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Abdominal Aortic Aneurysm Screening using transthoracic echocardiography in Patients with Significant Coronary Artery Disease and risk factors: A Prospective Observational Study

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Abstract

Background: Abdominal aortic aneurysm (AAA) is frequently asymptomatic until rupture and is associated with high mortality. Coronary artery disease (CAD) and AAA share common atherosclerotic risk factors. Opportunistic screening for AAA during transthoracic echocardiography (TTE) may facilitate early diagnosis in high-risk populations. ***Objectives:*** 1. To screen for AAA in patients aged ≥60 years with significant CAD and/or established risk factors. 2. To evaluate the association between AAA and conventional cardiovascular risk factors. ***Methods:*** This prospective cross-sectional observational study included 204 patients aged ≥60 years attending a tertiary cardiac centre between January 2019 and February 2020. Patients had angiographically proven CAD (≥50% epicardial stenosis) and/or ≥1 AAA risk factor. During routine TTE, infrarenal abdominal aortic diameter was measured using a 3.5 MHz transducer (outer-to-outer method). AAA was defined as diameter ≥30 mm. Statistical analysis was performed using SPSS v17. ***Results:*** AAA was detected in 4 patients (2.0% prevalence), all of fusiform type. AAA was present in 0.0 % of patient in age group of 60-69 yrs, 2.6 % of patients in 70-79 yrs and 21.4 % of patients in 80-89 yrs age group. The correlation between age distribution and the study groups is highly significant (p value of <0.001). In relation to distribution of males and females according to history of smoking. It was observed that among males, 32.1% of males had history of smoking and 8.2% of females had history of smoking. Smoking showed strong gender association (p<0.001). Correlation between other risk factors and AAA did not reach statistical significance (likely due to small AAA sample size). ***Conclusion:*** Opportunistic AAA screening during routine echocardiography in elderly patients with CAD and risk factors is feasible, rapid, and cost-effective. Although overall prevalence was 2%, early detection may reduce catastrophic rupture-related mortality. Larger multicentric Indian studies are warranted.

Keywords: Abdominal aortic aneurysm, Coronary artery disease, Echocardiography, Screening, Atherosclerosis

INTRODUCTION

Abdominal aortic aneurysm (AAA) is defined as an infrarenal aortic diameter ≥30 mm or ≥50% dilation relative to normal diameter. AAA represents a degenerative vascular process involving elastin degradation, inflammation, and smooth muscle cell loss. Thus, refers to pathological dilatation of aortic segment that has tendency to expand and rupture.(1)

Aortic aneurysms are described in terms of their size, locations, morphology and cause. Aortic aneurysms are either fusiform or saccular in shape. Fusiform aneurysms are most common and are characterized by a general symmetric dilation with a fairly uniform shape involving the entire aortic wall circumference. Saccular aneurysms exhibit localized dilation involving only a portion of the aortic wall circumference, appearing as a focal outpouching. The prevalence of AAA has been reported in Western countries as 1.3–8.9% in men and 1.0–2.2% in women whereas that in Korean population is 0.5%, and AAA was present in 3.5% of CAD patients in India, found by the routine screening for AAA during transthoracic echocardiography (TTE).(2,3)

CAD and AAA share common risk factors including age, male gender, smoking, hypertension, and dyslipidemia. The disorder is more common in men than in women in the ratio of 2:1. The incidence of AAA increases with age, particularly over 60 yrs of age. Indian data on AAA prevalence in CAD populations are limited.(4) Biomarkers such as white blood cell count, fibrinogen, D-dimer, troponin T, N-terminal pro brain natriuretic peptide, and C-reactive

protein can also be useful in AAA risk assessment. The Atherosclerosis Risk in Communities (ARIC) study conveyed that higher concentrations of these biomarkers were associated with an increased risk of AAA(5).

AAA rupture carries mortality exceeding 50%, whereas elective repair mortality is <5%. Therefore, screening high-risk populations may significantly reduce mortality.

Transthoracic echocardiography (TTE), routinely performed in CAD patients, allows visualization of the abdominal aorta with minimal additional time (≈5 minutes). The guidelines for abdominal aortic ultrasound screening for AAA by the United States Preventive Services Task Force in select populations (men, age > 64 years, history of tobacco use) and by several Vascular Societies are supported by evidence showing a reduction in aneurysm-related mortality(2,6.) This provides an opportunity for opportunistic AAA screening without additional infrastructure.

MATERIALS AND METHODS

Study Design

Prospective, cross-sectional observational study.

Study Setting

Department of Cardiology, Batra Hospital and Medical Research Centre, New Delhi, India.

Study Period

January 2019 – February 2020.

Study Population

204 patients aged ≥60 years with:

- Angiographically proven CAD (≥50% stenosis), and/or
- ≥1 AAA risk factor (hypertension, diabetes, smoking, dyslipidemia, PAD)

Exclusion Criteria

- Hemodynamic instability
- Refusal of consent

Echocardiographic Assessment

- Philips EPIQ 7C machine
- 3.5 MHz transducer
- Supine position
- Subcostal longitudinal and transverse views
- Outer-to-outer diameter measurement
- AAA defined as ≥30 mm

Statistical Analysis

- SPSS v17.0
- Continuous variables: mean ± SD
- Categorical variables: frequency (%)
- Chi-square test
- $p < 0.05$ significant

Ethical approval obtained; written informed consent taken.

RESULTS

Table 1: Baseline Characteristics of study population (n=204)

Variable	Frequency (%)
Male	131 (64.2%)
Hypertension	95 (46.6%)
Smoking	48 (23.5%)
Dyslipidemia	74 (36.3%)
Diabetes	61 (29.9%)
PAD	26 (12.7%)
CAD	127 (62.3%)

Table 2: Distribution of patients according to presence of abdominal aortic aneurysm

Incidence of AAA	Frequency	%
Normal	200	98%
AAA	4	2.0%
Total	204	100%

It was observed that 2% of the patients had abdominal aortic aneurysm while 98% of the patients did not have abdominal aortic aneurysm.

Table 3: Distribution of patients according to type of abdominal aortic aneurysm.

Saccular/fusiform	Frequency	%
Normal	**200**	**98.0%**
Fusiform	**4**	**2.0%**
Total	**204**	**100%**

4 out of 204 (2%) of the patients had fusiform type of abdominal aortic aneurysm while 200 out of 204 (98%) of the patients did not have abdominal aortic aneurysm.

Table 4: Correlation between Age distribution and the two study groups.

Age Groups	Total cases	Groups				P Value
		Normal		AAA		
		Frequency	%	Frequency	%	
60 - 69 yrs	151	151	100.0%	0	0.0%	<0.001
70 - 79 yrs	39	38	97.4%	1	2.6%	
80 - 89 yrs	14	11	78.6%	3	21.4%	
Total	204	200	98.0%	4	2.0%	

AAA was present in 0.0 % of patient in age group of 60-69 yrs, 2.6 % of patients in 70-79 yrs and 21.4 % of patients in 80-89 yrs age group. The correlation between age distribution and the study groups is highly significant (p value of <0.001).

Other risk factors including hypertension, smoking, dyslipidemia, diabetes mellitus, peripheral artery disease and coronary artery disease did not show statistical significance correlation with AAA (likely due to small AAA sample size)

DISCUSSION

The present prospective observational study evaluated the feasibility and yield of opportunistic abdominal aortic aneurysm (AAA) screening during routine transthoracic echocardiography (TTE) in elderly patients with significant coronary artery disease (CAD) and/or established cardiovascular risk factors.

In our study the prevelance of AAA was 2% which is lower than that reported in Western screening studies, where prevalence ranges from 1.3–8.9% in men and 1.0–2.2% in women.(1) Meta-analysis by Elkalioubie et al. demonstrated a pooled AAA prevalence of 8.4% among CAD patients, significantly higher than in non-CAD populations. Indian data remain limited.(7) Khandelwal et al. reported a prevalence of 3.5% in angiographically proven CAD patients, which is slightly higher than our findings. (8) Differences may be attributable to the smaller sample size in our study, regional demographic differences, lower smoking burden compared to Western cohorts and genetic and ethnic variations in aneurysm biology. Importantly, despite the lower prevalence, all aneurysms detected were fusiform in shape but clinically silent, underscoring the importance of screening in high-risk groups.

Advancing age demonstrated a significant association with AAA. (p<0.001). All AAA cases occurred in patients older than 70 years, with the highest prevalence in the 80–89 year group. This aligns with established epidemiologic data showing exponential rise in AAA prevalence after 65 years. Lee et al. 20151 in his study found that the prevalence tended to increase with age over 65 years old with CAD, and the prevalence of AAA reached 4.9%. Several previous studies of Caucasian CAD patients have reported varying rates of AAA prevalence ranging from 6.9% to 14%.(1) Degenerative elastin fragmentation, medial thinning, chronic inflammation, and oxidative stress contribute to age-related aortic dilation. Our findings reinforce that advancing age remains the strongest non-modifiable determinant of AAA in the Indian CAD population.

Smoking is considered the strongest modifiable risk factor for AAA. In our study, smoking showed strong gender association (p<0.001), but not independent association with AAA due to small case number. Multiple cohort studies demonstrate smoking increases AAA risk by 5–7 fold. Aune et al. 2018 found causal relationship between smoking and AAA.(9) The effect of smoking appears stronger for AAA than for CAD, suggesting distinct pathobiology despite shared atherosclerotic substrate. Shared atherosclerotic mechanisms likely explain CAD–AAA coexistence. But, smoking remains the strongest modifiable risk factor.

Although AAA was more prevelant among male gender, hypertension, smoking,CAD and PAD patients, statistical significance was limited by small case numbers.

A major strength of this study is demonstration of feasibility. Abdominal aorta visualization was achieved efficiently with no additional equipment, no contrast exposure, no radiation, minimal time addition (~5 minutes). Given that TTE is routinely performed in elderly CAD patients, opportunistic screening represents a cost-effective strategy. Several international studies have supported opportunistic TTE-based AAA screening, especially in hospital settings. The incremental effort is minimal, while the potential benefit of preventing rupture is substantial.

Clinical Implications

Although prevalence was modest (2%), early detection:

- Allows surveillance of small aneurysms
- Enables timely referral for vascular consultation
- Prevents catastrophic rupture (mortality >50%)
- Facilitates elective repair (mortality <5%)

Study Limitations

- Single-center design
- Limited sample size
- Only four AAA cases
- No longitudinal follow-up for aneurysm growth
- No multivariate regression due to low event count

Larger multicentric Indian registries are required to determine true prevalence and risk stratification models.

CONCLUSION

Screening for AAA during routine echocardiography in elderly CAD patients is feasible and identifies clinically silent aneurysms. While prevalence was modest (2%), early diagnosis can prevent catastrophic rupture and facilitates elective repair with minimal time addition without increasing the expenditure. Larger multicenter Indian studies are recommended to define national screening strategies.

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