.

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

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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.cm^2, and for percutaneous coronary intervention (PCI), 13600 cGy.cm^2.

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.

Comparative study of patient doses on four CT scanners

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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.

Patient exposures from three different modalities on one mammography unit

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