INTRODUCTION
Coronary artery disease (CAD) is one of leading causes of morbidity and mortality worldwide.\(^1,2\) Atherosclerosis is a diffuse process, so it is not uncommon to find diffuse intermediate coronary artery disease on coronary angiography producing blood turbulence in coronary lumen resulting impaired blood flow and myocardial ischemia.\(^3,4\) Coronary artery lesions can be assessed both anatomically and physiologically. Coronary angiography is the gold standard method for anatomical evaluation while intravascular ultrasound (IVUS) further improves anatomical evaluation. The physiological assessment of myocardial ischemia is by fractional myocardial flow reserve (FFR). Coronary Angiography has certain limitations in assessing hemodynamic or functional significance of diffuse intermediate stenosis\(^5\) hence these lesions are not considered to be suitable for revascularization.\(^6\) Although quantitative coronary angiography (QCA) reduced these limitations but cannot determine the severity and functional importance of diffuse intermediate coronary lesions\(^7\). Any stenotic
lesion in the coronary vessel that induces ischemia if vascularized improves clinical outcome.\textsuperscript{8} Performing PCI on non-ischemic stenosis is not beneficial and is probably harmful.\textsuperscript{9}

In the last few years, the physiological assessment of coronary stenosis with fractional flow reserve (FFR) is useful diagnostic and prognostic modality. FFR is the ratio between distal and proximal pressures of lesion under conditions of maximal hyperemia\textsuperscript{10} and is indicated in coronary lesions of intermediate angiographic severity (40–70\%).\textsuperscript{11} FFR of normal coronary artery is widely accepted as 1.0. CAD resulting in significant ischaemia if value of FFR is <0.80 and it is > 90% accurate.\textsuperscript{12}

In this study the hemodynamic significance of diffuse intermediate CAD by FFR is determined which is valuable tool for assessing myocardial ischemia otherwise these diffuse intermediate lesions may be neglected on just visual assessment on coronary angiography, so that we can offer early treatment and revascularization of these significant lesions.

Objective
To determine the correlation between mean lesion length of diffuse intermediate stenosis (40%-70\% stenosis) of proximal and mid segment of major coronary arteries and mean fractional flow reserve (FFR).

OPERATIONAL DEFINITIONS

Fractional Flow Reserve (FFR)
Measurement of pressure differences across a coronary artery stenosis during coronary catheterization to determine ischemic significance of stenosis.

Hemodynamic or Functional Significance of Coronary Stenosis
Stenosis of coronary vessel is significant if it induces ischemia (decrease blood supply to heart) in case of stress.

Intermediate coronary artery stenosis
Coronary artery luminal narrowing of 40\% to 70\% on coronary angiography.

Major coronary arteries
The three major coronary arteries, Left Anterior Descending (LAD), left Circumflex (LCX) and Right Coronary Artery (RCA).

Quantitative coronary angiography
It is a computerized process that determines the degree of stenosis or narrowing in coronary arteries.

Diffuse Coronary Lesions
Lesions that exceed 2 cm (20mm) in length

Proximal and mid segment of left anterior descending artery (LAD)
The portion of the artery between left main stem and origin of 1\textsuperscript{st} major septal branch is proximal segment while the segment of LAD after 1\textsuperscript{st} septal branch to angle of heart (RAO view).

Proximal portion of circumflex artery (LCX)
The portion of the artery prior to the origin of the 1\textsuperscript{st} obtuse marginal branch (OM-1).

Proximal and mid portion of right coronary artery (RCA)
Proximal segment starts from its origin to one half of distance to acute margin of heart. Mid segment starts from end of proximal part to acute margin of heart.

MATERIAL AND METHODS

Setting
Department of Cardiology, Faisalabad Institute of Cardiology, Faisalabad.

Study duration
From 1-07-2015 to 31-12-2015.

Study design
Cross sectional study.

Sample size
- By using correlational sample size calculator: \( r = 0.63 \)
Type 1 error = 5%
Type 2 error = 10%
Sample size = 60
Confidence level = 95%

SAMPLE TECHNIQUE
Non probability, purposive sampling

Inclusion Criteria
Following patients was included in the study.
• Age 20-70 years
• Either sex
• All lesions of moderate angiographic stenosis (40–70% stenosis on QCA) and a lesion length of >20 mm.

Exclusion Criteria
• Recent myocardial infarction within 6 months
• Acute coronary syndrome
• Lesions with collateral vessels
• Patients having valvular heart disease
• Patients with deranged renal function (serum creatinine >1.8)
• Cardiogenic shock (systolic blood pressure <90mmHg with signs of poor perfusion)
• Left ventricular systolic dysfunction (ejection fraction <40%)
• Patient having previous history of revascularization.
• Those with angiographic signs of instability such as thrombus (Spherical intraluminal filling defect), dissection (a tear causing blood to flow between the layers of coronary vessel which forces them apart)

DATA COLLECTION PROCEDURE
After approval from hospital Ethical committee and informed consent, 60 patients were selected having intermediate diffuse lesions on coronary angiography from Faisalabad Institute of Cardiology. After routine investigations, FFR assessment of diffuse intermediate lesion was done. For FFR assessment, adenosine induced hyperemia FFR wire is used to measure pressure. 300–500 µg of intracoronary adenosine is given during FFR assessment procedure. The information was documented.

DATA ANALYSIS
All the data was entered and analyzed by using SPSS V-16. Mean and standard deviation was calculated for all the quantitative variables like age, lesion length and FFR. Frequency and percentage was calculated for the qualitative variables like gender. Pearson correlation was applied. Significant P-value was <0.05.

RESULTS
Cases fulfilling the inclusion/exclusion criteria were enrolled. Age distribution of the patients was done showing that 28.33% (n=17) were between 20-50 years of age, mean+SD was calculated as 55.17+8.04 years. (Table No. I). Gender distribution of the patients shows that 51.67% (n=31) were male and 48.33% (n=29) were females. (Table No. II).

Correlation between mean lesion length of diffuse intermediate stenosis (40%-70% stenosis) of proximal and mid segment of major coronary arteries and mean fractional flow reserve (FFR) was recorded it showed that mean lesion length was 24.53+4.78mm while FFR was recorded as 0.72+0.12, the R value is -0.1928, technically a negative correlation, hence relationship between variables is only weak (the nearer the value is to zero, the weaker the relationship). The value of R^2, the coefficient of determination, is 0.0372. (Table No. III)

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<th>Age(in years)</th>
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<table>
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<th>Gender</th>
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<th>Lesion length/FFR</th>
<th>Mean</th>
<th>SD</th>
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<td>Lesion length</td>
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<td>4.78</td>
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<tr>
<td>FFR</td>
<td>0.72</td>
<td>0.12</td>
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Table-I. Age distribution (n=60)
Table-II. Gender distribution (n=60)
Table-III. Correlation between mean lesion length mean fractional flow reserve (FFR) (n=60)
The value of R is -0.1928. Statistically a negative correlation, the relationship between variables is only weak. The value of $R^2$, the coefficient of determination, is 0.0372.

**DISCUSSION**

This study was planned with the view to determine the hemodynamic significance of diffuse intermediate lesions by FFR which is valuable tool for assessing myocardial ischemia.

In our study, 28.33% (n=17) were between 20-50 years of age, mean±SD was calculated as 55.17±8.04 years, 51.67% (n=31) were male and 48.33% (n=29) were females. Correlation between mean lesion length of diffuse intermediate stenosis (40%-70% stenosis) of proximal and mid segment of major coronary arteries and mean fractional flow reserve (FFR) was recorded it shows that mean lesion length was 24.53±4.78mm while FFR was recorded as 0.72±0.12, R is -0.1928, statistically suggesting only a weak relationship. The value of $R^2$, the coefficient of determination, is 0.0372. A similar study was conducted by López-Palop R et al\(^{13}\) in which correlation between Fractional Flow Reserve (FFR) and lesion length was found to be significant ($r: 0.63$) however our findings are in contrast with this study being weak correlation.

Iguchi T and others\(^{14}\) studied coronary lesions based on QCA data. They considered cases as intermediate stenosis (group I) with 40% to 70% stenosis and significant stenosis (group S) with ≥70% stenosis. Their objective was to determine functional significance of lesion length in intermediate coronary disease. In group S inverse correlation between the percentage of diameter stenosis (%DS) and FFR in group S ($r = -0.83, P < 0.0001$) while in group I, no significant correlation was found between %DS and FFR ($r = -0.06, P = 0.55$), whereas lesion length was significantly inversely correlated with FFR ($r = -0.79, P < 0.0001$). Receiver operating characteristic curve analysis demonstrated that the best cutoff value for predicting an FFR value <0.80 was a lesion length >16.1 mm in group I (sensitivity, 86%; specificity, 94%) and concluded that the lesion length in intermediate-grade coronary lesions has a physiologically significant impact.

Brosh D et al\(^{15}\) evaluated intermediate-grade lesions (63 patients) with FFR. Quantitative coronary angiography (QCA) analysis was used to determine lesion length and percent diameter stenosis (% DS). They concluded that lesion length has a significant impact on the physiological significance of intermediate-grade coronary lesions.

Though previous studies have shown a significant strong relation between lesion length and FFR. Our relation was weak, it may be due to smaller sample size in our study or use of bolus technique of adenosine administration vs continuous infusion.

**CONCLUSION**

In our study the correlation between mean lesion length of diffuse intermediate stenosis (40%-70% stenosis) of proximal and mid segment of major coronary arteries and mean fractional flow reserve (FFR) was weak, it may be due to smaller sample size of our study or use of bolus technique of adenosine administration vs continuous infusion.

**REFERENCE**


PREVIOUS RELATED STUDY

Abdul Samad, Abdul Baseer. EFFECT OF CORONARY ARTERY DISEASE DURATION ON; PLASMA LIPIDS & LIPOPROTEINS CONCENTRATION (Original) Prof Med Jour 10(1) 55 - 57 Jan, Feb, Mar, 2003.

Fida Muhammad, Abdul Rehman Abid, Ajaz Ahmad, Shahid Imran, Nadeem Hayat Mallick. CORONARY ARTERY DISEASE; PATTERN OF CLINICAL AND ANGIOGRAPHIS FINDINGS IN YOUNG MALES (Original) Prof Med Jour 16(2) 192-197 Apr, May, Jun 2009.

AUTHORSHIP AND CONTRIBUTION DECLARATION

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