713 PUBLICATION

Non invasive tissue diagnostic by means of backscattered light

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Purpose: To use a small power laser for tissue diagnosis especially in oncologic patients presenting with apparent or occult malignant disease on an out-patient basis avoiding invasive methods.

Methods: We developed a device based on backscattered light from tissue. It consists of a small pen like power laser (power output 0.8 Milli-Watt) at a wavelenght of 670 Nanometer. The laser output is placed on the tissue surface. In contrast to most methods which use tissue dependent absorption we look at the backscattered light whereby scattering exceeds absorption in case of (normal) biological tissue about two orders of magnitude. Backscattered light is guided by a glass fibre to an optio-electrical converter. This is realized by a transimpedance sensitive transimpedance amplifier with an upper bandwith of 1 KiloHertz. Only the time dependent share of the signal (in the range of some 10 to 100 PicoWatt) is further amplified, filtered to reduce the overall bandwith from 1.5 Hertz to 100 Hertz, analog-to-digital converted and stored on a PC for further off-line analysis. Frequency distribution of the signal is between 10 to 30 Hertz in case of physiological tissue.

Results: For malignancies we found a distinct lowering of the frequencies between 4 to 7 Hertz. These results were verified by clinical inspection and histological findings. We also show scarred tissue with small amplitudes and high frequencies and infiltration characterised by high amplitudes and high frequencies.

Conclusion: The proposed non invasive device offers an out-patient method to distinguish different tissues and to prove lesions as malign. Moreover, no (photo) sensitizing agents must be administered. For further analysis methods of chaos theory will be used.

714 PUBLICATION

Serum TNF-α and IL-6 alterations and blood cell counts during the acute phase following head and neck irradiation: An animal study

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Purpose: The potential modulatory role of zinc-desferrioxamine [Zn-DFO] on the effects of irradiation [IR] was examined because of its known ability to protect against the damage induced by free radicals mediated by redox-active metal ions.

Materials/Methods: Three groups of male Wistar rats were used: sham irradiated controls; irradiated [15 Gy]; irradiated and treated with Zn-DFO [20 mg/k] one hour prior to IR. During the first two weeks post-IR, body weight and food and water intake were monitored daily, while lymphocytes, segmented neutrophils and white blood cells [WBC] were counted at 10 mins, 4 and 16 hours and 1, 3, 7 and 14 days. Serum TNF-α and IL-6 were obtained at 10 rains and 7 days.

Results: On day 7 post-IR, body weight and food and water intake were reduced by 84%, 96% and 85%, respectively. This resulted in the death of 22% of the animals and was followed by recovery toward the end of the second week At all time points examined, WBC were reduced by 52–74%. On the 7th day, Zn-DFO demonstrated a 33% protective effect against the WBC reduction. At 10 rains post-IR, a 84.8-fold increase of TNF-α but not IL-6 was noted. However, on the 7th day post-IR, both TNF-α and IL-6 levels were increased by 48.5 and 102.5-fold respectively.

Conclusion: The severe cachetic and immunocompromised status of the animals should be considered when performing short-term studies with this model. Nutritional and immunological support is recommended. Further evaluation of the underlying mechanisms of IR-induced leukopenia and cachexia in the animals and the possible implications for humans are warranted.

715 PUBLICATION

Investigation of pentoxyfilline and taxol as a potential radiation sensitizer in C3H mice with FM3A breast tumor

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Pupose: Pentoxyfillin (PTX), a methylxanthine derivative, increases the oxygen partial pressure in murine tumors and enhances the radioresponse of the tumors probably by increasing the tumor blood perfusion. Paclitaxel's (TX) ability to arrest cells in the G2 and M phases makes it a potential radiosensitizer. The purpose of present investigation was to elucidate whether the radiation (RT) damage in tumors can be increased with PTX alone or in combination with TX by using growth delay of FM3A tumors in C3H mice as the endpoint.

Methods: Female C3H/HeNBom mice bearing 8 mm FM3A breast carcinoma in their hind legs, were studied in three treated groups that were RT, RT + PTX, RT + PTX + TX and one no treatment (control) group. 50 mg/kg PTX ip. and 60 mg/kg TX iv. were given 15 min. and 24 h before 20 Gy single dose local tumor irradiation respectively. Radiation sensitizer effects were mesured using tumor growth delay (TGD).

Results: There were significant tumor growth delay difference between treatment and control groups. RT, RT + PTX and RT + PTX + TX were more effective on TGD respectively. The enhancement factors were 1.35 in RT + PTX group and 1.85 in RT + PTX + TX group.

Conclusion: PTX and TX gave additive radiopotentiating effect. The present data suggest that these drugs should be considered as a radiation enhancer for clinical radiotherapy.

716 PUBLICATION

Age-related differences in compensation of bone marrow injury after therpeutic irradiation

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Purpose: To determine age-related peculiarities of hematopoietic compensation after therapeutic irradiation.

Methods: BM scintigraphy with radiocolloids was performed 1–127 months after the end of radiotherapy (RT) in 69 adults and in 29 children. BM doses ranged from 28 to 45 Gy, irradiated volumes – from one field to total nodal irradiation (TNI). "In-field" BM activity and peripheral expansion of hematopoiesis (PEH) were estimated: from grades 1–2 – no or reduced BM activity to grades 3–4 – partial or full BM recovery; from grades 1–2 -slight or moderate PEH to grade 3 – severe PEH.

Results: During first half a year after RT scintigraphic signs of BM depression were mentioned in 70 of 71 (98%) regions evaluated in adults and in 17 of 17 (100%) – in children. Between 6–12 months after irradiation there were 75% (in 6 of 8 areas) of BM recovery in children and 52% (in 17 of 33 areas) – in adults ($p < 0.05$). Age-related differences in the rates of BM recovery persisted even 13 and more months after RT: grades 3–4 of tracer uptake were detected in 63% (80 of 120) of irradiated regions in adults and in 77% (14 of 18) – in children. PEH was common mechanism of compensation in children. Grade 3 PEH occurred in 12 of 15 patients and appeared even after limited field irradiation. In adults severe PEH was revealed only after TNI and usually appeared 12 and more months after the end of RT.

Conclusion: In children post-RT compensation of hematopoiesis characterised by early PEH and increased rates of "in-field" BM recovery.

717 PUBLICATION

Tumor growth suppression by boron neutron capture therapy with 10B entrapperd PEG-liposome in pancreatic cancer model in vivo

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The tumor cell destruction in boron neutron-capture therapy (BNCT) is due to the nuclear reaction between 10B and thermal neutrons. It is necessary for effective BNCT to accumulate of 10B atoms in the tumor cells.