Original Research Article

Study of correlation of MDCT angiography in diagnosis of type of Stanford aortic dissection with surgical or endovascular stent graft repair findings

Anil Gopal Tapdiya[1], Ashok Shyam Rao Kadam[2*], Ameet Panchmahalkar[3]

[1,2,3]Associate Professor, Department of Radiology, Government Medical College, Vishnupuri, Nanded, Maharashtra, INDIA.
Email: aniltap@yahoo.co.in , ashok.kadam@gmail.com

Abstract

Background: Aortic dissection is the result of a spontaneous longitudinal separation of the aortic intima and adventitia caused by circulating blood gaining access to and splitting the media of the aortic wall. Various diagnostic modalities are used for inpatients with suspected acute aortic dissection, though findings during surgical or endovascular stent graft repair are confirmatory. In present study we studied correlation of MDCT angiography in diagnosis of type of Stanford aortic dissection with surgical or endovascular stent graft repair findings. **Material and Methods:** Present study was single-center, prospective, observational study, conducted in patients of any age group, gender with clinically suspected cases of aortic dissection with suboptimal Trans-thoracic echocardiography, underwent surgical or endovascular stent graft repair. **Results:** In present study, 25 out of 40 cases with suspicion of aortic dissection who met our study criteria were evaluated. Patients ranging from 21-70 years underwent MDCTA, however, majority of patients belonged to age group of 51 to 60 years (52%), 31-40 years (24%) ,41- 50 years (16%), 21-30 years (4%) and 61-70 years(4%). Gender distribution in our study was 15 males (60%) and 10 female patients (40%) (Ratio 1.5:1). 20 cases (80%) were STANFORD-A and 5 (20%) were STANFORD-B types of aortic dissection. 20 subjects underwent MDCT angiography who were diagnosed as Stanford-A aortic dissection are confirmed with surgical findings. Remaining 5 subjects underwent MDCT angiography who were diagnosed as Stanford-B aortic dissection are confirmed with endovascular stent graft repair findings. Out of 25 operated/endovascular repair cases of aortic dissection, 25 were detected on MDCTA (100% Sensitivity and 100% Accuracy). MDCT Angiography diagnosis was highly significantly ($p < 0.001$) correlated with Surgical /endovascular repair findings. **Conclusion:** Modern MDCT allows rapid image acquisition and data reconstruction and aids in treatment planning.

Keywords: Study of correlation of MDCT angiography, Stanford type, aortic dissection, surgical or endovascular stent graft repair.

***Address for Correspondence:**
Dr Ashok Shyam Rao Kadam, Associate Professor, Department of Radiology, Government Medical College, Vishnupuri, Nanded, INDIA.
Email: ashok.kadam@gmail.com

Received Date: 13/08/2021 Revised Date: 08/09/2021 Accepted Date: 20/10/2021

This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

Access this article online	
Quick Response Code:	Website: www.medpulse.in
	DOI: https://doi.org/10.26611/10132022

INTRODUCTION

Aortic dissection is the result of a spontaneous longitudinal separation of the aortic intima and adventitia caused by circulating blood gaining access to and splitting the media of the aortic wall.[1,2] By definition, acute aortic dissection is characterized by symptoms that are present for less than 14 days; in chronic dissections, the symptoms are present for a longer period.[1,3] The aorta can be divided by anatomical segments ,which have a discrete function and unique embryologic development, including the aortic root, ascending aorta, aortic arch, descending aorta, and the

How to cite this article: Anil Gopal Tapdiya, Ashok Shyam Rao Kadam, Ameet Panchmahalkar. Study of correlation of MDCT angiography in diagnosis of type of Stanford aortic dissection with surgical or endovascular stent graft repair findings. *MedPulse International Journal of Radiology.* November 2021; 20(2): 28-32. http://www.medpulse.in/Radio%20Diagnosis/

sub-diaphragmatic abdominal aorta.[4] Based on the location of the entry tear, aortic dissections are actually classified as type A when the proximal tear is located in the ascending aorta and as type B when the tear is present after the origin of the LSCA (Stanford classification).[5] Aortic dissection affects more commonly the fifth decade of life and the male population, with a frequency varying from 2:1 to 5:1, compared to the females.[5,6,7] Patients with type A are usually younger (25-55 years old) than those with type B, who aged between 60 and 70 years. [5,6,7] It has been reported that up to 20% of patients with acute aortic dissection may present with syncope without a history of typical pain or neurologic findings.[8,9] Various diagnostic modalities such as chest radiography, computed tomography aortography with or without contrast, multi detector computed tomography (MDCT), magnetic resonance angiography, echocardiography, Trans Esophageal Echocardiography (TTE), angiography, digital subtraction angiography (DSA) are used for inpatients with suspected acute aortic dissection,[1,4] though findings during surgical or endovascular stent graft repair are confirmatory. In present study we studied correlation of MDCT angiography in diagnosis of type of Stanford aortic dissection with surgical or endovascular stent graft repair findings.

MATERIAL AND METHODS

Present study was single-center, prospective, observational study, conducted in Department of Radio-Diagnosis, Care Hospital, Banjara hills, Hyderabad, India. Study duration was of 2 years (August 2013 To August 2015). Study was approved by institutional ethical committee. Present study was conducted with help of other departments as department of cardiothoracic surgery, department of interventional radiology, department of cardiology and department of emergency medicine. Patients came to OPD or Emergency Room, Suspected to have aortic dissection on Clinical examination with suboptimal transthoracic echocardiography are subjected for CT imaging (SIEMENS SOMATOM DEFINITION 64 SLICE DUAL SOURCE MDCT) at our Hospital, with a dedicated imaging Protocol and subsequently gets emergency surgery/endovascular repair at our hospital.

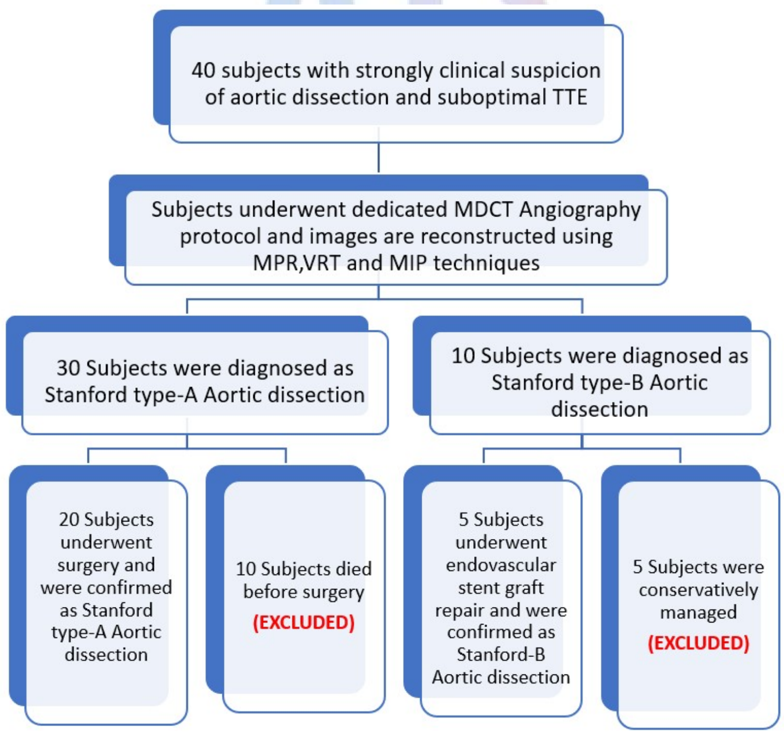

Figure 1: FLOWCHART SHOWING THE STUDY DESIGN

Inclusion criteria: Patients of any age group, gender with clinically suspected cases of aortic dissection with suboptimal Trans-thoracic echocardiography, underwent surgical or endovascular stent graft repair.

Exclusion criteria: Other causes of acute aortic syndrome (aortic intramural hematoma, penetrating atherosclerotic ulcer, aortic aneurysmal rupture, traumatic aortic transection) and acute coronary syndrome/acute myocardial infarction. Patients with known contrast allergy. Patients with Chronic Kidney Disease.

All CT images are interpreted by research person, by guide and by senior consultant radiologist, specialist in cardiovascular imaging. Initially Plain CT Study was done and findings noted. Non-contrast CT scan images were analysed to see internal displacement of intimal calcifications and hyper-attenuation of false lumen. For imaging sections were taken from the root of neck to the level of femoral arteries, with specifications as series – plain, Arterial and Venous Phases, kVp – 120 and mAs – 300(varies), collimation – 64 x 0.6mm, slice thickness – 5mm with increment – 0.6mm. Contrast used was nonionic contrast media (OMNIPAQUE 350), by bolus tracking method, intravenous with flow rate – 4 ml/sec by an injection pump and about 1.5 ml /kg. The examination initiated 5 sec after attenuation of the region of interest. For three dimensional images, the volumetric CT data sets were processed on a separate workstation with multi-planar reformatting, maximum intensity projection and volume rendering. Axial source images, the two- and three-dimensional data sets were evaluated for each subject. ECG gating was used because it allows delineation of the aortic root and of coronary artery involvement. It also allows clear differentiation of motion artefact in the ascending aorta from true aortic dissection. CT images were reconstructed into Axial, Coronal and Sagittal Planes. Reconstruction images obtained using multi-planar reformations, volume rendering and maximum intensity projection techniques. Contrast-enhanced CT scan images were analysed to see intimal flap that separates the true lumen from false lumen. False lumen was identified by features like large cross-sectional area, attenuation values, cob-web sign and beak sign. True lumen was identified by features like small cross-sectional area, attenuation values and its continuity with un-dissected portion of aorta. Imaging features are divided into Stanford type-A aortic dissection and Stanford type-B aortic dissection. A CT scan was read as positive for Stanford type-A aortic dissection when dissection is involving ascending thoracic aorta with or without involvement of arch of aorta, descending thoracic aorta or abdominal aorta. A CT scan was read as positive for Stanford type-B aortic dissection when dissection was involving descending thoracic aorta distal to left subclavian artery with or without involvement of abdominal aorta. The collected data were entered and analyzed using Microsoft office window excel 2007 and SPSS version 16 (SPSS 16.0 for Windows, release 16.0.0. Chicago: SPSS Inc). To assess the diagnostic ability of a test, we calculated sensitivity and accuracy. Chi-square test was used and considered to be significant when the p-value was less than0.05.

RESULTS

In present study, 25 out of 40 cases with suspicion of aortic dissection who met our study criteria were evaluated.

Patients ranging from 21-70 years underwent MDCTA, however, majority of patients belonged to age group of 51 to 60 years (52%), 31-40 years (24%) ,41- 50 years (16%), 21-30 years (4%) and 61-70 years(4%). Gender distribution in our study was 15 males (60%) and 10 female patients (40%) (Ratio 1.5:1).

Table 1: Age and gender distribution

General characteristics	No. of cases (n=25)	Percentages
AGE (in years)		
21-30	1	4 %
31-40	6	24 %
41-50	4	16 %
51-60	13	52 %
61-70	1	4 %
Gender		
Male	15	60 %
Female	10	40 %
SEX RATIO (M:F)	1.5:1	

In our study, intimal flap was identified easily and readily and thus true lumen was differentiated from false lumen in all 25 subjects. True lumen was identified with features of its continuity with un-dissected portion of aorta and smaller than false lumen in all subjects. False lumen was identified with features of large cross-sectional area, Beak sign and Cobweb sign and False lumen was thrombosed in 5 subjects. On MDCTA, 10 subjects showed left renal artery arising from false lumen, 5 subjects showed celiac axis arising from false lumen, and 3 subjects showed superior mesenteric artery arising from false lumen. 20 cases (80%) were STANFORD-A and 5 (20%) were STANFORD-B types of aortic dissection.

Table 2: MDCT angiography findings and Stanford classification

Stanford classification	No. of cases (n=25)	Percentages
Stanford A - intimal flap involving ascending aorta and extending into arch of aorta, descending thoracic aorta and abdominal aorta	20	80 %
Stanford B - intimal flap involving descending thoracic aorta and extending into abdominal aorta	5	20 %

20 subjects underwent MDCT angiography who were diagnosed as Stanford-A aortic dissection are confirmed with surgical findings. Remaining 5 subjects underwent MDCT angiography who were diagnosed as Stanford-B aortic dissection are confirmed with endovascular stent graft repair findings. Out of 25 operated/endovascular repair cases of aortic dissection, 25 were detected on MDCTA (100% Sensitivity and 100% Accuracy). MDCT Angiography diagnosis was highly significantly ($p < 0.001$) correlated with Surgical /endovascular repair findings.

Table 3: Correlation of MDCT angiography diagnosis and surgical treatment/endovascular repair

		Surgical Treatment / Endovascular Repair			
MDCT angiography diagnosis	Gender	Type A- Surgery	Type B- endovascular stenting	Total	P value
	Male	10 (40%)	5 (20%)	15	
	Female	10 (40%)	0	10	<0.0001
TOTAL		**20**	**5**	**25**	

DISCUSSION

Aortic dissection is an acute aortic disorder, with an incidence up to 0.2– 0.8%, and also carries the highest mortality rate.[1] The overall outcome is determined by the type and extent of dissection and the presence of associated complications; therefore, evaluation of the entire aorta, branch vessels, and iliac and proximal femoral arteries is recommended to aid in treatment planning.[2] CT with contrast injection is indicated in the diagnosis of Aortic dissection.[10] CT was the most common initial diagnostic test performed in patients enrolled in the International Registry of Acute Aortic Dissection.[10] More recent MDCT studies enrolling up to 57 patients have reported sensitivities and specificities of 100%.[11] Patients with Stanford type A dissection traditionally undergo surgical replacement of the ascending aorta while patients with Stanford type B dissection are increasingly undergoing endovascular stent-graft treatment. Of the 30 subjects who were diagnosed as Stanford-A aortic dissection non MDCT angiography, 20 subjects underwent surgery and were confirmed as Stanford type-A aortic dissection. Remaining 10 subjects were died even before surgery as Stanford type-A aortic dissection causes high mortality. Of the 10 subjects who were diagnosed as Stanford-B aortic dissection non MDCT angiography, 5 subjects underwent endovascular stent graft repair under fluoroscopy guidance and were confirmed as Stanford type-B aortic dissection. Remaining 5 subjects were conservatively managed and advised follow-up (FLOWCHART). The above findings confirmed that MDCT angiography is 100 % sensitive and 100% accurate in diagnosing aortic dissection, type of aortic dissection and decides the treatment for which the patient should undergo. These results are in close agreement with Yoshida S *et al.*[12] studied 57 patients with acute chest pain underwent emergency helical CT and subsequent surgery for type A Aortic Dissection .Sensitivity, specificity, and accuracy of helical CT, along with 95% CIs, were calculated by using surgical confirmation as the reference standard and concluded that helical CT was 100% sensitive,100% specific and 100% accuracy in diagnosing aortic dissection arising from ascending aorta, aortic arch and descending aorta. Our results are also in close agreement with Zeman RK *et al.*[13] studied 23 patients with suspected Aortic Dissection and performed helical CT in those patients and found that axial sections resulted in 15 true-negative, 7 true- positive, and 1 false-positive interpretation. In three of seven patients with dissection, they found difficult to determine the extent of the intimal flap on axial sections; multi-planar reformation or 3D views clarified the relevant anatomy in all these 3 cases and concluded that multi-planar reformation and 3D rendering of helical CT scans would be a valuable addition to axial display of CT studies used to detect Aortic Dissection and to determine the extent of the intimal flap and concluded that CT findings agreed with angiographic and surgical findings in all patients with type- A and type-B dissection. Our results are also in close agreement with Adachi H *et al.*[14] studied 68 patients with 3D-CTA, 35 patients were diagnosed as aortic dissection. Surgical intervention was used in most of the patients and concluded that preoperative 3D-CTA findings were quite similar to intraoperative findings, and were useful in determining operative procedures. Rapid and accurate assessment of aortic disease was achieved by 3D-CTA. 3D-CTA can play an important role in the preoperative assessment of Aortic Dissections leading to successful surgical treatment. Our results are also in close agreement with Small JH *et al.*[15] evaluated in 81 patients with suspected acute aortic dissection who were examined on a fast CT system capable of a 1s data acquisition time. 17 patients had Type A and nine had Type B dissections. When 78 confident reports alone were considered, both sensitivity and specificity reached 100% and concluded that CT can often be used as the single investigation prior to surgery for acute Type A dissections. Our results are also in close agreement with Sommer T *et al.*[16] in their study in 1996, studied on forty-nine symptomatic patients with clinically suspected Aortic Dissection Aortic Dissection were examined with contrast material-enhanced spiral CT and concluded that sensitivity and specificity of contrast material- enhanced spiral CT was 100% in detection of thoracic aortic dissection. Sakamoto *et al.*[17] studied 107 patients with clinical suspicion of Acute Aortic Dissection who underwent non-enhanced MDCT had a sensitivity of only 87% which is less than our sensitivity which is100%. In present study, we used the parameters of 120 kVp and 231 mAs (varied automatically according to body size) to provide optimal quality images without any significant loss of diagnostic data. Because of the radiation burden and invasiveness, we were not able to compare this technique with conventional angiography. Our study has few limitations. such as small sample size, lack of conventional angiography and MRA to assess the

Copyright © 2021, Medpulse Publishing Corporation, MedPulse International Journal of Radiology, Volume 20, Issue 2 November 2021

accuracy of the MDCT data. Sample size (n=25) was less because study was done for a limited period (two years). Aortic dissection is a rare disease and is frequently lethal and can easily be mistaken for less serious pathology. Some of the aortic dissections are missed at presentation and first diagnosed at autopsy. This study may have substantial impact on economic costs, patient experience, radiation that we cannot comment upon.

CONCLUSION

MDCT has the advantages of shorter acquisition time, wide availability, and high diagnostic accuracy and has, therefore, classically been the modality of choice for the evaluation of aortic dissection. Modern MDCT allows rapid image acquisition and data reconstruction and aids in treatment planning. Multimodality approach of using MDCT angiography, MRA and TEE also can be practiced if the patients are stable.

REFERENCES

1. McMahon MA, Squirrell CA. Multidetector CT of Aortic Dissection: A Pictorial Review. Radiographics. 2010 Mar;30(2):445-60.
2. Dähnert W. Cardiovascular disorders: aortic dissection. In: Radiology review manual. 5th ed. Philadelphia, Pa: Lippincott Williams and Wilkins, 2003;607–609.
3. Prêtre R, Von Segesser LK. Aortic dissection. Lancet 1997;349(9063):1461–1464.
4. Murillo H, Lane MJ, Punn R, Fleischmann D, Restrepo CS. Imaging of the aorta: embryology and anatomy. Semin Ultrasound CT MR. 2012 Jun;33(3):169-90.
5. Hagan PG, Nienaber CA, Isselbacher EM, Bruckman D, Karavite DJ, Russman PL, *et al.* The International Registry of Acute Aortic Dissection (IRAD):new insights into an old disease. JAMA 2000 Feb16;283(7):897-903.
6. Clouse WD, Hallett JW, Jr., Schaff HV, Spittell PC, Rowland CM, Ilstrup DM, *et al.* Acute aortic dissection : population-based incidence compared with degenerative aortic aneurysm rupture. Mayo Clin Proc 2004 Feb;79(2):176- 80.
7. Olsson C, Thelin S, Stahle E, Ekbom A, Granath F. Thoracic aortic aneurysm and dissection: increasing prevalence and improved outcomes reported in a nationwide population-based study of more than 14,000 cases from 1987 to 2002. Circulation 2006 Dec12;114(24):2611-8.
8. Mehta RH, O'Gara PT, Bossone E, *et al.* Acute type A aortic dissection in the elderly: clinical characteristics, management, and outcomes in the current era. J Am Coll Cardiol 2002;40(4):685–692.
9. Januzzi JL, Isselbacher EM, Fattori R, *et al.* Characterizing the young patient with aortic dissection: results from the International Registry of Aortic Dissection (IRAD). J Am Coll Cardiol 2004;43(4):665–669
10. Moore AG, Eagle KA, Bruckman D, *et al.* Choice of computed tomography, transesophageal echocardiography, magnetic resonance imaging, and aortography in acute aortic dissection: International Registry of Acute Aortic Dissection (IRAD). Am J Cardiol.2002;89(10):1235-1238.
11. Imoto K, Uchida K, Karube N, *et al.* Risk analysis and improvement of strategies in patients who have acute type A aortic dissection with coronary artery dissection. Eur J Cardiothorac Surg. 2013;44(3):419-424;discussion 424-415.
12. Yoshida S, Akiba H, Tamakawa M, *et al.* Thoracic involvement of type A aortic dissection and intramural hematoma: diagnostic accuracy--comparison of emergency helical CT and surgical findings. Radiology.2003;228(2):430- 435.
13. Zeman RK *et al.* Diagnosis of aortic dissection: value of helical CT with multiplanar reformation and three-dimensional rendering. AJR Am J Roentgenol.1995 Jun;164(6):1375-80.
14. Adachi H, Ino T, Mizuhara A, Yamaguchi A, Kobayashi Y, Nagai J. Assessment of aortic disease using three-dimensional CT angiography. J Card Surg. 1994 Nov;9(6):673-8.
15. Small JH, Dixon AK, Coulden RA, Flower CD, Housden BA Fast CT for aortic dissection. Br J Radiol. 1996 Oct; 69 (826):900-5.
16. Sommer T *et al.* Aortic dissection: a comparative study of diagnosis with spiral CT, multiplanar transesophageal echocardiography, and MR imaging. Radiology. 1996 May ; 199 (2):347-52.
17. Sakamoto S, Taniguchi N, Nakajima S, Takahashi A. Diagnostic value of nonenhanced multidetector computed tomography for ruling out acute aortic dissection in patients presenting with chest or back pain. Int J Cardiol.2013 Sep 30;168(2):734-8.

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