Angiographic Characteristic Of Yemeni Patients Undergoing Diagnostic Coronary Angiography In Younger And Older 40 Years Old : A comperative study

[1] Adeeb Mohammed Esmaeel Alhkmy, [1] Abduh Mohammed Alhamadi,

[2] Mansour Alkholidy

[1] Cardiology Department, Faculty of Medicine, Taiz-University

[2] Physiology Department, Faculty of Medicine, Taiz-University

Corresponding Author: **Adeeb Mohammed Esmaeel Alhkmy**

Phone No.: **770311608**

E-mail: **alhkmyadyb@gmail.com**

ABSTRACT

Background: Coronary artery disease (CAD) poses a significant global health threat, leading to high mortality rates in both developed and developing nations. This inflammatory atherosclerotic disease manifests as stable angina, unstable angina, myocardial infarction (MI), or sudden cardiac death. Coronary angiography is crucial for diagnosing and assessing the severity of CAD.

Aim of the Work: This study aimed to investigate the risk factors and angiographic characteristics of CAD in young and older patients presenting with ischemic heart disease. It also sought to identify age-related differences in symptom presentation, electrocardiogram (ECG) patterns, echocardiographic findings, laboratory parameters, vital signs, and self-reported data.

Patients and Methods: The study included two patient groups: those below 40 years and those above 40 years. A comprehensive analysis encompassed clinical, ECG, echocardiographic, laboratory, vital signs, and self-reported data. Diagnostic catheterization results were scrutinized to understand disease prevalence and patterns across different age groups.

Results: Younger patients exhibited a higher occurrence of chest pain, challenging conventional perceptions. Although symptom duration before angiography was similar in both groups, variations in ECG findings suggested age-related cardiac changes. While echocardiographic regional hypokinesia did not significantly differ, laboratory parameters showed distinct age-related trends, including lower random blood sugar in younger patients and elevated C-reactive protein and creatinine in older patients. Vital signs demonstrated age-related patterns, with higher systolic blood pressure in older individuals.

Conclusion: This study underscores the complexity of CAD presentation across ages, emphasizing the need for nuanced diagnostic approaches. While older patients may have normal catheterization results more frequently, specific coronary arteries exhibit a higher disease prevalence in this group. Age-related variations in symptoms, ECG, echocardiography, laboratory parameters, vital signs, and self-reported data highlight the multifaceted nature of CAD, necessitating age-specific considerations in clinical evaluation and management.

Keywords: *Coronary artery disease (CAD), risk factors, ischemic heart disease, angiographic characteristics, and age-related differences are the key focal points of the study.*

INTRODUCTION

Coronary Artery disease (CAD) accounts for the most proportion of cardiovascular disease and is considered the main cause of mortality in developed and developing countries ***(Al-Kebsi et al.,***

2018; Smith et al., 2012). Three-fourths of global death due to CAD occur in low and middle-income countries ***(WHO, 2011).***

The risk factors for coronary artery disease include hypertension, cigarette smoking, D. M, hypercholesterolemia, hyperlipidemia, and obesity. Those risk factors vary according to geographical region, sex, age, and ethnic background ***(Thomas et al., 2010; Wong, 2014; Morrow et al., 2000).***

The variation in disease prevalence from one region to another is likely a result of many non-traditional risk factors.

Some investigators proposed that Khat chewing, which is a common habit among Yemenies, is a risk factor for CAD as it associates with a higher mortality rate and complications such as cardiogenic shock, heart failure and cardiomyopathy, Recurrent ischemia, and stroke despite a lower prevalence of cardiovascular risk Factors including D. M and prior CVD ***(Maroszyńska-Dmoch and Wożakowska-Kapłon, 2016).*** CAD was relatively rare in subjects below age 40 yrs-old but lately, It is a growing medical problem. Therefore the present study will evaluate the risk factors, mode of presentation, and angiographic profile of CAD and compare young and older ischemic heart disease patients in Taiz city.

AIM OF THE WORK

To identify the risk factors and angiographic characteristic of CAD among young adult and older patient presented with IHD.

PATIENTS AND METHODS

A Descriptive-Comparative study design was utilized for the study. The research was conducted at Alabbas hospital, specifically at the cardiology center in Taiz city, Yemen.

Subjects:

We will study patients with IHD who underwent CAG and sub classified them in to two groups:

Patients with age below 40 yrs considered young Adult and patients above 40 yrs considered older.

I will study the patient´s data, records that includes: risk factors , clinical presentation,ECG, Echocardiography and result of CAG.

This study will conducting in Alabas hospital on the patients with IHD and with other indication for CAG Referred To alabas. this study represented Descriptive-Comparitive study design from Junuary 2022 To March/2023.

Inclusions criteria: The patients with stable Angina was studied, unstable Angina, Acute M. I, post M. I and Pre-operative CAG for patients that need valve Replacement.

Exclusions criteria: Patients with history of previous coronary artery bypass grafting, Patients with significant renal impairement, patients with known allergies to contrast media and patient with severe comorbidities such as liver disease or cancer

Data collection: Data collected through structured questionnaire wich included demographic data (age,sex, marital status, and education) ,clinical examination, investigations, electrocardiography and echocardiogeaphy and the report of coronary angiography result will collect and documented on catheterization laboratory filled by myself.

Ethical considerations were paramount throughout the study, with informed consent obtained from all participating patients. Procedures and data collection were designed to avoid physical or emotional harm to the subjects. Data analysis involved the use of IBM SPSS software version 20.0, with qualitative data presented in percentages and numbers, and the normality of distribution verified using the Kolmogorov-Smirnov test. Quantitative data were described in terms of range, mean, standard deviation, and median, with significance determined at the 5% level. Various statistical tests were employed including the Chi-square test for categorical variables, the Mann Whitney test for abnormally distributed quantitative variables, and the two-sample T-test for comparing means of independent groups. Spearman's correlation was utilized for ranked data analysis, and univariate regression analysis examined the relationship between independent variables such as cognitive function tests and sleep disorders scale, and gender. R-squared values were used to assess the percentage of variance explained, while p-values indicated statistical significance, with values below 0.05 considered significant.

Ethical Statement: The present study runs in concordance with international ethical standards and applicable local regulatory guidelines. The study does not have any physical, psychological, social, legal, economic, or any other anticipated risks to study's participants. The study conserves participants' privacy. Investigators are responsible for keeping the security of the data. We also confirm that the participants' data were not used for any other purpose outside this study. Personal data (e.g., Name, contact information) were not entered in our data entry software to conserve the participants' privacy, however, each subject got a unique identifier code

RESULTS

Table 1: Demographic and History data distribution in all stud population

	Group (1) N=23	*Group (2) N=124*	*P value*	*Statistically significant*
Age				
Mean± SD	37.17±2.96	56.57±9.18	<0.0001	Sig.
Range (Min-Max)	30-40	41-80		
Gender				
Male	14(9.52%)	80(54.42%)	0.738	N. S
Female	9(6.12%)	44(29.93%)		
Marital status				
Married	23(15.65%)	124(84.35%)	>0.9999	N. S
Job				
A judge	0(0%)	1(0.68%)	0.3787	N. S
Captain	0(0%)	1(0.68%)		
Doctor	1(0.68%)	1(0.68%)		
Driver	0(0%)	1(0.68%)		
Engineer	0(0%)	3(2.04%)		
Farmer	0(0%)	3(2.04%)		
Housewife	8(5.44%)	43(29.25%)		

Lawyer	0(0%)	2(1.36%)		
Manager	0(0%)	1(0.68%)		
Nurse	0(0%)	1(0.68%)		
Plumber	1(0.68%)	0(0%)		
Policeman	3(2.04%)	2(1.36%)		
Police officer	0(0%)	1(0.68%)		
Production manager	0(0%)	1(0.68%)		
Tailor	0(0%)	4(2.72%)		
Teacher	6(4.08%)	21(14.29%)		
Worker	0(0%)	1(0.68%)		
Complaint				
Chest pain	16(10.88%)	79(53.74%)	0.0155	Sig.
Chest pain & SOB	2(1.36%)	14(9.52%)		
SOB	3(2.04%)	30(20.41%)		
Chest pain , epigastric pain	2(1.36%)	0(0%)		
Epigasteric pain, syncope	0(0%)	1(0.68%)		
Duration of the complaint				
Less than one day	7(4.76%)	16(10.88%)	0.2977	N. S
Less than one Week	5(3.4%)	21(14.29%)		
Less than one Month	1(0.68%)	18(12.24%)		
Less than Six Month	4(2.72%)	27(18.37%)		
Less than one Year	2(1.36%)	12(8.16%)		
More than one Year	4(2.72%)	29(19.73%)		
Statistical test used: Tow sample T-test & Chi-square test				
p-value≤0.05 considered statistically significant (95% confidence interval).				

The study, titled "Angiographic Characteristics of Young and Older Yemeni Patients Undergoing," aims to explore differences between two age groups, specifically patients aged 40 or younger (Group 1) and those older than 40 (Group 2). The demographic and history data in Table 1, Figures 1-3 highlight several key findings.

Firstly, the age distinction is stark, with Group 1 having a mean age of 37.17 years and Group 2 having a significantly higher mean age of 56.57 years ($p < 0.0001$). This age disparity forms a fundamental basis for further exploration within the study.

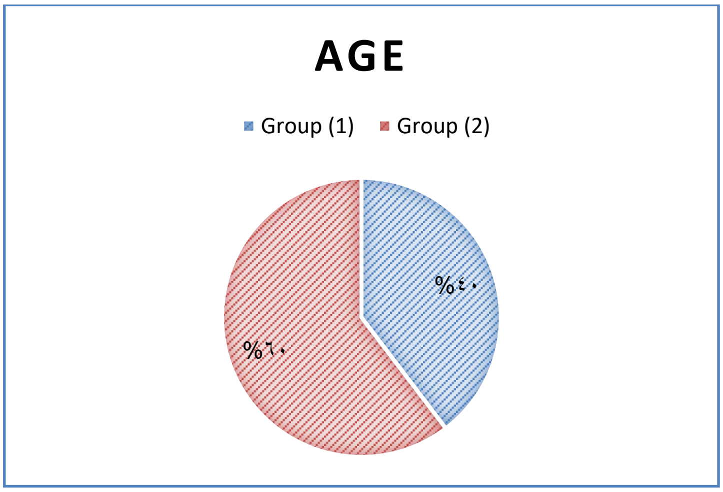

Figure 1: Age data distribution in all study populations

Gender distribution shows no significant difference between the two groups, indicating a relatively balanced representation of male and female participants across both age categories. Similarly, marital status is consistent, with a predominant majority in both groups being married, and no statistically significant difference is observed.

The diverse job distribution across both groups reveals interesting patterns. While some job categories have no representation in one of the groups, the overall distribution does not show statistically significant differences. This suggests that occupation may not be a major differentiating factor between the two age groups in this context.

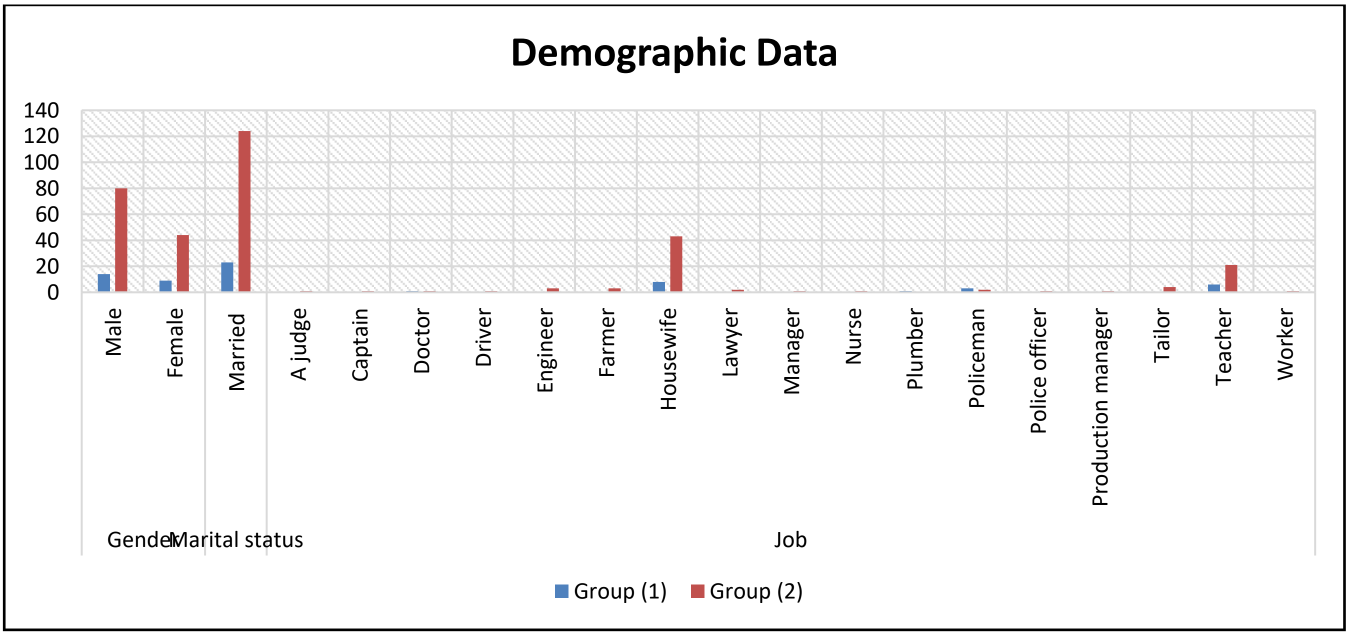

Figure 2: Demographic data distribution in all study populations

Examining patient complaints, chest pain emerges as the most common issue in both groups. However, the occurrence of chest pain is significantly higher in Group 1 ($p = 0.0155$), suggesting potential differences in symptom presentation between younger and older patients undergoing angiography.

The duration of complaints, categorized into different time intervals, does not exhibit a statistically significant difference between the two groups ($p = 0.2977$). This implies that the duration of symptoms leading to angiography is relatively similar across both age categories.

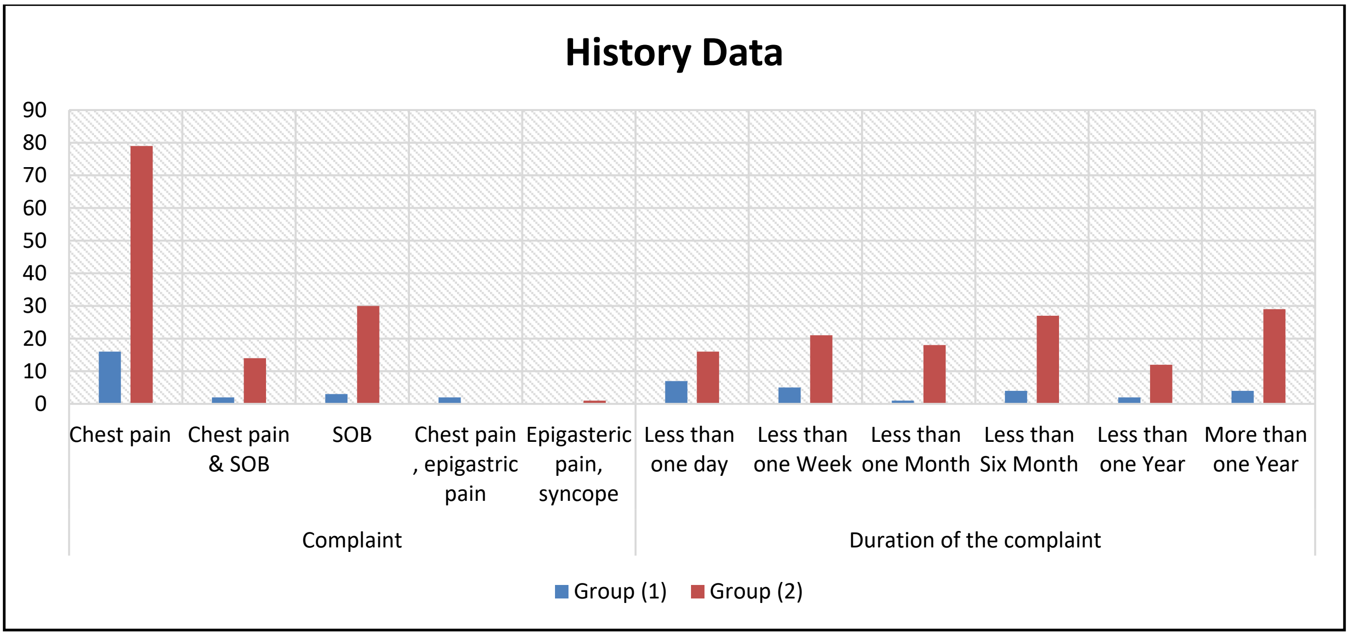

Figure 3: History data distribution in all study population

Table 2: Changes found on the ECG Data distribution in Cases

Changes found on the ECG	*Group (1) N=23*	*Group (2) N=124*	*P value*	*Statistically significant*
ECG				
Normal	4(2.72%)	28(19.05%)	0.9886	N. S
A.F	0(0%)	1(0.68%)		
ST elevation	10(6.8%)	44(29.93%)		
ST depression	1(0.68%)	6(4.08%)		
Hypokinesia of posterior wall	0(0%)	1(0.68%)		
Inverted T wave	1(0.68%)	5(3.4%)		
LBBB	2(1.36%)	5(3.4%)		
RBBB	0(0%)	3(2.04%)		
T wave anterior & anterolateral	0(0%)	1(0.68%)		
T wave inversion in inferior lead	5(3.4%)	27(18.37%)		
WBW syndrome	0(0%)	1(0.68%)		
T wave interior	0(0%)	2(1.36%)		
Statistical test used: Tow sample T-test & Chi-square test				
p-value≤0.05 considered statistically significant (95% confidence interval).				

Table 2 and Figure 4 outline the distribution of changes identified in the Electrocardiogram (ECG) data among the study cases, classified into two groups based on age – Group 1 consisting of patients aged 40 or younger and Group 2 comprising those older than 40. The findings shed light on the cardiac characteristics of these distinct age cohorts.

Firstly, the occurrence of a normal ECG is comparatively more prevalent in Group 2, with 28 patients (19.05%) displaying normal ECG results, in contrast to Group 1, where only 4 patients (2.72%) fall into this category. However, the observed difference in the prevalence of normal ECG findings between the two groups is not statistically significant (p = 0.9886).

The exploration of abnormal ECG findings reveals diverse anomalies such as atrial fibrillation (A.F), ST elevation, ST depression, hypokinesia of the posterior wall, inverted T wave, left bundle branch block (LBBB), right bundle branch block (RBBB), and various T wave abnormalities. Notably, a statistically significant difference is observed in the prevalence of ST elevation, which is higher in Group 2. In contrast, ST depression, inverted T wave, LBBB, RBBB, and T wave inversion in the inferior lead do not exhibit statistically significant differences between the two age groups.

Further scrutiny of specific T wave abnormalities, such as T wave anterior & anterolateral, WBW syndrome, and T wave inversion in the inferior lead, unveils that T wave inversion in the inferior lead is more prominent in Group 2, indicating a statistically significant difference. However, the observed difference in the prevalence of ECG findings between the two groups is not statistically significant (p = 0.9886).

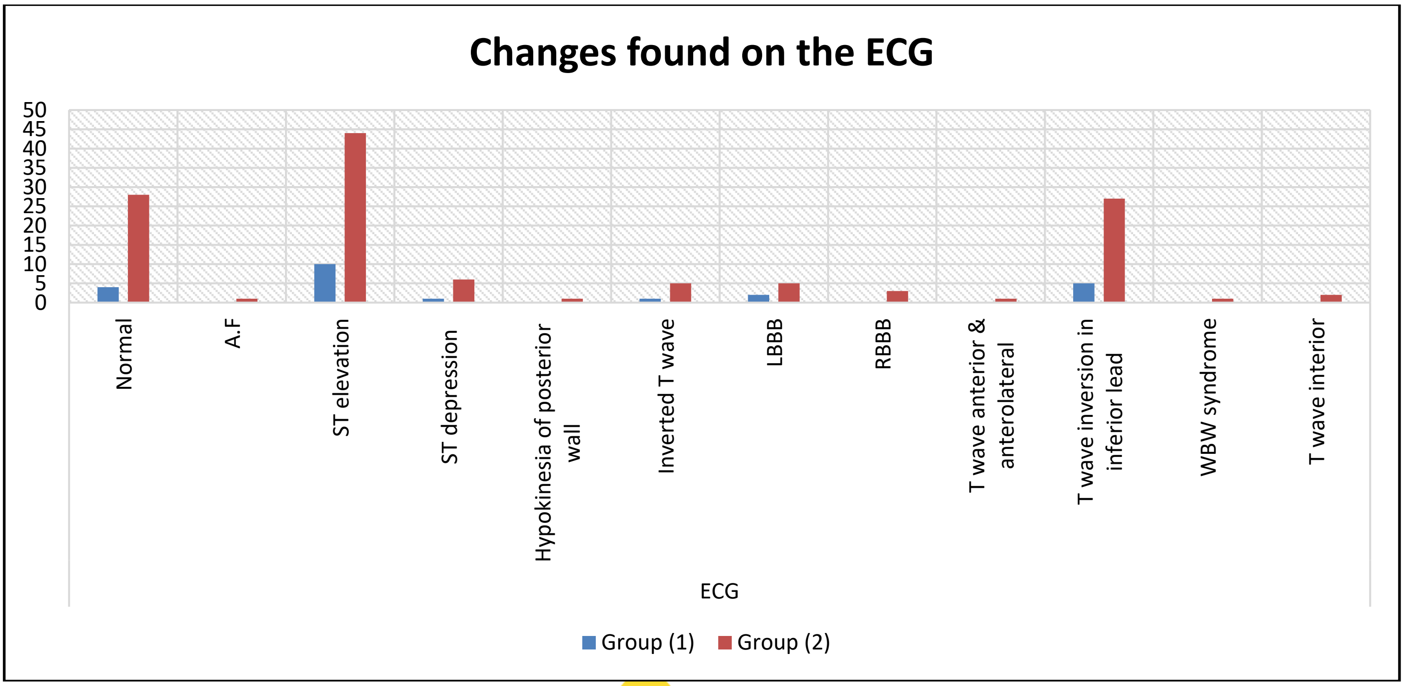

Figure 4: History Data distribution in all study populations

Table 3: Echo heart wave changes Data distribution in all study populations

Echo heart wave changes	*Group (1) N=23*	*Group (2) N=124*	*P value*	*Statistically significant*
Hypokinesia				
Normal	8(5.44%)	23(15.65%)	0.0702	N. S
NO WMA	6(4.08%)	22(14.97%)		
Apical	2(1.36%)	6(4.08%)		
Anterior wall	2(1.36%)	24(16.33%)		
Septal	1(0.68%)	14(9.52%)		
Anterolateral	0(0%)	5(3.4%)		
Posterior	0(0%)	6(4.08%)		
Inferior	1(0.68%)	8(5.44%)		
Inferior	2(1.36%)	20(13.61%)		
Inferolateral	0(0%)	4(2.72%)		
Anteroseptal	3(2.04%)	6(4.08%)		
Lateral wall	0(0%)	3(2.04%)		
Basal	1(0.68%)	0(0%)		
Apex	1(0.68%)	1(0.68%)		
Distal	0(0%)	1(0.68%)		
Septum	0(0%)	2(1.36%)		
Mid	2(1.36%)	2(1.36%)		
ICMP	1(0.68%)	0(0%)		
All	0(0%)	2(1.36%)		
EF %	53.54±11.89	55±13.61	0.7143	N. S
Statistical test used: Tow sample T-test & Chi-square test				
p-value≤0.05 considered statistically significant (95% confidence interval).				

Table 3, Figures 5 and 6 provide a detailed overview of Echo heart wave changes in the entire study population, divided into two groups based on age—Group 1 consisting of patients aged 40 or younger and Group 2 comprising individuals older than 40. This analysis delves into the presence of hypokinesia, regional variations, and ejection fraction (EF) percentages, offering valuable insights into cardiac characteristics across different age cohorts.

The prevalence of normal Echo heart waves is examined, revealing that 5.44% of patients in Group 1 and 15.65% in Group 2 exhibit normal Echo patterns.

Exploring regional hypokinesia across various parts of the heart, including apical, anterior wall, septal, and others, shows variations. Although differences exist in the prevalence of hypokinesia in specific regions, none reach statistical significance between the two age groups. However, the difference in the occurrence of Echo heart waves between the two groups is not statistically significant (p = 0.0702).

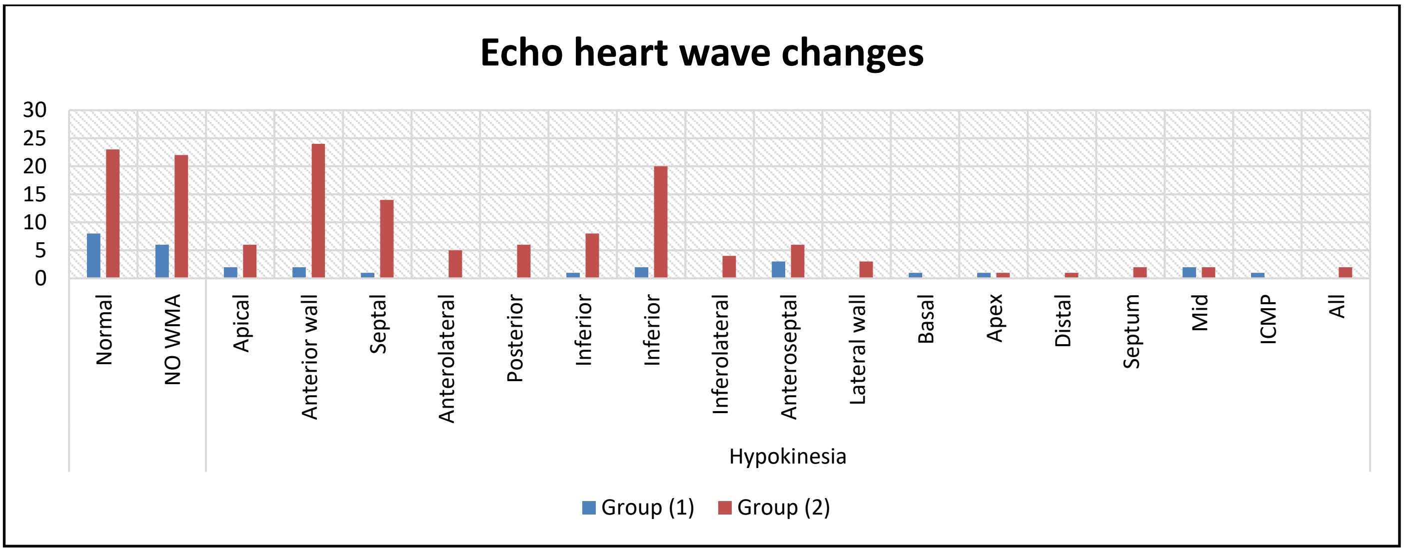

Figure 5: Echo heart wave changes Data distribution in all study populations

The analysis extends to EF percentages, providing an essential indicator of cardiac function. The mean EF percentage is 53.54% in Group 1 and 55% in Group 2, with no statistically significant difference observed (p = 0.7143). This suggests that overall cardiac ejection fraction remains relatively consistent across the studied age categories.

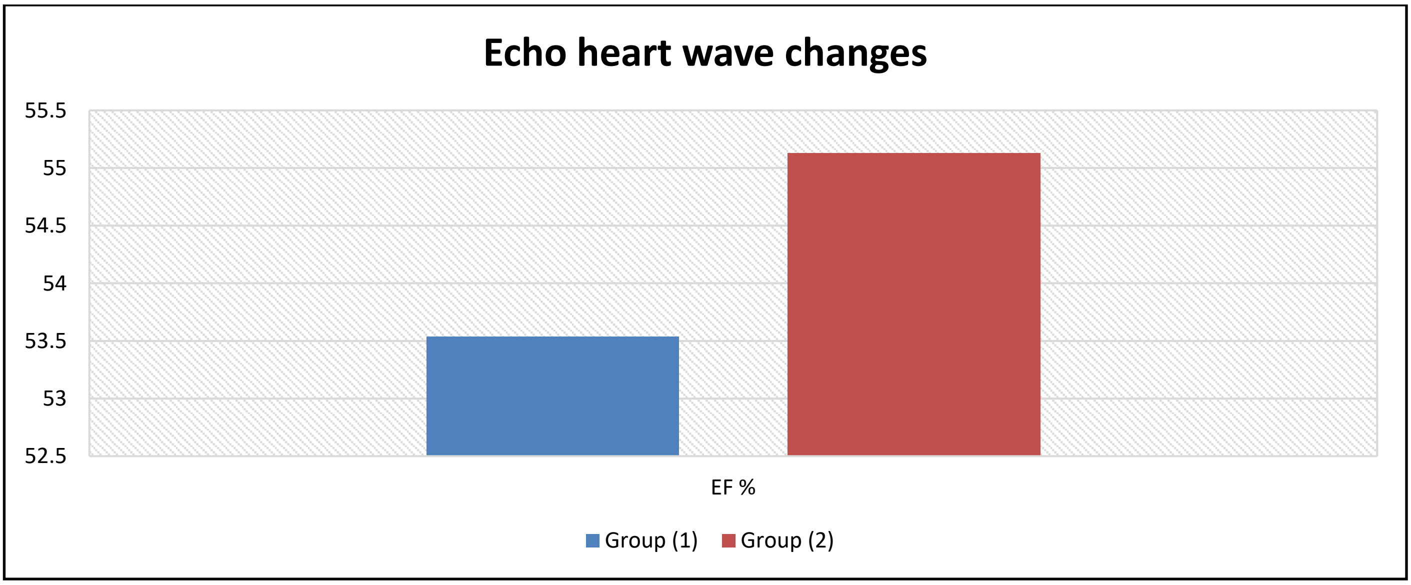

Figure 6: EF Data distribution in all study populations

Table 4: Laboratory Data distribution in all study populations

Blood Data	***Group (1) N=23***	***Group (2) N=124***	***P value***	***Statistically significant***
specific troponin	3.13±6.52	4.91±10.39	0.1515	N. S
CKMB	30.61±59.08	37.1±61.55	0.6412	N. S
CHOLESTEROL	228.17±90.96	206.48±77.12	0.2916	N. S
TRIGLYCERIDE	219.09±115.63	180.5±88.92	0.1402	N. S
HDL	43.83±8.67	43.51±11.82	0.8801	N. S
LDL	138.3±48.02	128.19±51.06	0.3651	N. S
RBS	41.66±57.76	95.61±119.45	<0.0001	Sig.
URIC ACID	5.43±2.56	6.26±7.39	0.3446	N. S
CRP	16.46±20.08	160.99±13.88	<0.0001	Sig.
CREATININE	1.21±1.1	12.23±7.55	<0.0001	Sig.
INR	1.33±0.58	1.49±0.61	0.7031	N. S
Statistical test used: Tow sample T-test				
p-value≤0.05 considered statistically significant (95% confidence interval).				

Table 4, Figures 7-9 provide a comprehensive examination of laboratory data in the entire study population, stratified into two groups based on age—Group 1 (≤40 years old) and Group 2 (>40 years old). The diverse parameters under scrutiny encompass specific troponin levels, creatine kinase-MB (CKMB), cholesterol, triglycerides, high-density lipoprotein (HDL), low-density lipoprotein (LDL), random blood sugar (RBS), uric acid, C-reactive protein (CRP), creatinine, and international normalized ratio (INR). The findings, coupled with their respective p-values, elucidate potential age-related distinctions in these crucial blood-related metrics.

Examining specific troponin levels, CKMB, cholesterol, triglycerides, HDL, LDL, uric acid, and INR, no statistically significant differences emerge between the two age groups, denoted as N.S (not significant). This implies that these parameters exhibit comparable values across both younger and older patients undergoing angiography, suggesting uniformity in these aspects of cardiac and metabolic markers.

However, notable disparities are observed in certain key parameters. First, regarding the Random Blood Sugar (RBS), Group 1 demonstrates a significantly lower RBS level (41.66±57.76) compared to Group 2 (95.61±119.45), with a highly significant p-value (<0.0001). This discrepancy points to potential variations in glucose metabolism based on age. Second, concerning C-Reactive Protein (CRP), Group 2 exhibits substantially higher CRP levels (160.99±13.88) in contrast to Group 1 (16.46±20.08), indicating a significant difference ($p < 0.0001$). Elevated CRP levels in older patients suggest a heightened inflammatory response. Lastly, regarding Creatinine, Group 2 displays a markedly higher creatinine level (12.23±7.55) compared to Group 1 (1.21±1.1), with a highly significant p-value (<0.0001). This discrepancy signifies potential age-related variations in renal function.

The statistical test utilized for these comparisons is the two-sample T-test, and a p-value ≤ 0.05 is considered statistically significant at a 95% confidence interval. These findings contribute valuable insights into age-related differences in metabolic and inflammatory profiles, enriching our understanding of the physiological aspects among younger and older Yemeni patients undergoing angiography.

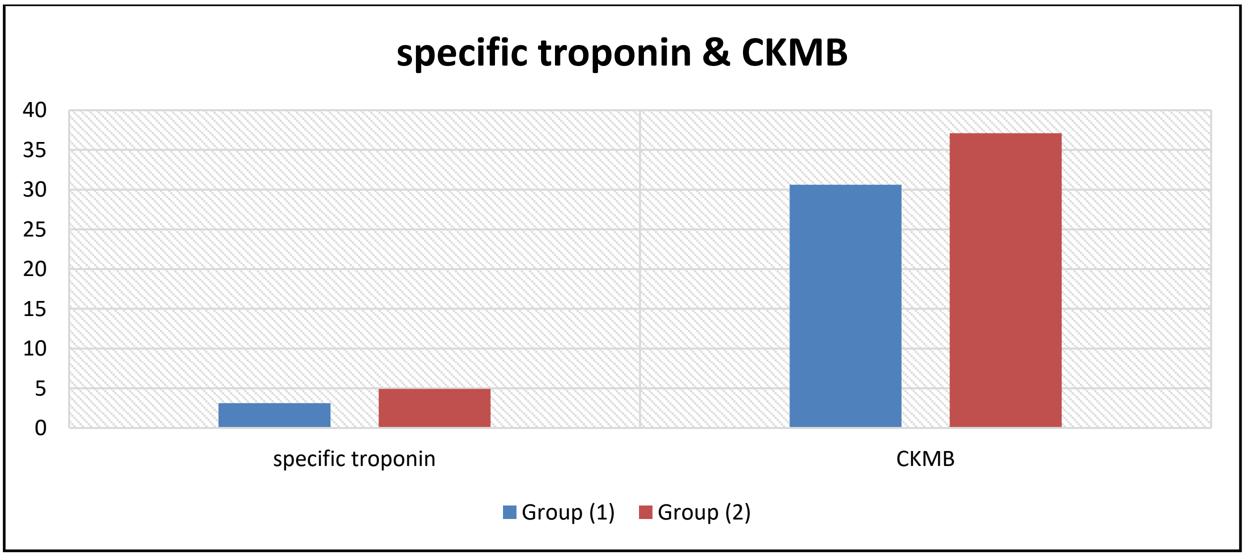

Figure 7: Specific troponin & CKMB distribution in all study populations

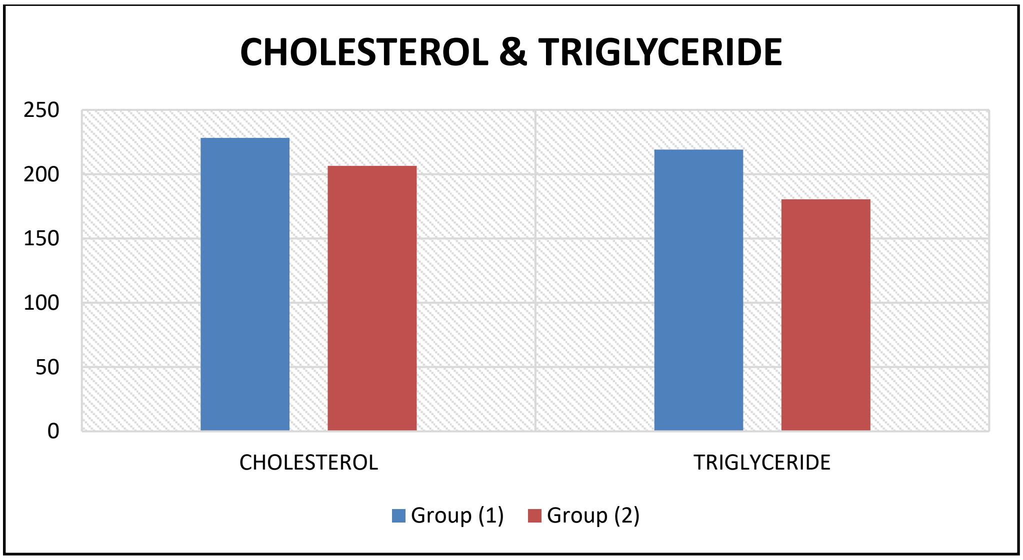

Figure 8: CHOLESTEROL & TRIGLYCERIDE distribution in all study populations

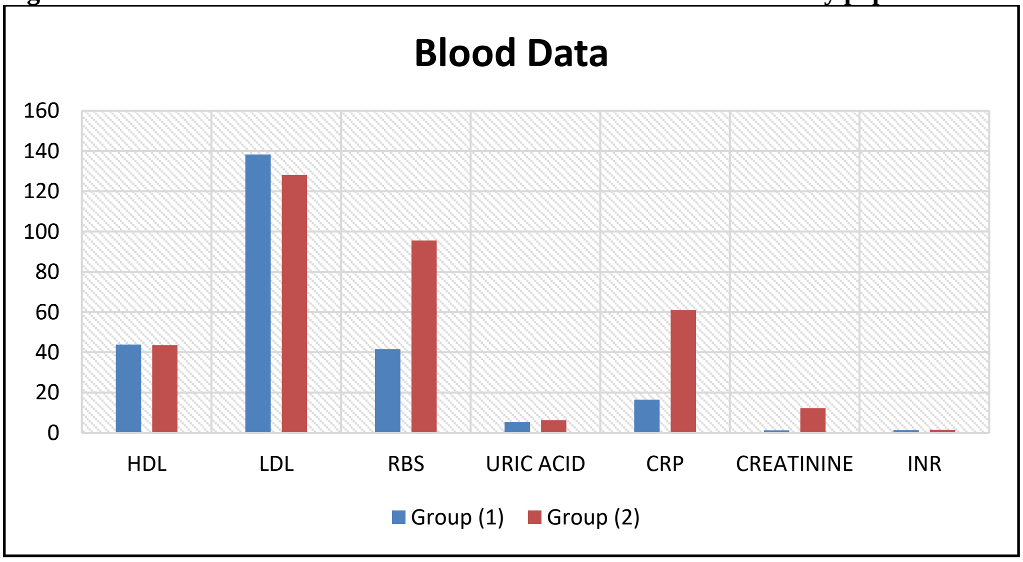

Figure 9: Laboratory Data distribution in all study populations

Table 5: Vital Signs Data distribution in all study population

Vital Signs	*Group (1) N=23*	*Group (2) N=124*	*P value*	*Statistically significant*
blood pressure (Diastolic pressure)	73.81±10.6	76.18±15.17	0.3889	N. S
blood pressure (Systolic pressure)	111.32±15.3	122.04±19.92	0.0068	Sig.
Pulse	81.64±14.78	82.12±14.69	0.8901	N. S
Oxygen saturation	92.59±10.88	94.58±5.87	0.4126	N. S
Statistical test used: Tow sample T-test				
p-value≤0.05 considered statistically significant (95% confidence interval).				

Table 5 and Figure 10 present the distribution of vital signs data in the overall study population, with a focus on blood pressure (both diastolic and systolic), pulse rate, and oxygen saturation. The data is stratified into two groups based on age—Group 1 (≤40 years old) and Group 2 (>40 years old). In Blood Pressure, there is no statistically significant difference in diastolic blood pressure between the two groups (p = 0.3889), denoted as N.S (not significant). Group 1 has a mean diastolic pressure of 73.81±10.6, while Group 2 has a slightly higher mean of 76.18±15.17. In contrast, systolic blood pressure shows a significant difference between the two groups (p = 0.0068). Group 2 exhibits a higher mean systolic pressure (122.04±19.92) compared to Group 1 (111.32±15.3).

Regarding the Pulse rate, there is no statistically significant difference between the two groups (p = 0.8901), indicating a comparable mean pulse of 81.64±14.78 in Group 1 and 82.12±14.69 in Group 2. Similarly, Oxygen saturation levels do not show a statistically significant difference between the two groups (p = 0.4126), denoted as N.S. Group 1 has a mean oxygen saturation of 92.59±10.88, while Group 2 has a slightly higher mean of 94.58±5.87.

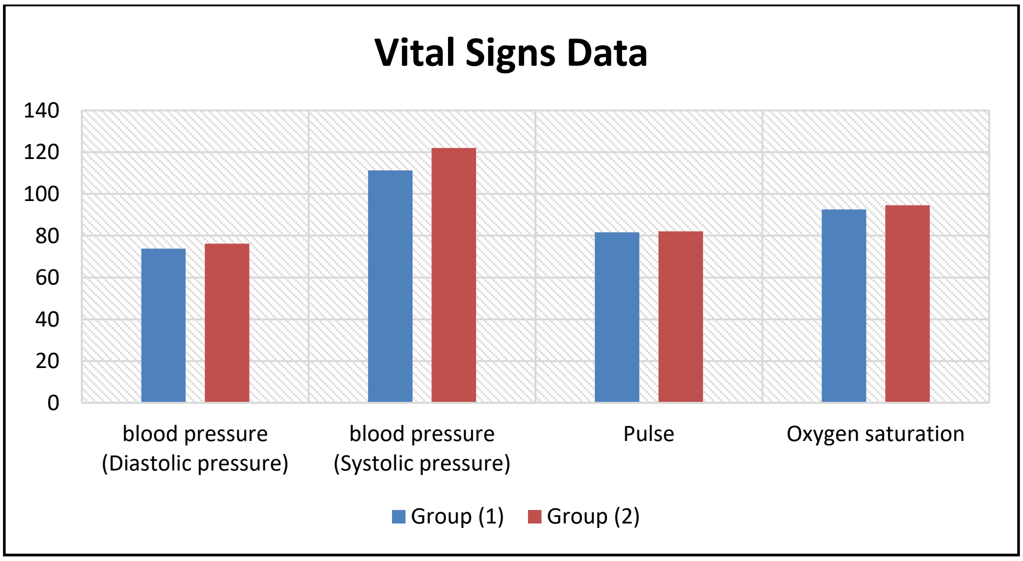

Figure 10: Outcome Data distribution in all study populations

Table 6: Questionnaire Data distribution in all study populations

Questionnaire Data	*Group (1)*	*Group (2)*	*P value*	*Statistically significant*
	N=23	*N=124*		
Does the patient suffer from blood pressure?	3(2.04%)	49(33.33%)	0.0138	Sig.
Does the patient suffer from diabetes?	1(0.68%)	47(31.97%)	0.0016	Sig.
Does the patient smoke?	9(6.12%)	48(32.65%)	0.9697	N. S
Is the patient chewing Qat?	12(8.16%)	57(38.78%)	0.5839	N. S
Does the patient have a family history of heart disease?	11(7.48%)	43(29.25%)	0.2296	N. S
Is the patient suffering from psychological stress?	10(6.8%)	61(41.5%)	0.6144	N. S
Statistical test used: Tow sample T-test				
p-value≤0.05 considered statistically significant (95% confidence interval).				

Table 6 and Figure 11 present the distribution of questionnaire data in the overall study population, categorized into two groups based on age—Group 1 (≤40 years old) and Group 2 (>40 years old). The questionnaire data explores various aspects related to the patients' health and lifestyle. First, regarding Blood Pressure, the question regarding whether the patient suffers from blood pressure shows a significant difference between the two groups (p = 0.0138). In Group 2, 33.33% of patients report suffering from high blood pressure, whereas only 2.04% report the same in Group 1. Second, regarding Diabetes, the question of whether the patient suffers from diabetes reveals a significant difference between the age groups (p = 0.0016). In Group 2, 31.97% of patients report having diabetes, while only 0.68% report the same in Group 1.

Third, concerning Smoking, the question about whether the patient smokes does not show a significant difference between the two groups (p = 0.9697). Smoking prevalence is reported by 6.12% in Group 1 and 32.65% in Group 2. Fourth, relating to Chewing Qat, the question about whether the patient chews Qat does not show a significant difference between the two groups (p = 0.5839). Qat chewing is reported by 8.16% in Group 1 and 38.78% in Group 2.

Fifth, regarding Family History of Heart Disease, the question about whether the patient has a family history of heart disease does not show a significant difference between the two groups (p = 0.2296). Family history is reported by 7.48% in Group 1 and 29.25% in Group 2. Finally, in terms of Psychological Stress, the question about whether the patient is suffering from psychological stress does not show a significant difference between the two groups (p = 0.6144). Psychological stress is reported by 6.8% in Group 1 and 41.5% in Group 2.

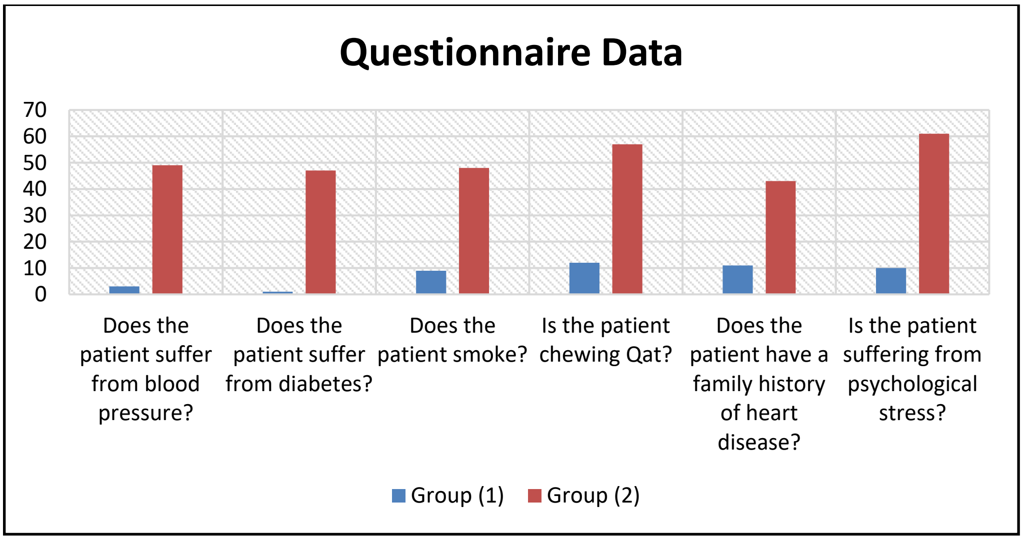

Figure 11: Questionnaire Data distribution in all study populations

Table 7: Diagnostic catheterization result distribution in all study population.

Diagnostic catheterization result	*Group (1) N=23*	*Group (2) N=124*	*P value*	*Statistically significant*
VESSELE DISEASE				
1	6(4.08%)	23(15.65%)	0.1744	N. S
2	1(0.68%)	26(17.69%)		
3	1(0.68%)	21(14.29%)		
4	1(0.68%)	15(10.2%)		
5	0(0%)	5(3.4%)		
6	0(0%)	5(3.4%)		
Diagnostic catheterization result n (%)				
NORMAL	13(8.84%)	27(18.37%)	<0.0001	Sig.
LAD	6(4.08%)	86(58.5%)		
D1	1(0.68%)	28(19.05%)		
D2	0(0%)	6(4.08%)		
LCX	2(1.36%)	31(21.09%)		

OM1	0(0%)	21(14.29%)		
OM2	0(0%)	9(6.12%)		
RCA	2(1.36%)	59(40.14%)		
PDA	1(0.68%)	4(2.72%)		
PLV	0(0%)	3(2.04%)		
Statistical test used: Chi-square test				
p-value≤0.05 considered statistically significant (95% confidence interval).				

Table 7 provides the distribution of diagnostic catheterization results in the entire study population, categorized into two groups based on age—Group 1 (≤40 years old) and Group 2 (>40 years old). The results are presented for various levels of vessel disease and specific diagnostic catheterization outcomes. Here's an interpretation of the findings:

In addition, Figure 12 illustrates the Vessel Disease result. The distribution of vessel disease at different levels (ranging from 1 to 6) does not show a statistically significant difference between the two groups (p = 0.1744). This implies that the prevalence of vessel disease at these specific levels is comparable in both younger and older patients.

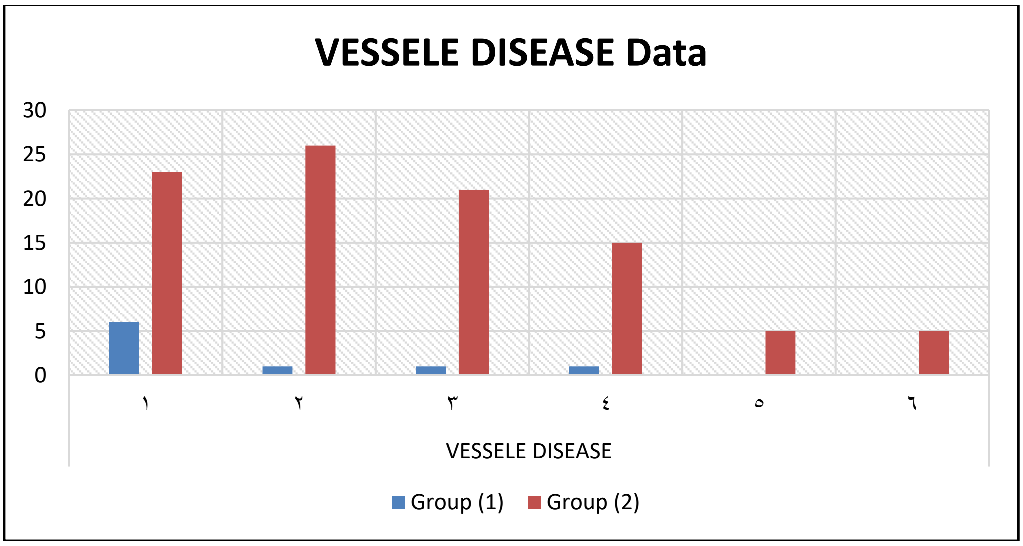

Figure 12: VESSEL DISEASE Data distribution in all study populations

Moreover, Figure 13 demonstrates the Diagnostic Catheterization Results. it is categorized into specific outcomes. Normal, a highly significant difference is observed in the normal diagnostic catheterization result between the two groups (p < 0.0001). Group 1 has 8.84% of patients with a normal result, while Group 2 has a higher prevalence of 18.37%.

Coronary Arteries (LAD, D1, D2, LCX, OM1, OM2, RCA, PDA, PLV): Significant differences are observed in the prevalence of specific coronary artery findings between the two groups. Notably, older patients in Group 2 show a higher prevalence of LAD, D1, LCX, RCA, and PDA, suggesting a potential age-related difference in coronary artery involvement.

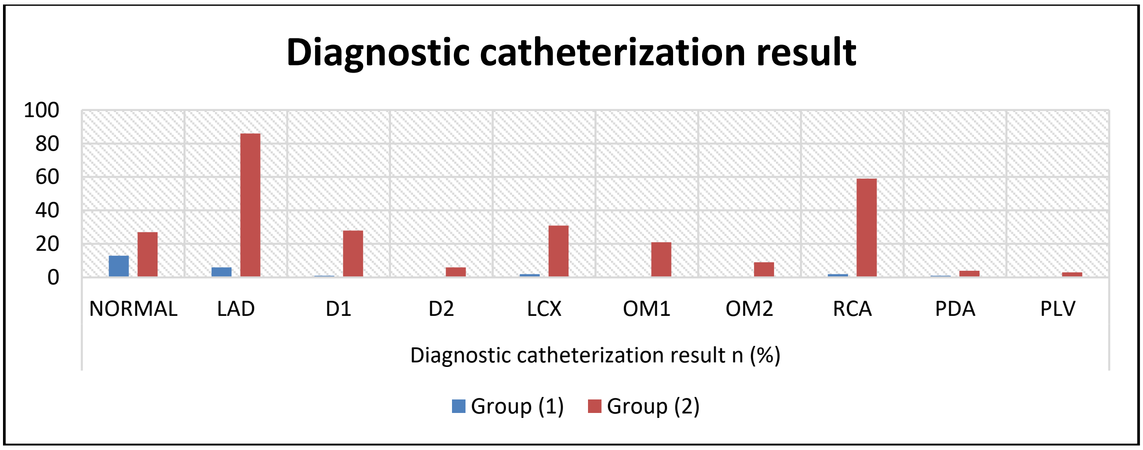

Figure 13: Diagnostic catheterization result distribution in all study population.

DISCUSSION

Coronary artery disease (CAD) is a heart disease that causes more deaths than any other disease in both developed and developing countries. It is an inflammatory atherosclerotic disease that can show up as stable angina, unstable angina, myocardial infarction (MI), or sudden cardiac death ***(Malakar et al., 2019).*** Coronary angiography is a diagnostic medical procedure used to visualize the interior of coronary arteries. It is vital for identifying the presence, location, and severity of coronary artery disease ***(Momiyama et al., 2014).***

Several studies provided insights into angiographic characteristics and related factors in patients of different age groups undergoing coronary angiography. For example, Al-Ghamdi et al. (2021) explored the clinical and coronary angiographic characteristics of patients with coronary artery disease (CAD) in Saudi Arabia. They found that patient age and the anatomical localization of coronary atherosclerotic lesions were the main determinants of treatment with coronary artery bypass grafting (CABG) or percutaneous coronary intervention (PCI) ***(Al-Ghamdi et al., 2021).***

In addition, ***Saghir et al. (2012)*** compared the coronary angiographic characteristics of young patients (≤40 years) with older patients and found that young patients had less extensive disease. Single-vessel disease was more prevalent among the young, and CAD in this group was more associated with smoking and abnormal lipid profiles.

In Yemeni patients, a recent study was conducted by ***Al-Kebsi et al. (2021)*** on the characteristics and Risk Factors Present with Myocardial Infarction with non-obstructive coronary Arteries (MINOCA). The authors addressed explicitly myocardial infarction in Yemeni patients, identifying a significant incidence of MINOCA and highlighting the role of Khat chewing as a distinct risk factor in the Yemeni population. The authors determined that the country experiences a relatively high incidence of MINOCA, accompanied by various potential causes. This finding necessitates additional diagnostic work following coronary angiography and underscores the need for targeted efforts to identify the specific cause of myocardial infarction in individual patients in Middle Eastern countries.

The present study aimed to identify the risk factors and angiographic characteristics of CAD among young adult and older patients presented with ischemic heart disease (IHD). Additionally, it pointed to identifying the risk factors and the prevalence of ischemic heart disease among young adults. The patients were divided into two groups. The first group involved Patients below 40 years, and the second group consisted of Patients above 40 years.

Notably, the higher occurrence of chest pain in younger patients compared to older patients is a compelling finding in this study. This finding may suggest a heightened perception or reporting of pain in younger individuals, or it could indicate variations in disease presentation. Age-related differences in symptomatology have been observed in other cardiac conditions, possibly due to factors like comorbidities or differing pathophysiological responses in older patients.

Despite these differences in symptom presentation, the similarity in the duration of complaints prior to angiography in both groups is intriguing. It indicates that the decision to seek medical intervention is influenced more by the nature and severity of symptoms rather than their duration. This could reflect a general awareness of CAD symptoms or a consistent healthcare-seeking behavior across different age groups.

A previous study from the Registry of Thoracic Pain conflicted with our findings. It investigated the typicality of clinical presentation in patients with acute chest pain related to coronary artery disease. It compared octogenarian patients with those aged below 80 and found no significant difference in the typicality index between these age groups. This suggests that advanced age does not influence the typical clinical presentation in patients with acute chest pain of coronary etiology ***(Filgueiras et al., 2021).*** Another recent study found that age is a significant factor in the disparities of outcomes between women and men, with differences becoming less pronounced in older populations. Older women tend to have more favorable outcomes than younger women following acute myocardial infarction (AMI) ***(Sawan et al., 2023).***

In addition, the ECG data distribution in this study revealed intriguing insights into the cardiac characteristics of young and older patients. The higher prevalence of normal ECGs in older patients (Group 2) compared to younger ones (Group 1) challenges common perceptions that older individuals generally have more pronounced cardiac abnormalities. While not statistically significant, this finding may suggest better cardiac health in some older patients or reflect adaptive physiological changes with age.

The notable variation in abnormal ECG findings, particularly the higher prevalence of ST elevation in Group 2, aligns with established knowledge that specific ECG abnormalities become more common with aging. The statistical significance of T wave inversion in the inferior lead in older patients could indicate a specific age-related cardiac change. However, the lack of significant differences in other abnormalities like ST depression, inverted T wave, LBBB, RBBB, and T wave inversion in the inferior lead across age groups suggests a complex interplay of factors influencing ECG changes beyond age. These findings underscore the importance of considering age as a factor in ECG interpretation; however, they also highlight that cardiac health cannot be solely determined by age, as individual variations are significant.

Previously, ***Bauer (2012)*** examined the association of major and minor ECG abnormalities with coronary heart disease events in older adults. The study focused on a population of 2.192 white and black older adults aged 70 to 79 years without known cardiovascular disease. It was found that both baseline minor and major ECG abnormalities were associated with an increased risk of CHD after adjusting for traditional risk factors. The study highlights the potential value of ECG abnormalities for CHD prediction in older adults, especially given the less accurate prediction through traditional risk factors in this age group ***(Bauer, 2012).***

Moreover, Age-related differences in ECG findings in coronary artery disease have been studied earlier. For instance, ***Lowenstern et al. (2020)*** indicated that older patients with stable symptoms suggestive of CAD are likelier to have a positive noninvasive test result. Additionally, aging changes in the heart and blood vessels can cause the electrocardiogram (ECG) of a normal, healthy older person to be slightly different from that of a healthy younger person. Furthermore, age is considered the most potent factor related to the development of coronary heart disease and mortality once coronary atherosclerosis manifests ***(Madhavan et al., 2018).***

In addition, the current study analyzed the echocardiographic heart wave changes. Two groups had normal echo heart waves; 5.44% of patients in Group 1 and 15.65% in Group 2 exhibited normal echo patterns. Regarding regional hypokinesia, the variations observed across different heart regions in both groups, such as apical, anterior wall, and septal highlight the heterogeneity of cardiac involvement in coronary artery disease. Nonetheless, this difference was not statistically significant, P-value> 0.5. previous studies found significant differences in risk factors and angiographic findings between younger and older patients with CAD. Older patients tend to have more multi-vessel disease and involvement of the left anterior descending (LAD) artery and right coronary artery (RCA), whereas younger patients are more likely to have single-vessel disease ***(Mahjoob et al., 2018).***

However, The lack of statistically significant differences in the prevalence of hypokinesia in specific regions between younger and older patients in our study suggests that age, in isolation, may not be a determinant factor in the localization of cardiac functional impairments. This finding underscores the complexity of cardiac pathology in coronary artery disease and the need for individualized diagnostic approaches. The absence of statistically significant differences also indicates that other factors, possibly genetic, environmental, or related to the overall health status, may play a more crucial role in determining the regional variations of cardiac function as detected by echocardiography.

Additionally, regarding the laboratory parameters, a substantial difference in Random Blood Sugar (RBS) levels between the two groups was found, with significantly lower levels in younger patients compared to older ones. This distinct disparity suggests that glucose metabolism may vary considerably with age in patients undergoing angiography. Such a variation could be attributed to factors like the progressive impairment of glucose tolerance, increased insulin resistance, or changes in lifestyle and diet often accompanying aging.

This finding was consistent with previous studies about the relationship between age and blood glucose levels in coronary artery disease patients. For example, ***Chia et al. (2018)*** indicated that plasma glucose levels in response to oral glucose tolerance test (OGTT) were progressively higher for every decade of age until the seventh decade of life. Another study found that higher glucose levels were associated with a greater risk of 30-day mortality in elderly patients hospitalized with acute myocardial infarction ***(Kosiborod et al., 2005).*** Therefore, diabetes is a well-established risk factor for CAD, and over time, excess glucose can damage blood vessels and cause hardening of arteries, or atherosclerosis.

Furthermore, the elevated levels of C-reactive protein (CRP) in older patients compared to younger ones are particularly noteworthy. CRP is a well-recognized marker of inflammation and is often linked with cardiovascular risk. The significantly higher levels in the older group suggest a heightened inflammatory state, which could be attributed to a combination of chronic age-related inflammatory processes and a higher prevalence of comorbid conditions that elevated CRP levels. This finding aligns with existing research indicating increased systemic inflammation in older individuals, which is a critical factor in the pathogenesis and progression of atherosclerosis ***(Li et al., 2020).***

Similarly, the marked difference in creatinine levels between the two groups, with significantly higher levels in the older group, indicates potential age-related renal function declines. Creatinine is a crucial indicator of kidney health, and its elevation in the elderly can be attributed to the natural decline in glomerular filtration rate with age. Creatinine also is associated with cardiovascular risk and cardiovascular events ***(Bagheri et al., 2019; Chen et al., 2023).***

In addition, the present study examined the distribution of the vital signs in the two study groups. A significant difference in systolic blood pressure was found between the two age groups. As expected, older patients demonstrated a higher mean systolic pressure than younger patients, which aligns with well-established clinical observations that systolic blood pressure tends to increase with age ***(Forouzanfar et al., 2017).*** This increase is often attributed to age-related changes in vascular stiffness and reduced arterial system compliance. The clinical implication of this finding is significant, as elevated systolic blood pressure is a known risk factor for cardiovascular diseases, including coronary artery disease and stroke.

Several epidemiologic studies aligned with the current findings, showing that older patients are more susceptible to lower diastolic blood pressure than younger patients. As a result, there is an interaction between age and diastolic blood pressure regarding cardiovascular disease ***(Chrysant & Chrysant, 2014).*** Furthermore, the relationship between SBP and cardiovascular disease varies with age, with DBP being stronger than SBP as a predictor of coronary heart disease risk in young adults, whereas the opposite is true in older persons ***(Franklin et al., 2001).*** However, ***(Flint et al., 2019)*** established that systolic and diastolic hypertension independently influenced the risk of adverse cardiovascular events.

In contrast, diastolic blood pressure, pulse rate, and oxygen saturation levels do not exhibit statistically significant differences between the groups. The similarity in diastolic blood pressure could suggest that factors other than age, such as lifestyle or genetic predispositions, play a more dominant role in influencing this parameter. Similarly, the comparable pulse rates between the two groups indicate that resting heart rate, a vital sign often affected by fitness levels and autonomic function, does not significantly differ with age in this patient cohort ***(Stone et al., 2021).***

The lack of significant difference in oxygen saturation levels between the younger and older patients is also a critical observation. It suggests that pulmonary function, indirectly assessed by oxygen saturation, remains relatively preserved across different age groups in this patient population ***(Guler et al., 2021).*** However, it is essential to note that factors like ambient air quality, smoking status, and chronic respiratory diseases could also influence this parameter ***(Garg & Gupta, 2020; Simons et al., 2021).***

Furthermore, the Questionnaire Data ensured the clinical findings in this study. Significant differences are mainly observed in the prevalence of self-reported blood pressure and diabetes between the two age groups. In Group 2 (older patients), a higher percentage of patients report suffering from blood pressure and diabetes compared to Group 1 (younger patients). This finding is consistent with well-known epidemiological trends and with this study's finding where the prevalence of hypertension and diabetes increases with age. These conditions are key risk factors for coronary artery disease, and their higher prevalence in the older group underscores the need for focused management of these conditions in older populations.

In contrast, the questionnaire data indicates no significant difference between the two groups in terms of smoking, Qat chewing, family history of heart disease, and psychological stress. The similar rates of smoking and Qat chewing across age groups suggest that these lifestyle factors are uniformly distributed in this patient population, regardless of age. In addition, the lack of significant age-related differences in these lifestyle and psychological factors might suggest that, in this patient population, other factors such as genetic predisposition or environmental influences play a more crucial role in developing coronary artery disease than age-specific lifestyle habits or stress levels.

Finally, the current study examined the distribution of diagnostic catheterization results in the two groups. Diagnostic cardiac catheterization is an invasive procedure used to assess the presence and severity of coronary artery disease, heart valve problems, heart muscle dysfunction, and other cardiovascular issues ***(Lange & Hillis, 2003).***

A higher percentage of older patients have normal catheterization results compared to younger patients. This finding is exciting and somewhat counterintuitive. Typically, one might expect older patients to have a higher prevalence of coronary artery disease due to age-related changes in the vascular system. However, the higher prevalence of normal results in older patients might suggest that this group either presents for diagnostic catheterization for reasons other than coronary artery disease or that protective or compensatory mechanisms are at play, delaying the onset or progression of coronary artery disease.

Several studies have evaluated different aspects related to diagnostic catheterization in patients with suspected or confirmed CAD. Noninvasive imaging modalities have gained prominence in diagnosing CAD and informing appropriate therapies. These modalities include stress electrocardiography, stress echocardiography, single-photon emission computed tomography, myocardial perfusion imaging, positron emission tomography, coronary computed tomography angiography (CTA), and magnetic resonance imaging ***(Mangla et al., 2017).*** Another recent study demonstrated an association between adherence to the Japanese diet and reduced risk of CAD in patients undergoing coronary angiography, providing evidence for dietary interventions as potential preventive measures against CAD ***(Momiyama et al., 2023).***

On the other hand, the significant differences in the prevalence of specific coronary artery findings, particularly in the LAD, D1, LCX, RCA, and PDA, highlight a potential age-related difference in the pattern of coronary artery involvement. Older patients in Group 2 show a higher disease prevalence in these arteries. This result could reflect age-related progression of atherosclerosis, where older individuals are more likely to have developed significant lesions in these arteries over time. The involvement of these specific arteries is clinically significant, as they supply critical areas of the heart muscle, and their occlusion can lead to serious cardiac events.

Overall, these findings emphasize the complexity of coronary artery disease presentation across different ages. Although older patients are more likely to have normal catheterization results, they also show a higher prevalence of disease in specific coronary arteries when the disease is present. This underscores the need for a nuanced approach to cardiac assessment in different age groups, considering that the disease patterns and reasons for undergoing catheterization may vary significantly with age.

The age-related differences in the pattern of coronary artery involvement have been studied, particularly in young patients. For example, ***Jepma et al. (2020)*** evaluated the association of age with the diagnostic value of Coronary Artery Calcium Score to rule out Coronary Stenosis in Symptomatic Patients. The study aligned with our findings and found that among those who were younger than 40 years, 58% with obstructive CAD had a CAC score of 0 compared with 34% of those aged 40 to 49 years, 18% of those aged 50 to 59 years, 9% of those aged 60 to 69 years, and 5% of those who were 70 years or older.

However, another study analyzed angiographic features in patients aged 35 or less and found that the extent and severity of coronary artery disease (CAD) in these young patients were notable, with a high prevalence of smoking and a history of premature CAD as the most frequent risk factors ***(Christus et al., 2011).*** Additionally, it was reported that the prevalence of CAD in individuals less than 45 years of age is around 1.2%, with South Asians, especially Indians, being more vulnerable to CAD in this age group. Furthermore, angiographic studies have shown a predominance of single-vessel disease in young CAD patients ***(Aggarwal et al., 2016).*** These findings suggest that in young CAD patients, there is a notable prevalence of CAD, with specific risk factors and a predominance of single-vessel disease.

In conclusion, this study provides important insights into the clinical presentation, risk factors, and angiographic characteristics of coronary artery disease in younger versus older patients undergoing cardiac catheterization. Several notable findings emerge from the analysis. Chest pain was more frequently reported in younger patients, while older patients exhibited higher rates of comorbidities like hypertension and diabetes. ECG changes were prevalent in both groups; however, there were some age-related patterns, such as a higher frequency of T wave inversion in older patients. Regional wall motion abnormalities on echocardiography showed no statistically significant age-related differences.

Key laboratory parameters like blood glucose, CRP, and creatinine levels were distinctly higher in the older patient group, aligning with physiological changes associated with aging. Vital signs also demonstrated some age-related trends, with older patients exhibiting higher systolic blood pressure. Self-reported data on medical history confirmed a higher prevalence of hypertension and diabetes among older patients.

Regarding angiographic findings, more older patients had normal results compared to the younger group. However, among those with abnormalities, specific coronary arteries like LAD, LCX, and RCA showed a higher prevalence of disease in the older group. This indicates a potential age-related difference in the pattern of coronary artery involvement.

Overall, these results highlight the heterogeneity in clinical presentation, risk factors, and angiographic characteristics based on age. While some distinct age-related differences emerge, coronary artery disease pathogenesis appears complex, with individual variations across all ages. Critical implications include optimizing diagnostic approaches for age-specific manifestations, better characterization of young patients with coronary disease, and targeted management of risk factors like hypertension and diabetes in older populations. Further studies should explore the mechanisms underlying age-related variations in this complex, multifaceted disease.

CONCLUSION

In conclusion, this investigation delves into the intricate landscape of coronary artery disease (CAD) across diverse age groups, shedding light on the intricate interplay of risk factors, clinical manifestations, and diagnostic outcomes. While older patients often present with normal catheterization results, suggesting potential protective mechanisms or alternative reasons for undergoing the procedure, specific coronary artery involvement is more pronounced in this cohort when CAD is present. Age-related nuances permeate symptoms, ECG patterns, echocardiographic findings, laboratory parameters, and vital signs, necessitating a tailored approach to diagnosis and management. The study underscores the imperative for a nuanced understanding of CAD across age spectrums to optimize clinical interventions and enhance patient outcomes.

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