



Dual Energy Computed Tomography (DECT) Applications In Abdominal Imaging

An Essay

Submitted for partial fulfillment of

Master Degree of Radiodiagnosis

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2015

Acknowledgement

First and foremost, I submit all my gratitude to ALLAH to whom I owe every success in my life.

*I would like to express my sincere appreciations and profound gratitude to **Prof. Dr. Omnia Ahmed Kamal**, Professor of Radiodiagnosis, Faculty of Medicine – Ain Shams University, for her help, kind guidance, continuous support & giving me such an honor to work under her supervision.*

*I would like to express my respect, appreciation, and thanks for **Dr. Mostafa Farag El-shafie**, Lecturer of Radiodiagnosis, Theodor Bilhars Research institute, for his assistance, encouragement, invaluable guidance, constructive criticism and great help in supervising this work.*

To my MUM,

DAD,

And WIFE

FOR

THEIR HELP,

SUPPORT,

GREAT CARE,

ENCOURAGEMENT

AND CONTINUOUS 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*).