

# 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

**Sudip Paul, Angana Saikia, Vinayak  
Majhi, Vinay Kumar Pandey**



## **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      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      **Radiation Protection in Medical Imaging and Radiation Oncology** Richard J. Vetter, Magdalena S. Stoeva, 2016-01-05 Radiation Protection in Medical Imaging and Radiation Oncology focuses on the professional operational and regulatory aspects of radiation protection Advances in radiation medicine have resulted in new modalities and procedures some of which have significant potential to cause serious harm Examples include radiologic procedures that require ve      **Patient Radiation Exposure Monitoring in Medical Imaging** IAEA, 2023-07-06 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

*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

Radiological Safety and Quality Lawrence Lau, Kwan-Hoong Ng, 2013-11-22 This book is the product of a unique collaboration by experts from leading international regional and national agencies and professional organizations discussing on the current hot issue on the judicious use and safety of radiation in radiology There have been several cases involving radiation overexposure that have received international attention Strategies and solutions to guide readers how to maximize the benefits and minimize the risks when using radiation in medicine are covered

**Evidence-Based Imaging in Pediatrics** L. Santiago Medina, Kimberly E. Applegate, C. Craig Blackmore, 2010-03-10 This

practical book is ideal for readers who want to rapidly determine the appropriate imaging for pediatric patients The text provides a concise and accessible summary of the literature on how and when to use imaging studies Chapters address the essentials such as cost effectiveness and are written in collaboration by renowned specialists in the fields of pediatrics and pediatric radiology Topics cover common clinical scenarios in neuroimaging and musculoskeletal chest and abdominal imaging Each imaging recommendation is presented along with the supporting data and the strength of the evidence

Quality and Safety in Imaging Lluís Donoso-Bach, Giles W. L. Boland, 2018-09-18 This book provides a roadmap for optimizing quality and safety within radiology practices whether academic or private and irrespective of their national setting All aspects of the radiology workflow are addressed from imaging appropriateness examination scheduling and patient preparation through to imaging protocol optimization including radiation dose management modality operations reporting including structured reporting and report communication The book highlights innovative IT tools including clinical decision support that drive compliance with national best practice standards and guidelines The use of big data tools to manage and enhance clinical delivery is addressed Finally metrics designed to measure the value that radiology brings to patient care and patient outcomes are introduced Readers wishing to deepen their understanding of contemporary best practices regarding quality and safety will find this book to be a rich source of practical information

**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

*Paediatric Imaging Manual* Jochen Tröger, Peter R. Seidensticker, 2008-08-15 Compared to adults children and adolescents suffer from different diseases and require different

treatments The same is true where imaging is concerned The diagnostic strategies are different The care prior to during and following the examination also differs from that of adults This CME accredited Manual provides a comprehensive overview on the field of paediatric radiology and suggests imaging strategies for the most common clinical indications in children and adolescents **The Essential Physics of Medical Imaging** Jerrold T. Bushberg,J. Anthony Seibert,Edwin M.

Leidholdt,John M. Boone,2011-12-28 This renowned work is derived from the authors acclaimed national review course Physics of Medical Imaging at the University of California Davis for radiology residents The text is a guide to the fundamental principles of medical imaging physics radiation protection and radiation biology with complex topics presented in the clear and concise manner and style for which these authors are known Coverage includes the production characteristics and interactions of ionizing radiation used in medical imaging and the imaging modalities in which they are used including radiography mammography fluoroscopy computed tomography and nuclear medicine Special attention is paid to optimizing patient dose in each of these modalities Sections of the book address topics common to all forms of diagnostic imaging including image quality and medical informatics as well as the non ionizing medical imaging modalities of MRI and ultrasound The basic science important to nuclear imaging including the nature and production of radioactivity internal dosimetry and radiation detection and measurement are presented clearly and concisely Current concepts in the fields of radiation biology and radiation protection relevant to medical imaging and a number of helpful appendices complete this comprehensive textbook The text is enhanced by numerous full color charts tables images and superb illustrations that reinforce central concepts The book is ideal for medical imaging professionals and teachers and students in medical physics and biomedical engineering Radiology residents will find this text especially useful in bolstering their understanding of imaging physics and related topics prior to board exams Introduction to Biomedical Instrumentation and Its Applications Sudip Paul,Angana Saikia,Vinayak Majhi,Vinay Kumar Pandey,2022-02-22 Introduction to Biomedical Instrumentation and Its Applications delivers a detailed overview of the various instruments used in the biomedical and healthcare domain focusing on both their main features and their uses in the medical industry Each chapter focuses on biomedical instrumentation in a different medical discipline covering a range of different topics including radiological devices instruments used for blood analysis defibrillators ventilators nerve stimulators and baby incubators This book seeks to provide the reader with in depth knowledge on biomedical devices thus enabling them to contribute to the future development of instruments in the healthcare domain This is a concise handbook that will be useful to students researchers and practitioners involved in biomedical engineering as well as doctors and clinicians who specialize in areas such as cardiology anesthesiology and physiotherapy Provides detailed insights into a variety of biomedical instruments for use in different medical areas such as radiology cardiology and physiotherapy Considers the advantages disadvantages and future developments of various biomedical instruments Equips researchers with an understanding of the working principles of various instruments thus

preparing them for the future development and design of innovative devices in the health domain Contains various mathematical derivations and numerical data that connect theory with the practical environment Features a section on patient safety and infection control in relation to the use of biomedical instruments     *Nelson Textbook of Pediatrics E-Book* Robert Kliegman, Joseph W. St. Geme III, 2019-04-01 Welcome to the 21st Edition of Nelson Textbook of Pediatrics the reference of choice among pediatricians pediatric residents and others involved in the care of young patients This fully revised edition continues to provide the breadth and depth of knowledge you expect from Nelson while also keeping you up to date with new advances in the science and art of pediatric practice Authoritative and reader friendly it delivers the information you need in a concise easy to use format for everyday reference and study From rapidly changing diagnostic and treatment protocols to new technologies to the wide range of biologic psychologic and social problems faced by children today this comprehensive reference keeps you on the cutting edge of the very best in pediatric care Includes more than 70 new chapters including Postural Orthostatic Tachycardia Syndrome POTS Rare and Undiagnosed Diseases Approach to Mitochondrial Disorders Electronic Nicotine Delivery Systems Zika update on Ebola Epigenetics Autoimmune Encephalitis Global Health Racism Media Violence Strategies for Health Behavior Change Positive Parenting and many more Features hundreds of new figures and tables throughout for visual clarity and quick reference Offers new and expanded information on CRISPR gene editing LGBT health care gun violence vaccinations immune treatment with CAR T cells new technology in imaging and genomics new protocols in cancer genetics immunology and pulmonary medicine and much more Provides fresh perspectives from four new associate editors Nathan J Blum of The Children s Hospital of Philadelphia Karen Wilson of Mt Sinai School of Medicine in New York Samir S Shah of Cincinnati Children s Hospital Medical Center and Robert C Tasker of Boston Children s Hospital Remains your indispensable source for definitive evidence based answers on every aspect of pediatric care     **Grainger & Allison's Diagnostic Radiology E-Book** Andy Adam, Adrian K. Dixon, Jonathan H Gillard, Cornelia Schaefer-Prokop, Ronald G. Grainger, 2014-06-16 Long recognized as the standard general reference in the field this completely revised edition of Grainger and Allison s Diagnostic Radiology provides all the information that a trainee needs to master to successfully take their professional certification examinations as well as providing the practicing radiologist with a refresher on topics that may have been forgotten Organized along an organ and systems basis this resource covers all diagnostic imaging modalities in an integrated correlative fashion and focuses on those topics that really matter to a trainee radiologist in the initial years of training the latest edition continues the fine tradition set by its predecessors help young radiologists to prepare for their examinations and continue to be a source of information to be dipped in and out of senior radiologists will also find the book useful Reviewed by RAD Magazine March 2015 I am sure the current edition will be successful and help young radiologists to prepare for their examinations and continue to be a source of information to be dipped in and out of Reviewed by RAD Magazine March 2015 Master the field and prepare for certification or recertification

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*The Essential Physics of Medical Imaging* Jerold T. Bushberg, J. Anthony Seibert, Edwin M. Leidholdt, Jr., John M. Boone, 2020-11-24 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

**Hendee's Physics of Medical Imaging** Ehsan Samei, Donald J. Peck, 2019-02-08 An up to date edition of the authoritative text on the physics of medical imaging written in an accessible format The extensively revised fifth edition of Hendee's Medical Imaging Physics offers a guide to the principles technologies and procedures of medical imaging Comprehensive in scope the text contains coverage of all aspects of image formation in modern medical imaging modalities including radiography fluoroscopy computed tomography nuclear imaging magnetic resonance imaging and ultrasound Since the publication of the fourth edition there have been major advances in the techniques and instrumentation used in the ever changing field of medical imaging The fifth edition offers a comprehensive reflection of these advances including digital projection imaging techniques nuclear imaging technologies new CT and MR imaging methods and ultrasound applications The new edition also takes a radical strategy in organization of the content offering the fundamentals common to most imaging methods in Part I of the book and application of those fundamentals in specific imaging modalities in Part II These fundamentals also include notable updates and new



content including radiobiology anatomy and physiology relevant to medical imaging imaging science image processing image display and information technologies The book makes an attempt to make complex content in accessible format with limited mathematical formulation The book is aimed to be accessible by most professionals with lay readers interested in the subject The book is also designed to be of utility for imaging physicians and residents medical physics students and medical physicists and radiologic technologists preparing for certification examinations The revised fifth edition of Hendee's Medical Imaging Physics continues to offer the essential information and insights needed to understand the principles the technologies and procedures used in medical imaging

*Health Care Reform in Radiology* Richard C. Semelka, Jorge Elias, 2013-05-29 The first book length treatment of the absolutely essential topic of U S health care reform for imaging specialists This latest volume in the Current Clinical Imaging series offers all professionals involved with imaging a cogent concise discussion of major issues related to health care reform from the perspective of fellow imaging specialists It provides radiologists with a solid footing in understanding where they are now and where they can expect to be in the evolution of health care reform over the next ten years Presenting an excellent balance of clinical and health care policy issues Health Care Reform in Radiology reinforces the central role of health promotion and preventive medicine in U S health care systems while offering an international perspective on the subject Topical coverage includes evidence based outcomes for health care delivery the impact of the determination of imaging tests effectiveness patient safety medicolegal reform reimbursement issues and universal healthcare benefits and challenges Health Care Reform in Radiology presents a program to Enhance patient safety and quality of care Anticipate new or revised standards for all imaging modalities Suggest the more appropriate use of imaging based on the latest clinical evidence Discuss the evolving regulations defining the training required to perform imaging procedures Encourage career long learning CME maintenance of certification etc Show fellow radiologists how to provide added value for patients and referring physicians Developed and written by two top experts in the field this is an ideal book for all professionals involved with imaging as well as physician groups that depend on radiology

Therapeutic Imaging Techniques and Patient Handling in Modern Medical Imaging Pasquale De Marco, 2025-04-11 Step into the world of modern medical imaging with Therapeutic Imaging Techniques and Patient Handling in Modern Medical Imaging This comprehensive guide unveils the intricacies of cutting edge imaging technologies patient centered approaches and the ethical considerations that shape this rapidly evolving field Within these pages you'll embark on a journey through the diverse spectrum of medical imaging modalities from the well established X ray to the groundbreaking advancements in molecular imaging and hybrid imaging techniques Discover the principles applications and safety aspects of each modality gaining a deeper understanding of their role in accurate diagnosis effective treatment and improved patient outcomes As patient care remains paramount the book delves into the importance of patient positioning and preparation for imaging examinations Learn the intricacies of patient positioning for various imaging procedures the optimization of radiation doses

and the appropriate use of sedation and anesthesia Explore infection control and sterilization protocols ensuring patient safety and minimizing the risk of infections The exploration continues with a thorough examination of radiation therapy and image guided procedures encompassing radiation therapy treatment planning advanced image guided radiotherapy techniques and the seamless integration of imaging in radiation therapy delivery Delve into the life saving applications of imaging in emergency medicine and trauma care highlighting its critical role in timely diagnosis and effective management of life threatening conditions Uncover the realm of advanced imaging techniques and applications where molecular imaging functional imaging and hybrid imaging modalities unveil the intricate workings of the human body Explore the integration of artificial intelligence in medical imaging witnessing the transformative power of technology in enhancing diagnostic accuracy and treatment planning Our journey concludes with an in depth exploration of imaging in specialized fields including women's health and obstetrics pediatric imaging geriatric imaging and nuclear medicine Each chapter provides a comprehensive overview of imaging techniques applications and considerations specific to these patient populations ensuring a well rounded understanding of the diverse applications of medical imaging Throughout the book you will find a wealth of illustrations diagrams and clinical images that illuminate complex concepts and enhance your understanding of medical imaging

Therapeutic Imaging Techniques and Patient Handling in Modern Medical Imaging stands as an indispensable resource for medical professionals students and healthcare practitioners seeking to expand their knowledge and skills in this dynamic and ever evolving field Embark on this enlightening journey and elevate your expertise in medical imaging today If you like this book write a review on google books      [Medical Imaging in Clinical Trials](#) Colin G. Miller, Joel Krasnow, Lawrence H. Schwartz, 2014-01-30 In the last few years the use of medical imaging has increased exponentially in routine clinical practice This has been reflected in a rapidly increasing use of medical imaging in clinical trials through all phases More recently this has culminated in a number of interdisciplinary meetings with the various stakeholders including the FDA Changes in the regulatory process has resulted when it comes to the submission of data to the FDA in a therapeutic agent where one or more of the trial endpoints is the assessment of a radiological endpoint No longer is it sufficient to have the images read by the local investigator site The FDA has also identified Medical Imaging as one of the key 6 points in the Critical Path initiative which was launched in 2004 This puts a keen focus on the role of imaging and the need to clearly identify and understand this aspect of clinical trials As the pharmaceutical biotech and medical device industry continues to identify ways to improve and speed up product development medical imaging plays a more significant role An understanding of the methodology and the metrics is therefore required but difficult to ascertain in one easy to read volume for individuals entering this field This book will therefore fulfill this void be it for the pharmaceutical personnel from medical director to monitor or the Principal Investigator who is having to understand the complexities of the imaging and why it is having to be sent off site for a central read

## Enjoying the Melody of Phrase: An Mental Symphony within **Radiation Risks In Medical Imaging**

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