

Original Research Article

To study importance of carotid artery intima-media thickness by Doppler in patients presenting with acute coronary syndrome.

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Abstract:

Background: The aim of the study is to study importance of carotid artery intima-media thickness by Doppler in patients presenting with acute coronary syndrome. Carotid IMT has been a good indicator of the presence and extent of CAD in many observational studies.

Result: Both coronary and carotid vascular beds share common risk factors and pathogenesis for atherosclerosis. In the study group, the mean age of presentation was 56.8 years. Higher levels of total cholesterol and LDL cholesterol and lower level of HDL cholesterol were seen in cases. They significantly differed in comparison to controls. The carotid intima-media thickness was found to be higher in patients with acute coronary syndrome, as compared to controls. The difference between cases and controls was statistically significant.

Conclusion:

The carotid IMT was found to be higher in cases with traditional risk factors like smoking, diabetes mellitus, hypertension and dyslipidemia. The IMT increases with increase in the number of risk factors. Thus the present study shows that carotid IMT is marker of atherosclerosis, which is strongly associated with traditional risk factors. It can be used as a surrogate marker in prediction of coronary events. Carotid B-mode ultrasound is safe, non-invasive procedure for detecting clinical and preclinical coronary artery disease.

Keywords: carotid, artery, intima-media, Doppler & ACS.

Study Designed: Observational Study.

1. Introduction

Coronary artery disease (CAD) is a major cause of mortality and morbidity and its incidence is increasing in developing countries. CAD manifests as acute coronary syndrome (ACS) and stable angina. ACS is a spectrum of myocardial ischemia, ranging from unstable angina to non-ST elevation myocardial infarction and ST elevation myocardial infarction[1].

Besides novel risk factors, atherosclerosis is the important factor predisposing to CAD. Traditional risk factors like hypertension, diabetes mellitus, smoking, age, obesity, family history of premature CAD, dyslipidemia etc all act by initiating and producing atherosclerosis. ACS results from plaque formation, plaque rupture and platelet activation in coronary arteries[2].

Since atherosclerosis is a generalized inflammatory process, simultaneous affection of various arterial beds is seen. An early sign is hypertrophy of the arterial wall. Measurement of intima-media thickness (IMT) in carotid arteries has been proved as a surrogate marker for atherosclerosis[3]. IMT of the carotid arteries is influenced by the same risk factors as of CAD. The demonstration of a correlation between IMT and cardiovascular events in clinical studies have led to accepting 2D ultrasound as a valid technique in measuring atherosclerosis. This technique is non-invasive, cost-effective, simple, safe and reproducible[4].

The IMT corresponds to the thickness of the histological intima and media. IMT is defined as the distance from the leading edge of the lumen-intima interface of the far wall to the leading edge of the media-adventitia interface of the far wall[5]. The rate change of IMT with age in previous studies has been calculated to be about 0.01 mm/year in the general population and 0.03-0.06 mm/year in patients with CAD. The present study is undertaken in order to correlate the role of IMT in patients with ACS.

2. Material & Method

For the study, patients with diagnosis of acute coronary syndrome (ACS) admitted in J.A. Group of Hospitals and those patients who had recovered from a recent acute coronary event attending medicine OPD were taken as cases. Age and sex matched control, without any evidence of coronary artery disease was taken from the medical wards. Study was done between September 2021 and September 2022. Number of cases & control 40 each.

Inclusion criteria:

All patients presenting with acute coronary syndrome between the age group of 35-74 yrs.

Exclusion criteria:

Patients with carotid artery stenosis already confirmed by Doppler or angiography.

Patients on long-term oral hypolipidemic drugs.

Informed consent was obtained from all patients. Each patient was subjected to a detailed history and clinical examination. Clinical examination included blood pressure measurement, general physical examination, anthropometric measurement, body mass index, and systemic examination. Biochemical assessment included fasting and random blood sugar, blood urea, serum creatinine and lipid profile. History of hypertension, diabetes mellitus, chronic kidney disease, dyslipidemia were noted.

3. Results

Table No. 1: Distribution of patients according to age

| Age | Cases | Control |
|--------------|-----------|-----------|
| 35-44 | 4 | 5 |
| 45-54 | 13 | 12 |
| 55-64 | 10 | 12 |
| 65-74 | 13 | 11 |
| Total | 40 | 40 |

In this study, 40 patients who presented with acute coronary syndrome were studied, along with 40 age and sex matched controls, who did not have any evidence of coronary artery disease. Majority of cases belonged to age groups 45-54 (n=13) and 65-74 (n=13). Mean age of the cases was 56.8 yrs.

Table No. 2: Distribution of risk factors in cases (n=40) and controls ((n=40)

| Symptoms | No. of cases | No. of controls |
|-------------------|--------------|-----------------|
| Hypertension | 16 | 8 |
| Diabetes Mellitus | 8 | 4 |
| Dyslipidemia* | 20 | 8 |
| Smoking | 16 | 12 |
| Alcohol | 2 | 2 |
| Family history | 3 | 3 |

Table No. 3: Mean BP Distribution in cases and control

| BP | Case | Control | p value |
|-------------|-------------|--------------|---------|
| Mean S.B.P. | 132.25±19.3 | 132.15±15.62 | 0.979 |
| Mean D.B.P. | 82.5±8.9 | 83.4±8.16 | 0.638 |

Mean systolic blood pressure and mean diastolic blood pressure did not show statistically significant difference in the present study.

Table No. 4: Intima media thickness and coronary artery disease (ACS) cross tabulation

| | Cases (ACS) | Control (without ACS) |
|------------|-------------|-----------------------|
| IMT <0.8mm | 5 | 36 |
| IMT >0.8mm | 35 | 4 |

Yates corrected chi square test : 45.03

Risk ratio (95% CI) : 0.14

Odds ratio (95% CI): 0.02

p value : 0.000001 i.e., **p value <0.01**

In the case group, 35 patients had IMT greater than 0.8 mm while in control group only 4 subjects had more than 0.8 mm. IMT was significantly increased in patients who had acute coronary syndrome.

Table No. 5: Mean IMT (mm) in cases and controls

| Cases | Controls |
|---|------------|
| 1.025±0.279 | 0.62±0.158 |
| p value < 0.01 (p value = 0.000001) | |

Mean IMT was significantly increased in the cases than the controls and the difference was statistically significant.

Table No. 6: Mean IMT cross tabulation according to number of cardiovascular risk factors in cases (n=40)

| | Cases with 0-2 risk factors | Cases with \geq 3 risk factors |
|---|-----------------------------|----------------------------------|
| MeanIMT | 0.994±0.135 | 1.400±0.279 |
| P value < 0.05 (p value = 0.0119) | | |

Mean IMT was higher in the case group with 3 or more risk factors that in the group with 0-2 risk factors and the difference was statistically significant.

Table No. 7: Mean IMT in Hypertensive cases and Hypertensive controls

| Cases | Controls |
|--------------------------|-------------|
| 1.06±0.312 | 0.575±0.088 |
| p value < 0.01 | |

The mean IMT in the hypertensive cases was found to be higher than the controls, and the difference was statistically significant.

Table No. 8: Mean IMT in diabetic cases and controls

| Cases | Controls |
|--------------------------|-----------|
| 1.012±0.235 | 0.60±0.08 |
| p value < 0.01 | |

The mean IMT in the diabetic case group was higher than in the control group and the difference was statistically significant.

Table No. 9: Mean IMT in smokers (cases and controls)

| Cases | Controls |
|--------------------------|-------------|
| 1.018±0.335 | 0.633±0.088 |
| p value < 0.01 | |

The mean IMT in the smokers in case group was higher than the control group, and the difference was statistically significant.

Table No. 10: Showing mean IMT and plaque occurrence in cases and controls

| | Cases | Controls |
|-------------------|----------|-----------|
| IMT (mean) | 1.025 | 0.612 |
| Plaque occurrence | 20 (50%) | 7 (17.5%) |

One or more plaques were seen in carotid artery in about 50% of ACS patients, while only 17.5% controls had plaques in their carotid arteries. Positive predictive value for diagnosis of CAD with plaque occurrence is 74%.

4. Discussion

Coronary artery disease (CAD) is a major cause of mortality and morbidity in developed world, and in developing countries the incidence is rising. Atherosclerosis is the major cause of CAD. CAD manifests as acute coronary syndrome (ACS) and stable angina. Atherosclerosis can be detected and documented in early stages by examining intima media thickness (IMT) of peripheral arteries, especially carotid artery[6]. IMT is measured by B-mode ultrasound. Reproducibility of IMT determination is best in carotid artery of healthy subjects and in patients with advanced atherosclerosis. Ultrasound scanning of carotid IMT is of clinical value in the screening of patients with CAD.

Both coronary and carotid vascular beds share common risk factors. (Geroulakas). Atherosclerotic plaques start to develop in the carotids at approximately the same time as in aorta and precedes in coronary arteries[7]. A close histologic relation between carotid and coronary atherosclerosis has been seen in autopsy studies. (Mitchell et al 1992). Finally, carotid IMT has been a good indicator of the presence and extent of CAD in many observational studies. The present study is done to correlate carotid IMT in patients with ACS.

The mean age was 56.8 ± 10.8 years in the study group. Majority of cases were in the age groups of 45-54 years (32.5%) and 65.74 years (32.5%). The mean age in the study by Jadhav et al was 52.8 ± 8.1 years.

The mean Total cholesterol in cases was 207.5 ± 30.6 and controls 194.5 ± 14.3 mg/dl. Total cholesterol was higher in cases than control and the difference was statistically significant ($p < 0.05$).

In Jadhav et al study, total cholesterol was 208.4 ± 43.4 mg/dl and is comparable to our study[8].

In our study, IMT in patients with ACS was studied and compared with controls, who had cardiovascular risk factors but no evidence of CAD.

Of the 40 cases, 35 patients had $IMT > 0.8$ mm which was taken as significant IMT based on previous studies. Among 40 controls, only 4 had $IMT > 0.8$ mm and 36 had $IMT < 0.8$ mm.

On applying Chi-square test, the odds ratio (95% CI) is 0.02 and Risk ratio (95% CI) is 0.14 and p value is highly significant ($p < 0.001$). This means that IMT was significantly increased in patients who had ACS.

The mean IMT in cases was 1.025 ± 0.379 mm and controls was 0.62 ± 0.158 . The difference was statistically significant ($p < 0.001$)

Rosa et al showed that IMT in case patients was 0.81 ± 0.25 and in controls, 0.62 ± 0.18 mm.

Rotterdam study showed that higher the baseline IMT greater is the risk of M.I.

In **Jadhav et al** study, IMT was > 0.8 mm in cases. They observed 59.2% of CAD patients had significant IMT as against 40.8 % in those without CAD[8].

In **cardiovascular health study** the mean IMT was 1.03 ± 0.2 mm which is comparable to our study. **Adams et al** reported IMT of 0.83 ± 0.20 mm in CAD. **Blankenhorn et al** reported IMT of 0.65 ± 0.11 mm and **Lamont et al** reported a mean of 0.79mm in CAD.

In the present study, we found that mean IMT in patients with 0-2 cardiovascular risk factors was 0.994 ± 0.135 .

Mean IMT in patients with > 3 cardiovascular risk factors is 1.400 ± 0.279 . The difference between these 2 subgroups of ACS patients is statistically significant. It means that more the number of risk factors, more is the risk of development of atherosclerosis, and its complications.

5. Conclusion

In the study group, the mean age of presentation was 56.8 years. Higher levels of total cholesterol and LDL cholesterol and lower level of HDL cholesterol were seen in cases. They significantly differed in comparison to controls. The carotid intima-media thickness was found to be higher in patients with acute coronary syndrome, as compared to controls. The difference between cases and controls was statistically significant.

The carotid IMT was found to be higher in cases with traditional risk factors like smoking, diabetes mellitus, hypertension and dyslipidemia. The IMT increases with increase in the number of risk factors. Thus the present study shows that carotid IMT is marker of atherosclerosis, which is strongly associated with traditional risk factors. It can be used as a surrogate marker in prediction of coronary events. Carotid B-mode ultrasound is safe, non-invasive procedure for detecting clinical and preclinical coronary artery disease.

6. References

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