

The relative impact of smoking or Hypertension on severity of premature coronary artery disease

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Abstract

Background: Not much information is available about the effect of smoking and hypertension on the number and severity of vessel involvement and left ventricular ejection fraction (LVEF) at coronary angiography of young patients with coronary artery disease. The present study describes the relative importance and comparative effect of smoking and hypertension on severity of premature coronary artery disease.

Methods: The study comprised 240 consecutive patients under the age of 45 years, with a diagnosis of acute myocardial infarction (AMI), unstable angina or stable angina, who underwent coronary angiography. Other aspects investigated included evaluation of smoking profile and HTN in each patient, LVEF, the number and type of vessel involvement as well as the severity of stenosis.

Results: Of 216 patients, 142 (approximately 60%) were smoker and 74 (31%) were hypertensive. Left anterior descending coronary artery (LAD) involvement was more common in smoker young patients who had more severe stenosis of LAD vessel and lower LVEF than hypertensive young subjects. Higher frequency of right coronary artery (RCA) involvement and more severe stenosis of this vessel were found in hypertensive young individuals compared to smoker young patients.

Conclusion: Our study indicated that smoking was more prevalent and also a more important risk factor in coronary artery disease of young adults. Smoker young patients tended to have more LAD involvement, more severe stenosis of this vessel and also lower LVEF, compared to hypertensive young patients.

Keywords: Smoking; Hypertension; Premature coronary artery disease

Introduction

Coronary artery disease (CAD) is one of the major health problems responsible for increasing mortality and morbidity worldwide.¹ Nearly half of the cardiovascular deaths result directly from CAD.² CAD, primarily occurs in patients over the age of 40, although younger men and women can be affected.^{3,4} There has been some disagreement about the proportion of young patients among those with CAD.^{5,6} In recent studies, 4-10% of patients with CAD were ≤ 40 or 45 years of age.^{5,7} Younger adults with CAD, are important candidates for studying the risk factor modification and secondary prevention, because of

the devastating effect of CAD on their active life styles. Smoking, as a risk factor, plays a dominant role in premature atherosclerosis, particularly in South Asian countries.^{1,8,9} In addition to accelerating atherosclerosis, smoking may enhance oxidation of low-density lipoprotein (LDL) cholesterol and impairs endothelium-dependent coronary artery vasodilation.^{10,11}

Cigarette smoking currently causes an estimated 4.9 million deaths annually (8.8% of all deaths). This represents 1 million more tobacco-related deaths than in 1990, with the increase being most marked in developing Countries.^{12,13} If current smoking trend to continue, the global burden of disease attributable to tobacco will reach 9 million deaths annually by 2020, of which 7 millions would belong to developing countries.¹⁴

Also, another important risk factor for CAD is hypertension (HTN). HTN predisposes to vascular injury and accelerates the development of atherosclerosis.¹⁵ Worldwide, approximately 49% of cases of

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ischemic heart disease are due to suboptimal (>115 mmHg) blood pressure, which is believed to account for more than 7 millions death annually.¹⁶ An analysis of several large cohort studies from developing countries, demonstrated continuous log-linear associations between systolic blood Pressure and risks of ischemic heart disease and total Cardiovascular death.¹⁷ Young adults constitute one of the most important socioeconomic arms of community and have more active life style. Most studies have used an age limit of 40-45 years to define young patients with CAD or acute myocardial infarction (AMI).¹⁸ The objective of present study was to demonstrate the involvement of more important risk factor, smoking or HTN, in the severity and extent of coronary artery stenosis at coronary angiography in this active young population.

Materials and Methods

We examined data from 240 young consecutive patients prospectively diagnosed as having stable angina, acute coronary syndrome (ACS), who were admitted to Chamran Hospital Medical Center in Isfahan, Central Iran from September 2005 through October 2006, for coronary angiography. Patients were admitted either from emergency center or directly from physician's clinic, or transferred from other hospitals.

Inclusion criteria were age ≤ 45 years, HTN (defined by BP $\geq 140/90$, current or previous therapy for control of BP or history of BP $\geq 140/90$)^{1,19} or currently smoking more than 3 cigarettes/day for more than six months. These patients should be investigated for a stable angina, unstable angina (USA) or AMI by a history of typical angina, standard ECG, and enzyme criteria (CK-MB or troponine). Having identified the duration and number of cigarettes smoked per day (cig./d), smokers were categorized according to the criteria of Rastogi et al.^{20,21} These comprised mild smokers. (1-10 cig./d) and moderate to heavy smokers (>10 cig./d). Twenty-four patients (10%) were excluded from the study because they were both hypertensive and smokers. Prior to undergoing coronary artery angiography, the patients underwent history and physical examination. Angiographers made a subjective assessment of left ventricular ejection fraction (LVEF), and characterized type and number of coronary vessels involvement including diseases related to the left anterior descending coronary artery (LAD), left circumflex coronary artery (LCX) or right coronary artery (RCA). Also, severity

of coronary artery stenosis was evaluated and defined as significant obstructive coronary artery stenosis of >70% in diameter and severe stenosis representing 90%-100% obstruction, (100% Stenosis=Cutoff).²²

All data were collected on standardized forms and subsequently entered into a computerized database. Coronary angiographic data from hypertensive and smoker young patients were compared and inter-group differences between parameters were studied by using Chi-Square test.

Results

The patients aged from 26 to 45 years (40.9 ± 4.09 years). 74 (31%) of patients were hypertensive and 142 (60%) were smokers. Among smokers 123 (51.3%) patients belonged to moderate and heavy category and 19 (7.9%) were mild smokers. Smoking was a more common risk factor in young patients with coronary artery disease (60%) than hypertensive patients (31%). A significant number of smokers (123) comprising 51.3%, belonged to moderate and heavy category (>10 cig./d). Table 1, shows number of diseased vessel at coronary angiography of hypertensive and smoker young patients.

Table 1: Distribution of coronary artery involvement in smokers and patients with hypertension (HTN).

Variable	1-vessel	2-vessel	3-vessel	Total
Smokers:	114	20	6	142
No.				
%	80.3	14.1	4.2	100.0
HTN	60	8	5	74
No.				
%	81.1	10.8	6.8	100.0

There was no significant difference between two groups of hypertensive and smoker patients ($P=0.601$), with respect to the number of vessel involvement. Approximately 81% of both smokers and hypertensive patients had 1-vessel involvement and small percentage of patients were 3-vessel and L.M disease (1.4% versus 1.4%). Also, single vessel disease was most common in both mild and moderate to heavy smokers, which included 63.2% and 84.3% respectively. LAD was involved in approximately 69% of smokers compared to 55.5% in hypertensive young patients (Table 2). LAD stenosis was particularly prevalent (71.5 %) among moderate to heavy smokers. Smoker young patients had more severe

involvement at LAD vessel than hypertensive young patients. Approximately 43% of smokers had 90-100% (cutoff) stenosis at LAD compared to 36.5% in hypertensives ($P=0.440$). Among smokers, moderate to heavy category had significantly higher percentage of severe stenosis or cutoff compared to mild smokers (48% and 10.5% respectively; $P=0.005$). There was no significant difference between smoker and hypertensive patients in regard to the LCX stenosis and its severity ($P=0.773$). Approximately 19% in both groups had LCX involvement and severe stenosis with cutoff values ranging from 9.5% to 11.26%. Among smokers, also, no significant difference was found between mild and moderate to heavy smokers. On the average, 22% of each group had LCX involvement ranging from 26.3% in mild smokers to 17.3% in moderate to heavy smokers. Also, severe stenosis and cutoff was noted in 11.4% of moderate to heavy smokers and 10.5% of mild smokers. Considering RCA stenosis, hypertensive young patients had higher percentage of RCA involvement compared to smoker young patients (approximately 44.5% vs 33% respectively; $P=0.130$). Hypertensive patients also had more severe stenosis of RCA vessel ($P=0.054$), compared to smokers (30% versus 17%

respectively). Among smokers, moderate to heavy smokers had higher percentage (70%) of RCA stenosis than mild smokers (47.3%) who had significantly less severe stenosis, compared to moderate to heavy smokers (5.3% versus 17.9%). Finally, 40 (28.2%) of smoker young patients had LVEF < 40% compared to 13 (17.6%) of hypertensive young patients ($P=0.114$). Among smokers, 38 (31.1%) of moderate to heavy smokers had LVEF < 40% compared to 2 (10.5%) of mild smokers. In view of HTN, 46 (62.2%) of hypertensive patients had normal LVEF (>50%) compared to 70 (49.29%) of smokers ($P=0.108$).

Discussion

The Study of CAD in young individuals is important in the current era of primary and secondary preventive cardiology. Some studies have identified smoking as the most common risk factor in young patients with CAD. These studies reported that from 60% to 90% of young patients with CAD were smokers compared to 40% of older patients.^{23, 24, 25} Also, smoking is a notable risk factor for the development of fatty streaks in the aorta and coronary arteries revealed at autopsy of young autopsy patients.²⁶ Previous studies suggested that effects of smoking were dose-dependant. However, smoking of as few as one to four cigarettes per day, increased the risk of coronary artery disease. These studies reported that, compared with non smokers, persons who smoked 10 or more cigarettes daily, had 2 to 3 folds increase in total coronary artery disease.²⁷ In our study, smokers represented 60% of CAD patients.

HTN, is another important risk factor for CAD risk. In the previous studies, young patients were found to be less likely to have a history of HTN.²⁸⁻³⁰ In the present study, also, prevalence of patients with HTN was approximately half of the smoker young patients (31% vs 60%). HTN accelerated the development of atherosclerosis within the coronary vessels, increased myocardial O₂ demand and intensified ischemia in patients with preexisting obstructive CAD.¹⁵ Our study showed that HTN and smoking in the young patients with CAD, were not significantly different with respect to number of vessel involvement and LM disease. In both groups, one-vessel involvement was the most prevalent in respect of the type of vessel involved, severity of stenosis and also LVEF between smoker and hypertensive young patients but the difference was not significant. LAD vessel is usually, more important than LCX

Table 2: Distribution of severity of coronary artery stenosis and LVEF by smoking and hypertension.

	Smokers No=142 (%)	HTN No=74 (%)	P value
LAD			
Normal or < 70% stenosis	43 (30.3)	33 (44.6)	0.101
70-90%	38 (26.8)	14 (18.9)	
90-100% (Cutoff)	61 (43.0)	27 (36.5)	
LCX			
Normal or < 70% stenosis	116 (81.7)	60 (81.1)	0.773
70-90%	10 (7.0)	7 (9.5)	
90-100% (Cutoff)	16 (11.3)	7 (9.5)	
RCA			
Normal or < 70% stenosis	95 (66.9)	41 (55.4)	0.066
70-90%	24 (16.9)	11 (14.9)	
90-100% (Cutoff)	23 (16.9)	22 (29.5)	
LVEF			
> 50%	70 (49.3)	46 (62.2)	0.152
40-50%	31 (21.8)	15 (20.3)	
< 40%	40 (28.2)	13 (17.6)	

and RCA vessels. Its septal perforating branches supplied the Av (His) bundle and proximal left bundle branch. Diagonal branches of the LAD supplied the anterior left ventricular free wall, part of the anterolateral mitral papillary muscle, and the medial one-third of the anterior right ventricular free wall.^{31,32} In our study, smokers had more LAD involvement than hypertensive young patients, especially moderate to heavy smokers. Also, smoker patients had more severe stenosis and cutoff in the LAD artery than hypertensive patients. Also moderate to heavy smokers had more severe stenosis of the LAD vessel.

LVEF is a well - known predictor of cardiovascular mortality.⁴ In the present study, smoker patients had higher percentage of low LVEF (<40%) compared to hypertensive patients. Moderate to heavy smokers had more prevalence of low EF, than mild category. This was likely to reflect high prevalence and also, more severe stenosis of LAD artery among smokers compared to hypertensive young patients, who had more prevalence of RCA stenosis and, therefore, lesser extent of ischemia or infarction of myocardium.

In addition, compared with non-smokers, smokers had an increasing prevalence of coronary artery spasm. Occurrence of spasm in preexisting obstructive CAD, could cause a more severe stenosis and is probably one of the contributing factors accounting for more prevalence of severe stenosis and cut off and thus, low LVEF in smoker young patients. Finally, smoking was not only a more prevalent risk factor than HTN in young patients with CAD, and it could also affect the pattern of vessel involvement, severity of stenosis and LVEF at coronary artery angiography of these patients.

As Twardella et al.³³ found that stopping smoking by individuals after an acute coronary syndrome or coronary revascularization, could cut a patient risk of another cardiovascular disease event by up to 20% over the following year. Giving up smoking may be one of the most vital steps to save young smokers from premature CAD. Therefore, clinicians must focus on the elimination of known risk factors for premature CAD. The importance of these risk factors, particularly cigarette smoking was demonstrated in our studies.

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