ROLE OF MULTISLICE COMPUTED TOMOGRAPHY IN PATIENTS PRESENTING WITH HEMOPTYSIS

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List Of Abbreviations

ABPA	Allergic broncho-Pulmonary Aspergillosis
ACS	American Cancer Society
BA	Bronchial Artery
BAE	Bronchial Artery Embolization
CB	Central Bronchiectasis
CT	Computed Tomography
C-TYPE	Central Type
BI	Bronchus Intermedius
Cm	Centimeter
3D	3 Dimensional
DA	Descending Aorta
GE	General Electric
HAM	High Attenuation Mucus
HU	Hounsfield Unit
HRCT	High Resolution Computed Tomography
FOB	Fiberoptic Bronchoscopy
ICBT	Intercostobronchial trunk
IPA	Interlobar pulmonary artery
IV	Intravenous
MIP	Maximum Intensity Projection
MinIP	Minimum Intensity Projection
Min	Minute
ml	Milliliter

List of Abbreviations

mm	Millimeter
MPA	Main Pulmonary Artery
MPR	Multiplanar Reformation
MSCT	Multislice Computed Tomography
MDCT	Multidetector Computed Tomography
NBSA	Non Bronchial Systemic Artery
NSCLC	Non-Small Cell Lung Carcinoma
PAVM	Pulmonary Arteriovenous Malformation
P-TYPE	Peripheral Type
Sec	Second
SCC	Squamous Cell Carcinoma
SCLC	Small Cell Lung Carcinoma
S	Superior Vena Cava
SCA	Subclavian Artery
SSD	Shaded Surface Display
TB	Tuberculosis
RPA	Right pulmonary artery
VB	Virtual bronchoscopy
VOI	Volume Of Interest
VR	Volume Rendering
VRT	Volume Rendering Technique
WHO	World Health Organization

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Introduction

Hemoptysis is coughing up blood originating from the lower respiratory tract ***(Anderson, 2006).***

It refers to a wide clinical spectrum, ranging from a nonalarming bloody expectoration to a life-threatening condition associated with an immediate risk of airway obstruction and death ***(Savale et al., 2007).***

Although hemoptysis may cease temporarily, a possible life-threatening condition may still be present, requiring complete evaluation and treatment ***(Anderson, 2006).***

The challenge for the physician caring for patients with hemoptysis is not only to assess the severity but also to identify the underlying cause and site of bleeding, which may influence both management and outcome ***(Savale et al., 2007).***

There are multiple causes of hemoptysis, from airway diseases, parenchymal diseases, cardiovascular diseases, and other causes ***(Anderson, 2006).***

The cause of hemoptysis cannot be determined in 20-30% of cases ***(Anderson, 2006).*** That is why hemoptysis warrants a comprehensive evaluation of the lung parenchyma, airways, and thoracic vasculature ***(Bruzzi et al., 2006).***

The bronchial arteries are the source of bleeding in most cases of hemoptysis; while hemoptysis is related to pulmonary artery injury in up to 11% of cases ***(Khalil et al., 2007).*** Contributions from the non-bronchial systemic arterial system represent an important cause of recurrent hemoptysis following apparently successful bronchial artery embolization. Vascular anomalies such as pulmonary arteriovenous malformations and bronchial artery aneurysms are other important causes of hemoptysis. ***(Bruzzi et al., 2006)***

The diagnosis of hemoptysis is usually based on the combination of physical examination; chest X-ray, fiberoptic bronchoscopy, and computed tomography (CT) scan ***(Savale et al., 2007).***

Conditions such as bronchiectasis, chronic bronchitis, lung malignancy, tuberculosis, and chronic fungal infection are some of the most common underlying causes of hemoptysis and are easily detected with conventional CT ***(Bruzzi et al., 2006).***

Multi–detector row CT (MDCT) permits a more sensitive, more rapid and accurate assessment of the cause and consequences of hemorrhage into the airways and helps guide subsequent management ***(Bruzzi et al., 2006).***

CT is superior to fiberoptic bronchoscopy in finding a cause of hemoptysis, its main advantage being its ability to show distal airways beyond the reach of the bronchoscope, and the lung parenchyma surrounding these distal airways (***Sirajuddin & Mohammed, 2008).***

Data suggest that CT could replace bronchoscopy as the first-line procedure for screening patients with large and those with massive hemoptysis ***(Revel et al., 2002).***

The addition of MDCT angiography provides a more precise depiction of the bronchial arteries than conventional angiography ***(Khalil et al., 2007***). MDCT angiography is the optimal CT study for evaluating hemoptysis. In addition to showing the lung parenchyma and airways, it allows one to evaluate the integrity of pulmonary, bronchial, and nonbronchial systemic arteries within the chest ***(Sirajuddin & Mohammed, 2008).***

Multidetector CT angiography is recommended before bronchial artery embolization to help one plan the procedure and shorten the procedure time (***Sirajuddin & Mohammed, 2008).***

The combined use of thin-section axial scans and more complex reformatted images provides the interventional radiologist with better information about the bleeding side, the underlying disease, and the vascular origin of the bleeding causing hemoptysis (bronchial artery, nonbronchial systemic artery, pulmonary artery, or a combination of these arteries) ***(Bruzzi et al., 2006 & Khalil et al., 2007)***

Aim of the Work

The aim of the current study is to describe the role of MDCT with its new applications such as reformatted images, high resolution imaging, and post-processing techniques, for determining the cause and site of bleeding, and to determine the additional benefit of MDCT angiographic technique (in selected patients) in identifying the site of bleeding and its vascular origin.

Gross Anatomy of the Lungs

Tracheo-bronchial tree (Fig.1):

Trachea:

The trachea is about 10-11cm long, descends from the larynx, extending from the level of the sixth cervical to the upper border of the fifth thoracic vertebra, where it divides into right and left principal bronchi ***(Standring et al., 2005)***.

Right principal bronchus

The right principal bronchus is wider, shorter and more vertical than the left, being 2.5cm long. It gives rise to its first branch "the superior lobar bronchus ", and then crosses the posterior aspect of the pulmonary artery to enter the right lung hilum at 5^{th} thoracic vertebra, where it divides into a middle and inferior lobar bronchus ***(Drake et al., 2007)***.

Left principal bronchus

The left principal bronchus which is narrower and less vertical than the right is nearly 5cm long and enters the hilum of the left lung at the level of 6^{th} thoracic vertebra. Passing left inferior to the aortic arch, it crosses anterior to the esophagus, thoracic duct and descending thoracic aorta. The left pulmonary artery is anterior then superior to it. As it enters the hilum it