ORIGINAL RESEARCH PAPER
Volume-9 | Issue-3 | March-2020 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

ROLE OF MDCT ANGIOGRAPHY IN HAEMOPTYSIS PATIENTS - A REVIEW

Radiology

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ABSTRACT

Haemoptysis is expectoration of blood from the respiratory tract. In patients with mild haemoptysis it is self limiting. Haemoptysis is a life-threatening condition in patients with massive haemoptysis (5%), needs urgent investigations and treatment. Multi–detector computed tomography (MDCT) angiography is a very useful noninvasive imaging modality of haemoptysis. This article aims to provide a comprehensive review on MDCT along with thin-section axial scans and complex reformatted images allows in identifying the underlying cause of haemoptysis, site of bleeding, and vascular anatomy of the respiratory system to localise the bleeding vessel. Treatment options for massive haemoptysis through bronchial artery embolization are summarized. Based on the review of multiple studies, it can be concluded that MDCT Angiography has a major role in diagnosis and management of haemoptysis.

KEYWORDS

Mdct- Multi Detector Computed Tomography, Haemoptysis, Bronchial Artery Embolisation.

INTRODUCTION:

Multi detector computed tomography (MDCT) was introduced in the year 1998. MDCT provides advantage in data acquisition speed, longitudinal resolution and more efficient use of X- rays as compared to conventional computed tomography.

It is a comprehensive, non-invasive method for evaluating the entire thorax, allowing detailed assessment of mediastinum, lung parenchyma and detailed anatomy of vascular structures. Allows delineation of the bronchial and non bronchial systemic arteries by using multi planar reformatted images used as guide in therapeutic arterial embolization procedures.

In a study conducted by kadou.A et al have described that haemoptysis results due to bleeding from systemic or pulmonary arteries.[2] Haemoptysis is classified as mild (<30 ml), moderate (31–100 ml), severe (100–600 ml), and massive haemoptysis 100-600ml in 24hrs with respiratory or hemodynamic compromise.[3]

A study conducted by Bhalla.A described the multiple respiratory diseases that present with haemoptysis, which include tuberculosis, histoplasmosis, aspergillosis, amyloidosis, cystic fibrosis, bronch iectasis, AV malformations, lung cancers and metastasis.[4]

A study conducted by Guptha.M described that in developing countries like India pulmonary tuberculosis accounts for majority of cases, where as in developed countries bronchiectasis, bronchitis and lung cancer are common etiologies.[5]

Detailed knowledge of the cause, severity, bleeding site and mech anism of haemoptysis is essential for planning appropriate treatment. Diagnostic studies available for management of haemoptysis are radiography, bronchoscopy, MDCT angiography and Digital subtraction angiography.

Earwood .JS et al have described that chest radiography is the first diagnostic imaging modality acquired. It is quick, universally ava il able, economical and low radiation burden to the patient. Common causes like pulmonary tuberculosis, pneumonia, lung abscess, malignant tumour and cardiac causes like mitral stenosis can be detected. [6]

Bhalla AS et al have described that CT angiography with maximum intensity projection (MIP), multi planar reconstruction (MPR), three-dimensional (3D) improves in visualization of pulmonary pathology in detail and also provide anatomical details before planning the therapeutic interventions like, bronchial artery embolization, or surgery.[7,8]

Lungs have dual blood supply from pulmonary and systemic arteries, pulmonary arteries provide gaseous exchange within alveoli and contr ibutes to 99% of arterial supply, and the remaining 1% is from the bronchial arteries. [7,9,10]

In a study conducted by Khalil.A et al have described the major source of haemoptysis is bronchial and non bronchial systemic arteries.[11]

Ittrich.H et al have described that bronchial arteries originates at the level of T5-T6 vertebral level from descending thoracic aorta, often two to three in number.[10] Bronchial artery courses with the bronchi and gives the supplying branches to trachea, oesophagus, bronchi, vasa vasorum of pulmonary arteries, small bronchopulmonary branches to lung, visceral pleura and subcarinal lymphnodes.[12]

Bronchial arteries proliferate and enlarge in size as a compensatory mechanism in cases of restricted pulmonary circulation caused by hypoxia, thrombosis, vasculitis, vasoconstriction and chronic inflam matory lung diseases.

As bronchial arteries have thinner and more fragile walls, they are subjected to increased arterial pressure in the diseased parenchyma. They rupture frequently and bleed into the airways which presents as haemoptysis.

A study by Akgun. V et al described that bronchial arteries are considered abnormal when the diameter of the bronchial artery is >2 mm in diameter, or the course of bronchial artery is tortuous and visualized up to the hilum.[13]

Ittrich .H et al have described the site of bleed presents as two major signs in MDCT imaging - ground glass opacities, alveolar consolidation. In some patients, MDCT will show extravasations of contrast medium into a bronchus or as intrapulmonary shunting.[10]

Non bronchial systemic arteries enter through inferior pulmonary ligament and are considered abnormal when arteries appear tortuous and dilated, and when seen extending up to extra pleural fat in association with pleural thickening >3 mm.[2]

The pulmonary arteries should be evaluated for pulmonary embolism, lung infarction, rasmussen aneurysms in the walls of tubercular cavities, invasion of pulmonary artery branches by neoplastic disease or by the necrotizing inflammatory disease contribute to mild to moderate haemoptysis.

The management of haemoptysis is to monitor and stabilize the cardiopulmonary status of the patient. Intensive care monitoring and endotracheal intubation is performed in patients with massive haemoptysis.

Larici AR et al have described that mild to moderate haemoptysis is usually controlled with conservative therapy, antibiotics. Bronchial

artery embolization (BAE) is the most effective and method of choice in massive and recurrent haemoptysis.[1]

The aim of the bronchial artery embolization is to decrease the sys t emic arterial perfusion pressure from the abnormal bronchial arteries.

Ryuge M et al have described that somatosensory monitoring is indic ated prior to and during the procedure as studies depicts complications such as spinal cord ischemia following BAE procedure.[14]

BAE is performed by intervention radiologist experienced in emboli zation techniques with the help of high-resolution digital subtraction angiography (DSA) unit.

Common femoral artery is punctured under sterile conditions, by introducing vascular sheath (4 F or 5 F) and a flush catheter into the upper part of the descending thoracic aorta. Images are acquired by injecting iodine-based contrast agent, 20-25ml/s and lasting for about 2seconds (flush aortogram is used to identify pathologic bronchial artery).The flush catheter is then exchanged for a selective diagnostic catheter with no side holes. (e.g. cobra-curved, multipurpose or Simmons-type catheters).Selective diagnostic catheter is then advanced into target vessel and angiography is performed (frame rate 3/s).

Selective angiography helps to demonstrate any connections between target vessel and other vascular territories (e.g. anterior spinal artery). If side branches are present tip of catheter is advanced beyond the point of origin of these branches. Test injection of contrast medium is done to check for backflow into the descending thoracic aorta. The embolic agents most commonly used are PVA particles 500–700 microns. The embolic particles are dispersed with contrast medium, in order to view for backflow and to monitor for rate of flow.[14]

It is advised to perform repeat aortic angiography, in view to cross check and identify any additional pathologic vessels that were previously not visible.[14] If present, these vessels are also embolized to avoid the recurrence of haemoptysis.

MDCT angiography reduces procedural time and also the potential iatrogenic complications of flush aortography used for selective search of ectopic bronchial or abnormal nonbronchial systemic arteries.

CONCLUSION:

MDCT angiography and the reformatted images helps to identify the probable site of bleed and the anatomical course of bleeding vessels supplying the abnormal lung parenchyma. It provides a precise road map to guide for further therapeutic embolization procedures.

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