Original Research Article

CT angiographic analysis of patients with aortic aneurysm

Ameet Panchmahalkar[1], Mangesh Warkad[2*]

[1]Associate Professor, [2]Senior Resident, Department of Radiology, Dr. Shankarrao Chavan Government Medical College, Vishnupuri, Nanded—431606, Maharashtra, INDIA.
Email: dr_ameet_21@yahoo.com

Abstract

Background: Multidetector computed tomographic (CT) angiography is routinely performed for the diagnosis and evaluation of thoracic aortic aneurysms. It demonstrates not only the lumen of an aneurysm, but CT angiography also demonstrates the wall and contents of an aneurysm, including thrombus. **Aim:** To analyze CT angiographic features of patients with aortic aneurysm. **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 present study, 16 patients (32%) had aortic aneurysms. CT angiography was performed with 128-slice PHILIPS ingenuity core CT scanner. Images were processed using Intellispace portal software. **Results:** In present study, 16 patients (32%) had aortic aneurysms. 93.25% patients had true aneurysm, while 6.75% patients had pseudo or false aneurysm. 3 patients had saccular aneurysm, while 13 patients had fusiform aneurysms. 87.5% patients (14 out of 16) had single aneurysm and 12.5% patients (2 out of 16) had multiple aneurysms. 11 patients (68.75%) had involvement of thoracic aorta. 4 (25%) patients had involvement of abdominal aorta. **Conclusion:** Accurate identification of location, appearance and cause of both common and uncommon aortic aneurysms is essential for prompt and accurate diagnosis. Multidetector CT angiography is routinely used to evaluate the spectrum of thoracic aortic aneurysm.
Key Word: multi-detector computerized tomography, CT angiography, aorta, aneurysm

***Address for Correspondence:**
Dr. Mangesh Warkad, Senior Resident, Department of Radiology, Dr. Shankarrao Chavan Government Medical College, Vishnupuri, Nanded—431606, Maharashtra, INDIA.
Email: dr_ameet_21@yahoo.com
Received Date: 16/10/2018 Revised Date: 28/11/2018 Accepted Date: 10/12/2018
DOI: https://doi.org/10.26611/1013832

Access this article online

Quick Response Code:

Website: www.medpulse.in

Accessed Date: 23 December 2018

INTRODUCTION

A thoracic aortic aneurysmis defined as a permanent abnormal dilatation of the thoracic aorta.[1] Although the aortic diameter increases slightly with age, the normal diameter of the mid ascending aorta should always be less than 4 cm, and that of the descending aorta no more than 3 cm.[2] Multi detector computed tomographic (CT) angiography is routinely performed for the diagnosis and evaluation of thoracic aortic aneurysms. It demonstrates not only the lumen of an aneurysm, but CT angiography also demonstrates the wall and contents of an aneurysm, including thrombus, thereby allowing a more accurate measurement of aneurysm size and the evaluation of morphologic features and surrounding structures.[3]The present study was conducted to analyze CT angiographic features of patients with aortic aneurysm.

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. The study was carried out after obtaining sanction from the Institute Research Committee and Ethical Committee.A written informed consent was obtained from each patient. 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. In present study, 16 patients (32%) had aortic aneurysms. 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 aneurysm.

RESULTS

In present study, 16 patients (32%) had aortic aneurysms. 93.25% patients had true aneurysm, while 6.75% patients had pseudo or false aneurysm. 3 patients had saccular aneurysm, while 13 patients had fusiform aneurysms. 87.5% patients (14 out of 16) had single aneurysm and 12.5% patients (2 out of 16) had multiple aneurysms. 11 patients (68.75%) had involvement of thoracic aorta. 4 (25%) patients had involvement of abdominal aorta. One (6.25%) patient had aneurysms involving both thoracic and abdominal aorta. 8 patients had presence of thrombus within aneurysm sac. 8 patients had involvement of branch vessels, 5 patients had involvement of aortic root. Morphological features of all aneurysm and associated complications were very well detected on CT Angiography.[6] patients had complications related to aortic aneurysm. 1 patients had contained rupture into retroperitoneum, 2 patients had mass effect. (SVC compression in one patient and compression on carina, vertebral erosions in other patient. One patient had dissection and one patient had mycotic aneurysm. 3 patients had been treated with stent graft placement in aneurysm. All the patients had patent stent. One patient had trouser type of stent.

Table 1: Analysis of patients with Aneurysm

Aneurysm	No. of patients	Percentage
Type		
True	15	93.75
Pseudo	1	6.25
Saccular	3	18.75
Fusiform	13	81.25
Single Aneurysm	14	87.5
Multiple Aneurysm	2	12.5
Location		
Thoracic	11	68.75
Abdominal	4	25

Both	1	6.25
Others	0	00
Presence of thrombus	8	50
Involvement of branch vessels	8	50
Involvement of aortic root	5	31.25
Complication		
Rupture	1	6.25
Mass effect	2	12.5
Dissection	2	12.5
Infection	1	6.25
Post intervention	3	18.75

16 patients (32%) had aortic aneurysm at imaging (true or pseudoaneurysm). Aneurysm had varied etiologies. Out of 16 patients, Atherosclerosis was determined as etiology in 50 % of patients. 12.5 % of aneurysms were post stenotic. Rest of 9 patients had different etiologies distributed equally as described in table 2.

Table 2: Aneurysm Etiology (n=16)

Etiology	No of Patients	Percentage
Dissecting Aneurysm	1	6.2
Marfan	1	6.2
Atherosclerosis	8	50
Mycotic	1	6.2
Takayasu arteritis	0	0
Post stenotic	2	12.5
Bicuspid aortic valve	1	6.2
Post intervention	1	6.2
Unknown	1	6.2

DISCUSSION

Thoracic aortic aneurysms (TAAs) can be broadly divided into true aneurysms and false aneurysms (pseudoaneurysms). True aneurysms contain all three layers of the aortic wall (intima, media, and adventitia), whereas false aneurysms have fewer than three layers and are contained by the adventitia or periadventitial tissues. In our study, 16 patients (32%) had aortic aneurysms. 93.25% patients had true aneurysm, while 6.75% patients had pseudo or false aneurysm. Three patients had saccular aneurysm, while 13 patients had fusiform aneurysms. 87.5% patients (14 out of 16) had single aneurysm and 12.5% patients (2 out of 16) had multiple aneurysms. Crawford ES *et al* did a review of 1,510 patients treated for aortic aneurysms at all levels and found that 191 (12.6%) had multiple ones. More than half of those with thoracic aneurysms had other lesions, and 12% of those with abdominal aneurysms had thoracic aneurysms. Abdominal lesions were the most common secondary lesions in the former group.[4] 11 patients (68.75%) had involvement of thoracic aorta. 4 (25%) patients had involvement of abdominal aorta. One (6.25%) patient had aneurysms involving both thoracic and abdominal aorta. In a study of 249 aneurysms of the aorta and its branches by Fomon JJ *et al*, most of the aneurysms were found in the abdominal aorta (30.9% of cases), whereas the thoracic aortic aneurysm were most frequently seen in the ascending aorta (22.1%). Arch aneurysms, descending aortic aneurysms, and thoracoabdominal aneurysms were seen in 11.6%, 7.6%, and 2.8% of cases, respectively.[5] According to Isselbacher EM, 60%of thoracic aortic aneurysms involve the aortic root and/or ascending aorta, 40% involve the descending aorta, 10% involve the arch, and 10% involve the thoracoabdominal aorta (with some involving >1 segment).[6]Eight patients had presence of thrombus within aneurysm sac. 8 patients had involvement of branch vessels, 5 patients had involvement of aortic root. Morphological features of all aneurysm and associated complications were very well detected on CT Angiography. 6 patients had complications related to aortic aneurysm. 1 patients had contained rupture into retroperitoneum Siegel CL *et al*. evaluated CT scans of patients with ruptured and nonruptured abdominal aortic aneurysms to determine whether a number of morphologic features were associated with rupture. The length of the aneurysm was not significantly different between the rupture and control groups. The ruptured aneurysms had significantly larger anteroposterior and transverse dimensions. The two groups had similar rates of lumen irregularity. Ruptured aneurysms contained a lesser amount of thrombus than aneurysms that were not ruptured. Thrombus calcification was seen more commonly in nonruptured aneurysms, which was thought to be related to the greater amount of thrombus in the nonruptured aneurysms.[7] According to Schwartz SA *et al* high-attenuating crescents were present

in 77% of patients with complicated aneurysms. The specificity of the "high-attenuating crescent" sign was 93%.[8]Two patients had mass effect. (SVC compression in one patient and compression on carina, vertebral erosions in other patient. According to Juan D *et al* progressive growth of an aortic pseudoaneurysm can erode the bony structures of the sternum. Rupture is an imminent sequela of large ascending aortic pseudoaneurysms.[9]One patient had dissection and one patient had mycotic aneurysm. Aneurysm had varied etiologies. Out of 16 patients, Atherosclerosis was determined as etiology in 50% of patients. 12.5% of aneurysms were post stenotic. One patient (2%) had Marfan syndrome with annuloaortic ectasia. According to Ha HI *et al* cardiovascular and valvular disease is seen in the majority of patients (90%) and is the dominant cause of mortality. The term annuloaorticectasiais found in 60%–80% of adults with Marfan syndrome.[10] One patient had mycotic aneurysm. According to Kim SY *et al*, MDCT angiography is the current imaging modality of choice for the evaluation of suspected infected aneurysms. The most characteristic findings of this entity are its saccular shape and lobulated contour, and most cases are solitary. The thoracic aorta and abdominal aorta at or above the renal arteries are involved in almost 70% of infected aneurysms.[11]

CONCLUSION

Accurate identification of location, appearance and cause of both common and uncommon aortic aneurysms is essential for prompt and accurate diagnosis. Multi detector CT angiography is routinely used to evaluate the spectrum of thoracic aortic aneurysm.

REFERENCES

1. GreenCE, Klein JF. Multidetector row CT angiography of the thoracic aorta. In: Boiselle PM, White CS, eds. New techniques in cardiothoracic imaging. New York, NY: Informa Healthcare. 2007; 105–126.
2. AronbergDJ, Glazer HS, Madsen K, Sagel SS. Normal thoracic aortic diameters by computed tomography. J Comput Assist Tomogr. 1984; 8: 247–250.
3. Yu T, Zhu X, Tang L, Wang D, Saad N. Review of CT angiography of aorta. Radiologic Clinics of North America. 2007 May 31; 45(3):461-83.
4. Crawford ES, Cohen ES. Aortic aneurysm: a multifocal disease: presidential address. Archives of Surgery. 1982 Nov 1; 117(11):1393-400.
5. Fomon JJ, Kurzweg FT, Broadaway FK. Aneurysms of the aorta: a review. Annals of surgery. 1967 Apr; 165(4):557.
6. Isselbacher EM. Thoracic and abdominal aortic aneurysms. Circulation. 2005 Feb 15; 111(6):816-28.
7. Siegel CL, Cohan RH, Korobkin M, Alpern MB, Courneya DL, Leder RA. Abdominal aortic aneurysm morphology: CT features in patients with ruptured and nonruptured aneurysms. AJR. American journal of roentgenology. 1994 Nov; 163(5):1123-9.
8. Schwartz SA, Taljanovic MS, Smyth S, O'Brien MJ, Rogers LF. CT findings of rupture, impending rupture, and contained rupture of abdominal aortic aneurysms. American Journal of Roentgenology. 2007 Jan; 188(1):W57-62.
9. Garisto JD, Medina A, Williams DB, Carrillo RG. Surgical management of a giant ascending aortic pseudoaneurysm. Texas Heart Institute Journal. 2010; 37(6):710.
10. Ha HI, Seo JB, Lee SH, Kang JW, Goo HW, Lim TH, *et al*. Imaging of Marfan syndrome: multisystemic manifestations. Radiographics. 2007 Jul; 27(4):989-1004.
11. Kim SY, Park JH, Chung JW, Kim HC, Lee W, So YH, *et al*. Follow-up CT evaluation of the mural changes in active Takayasu arteritis. Korean journal of radiology. 2007 Aug 1; 8(4):286-94.

Source of Support: None Declared
Conflict of Interest: None Declared