PATTERN OF CORONARY ATHEROSCLEROSIS IN SMOKERS AND NON-SMOKERS

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SUMMARY

OBJECTIVE:
The study was carried out to determine the pattern of coronary atherosclerosis among smokers and non-smokers.

METHODS:
The study was carried out in LNH; angiograms of smokers and non-smokers were reviewed and recorded on Performa. Variables were displayed as percentages, compared by chi square test. R-R and CI were also obtained fo different variables.

RESULTS:
A total of 400 patients were enrolled, 184 were smokers and 216 were non-smokers. There were 83% male smokers and 73% males in non-smoking group. Hypertension was seen in 43%, DM was seen in 31% and Dyslipidemia was seen in 28% of smokers. Among smokers 71% had lesions in LAD (p-0.002), 56% in Cx (p-0.001) and 59% in RCA (p-0.013). 18% of smokers had single vessel disease, 26% had two-vessel disease and 42% had triple vessel disease (p-0.04). CABG was done in 37% and 24% were managed by PTCA. Among non-smokers 53% had hypertension, 32% had DM and 33% found to have dyslipidemia. LAD was involved in 59%, Cx in 37% and RCA was involed in 46% of non-smokers. Triple vessel disease was seen in only 29% and CABG was performed in 26% of non-smokers.

CONCLUSION:
Smokers tend to have significantly high multi-vessel disease with lower incidence of known predisposing risk factors for atherosolerosis. LAD was more commonly affected in smokers and more of our CAD patients who smoke underwent CABG.

INTRODUCTION

Tobacco consumption in known to substantially increase the risk of myocardial infarction, sudden cardiac death, stroke and peripheral vascular disease[1]. It not only increases the risk of developing CAD but morbidity and mortality is further increased in patients with known CAD[2]. Conversely the excess risk of cardiovascular events gradually declines after cessation of smoking[3].

Tobacco and its products remains a major modifiable risk factor in patients prone to develop CAD, which may interact with variety of other risk factors that accelerates the process of atherosclerosis. The adverse effects of smoking are mediated by several mechanisms. Nicotene is a potent agonist for adrenergic nervous system, it causes increased plasma norepinephrine, impairs coronary vasoreactivity[4] may enhance coronary vasospasm. The coronary vascular tone is increased with enhanced vasoconstriction in patients with CAD. It is known to cause endothelial dysfunction and increased platelet aggregation[5,6] Studies have shown that smoking can inhibit prostacyclin production by vascular endothelial cells, impair endothelial function[8], activate platelets, and impair the baseline fibrinolytic activity in blood[10], thus enhancing platelet aggregation and thrombosis[11]. In patients with angina, the pain threshold is reduced as carboxyhemoglobin

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decreases oxygen delivery as well as rise in the rate-pressure product at rest and during exercise. Smokers may have higher total cholesterol and low HDL than non-smokers. The acute risk may be related to acute homodynamic effects (increased heart rate and BY, increased myocardial oxygen consumption, increased carboxyhemoglobin and effects on endothellum causing inappropriate vasoconstriction) thereby predisposing to plaque rupture[12] . The risk is related to both the dose and length of exposure of smoking[13] Passive smokers particularly spouse also carries high risk of CAD with an increased in acute eventS14 . Among the population of 65 years of age, 45% of CAD in men and 40% in women appears to be related to smoking 14 . The development of new lesions in patients with existing CAD is also enhanced among smokers than nonsmokers. No previous study has seen the pattern of disease involvement between smokers and non-smokers in Pakistan. The aim of this study is to examine the pattern of coronary atherosclerosis between smokers and non-smokers.

MATERIAL AND METHODS:

400 consecutive patients under going coronary angiography for various indications were included. Patients demographic data with clinical history was recorded before the procedure. ECG findings and echocardiography data was also recorded, if the patient has undergone exercise test or nuclear scan, it was also documented. The procedure was performed via right femoral artery mainly using judkins coronary catheter. Angiograms were performed by standard techniques and angiograms were recorded on CD using Dicom soft ware. A minimum of two views for right coronary artery and three for left coronary artery were recorded. Additional views were taken if it was felt necessary to define and visualize the anatomy of the vessel. The individual operators reported the angiograms then reviewed in cardiac cath meetings. The occlusive lesions were recorded in terms of percentages from 30%-100%. Plaques less than 50% were as marginal irregularities, simple plaques or as non-occlusive coronary artery disease. Lesion was considered diffuse if it is more than 15mm long.

Statistical analysis was performed by SPSS soft ware programme. Nominal type variables were displayed as percentages and compared by the chi-square test for the two groups; smokers and non-smokers. Variables included demographic data (age, gender), clinical characteristics (DM, Hypertension, Dyslipidemia) and angiographic characteristics (lesion location, number of vessels involved, management offered). The p-value was set at 0.05.

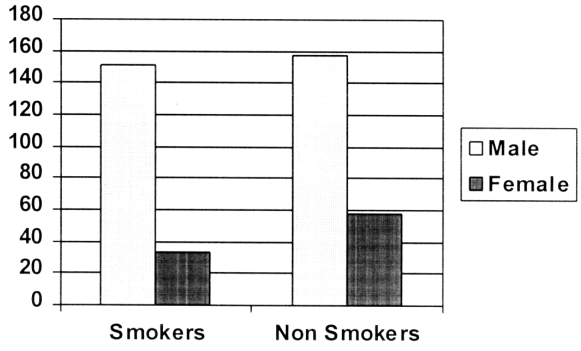
RESULTS:

There were 33 (17%) female smokers and 58 (26%) females in non-smoking group (pvalue 0.034). Smokers were slightly younger with a peak age of 50 years. (Graph 1)
Smokers are more likely to have significant CAD in the absence of major coronary risk factors. Among smokers 28.8% had dyslipidemia compared to 32.9% in non-smokers. Hypertension was present in 43.4% of smokers and 53.2% of non-smokers. There were nearly equal percentages of diabetics, 31.55% and 31.9% in smokers and non-smokers respectively. Among the risk factors hypertension was more common in both categories. (Graph 2)

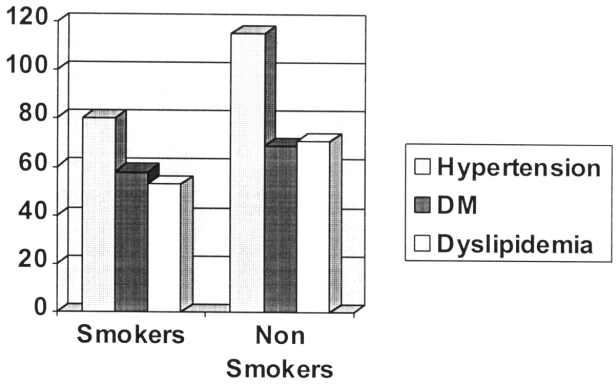
Table 1
Demographic and Clinical Characteristics

	Smokers	Non-Smokers
Age	**50.63**	**51.80**
Male	151(82%)	158(73.1%)
Female	33(17.9)	58(26.9%)
Hypertension	80(43.5%)	115(53.2%)
Diabetes Mellitus	58(31.5%)	69(31.9%)
Dyslipidemia	53(28.8%)	71(32.9%)

GRAPH. 1



GRAPH. 2



Among smokers LAD was involved in 71.7%, Cx in 56% and RCA in 59.2%. LAD artery was involved in 56.9%, Cx in 37% and RCA in 46% in non-smokers. The p-value is highly significant for LAD (0.025) with a R-R of 1.33 and a Cl of 1.11-1.58, p-value Of Cx (0.0001) with a R-R of 1.43 and Cl of 1.18-1.74 but the p-value for RCA is not significant (0.013) with a R-R of 1.5 . The relative risk of LAD was two times in smokers, the risk was also high in case of Cx but it was not high in case of RCA. (Graph 3)

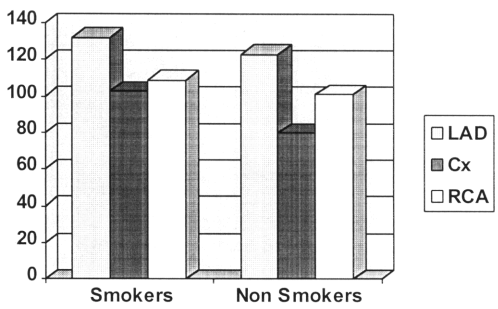
Single vessel disease was seen in 18.55, two-vessel disease was seen in 26% and triple vessel disease in 42.9% of smokers. The p-value is statistically significant for triple vessel disease in smokers but not for single vessel and two-vessel disease. The relative risk of triple vessel disease was significantly high in smokers (1.36) with a Cl of 1.11. On the other hand non-smokers had single vessel disease in 20.4%, two-vessel disease in 25.9% and triple vessel disease in 29.2% (Graph 4)

CABG was performed in 37% of smokers and 26.4% of non-smokers with a relative risk about twice than non-smokers. PTCA was performed in 24% of smokers and 23% of non-smokers. (Graph 5)

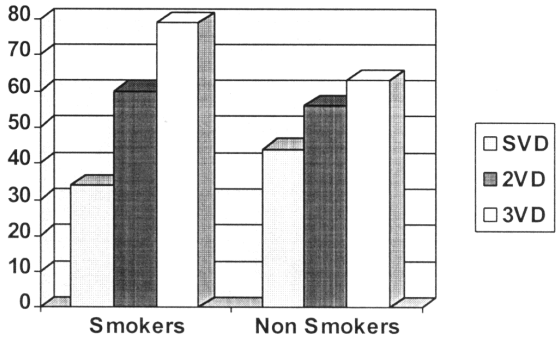
Table 2
Angiographic Findings

	Smokers	Non-Smokers	P-Value
LAD	132(71.7%)	123(56.9%)	0.002
Cx	103(56%)	80(37%)	0.001
RCA	109(59.2%)	101(46.8%)	0.013
SVD	34(18.5%)	44(20.4%)	0.634
2VD	60(26%)	56(25.9%)	0.142
3VD	79(42.9%)	63(29.2%)	0.004
CABG	68(37%)	57(26.4%)	0.063
PTCA	45(24.4%)	50(23.5%)	0.073

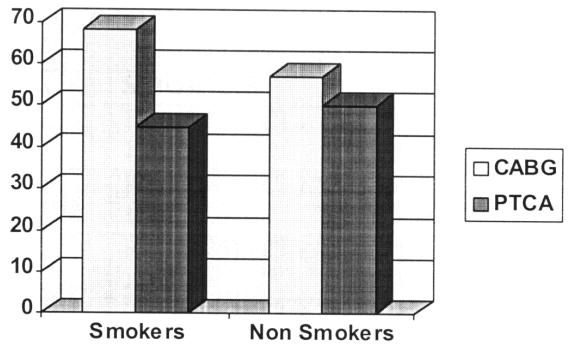
GRAPH. 3



GRAPH. 4



GRAPH. 5



About 20% of subjects in smoking and 38% in non-smoking groups were followed Lip with medical treatment. In our study smokers tend to have diffuse (46 %) and occlusive (65%) disease than non-smokers. (Graph 6)

Table 3

	Smokers	Non-Smokers	P-Value
Diffuse Disease	86(46%)	75(35%)	0.18
Discrete Disease	72(39%)	80(37%)	0.189

Table 4

	Smokers	Non-Smokers	P-Value
Occlusive Disease	120(65%)	90(41%)	0.021
Non-Occlusive Disease	42(22%)	96(44%)	0.001

GRAPH. 6

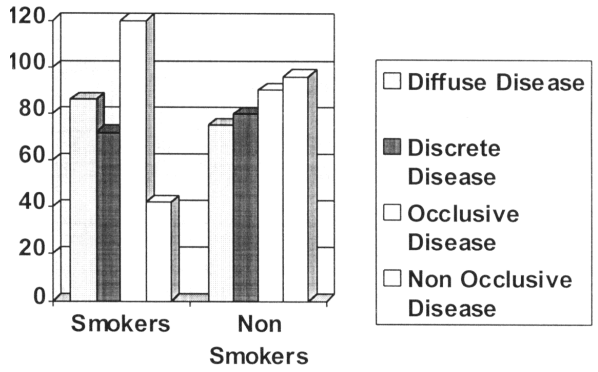


Table 5
Relative Risk of vessel Involvement

	Smokers	Non-Smokers
LAD	R-R(1.33) CI 1.11-1.58	R-R (0.693) CI 0.54-0.88
Cx	R-R (1.43) CI 1.18-1.74	R-R (0.66) CI 0.535-0.88
RCA	R-R (1.25) CI 1.05-1.50	R-R (1.05) CI 0.61-0.94
SVD	R-R (0.93) CI 0.70-1.23	R-R (1.05) CI 0.87-1.31
2VD	R-R (1.18) CI 0.95-1.47	R-R (0.85) CI 0.95-1.47
3VD	R-R (1.36) CI 1.11-1.68	R-R (0.78) CI 0.606-0.92

DISCUSSION:

There are a significantly higher proportion of men in our smoking category and they were also slightly younger than non-smokers. This is evident from table 6 that overall CAD is seen in younger age in our population in both categories compared to western population. Another interesting feature is that the risk factors for CAD are more common in non-smokers. This observation is also noted in other studies[15,16] (table 6).

Table 6
Comparison of Clinical Characteristics

	Current Study 2004.		A Gviolaris Heart 2000; 84:299-306.		David Hasdai NEJM 1997; 336:755-61	
	Smokers	Non-smokers	Smokers	Non-smokers	Smokers	Non-smokers
AGE	50±8	51.8±10	54±9	59.9±9.4	55±11	67±11
HYPERTEN-SION	43%	53%	24%	37%	39%	54%
DIABETES	31%	31%	9%	12.6%	10%	21%
DYSLIPIDE MIA	28%	33%	30%	32%	38%	40%

Conversely smokers in the absence of these risk factors exhibit more severe and advanced disease. Although not looked into, other factors like abdominal obesity. sedentary life style and hyperinsulinemia may be responsible which appears more common in south Asian population[17]. This finding emphasizes the fact that cigarette smoking is an independent and serious risk factor for developing CAD.

Smoking more than doubles the incidence of CAD and increases the mortality from CAD by 70%[18]. Another observation is that more of our smoking population has involvement of LAD artery than non-smokers. This relationship is less strong, in case of RCA. This observation is completely different to other studies, (table 7) where nonsmokers have more lesions in LAD and less in RCA than smokers. Vande Zwaag and colleagues also noticed this observation in their study, where smokers had more lesions ill their RCA than LAD[19].

Table 7
Comparisonof Angiographic Features

	Current study 2004		A Gviolaris Heart 2000; 84:299-306	
	Smokers	Non-smokers	Smokers	Non-smokers
LAD	71%	57%	41%	50%
Cx	56%	37%	23%	22%
RCA	59%	46%	34%	26%

A higher numbers of our smokers have triple vessel disease than non-smokers. Tills is quite different in studies shown in the table 8, where they noticed their smoking population tend to have more single vessel and two-vessel disease.

Table 7
Comparison of Angiographic Findings

	Current Study 2004.		A Gviolaris Heart 2000; 84:299-306.		David Hasdai NEJM 1997; 336:755-61	
	Smokers	Non-smokers	Smokers	Non-smokers	Smokers	Non-smokers
1VD	18.5%	20.4%	66%	65%	55%	50%
2VD	32%	25%	25%	26%	36%	36%
3VD	43%	29%	76%	78%	9%	14%
CABG	37%	26.4%	4%	3.6%	12%	17%
PTCA	24.4%	23.5%	5%	4%	7.8%	8%

The involvement of a different vascular bed with more severe disease in LAD artery and presence of multi vessel disease in our smoking population is quite obvious. A small sample size of our study may explain this difference. Further studies with a bigger sample size may clarify this issue, but this may be due to a different response to the same stimulus in a genetically and racially different population. In our study smokers more often underwent CABG than PTCA. The finding could be explained due to the fact that smokers tend to have more diffuse and occlusive disease than non-smokers. BLit Ill our society, socio-economic condition is a more important reason of a greater number of CABG than PTCA, as CABG appears as a more cost effective option than multi-vessel PTCA.

Waters et al followed up smoking and non-smoking patients with angiographically documented CAD, they found that arteriosclerosis progressed more rapidly in smokers than in non-smokers. In addition more new lesions developed in placebo treated smokers compared to placebo treated non-smokers. A major finding in Waters and colleague study was greatly enhanced new lesion formation in smokers; intact smoking was the strongest predictor of new lesion formation in the control group . The development of more new lesion is associated with higher myocardial infarction rates by providing them with more sites to to develop plaque rupture. This could show why smokers require coronary intervention almost six years earlier than non-smokers15. Quitting or not quitting smoking may influence the decision making about revascularization procedure. A policy of riot performing revascularization in persistent smokers has been advocated by some clinicians but is not followed in our center.

At present we don't have enough data in Pakistan on the pattern of coronary atherosclerosis, but there is no doubt that smoking accelerates atherogenesis, cause more severe and wide spread coronary artery disease, both in terms of number of corollary vessels and number of lesions. Smokers with less severe coronary artery disease than non-smokers are prone to have more acute events.

CONCLUSION

Our study found multi- vessel disease with significantly more involvement of LAD artery among smokers and more of them underwent CA13G. There appears no significant age difference between the two groups in our study, which may have been masked by the relatively small numbers, and somewhat selective population. Coronary artery disease is on the rise in our society, affecting a younger population with no significant age difference between smokers and non-smokers. The clinical implication of our study stresses on risk factor modification with strong emphasis on quitting smoking, increasing physical activity and attempts at weight optimization in obese patients to reduce the burden of disease and early coronary intervention to manage these high-risk CAD patients. Public awareness of smoking related hazards to both active and passive smoking needs to be increased. The aggressive risk factor modification coupled with early coronary intervention would help in reducing the morbidity and mortality among smokers with coronary artery disease.

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