Original Research Article

CT angiographic evaluation of Takayasu arteritis

Warkad M B[1], Panchmahalkar A C[2*], Nanivadekar A[3]

Department of Radiology, Dr SCGMC, Nanded, Maharashtra, INDIA.
Email: dr_ameet_21@yahoo.com

Abstract

Background: Takayasu arteritis, a rare granulomatous vasculitis affecting young people, is associated with considerable morbidity and premature mortality. CT angiography has emerged as a non-invasive, reliable tool in depicting both luminal and mural lesions in the aorta and its main branches. **Aim:** To evaluate the CT angiographic findings in Takayasu arteritis disease. **Material and Methods:** A total of 50 patients presenting with sign and symptoms of aortic diseases or incidental detection of aortic disease in asymptomatic patients were included in the study. CT angiography was performed with 128-slice PHILIPS ingenuity core CT scanner. Images were processed using Intellispace portal software. The diagnosis of TA was made in 5 patients on the basis of clinical, laboratory and CT angiographic findings. **Results:** All TA patients were females. Stenosis of main vessel or branch vessel was present in all patients (100%). 80% patients had involvement of arch vessels (subclavian artery and carotid artery). 40% patients had involvement of renal artery. No patient had aortic aneurysm. 20% had presence of collaterals. 50% had type VTakayasu arteritis. **Conclusion:** CT angiography provides accurate angiographic depiction of luminal lesionsalong with mural information in the evaluation of disease Takayasu arteritis.

Key Words: Takayasu arteritis, CT angiography, luminal lesions, mural lesions.

[*]**Address for Correspondence:**
Dr. Ameet Panchmahalkar, Flat no.3, bhatia Complex, Bandaghat road, mahavir chowk, Vazirabad, Nanded, Maharashtra, INDIA.
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INTRODUCTION

Takayasu arteritis (TA) is a chronic, idiopathic, inflammatory disease that primarily affects large vessels, such as the aorta and its major branches, pulmonary and coronary arteries. It is associated with considerable morbidity and premature mortality. Accurate and early diagnosis plays a crucial role in improving the outcomes for patients with TA.[1] Conventional angiography has been traditionally considered the gold standard to evaluate the luminal abnormalities of vessels involved in TA.[2] However, multidetector CT angiography (CTA) is emerging as a reliable tool in non-invasively depicting both luminal and mural lesions in the aorta and its main branches, which may facilitate the detection of vasculitis during the early systemic phase of TA. The present study was conducted to evaluate the CT angiographic findings in Takayasu arteritis disease.

MATERIAL AND METHODS

The present descriptive cross sectional study was conducted in the department of Radiodiagnosis, Ruby Hall Clinic, Pune in collaboration with the department of Cardiology and Cardiothoracic and vascular surgery. A total of 50 patients presenting with sign and symptoms of aortic diseases or incidental detection of aortic disease in asymptomatic patients were included. All patients underwent CT Angiography for aortic evaluation. It was carried out after obtaining sanction from the Institute Research Committee and Ethical Committee. A written informed consent was obtained from each patient. Out of these 50 patients, five were diagnosed as Takayasu arteritis. The diagnosis was made on the basis of clinical, laboratory and CT angiographic findings.[3] CT angiography was performed with 128-slice PHILIPS ingenuity core CT scanner. Images were processed using Intellispace portal software.The complete CT angiographic study was explained to each subject with risk involved during and/or after intravenous contrast

administration and radiation exposure during the CT study. Written and informed consent was taken before scanning. Blood urea and serum creatinine levels were checked before intravenous contrast administration. MDCT was carried out after 6 hours of fasting. Scout was taken from the level of thoracic inlet to the level of aortic bifurcation (Modification was done according to pathology suspected). Non contrast CT was performed first. After that contrast was injected and angiographic study was performed. Venous phase and delayed phase were taken in selected patients. Image acquisition was carried out adhering to ALARA (as low as reasonably achievable) protocol. Contrast volume was adopted to scan protocol. The contrast used was low osmolar non-ionic water soluble contrast (ULTRAVIST).The goal of contrast administration was to achieve homogenous vascular enhancement synchronized with image acquisition. Great care was taken regarding the intravenous access, dose and density of contrast material and rate of injection. For all the CT angiography examinations, an automatic double head injector was used for contrast administration, using a biphasic injection at a flow rate of 4.5 to 5 ml/s. The volume (*V*) of non-ionic iodinated contrast was calculated using the following equation: V= (scan delay + scan time) × flow rate, followed by 50ml of saline solution at the same rate. For timing purposes, a bolus test technique / automatic triggering (Care Bolus) technique was used with the region-of-interest (ROI) placed in the descending aorta at carinal level. The scanning was started when a threshold of 100 HU was attained. An additional delay of ten seconds was added after the desired HU value was attained at the ROI. Contrast at a dose of 1.5-2 ml/kg was injected at the rate of 2.5-4.5 ml/sec at a pressure of 150 to 175 psi followed by saline flush. Image processing and data analysis was performed on a separate workstation using Intellispace portal software. 2D reconstruction was performed by curved multiplanar reformations (MPR) and Maximum intensity projection (MIP).These allows curved and tortuous vessels and their branches to be visualized in a single tomography volume. Minimum intensity projections were used to evaluate the airway. For 3 dimensional reformatting of complex anatomy, the volume rendering technique was used. Imaging findings from different imaging modalities were noted. CT angiographic evaluation of aorta was done under different headings like origin of aorta, direction of arch, segment involved, characteristics of aortic wall, presence of any thrombosis/stenosis/dissection/ aneurysm and any extraluminal findings. Follow up of patients was taken. According to the vessels involved, the most recently proposed angiographic classification divides TA into six types:[4,5]

1. Type I involves only the branches of the aortic arch.
2. Type IIa involves ascending aorta, aortic arch and its branches.
3. Type IIb affects ascending aorta, aortic arch and its branches, and thoracic descending aorta.
4. Type III involves the descending thoracic aorta, the abdominal aorta and/or the renal arteries. The ascending aorta, the aortic arch and its branches are not affected.
5. Type IV involves only the abdominal aorta and/or renal arteries.
6. Type V has combined features of Type IIb and IV.

RESULTS

Out of the 50 patients included, five (10%) were diagnosed as Takayasu arteritis. The diagnosis was made on the basis of clinical, laboratory and CT angiographic findings. All 5 patients (100%) were females. 2 (40%) patients were in 3rd decade of life and 2 (40%) in 2nd decade of life. One patient (20%) was in fourth decade of life. Mural thickening was present in all 5 patients (100%). Wall calcification was not present in any patients.

Table 1: Analysis of CT angiographic features of Takayasu Arteritis

	Case 1	Case 2	Case 3	Case 4	Case 5
Age Group	14-20 years	21-30 years	31-40 years	14-20 years	21-30 years
Sex	F	F	F	F	F
Mural thickening	Y	Y	Y	Y (branches)	Y (branches)
Wall calcification	No	No	No	No	No
Stenosis	Y	Y	Y	Y	Y
Ectasia	No	No	No	No	No
Aneurysm	No	No	No	No	No
Collateral	No	No	No	Y	No
Pulmonary artery involvement	No	No	No	No	No
Coronary artery involvement	No	No	No	No	No
Subclavian and carotid artery involvement	Y	Y	No	Y	Y
Renal Artery involvement	Y	No	No	No	No
Type	V	IIb	IV	I	I

Stenosis of main vessel or branch vessel was present in all patients (100%). 80% patients (4 out of 5) had involvement of arch vessels (subclavian artery and carotid artery). 40% patients (2 out of 6) had involvement of renal artery. No patient had aortic aneurysm. 1 patients (20%) had presence of collaterals. No patient had coronary artery involvement. No patient had pulmonary artery involvement. 3 patients (50%) had type V Takayasu arteritis. 2 patients had type I Takayasu arteritis with involvement of branches of arch. While type IIb, IV and V was found in one patient each.

DISCUSSION

The clinical symptoms and signs, physical examinations, and laboratory findings of Takayasu arteritis, are all nonspecific, especially in the early stage of the disease. In the late occlusive phase, the diagnosis might be made by evaluating the ischemic symptoms due to involvement of the aorta and its major branches. CT angiography clearly depicted luminal changes and is emerged as a non-invasive reliable tool in the diagnosis of Takayasu arteritis. Angiographic findings such as focal or diffuse narrowing of the aorta and its major branches are considered to be specific in the diagnosis of Takayasu arteritis.[6,7] In our study, 5 patients (10%) had takayasu arteritis. Out of these 5, all the patients (100 %) were females. 2 (40 %) patients were in 3rd decade of life and 2 (40 %) in 2nd decade of life.1 patient was in fourth decade of life. According to Yamada I *et al*, Takayasu arteritisbasically affects girls and young women (80%–90% of patients with Takayasu arteritis are female and in the second or third decade of life).[8]Mural thickening was present in all 5 patients (100%). Wall calcification was present in none.Chung JW *et al*concluded that Aortic involvement in Takayasu arteritis can occur from the aortic root to below the iliac bifurcation, and isolated branch vessel involvement is also possible.[9] Previous works suggested that mural thickening may be the most important finding in the early phases of the disease. According to Khandelwal N *et al* the calcification is usually transmural and has been observed in 27% of patients.[10] Stenosis of main vessel or branch vessel was present in all patients (100%). 80% patients (4 out of 5) had involvement of arch vessels (subclavian artery and carotid artery). 20% patients (1 out of 5) had involvement of renal artery. According to Mason JC *et al* stenosis is the most commonly seen finding associated with mural thickening and can be observed in approximately 90% of patients.[1] Luminal stenosis of the abdominal and thoracic descending aorta has been reported in more than 60% of patients. With regard to the branches, stenotic lesions are most frequently founded in the subclavian and common carotid arteries, followed by the renal arteries.[1] None of the patients (0%) had aortic ectasia or aortic aneurysms. (Aneurysmal variety of Takayasu arteritis). According to Sueyoshi E *et al* dilatation and aneurysms are usually seen in the ascending and abdominal aorta, respectively. Aneurysmal dilatation and rupture of the affected aorta are not rare, with a prevalence of 45% and 33%, respectively.[11] One patient (20%) had presence of collaterals. None of the patient (0 %) had coronary artery involvement or pulmonary artery involvement. Soto ME *et al* studied 18 patients of Takayasu arteritis by MDCT and found coronary artery involvement in 44.4% of patients. Most of the lesions were located in ostial or proximal coronary artery location.[12] In present study, 2 patients (40%) had type ITakayasu arteritis. While type IIb, V and IV was found in one patient each. Aortic involvement in Takayasu arteritis is common, with the abdominal aorta affected most often, followed by the descending thoracic aorta and aortic arch.[8] In conclusion, CT angiography provides accurate angiographic depiction of luminal lesionsalong with mural information in the evaluation of disease Takayasu arteritis.

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