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Are microvilli and cilia sensors of electromagnetic fields?

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Abstract

A previously proposed hypothesis that "actin-microvilli content non-hearing cells" are able to sense electromagnetic fields (Physica Medica 2001; XVII(2): 37-66) has been extended to microtubule-containing cilia. The biophysical properties of actin microfilaments and microtubules, together with the experimental evidence of various effects induced by electromagnetic fields upon the cytoskeleton, corroborate this hypothesis and suggest the existence of an M- and C-cell system widely distributed throughout the human body and sensitive to electromagnetic fields.

Among the wealth of M- and C-cells, the *ependyma* in the Central Nervous System may be regarded as a good candidate for the role of electromagnetic field receptor organ.

The paper may contribute to theorethical and experimental research in the field of non-thermal effects and radiation protection.

KEYWORDS: Microvilli, cilia, cytoskeleton, hair cells, sense organs, electromagnetic acoustic transduction, electromagnetic sensitivity.

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A Collimated Four Detector Gamma Probe for Radioassisted Surgery**

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Abstract

An improved version of a hand held non imaging γ-probe based on an array of four CdTe solid state detectors is presented. The probe can be equipped with two alternative collimators: the Cross-Collimator (CC) and the Shielded Cross-Collimator (SCC). The CC allows a better position sensitivity and a lower searching time than the conventional probes, for localizing an isolated γ-source. The SCC allows good position sensitivity in the localization of a pointlike γ-source close to an higher activity γ-source of background.

KEYWORDS: Radioassisted surgery, γ-ray probes, special γ-collimators.

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Rectal Dosimetry: a Practical Approach

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Abstract

The aim of this study is to describe a practical method for measuring rectal dose by using a semiconductor detector (diode) placed in rectum, in order to compare *in vivo* dosimetric data to dose values reconstructed by the radiotherapy treatment planning system (RTPS).

Patients undergoing this study had rectal cancer. The treatment was performed with patient in prone position and using three isocentric 18MV photon beams produced by two linear accelerators (Varian Clinac 1800 and 2100c, $TPR^{20}_{10} = 0.78$). The dosimetric technique developed by us can be divided into three steps. First, to develop a mathematical algorithm accounting for calibration and correction factors for different geometries. Second, to develop a departmental protocol for placement of diode into patient for simulation and treatment. Third, to evaluate data. During the simulation the probe position and the distance from the anal verge is determined. This distance is used during the treatment where, starting from two orthogonal portal films, point dose coordinates are evaluated. The RTPS allows us to calculate the dose at this point and finally the data are compared to the ones obtained by the probe. This procedure was applied to 15 patients affected with rectal cancer. These patients were treated with a posterior anterior (PA) conformal field combined with two opposite lateral wedged conformal fields.

Correction factor application is not relevant to the dose calculation, since the resulting values are very close to unity, apart field dimension correction factor. The clinical results show a good agreement between the experimental values and the RTPS ones: an overall uncertainty that can be quantified in 1.1% ± 3.3%, that corresponds to 1 standard deviations, for single field doses and 1.4% ± 2.0% for total internal dose at the rectum.

Owing to its simplicity, it is promising to employ this method in particular treatments where it is important to know the dose actually imparted to specific organs.

KEYWORDS: Radiotherapy, Intracavitary dosimetry, Semiconductor detector.

In vivo Effectiveness of Gadolinium Filter for Paediatric Cardiac Angiography in Terms of Image Quality and Radiation Exposure*

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Abstract

We investigated the in vivo effectiveness of using a gadolinium filter for cardiac angiography of small children (aged 0-6 yr) to reduce the patients' exposure while maintaining image quality. During 10 interventional procedures that necessitated a double angiographic examination (i.e., pre- and post-intervention), data were acquired using an Exposure Area Product (EAP) meter and by filtering the incident X-ray beam with a foil of 0.1 mm of gadolinium. Image quality was assessed by two independent cardiologists who scored noise, contrast and visualisation of small details from corrisponding images extracted from sequences obtained on the same patient with and without the filter, while effective dose per frame estimates were calculated from EAP measurements. When the filter was used, the mean radiological and effective doses significantly decreased (from 10.0% to 20.3% in the individual patient, mean of 14.3%), without any observable difference in image quality. Such dose reductions could be of relevance for young paediatric patients requiring cardiac angiography.

KEYWORDS: Radiological exposure, X-ray beam filtration, Gadolinium, Image quality, Angiography.

A practical approach for accurate quantitative measurements involving planar imaging by gamma-camera*

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Abstract

In internal emitter therapy, an accurate description of the absorbed dose distribution is necessary not only to establish an administered dose-response relationship, but also to avoid critical organ toxicity. In this context, quantitative scintigraphic imaging represents an important approach to extracting patient pharmacokinetic information. The most commonly employed imaging method for quantification of radioactivity in vivo uses 180° opposed planar images (conjugate views technique) in combination with transmission data trough the subject and a system calibration factor.

This paper proposes a new approach to convert source region count rate into absolute activity. Measuring planar sources in air according to different geometries has in fact allowed us to calculate a calibration factor curve as a function of source-collimator distance for each fixed threshold value tested (ranging 10%-50%) to define ROIs. This method has proved to be successful for two reasons. On one hand, it permitted to subsequently derive the calibration factor C for conjugate views with the only knowledge of heads distance; nor prefixed geometric configurations neither reference sources are required. On the other hand, it permitted an accurate quantification even if the source is clearly visible only in one view.

Corrections for source thickness, attenuation, background and scattering are easily integrated with a similar approach. In our analysis we tested step by step all these corrections on known sources in different situations; the total experiment test set consisted of 53 × 2 sources images. The error estimation was within 9% for single views and within 5% for double conjugate views.

KEYWORDS: Quantitative gamma-camera imaging, in vivo radioactivity quantification, conjugate views, internal dosimetry.

A multipurpose head phantom for stereotactic radiotherapy*

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Abstract

A bullet shaped head phantom was designed for the verification of the localization and the treatment delivery of stereotactic radiotherapy procedure. The phantom allows the accommodation of TLDs, films, and test objects. It can be easily constructed and it can be used in any linac-based stereotactic unit for both routine and commissioning performance testings. Its use at the stereotactic unit of the University Hospital of Patras indicated a mean error in the localization procedure of (1.0 ± 0.5) mm and a mean spatial uncertainty in treatment delivery of (1.7 ± 0.6) mm. In addition, the deviation of the isocenter dose determined using TLDs from the calculated one was less than 1.5%, when corrected for the density difference between water and PMMA. The dose distributions obtained with radiochromic films were in good agreement with the calculated. However, thermoluminescent dosimetry indicated sharper dose distributions (1-2 mm).

KEYWORDS: Phantom, dosimetry, localization errors, stereotactic radiotherapy.