Impact of shisha smoking on the extent of coronary artery disease in patients referred for coronary angiography

Koroner anjiyografi önerilen hastalarda nargile içiminin koroner arter hastalığının yaygınlığına etkisi

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Abstract

Objective: To study the impact of shisha smoking on the extent of coronary artery disease.
Methods: Patients who underwent coronary angiography were included in this observational cohort study and were divided to four groups according to the smoking pattern: shisha smokers, cigarettes smokers, mixed smokers (shisha and cigarettes) and non-smokers. Coronary angiography was done and the severity of coronary artery disease was defined according to Duke Jeopardy Score (DJ).
Results: The study comprised of 287 consecutive patients; 22% were shisha smokers, 35% cigarette smokers, 5% mixed smokers and 38% non-smokers. Significant elevation of systolic blood pressure (p=0.009) and heart rate (p<0.001) were observed among mixed smokers followed by shisha smokers, cigarettes smokers and non-smokers respectively. The mean value of DJ score was highest among shisha smokers than mixed smokers, cigarettes smokers and non-smokers respectively (p=0.012). We also compared DJ score in shisha smokers with CAD vs non-shisha smokers with CAD and we found that 71.43% of shisha smokers had an advanced DJ score (>6) which was statistically significant (p=0.008) where shisha smokers showed significantly higher resting pulse (p<0.001) and systolic blood pressure (p=0.001) compared to non-shisha smokers and mean DJ score was significantly higher among shisha smokers (6.961±3.238) vs non-shisha smokers (5.762±3.062) (p=0.004).
Conclusion: Shisha smoking is associated with severe coronary artery disease that calls for the need to enroll them in tobacco cessation courses. *(Anadolu Kardiyol Derg 2013; 13: 647-54)*
Key words: Coronary artery disease, shisha smoking, Duke Jeopardy score

Özet

Amaç: Nargile içiminin koroner arter hastalığının (KAH) yaygınlığına etkisini araştırmak.
Yöntemler: Bu gözlemsel kohort çalışmaya koroner anjiyografi yapılan hastalar dahil edildi ve sigara içme alışkanlıklarına göre dört gruba ayrıldı; nargile içenler, sigara içenler, karışık içenler (nargile ve sigara) ve sigara içmeyenler. Koroner anjiyografi yapıldı ve koroner arter hastalığının ciddiyetini belirlemek için Duke Jeopardy skorlaması (DJS) kullanıldı.
Bulgular: Ardışık 287 hastadan oluşan çalışmanın; %22'si nargile içenler, %35'i sigara içenler, %5'i karışık içenler ve %38'i sigara içmeyenlerdir. Sırasıyla; karışık içenler, nargile içenler, sigara içenler ve içmeyenlerin sistolik kan basıncı (p=0,009) ve kalp hızında (p<0,001) önemli yükselmeler gözlenmiştir. Ortalama DJ score nargile içenler arasında; sırasıyla karışık içenler, sigara içenler ve içmeyenlerden daha yüksektir (p=0,012). Ayrıca, KAH'lı nargile içen hastaların DJ score'u ile nargile içmeyen KAH'lı hastaların scorlarını karşılaştırdık ve nargile içenlerin %71,43'ünün içmeyenlere göre istatistik anlamda (p=0,008) ileri DJ score'u (>6) vardı. Buna karşılık nargile içenler; nargile içmeyenlerle karşılaştırıldığında istirahat nabzı (p<0,001) ve sistolik kan basıncı (p=0,001) önemli derecede daha yüksekti; ortalama DJ score nargile içmeyenlere göre (5,762±3,062) nargile içenlerde (6,961±3,238) önemli derecede (p=0,004) daha yüksekti.
Sonuç: Nargile içimi ciddi koroner arter hastalığı ile ilişkilidir ve KAH bu hastaların tütün bırakma programlarına katılma ihtiyaçlarını doğurmuştur. *(Anadolu Kardiyol Derg 2013; 13: 647-54)*
Anahtar kelimeler: Koroner arter hastalığı, nargile içimi, Duke Jeopardy skoru

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Introduction

Water pipe smoking (also known as "nargile", shisha and "hookah") is a centuries-old tobacco use method that is increasingly becoming a worldwide phenomenon specially among college and university students (1-4).

Water pipe smoking may affect different systems directly by either contact or the smoke itself (5). Evidence suggests that water pipe tobacco smoking is associated with a number of deleterious health outcomes including lung cancer, respiratory illness, low birth-weight and periodontal disease (5). It is also associated with markers of atherosclerosis (6), elevation of total plasma lipids (7), a significant elevation of blood pressure and heart rate(8) and deterioration of right ventricular function (9). However, none has studied its correlation with the severity of coronary artery disease (CAD) (10-12).

Our objective was to study the impact of shisha smoking, compared to cigarettes and non-smokers, on the extent of coronary artery disease in patients referred for coronary angiography and whether flavored or unflavored tobacco was associated with higher extent and jeopardy of CAD, and whether shisha smokers had special demographic criteria (gender, education, residence)

Methods

Study design

This is an observational prospective cohort study.

Study population

The study was included all patients who were referred consecutively for coronary angiography for the first time at Ain Shams University hospital during the period from May 2010 to October 2010 and were then referred for coronary revascularization. Recent smokers (<1 year) as well as patients with normal coronary angiography, previous coronary artery bypass surgery (CABG) or previous percutaneous coronary intervention (PCI) were excluded.

Patients were compared at 3 different levels

1. Smokers vs non-smokers (as regards demographic and vital data)
2. Patients were first divided according to their smoking habit into: Group 1: Shisha smokers only, Group 2: Cigarettes only, Group 3: Mixed shisha and cigarette smokers and group 4; Non-smokers
3. Then patient cohort was re-classified into two groups according to shisha smoking pattern: shisha smokers (includes those who smoked shisha only and those who smoked shisha and cigarettes), non-shisha smokers (includes those who never smoked shisha (cigarettes smokers and non-smokers)

All subjects signed an informed consent.

Study variables and protocol

All patients were asked about cardiovascular risk factor profile (age, sex, diabetes mellitus, smoking, hypertension, dyslipidemia and family history of CAD as well as personal data; age (in years), sex, occupation, residence (urban/rural), level of education and special habits of medical importance (tobacco chewing, drug abuse). Medical history of diabetes mellitus as per American Diabetic Association criteria (13), dyslipidemia per National Cholesterol Education Program (NCEP) criteria (14), and hypertension per Joint National Committee (JNC 7) criteria (15) in addition to drug history (antihypertensive, antidiabetic, or cholesterol- lowering medications) were obtained.

All patients underwent clinical examination with special emphasis on blood pressure, pulse, waist circumference, height and weight with the body mass index (BMI) calculated (kg/m^2) and then underwent coronary angiography.

Assessment of smoking

In this study, we used a specially designed questionnaire where questions were asked orally to patients. It comprised the following sections; socio-demographic data, questions that assess smoking prevalence and pattern, detailed information about smoking behavior and medical treatment. Screening 30 random coffee shops which sell tobacco boxes for shisha serving in Cairo and Egypt was done to evaluate the average weight of tobacco used to fill one shisha serving.

Detailed smoking history was obtained. Shisha smokers were asked about duration and frequency of smoking (sessions in minutes/day/week). They were also asked about the type of nicotine (flavored or non-flavored) and where they smoked most of the time (indoors/outdoors/both). Cigarettes smokers were asked about the duration and frequency (the average number of cigarettes smoked per day or week), as well as where they smoked mostly (indoors/outdoors/both). Smoking was defined based on its active presence in the last one year; and a non-smoker was someone who never smoked. Accordingly, smokers were grouped into: cigarette smokers defined as subjects who were current and regular smokers for more than one year and were not known to have any other cardiovascular risk factor; shisha smokers were defined as subjects who were current and regular smokers for more than one year and were not known to have any other cardiovascular risk factor.

Coronary angiography

Coronary angiography was performed via the femoral or radial artery using standard technique using Phillips Alluracath lab system (Xper FD20, USA).

The standard coronary views were obtained, which included an average 6 left coronary and two right coronary artery injections giving sufficient data to enable quantitative angiography. The procedures were recorded on compact discs and each coronary angiogram was analyzed visually by at least two of the staff cardiologists at Aim Shams University hospital.

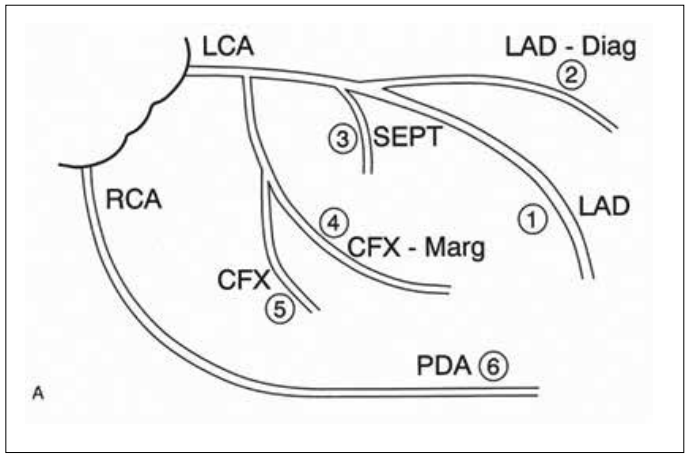

Figure 1. The Duke jeopardy score (DJ score) divides the coronary tree into six segments, with segments distal to ≥70% stenosis or ≥50% left main (LM) stenosis receives 2 points

Figure 2. Angiograms of a patient with Duke Jeopardy score 6

The Duke jeopardy score (DJ score) was used to describe the severity of CAD based on the amount of myocardium at risk (16). Visual estimation of size of vessel and lesion was performed in reference to diameter of diagnostic catheter (6 f in 100% of cases). For derivation of the Duke jeopardy score, the coronary tree was divided into 6 segments: (Fig. 1): 1) the left anterior descending coronary artery (LAD), 2) major diagonal branch of LAD, 3) major septal perforator, 4) the left circumflex coronary artery (LCX), 5) major obtuse marginal branch of the LCX, 6) posterior descending coronary artery (PDA) (16).

All segments distal to ≥70% stenosis or ≥50% left main (LM) stenosis were considered to be at risk. Each such segment received 2 points and, as result, the DJ score can range from 0 to 12, depending on extent of coronary disease (16). For example, a patient with a single 80% proximal LAD lesion occurring before the largest septal perforator and diagonal received a score of 6 (2 each for the LAD, septal perforator, and diagonal artery) (16) (Fig. 2).

Statistical analysis

The statistical analysis of data done by using SPSS software version 20 (IBM SPSS, Chicago, IL, USA). The following tests were done: t- test for independent samples, ANOVA and Chi-square test. To test the association between quanititative variables, correlation coefficicency test was used. ROC curve was drawn to detect cut-off point with highest sensitivity and specificity. A p value was accepted as significant if <0.05 at confidence interval 95%.

Results

The study comprised of 287 consecutive patients of which 62% were smokers: 22% shisha smokers, 35% cigarette smokers, 5% mixed smokers and 38% non-smokers.

Demographic data

Regarding gender, it was found that smokers in general were exclusively males while non-smokers was 50.91% males and 49.09% females.

There was no statistically significant difference between the studied groups as regards age (p=0.461) or residence (urban & rural) (p=0.457).

Regarding the level of education we found that 58.76% of smokers were uneducated, 25.99% received an intermediate (school) education and 15.25% received higher level of education (university or above).

Among the high educated patients (university or above) shisha smokers (15.63%) were significantly more than mixed smokers (15.38%), cigarettes smokers (15.00%) and non-smokers (10.00%) respectively (p=0.003).

Among shisha smokers 64.06% were non educated, while 20.31% received intermediate (school) education and 15.63% received higher level of education (university or above).

Prevalence of CAD risk factors

Comparing smokers and non- smokers as regards to prevalence of risk factors for CAD, we found statistically high significant prevalence of DM among smokers vs. non-smokers (p<0.001), non-significant difference in the prevalence of hypertension (p=0.411), more prevalence of dyslipidemia, obesity and abdominal obesity, though non-significant (p=0.055, p=0.974 and p=0.095, respectively) (Table 1).

Comparing prevalence of CAD risk factors among different smoking habits and non-smokers, we found higher prevalence of DM among non-smokers, followed by cigarette smokers, shisha smokers and mixed smokers and this was statistically highly significant (p<0.001).

There was also a high prevalence of abdominal obesity among mixed smokers, followed by non-smokers, shisha smokers and cigarette smokers and this was statistically significant (p=0.024) (Tables 2, 3).

Vital data

Comparing smokers and non-smokers as regards to vital data, we found that pulse was significantly higher among smokers (79.70±9.87) than non-smokers (76.10±10.40) (p<0.005), while both SBP and DBP were higher among smokers (132.03±10.46) vs (83.50±8.19) than non-smokers (129.800±10.729 vs. 81.63±7.84) respectively, although statistically non-significant.

Table 1. Prevalence of major risk factors of CAD among smokers and non-smokers

Variables		Non-smokers		Smokers		Total		*Chi square	*p
		N	%	N	%	N	- %		
Hypertension		70	63.64	104	58.76	174	60.63	0.677	0.411
Diabetes		61	55.45	50	28.25	111	38.68	21.171	<0.001
Dyslipidemia		19	17.27	48	27.12	67	23.34	3.675	0.055
Family history of CAD		10	9.09	15	8.47	25	8.71	0.032	0.857
BMI	Over weight (25–29.9)	50	45.45	80	45.20	130	45.30	0.052	0.974
	Obese (≥30)	48	43.64	79	44.63	127	44.25		
Abdominal obesity (WC)	Non obese	51	46.36	100	56.50	151	52.61	2.794	0.095
	Obese*	59	53.64	77	43.50	136	47.39		

*Obese=WC ≥88 cm in women or ≥102 cm in men.
Data are presented as number (percentage)
*Chi-square test
CAD - coronary artery disease

Table 2. Prevalence of CAD risk factors among different smoking habits and non-smokers

Risk factors, n (%)	Shisha	Cigarette	Mixed	Non-smokers	*Chi-square	*p
Hypertension	43 (67.19)	52 (52)	9 (69.23)	70 (63.64)	5.092	0.165
Diabetes	16 (25)	31 (31)	3 (23.08)	61 (55.45)	21.921	<0.001
Dyslipidemia	20 (31.25)	22 (22)	6 (46.15)	19 (17.27)	7.852	0.049
Family history of CAD	7 (10.94)	8 (8)	0 (0)	10 9.09)	2.826	0.419
Overweight (18.524.9)	28 (43.75)	48 (48)	4 (30.77)	50 (45.45)	7.126	0.309
Obesity (2529.9)	31 (48.44)	39 (39)	9 (69.23)	48 (43.64)		
Abdominal obesity	28 (43.75)	39 (39)	10 (76.92)	59 (53.64)	9.433	0.024

Data are presented as number (percentage)
*Chi-square test
CAD - coronary artery disease

Table 3. Prevalence of CAD risk factors in shisha smokers with CAD vs non-shisha smokers with CAD

Risk factor, n (%)	Shisha smoker	Non-shisha smoker	*Chi-square	*p
Hypertension	52 (67.53)	122 (58.1)	2.136	0.144
Diabetes	19 (24.68)	92 (43.81)	9.076	0.003*
Dyslipidemia	26 (33.77)	41 (19.52)	6.073	0.014
Family history of CAD	7 (9.09)	18 (8.57)	0.019	0.890
Overweight (18.5-24.9 kg/m^2)	32 (41.56)	98 (46.67)	3.435	0.180
Obesity (25-29.9 kg/m^2)	40 (51.95)	87 (41.43)		
Abdominal obesity	38 (49.35)	98 (46.67)	0.163	0.687

Data are presented as number (percentage)
*Chi-square test
CAD - coronary artery disease

Comparing vital data among shisha, cigarette, mixed and non-smokers: A significant elevation of SBP and heart rate was observed among shisha smokers and mixed smokers as we found that the (HR was the highest among mixed smokers (87.30±9.26) followed by shisha smokers (83.57±9.81), cigarettes smokers (76.24±8.50) and non-smokers (76.109±10.408) respectively (p<0.001), whereas SBP was the highest among mixed smokers (136.92±10.31) followed by shisha smokers (134.53±9.24), cigarettes smokers (130.364±11.881) and non-smokers (129.800± 10.729) respectively (p=0.009).

The DBP was the highest among mixed smokers (85.38±5.18) followed by shisha smokers (83.90±8.84), cigarettes smokers (83.00±8.10) and non-smokers (81.63±7.84) respectively but this was statistically non-significant (p=0.183).

Comparing vital data among shisha and non-shisha smokers (Table 4), we found higher resting pulse and SBP compared to non-shisha smokers (p<0.001 and p=0.001, respectively).

Smoking history

The mean number of sessions per day among shisha smokers was (5.859±5.318) while the mean number of cigarettes smoked per day among cigarettes smokers was (21. 350±14.051).

Also, we found that patients smoked cigarettes for a longer period (33.090±10.385 years) than patients who smoked shisha (27.063±14.459 years) as shisha smokers started at a later age while cigarette smokers at an earlier age.

Table 4. Vital data in shisha and non-shisha smokers

Variables	Groups	Range		Mean±SD	*t	*p
Pulse	Shisha	65.000	110.000	84.208±9.769	6.289	<0.001*
	Non-smoker, non-shisha	50.000	140.000	76.171±9.526		
Systolic BP	Shisha	120.000	160.000	134.935±9.407	3.350	0.001*
	Non-smoker, non-shisha	100.000	180.000	130.095±11.323		
Diastolic BP	Shisha	70.000	100.000	84.156±8.327	1.739	0.083
	Non-smoker, non-shisha	70.000	100.000	82.286±7.978		

*t-test for independent samples
BP - blood pressure

Duke jeopardy score

Smokers demonstrated a more severe coronary artery disease than non-smokers as the mean value of the DJ score was higher among smokers (6.49±3.13) than non-smokers (5.41±3.06) and this was statistically significant (p=0.005).

The present study showed that among shisha smokers there was highly significant positive relation between duration of shisha smoking (years) and DJ score (p<0.001) and significant positive relation between number of sessions of shisha smoking per day and DJ score (p=0.028).

Among cigarette smokers there was a significant positive relation between the severity of CAD by DJ score and the duration of cigarettes smoking (years) and (p=0.047) as well as the number of cigarettes smoked per day (p=0.041) (Table 5). Determining 6 as cut-off point in DJ score, we found that 71.43% of shisha smokers had an advanced DJ score (>6) which was statistically significant (p=0.008) (Table 6).

Despite this we found that CAD outcome was worse among shisha smokers than among cigarette smokers as the mean value of DJ score was highest among shisha smokers (6.96±3.28) than mixed smokers (6.92±3.12), cigarettes smokers (6.14±3.02) and non-smokers (5.41±3.06) and this was statistically significant (p=0.012). Overall the DJ score was significantly higher in shisha smokers than in non-shisha smokers (p=0.004) (Table 7).

Screening 30 random coffee shops, which sell tobacco boxes for shisha serving was done to evaluate the average weight of tobacco used to fill one shisha serving, it was found that an average of (7-12 gr) of tobacco was used. There was no significant difference in the DJ score between the type of tobacco used in shisha smoking (flavored/non-flavored) (p=0.190) (Table 8).

Table 5. Correlation between duration of smoking (years) and DJ score among shisha smokers) and cigarette smokers

		DJ score	
	Groups	r	p
Duration of smoking (Period of smoking)	Shisha smokers	0.574	<0.001
	Cigarette smokers	0.425	0.047

Discussion

Due to the new popularity of waterpipe smoking and little information available on its impact of CAD compared to cigarette smoking, we sought to study the impact of shisha smoking on the extent of CAD in 287 consecutive patients referred for coronary angiography. CAD was worse among shisha smokers than among cigarette smokers as the mean score of DJ score was statistically significant (p=0.012).

In this study, the lack of female smokers may be attributed to the reluctance of females in Egypt to report their smoking habit due to the social stigma associated with tobacco use among females (17, 18).

In this study 58.76% of smokers were uneducated, while 25.99% received an intermediate (school) education and only 15.25% received higher level of education (university or above). Similarly, 64.06% of shisha smokers were uneducated while 20.31% received intermediate (school) education and only 15.63% received higher level of education (university or above).

These results are supported by a study conducted in rural Egypt and found that smoking in general (water pipe and cigarette smoking) in rural Egypt is more prevalent among the less educated people as most of them have their own water pipes in their houses and believed that it was less hazardous than smoking cigarettes (17).

Risk factors for CAD were more prominent among shisha smokers than cigarette smokers whereas HTN, dyslipidemia, family history of CAD, BMI and abdominal obesity were more prevalent among shisha smokers than cigarette smokers which may explain why shisha smokers had more advanced DJ score and worse CAD than cigarette smokers.

Regarding the vital data, a significant elevation of SBP and heart rate was observed among shisha smokers and mixed smokers. This agrees with a randomized cross-sectional epidemiological study conducted in Jordan by Shafey et al. (17) who found a significant elevation of blood pressure (SBP, DBP) and heart rate was observed among shisha smokers compared to non-tobacco smokers.

There was significant positive relation between severity of CAD by DJ score and duration of smoking (years) & number of sessions per day among shisha smokers.

This may be explained by the study of Shihadeh et al. (18) who found that a typical smoking session consists of hundreds

Table 6. Proportion of shisha and non-shisha smokers as regards to low and high DJ score (6 as cut off value)

		Shisha		Non-smokers& Non-shisha smokers		Total		*Chi-square	p
		N	(%)	N	(%)	N	(%)		
DJ score	Low (<6)	22	28.57	96	45.71	118	41.11	7.045	0.008*
	High (≥6)	55	71.43	114	54.29	169	58.89		
*Chi-square test									

Table 7. DJ score among shisha and non-shisha smokers

		Range		Mean±SD	*t	*p
DJ score	Shisha	2.000	12.000	6.961±3.238	2.894	0.004*
	Non-shisha	2.000	12.000	5.762±3.062		
*t-test for independent samples						

Table 8. DJ score among users of flavored and non-flavored tobacco DJ score

	Flavored	Non flavored		
DJ score	Mean±SD	Mean±SD	*t	–*p
	4.778±2.756	6.000±3.502	1.326	0.190
*t-test for independent samples DJ score - Duke Jeopardy score				

of puff cycles executed over a period of approximately an hour with cumulative inhaled volume of the about 100 liters. Hence, the more frequent number of sessions, the more inhaled shisha tobacco and more exposure to hazards of smoke.

The results are further confirmed and emphasized when we compared DJ score in shisha smokers with CAD vs non-shisha smokers with CAD and we found that 71.43% of shisha smokers had an advanced DJ score (>6) which was statistically significant (p=0.008) and mean DJ score was significantly higher among shisha smokers vs non-shisha smokers (p=0.004).

Shisha smokers also showed significantly higher resting pulse (p<0.001) and systolic blood pressure (p=0.001) compared to non-shisha smokers.

In this study we used DJ score to measure the extent of CAD because it is a simple, effective scoring system for quantifying the amount of myocardium at risk and it can provide a more accurate prediction of survival in patients with coronary artery disease than can be accomplished with using the number of diseased coronary arteries (16) and also it did not requiresophisticated computer software like other scoring systems which may not be widely applicable (19).

The DJ score has been independently validated in >20000 patients in the APPROACH database. The mortality increased in stepwise fashion as the DJ score increased from 2 of 12 to 12 of 12 (20).

There was significant positive relation between severity of CAD by DJ score and duration of cigarettes smoking (years) & number of cigarettes per day which agrees with Herbert (21) who demonstrated a significant correlation between the number of cigarettes consumed and the severity of CAD, as well as the accelerating effect of cigarette consumption on the development of CAD.

In yet another study, the association between the extent and duration of the smoking habit and the severity of coronary atheroma was examined in 387 patients who underwent routine coronary arteriography before valve replacement surgery. The total number of cigarettes which were smoked in life correlated significantly with the severity of the coronary artery disease (p<0.001) and the number of coronary arteries correlated with stenosis of 50% or more (p<0.001) (18).

This agrees with The European Guidelines on cardiovascular disease prevention in clinical practice, 2012 (20) that the risk associated with smoking is primarily related to the amount of tobacco smoked daily and shows a clear dose-response relationship with no lower limit for deleterious effects (22). Duration also plays a role, and, while cigarette smoking is the most common, all types of smoked tobacco are harmful (20). Smoking is deleterious regardless of how it is smoked, including waterpipe (23).

This suggests the need to enroll smokers in tobacco cessation courses whenever possible as part of both primary and secondary cardiovascular prevention.

In this study we found that smokers had more severe coronary artery disease than non-smokers as the mean value of the DJ score was higher among smokers than non-smokers and this was statistically significant (p=0.005).

The study showed that shisha smokers started to smoke at a later age while cigarette smokers at an earlier age.

Despite this, CAD outcome was worse among shisha smokers than among cigarette smokers as the mean value of DJ score was highest among shisha smokers than mixed smokers, cigarettes smokers and non-smokers respectively and this was statistically significant (p=0.012). Graham et al. (19) demonstrated that the DJ score when applied to >20.000 patients undergoing coronary catheterization was predictive of 1-year mortality, especially in those patients undergoing coronary bypass surgery, thus representing a potentially valuable tools in predicting cardiovascular outcome.

This could be explained by a study conducted by Hadidi and Mohammed in 2004 (24) who found striking evidence of

higher nicotine content in the tobacco used in waterpipe smoking. An analysis of 13 commercial types of waterpipe tobacco used in Saudi Arabia was carried out and a wide variation in nicotine content in all brands was noticed with an average of 8.32 mg/g tobacco (range 1.8-41.3 mg/g). The average nicotine content in each waterpipe head (20 g) of unflavored tobacco was said to be 713 mg/head and flavored tobacco 67 mg/head. Smoking one head of flavored (ma'assel) tobacco, which contains on average one-third of nicotine presented in 20 cigarettes (204 mg/pack), resulted in a 20% higher plasma nicotine level (24).

Also, waterpipe smoking produces more smoke than cigarette smoking and it has been estimated that smoke exposure could be as much as 100-200 cigarettes per session (25).

This would point out dramatically how shisha smokers are exposed to higher nicotine content per head (per session) and much more smoke compared to cigarette smokers & in turn expect advanced DJ score among shisha smokers which reflects the extent of coronary artery disease.

However, it is worth noting that it was difficult to standardize exposure measurements to this type of tobacco smoking (Shisha tobacco) to ensure comparable results given that a waterpipe session is generally characterized as a social event, puffing on the waterpipe can be intermittent, and smoking patterns can vary based on quantity, rate, depth, and duration of smoke inhalation (18). For example, a large Egyptian survey in 2009 reported that 43.7% of current shisha smokers reported their last session had lasted less than 10 minutes; with 17.9% reporting the length as over 45 minutes (17), whereas in other areas the average duration of a waterpipe session is reported to be 45-60 minutes smoking time with 10-20 g of tobacco consumed (26). These differences can influence the amount of toxic components inhaled (27). Also, the amount of smoke inhaled from a waterpipe varies based on the size of the waterpipe, water bowl capacity, and the length of the flexible hose (28). Constituents of the waterpipe mainstream smoke also vary depending on the type and amount of charcoal used (29).

Study limitations

This is a small single site observational study which was conducted in Ain Shams University hospital where the studied cohort may be of low socioeconomic status which may limit the generalization of our results to the society at large. The questionnaire was asked to the patient orally and not by self-report method, thus it is possible that patients might have underreported their smoking habits and patterns. There was a need for more standardization of intensity and frequency of tobacco exposure (puff volume, number and duration) for better comparability between both types of tobacco used in shisha smoking. Most of the patients of the study were on anti-ischaemic treatment (nitrates, antiplatelet agents, beta-blockers, statins and ACE inhibitors) which may have hindered statistically significant data.

Conclusion

CAD affection was worse among shisha smokers than among cigarette smokers and this may be due to the higher tobacco nicotine content, the higher toxins within the smoke and its magnified effect as environmental tobacco smoke in closed places.

There is significant positive relation between the severity of CAD and the duration of smoking per years among both shisha and cigarette smokers as well as the number of cigarettes/shisha sessions per day.

It is important to enroll shisha smokers in tobacco cessation courses whenever possible as part of both primary and secondary cardiovascular prevention especially those with low socioeconomic status.

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