Dual Energy Computed Tomography (DECT) Applications In Abdominal Imaging

An Essay

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To my MUM,

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FOR

THEIR HELP,

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AND CONTINOUS PUSH

LIST OF APPREVIATIONS

3D : 3 Dimensions

AAA : Abdominal Aortic Aneurysm

CIN : Contrast Induced Nephropathy

CICT : Color-coded Iodine CT

CM : Contrast Medium

CNR : Contrast to Noise Ratio

CT : Computed Tomography

CTA : Computed Tomography Angiography

DECT : Dual Energy Computed Tomography

DSDECT : Dual Source Dual Energy Computed Tomography

DSDECTA: Dual Source Dual Energy Computed Tomography Angiography

DVU : Delayed Virtual Unenhanced

EAP : Early Arterial Phase

ECM : Extra Cellular Membrane

EP : Equilibrium Phase

EVAR : Endo Vascular Aneurysm Repair

EVU : Early Virtual Unenhanced

Fig : Figure

FL : Falciform Ligament

FOV : Field Of View

GIB : Gastro Intestinal Bleeding

HCC : Hepato Cellular Carcinoma

HCV : Hepatitis C Virus

HIV : Human Immunodeficiency Virus

HPI-M : Hard Plaque Imaging-Modified

HPI-S : Hard Plaque Imaging-Standard

HU : Hounsfield Unit

IMA : Inferior Mesenteric Artery

IPMN : Intraductal Papillary Mucinous Neoplasms

ITPN : Intraductal Tubulo Papillary Neoplasms

IV : Intra Venous

IVC : Inferior Vena Cava

KEV : Kilo Electron Volt

KV : Kilo Volt

Kvp : Kilo voltage peak

L : Liter

LAP : Late Arterial Phase

LHV : Left Hepatic Vein

LPV : Left Portal Vein

mA : milli Ampere

MCN : Mucinous Cystic Neoplasm

MDCT : Multi Detector Computed Tomography

MHV	**:** Middle Hepatic Vein
MIP	**:** Maximum Intensity Projection
MPR	**:** Multi Planar Reconstruction
MR	**:** Magnetic Resonance
MRI	**:** Magnetic Resonance Imaging
MSCT	**:** Multi Slice Computed Tomography
PanIN	**:** Pancreatic Intraepithelial Neoplasia
PVP	**:** Portal Venous Phase
RHV	**:** Right Hepatic Vein
RNA	**:** Ribo Nucleic Acid
RPV	**:** Right Portal Vein
SECT	**:** Single Energy Computed Tomography
SMA	**:** Superior Mesenteric Artery
ssDECT	**:** single source Dual Energy Computed Tomography
TACE	**:** Transcatheter Arterial Chemoembolization
TNE	**:** True Non-Enhanced
TUE	**:** True Un Enhanced
UA	**:** Uric Acid
UE	**:** Un Enhanced
UVJ	**:** Uretero Vsical Junction
VNC	**:** Virtual Non Contrast
VNE	**:** Virtual Non-Enhanced

VUE : Virtual Un-Enhanced

WSS : Wall Shear Stress

μ : Linear attenuation coefficient

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INTRODUCTION

Changes are occurring in medical CT imaging that promise to augment the already well recognized CT strengths of speed, high resolution, excellent patient tolerance, and large territory coverage. These changes include dose reduction, noise reduction, and more speed ***(Yeh et al., 2009).***

The concept of dual-energy computed tomography (CT) originated during the early development of CT. However, it was only recently that advances in scanner technology made dual-energy CT possible for routine clinical use ***(Kaza et al., 2012).***

Dual-energy CT is gradually changing the way CT is practiced today. By interrogating the unique characteristics of different materials at different x-ray energies, dual-energy CT provides quantitative information about tissue composition, overcoming the limitations of attenuation based conventional single energy CT imaging ***(Marin et al., 2014).***

Two major advantages of DECT are material decomposition by the almost simultaneous acquisition of two image series with different kVp (80 and 140 kVp) and the elimination of misregistration artifacts ***(Karçaaltıncaba and* Aktaş, *2011).***

Implementation of DECT in abdominal CT provides a variety of applications to improve tissue characterization. Reconstruction of virtual unenhanced series can be used in the assessment of renal or adrenal lesions incidentally detected by single-phase contrast-enhanced DECT while considerably reducing radiation dose compared with a dual-phase, single-energy CT protocol with true unenhanced acquisition ***(Heye et al., 2012).***

By using the spectral information of DECT iodinated contrast media can be selectively visualized to improve the conspicuity of enhancing focal liver lesions, or to suppress the iodine signal to create a virtual non-enhanced CT data set ***(Johnson et al., 2012).***

Although many of its clinical applications are still in the investigative stage, DECT shows great promise as a powerful tool in abdominopelvic imaging. With improved lesion detection and the ability to exploit differences in tissue behavior at different energy levels, DECT has a potential role in each organ system ***(Del Gaizo et al., 2014).***