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Sanjeev Bhalla

The Beatles, the Nobel Prize, and Chest CT Scan 1

Lawrence R. Goodman

From its first test scan on a mouse, in 1967, to current medical practice, the CT scanner has become a core imaging tool in thoracic diagnosis. Initially financed by money from Beatles' record sales, the first patient scan was performed in 1971. Only 8 years later, a Nobel Prize in Physics and Medicine was awarded to Hounsfield and Cormack for their discovery. This article traces the history of CT scanner development and how each technical advance expanded chest diagnostic frontiers. Chest imaging now accounts for 30% of all CT scanning.

Optimization of Contrast Enhancement in Thoracic MDCT 9

Kyongtae T. Bae

Many clinical applications of thoracic computed tomography (CT) require contrast medium to enhance and delineate vascular, mediastinal, hilar, and cardiac structures, and differentiate normal and pathologic vascular or tumoral conditions. Multidetector row computed tomography (MDCT) is superior to single-detector row CT (SDCT) because MDCT permits more efficient and flexible use of intravenous contrast medium to achieve enhancement. However, to fully reap the benefits of MDCT contrast enhancement, the technical challenges associated with optimizing enhancement and scan timing in MDCT need to be solved. This article reviews the basic principles of CT contrast enhancement and discusses common clinical considerations and the protocol design modifications that are necessary to achieve optimal contrast enhancement in thoracic MDCT.

Acute Pulmonary Embolism 31

Jean Kuriakose and Smita Patel

Evolving MDCT technology and high accuracy for pulmonary embolism detection has led to CT pulmonary angiography (CTPA) becoming a first-line imaging test. Rapid and accurate assessment for DVT and PE can be performed with a single test. Concerns remain regarding the radiation exposure incurred with CTPA and CT venography, especially in young patients. There are concerns also regarding radiation exposure in pregnancy and search for the best diagnostic test for PE in pregnancy. The increased detection of subsegmental emboli raises the question as to which emboli are significant and should be treated and which should be left alone. We review the current role of CT in the diagnosis of pulmonary embolism.

Multidetector Computed Tomographic Pulmonary Angiography: Beyond Acute Pulmonary Embolism 51

Kristopher W. Cummings and Sanjeev Bhalla

Although multidetector computed tomographic (MDCT) pulmonary angiography has found widespread use in the evaluation of acute pulmonary embolism,

advances in technology have allowed for its application in realms that were previously exclusive to conventional pulmonary angiography. In this article, the authors address the use of MDCT in the evaluation of chronic thromboembolic pulmonary hypertension and pulmonary arteriovenous malformations. These examples demonstrate the potential for MDCT to expand the use of computed tomographic angiography in the evaluation of the pulmonary arteries. Technical parameters, diagnostic findings at MDCT, and therapeutic implications of such findings are discussed for each condition.

MDCT Evaluation of Acute Aortic Syndrome

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Seung Min Yoo, Hwa Yeon Lee, and Charles S. White

This article provides a summary of acute aortic syndrome (AAS), focusing especially on the multidetector CT technique and findings of AAS, as well as recent concepts regarding the subtypes of AAS, consisting of aortic dissection, intramural hematoma, penetrating atherosclerotic ulcer, and unstable aortic aneurysm.

Congenital Thoracic Vascular Anomalies

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José A. Maldonado, Travis Henry, and Fernando R. Gutiérrez

Congenital vascular anomalies of the thorax represent an important group of entities that can occur either in isolation or in association with different forms of congenital heart disease. It is extremely important that radiologists have a clear understanding of these entities, their imaging characteristics, and their clinical relevance. The imaging armamentarium available to diagnose these diverse conditions is ample, and has evolved from such traditional methods as chest radiography, barium esophagography, and angiography to new modalities that include echocardiography, multidetector row CT (MDCT), and MR imaging. These imaging modalities have added safety, speed, and superb resolution in diagnosis and, as in the case of MDCT, provide additional information about the airway and lung parenchyma, resulting in a more comprehensive examination with greater anatomic coverage. This article reviews the most important congenital thoracic vascular anomalies, their embryologic foundation, clinical presentation, and imaging characteristics, especially those of MDCT.

Multidetector Computed Tomography in the Preoperative Assessment of Cardiac Surgery Patients

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Nila J. Akhtar, Alan H. Markowitz, and Robert C. Gilkeson

The expanding imaging capabilities of multidetector computed tomography (MDCT) have made it an important part of the preoperative assessment of the cardiac surgery patient. Ever decreasing imaging times, superior spatial resolution, and the 3-dimensional capabilities of MDCT improve diagnosis and enhance surgical planning. Understanding the imaging advantages of MDCT enable improved outcomes in this important patient population.

Multidetector CT of Solitary Pulmonary Nodules

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Mylene T. Truong, Bradley S. Sabloff, and Jane P. Ko

With the increasing use of multidetector CT, small nodules are being detected more often. Although most incidentally discovered nodules are benign, usually the

sequelae of pulmonary infection and malignancy, either primary or secondary, remains an important consideration in the differential diagnosis of solitary pulmonary nodules. This article reviews the role of imaging in the detection and characterization of solitary pulmonary nodules. Strategies for evaluating and managing solitary pulmonary nodules are also discussed.

MDCT of Trachea and Main Bronchi

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Cylen Javidan-Nejad

Tracheobronchial imaging has undergone a major revolution. The improved spatial and temporal resolution has introduced newer techniques such as dynamic expiratory imaging to evaluate for tracheomalacia. This article describes these techniques and a practical approach to diagnosis of diseases of the central airways.

Volumetric Expiratory HRCT of the Lung: Clinical Applications

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Mizuki Nishino, George R. Washko, and Hiroto Hatabu

Expiratory high-resolution CT (HRCT) of the chest offers a powerful adjunct to inspiratory HRCT in the detection of lung diseases involving the small airways. In 2003 a clinical HRCT scan protocol was developed. It has since been used for evaluation of diffuse lung disease with suspected airway abnormalities. It provides volumetric assessment of the entire thorax at end-inspiration and at end-expiration, and allows for detailed analysis of the airway and parenchyma. It offers a powerful adjunct to inspiratory HRCT in the detection of lung diseases involving the small airways. This article explores its clinical applications for chronic obstructive pulmonary disease, bronchiectasis, and sarcoidosis. It concludes that standardization of image acquisition and post-processing in CT examinations will be necessary for the real application of quantitative data derived from volumetric expiratory HRCT to daily clinical medical practice.

Multidetector CT Scan in the Evaluation of Chest Pain of Nontraumatic Musculoskeletal Origin

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Travis J. Hillen and Daniel E. Wessell

Acute nontraumatic chest pain is a common presenting symptom to the emergency department. Often, it is evaluated by thin-collimation multidetector computed tomography scan (MDCT) using pulmonary embolism, aortic dissection, or coronary artery protocols. The parameters used for these protocols are very similar to those used in protocols for dedicated imaging of the musculoskeletal system. In essence, every MDCT of the chest is also a musculoskeletal examination of the chest. Familiarity with the MDCT-imaging appearance of common musculoskeletal causes of acute nontraumatic chest pain aids in interpretation of the images. This article discusses the MDCT appearance of a number of musculoskeletal causes of chest pain, including those of infectious, rheumatologic, and systemic causes.

Thoracic Applications of Dual Energy

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Martine Remy-Jardin, Jean-Baptiste Faivre, François Pontana, Anne-Lise Hachulla, Nunzia Tacelli, Teresa Santangelo, and Jacques Remy

Recent technological advances in multidetector computed tomography (CT) have led to the introduction of dual-source CT, which allows acquisition of CT data at the same energy or at 2 distinct tube voltage settings during a single acquisition.

The advantage of the former is improvement of temporal resolution, whereas the latter offers new options for CT imaging, allowing tissue characterization and functional analysis with morphologic evaluation. The most investigated application has been iodine mapping at pulmonary CT angiography. The material decomposition achievable opens up new options for recognizing substances poorly characterized by single-energy CT. Although it is too early to draw definitive conclusions on dual-energy CT applications, this article reviews the results already reported with the first generation of dual-source CT systems.