International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2019): 7.583

ASI and AHI Scores in Acute Type a Aortic Dissection: A Reliable Predictor of Complications and Useful Criteria for Early Intervention

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Abstract: ***Thoracic aortic aneurysm is defined as an aortic size 50% greater than the expected aortic diameter.In practice, 5 cm axial dimension is most oftenused since intervention is otherwise rarely considered in the asymptomatic patient. If this relationship is reversed, aortic monitoring for aneurysm development should be considered. CTangiography of heart and great vessels scan characterize thoracicascending aortic aneurysms by their size, location and shape. Hence, Aim of the study was to properly delineate increasing diameter of ascending aorta, hence aortic surface index(ASI) and aortic height index(AHI) was calculated as reliable predictor of complication,and as useful criteria for intervention.***

Keywords: Type AThoracic Ascending Aortic Aneurysm (TAAA), ASI, AHI

1. Introduction

The criteria for Surgical intervention in Thoracic Ascending Aortic Aneurysm (TAAA) are based on aortic diameter > 5.5 cm for asymptomatic TAAA and between 4.0 and 5.0 cm for various genetic aortopathies[1,2]. These size cutoffs in turn are based on annual rising natural risk of grave complication such as aortic rupture, dissection and/or death[3,4,5]. It has always seemed to beusing how two patients with great difference in body framework could share the same aortic size criterion for intervention. A drawback of using aortic diameter in predicting complications and deciding when to intervene is the inability to factor in a significant determinant of aortic dimensions: the patient's body size[6].The Aim of our study is to formulate a biometric index for aortic size so that before the aorta reaches a dangerous size a presumptive surgery can be done, hence saving more lives.

2. Review of Literature

In 2006, Davies RR, Gallo A, Coady MA, et al. determined that relative aortic size index(aortic size to the body surface area of a patient) was a more accurate predictor of the risk of aortic rupture, dissection, or death than aortic size alone. Zafar et al compared with indices including weight, the simpler height-based ratio (excluding weight and BSA calculations) yields satisfactory results for evaluating the risk of natural complications in patients with TAAA.

3. Material and Methods

A total of 24 patients with diagnosis of type A aortic dissection were operated in our Department of CTVS at GB Pant Hospital from August 2018 to Nov 2020. We calculated aortic dimensions using CT angiography of heart and great vessels for every patient {Fig1}. Aortic height index (AHI){Fig3} and Aortic surface index (ASI){Fig2} was calculated and data was analyzed.We conducted a retrospective study in Acute type A Aortic dissection patients at our institute to evaluate the correlation between ASI and AHI with aortic dimension in these patients.

Inclusion criteria-
1) All patient with age – 18-75 years
2) Both male and female

Exclusion criteria-
1) Patients having co-morbidities, like diabetes, hypertension
2) Syndromic patients

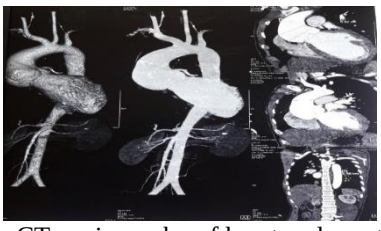

Figure 1: CT angiography of heart and great vessels

Table 1

S No.	Demographic characteristics	Range	Mean ± SD	Median(IQR)
1	Age(years)	18-75	39.71 ± 14.8	35(30-46)
			No.	Percentage
2	Gender	Male	17	70.83%
		Female	7	29.17%
3	Height(cm)	145-190	169.92 ± 10.45	168(165-178.5)
4	Weight(kg)	40-82	60.67 ± 12.73	60(50-72.75)
5	BSA(m^2)	1.27-2.06	1.68 ± 0.21	1.67(1.542-1.848)
6	Aortic Dimension	4.1 – 8.2	6.43 ± 1.09	6.45(5.875-7.225)
		4.1-5	4	16.67%
		5.1-6	4	16.67%
		6.1-7	8	33.33%
		>7	8	33.33%
7	Aortic Surface Index	<=3.5	7	29.17%
		3.51-4	10	41.67%
		4.01-4.5	2	8.33%
		>4.5	5	20.83%
8	Aortic Height Index	<=3.5	8	33.33%
		3.51-4	8	33.33%
		4.01-4.5	6	25.00%
		>4.5	2	8.33%
			Correlation coefficient	P value
9	Correlation with Aortic surface index		0.734	<0.0001
10	Correlation with Aortic height index		0.952	<0.0001

Statistical analysis

Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean ± SD and median. Normality of data was tested by kolmogorov-smirnov test. If the normality was rejected then non parametric test was used. Pearson correlation coefficient was used to assess the correlation of aortic dimension with aortic surface index and aortic height index. p value of <0.05 was considered statistically significant. The data was entered in MSEXCEL spreadsheet and analysis was done using statistical package for social sciences (SPSS) version 21.0.

4. Results

The demographic characteristics (table 1) of the study subjects shows the mean age is 39.71 ± 14.8 years, mean height 169.92 ± 10.45 cm and mean BSA 1.68 ± 0.21.Aortic dimensions (table 1) of study population as mean of 6.43 ± 1.09 cm with 66.66% of patients having diameters above 6 cm.The mean aortic surface index (table 1) is 3.83 ± 0.6 cm with >41% patients having ASI between 3.51 to 4.0 and 29.17 % patients having ASI < 3.5. Thus 70% patients in the study group had ASI < 4.0 and 30% had ASI > 4.1.The mean Aortic height index AHI is 3.76 ± 0.51. There are 66.66% patients in group < 4 and 25% patients in group 4.01 to 4.5 thus 91% patients were below 4.5 AHI.The correlation coefficient of ASI vs Aortic dimesion was calculated. It was, 0.734 for ASI with p value < .0001and for AHI 0.952 with p value <.0001. Hence, the results show that biometric indexing of Aortic size has good correlation with Aortic dimension with significant P values. Although both scores have high correlation, AHI is more intimately related to the aortic dimension.

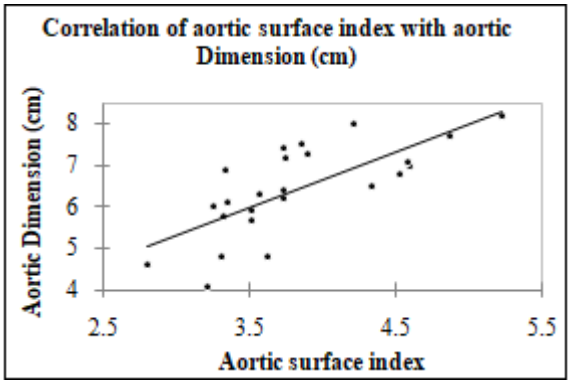

Figure 2: Correlation of aortic surface index with aortic Dimension (cm).

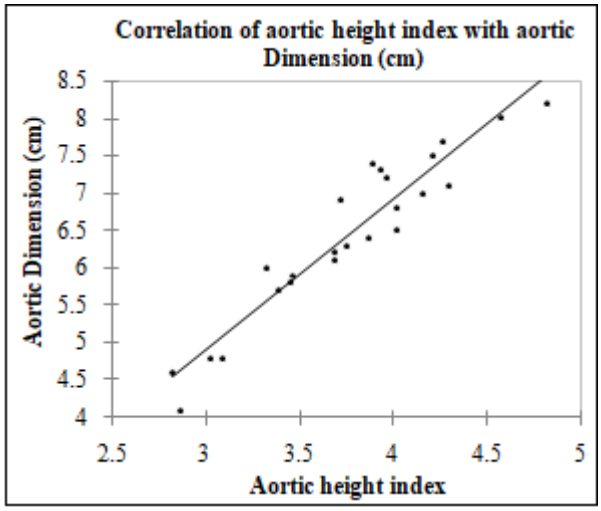

Figure 3: Correlation of aortic height index with aortic Dimension (cm).

5. Discussion

For patients with TAAA, dissection and rupture are no longer the primary contributors to complications; rather,

death in patients not previously known to us is becoming the main contributor.Therefore, the focus and challenge for the future will be to identify those asymptomatic individuals who die from this disease before being diagnosed.The aortic size > 6 cm has been shown to be associated with increased chances of dissection and even in our study the mean aortic size came out to be 6.43 ± 1.09 cm. Svensson and colleagues provided the concept of indexing aortic dimensions to patient stature to better inform surgical decision making in patient with aneurysms[9]. The zafar et al in their study estimated probability of risk of natural complications (rupture and dissection) and they found 2 ''hinge points'' at the aortic sizes associated with increased risk of rupture and dissection[8]. One sharp hinge point was observed at 5.75 to 6 cm.4 and a second hinge point is also seen at 5.25 to 5.5 cm. The size range above 5 cm suggests that we may need to move the intervention criterion, toward a smaller size.

Based on the present study, we have been able to provide ASI (aortic size corrected to BSA) and AHI (aortic size corrected to height) for the patients with type A aortic dissection , hence a biometric index for clinical decision making. The predictive value of the ASI for aortic dissection is demonstrated in the present study as correlation coefficient came out to be ASI 0.734 with p value < .0001 and the correlation coefficient for AHI came out to be 0.952 with p value <.0001 suggesting that the AHI is more effective biometric index for clinical decision making. Furthermore, because height is genetically predetermined, it may be more closely correlated to aortic size. Two patients with identical aortic size and height will have the same risk of complications using the AHI. But if one person is heavier than the other (and thus has a greater BSA), the ASI will assign the heavier individual a lower risk of adverse events. However, computing the BSA factors in patient weight, which is prone to significant fluctuation throughout adulthood. In contrast, height remains fairly constant and is not prone to wide fluctuations.

Hence the studies have validated a relative aortic measure, either , the aortic size index (ASI), defined as aortic diameter divided by body surface area (BSA) or the aortic height index (AHI), defined as aortic size divided by patient height, as patient-specific predictor of dissection, rupture, and death than absolute aortic diameter[7]. In a recent study by Masri and colleagues,ratio of aortic root (or ascending aortic) cross-sectional area to height was identified as an independent predictor of long-term mortality in patients with TAAA. The authors reported that this height adjusted ascending aortic area better classified the mortality risk compared with the raw aortic diameter.

6. Conclusion

The present study shows that although both ASI And AHI scores for type A aortic dissection have good correlation with aortic size however the AHI is more reliable biometric index for clinical decision making and is more intimately related to aortic size in comparison with the ASI. Thus, all patients with thoracic aortic aneurysm must be subjected to biometric analysis and patients with AHI scores of >3 must be considered as high risk and must be intervened irrespective of aortic diameter. Since ASI scores are weight dependent they are subjected to change over time hence are not reliable index for intervention as AHI although ASI scores are also closely correlated with Aortic dissection.

References

[1] Hiratzka LF, Bakris GL, Beckman JA, Bersin RM, Carr VF, Casey DE, et al. 2010 ACCF/AHA/AATS/ACR/ASA/SCA/SCAI/SIR/STS/SVMguidelines for the diagnosis and management of patients with thoracic aortic disease: a report of theAmerican College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines, American Association for Thoracic Surgery, American College of Radiology, American Stroke Association, Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, Society of Interventional Radiology, Society of Thoracic Surgeons, and Society for Vascular Medicine. J Am CollCardiol. 2010;55:e27-129.

[2] Erbel R, Aboyans V, Boileau C, Bossone E, Di Bartolomeo R, Eggebrecht H, et al. 2014 ESC guidelines on the diagnosis and treatment of aortic diseases: document covering acute and chronic aortic diseases of the thoracic and abdominalaorta of the adult. The task force for the diagnosis and treatment of aortic diseases of the European Society of Cardiology (ESC). Eur Heart J. 2014;35: 2873-926.

[3] Elefteriades JA, Ziganshin BA, Rizzo JA, Fang H, Tranquilli M, Paruchuri V, et al. Indications and imaging for aortic surgery: size and other matters. J ThoracCardiovasc Surg. 2015;149(2 Suppl):S10-3.

[4] Coady MA, Rizzo JA, Hammond GL, Mandapati D, Darr U, Kopf GS, et al. What is the appropriate size criterion for resection of thoracic aortic aneurysms? J ThoracCardiovasc Surg. 1997;113:476-91; discussion 489-91.

[5] Davies RR, Goldstein LJ, Coady MA, Tittle SL, Rizzo JA, Kopf GS, et al. Yearly rupture or dissection rates for thoracic aortic aneurysms: simple prediction based on size. Ann Thorac Surg. 2002;73:17-27; discussion 27-8.

[6] Davis AE, Lewandowski AJ, Holloway CJ, Ntusi NA, Banerjee R, Nethononda R, et al. Observational study of regional aortic size referenced to body size: production of a cardiovascular magnetic resonance nomogram. J CardiovascMagnReson. 2014;16:9.

[7] Davies RR, Gallo A, Coady MA, et al. Novel Measurement of Relative Aortic Size Predicts Rupture of Thoracic Aortic Aneurysms. Ann ThoracSurg 2006;81:169-77.

[8] Zafar et al Height alone, rather than body surface area, suffices for risk estimation in ascending aortic aneurysm J ThoracCardiovascSurg 2018;155:1938-50

[9] SvenssonL.G.Kim K.H. Lytle B.W. Cosgrove D.M.Relationship of aortic cross-sectional area to height ratio and the risk of aortic dissection in patients with bicuspid aortic valves.*J ThoracCardiovasc Surg.* 2003; **126**: 892-893