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ROLE OF MULTIDETECTOR ROW COMPUTED TOMOGRAPHY ANGIOGRAPHY IN IDENTIFICATION OF THE VASCULAR SOURCE OF BLEEDING IN THE PATIENTS WITH HEMOPTYSIS

Radio-Diagnosis

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ABSTRACT

We aimed to report our experience with the use of multidetector row computed tomography (MDCT), with angiography in the evaluation of patients with hemoptysis. **OBJECTIVE**: Role of multidetector row computed tomography angiography in identification of the vascular source of bleeding in the patients with hemoptysis. **METHODS:** A prospective study was carried out on 50 patients suffering from hemoptysis. They underwent MDCT using a 128-detector row scanner with bronchial and pulmonary angiographic techniques. **RESULTS**: MDCT identified the cause of hemoptysis in 92% of patients. MDCT angiography was able to detect the site and vascular source of bleeding in 86% of patients. A total of 86 bronchial arteries were detected in 76% of patients; 33% of these arteries (40.74%) were abnormally dilated. **CONCLUSION**: Our results confirm that MDCT angiography is a useful method to identify and depict the bronchial arteries and to predict the presence of nonbronchial systemic vessels that supply a parenchymal lesion. MDCT angiography allows a rapid and detailed identification of abnormal vasculature and provides a precise road map which can be used to guide therapeutic arterial embolization.

KEYWORDS

Utility, multidetector CT, angiography, hemoptysis.

INTRODUCTION

Hemoptysis is defined as bleeding arising from the lower air ways[1]. Hemoptysis, it is classified as "mild" (<30 mL), "moderate"(30–600 mL), "severe" or "massive"(>600 mL)[2]. In majority of the cases (approximately 90–95% cases), hemoptysis results from hypervascularity of lung parenchyma by bronchial and non-bronchial systemic arteries, while bleeding from pulmonary artery origin is rare [3].

Conditions such as bronchiectasis, chronic bronchitis, lung malignancy, tuberculosis, and chronic fungal infection are easily detected with conventional CT. Multi-detector CT angiogram provides an excellent, rapid, non-invasive, and comprehensive evaluation of the entire thorax in patients with hemoptysis, allowing clear depiction of the tracheo bronchial tree, pulmonary parenchyma, and the lung vasculature in a single examination. It helps in identifying the cause of hemoptysis and localize the site of bleeding, as it provides a precise depiction of the bronchial arteries and non-bronchial systemic arteries[4] and also forms a basis for subsequent planning of therapeutic options (conservative, endovascular, or surgery) in such patients

MATERIALS AND METHODS :

Our study was a hospital based descriptive study conducted at S.M.S. medical college and hospital, Jaipur. Total 50 patients with hemoptysis were included. After approval from institutional ethical committee, patients of hemoptysis referred to radiodiagnosis department for MDCT angiography were included in the study, hemodynamically unstable patients were excluded. All the scans were performed using Inguinity 128 slice MDCT Philips machine. Results were analysed by a descriptive analysis and specific findings were compiled.

RESULTS

In our study total 50 patients were included.

Age and sex wise distribution of patients:

The age and sex wise distribution of the patients in this study ranged from 20 years to 80 years is shown in chart 1. Out of 50 patients 31 (62%) were males and 19(38%) were females. Male predominance noted.

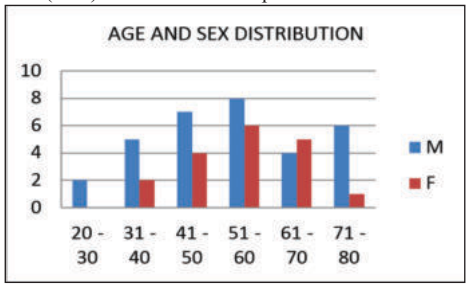

Chart 1: Column diagram showing age and sex distribution of cases.

Table – 1 Source of bleeding detected by MDCT and its relation to parenchymal abnormality.

Source of bleeding	No of patients	With parenchymal abnormality	Without parenchymal abnormality
Bronchial artery Supply	33(66%)	27	6
Non-bronchial systemic artery	6(12%)	6	0
Pulmonary artery	4(8%)	2	2
Not detected	7(14%)	3	4

Grade of hemoptysis :

Among the 50 studied patients most patients have moderate hemoptysis 32(64%), followed by mild and severe 12(24%) and 6(12%).

Assessment of lung parenchyma and pleura :

In our study, MDCT identified the cause of hemoptysis in total 46 out of 50 patients of the study (92%). The cause of hemoptysis were classified into: 38 patients (76%) with lung parenchymal pathology [35 of which had associated vascular abnormalities (70%) while 3 patients (6%) had no associated vascular abnormality and 8 patients (16%) had isolated vascular abnormalities without parenchymal pathology detected.

Assessment of bronchial arteries :

MDCT angiography was able to detect the vascular source of bleeding in 43 out of 50 (86%). Bronchial arteries were the major source of bleeding, being detected in 33 (66%) patients followed by non bronchial systemic arteries and pulmonary arteries of 6(12%) and 4(8%).

Right bronchial arteries :

Right Bronchial Arteries were noted in 27 out of 50 cases(54%). Totally 27 right bronchial arteries were visualized which have single origin. Hypertrophied Right Bronchial artery (more than 2mm) was noted in 19 out of 50 cases (38%). 19 out of the 27 right bronchial arteries (70%) were found to be hypertrophied.

Left bronchial arteries :

Left Bronchial Arteries were noted in 38 patients out of 50 cases (76%). (Figure 28) Totally, 59 left bronchial arteries were visualized in 50 cases. A maximum of 2 bronchial arteries were noted per patient. Single left bronchial artery was noted in 17 cases and double left bronchial supply in 21 cases. The mean Diameter of left bronchial artery was found to be 1.478 mm.

Hypertrophy of left bronchial artery (more than 2mm diameter) was noted in 14 out of 50 cases (28%) or 14 out of 59 Arteries (23.72%).

Nonbronchial systemic arteries :
Dilated nonbronchial systemic supply was noted on the right side in 4 out of 50 patients (8%) and on the left side in 2 out of 50 patients (4%). The mean diameter of internal mammary artery in all cases (N=50) was noted to be 2.64 mm. (Min = 1.8mm. Max = 4.9mm). Nonbronchial Systemic supply from internal mammary artery was noted in 3 cases out of 50 (6%).

The pulmonary circulation contributed to hemoptysis in 4 (8%) patients.

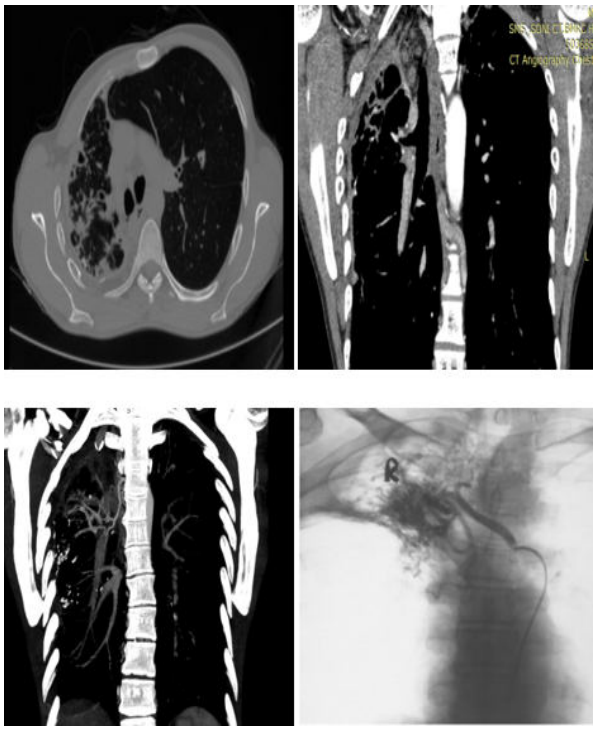

Figure 1 a) Axial NCCT image shows the tree in bud appearance in right upper lobe with bronchiectatic changes (b & c) image shows the dilated right bronchial artery which is traversing towards the lesion and MIP image shows the tortuous course.(d) Conventional angiogram in same patient -catheter tip engaged at the right bronchial artery show contrast material filling the bronchial artery with distal blushing.

DISCUSSION

Identifying the etiology of hemoptysis and classifying it in terms of the amount of blood expectorated play a fundamental role in optimizing the management strategy. Our study showed that lung TB was the most encountered cause for hemoptysis (36%), followed by those underlying chronic lung diseases, like lung mass and Bronchiectasis, in 18% and 14% patients, respectively.

Despite the fact that bronchial arteries are the most common source of massive or life-threatening hemoptysis due to the high pressure of that circuit, non-bronchial systemic circulation may contribute between 10% and 30% of cases. Missing the nonbronchial[5] systemic arteries at initial angiography may result in early recurrent bleeding after successful embolization of the bronchial artery. So, a comprehensive search for non-bronchial systemic arterial supply should be made.

Our study revealed that, MDCT identified the cause of hemoptysis in 48 out of 50 patients (92%). These results are in agreement to those reported by Khalil et al., 90.5% [8].

Diffuse opacities or those predominantly in the dependent portion of the lungs were considered non-localizing. Three types of non-specific radiologic MDCT abnormalities were prescribed in the literature (1) ground-glass opacities and/or (2) alveolar consolidation; the latter abnormalities were considered to reflect the filling of the alveolar lumen with blood, and (3) atelectasis, induced by clots obstructing the bronchi. The presence of alveolar filling, cavitation and/or a mass was considered to be localizing lesions[6,7]

Our study showed that MDCT angiography was able to detect the vascular source of bleeding in 43/50 (86%) of patients. Bronchial arteries were the major source of bleeding, being detected in 33 (66%) patients. A total of 86 BAs were detected in 38 out of 50 (76%) patients (27 right BAs and 54 left BAs). 33 out of 86 detected BAs (38.37%) were seen to be dilated (>2 mm) in 33 patients (19 right BAs and 14 left BAs). Gupta and coworkers[8], with the use of a cutoff value of 2 mm on MDCT, could prospectively detect all abnormal bronchial arteries by MDCT before detecting them later with conventional angiography.

We demonstrated that 77/86 (89.53%) of the BAs seen in our study were orthotopic, while 09/86 (10.46%) were ectopic. Those ectopic arteries were seen in 8 patients, 5 were right-sided (3 from the aortic arch, and 2 from the subclavian artery) and 4 were left-sided (2 from the aortic arch and 2 from lower part of descending thoracic aorta).We identified non bronchial systemic arteries in 6 (12%) of our patients.

Conventional bronchial angiography was performed after MDCT study in 9 (18%) patients who were indicated for embolization and showed positive findings in 8/9 (88.9%) patients, where abnormal BAs were identified in 7 patients and an abnormal NBSA was seen in one patient.

To summarize, our experience confirmed those reported in the literature, that MDCT chest with angiography is considered a primary noninvasive imaging modality in the evaluation of patients with hemoptysis.

CONCLUSION

This study has showed that MDCT is an important diagnostic tool in the evaluation of hemoptysis, It aids in evaluation of the lung parenchyma, helps to diagnose the disease process, estimates the volume of lung parenchymal loss and detects pathologic bronchial and nonbronchial arteries. A new mode of reference for the axial localization of bronchial arteries by the clock method was used in this study and found to be very helpful in the selective catheterization of bronchial arteries. For z-axis (cranio-caudal) localization, it was found that the vertebral body level is a good reference level for comparison, but the use of the left main bronchus as a reference level was found to be more useful for the interventional radiologist.

Most of the bronchial arteries were found to arise between D4 and D7 level and these arteries followed expected normal course. The intercostal arteries were also found to have a fixed ostial position. These data may be extremely useful for the interventional radiologist and helps to avoid thoracic aortography.

The predictors for nonbronchial supply like a significant pleural thickening (3mm and above), hypertrophied internal mammary artery (3mm and above) and inferior phrenic artery (2mm and above) have been validated by this study. Multiple nonbronchial systemic arteries were detected in this study with as many as 6 arteries and this indicates the need for a search for such arteries prior to embolotherapy in order to prevent recurrent hemoptysis. This study will aid to evolve a new protocol for evaluation of life threatening hemoptysis, which is very common in our country because of tuberculosis and has the potential to save many lives.

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