

RADIATION RISKS TO CHILDREN FROM MEDICAL IMAGING

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INTRODUCCIÓN

Medical imaging is extremely important value and role in the care of the ill or injured child. This includes diagnosis of emergent including life threatening conditions, as well as an aid in management, such as appropriate triage to promote efficient and judicious use of medical resources. For example, CT and MR have been heralded as one of the most significant medical advancements in the past 30 years, based on a survey of medical practitioners (1). While much of the following material will discuss the specific risks of ionizing radiation related to medical imaging, one must not lose sight that when used appropriately, the benefits of medical imaging are far in excess of real and potential risks.

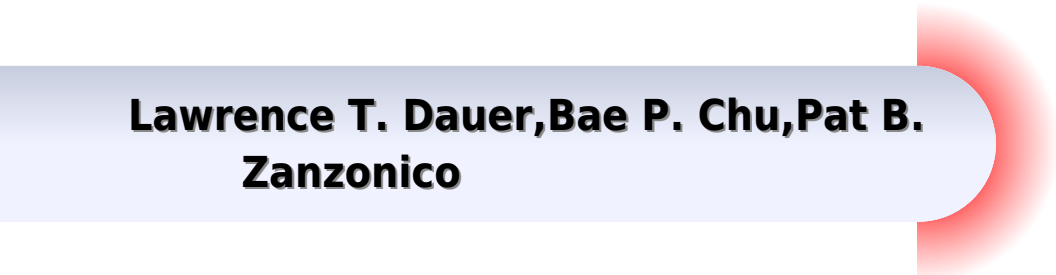
Much of medical imaging depends on the use of x-rays, a type of ionizing radiation, for imaging formation. The general modalities that use x-rays consist of radiography, fluoroscopy (including angiography), computed tomography (CT) and nuclear imaging (also known as nuclear medicine). Other modalities which do not use ionizing radiation which are commonly used for medical imaging consist of sonography, and magnetic resonance imaging. Radiation, in relatively high doses, has known biological effects. These effects include the induction of cancer. Almost without exception, diagnostic medical imaging uses low levels of radiation and the types of biological effects and attendant risks of cancer will be different (as discussed below). The topic of radiation

risk in medical imaging is also timely, especially in the United States where there has been increased public attention mostly through media scrutiny reporting radiation doses from medical imaging and biological effects. These reports included hair loss from perfusion imaging (a type of brain CT examination) (2), radiation dermatitis from CT examination in a child (3), relatively high doses from radiography in dental evaluation (4), and excessive radiation doses from improperly performed neonatal radiography (5). Because radiation related effects especially cancer may not be evident for years even decades, concern may be long lasting. I have received communications from parents even several years after imaging evaluation who are concerned about what they have heard about cancer risks and radiology in the media. Recently, the first scientific investigation associating pediatric CT with cancer was published in Lancet (6). Taken together, the importance of medical imaging using ionizing radiation, and continued, and in some circumstances, escalating use of this imaging in both adults and children, and the persistent and often pervasive attention to the long lasting possibility of cancer from ionizing radiation in levels found with diagnostic medical imaging necessitates a reasonable understanding of the risk aspect of the risk/benefit ratio for diagnostic medical imaging. This basic understanding applies to all medical practitioners, not just those with imaging expertise (i.e. radiologist). These healthcare providers, such as pediatricians or emergency medicine physicians will be potentially involved in discussions with colleagues about risks and benefits in patient management, as well as conversations with patients about the potential risks and benefits.

This topic of radiation risk and medical imaging applies to all ages. However, it is particularly important in children. Children are relatively

Radiation Risks In Medical Imaging

**Lawrence T. Dauer, Bae P. Chu, Pat B.
Zanzonico**



Radiation Risks In Medical Imaging:

Radiation Risks in Medical Imaging Joseph P. Whalen, Stephen Balter, 1984 **Dose, Benefit, and Risk in Medical Imaging** Lawrence T. Dauer, Bae P. Chu, Pat B. Zanzonico, 2018-10-11 This timely overview of dose benefit and risk in medical imaging explains to readers how to apply this information for informed decision making that improves patient outcomes The chapters cover patient and physician perspectives referral guidelines appropriateness criteria and quantifying medical imaging benefits The authors have included essential discussion about radiologic physics in medical imaging fundamentals of dose and image quality risk assessment and techniques for optimization and dose reduction The book highlights practical implementation aspects with useful case studies and checklists for treatment planning Clinicians students residents and professionals in medical physics biomedical engineering radiology oncology and allied disciplines will find this book an essential resource with the following key features Discusses risk benefit dose optimization safety regulation radiological protection and shared informed decision making Covers regulatory oversight by government agencies manufacturers and societies Highlights best practices for improving patient safety and outcomes Gives guidelines on doses associated with specific procedures **Tracking Radiation Exposure from Medical Diagnostic Procedures** Committee on Tracking Radiation Doses from Medical Diagnostic Procedures, Nuclear and Radiation Studies Board, Division on Earth and Life Studies, National Research Council, 2012-06-26 The growing use of medical diagnostic procedures is correlated with tremendous and undeniable benefits in the care of most patients However it is accompanied by growing concerns about the risks associated with diagnostic computed tomography and other procedures that utilize ionizing radiation A number of initiatives in radiation safety in medicine have taken place in the United States and internationally each serving different purposes Their ultimate goals are to provide higher quality clinical management of the patient and to ensure that reasonable steps are taken to keep the exposures as low as possible without compromising diagnostic efficacy Tracking Radiation Exposure from Medical Diagnostic Procedures Workshop Reports provides a summary of the presentations and discussions that took place during the December 8 9 2011 workshop titled Tracking Radiation Exposure from Medical Diagnostic Procedures This workshop was organized by the Nuclear and Radiation Studies Board of the National Academy of Sciences and sponsored by the Centers for Disease Control and Prevention the U S Food and Drug Administration and the U S Department of Health and Human Services This workshop report was authored by a six member committee of experts appointed by the National Academy of Sciences This committee brought together public health regulators physicians manufacturers researchers and patients to explore why what and how to track exposure from medical diagnostic procedures and possible next steps *Tracking Radiation Exposure from Medical Diagnostic Procedures* National Research Council, Division on Earth and Life Studies, Nuclear and Radiation Studies Board, Committee on Tracking Radiation Doses from Medical Diagnostic Procedures, 2012-06-12 The growing use of medical diagnostic procedures is correlated with

tremendous and undeniable benefits in the care of most patients. However, it is accompanied by growing concerns about the risks associated with diagnostic computed tomography and other procedures that utilize ionizing radiation. A number of initiatives in radiation safety in medicine have taken place in the United States and internationally, each serving different purposes. Their ultimate goals are to provide higher quality clinical management of the patient and to ensure that reasonable steps are taken to keep the exposures as low as possible without compromising diagnostic efficacy.

Tracking Radiation Exposure from Medical Diagnostic Procedures Workshop Reports provides a summary of the presentations and discussions that took place during the December 8-9, 2011 workshop titled *Tracking Radiation Exposure from Medical Diagnostic Procedures*. This workshop was organized by the Nuclear and Radiation Studies Board of the National Academy of Sciences and sponsored by the Centers for Disease Control and Prevention, the U.S. Food and Drug Administration, and the U.S. Department of Health and Human Services. This workshop report was authored by a six-member committee of experts appointed by the National Academy of Sciences. This committee brought together public health regulators, physicians, manufacturers, researchers, and patients to explore why, what, and how to track exposure from medical diagnostic procedures and possible next steps.

Patient Radiation Exposure Monitoring in Medical Imaging (IAEA, 2023-07-06) was written to assist the implementation in medical imaging practice of the requirements of the IAEA Safety Standards Series No. GSR Part 3, *Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards*. This publication provides consolidated information and detailed advice for setting and implementing patient radiation exposure monitoring programmes at the local or national level. In medical imaging using ionizing radiation, including X-ray diagnostic radiology, diagnostic nuclear medicine, and image-guided interventional procedures, radiation protection of patients is achieved by selecting the most appropriate imaging procedure for the individual needs of the patient and by keeping exposure to the minimum necessary to achieve the diagnostic and interventional objective. Monitoring of radiation exposure of patients provides critical information for health care professionals and authorities who are responsible for ensuring justified and optimized use of radiation in medicine. This Safety Report provides guidance on recording, collecting, and analysing relevant patient exposure data by using manual or automatic means. An aim of the publication is to encourage the future use and development of automatic digital systems to improve access to information about patient radiation exposure and thus contribute to improved implementation of the requirements for radiation protection of patients throughout the world.

Radiation Protection in Medical Radiography (Mary Alice Statkiewicz Sherer, Paula J. Visconti, PhD, DABR, E. Russell Ritenour, Kelli Haynes, MSRS, RT(R), 2013-12-04) is a full-color resource. *Radiation Protection in Medical Radiography* 7th Edition makes it easy to understand both basic and complex concepts in radiation protection biology and physics. Concise coverage promotes the safe use of ionizing radiation in all imaging modalities, including the effects of radiation on humans at the cellular and systemic levels, regulatory and advisory limits for human exposure to radiation, and the implementation of

radiation safety practices for patients and personnel This edition includes NEW content on the impact of radiation levels during the nuclear power plant crisis that followed the 2011 earthquake tsunami in Japan From an author team led by well known radiation protection expert Mary Alice Statkiewicz Sherer this text has consistently helped students perform well on the ARRT exam well written and easy to comprehend Reviewed by Kirsten Farrell on behalf of RAD Magazine March 2015 Full color illustrations reinforce important information Convenient easy to use features include chapter outlines and objectives highlighting of key terms and bulleted summaries and review questions to enhance comprehension and retention Clear and concise writing style covers complex concepts in radiation protection biology and physics in a building block approach from basic to more complex concepts Review questions are included at the end of chapters to assess your comprehension with answers on the Evolve companion website Coverage of historical radiological disasters includes photos and text on Hiroshima Chernobyl and Three Mile Island UPDATED NCRP and ICRP content includes guidelines regulations and radiation quantities and units explaining the effects of low level ionizing radiation demonstrating the link between radiation and cancer and other diseases and providing the regulatory perspective needed for practice NEW Discussion of Total Effective Dose Equivalent TEDE covers the radiation dosimetry quantity defined by the U S Nuclear Regulatory Commission to monitor and control human exposure to ionizing radiation NEW Coverage of the Fukushima Daiichi Nuclear Plant Crisis addresses the impact of radiation levels following Japan s earthquake tsunami in March 2011 NEW TRACE section covers the Tools for Radiation Awareness and Community Education program a two phase approach to radiation dose awareness and overall patient dose reduction through a joint venture of AHRA and Toshiba s Putting Patients First NEW Discussion of the FDA white paper Initiative to Reduce Unnecessary Exposure from Medical Imaging promotes the safe use of medical imaging devices supports informed clinical decision making and leads to increased patient awareness

Radiation Protection In Diagnostic X-Ray Imaging , **Radiation Exposure and Occupational Risks** Eberhard Scherer,Christian Streffer,Klaus-Rüdiger Trott,2012-12-06 The aim of radiation protection standards is to make the radiation workplace as safe as is humanly possible The gradual evolution over the last 20 years has been towards a more precise definition of the limits for occupational exposure These have been created not only in terms of short term effects but also more importantly in terms of long term risks involving such problems as the potential for carcinogenesis and genetic change In the United States the National Committee for Radiation Protection has recommended that 5 rems 50 mSv should remain as the maximum permissible dose equivalent for total body exposure This would represent the sum of internal and external exposure and should be regarded as the upper limit allowed The community of radiation users is required to conduct its operations in such a manner that the absolute value of the individual s dose equivalent in rems does not exceed his age in years There should be additional limits for tissues and organs based on short term effects Therefore individual organs are limited to dose equivalents low enough to ensure that the dose threshold values are not exceeded **The Essential Physics**

of Medical Imaging Jerold T. Bushberg, J. Anthony Seibert, Edwin M. Leidholdt, Jr., John M. Boone, 2012-11-24 Widely regarded as the cornerstone text in the field the successful series of editions continues to follow the tradition of a clear and comprehensive presentation of the physical principles and operational aspects of medical imaging The Essential Physics of Medical Imaging 4th Edition is a coherent and thorough compendium of the fundamental principles of the physics radiation protection and radiation biology that underlie the practice and profession of medical imaging Distinguished scientists and educators from the University of California Davis provide up to date readable information on the production characteristics and interactions of non ionizing and ionizing radiation magnetic fields and ultrasound used in medical imaging and the imaging modalities in which they are used including radiography mammography fluoroscopy computed tomography magnetic resonance ultrasound and nuclear medicine This vibrant full color text is enhanced by more than 1 000 images charts and graphs including hundreds of new illustrations This text is a must have resource for medical imaging professionals radiology residents who are preparing for Core Exams and teachers and students in medical physics and biomedical engineering

The Creative Destruction of Medicine Eric Topol, 2012-01-31 A professor of medicine reveals how technology like wireless internet individual data and personal genomics can be used to save lives

Radiation Risks In Medical Imaging Book Review: Unveiling the Power of Words

In some sort of driven by information and connectivity, the energy of words has are more evident than ever. They have the capacity to inspire, provoke, and ignite change. Such may be the essence of the book **Radiation Risks In Medical Imaging**, a literary masterpiece that delves deep into the significance of words and their affect our lives. Published by a renowned author, this captivating work takes readers on a transformative journey, unraveling the secrets and potential behind every word. In this review, we will explore the book is key themes, examine its writing style, and analyze its overall impact on readers.

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