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Impact of homocysteine and calcium score levels on the risk assessment of percutaneous transluminal coronary angioplasty (PTCA) undergone patients

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Abstract
A clinical study in Andhrapradesh reported PTCA in 48.25 per cent. The present study aimed to investigate the impact of C-reactive protein and calcium score levels in the risk assessment of percutaneous transluminal coronary patients. Four hundred cardiovascular patients irrespective of sex were randomly selected from Visakhapatnam district Andhrapradesh. Information on economic background, anthropometric measurements, diet history, life style habit and medical history of the subjects were collected using an interview schedule. All the subjects were screened to know they are on medical management or on surgical management. Data collected were consolidated and tabulated. Among the four hundred subjects 220 subjects were found to undergo PTCA. From this group a sub sample of 50 patients were selected and analysed for their lipid profile, C-reactive protein, serum albumin, homocystiene and calcium score levels before and after PTCA. Statistical analysis was done and interpreted. Eventhough a wide variety of biomarkers were available for assessing the risk of coronary artery disease subjects, C-reactive protein and calcium score levels were found to be the most significant biomarkers to predict the risk of cardiovascular diseases. The present study identified these two parameters as the most predictive biomarkers among the usual clinical investigations conducted for the clinicians to predict the severeness of the cardiovascular disease and to correct the scenario with PTCA.

Keywords: coronary artery disease, PTCA, Biomarkers

1. Introduction

Percutaneous coronary intervention (PCI) otherwise known as percutaneous transluminal coronary angioplasty is the process of dilating a coronary artery stenosis using an inflatable balloon and metallic stent introduced into the arterial circulation via the femoral, radial or brachial artery [1]. PTCA offers an effective means of immediate palliation in symptomatic coronary artery disease. Coronary artery disease is multifactorial in origin giving rise to the risk factor concept. Biomarkers are generally considered to be proteins or enzymes – measured in serum, plasma, or blood – that provide independent diagnostic and prognostic value by reflecting an underlying disease state. Early identification and treatment of risk factors are much needed to accelerate disease prevention and morbidity improvement [2]. Numerous physiological biomarkers based on serum lipid, glucose and hormone biomarkers serum lipid, glucose and hormone profile have been identified that are associated with increased cardiovascular risks. There are many well established cardiovascular risk markers to confirm the clinical outcomes. The present study was undertaken to (i) find out the PTCA undergone patients in Visakhaptanam, Andhrapradesh (ii) study the impact of homocysteine and calcium score levels as biomarkers to assess the risk of coronary artery disease and allows the clinicians to decide on PTCA.

2. Methodology

Four hundred cardiovascular patients irrespective of sex from Visakhapatnam district Andhrapradesh was selected for the study. Background details, anthropometric measurements, lifestyle behavior, dietary pattern and medical history of the subjects were collected using an interview schedule. All the selected subjects were screened to lipid profile, blood pressure, homo cysteine, C-reactive protein, calcium score and serum albumin.

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Among the 400 cardiovascular patients, 193 patients were identified as PTCA undergone patients. From the pool of 193 PTCA undergone patients, a sub sample of 50 patients were selected in the present study to investigate the impact of homocysteine and calcium score levels as biomarkers to assess the risk of cardiovascular diseases. The selected PTCA undergone patients were screened for their biochemical indices before and after PTCA. The pre and post levels of both parameters were assessed and compared with the normal standard values. Statistical analyses were done and the data was interpreted.

3. Result and discussion
3.1. Background Details of the Selected Subjects
The background details of the selected subjects studied with reference to their age, family history, educational status and religion. The background details of the selected subjects are given in Table I.

Table 1: Background details of the selected subjects, N=400

Particulars	Number	Per cent
Age Category		
30-40	208	52
40-50	67	16.8
50-60	90	22.5
60-70	35	8.8
Family history		
None	290	72.5
First Degree Relatives	62	15.5
Second Degree Relatives	48	12.0
Religion		
Hindu	65	16.2
Christian	80	20.0
Muslim	255	63.8
Education		
Below High School	235	58.8
High School	136	34.0
Above High School	29	7.2

It was observed that among the 400 cardiovascular patients selected, majority (52%) belonged to middle aged group ranging from 30-40 years. The percentage of cardiovascular patients in the age ranging from 40-50 was 16% and in the age group of 50- 60 was 22.5 respectively. Only 8.8 per cent of the cardiovascular patients belonged to the age group of 60-70. According to reports from the National Commission on Macroeconomics and Health, 62 million people in India will have CAD by 2015, with 23 million of these below 40 years of age [3].

The distribution of family history of the respondents in the occurrence of the cardiovascular diseases showed that the highest percentage (72.5%) of the subjects had no family history of cardiovascular diseases. Next to this were first degree relatives (15.5). The least percentage (12%) was found in the case of the second degree relatives showing a hereditary occurrence of cardiovascular diseases.

The religious distribution of respondents was that nearly 63.8 % of the subjects were Muslims, whereas Christians and Hindus constituted 20 per cent and 16.2 per cent respectively. It is remarkable that 58.8 % of the cardiovascular patients had low educational status below high school. Among them, 41.8% of the subjects had passed higher secondary levels and only 7.2 % were above high school level and possessed professional qualifications too. Epidemiological studies in India among urban populations have reported that the disease is increasing more among the illiterate and low educational

classes as compared to the highly literate and higher socioeconomic subjects. All these data portend a widely prevalent coronary heart disease epidemic among the low socioeconomic status subjects in India [4].

3.2. Biochemical Indices of the selected subjects
3.2.1. Lipid profiles and Blood pressure
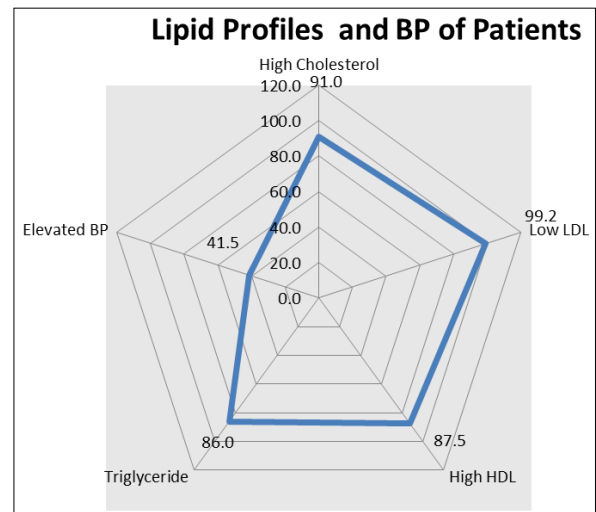
The above figure indicates that more than 86% of the respondents have high cholesterol, high LDL, low HDL and TG and only 41.5% of the respondents have elevated BP. Raised low-density lipoprotein cholesterol (LDLc) plasma concentration is a major risk factor for atherosclerotic cardiovascular disease. Moreover, a sharp rise in LDLc plasma concentration indicates high cardiovascular risk and needs earlier clinical care [5].

3.2.2 Important Biochemical Indices
Table II represents the percentage distribution of biochemical indices.

Table 2: Biochemical indices of the selected subjects, N=400

Particulars	Number	Per cent
C-reactive Protein		
Mild Evidence	16	4.0
Moderate Evidence	148	37.0
Extensive Evidence	236	59.0
Serum Albumin		
Lower than normal	200	50.0
Normal	192	48.0
Greater than normal	8	2.0
Homocysteine levels		
Lower than normal	14	3.5
Normal (15-30 micromoles/l)	22	5.5
Greater than normal (>100 micromoles/l)	172	43.0
Intermediate (30-100 micrmoles/l)	192	48.0
Calcium Score Levels		
Mild Evidence	89	22.2
Moderate Evidence	66	16.5
Extensive Evidence	245	61.2

The above table reveals that the C-reactive protein levels were found to be intermediate or severe in about 96% of the cases. C-reactive protein (CRP) is the best studied of the inflammatory biomarkers in CAD. This inflammatory biomarker has several characteristics that render it particularly attractive. It is an acute phase protein that has been shown to be a marker of systemic inflammation, elevated in response to

injury, infection, and other inflammatory stimuli [6]. About 50% of patients had albumin levels lower than normal levels. Presence of homocystene observed was intermediate or severe in about 90% of the cases. Mild to moderate hyperhomocysteinemia has an independent association with CAD, MI, PVD, and cerebrovascular disease, including stroke [7]. Calcium evidence was seen to be a sure bio-marker in the case of heart diseases. Extensive evidence was seen in the majority of cases. Mild and moderate evidence was seen in lesser number of cases (39%). Detection of coronary calcium score by a helical computed tomography scanner is a useful tool for predicting the presence of significant coronary artery disease in intermediate-to-high risk patients. On the other extreme, score > 400 is highly predictive of the presence of coronary artery disease, and virtually confirms the presence of significant coronary artery disease in intermediate-to-high risk patients [8].

3.2.3 Treatment Types advised to the selected subjects
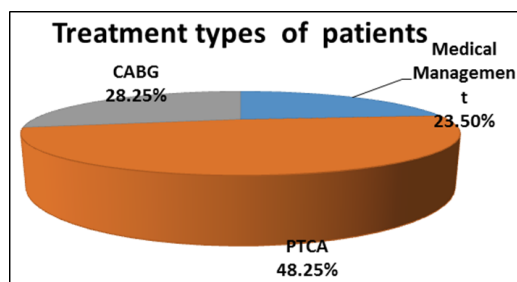
The above figure shows the categorization of the selected cardiovascular patients depending on their advised treatments. This showed that among the 400 cardiovascular patients 48.25 % of them were treated with PTCA, 28.25 % were advised CABG and 23.25% were on medical management.

3.3 Selection of PTCA undergone patients
3.3.1. Categorisation of the selected PTCA undergone patients based on C-reactive protein and Calcium Score levels

Table III represents categorization of selected subjects according to total C-reactive protein and Calcium score level.

Table 3: Categorization ptca undergone patients based on C-reactive protein and calcium score levels, N=193

Particulars	Number	Per cent
Homo cysteine levels		
Lower than normal	5	2.6
Normal	4	2.1
Intermediate	92	47.7
Severe	92	47.7
Calcium Score levels		
Moderate Evidence	1	0.5
Extensive Evidence	192	99.5

The above table categorizes the patients according to standard values of the calcium score levels, as the score 1-112 indicates average risk, 100-400 for moderate risk, 400-999 high risk and 100 and above as very high risk [9].

3.4. Selection of PTCA undergone patients before and after intervention
3.4.1 Comparison of homocysteine and calcium score levels of PTCA undergone patients before and after intervention

Paired Samples Statistics				
PTCA group		**Mean**	**N**	**Std. Deviation**
Homocysteine levels	Preintervention	117.02	50	30.837
	Postintervention	30.131	50	27.6218
Calcium Score levels	Preintervention	512.39	50	260.79818
	Postintervention	88.3766	50	88.40697

In order to see the apparent effect of intervention (i.e. nutrient counseling to the patients) paired sample t-test were used. The paired sample t-test is employed to observe any statistical significant difference between the before and after treatment effects. Table IV clearly shows that the (pre-intervention means = 11.02 ± 30.837) and (post intervention mean= 30.131 ± 27.6218). The paired sample t-test for homocysteine levels in patients was found to be significantly lower (mean diff=86.889, t = 13.518; p < 0.001).

Paired Samples Test				
PTCA group		**T**	**DF**	**Sig. (2-tailed)**
Homocysteine levels	Pre- post intervention	13.518	49	.000
Calcium Score Levels	Pre- post intervention	13.297	49	.000

The homocysteine levels after the intervention (Nutritional counseling) are found to be significantly less than the homocysteine levels after the intervention at 5% level of significance. The calcium score levels after the intervention (Nutritional counseling) are found to be significantly less than the homo cysteine levels after the intervention at 5% level of significance. The paired sample t-test is employed to observe any statistical significant difference between the before and after treatment effects. Table V depicts that the analysis for the calcium score level was found to be significantly lower (mean difference=424.0134; t =13.297; df= 49; p, 0.01) in post intervention (mean = 88.3766 ± 88.40) than pre-intervention (512.39 ± 260.79812).

4. Conclusion
The exact role of the biomarkers plays in the pathogenesis of atherosclerosis remains. Prospective clinical trials establish that modifying these markers actually decreases the incidence of cardiovascular events. Emergence of new biomarkers enables the clinicians to confirm the progression of the disease.

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