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Coronary Angiographic Profile in Smokeless Tobacco Users in Patients Presenting with Acute Coronary Syndrome at A Tertiary Care Cardiac Center

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ABSTRACT

Smokeless tobacco users with acute coronary syndrome (ACS) at tertiary care cardiac centers are more likely to develop significant coronary artery disease (CAD). With multi-vessel involvement, highlighting its significant risk factor. **Objectives:** To determine the frequency of coronary angiographic profiles in smokeless tobacco users with ACS at a cardiac center. **Methods:** A study involving 159 smokeless tobacco users aged 18-70 with acute coronary syndrome was conducted at the National Institute of Cardiovascular Diseases (NICVD) Karachi from Mar 2022 to Jan 2024, recording demographic data such as gender, age, height, and weight. Before an angiography procedure, the patient's medical history, including hypertension, diabetes, family history, and obesity, was reviewed, along with their smokeless tobacco use, recording type, frequency, and duration. **Results:** A study involving 159 smokeless tobacco users aged 18-70 years, with a mean age of 46.64 ± 10.186, included 134 male (84.3%) and 25 female (15.7%). The study revealed that male accounted for 63 (39.62%) of the total ACS with Single vascular disease (SVD), while unstable angina was typical in 52 (32.70%) cases. The study found a significant association between age groups, ACS type, culprit artery, and tobacco use on the day of ACS (p=0.004, 0.027, 0.044, and 0.024), respectively. However, no significant association was seen between gender, tobacco type, and risk variables. **Conclusions:** It was concluded that smokeless tobacco significantly contributes to ACS, with a high percentage of single vessel blockage involving RCA, and that duration and number of use also contribute to ACS.

INTRODUCTION

Cardiovascular diseases (CVDs) accounted for over one-third of global fatalities in 2021, causing 20.5 million deaths [1]. Acute Coronary Syndrome (ACS) is an umbrella term for various types of coronary artery disease (CAD) caused by plaque formation in coronary arteries, resulting in decreased blood flow to the heart. This condition is characterized by an imbalance in oxygen demand and supply, primarily due to the development of plaques in the coronary artery lumen [2, 3]. Coronary angiographic profiles in acute coronary syndrome (ACS) patients indicate significant trends. Single vascular disease (SVD) is more prevalent in young people, non-diabetics, and smokers [4, 5]. The left anterior descending artery is most commonly implicated. Diabetics are more likely to develop severe triple-vessel disease. Smokeless tobacco users had comparable vascular involvement patterns to smokers, with SVD and left anterior descending artery involvement being common [4-6]. Studies indicate that smokeless tobacco use, including products like Naswar and Snus, can lead to coronary vasoconstriction and increased complication rates during coronary interventions (like re-stenosis) [7]. Smokeless tobacco creates greater nicotine

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levels, which causes sympathetic neuronal activation and immediate cardiovascular consequences [8]. Smoking significantly impacts cardiovascular health by affecting coronary vasomotor tone, endothelial and platelet function, and accelerating atherosclerosis progression through vascular damage, endothelial dysfunction, oxidative stress, thrombosis, lipid changes, and inflammation [9]. Smoking is a significant risk factor for coronary artery disease, but smokeless tobacco has not received considerable attention due to insufficient data on coronary obstructive patterns.Smokeless tobacco product patterns vary regionally, and there are no studies on angiographic patterns in Pakistani patients, and limited global data is available.

This study aims to evaluate coronary obstruction patterns in smokeless tobacco users, enabling the development of targeted preventive strategies for future use.

METHODS

An observational cross-sectional research study was carried out in the Department of Cardiology, NICVD, Karachi, from March 2022 to January 2024. This study was approved by the hospital's ethical review. Committee and the College of Physicians and Surgeons of Pakistan with Ref No: CPSP/REU/PED-2019-195-1995. Participants were informed of the study's purpose and benefits, and consent was obtained.The study involved 18-70-year-old smokeless tobacco users with acute coronary syndrome at the NICVD in Karachi. Demographic details, including gender, age, height, and weight, were obtained at hospital arrival. Medical history was also assessed for hypertension, diabetes, family history, and obesity.Patients were interviewed about their use of smokeless tobacco, recording their type, frequency, and duration. In the study, acute coronary syndrome (ACS) was diagnosed based on two criteria: 1. STEMI (ST-Segment Elevation Myocardial Infarction): Common chest discomfort (>20 min) exacerbated by physical activity or stress, is eased by rest or nitroglycerin. New ST-elevation at the J-point in 2 contiguous leads is present, with cut points ≥1 mm in all leads except leads V2-V3 (cut points male (≥2.5 mm), in females (≥1.5 mm). 2. (NSTEMI) Non-ST-segment elevation myocardial infarction): STEMI is a chest discomfort lasting over 20 minutes, exacerbated by physical activity or stress, and relieved by rest or nitroglycerin. NSTEMI is diagnosed by chest pain lasting over 20 minutes, with ECG showing ST depression, ST elevation, wave inversions, and a rise in cardiac troponin above the normal range. Unstable angina is diagnosed in patients with chest pain, negative troponin results, and ST-segment depression measuring 1 mm on limb leads and 2 mm on chest leads. An angiography procedure was accomplished by a consultant cardiologist with over 5 years of experience. The principal investigator recorded angiographic patterns, disease extent, and the culprit artery on a predesigned pro forma, along with other collected data. In the study, 159 patients were calculated in the sample size by applying the WHO calculator by assuming the prevalence of mid-right coronary artery disease in the smokeless tobacco users, p=28% [10], taking the confidence level (95%) and the margin of error (7%). 159 patients made up the total sample size. In the study, the consecutive sampling method was applied. The study includes both genders, aged 18-70, patients with acute coronary syndrome, and smokeless tobacco users who are chewing or taking any smokeless tobacco such as paan, naswar, gutka, main puri, or mawa with the frequency of at least twice a day for more than 6 months, while exclusion criteria include refusal to give consent, prior cardiac-related surgery history, and patients who have smoked ten or more cigarettes a day for at least 02 years, or five or more cigarettes a day for no less than four years, as well as those who have had any previous heart condition-related surgeries

RESULTS

159 patients, aged 18 to 70, met the study's inclusion requirements and were accepted. The average age, including standard deviation, was 46.64 ± 10.186 years, while other quantitative variables such as age in groups, smokeless tobacco use per day, and year are presented in Table 1.

Table 1: Descriptive Statistics of Different Variables

Variables	Mean ± SD	95%CI (LB-UB)	Median (IQR)	Range	Min	Max
Age						
–	46.64 ± 10.186	50.6 ± 5.213	45 (16)	52	18	70
Age Groups						
18-40 Years	36.81 ± 4.178	35.77-37.86	38 (3)	22	18	40
40-60 Years	36.81 ± 4.178	49.41-51.80	51 (10)	30	41	60
61-70 Years	63.89 ± 3.510	44.04-48.21	63 (6)	10	61	70
Smokeless Tobacco Use Per Day						
–	14.66 ± 5.762	13.76-15.56	15 (06)	28	2	30
Smokeless Tobacco Use in Years						
-	15.25 ± 8.514	13.91-16.58	14 (13)	38	2	40

Frequencies regarding gender were calculated, and it was found that out of the total study subjects, 134 (84.3%) patients were male, while 25 (15.7%) were female while the other qualitative variable such as age in groups, an extension of disease (number of vessels involve), culprit artery involvement, type of ACS, type of tobacco and, risk factors i.e. D.M, hypertension, obesity and family history of CAD detailed is presented in Table 2.

Table 2: Frequency and Percentage of Demographic and Other Related Variables

Variables		Frequency (%)
Gender	Male	134 (84.3%)
	Female	25 (15.7%)

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Age Groups	18-40 Years	64 (40.3%)
	41-60Years	76 (47.80%)
	61-70 Years	19 (11.90%)
Coronary Angiographic Profile	SVD	76 (47.79%)
	2VD	28 (17.61%)
	3VD	55 (34.59%)
Culprit Artery	LAD	42 (26.40%)
	LCX	58 (36.50%)
	RCA	59 (37.10%)
Type of ACS	Unstable	93 (85.50%)
	Angina	31 (19.50%)
	STEMI	35 (22.00%)
Type of Tobacco	Paan	42 (26.42%)
	Naswar	64 (40.25%)
	Gutka	35 (22.01%)
	Main Purri	11 (06.92%)
	Mawa	07 (04.40%)
Risk Factors	Diabetes Mellitus	96 (60.38%)
	hypertension	35(22.01%)
	Obesity	13(08.18%)
	Family History of CAD	15(09.43%)

To determine the relationship, a chi-square test was used to stratify the coronary angiographic profile concerning gender, age group (years), type of ACS, type of risk factors, culprit artery, type of tobacco per day, and type of tobacco per year.A p-value of less than 0.05 was deemed significant.There was a substantial link between age groups. Type of ACS, Culprit artery, and use of tobacco in a day and years have a significant association with ACS (p=0.004, 0.027, 0.044, 0.024, and p=0.057), respectively. While no significant (i.e p=0.900 and 0.842) association with gender, type of tobacco and risk factors was observed, are presented in Table 3.

Table 3: Frequency and Association of Coronary Angiographic Profile with Different Variables (n=159)

Variables		Coronary Angiographic Profile			p-value
		SVD	2VD	3VD	
Age (Years)	18-40 Years	42	07	18	0.004
	40-60 Years	25	17	34	
	61-70 Years	09	04	06	
Gender	Male	63	24	47	0.900
	Female	13	4	8	
Type of Tobacco	Paan	28	02	12	0.094
	Naswar	27	15	22	
	Guttka	13	09	13	
	Mainpuri	06	01	04	
	Mawa	02	01	04	
Culprit Artery	LAD	24	02	16	0.044
	LCX	21	15	22	
	RCA	31	11	17	
Type of ACS	Unstable Angina	52	14	27	0.027
	STEMI	10	10	11	
	NSTEMI	27	11	17	
Risk Factors	Diabetes Mellitus	46	18	32	0.842
	Hypertension	18	06	11	
	Obesity	05	01	07	
	Family history of C	07	03	05	
Use of Tobacco /Day	1-10perday	23	06	07	0. 024
	11-20perday	42	22	38	
	>20 perday	11	00	10	
Use of Tobacco (Years)	1-5 Years	12	00	02	0.05
	6-10 Years	16	07	20	
	11-20Years	31	12	20	
	>20Years	17	09	13	

DISCUSSION

Coronary artery disease (CAD) is a prevalent heart condition characterized by the buildup of atherosclerotic plaque within the arterial lumen.Blood flow impairment reduces oxygen delivery to the myocardium.CAD is the most common cause of major morbidity and mortality in the US and worldwide [11].The present study included 159 patients between 18 and 70 years of age presenting with ACS. Even in the current research, where 84.3% of the patients are men, male sex is one of the most often reported risk factors for CAD in several studies that take into account the skewed gender distribution [12-14].Kaur *et al.*, found that males have more severe coronary artery disease [6]. Joshi *et al.*, found that men under 30 with AMI were significantly more prevalent in angiographic studies, often due to higher smoking rates and estrogen protection in women [13]. With a prevalence of over 60% in the current study, diabetes mellitus is a traditional risk factor for coronary artery disease (CAD). Between 20 and 80 percent of the study cohort in several other studies involving young AMI patients had diabetes [12, 14]. Nevertheless, with a prevalence of 11–15%, obesity was noted as an uncommon cause in the majority of earlier studies [12, 15]. CAD, diabetes mellitus and systemic hypertension well well-established risk factors. In comparison to this study, the studied population had a non-significantly lower frequency of diabetes mellitus (23.4%) and hypertension (12.2%) than this one.Other studies found that the prevalence of hypertension varied from 10 to 44 percent [14, 16]. A higher amount of plaque in the coronary arteries is linked to a favorable family history of early CAD.The results of the current study, which show a prevalence rate of 9.43%, are very similar to other Indian studies that reflect a significantly lower prevalence rate of positive family history of early CAD, which is centered around 10% [12, 17]. In contrast, a small number of Indian research studies suggest a significantly greater prevalence, ranging from 30 to 47% [13, 15].The most preventable cause of death in the world, tobacco use, harms all stages of atherosclerosis.A significant portion of the population under study used smokeless tobacco.Consuming smokeless tobacco is still

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not proven to be a cardiovascular risk factor.However, since it is so common among South Asians, it needs to be thoroughly tested before any particular recommendations regarding STEMI can be made.Events in life that are stressful can make the plaque unstable, which can lead to its rupture and STEMI[13].Following coronary angiography, all 159 patients in the current research had a prevalence of obstructive CAD of 48%, 34%, and 18% for SVD, 2VD, and 3VD, respectively.The above results are further supported by the literature that is currently available, with several studies showing comparable rates of obstructive CAD in their study group, which range from 60 to 70% [18, 19]. El-Rabbat *et al.*, in a comparative angiographic study, found very similar patterns in young adults with ACS: SVD most common, TVD least common [20]. Khan *et al.*, noted that angiographically normal coronaries in young AMI patients might be owing to spontaneous recanalization, thrombosis, or vasospasm, which is consistent with your results[21].Zhang *et al.*, discovered that LAD was the most commonly involved, followed by RCA.Your findings are consistent with past exceptions, such as Kennelly[22].On the other hand, obstructive CAD is far more common (>80%) in several other investigations [15, 17].Before coronary angiography, almost 60% of the patients had thrombolysis, which may have recanalized the artery associated with the infarct. Normal coronary arteries can arise from thrombosis with reperfusion. Common coronary artery spasms in younger individuals and spontaneous recanalization [23].The Glagov phenomenon, characterized by plaque development in the coronary artery and the ability to cause adaptive enlargement while maintaining the luminal area, could not be ruled out since intravascular ultrasonography(IVUS)was not used.[18, 24]. The current investigation found that TVD and DVD were extremely rare. Furthermore, other studies have found a considerable incidence of TVD(18%)and DVD(34%), which suggests that severe coronary involvement is rare in young person's presenting with ACS[25].The majority of research done on juvenile AMI patients shows a prevalence of SVD, which is found in 48% of cases in the current study[18, 26]. Acute coronary syndrome (ACS) is uncommon in young patients under 40 years of age, and these young patients have a different CAD pattern in comparison with older patients[27]. The study aims to investigate the clinical, risk factor, and coronary angiographic features of very young individuals under the age of 30 who present with their first STEMI, as the literature on this topic is quite restricted and particularly lacking in the community[28]. According to the current study, the most often affected artery is the RCA, which is implicated alone in 37.1% of instances, followed by the LCX in 36.5% of cases.The results do not closely match those of earlier studies in which the most often affected vessel was the LAD, followed by the RCA and the LCX, in that order [12, 24]. However, according to Kennelly *et al.*, 1982 study, the most often affected vessel in their sample was the RCA[29]. Remarkably, just 7(17.1%)of the patients had non-culprit vessels diagnosed with an illness, and only 4 (9.75%) of the patients had more than one lesion in the culprit artery, indicating that most of the lesions were non-atherosclerotic[24, 29].

CONCLUSIONS

It was concluded that this study highlights the coronary angiographic profile of smokeless tobacco users with ACS. A significant association was found between ACS and factors like age, type of ACS, culprit artery, and tobacco use frequency and duration, while gender and conventional risk factors showed no significant link. Single-vessel disease (SVD) was most prevalent, with RCA being the most affected artery, differing from prior studies that reported LAD dominance. With the rising use of smokeless tobacco, further research with larger samples and advanced imaging is needed to confirm its role in coronary artery disease. Public health initiatives should emphasize the cardiovascular risks associated with smokeless tobacco to mitigate its impact.

Authors Contribution

Conceptualization: S
Methodology: SH
Formal analysis: VKG
Writing review and editing: SDH, FAM, SU

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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