

PHYSICA MEDICA

<http://www.physicamedica.com>

Indexed/Abstracted in:

ISI (*Biophysics & Biochemistry Citation Index®*, *Science Citation Index-Expanded®*,
Journal Citation Reports Science®, *Bioscience Citation Index®*)

Excerpta Medica (*EMBASE*),

INSPEC (*Current Papers in Physics and Physics Abstracts*)

QUEST (a data base dedicated to Health and Medical Physics Journal).

VOL. XVII, N. 3, 2001, July-September

	page
Original Papers	
<i>M.-A. Bazioglou, J. Kalef-Ezra, C. Kappas</i> Comparison of dosimetric techniques for the assessment of basic dosimetric data of stereotactic fields	123
<i>Th.O.J. Fuchs, J.U. Krause, W.A. Kalender</i> Measurement of 3D Spatial Resolution in Multi-slice Spiral Computed Tomography	129
<i>V. Ekstrand, H. Berglund, H. Wiksell</i> Provocation of heat generated arterial thrombi in pigs	135
<i>A.M. Loske, F.E. Prieto</i> Dual-phase reflectors for extracorporeal shock wave lithotripsy	141
Technical Note	
<i>M.G. Brambilla, M. Ciocca, P. Lattuada, A.F. Monti, M. Princivalli, L. Raffaele</i> Energy constancy checks on a linear accelerator: comparison of different procedures	151
Abstract session	
<i>A European Congress of Medical Physics and Clinical Engineering, September 12-15, 2001, Belfast, UK (VII EFOMP Congress, IPEM Annual Scientific Meeting, APSM Annual Scientific Meeting)</i> Programme and Abstracts	159
Announcement	
<i>Galileo Galilei Award in Medical Physics</i>	205

Comparison of dosimetric techniques for the assessment of basic dosimetric data of stereotactic fields

M.-A. Bazioglou¹, J. Kalef-Ezra*¹, C. Kappas²

1. *Medical Physics Laboratory, Medical School, University of Ioannina, Ioannina (Greece)*

2. *Medical Physics Laboratory, Department of Medicine, School of Health Sciences, University of Patras, Patras (Greece)*

Manuscript received: October 10, 2000; revised: March 19, 2001

Accepted for publication: March 21, 2001

Abstract

The purpose of the present study was to compare the adequacy of various dosimetric techniques in the determination of the basic dosimetric data of 6 MV photon beams with diameters ranging from 10-40 mm. Ionization chambers of effective volumes 0.1 and 0.015 cm³, LiF:Mg,Ti ... TLDs of dimensions 1 × 1 × 1 mm³, radiographic films X-Omat V and radiochromic films MD-55-2 were used. The studied parameters were: collimator output factors (COF), percentage depth dose distributions (PDDs), FWHM, and penumbral width.

The 0.1 cm³ ionization chamber in vertical configuration underestimates the COF and overestimates the PDDs for depths beyond d_{max} , for field diameters less than 20 mm. The depth dose curves at depths beyond d_{max} obtained by the remaining techniques were in good agreement. All dosimetric techniques were in fair agreement in the determination of the FWHM. However, the films were superior in the determination of the penumbral widths. In conclusion, the combination of ion chamber and radiographic film dosimetry allows the accurate assessment of the basic dosimetric data in clinical practice.

KEYWORDS: Stereotactic radiotherapy, dosimetry, TLD, film.

Measurement of 3D Spatial Resolution in Multi-slice Spiral Computed Tomography

Th.O.J. Fuchs*, J.U. Krause, W.A. Kalender

Institute of Medical Physics, University of Erlangen-Nürnberg, Krankenhausstrasse 12, D-91054 Erlangen (Germany)

Manuscript received: January 23, 2001; revised: March 26, 2001

Accepted for publication: April 5, 2001

Abstract

The latest generation of Multi-slice Spiral CT (MSCT) systems with submillimeter slice collimation and improved z -filtering/interpolation algorithms is expected to yield definitely improved spatial resolution in all directions in clinical routine. In our study we developed appropriate methods to quantify and visualize 3D spatial resolution at that level in order to validate the expectations.

We assessed the spatial resolution of a clinical MSCT scanner with respect to the spatial coordinate axes x , y and z . The Point Spread Function (PSF) in the x/y -plane (transversal orientation) and the Slice Sensitivity Profile (SSP) in z -direction were experimentally evaluated. In both cases, the Modulation Transfer Function (MTF) was derived. We varied the in-plane acquisition mode and the convolution kernel for the transversal evaluation and the slice collimation and reconstructed slice width (S_{eff}) for the spiral scans, respectively. In addition, we used a 3D bar pattern phantom to quantify the limiting high-contrast spatial resolution.

The choice of acquisition mode dominates the limiting in-plane resolution which is described by the cut-off frequency of the MTF_{xy} . This value is higher than 15 Lp/cm and 25 Lp/cm for the standard and the high-resolution mode, respectively, for the clinical system we scrutinized. Similar limiting spatial frequencies were found in z -direction: With 2×0.5 mm collimation the first zero-crossing of the MTF_z is at approximately 15 Lp/cm and 10 Lp/cm for $S_{eff} = 0.5$ mm and 1.0 mm, respectively. With 4×1.0 mm collimation we found 5.0 Lp/cm, 6.5 Lp/cm and 10 Lp/cm for $S_{eff} = 2.0$ mm, 1.5 mm and 1.0 mm, respectively. The two curves for $S_{eff} = 1.0$ mm differed clearly with an improved MTF_z for the submillimeter collimation.

The analysis of the respective MTFs showed that multi-slice spiral data acquisition and submillimeter slice collimation can provide isotropic resolution of details with size equal or smaller than 0.5 mm in 3D. This allows for high quality 3D image post-processing such as multi-planar reformations or virtual endoscopy.

KEYWORDS: Computed Tomography (CT), Multi-slice Spiral CT (MSCT), Image Quality, 3D Isotropic Spatial Resolution.

Provocation of heat generated arterial thrombi in pigs

V. Ekstrand^{1,2}, H. Berglund³, H. Wiksell^{1,2}

1. *Division of Surgical Science, Department of Urology, Karolinska hospital, Stockholm (Sweden)*
2. *Comair AB, Stockholm (Sweden)*
3. *Department of Cardiology, Huddinge University Hospital, Stockholm (Sweden)*

Manuscript received: February 2, 2001

Accepted for publication: April 11, 2001

Abstract

Methods for provocation of arterial thrombi should be fast and reliable, utilise the natural coagulation system and capable of withstanding the blood pressure forces in vessel of a sufficient size to mimic the forces generated in human vessels of interest.

In a porcine model we used RF-energy transmitted in a bipolar catheter to cause a highly localised thermal injury. Changes in temperature and electrode impedance over time were measured positioning the catheter in dead and live muscle and in the femoral and carotid artery. After heating of the artery vessel wall the artery was occluded for 15 min.

Exposure for 30 seconds with approximately 6 W gave occlusive thrombi in 11 of 11 arteries. During heating the electrical electrode impedance first decreased and then abruptly increased.

We have demonstrated a fast and highly effective method to provoke occlusive arterial thrombosis in vessels of sufficient size to be relevant for human vessels such as the coronary arteries. The observed rapid increase of the impedance and the characteristic modulation of the RF-signal during the final phase may serve as tools to terminate the procedure when a sufficient dose has been delivered to the endothelium.

KEYWORDS: Thrombi, radiofrequency, catheter, occlusion, provocation.

Dual-phase reflectors for extracorporeal shock wave lithotripsy

A.M. Loske, F.E. Prieto

Instituto de Física, Departamento de Física Aplicada y Tecnología Avanzada, Universidad Nacional Autónoma de México, Juriquilla, Qro. (Mexico)

Manuscript received: February 13, 2001; revised: April 20, 2001.

Accepted for publication: April 26, 2001

Abstract

The goal of this study was to describe the design and performance of dual-phase reflectors to be used in electrohydraulic lithotripters in order to increase efficiency during extracorporeal shock wave lithotripsy (ESWL). These reflectors generate two phase-inverted pulses, instead of only one positive peak, followed by a trough, as in conventional systems. Pressure measurements and stone fragmentation efficiency of two novel reflectors were compared to that of a conventional reflector. One of the new reflectors was more efficient in breaking up kidney-stone models than the conventional ellipsoidal reflector.

KEYWORDS: ESWL, shock wave focusing, cavitation.

Energy constancy checks on a linear accelerator: comparison of different procedures

M.G. Brambilla¹, M. Ciocca^{2*}, P. Lattuada³, A.F. Monti⁴, M. Princivalli⁵, L. Raffaele⁶

1. *Department of Medical Physics, Ospedale Niguarda Cà Granda, piazza Ospedale Maggiore 3, Milano (Italy)*

2. *Department of Medical Physics, European Institute of Oncology, via Ripamonti 435, 20141 Milano (Italy)*

3. *Department of Radiation Oncology, Casa di Cura S. Pio X, via F. Nava 31, 20159 Milano (Italy)*

4. *Department of Medical Physics, Ospedale S. Anna, via Napoleona 60, 22100 Como (Italy)*

5. *Department of Medical Physics, Ospedale Ca' Foncello, piazza Ospedale 1, 31100 Treviso (Italy)*

6. *IST Genova, Istituto di Radiologia, Università di Catania, viale Santa Sofia 5, 95100 Catania (Italy)*

Manuscript received: May 30, 2000; revised: January 26 and May 28, 2001.

Accepted for publication: May 30, 20001

Abstract

Within a program of Quality Assurance on a medical linear accelerator, periodic tests of radiation energy constancy should be performed. In this work, different procedures adopted in Italy for energy constancy checks have been tested, in order to show relative differences in terms of practicability, adequacy and sensitivity to forced beam energy variations.

Energy constancy checks were performed in photon and electron beams, using an automatic water phantom, a solid slab phantom and a commercial phantom for quality control. Procedures suggested or adapted from five different technical reports were tested. Known variations of radiation beam energies were obtained using a 60° motorized wedge and by modifying beam bending magnet currents via software.

Depth dose measurements in the water phantom seemed to be the most reliable procedure, because several parameters related to both dose and depth (i.e., D10, D20, d_{80} , d_{50} and so on) could be analysed, but it was not as practical as other procedures. The sensitivity to beam energy variations strongly depended on the analysed parameter (depth dose values, dose ratios and depths) and beam quality. Methods based on measurements of depth dose ratios in a slab phantom appeared faster and more practical. The sensitivity of these procedures was very high for electron beams, while for photons it did not seem to depend significantly on the adopted geometry nor on the analysed parameter (TPRs and dose ratios). The method involving the use of a commercial phantom appeared to be quick enough to allow daily checks, although beam energy characterization using an off-axis detector did not seem reliable enough, due to sensitivity to fluctuations in beam flatness.

KEYWORDS: Linear accelerators, quality control, radiation energy checks.

Abstracts

A European Congress of Medical Physics and Clinical Engineering

VII EFOMP Congress

IPEM Annual Scientific Meeting

APSM Annual Scientific Meeting

September 12-15, 2001, Belfast, UK

Oral Presentations: Wednesday, September 12 page 159 to 166

Thursday, September 13 page 166 to 178

Friday, September 15 page 178 to 190

Poster Presentations: September 12-15 page 190 to 204

Abstracts for the UK British Nuclear Medicine Society's Autumn Meeting which is being held in parallel (and open to Congress participants) are not included except where the abstract forms part of the Congress.

PROGRAMME AND ABSTRACTS