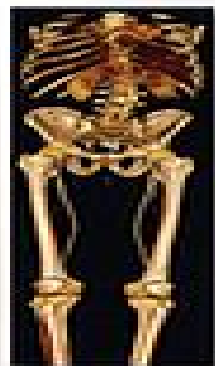
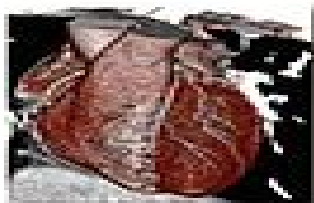


# MDCT Physics

## The Basics

**Technology, Image Quality  
and Radiation Dose**



**Mahadevappa Mahesh**



Wolters Kluwer  
Health

Lippincott  
Williams & Wilkins

# Mdct Physics The Basics Technology Image Quality And Radiation Dose

**D. Tack, Pierre Alain Gevenois**



## **Mdct Physics The Basics Technology Image Quality And Radiation Dose:**

MDCT Physics: The Basics Mahadevappa Mahesh, 2012-03-28 Written by the chief physicist at Johns Hopkins University Hospital this easy to read short textbook explains the physics behind multi detector CT technology particularly newer more complex technology The focus is on principles of physics effects of scan parameters on image quality and optimum radiation dosage The book includes numerous key points summaries and questions to assist in exam preparation **MDCT Physics** Mahadevappa Mahesh, 2009 *Computed Tomography* Shayne Chau, Christopher M Hayre, 2022-09-15 This book acts as a primer for radiographers upon performing computed tomography CT examinations The focus resides in radiation physics radiobiology anatomy imaging protocols and image evaluation It seeks to provide readers insight into the practical and innovative approaches within CT backed up with key literature and examples in practice Recent innovations and the importance of new technology to acquire enhanced quality remain a focal point These are essential in understanding the importance of dose optimization patient anatomy and common pathology observed Patient care will remain central in this book supported with a dedicated chapter discussing effective communication patient education informed consent coupled with the assessment of laboratory results and vital signs The editors draw from recent publications and clinical expertise supported with the growing trend of technological advances utilized within the CT environment Critically this volume focuses on the role of CT for an array of audiences but more specifically undergraduate and postgraduate radiographers worldwide

*Computed Tomography - E-Book* Euclid Seeram, 2022-06-16 Build the foundation necessary for the practice of CT scanning with *Computed Tomography Physical Principles Patient Care Clinical Applications and Quality Control* 5th Edition Written to meet the varied requirements of radiography students and practitioners this two color text provides comprehensive coverage of the physical principles of computed tomography and its clinical applications The clear straightforward approach is designed to improve your understanding of sectional anatomic images as they relate to computed tomography and facilitate communication between CT technologists and other medical personnel Chapter outlines and chapter review questions help you focus your study time and master content NEW Three additional chapters reflect the latest industry CT standards in imaging Radiation Awareness and Safety Campaigns in Computed Tomography Patient Care Considerations and Artificial Intelligence An Overview of Applications in Health and Medical Imaging UPDATED More than 509 photos and line drawings visually clarify key concepts UPDATED The latest information keeps you up to date on advances in volume CT scanning CT fluoroscopy and multislice applications like 3 D imaging CT angiography and virtual reality imaging endoscopy *Visual grading evaluation of reconstruction methods and dose optimisation in abdominal Computed Tomography* Bharti Kataria, 2019-10-15 Since its introduction in the 1970 s CT has emerged as a modality of choice because of its high sensitivity in producing accurate diagnostic images A third of all Computed Tomography CT examinations are abdominal CTs which deliver one of the highest doses among common examinations An increase in the

number of CT examinations has raised concerns about the negative effects of ionising radiation as the dose is cumulative over the life span of the individual Image quality in CT is closely related to the radiation dose so that a certain dose with an associated small but not negligible risk is a prerequisite for high image quality Typically dose reduction in CT results in higher noise and a decrease in low contrast resolution which can be detrimental to the image quality produced New technology presents a wide range of dose reduction strategies the latest being iterative reconstruction IR The aim of this thesis was to evaluate two different classes of iterative reconstruction algorithms statistical SAFIRE and model based ADMIRE as well as to explore the diagnostic value of a low dose abdominal CT for optimisation purposes This thesis included a total of 140 human subjects in four image quality evaluation studies three of which were prospective studies Papers I II and IV and one retrospective study Paper III Visual grading experiments to determine the potential dose reductions were performed with pairwise comparison of image quality in the same patient at different tube loads dose and reconstructed with Filtered back projection FBP and SAFIRE strength 1 in a low dose abdominal CT Paper I and FBP and ADMIRE strengths 3 and 5 in a standard dose abdominal CT Paper II Paper IV evaluated the impact of slice thicknesses in CT images reconstructed with ADMIRE strengths 3 and 5 when comparing multiplanar reconstruction MPR formatted images in a standard dose abdominal CT Paper III on the other hand was an absolute assessment of image quality and pathology between the three phases of a CT Urography CTU protocol to explore the diagnostic value of low dose abdominal CT The anonymised images were displayed in random order and image quality was assessed by a group of radiologists using image quality criteria from the European guidelines of quality criteria for CT The responses from the reviewer assessment were analysed statistically with ordinal logistic regression i e Visual Grading Regression VGR Results in Paper I show that a small dose reduction 5.9 % was possible using SAFIRE strength 1 and indicated the need for further research to evaluate the dose reduction potential of higher strengths of the algorithm In Paper II a 30% dose reduction was possible without change in ADMIRE algorithm strength as no improvement in image quality was observed between tube loads 98 and 140 mAs When comparing tube loads 42 and 98 mAs further dose reduction was possible with ADMIRE strength 3 22.47% However for images reconstructed with ADMIRE strength 5 a dose reduction of 34.74% was possible for some but not all image criteria Image quality in low contrast objects such as the liver parenchyma was affected and a decline in diagnostic confidence was observed Paper IV showed potential dose reductions are possible with increasing slice thickness from 1 mm to 2 mm 24.35% and 1 mm to 3mm 25.41% ADMIRE strength 3 continued to provide diagnostically acceptable images with possible dose reductions for all image criteria assessed Despite objective evaluations showing a decrease in noise and an increase in contrast to noise ratio ADMIRE strength 5 had diverse effects on the five image criteria depending on slice thickness and further dose reductions were limited to certain image criteria The findings do not support a general recommendation to replace ADMIRE3 with ADMIRE5 in clinical abdominal CT protocols Paper III studied another aspect of optimisation and

results show that visualisation of renal anatomy was as expected in favour of the post contrast phases when compared to the native phase Assessment of pathology showed no significant differences between the three phases Significantly higher diagnostic certainty for renal anatomy was observed for the post contrast phases when compared to the native phase Significantly high certainty scores were also seen for the nephrographic phase for incidental findings The conclusion is that a low dose series seems to be sufficient as a first line modality in certain patient groups This thesis clinically evaluated the effect of IR in abdominal CT imaging and estimated potential dose reductions The important conclusion from papers I II and IV is that IR improves image quality in abdominal CT allowing for some dose reductions However the clinical utility of the highest strength of the algorithm is limited to certain criteria The results can be used to optimise the clinical abdominal CT protocol The conclusion from paper III may increase clinical awareness of the value of the low dose abdominal protocol when choosing an imaging method for certain patient groups who are more sensitive to radiation Datortomografi DT anvnds i allt st rre omfattning vid bilddiagnostik och ger en viss str ldos till patienten DT r en viktig snabb och patientv nlig unders kningsteknik En f rdel med denna teknik r att bildmaterialet kan rekonstrueras i olika format f r att sk dligg ra anatomin p b stas tt beroende p vilken fr gest lning som ska besvaras Joniserande str lning fr n dessa unders kningar anses ka risken f r negativa effekter ven om risken f r den enskilde patient r mycket liten Antalet datortomografiunders kningar kar fr n r till r vilket kan leda till kade str ldoser tillbefolkningen Optimering av unders kningsteknik och val av unders kning f r att minska negativa effekter av r ntgenstr lning r d rf r n dv ndig Det vergripande m let med avhandlingen var att utv rdera bildkvalitetvid en DT unders kning av buken d dessa medf r en av de h gstastr ldoserna bland de vanliga r ntgenunders kningarna att kvantifiera m jlig str ldosminskning med hj lp av iterativa rekonstruktionsalgoritmer och att utv rdera diagnostiska v rdet av l gdosunders kningsteknik vid DT buk Av de fyra delstudierna var delarbeten I II och IV prospektiva och delarbete III retrospektivt F r de prospektiva studierna samlades bildmaterial in vid en kliniskber ttigad unders kning av l gdos DT av buken delarbetet I eller standarddos DT av buken delarbetet II och IV Bilder rekonstruerades meden standard bildrekonstruktionsalgoritm filtrerad terprojektion FBP och med styrka 1 av den iterativa algoritmen SAFIRE delarbetet I I delarbeten II och IV gjordes bildrekonstruktioner med FBP och med styrka 3 och 5 av den iterativa algoritmen ADMIRE Aidentifierade bildmaterialf r varje patient visades parvis i slumpm ssig ordning f r ett antal granskare och bildkvaliteten bed mdes med hj lp av europeiska bildkriterier I den retrospektiva studien delarbete III h mtades bildmaterialet fr n utf rda DT urografiunders kningar fr n bildarkivet F r varje unders kning visades bilder fr n varje fas i DT urografiunders kningen separat i slumpm ssig ordning F r samtliga delarbeten h mtades bildkriteriernafr n European Guidelines of Quality Criteria for CT och modifierades f r att passa till varje studie Granskarnas bed mning analyserades med ordinal logistisk regression s kallad visual grading regression VGR Resultat fr n delarbetet I visade att det fanns en signifikant inverkan av dos p

**Radiologie Interventionnelle osseuse et anti-douleur** Bruno Kastler,Adrian Kastler,2021-10-19 Le nombre d acte de

radiologie interventionnelle titre diagnostique et thérapeutique est en croissance exponentielle notamment en ostéoarticulaire et en algorithme de radiologie La radiologie interventionnelle RI anti douleur constitue désormais une option dans le cursus des radiologues Le besoin de formation en la matière est donc très important Cet ouvrage exhaustif est une référence sur le sujet Il est consacré principalement à l'aspect musculosquelettique de l'algorithme de radiologie mais aborde également les autres domaines moins connus où la RI est très prometteuse Rédigé dans une perspective pratique il propose une approche didactique des techniques notamment grâce de nombreuses illustrations Les chapitres sont présentés pour permettre un apprentissage pas à pas de notions essentielles la bonne réalisation des gestes indications contre indications rappels anatomiques techniques résultats complications Un bon nombre des techniques présentées sont accessibles aux praticiens ayant déjà une bonne expérience en RI percutanée diagnostique Les premiers chapitres présentent des notions de bases indispensables sur les différents aspects de la douleur psychisme effet placebo agents injectés anesthésie peropératoire astuces de guidage au scanner réduction de dose Vingt chapitres sont ensuite consacrés aux techniques d'infiltrations rachidiennes d'compressions discales consolidations cimentations et vissage ablations osseuses traitements endovasculaires chirurgie du canal carpien Les algies craniofaciales et fracturaires arthralgies algies vasculaires de la face neuralgie faciale et algoneurodystrophie sont abordées dans quatre chapitres Le traitement des douleurs abdominales et pelviennes neurolyse coeliaque et splanchnique sympatholyses infiltrations hypogastriques et impar est également abordé Enfin les deux derniers chapitres envisagent le guidage chirographique et IRM Cet ouvrage s'adresse tous les spécialistes radiologues algologues rhumatologues neurologues oncologues souhaitant approfondir leurs connaissances sur les dernières évolutions innovantes de l'algorithme de radiologie

**Oxford Textbook of Vascular Surgery** Matthew Thompson, Jon Boyle, 2016 The Oxford Textbook of Vascular Surgery draws on the expertise of over 130 specialist contributors to encompass the field of vascular surgery Through the use of figures findings of contemporary trials and additional online content this textbook is an excellent study material for surgical trainees entering their final two years of training in addition to serving as an effective reference source for practicing surgeons This volume discusses the epidemiology vascular biology clinical features and management of diseases that affect the vasculature and contains dedicated chapters which address topics such as paediatric surgery damage control surgery and amputations The text follows a logical framework which complements the published Intercollegiate Surgery Curriculum making it particularly useful in preparation for the Intercollegiate Examination The online version of The Oxford Textbook of Vascular Surgery is free for twelve months to individual purchasers of this book and contains the full text of the print edition links to external sources and informative videos demonstrating current surgical techniques making this a valuable resource for practicing surgeons The field of vascular surgery has advanced rapidly in recent years and has expanded to include the techniques of interventional radiology and cardiology which are also extensively covered in this volume making it an authoritative modern text By combining contemporary evidence based knowledge with informative figures online resources and links to the

current training curriculum The Oxford Textbook of Vascular Surgery is a highly valuable source of information and will become the standard reference text for all who study vascular disease and its treatment

**Pediatric Imaging: Case Review E-Book** Aylin Tekes-Brady, Daniel P Seeburg, Thierry A. G. M. Huisman, 2017-07-04 Pediatric Imaging Case Review is a quick review of common or rare but classic pediatric cases that tests your knowledge of pediatric imaging Featuring updated pediatric body and pediatric neuro imaging cases from fetus to young adolescents this case review book includes over 300 images and 600 all new multiple choice questions providing residents and radiologists with a current review of key pediatric imaging information Images and descriptions address most common classic as well as several rare but critical entities of pediatric radiology in a single source Distinguish between common and rare diagnoses with case studies organized into Opening Round Fair Game and Challenge sections that present varying levels of difficulty and occurrences Features completely updated cases throughout including new cases on congenital heart disease and over 300 new images Expanded cases include advanced and state of the art imaging modalities i e fetal MRI and CTA MRA of the heart Provides expanded coverage of radiation dose reduction in addition to new patient management physics quality and safety and non interpretive skills content 600 all new multiple choice questions are designed to mimic the format of core board and certification exams Incorporates up to date disease classification systems e g ISSVA 2014 of vascular anomalies Expert Consult eBook version included with purchase This enhanced eBook experience allows you to search all of the text figures images and references from the book on a variety of devices

**Body CT The Essentials** Eugene Lin, David Coy, Jeffrey Kanne, 2014-09-04 A PRACTICE CLINICALLY RELEVANT COMPUTED TOMOGRAPHY PRIMER Body CT The Essentials delivers an up to date detailed and practical review of CT imaging of the chest abdomen and pelvis It will prove especially valuable to trainees in diagnostic radiology and practicing radiologists with an interest in body imaging Primarily organized by organ system Body CT The Essentials also includes important technical chapters that review intravenous contrast administration scan parameters and radiation physics that enable you to perform quality studies with minimum patient radiation exposure Each organ specific chapter incorporates the latest advances in CT imaging and recommendations or guidelines for imaging as well as follow up findings Tables found within the chapters include differential diagnosis and each chapter concludes with suggested readings for a more detailed discussion of the topic Here s why this is the perfect CT primer Enhanced by more than 450 images Emphasizes the appropriateness and role of CT relative to other imaging modalities and protocols Includes coverage of the latest technologies such as cardiac CT CT colonography and CT enterography Focuses on the most practical concepts related to generating a concise accurate differential diagnosis and relevant report

**Thoracic Imaging, An Issue of Radiologic Clinics of North America, E-Book** Jane P. Ko, 2014-01-28 This issue of Radiologic Clinics will focus on the essentials of thoracic imaging Topics include lung cancer screening and staging systems radiation dose techniques nodule characterization PET CT in the thorax MDCT and MR evaluation of thoracic aorta pulmonary emboli and perfusion

imaging interstitial pneumonias emphysema and airway imaging post operative chest and thoracic infections in the immunocompromised host      *The British National Bibliography* Arthur James Wells,2009      Optimisation of Radiation Dose and Image Quality in Paediatric MDCT Scanning Kerstin Ledenius,2007      **MDCT** Mannudeep K. Kalra,Sanjay Saini,Geoffrey D. Rubin,2009-11-16 MDCT From Protocols to Practice tackles contemporary and topical issues in MDCT technology and applications As an updated edition of MDCT A Practical Approach this volume offers new content as well as revised chapters from the previous volume New chapters discuss important topics such as imaging of children and obese subjects the use of contrast medium in pregnant women coronary MDCT angiography and PET CT in abdominal and pelvic malignancies Furthermore an Appendix with over 50 updated MDCT scanning protocols completes this publication The book emphasizes the practical aspects of MDCT making it an invaluable source of information for radiologists residents medical physicists and radiology technologists in everyday clinical practice      **MDCT: A Practical Approach** S. Saini,G.D. Rubin,M.K. Kalra,2007-03-14 Computed tomography CT is the most rapidly evolving medical imaging technology This book describes current examination techniques and advanced clinical applications of state of the art multidetector computed tomography MDCT scanners in chapters contributed by several distinguished radiologists and clinicians Each chapter is written from a practical perspective so that radiologists residents medical physicists and radiology technologists can obtain relevant information about MDCT applications in neuroradiology cardiac imaging chest abdominal and musculoskeletal radiology subspecialties Each co author provides pertinent illustrations and tables for better understanding of current and advanced applications of MDCT scanners Readers will benefit from the experience these authors describe in chapters on MDCT technology contrast administration techniques contrast adverse effects and their management and advanced applications of MDCT      **Radiation Dose from Adult and Pediatric Multidetector Computed Tomography** D. Tack,Pierre Alain Gevenois,2007-12-31 Because of the radiation dose delivered multidetector row CT MDCT may induce cancers and the risk of death has been estimated at up to one per 1 000 examinations Despite this only a small proportion of referring clinicians radiologists and technologists are aware of both the radiation risks and their underlying mechanisms This book is designed to rectify this situation The first part of the book provides a comprehensive approach to all the factors that influence the radiation dose and subsequently the risk induced by using MDCT in children and adult patients In the second part guidelines are proposed for optimization of the radiation dose in order to obtain an image quality sufficient for appropriate diagnostic performance while restricting the dose delivered This book written by experts of international standing will appeal to both general and specialized radiologists including pediatric radiologists CT technologists physicists manufacturers and all professionals involved in MDCT      **Rad Tech's Guide to Computed Tomography** Euclid Seeram,2026-04-13 An up to date guide to CT that offers a comprehensive discussion of the technology and science of computed tomography and instructions for applying that knowledge to real world practice Rad Tech s Guide to Computed



Tomography Physics and Instrumentation is a comprehensive and accessible approach to learning the physics and instrumentation of CT. The text offers an intuitively organized treatment of the history of CT, development, data acquisition, image reconstruction, and the relationship between image quality and radiation dose. Using clear language, hands-on examples, and useful diagrams, the book is written to demystify complex topics like Hounsfield units, attenuation coefficients, and interpolation algorithms without compromising technical accuracy. This is an educational resource that shows readers how to perform imaging that generates diagnostically useful results that keep patients safe. Readers will find an up-to-date exploration of the use of artificial intelligence in medical imaging. Concise explorations of the physics of state-of-the-art CT scanners relevant to the day-to-day work of practicing RTs. Practical discussions of relevant selected topics including multi-slice CT, the basics of image postprocessing, and quality control fundamentals. Guidance on how to ensure consistent diagnostic performance without compromising patient safety. Complete treatments of data acquisition, including slice-by-slice and volume data acquisition. Perfect for students preparing to take professional certification examinations in CT. Rad Tech's Guide to Computed Tomography will also benefit practicing technologists interested in advancing their understanding, refining their technique, and expanding their professional skillset.

**CT at a Glance** Euclid Seeram, 2017-11-16. CT at a Glance gets readers quickly up to speed with the core knowledge and competencies required for computed tomography. CT scanning as established by the major radiography organizations around the world, including the ASRT and the CAMRT. This brand-new title describes the basic science behind CT with an emphasis on the theory that is essential for practice. Featuring an abundance of illustrations, succinct, straightforward explanations, and clear step-by-step guidance, it includes the fundamental physics, technical principles, and imaging strategies and procedures involved in CT scanning. Over the course of twenty-four concise modular chapters, CT at a Glance covers all the bases for entry to practice students, including the basic physics underlying CT scanning, state-of-the-art multi-slice technologies, data acquisition strategies, equipment components, their functions, and applications, image reconstruction, and image quality control, CT dose and dose optimization procedures, quality control fundamentals. CT at a Glance is an indispensable learning resource for students in medical imaging technology courses, including those covering radiography, nuclear medicine, and radiation therapy, as well as for biomedical engineering technology students.

*Spectral Multi-Detector Computed Tomography (sMDCT)* Xiangyang Tang, 2023-12-07. X-ray computed tomography (CT) has been one of the most popular diagnostic imaging modalities for decades in the clinic for saving patients' lives or improving their quality of life. This book is an introductory one-stop shop for technological and clinical topics in multi-detector computed tomography (MDCT). Starting with MDCT's fundamentals in physics and mathematics, the book provides an in-depth introduction to its system architecture and imaging chain, signal detection via energy integration and photon counting mechanisms, clinical application-driven scan modes and protocols, analytic and iterative image reconstruction solutions, and spectral imaging, the latest technological advancement in MDCT. The book extends its coverage

on image quality assessment under the theory of signal detection and statistical decision In recognition of its clinical relevance for conspicuity enhancement in angiographic and parenchymal imaging applications the book features a chapter dedicated to the fundamental chemical physical and physicochemical properties and clinical administration of iodinated contrast agent The book ends with an outlook of the contrast agents that are novel in material and delivery and their synergy with spectral MDCT to elevate CT's contrast resolution in cardiovascular neurovascular and oncologic applications This book will be an invaluable reference for researchers engineers radiological physicians and technologists and graduate and senior undergraduate students Features Provides an accessible introduction to the subject Up to date with the latest advances in emerging technologies and procedures Provides a historical overview of CT technology     Computed Tomography Willi Kalender, 2000-11-23 This book provides a comprehensive and user friendly description of the theoretical and technical essentials of computed tomography CT an imaging technique used extensively by the medical community Book Jacket     **CT Imaging** Alexander C. Mamourian, Harold I. Litt, 2013-03-14 After reading this book imagers and CT technologists should better understand the capabilities of modern multidetector CT scanners Imagers and technologists must understand how their scanners operate in order to take advantage of new capabilities for optimizing protocols that minimize patient dose In addition the reader will be better prepared to recognize the pitfalls and artifacts that appear on CT imaging Some of these are unfamiliar to most imagers and are the product of the large detector arrays offered on new CT scanners

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