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Comparison of instantaneous wave-free ratio and intravascular ultrasound-guided intervention strategy for clinical outcomes in patients with intermediate coronary stenosis

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Abstract
Background: Guidance for percutaneous coronary intervention using the instantaneous wave-free ratio (iFR) or intravascular ultrasound (IVUS)-guided PCI could provide more favorable outcomes than angio-guided PCI by confirming the lesion's hemodynamic significance and characteristics. The aim of this work was to compare the efficacy of iFR- guided PCI strategy with IVUS-guided PCI strategy in clinical outcomes of patients with intermediate coronary stenosis.
Methods: This prospective observational single-center investigation included 50 patients, with intermediate degree of stenosis eligible for stent implantation who need iFR or IVUS for further evaluation, target vessel size ≥ 2.5 mm and target lesions located at the proximal to mid part of coronary artery. All patients were subjected to iFR-guided (group I) and IVUS-guided PCI (group II). Patients were followed up for in-hospital, 30-day, and 6-month MACE (death, non-fatal MI, target lesion revascularization).
Results: Left ventricular ejection fraction, angiographic findings and laboratory investigations were insignificantly different between both groups. Procedural findings and interventional details were insignificantly different among both groups. There were no significant differences between the two groups regarding contrast used in the procedure and primary and secondary outcomes at one and six months. Radiation dose was significant difference between two groups with higher dose of radiation in the IVUS group (P=0.019).
Conclusion: Accurate physiological iFR and morphological IVUS assessments of intermediate coronary lesions are crucial for guiding decision-making and ensuring optimal outcomes. IVUS helps evaluate lesion characteristics, stenosis degree, plaque burden, and stent landing, while iFR identifies physiologically significant lesions and confirms results post-stent deployment.

Keywords: Instantaneous wave-free ratio, ultrasound-guided intervention strategy, clinical outcomes, intermediate coronary stenosis

Introduction
When it comes to coronary artery disease, drug-eluting stents (DESs) have been a lifesaver [1], particularly with angiographically intermediate stenosis, the question of whether revascularization is suitable persists [2].
The traditional clinical approach to assessing the degree of coronary stenosis has been visual examination of the narrowing of the coronary arteries ever since coronary angiography became available. Visual evaluations of the functional importance of stenoses and the narrowing of coronary artery lumen do not concur, and this method is limited by significant observer bias and intra- and inter-observer variability [3].
The instantaneous wave-free ratio (iFR) is a new way to measure the severity of coronary stenosis without using vasodilators. It is calculated at a specific moment in baseline diastole, when distal resistance is at its lowest and most stable. By doing away with the need for vasodilators, iFR would streamline intracoronary functional tests while reducing costs, alleviating patient discomfort, and shortening treatment times [4]. Compared to angiography-guided PCI and medicinal treatment, iFR-guided PCI is said to be superior [5, 6]. Even when

the stenosis is not functionally substantial, clinical events can nevertheless happen to patients during follow-up [6].

Contrarily, angiography-only-guided revascularization has been demonstrated to be inferior to PCI optimization using intravascular ultrasonography (IVUS) [7-9]. In addition to luminal narrowing, recent imaging studies highlight the significance of plaque burden [10, 11]. New imaging research highlights the significance of both luminal constriction and plaque burden [12], that are linked to potential health complications in the future [13]. Most notably, the application of second-generation DES, which are more safe and effective, significantly reduced clinical events following PCI when IVUS was utilized [14].

Unfortunately, no research has compared the results of an IVUS guided strategy that takes the anatomy into account (i.e., minimal luminal area, plaque burden, and plaque characteristics) and optimizes stent implantation to a standard ischemia- or iFR-guided strategy for intermediate stenosis, despite the fact that both approaches have their benefits [14].

The aim of this work was to compare the efficacy of iFR-guided PCI strategy with IVUS-guided PCI strategy in clinical outcomes of patients with intermediate coronary stenosis.

Patients and Methods

This prospective observational single-center investigation included 50 patients, with intermediate degree of stenosis (40%-70% stenosis by visual estimation in coronary angiography) eligible for stent implantation who need iFR or IVUS for further evaluation, target vessel size ≥ 2.5 mm and target lesions located at the proximal to mid part of coronary artery. The investigation was done from August 2019 to August 2021 after approval from the Ethical Committee Tanta University Hospitals, Tanta, Egypt. Patients' written informed consent was acquired.

Individuals who failed to fulfill the inclusion criteria had a history of bleeding diathesis, were known to have coagulopathy (including heparin-induced thrombocytopenia), were excluded due to known hypersensitivity or contraindication to the following medications: ticagrelor, heparin, aspirin, clopidogrel, prasugrel, or ticagrelor. Other exclusion criteria included non-cardiac comorbid conditions with a life expectancy of less than one year, patients with renal impairment, target lesions in the coronary arterial bypass graft or the left main coronary artery, and known coagulopathy.

Every single patient has to undergo a full history taking, clinical examination, laboratory investigations [complete blood count (CBC), blood urea and serum creatinine, prothrombin time and International Normalized Ratio (INR)], and radiological investigation [Standard 12- lead electrocardiogram (ECG) and echocardiography].

Standard 12- lead ECG was done before coronary angiography and at each follow up visit for checking of signs of any new ischemic events.

Echo-cardiography was done before coronary angiography for assessing the left ventricular function using both teichholz and biplane Simpson methods [15].

Patients undergoing diagnostic coronary angiography via femoral access, with intermediate coronary lesions and no exclusion criteria, were eligible for PCI and included in the study. Angiographically identified intermediate lesions were assessed for inclusion, and DESs (Xience Xpedition, Ultimaster, Promus Element Plus) were used. The individuals were randomly assigned in a 1:1 ratio to receive either iFR-guided or IVUS-guided PCI.

IVUS group

After giving unfractionated heparin to complete the dose to (70-100 IU/Kg), pre-PCI first IVUS run was performed to offer intravascular assessment of lesion. The decision based on IVUS data was noted and recorded to see if there were any changes in the operator plan according to IVUS data. The IVUS catheter was advanced at least 10 mm away from the lesion after 100 to 200 mg of nitroglycerin were administered intracoronarily. Opticross or Eagle Eye, two commercially available imaging systems with 40 MHz mechanical catheters, were used to acquire intravascular ultrasound (IVUS) pictures with automated pullback at 0.5 mm/s for onsite measurements. The imaging systems were developed and manufactured by Boston Scientific Corp/SCIMED in Minneapolis, MN or Volcano Therapeutics in Rancho Cordova, CA, respectively. After that, for use in offline measurements, all IVUS images were saved to a DVD [16]. Staining before The operator's decision was documented using angiographic data, and then an IVUS run examined the lesion to determine its degree of severity. and its morphologic features, such as the composition of the plaque and the degree of calcification. Using intravascular ultrasound, the lesion's MLA and plaque burden were measured. This was the base of the decision either to treat the lesion or not. For intermediate lesions with calculated MLA less than 3 mm^2, the lesion was stented, if MLA was 3.0-4.0 mm^2, and plaque burden was > 70%, the lesion was stented.133If IVUS evaluated all the lesions in a patient as being non-significant, no stenting would be done. Also, IVUS was implemented to assess the reference vessel size to choose best stent diameter. Another factor used to determine stent diameter was the distal reference's lumen diameter, which was either 1:1 or 0.8 times the media diameter. With a plaque burden of 50% or less, the distance between the proximal and distal landing zones can be measured, intravascular ultrasound (IVUS) was also employed to ascertain the stents' lengths [16]. To ensure correct management, an IVUS scan was performed after stenting to detect any issues such as stent apposition, expansion, edge dissection, or hematoma. One definition of mal-apposition is when the struts of a stent do not make contact with the underlying wall of the stent [17]. Non-compliant balloon was used in this condition and IVUS run was repeated to assure good apposition. Underexpansion is being defined as stents that had either minimum stent area (MSA) <5.0 mm^2 or <90% of the distal reference lumen area. This problem was also solved with non-complaint balloon, then IVUS run was repeated to confirm optimum final results [18]. We used both quantitative and qualitative methods to evaluate reference portions at the proximal and distal ends of the stent. The effective lumen cross sectional area (CSA), dissection length, and maximum dissection angle were measured at the location of the smallest lumen CSA inside the dissection segment. The area behind the dissection flap is subtracted from the lumen CSA to get the CSA [19].

iFR group

After administering unfractionated heparin to achieve a complete dose of (70-100 IU/Kg), guiding catheters were preferred over diagnostic catheters. It was standard practice

to administer nitrates (200 mg isosorbide mononitrate) intracoronarily in order to fully dilate the epicardial artery. Thoroughly establishing ambient pressure as the zero reference for the systems for measuring coronary pressure and the pressure transducer loaded with fluid was done prior to pressure wire insertion. When the coronary pressure-measuring equipment were electronically linked to the console, the "zero reference" could be taken either automatically or manually. In order to avoid an offset of 1-2 mmHg which could be significant for borderline stenoses the introducer needle was withdrawn before normalization. After that, the pressure sensor was advanced and placed 1 or 2 mm away from the guiding catheter's tip. The latter was rinsed with salt water to eliminate any trace of contrast that may have remained at the time the guide was positioned. Two pressures ought to be equal at that spot. In any other situation, the pressure readings would have to be electrically adjusted using the console's equalization feature. Two pressure systems exhibited comparable behavior following these "zeroing" and "equalization" processes. The sensor was positioned at least 2 to 3 cm distal to the stenosis that needed to be evaluated, a distance at which post-stenotic laminar flow is restored, and then modified in the distal section of the artery. A procedure called angiography was used to record the precise location of the sensor. It was common practice to average multiple heartbeats when calculating iFR, although it may also be done over a single beat. Once the iFR calculation was activated on the console, the algorithm began to measure over many heartbeats. IFR was calculated automatically by the ratio of the distal coronary artery pressure (Pd) to the pressure within the aortic outflow tract (Pa). According to the iFR value: [If iFR ≤ 0.89, revascularization was performed using drug eluting stents and if iFR > 0.89, revascularization was deferred]. PCI result was considered satisfactory and successful when iFR value becomes > 0.89 [20].

Procedural variables including radiation dose and contrast media volume used in the procedure were thoroughly calculated and noted.

The study evaluated primary and secondary endpoints for patients at both one- and six-months post-treatment.

Primary endpoints included all-cause mortality, non-fatal myocardial infarction, stroke and repeat revascularization. Secondary endpoints assessed patients' class of angina.

Statistical analysis

Statistical analysis was conducted using SPSS v26 (IBM Inc., Chicago, IL, USA). We determined if the data distribution was normal by using histograms and the Shapiro-Wilks test. With quantitative parametric data shown as mean and standard deviation (SD), the paired T-test was employed for comparison. We used a chi-square test or a fisher test, depending on the specific situation, to compare qualitative variables that were reported as percentages or frequencies. When doing statistical analyses, a two-tailed P value below 0.05 was thought to be substantial.

Results

The present study was conducted on 50 patients fulfilled the inclusion criteria and were diagnosed with intermediate coronary artery lesions by coronary angiography in the cardiology department of Kobry El-Kobba Military Hospital. We statistically examined all allocated patients that were followed up with figure 1.

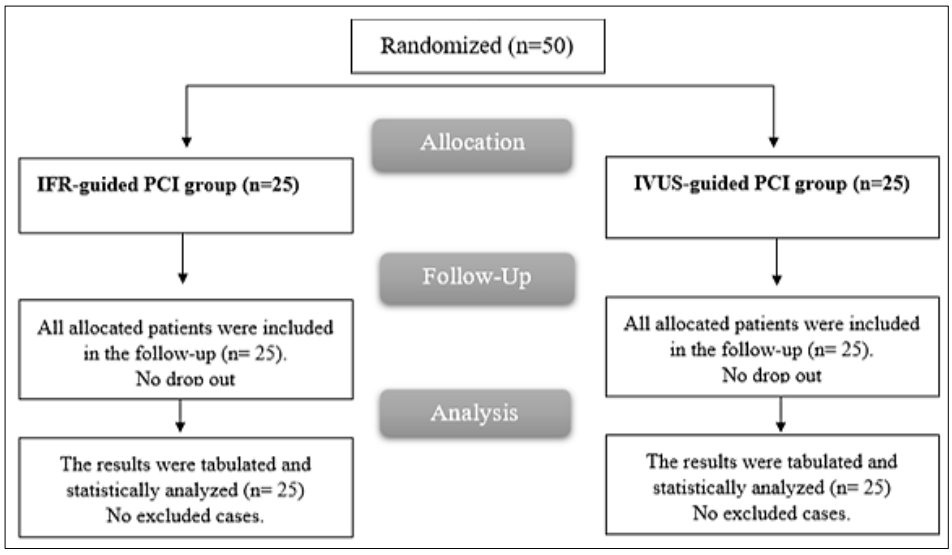

Fig 1: CONSORT flowchart of the enrolled patients

Demographic data, risk factors, past ischemic history and investigated and treated vessels by coronary angiography were insubstantially different between both groups Table 1.

Table 1: Demographic data, risk factors, past ischemic history and investigated and treated vessels by coronary angiography of the studied groups

		iFR-guided PCI group (n=25)	IVUS-guided PCI group (n=25)	P
Age (years)		60.68 ± 5.84	58.76 ± 5.88	0.252
Sex	Male	20 (80%)	19 (76%)	0.733
	Female	5 (20%)	6 (24%)	
Risk factors				
DM		9 (36%)	9 (36%)	1.000
Hypertension		17 (68%)	16 (64%)	0.765
Dyslipidemia		19 (76%)	18 (72%)	0.747
Smoker		9 (36%)	9 (36%)	1.000
Previous Stroke		1 (4%)	1 (4%)	1.000
Past ischemic history				
Previous MI		1 (4%)	1 (4%)	1.000
Previous PCI		5 (20%)	5 (20%)	1.000
Investigated vessels (n=41 vessels in each group)				
LAD		23 (92%)	22 (88%)	0.637
RCA		10 (40%)	9 (36%)	1.000
LCX		8 (32%)	10 (40%)	0.370
Target vessels				
LAD		8 (32%)	13 (52%)	0.152
RCA		1 (4%)	3 (12%)	0.297
LCX		3 (12%)	3 (12%)	1.000

This data is displayed as mean ± SD or frequency (%).iFR: Instantaneous wave free ratio, IVUS: Intravascular Ultrasound, DM: Diabetes Mellitus, MI: Myocardial infarction, PCI: Percutaneous coronary intervention, LAD: Left anterior descending artery, RCA: Right coronary artery, LCX: Left Circumflex artery.

Left ventricular ejection fraction, angiographic findings and laboratory investigations were insubstantially different between both groups Table 2.

Table 2: Left ventricular ejection fraction, angiographic findings and laboratory investigations of the studied groups

		IFR-guided PCI group (n=25)	IVUS-guided PCI group (n=25)	P
LVEF (%)		63.12 ± 4.18	62.2 ± 4.2	0.441
Angiographic findings	One vessel	13 (52%)	12 (48%)	0.777
	Two vessels	8 (32%)	9 (36%)	0.765
	Three vessels	4 (16%)	4 (16%)	1.000
	Multi vessel disease	12 (48%)	13 (52%)	0.777
Laboratory investigations	WBCs (cells/microlite)	6500 ± 1178.98	6840 ± 1178.98	0.930
	Hemoglobin (g/dl)	13.7 ± 0.79	13.72 ± 0.76	0.928
	Creatinine (mg/dL)	0.96 ± 0.11	1 ± 0.16	0.351
	Total cholesterol (mg/dL)	174.4 ± 18.05	170.4 ± 18.37	0.441
	Triglycerides (g/dl)	151.2 ± 12.69	153.6 ± 12.87	0.510

This data is displayed as mean ± SD or frequency (%). (%). iFR: Instantaneous wave free ratio, IVUS: Intravascular Ultrasound, LVEF: Left ventricular ejection fraction, WBCs: White blood cells.

Procedural findings and interventional details were insubstantially different among both groups Table 3.

Table 3: Procedural findings and interventional details of the studied groups

		IFR-guided PCI group (n=25)	IVUS-guided PCI group (n=25)	P
Number of investigated vessels		41	41	--
Target Vessel investigated	LAD (n=45)	23 (56.1%)	22 (53.7%)	0.861
	LCX (n=18)	8 (19.5%)	10 (24.4%)	
	RCA (n=19)	10 (24.4%)	9 (22%)	
Diameter of Stenosis (%) (n=41)		51 ± 10.3	52 ± 10.5	0.680
Minimal Luminal Area mm^2 (n= 41)		--	3.86 ± 0.87	--
Plaque Burden% (n=41)		--	65.1±16.7	--
Minimal stent area mm^2 (n = 19)		--	5.88 ± 0.37	--
iFR PRE (n = 41)		0.89 ± 0.10	(n=12) --	--
iFR post (n = 12)		0.95±0.02	P<0.001 --	--
Result of investigation	+Ve (n=31)	12 (29.3%)	19(46.3%)	0.111
	-Ve (n=51)	29 (70.7%)	22 (53.7%)	
Interventional details				
Patients treated with PCI (n=25) patients		11 (44%)	14 (56%)	0.396
Number of treated vessels per investigated vessels (n=41)		12 (29.3%)	19 (46.3%)	0.111
Treated Vessel (n=31)	LAD (n=21)	8(66.7%)	13 (68.4%)	0.861
	LCX (n=6)	3(25%)	3 (15.8%)	
	RCA (n=4)	1(8.3%)	3 (15.8%)	

Number of stents per treated vessel (n=12/19)		1.08 ±0.28	1.26 ±0.45	0.008
Number of stents/ patients (n=25)	0 (25)	14 (56%)	10 (40%)	0.06
	1 (19)	9 (36%)	8 (32%)	
	2 (4)	1 (4%)	5 (20%)	
	3 (2)	1 (4%)	2 (8%)	
Number of stent/ investigated vessel (n=41)	0 (50)	28 (68.3%)	22 (53.7%)	0.170
	1 (26)	12 (29.3%)	14 (34.1%)	
	2 (6)	1 (2.4%)	5 (12.2%)	
Stent Length mm/ stented vessel (n=12/19)		32.5± 12.2	41.8± 15.1	0.210
Stent Diameter (n=12/19)		3.58±0.35	3.25± 0.83	0.424
Pre-dilatation (n=12/19)		11 (91.7%)	18 (94.7%)	0.735
Post-dilatation (n=12/19)		8(66.7%)	14(73.7%)	0.675

This data is displayed as mean ± SD or frequency (%) .iFR: Instantaneous wave free ratio, IVUS: Intravascular Ultrasound, PCI: Percutaneous coronary intervention, LAD: Left anterior descending artery, RCA: Right coronary artery, LCX: Left Circumflex artery.

There were no substantial differences between among groups regarding contrast used in the procedure and primary and secondary outcomes at one and six months. Radiation dose was a substantial difference across both groups with higher dose of radiation in the IVUS group (P = 0.019) table 4.

Table 4: Contrast and radiation dose Primary and secondary outcomes at one and six months

	IFR-guided PCI group (n=25)	**IVUS-guided PCI group (n=25)**	**P**
Contrast (ml)	80± 21.32	82 ± 24.49	0.821
Radiation dose (mGy)	796 ± 307.52	1040 ± 397.91	0.019*
Outcomes			
Mortality	0 (0%)	0 (0%)	---
Non-fatal MI	0 (0%)	0 (0%)	---
TLR	1 (4%)	1 (4%)	1.000
Anginal symptoms	3 (12%)	0 (0%)	0.234
Stroke post	0 (0%)	0 (0%)	--

This data is displayed as mean ± SD or frequency (%). *: significant P value≤0.05, iFR: Instantaneous wave free ratio, IVUS: Intravascular Ultrasound, PCI: Percutaneous coronary intervention, MI: Nonfatal myocardial infarction. TLR: Target lesion revascularization.

Case 1: A 50-year-old male patient presented complaining of stable angina not relieved on medical ant-ischemic medications, coronary angiography was decided. The coronary angiogram showed mid segment LAD intermediate lesion. iFR wire was introduced into the lesion which showed significant value, so PCI to LAD with 1 DES was done with good angiographic results Figure 2.

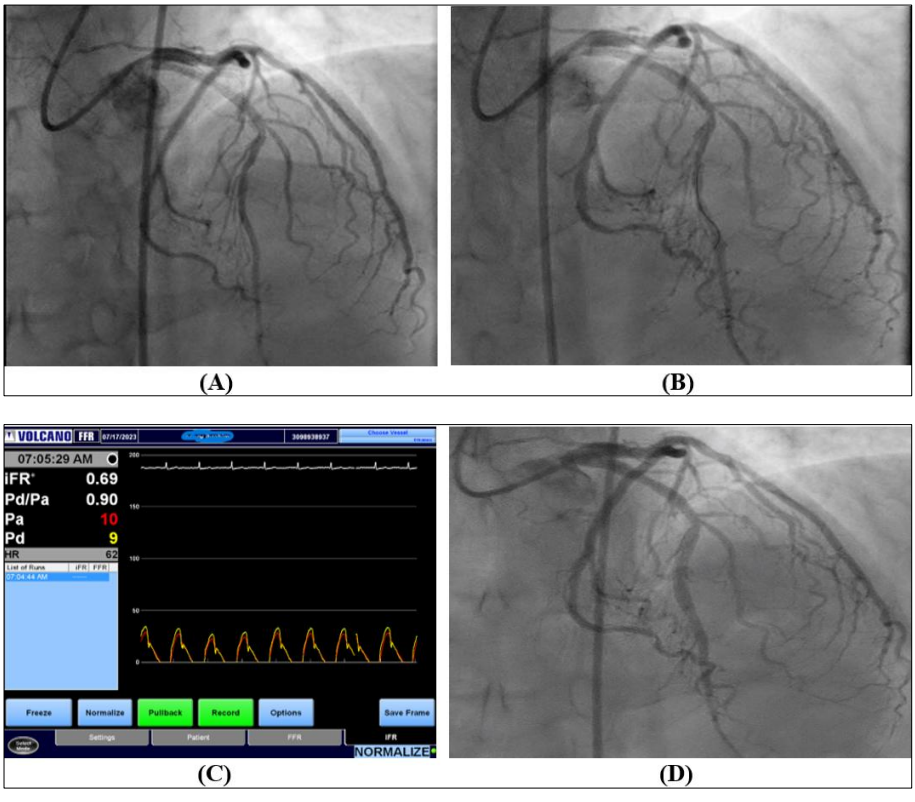

Fig 2: (A) Left cranial view showed LAD mid-segment intermediate lesion, (B) iFR wire distal to LAD lesion, (C) iFR showed significant value of 0.69 (<0.89), (D) after PCI to LAD by 1 DES

Case 2: A 59-year-old female patient presented complaining of recurrent chest pain and was diagnosed as chronic stable angina with equivocal exercise stress test and patient did not improve with medical treatment. The coronary angiogram showed LAD mid segment long intermediate lesion. IVUS was introduced into the lesion which showed significant lesion, so PCI to LAD with 1 DES was done with good angiographic results Figure 3.

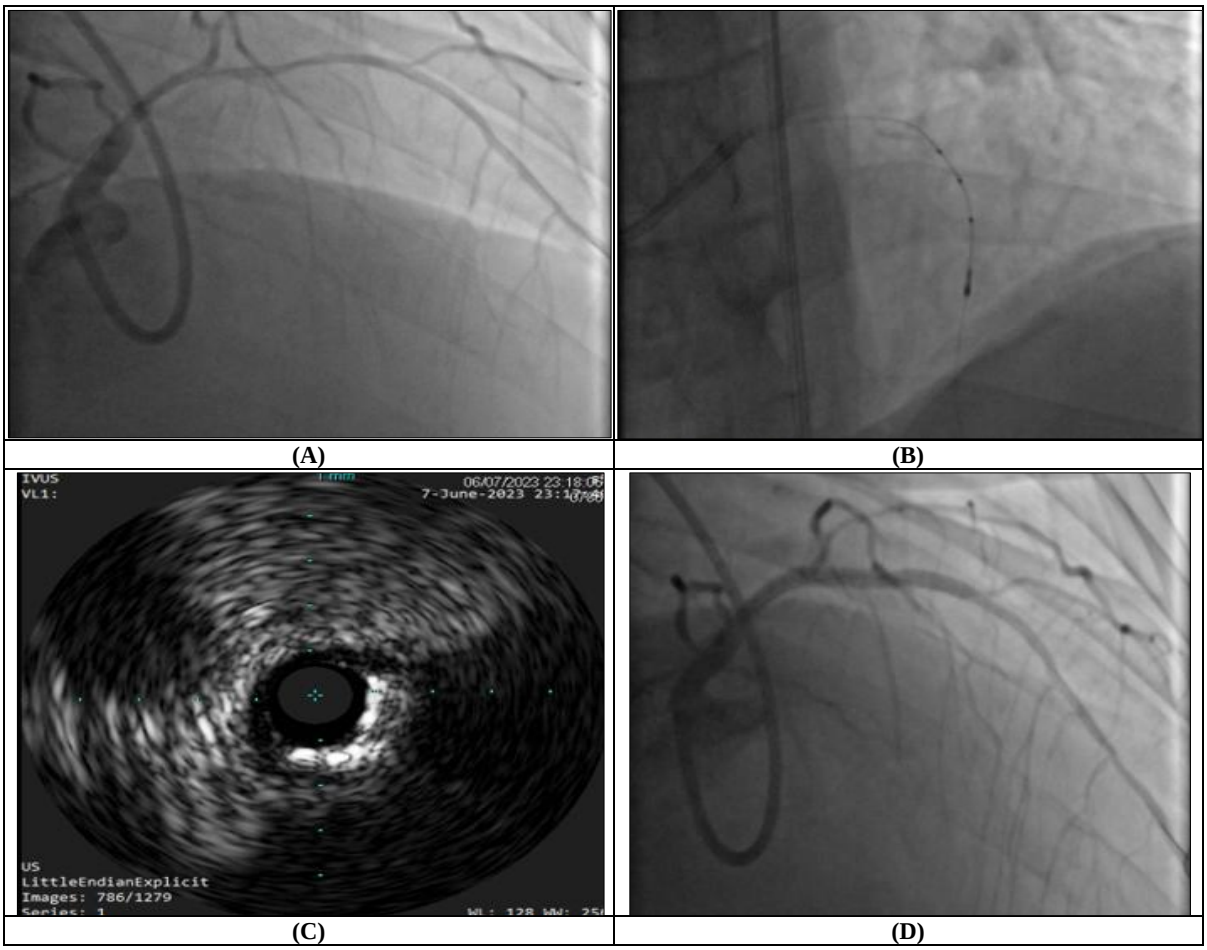

Fig 3: (A) Long intermediate lesion in mid-segment LAD, (B) IVUS catheter inside LAD lesion, (C) IVUS run showed MLA of 3.3 mm^2 with plaque burden 80%, (D) LAD after PCI by 1 DES

Discussion

Non-invasive imaging and functional tests are widely used and have shown to be satisfactory and have good sensitivity and specificity in diagnosing myocardial ischemia [21].

In our study, LAD was the most investigated vessel in the 2 groups, iFR was performed in 23 LAD vessels of 41 investigated vessel (56.1%), while it was investigated in 22 of 41 investigated vessels (53.7%) by IVUS in group II, while RCA was investigated 10 times (24.4%) while IVUS was done to RCA in 9 of 41 investigated vessels (22%) in group II and LCX was investigated 8 times (19.5%) by iFR while it was assessed by IVUS in 10 of 41 vessels (24.4%) in group II.

The iFR value was significant in 8 LAD vessels (66.7%) of 12 treated vessels in group I and PCI was done. Findings from the investigation corroborated of Barbin *et al*. [22] (Retrospective cohort study on the frequency of aberrant fractional flow reserve measures among major coronary arteries), one tertiary care hospital, enrolling all individuals who had cardiac catheterization procedures performed between 2011 and 2015 and had their fractional flow reserve (FFR) measured. Regarding the value of iFR in the investigated vessel at baseline in our study, it was of mean of 0.89 ± 0.10 with a range of (0.60 - 0.99). Matsushita K. *et al*. [4] carried out a study that included 80 lesions in 72 patients who underwent elective angiography and had intermediate lesions. All these lesions were assessed by iFR, FFR, IVUS, and OFDI. The mean of baseline value of iFR in these intermediate lesions was 0.92 ± 0.09.

In our study, the value of iFR after PCI in 12 vessels treated by iFR guided PCI had a mean of 0.95 ± 0.02. There was substantial difference between value of iFR at baseline and after PCI.

In our study, in the IVUS group, MLA at baseline assessment was of a mean of 3.86 ± 0.87 mm2 with a range of (2.5-5) mm^2. The plaque burden among those vessels had a mean of 65.1 ± 16.7% with a range from (40-90%). This was accordant with the study of Zhu Y *et al*. [23] research looking back at 206 individuals who underwent coronary angiography at Shanghai General Hospital, which is affiliated with Shanghai Jiao Tong University, between January 2020 and December 2020 for conditions such as stable angina, unstable angina, and asymptomatic myocardial ischemia. For the final analysis, 84 patients were considered who had 92 intermediate coronary lesions in vessels with a diameter of 2.50 mm or greater, as per their predetermined protocol. There was a 70% (50-76%), median MLA of 3.80 (3.03-4.91) mm2 as evaluated by IVUS at the associated target vascular lesion.

Also, regarding the number of deployed stents per treated vessels in both iFR group and IVUS group, there was substantial difference in the number of deployed stents where 14 stents were deployed in 12 treated vessels via the iFR, vs 24 stents were deployed in 19 vessels treated by IVUS guided PCI. This was concordant with Koo Bk *et al*. [24] whose study was conducted A total of 4355 patients were screened from July 2016 to August 2019. Out of those, An FFR-guided procedure was administered to 838 patients with intermediate coronary stenosis, whereas an IVUS-guided operation was administered to 844 patients. The patients were randomly assigned to one of the two groups. The results demonstrated that IVUS led to a higher number of stents than FFR. This did not match the study of Nam *et al*. [25] who research 167 consecutive individuals with intermediate coronary lesions assessed by either FFR or IVUS (83 lesions guided by FFR and 94 lesions by IVUS).

There was no substantial difference among groups regarding the number of patients who performed PCI, 11 patients (44%) in group I had performed PCI while 14 patients (56%) in group II had performed PCI. This did not match with Nam *et al*. [25] found out that the incidence of performing PCI was much lower in the FFR-guided group than IVUS-guided group (33.7% vs. 91.5%, P<0.001). Additionally, Koo BK, *et al*. [24] study that the number of patients who underwent PCI was higher in the IVUS group (65.3%) than in the FFR group (44.4%) with significant difference.

Contrast volume was insubstantially different among both groups, the volume of contrast used was of a mean of 80 ± 21.32 mL in group I, while in group II it was 82 ± 24.49 mL. Comparable research of Budrys P. *et al*. [26] included the contrast volume in FFR group was 162.3±61.6 ml while in the IVUS group was 157.7 ± 41.4 ml with no substantial difference. Tonino *et al*. [21] showed one hundred and five patients with coronary artery disease affecting more than one vessel were randomly allocated to receive percutaneous coronary intervention (PCI) with DES implantation guided either by angiography alone or by angiography and FFR measures. Substantially more contrast agents were used in the angiography group than in the FFR group. Additionally, Mariani J Jr. *et al*. [27] IVUS Guidance to Minimize the use of Iodine Contrast in PCI: The MOZART Randomized Controlled Trial.

The radiation dose in our study was substantially higher in IVUS-guided PCI group than IFR-guided PCI group with (P= 0.019). Additionally, in the study of Bensaid R. *et al*. [28] for intracoronary imaging, there were no differences among groups, except for contrast volume.

One month and major adverse cardiac events (death, non-fatal MI, target vessel revascularization) were monitored for six months. There was no substantial difference among groups. This was concordant with the investigation of Liu X *et al*. [29] identified five trials including 3208 people (three randomized controlled trials and two observational studies). From twelve to twenty-four months, the participants were followed up. Nam *et al*. [25] demonstrated the presence of non-substantial difference in MACE among two groups at 1 year.

Regarding mortality, the present study concluded that there were no deaths with no substantial difference in both groups. One patient in each group needed target lesion revascularization during the follow up period after initially being diagnosed as non-significant during the baseline procedure by iFR and IVUS. The results of this study was consistent with De Jaegere *et al*. [30] verified that the use of IVUS to guide stent implantation improved the angiographic results right away, which could explain the positive clinical and angiographic results at 6 months (the lowest thrombolysis rate was 5.7%, the restenosis rate was 9.7%, and the maximum minimal lumen diameter was 2.12±0.67, all of which are excellent results at this point).

In this study, they found that there was no substantial difference among the proportion of patients who were angina free at 1 year in the angiography guided and FFR guided PCI groups (81% versus 78%, respectively. Moreover, Toth *et al*. [20] found that both groups showed marked improvement in angina status without any difference between them, where the median (IQR) of CCS classification was 0 (0; 0) versus 0 (0; 0), respectively; with (P= 0.62).

In our study, there were no MI recorded in the 2 groups during the follow-up duration of one month and 6 months while in EXCELLENT 158 trial where patients were grouped into IVUS-guided versus IVUS-non-guided PCI (619 and 802 patients, respectively), IVUS guidance was associated with a significantly higher risk of periprocedural MI. Also, in another study, Yang HM *et al*. [31] demonstrated that there were no variations in IVUS features between the two groups, although patients with non-ischemic lesions with FFR ≥0.80 in intermediate coronary lesions had less severe stenosis and atheromatous plaque compared to those with functionally considerable iFR.

Limitations of the study included that small number of patients included in the investigation. Short - term clinical follow-up. The need for a third control angiography-only group.

Conclusion

The accurate physiological and morphological assessment of angiographically intermediate coronary lesion using iFR as a pressure wire and intracoronary imaging device using IVUS before and after the procedure is essential for obtaining accurate findings and guiding the decision. Imaging guidance can provide adequate assessment of the lesion characteristics, degree of the stenosis and plaque burden, land help in appropriate stent landing, which lead to improvement of clinical outcome. While iFR guidance help detect physiologically significant lesions and confirm good results by reassessment after stent deployment. iFR and IVUS are non-inferior in guiding PCI of intermediate coronary lesion at each individual step: from planning the decision of intervening or not to guidance during PCI, and finally checking the interventional results.

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Conflict of Interest: Nil.

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