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# The Value of Adding Nitroglycerine to Low-Dose Dobutamine Stress Echocardiography in Detection of Viable Myocardium in Post Myocardial Infarction Patients

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ORIGINAL ARTICLE

# The Value of Adding Nitroglycerine to Low-Dose Dobutamine Stress Echocardiography in Detection of Viable Myocardium in Post Myocardial Infarction Patients

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Abstract

*Background:* ***Dobutamine stress echocardiography is used to differentiate between stunning and hibernating myocardium in individuals with left ventricular failure and to detect coronary artery stenosis noninvasively.***

*Objective:* ***Find out how adding nitroglycerin to low-dose dobutamine stress echocardiography affects the viability of the heart in patients whose hearts do not show viability to dobutamine alone.***

*Patients and methods:* ***Eighty adult patients who had previously experienced a myocardial infarction and were seen in the cardiology department at Al-Azhar University Hospitals between September 2022 and October 2023 participated in a prospective interventional trial.***

*Results:* ***Compared to the LDDE + NTG Success group (1.68 ± 0.19), the WMSI was considerably higher in the Failure group (1.94 ± 0.14) (P= 0.000). However, there was no discernible difference in resting and LDDE between the two groups under study (P>0.05).***

*Conclusion:* ***Dobutamine-NTG echocardiography is a safer and more sensitive diagnostic technique for determining the presence of a viable myocardium compared to dobutamine echocardiography.***

*Keywords:* Dobutamine Stress Echocardiography; Myocardial Infarction; Nitroglycerine

## 1. Introduction

For prognosticating patients who have suffered a myocardial infarction (MI), viable dyssynergia myocardium must be identified.[1] Dobutamine echocardiography has been utilized effectively to detect hibernating myocardium in patients with a history of myocardial infarction. On the contrary, delayed thallium 201 scintigraphy, achieved through an early reinjection protocol or a 24-hour redistribution study, is a recognized clinical standard for quantifying viable cardiac tissue. The myocardial viability can also be evaluated using nitroglycerin (NTG). By lowering myocardial oxygen demand and wall tension, nitroglycerin enhances myocardial perfusion. These substances can increase blood flow in the myocardial infarction's surviving viable zones by vasodilating the collateral vessels.[2] Collaterals can sustain the myocardial regions distal to occluded coronary arteries or supply minimal nutrition.[3] Recent publications indicate that many individuals with angiographically normal coronary arteries possess functional collateral blood vessels. In fact, between one-fifth and one-fourth of these individuals do not manifest any symptoms consistent with myocardial ischemia during transient vascular occlusions. Prior research has established that coronary collateral vessels become imperceptible once the degree of coronary occlusion surpasses 90%.[4] Therefore, this study aims to determine whether adding sublingual nitroglycerin to low-dose dobutamine stress echocardiography improves cardiac viability in patients whose hearts do not exhibit viability when dobutamine alone is administered.

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## 2. Patients and methods

Eighty adult patients who had previously experienced a myocardial infarction and were seen in the cardiology department at Al-Azhar University Hospitals between December 2022 and October 2023 participated in a prospective interventional study.

Ethical consideration: Upon elucidating the research objective and following the principles in the Declaration of Helsinki, the patients provided their signed informed permission. The Ethical Scientific Committee of the Al Azhar Faculty of Medicine has approved the research protocol.

Inclusion criteria: Adult patients with a history of MI longer than four to six weeks and those with echocardiographic evidence and left ventricular systolic dysfunction (EF < 40%) and akinetic or hypokinetic segments associated with the affected territory.

Exclusion criteria: Patients with functional class IV heart failure, MI lasting less than four weeks, and other significant heart disease such as restrictive cardiomyopathy, DCM, LBBB, HCM, left ventricular thrombosis, and basal systolic blood pressure <90 mmHg.

All the patients were subjected to the following:

A thorough medical history includes The patient's demographic data, age, and gender. The individuals possess many risk factors for coronary heart disease, such as smoking, hypertension, diabetes mellitus, dyslipidemia, and aberrant Q waves on the ECG. In addition, they have a favorable family history of the ailment and a past of long-term medical therapy with pharmaceuticals such as acetylsalicylic acid, beta-blockers, statins, angiotensin-converting enzyme inhibitors, and angiotensin receptor blockers.

A clinical examination This includes a thorough evaluation that specifically examines peripheral pulsations, blood pressure, pulse, and the presence or absence of excessive jugular venous pressure (JVP). Furthermore, a comprehensive assessment of the heart at the local level was performed, focusing on ruling out murmurs resulting from significant valve pathology.

Resting 12-lead ECG focusing on Localization of myocardial infarction, Cardiac arrhythmias, and conduction abnormalities.

Echocardiography: Was done to identify the Akinetic and hypokinetic areas, Ejection Fraction, DD, and MR

Low dose Dobutamine stress Echocardiography: An automated infusion pump was used to deliver a graded dobutamine infusion dose commonly beginning at a rate of two and a half ug/kg per minute and increasing to doses of 5, 10, and 20 ug/kg per minute every three-five minutes. ECG was continuously monitored. Images were obtained using ECHO at different elevations in the parasternal long-axis, midventricular parasternal short-axis, apical four-chamber, and apical two-chamber views to assess improvements in segmental wall motion. This evaluation was conducted using the wall motion score index. Calculating the regional wall motion score index (WMSI) involves dividing the total sum of scores assigned to all Seventeen segments by the number of assessed segments. The standard scoring operates: a score of one corresponds to normal (systolic thickening of above twenty-five percent), a score of two corresponds to hypokinesia (systole thickening of below twenty-five percent), a score of three corresponds to akinesia (no endocardial excursion or systolic thickening) and a score of Four indicates dyskinesia (external motion during systole). According to the standards set out by ASE, it is recommended that the viability evaluation should include, at the very least, the observation of enhanced wall motion in a minimum of two of the left ventricle segments during echocardiographic examination. The determination of myocardial viability in each segment is based on a reduction of the wall motion score by more than one point. For instance, a drop from three to two (or one) or from two to one is indicative of viability. However, a decrease in wall motion score from four to three is not recognized as indicative of viability.[5] Myocardial viability is defined as a decrease of the LV WMSI ≥20% as previously proposed.[6]

Low-dose Dobutamine and Nitroglycerin stress Echocardiography: This was restricted to individuals whose low-dose dobutamine stress echocardiography indicated the absence of viability. The administration of sublingual nitroglycerin occurred concurrently with the continuation of the dobutamine infusion at a rate of 20 μg/kg/min. The decrease in systolic blood pressure by 5 to 10 mmHg indicates its efficacy. Both the blood pressure and the electrocardiogram (ECG) were continually monitored. ECG images were acquired similarly to basal images following a drop in systolic blood pressure of 5 to 10 mmHg. A regional wall motion assessment was completed based on a model with 17 segments.

Two observers examined 1360 segments in total. On 1292 (95%) occasions, the two observers assigned the same score; on the other 68, a score was determined after discussion.

Statistical Analysis

The data were documented and analyzed statistically using SPSS V.25 (IBM Corporation, 1 Orchard Rd, Armonk, NY 10504, USA) and Microsoft Excel 2019 (Microsoft Corporation, One Microsoft Way Redmond, WA 98052-6399 USA). The offered descriptive statistics include the mean ($\bar{x}$), median ($\tilde{x}$), and standard deviation (SD). The

statistical analysis included The Chi-Squared (x2) test, a statistical method used to ascertain a substantial relationship between two categorical variables. The objective of this study is to compare many groups based on a qualitative variable. The t-test, a classic statistical test, compares two groups, particularly for quantitative data that follows a normal distribution, often known as parametric data. A P value less than or equal to 0.05 is considered statistically significant.

## 3. Results

Figure 1 Illustrates a flowchart representing the research population. Among the patients who sought treatment at the cardiology department at Al-Azhar University Hospitals between September 2022 and October 2023, there were 99 individuals having a history of myocardial infarction. The research eliminated a total of 19 subjects. Two patients refused to participate, while 17 patients did not satisfy the inclusion criteria. Subsequently, the remaining 80 patients voluntarily agreed to participate and were subsequently separated into two distinct groups. Both groups had the same investigations but showed different results regarding NTG-LDDE. Group I had 21 patients who achieved success i.e showed viability with NTG-LDDE, while Group II comprised 59 patients who encountered failure i.e showed absence of viability with NTG-LDDE.

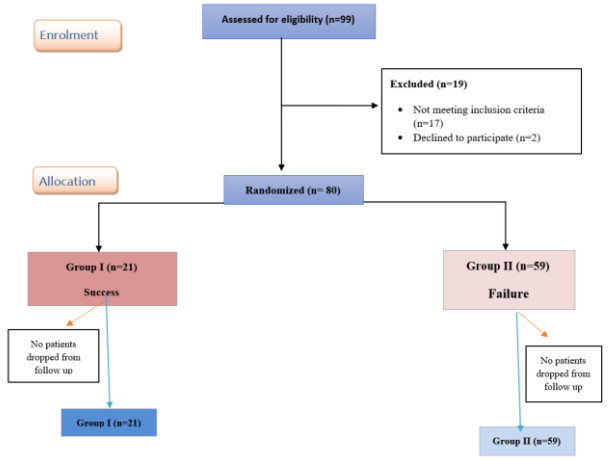


Figure 1. Flowchart of the studied patients.

There were no statistically significant differences between the success group and failure group in terms of sex and age . Table 1

*Table 1. Comparison between failed and success outcome regarding demographic data and characteristics of the studied patients (N= 80).*

| | SUCCESS (21) | | FAILURE (59) | | T TEST | P VALUE |
|---|---|---|---|---|---|---|
| | N | % | N | % | | |
| AGE (YEARS) MEAN ± SD | 64.24 ± 4.41 | | 64.19 ± 4.90 | | 0.042 | 0.966 |
| RANGE | 57 – 72 | | 57 – 74 | | | |
| SEX | | | | | $X^2$= | 0.867 |
| MALE | 16 | 76.2 | 46 | 78.0 | 0.028 | |
| FEMALE | 5 | 23.8 | 13 | 22.0 | | |

t: independent t-test. X2: Chi-square test.

There were no statistically significant differences seen between the two groups being evaluated in terms of Smoking, Family history of CAD, DM, HTN, and CA (P> 0.05) . Table 2.

*Table 2. Comparison between failure and success regarding co-morbidities of the studied patients (N= 80).*

| | SUCCESS (21) | | FAILURE (59) | | $X^2$ TEST | P VALUE |
|---|---|---|---|---|---|---|
| | N | % | N | % | | |
| SMOKING | | | | | 0.342 | 0.559 |
| NON-SMOKER | 6 | 28.6 | 21 | 35.6 | | |
| SMOKER | 15 | 71.4 | 38 | 64.4 | | |
| FAMILY HISTORY OF CAD | | | | | 0.339 | 0.560 |
| ABSENT | 16 | 76.2 | 41 | 69.5 | | |
| PRESENT | 5 | 23.8 | 18 | 30.5 | | |
| DM | | | | | 0.002 | 0.962 |
| ABSENT | 7 | 33.3 | 20 | 33.9 | | |
| PRESENT | 14 | 66.7 | 39 | 66.1 | | |
| HTN | | | | | 1.499 | 0.221 |
| ABSENT | 0 | 0.0 | 4 | 6.8 | | |
| PRESENT | 21 | 100.0 | 55 | 93.2 | | |
| CA | | | | | 0.035 | 0.852 |
| NO | 7 | 33.3 | 21 | 35.6 | | |
| YES | 14 | 66.7 | 38 | 64.4 | | |

X2: Chi-square test. *: Significant.

There were no significantly difference between the two studied groups regarding BB, ACE-I, Plavix, Ticagrelor, Aspirin, and Statins (P> 0.05). Table 3

*Table 3. Comparison between success and failure regarding drugs among the studied patients (N= 80).*

| | SUCCESS (21) | | FAILURE (59) | | $X^2$ TEST | P VALUE |
|---|---|---|---|---|---|---|
| | N | % | N | % | | |
| BB | | | | | 0.825 | 0.364 |
| NO | 3 | 14.3 | 14 | 23.7 | | |
| YES | 18 | 85.7 | 45 | 76.3 | | |
| ACE-I | | | | | 0.002 | 0.962 |
| NO | 7 | 33.3 | 20 | 33.9 | | |
| YES | 14 | 66.7 | 39 | 66.1 | | |
| PLAVIX | | | | | 0.785 | 0.376 |
| NO | 16 | 76.2 | 50 | 84.7 | | |
| YES | 5 | 23.8 | 9 | 15.3 | | |
| TICAGRELOR | | | | | 0.947 | 0.331 |
| NO | 19 | 90.5 | 48 | 81.4 | | |
| YES | 2 | 9.5 | 11 | 18.6 | | |
| ASPIRIN | | | | | 0.670 | 0.413 |
| NO | 2 | 9.5 | 10 | 16.9 | | |
| YES | 19 | 90.5 | 49 | 83.1 | | |
| STATINS | | | | | 0.527 | 0.468 |
| NO | 7 | 33.3 | 25 | 42.4 | | |
| YES | 14 | 66.7 | 34 | 57.6 | | |

BB: beta blockers, ACE-I: angiotensin-

converting enzyme inhibitor, X2: Chi-square test. *: Significant

In the success group two or more stents per patient (47.6%) was the most common number of stents followed by one stent (28.6%) and no PCI (23.8%). While, in the failure group No PCI (59.3%) was the most common number followed by two or more stents (23.7%) and one stent (16.9%) (P= 0.019). there were no significantly difference between the two studied groups regarding DBP, SBP, Number of vessels Affected and Heart rate (P>0.05).Table 4.

*Table 4. Comparison between success and failure regarding vital data and number of vessels affected among the studied patients (N= 80).*

| | SUCCESS (21) | | FAILURE (59) | | T TEST | P VALUE |
|---|---|---|---|---|---|---|
| | N | % | N | % | | |
| SBP (MMHG) MEAN ± SD RANGE | 112.57 ± 6.73 100 – 126 | | 112.20 ± 7.51 98 – 126 | | 0.198 | 0.844 |
| DBP (MMHG) MEAN ± SD RANGE | 75.52 ± 3.22 69 – 80 | | 75.53 ± 3.62 69 – 83 | | -0.002 | 0.999 |
| NUMBER OF VESSELS AFFECTED | | | | | $X^2$ = 8.006 | 0.046 |
| UNKNOWN | 7 | 33.3 | 21 | 35.6 | | |
| ONE VESSEL | 7 | 33.3 | 9 | 15.3 | | |
| TWO VESSELS | 2 | 9.5 | 22 | 37.3 | | |
| MVD | 5 | 23.8 | 7 | 11.9 | | |
| HEART RATE (/MIN) MEAN ± SD RANGE | 73.62 ± 5.01 65 – 84 | | 75.41 ± 5.82 65 – 87 | | -1.251 | 0.215 |

SBP: Systolic blood pressure, DBP: Diastolic blood pressure, t: independent t-test. X2: Chi-square test.

Pathological Q wave was high significantly increase in Failure group (62.7%) than Success group (23.8%), (P= 0.002). while, there were no significantly difference between the two studied groups regarding ST-T abnormalities, LVEDD, LVESD, LV diastolic function grade, LV diastolic function, MR (Resting), EF (%) (Resting) and MR (stress), (P> 0.05). *Table 5*

*Table 5. Comparison between success and failure regarding ECHO parameters among the studied patients (N= 80).*

| VARIABLES | SUCCESS (21) | | FAILURE (59) | | $X^2$ TEST | P VALUE |
|---|---|---|---|---|---|---|
| | N | % | N | % | | |
| ST-T ABNORMALITIES | | | | | 0.105 | 0.746 |
| NO | 7 | 33.3 | 22 | 37.3 | | |
| YES | 14 | 66.7 | 37 | 62.7 | | |
| PATHOLOGICAL Q WAVE | | | | | 9.399 | 0.002** |
| NO | 16 | 76.2 | 22 | 37.3 | | |
| YES | 5 | 23.8 | 37 | 62.7 | | |
| LVEDD (CM) MEAN ± SD RANGE | 6.09 ± 0.51 5.4 – 7.4 | | 6.01 ± 0.41 5.3 – 6.8 | | t= 0.692 | 0.491 |
| LVESD (CM) MEAN ± SD RANGE | 5.43 ± 0.35 4.9 – 6.4 | | 5.45 ± 0.40 4.9 – 6.3 | | t= -0.161 | 0.872 |
| LV DIASTOLIC FUNCTION | | | | | 0.215 | 0.898 |
| GRADE | | | | | | |
| 1 | 8 | 38.1 | 25 | 42.4 | | |
| 2 | 6 | 28.6 | 14 | 23.7 | | |
| 3 | 7 | 33.3 | 20 | 33.9 | | |
| LV DIASTOLIC FUNCTION | | | | | ---- | ---- |
| NORMAL | 0 | 0.0 | 0 | 0.0 | | |
| IMPAIRED RELAXATION | 21 | 100.0 | 59 | 100.0 | | |
| MR (RESTING) | | | | | 0.528 | 0.768 |
| NO | 0 | 0.0 | 0 | 0.0 | | |
| MILD | 2 | 9.5 | 7 | 11.9 | | |
| MODERATE | 5 | 23.8 | 18 | 30.5 | | |
| SEVERE | 14 | 66.7 | 34 | 57.6 | | |
| EF (%) (RESTING) MEAN ± SD RANGE | 34.00 ± 2.86 30 – 38 | | 34.58 ± 2.57 30 – 39 | | t= -0.857 | 0.394 |
| MR (STRESS) | 2 | 9.5 | 5 | 8.5 | 5.169 | 0.160 |
| NO | 5 | 23.8 | 19 | 32.2 | | |
| MILD | 14 | 66.7 | 26 | 44.1 | | |
| MODERATE | 0 | 0.0 | 9 | 15.3 | | |
| SEVERE | | | | | | |

LVEDD: left ventricular end diastolic diameter, LVESD: left ventricular end systolic diameter, EF: Ejection fraction, LV: left ventricular, MR: mitral regurgitation, t: independent t-test. X2: Chi-square test, **: high Significant

Regarding WMSI, was significantly increased in LDDE + NTG Failure group (1.94 ± 0.14) than LDDE + NTG Success group (1.68 ± 0.19), (P= 0.000). While, there was no significantly difference between the two studied group regarding Resting and LDDE (P> 0.05). Table 6

*Table 6. Comparison between success and failure regarding WMSI at resting after LDDE and after LDDE + NTG among the studied patients(N= 80).*

| WMSI | SUCCESS (21) | FAILURE (59) | T-TEST | P VALUE |
|---|---|---|---|---|
| RESTING MEAN ± SD RANGE | 2.06 ± 0.18 1.65 – 2.35 | 2.02 ± 0.14 1.71 – 2.41 | 0.935 | 0.353 |
| LDDE MEAN ± SD RANGE | 2.06 ± 0.18 1.65 – 2.35 | 2.01 ± 0.13 1.71 – 2.35 | 1.342 | 0.183 |
| LDDE + NTG MEAN ± SD RANGE | 1.68 ± 0.19 1.29 – 2 | 1.94 ± 0.14 1.65 – 2.35 | -6.782 | 0.000** |

**: high Significant

LDDE: low dose dobutamine echo, NTG: nitroglycerin, t: independent t-test.

Regarding Number of a kinetic segments, LDDE + NTG was significantly increased in Failure group (3.22 ± 0.97) than Success group (2.14 ± 0.85), (P= 0.000). While, there was no significantly

difference between the two studied group regarding Resting and LDDE (P> 0.05). Table 7

*Table 7. Comparison between success and failure regarding number of akinetic segments at resting after LDDE and after LDDE + NTG among the studied patients (N= 80).*

| NUMBER OF A KINETIC SEGMENTS | SUCCESS (21) | FAILURE (59) | T-TEST | P VALUE |
|---|---|---|---|---|
| RESTING | | | 0.756 | 0.452 |
| MEAN ± SD | 3.52 ± 1.12 | 3.32 ± 1.03 | | |
| RANGE | 2 – 5 | 2 – 5 | | |
| LDDE | 3.33 ± 1.07 | 3.22 ± 0.97 | 0.448 | 0.183 |
| MEAN ± SD | 2 – 5 | 2 – 5 | | |
| RANGE | | | | |
| LDDE + NTG | 2.14 ± 0.85 | 3.22 ± 0.97 | - 4.518 | 0.000** |
| MEAN ± SD | 1 – 3 | 2 – 5 | | |
| RANGE | | | | |

**: high Significant

LDDE: low dose dobutamine echo, NTG: nitroglycerin, t: independent t-test.

All patients not developed Chest pain After LDDE + NTG. Chest pain after LDDE was high significantly increase in Success group (28.6%) than Failure group (3.4%), (P= 0.001). While, there were no significantly difference between the two studied groups regarding Arrhythmia after LDDE and After LDDE + NTG (P> 0.05). Table 8

*Table 8. Comparison between success and failure regarding presence of hypotension, arrhythmia and chest pain after LDDE and after LDDE + NTG among the studied patients (N= 80).*

| | SUCCESS (21) | | FAILURE (59) | | $X^2$ TEST | P VALUE |
|---|---|---|---|---|---|---|
| | N | % | N | % | | |
| HYPOTENSION | | | | | | |
| AFTER | | | | | ---- | ---- |
| LDDE | 21 | 100.0 | 59 | 100.0 | | |
| ABSENCE | 0 | 0.0 | 0 | 0.0 | | |
| PRESENT | | | | | | |
| AFTER | | | | | ---- | ---- |
| LDDE + NTG | 21 | 100.0 | 59 | 100.0 | | |
| ABSENCE | 0 | 0.0 | 0 | 0.0 | | |
| PRESENT | | | | | | |
| ARRHYTHMIA | | | | | | |
| AFTER | | | | | 1.733 | 0.188 |
| LDDE | 16 | 76.2 | 52 | 88.1 | | |
| ABSENCE | 5 | 23.8 | 7 | 11.9 | | |
| PRESENT | | | | | | |
| AFTER | | | | | 1.227 | 0.268 |
| LDDE + NTG | 19 | 90.5 | 57 | 96.6 | | |
| ABSENCE | 2 | 9.5 | 2 | 3.4 | | |
| PRESENT | | | | | | |
| CHEST PAIN | | | | | | |
| AFTER | | | | | 10.912 | 0.001** |
| LDDE | 15 | 71.4 | 57 | 96.6 | | |
| ABSENCE | 6 | 28.6 | 2 | 3.4 | | |
| PRESENT | | | | | | |
| AFTER | | | | | ---- | ---- |
| LDDE + NTG | 21 | 100.0 | 59 | 100.0 | | |
| ABSENCE | 0 | 0.0 | 0 | 0.0 | | |
| PRESENT | | | | | | |

**: high Significant

LDDE: low dose dobutamine echo, NTG: nitroglycerin, X2: Chi-square test.

There was high significantly difference between Wall motion (resting), Wall motion with dobutamine echocardiography and Wall motion with dobutamine- NTG echocardiography regarding Hypokinesia, Akinesia and Normal (P= 0.001). In Wall motion (resting) and Wall motion with dobutamine echocardiography, Hypokinesia (63.6, 64, 7) was the most common then Akinesia (19.9, 18.8%) and Normal (16.5, 16.5%) respectively. While, Wall motion with dobutamine-NTG echocardiography, Hypokinesia (52.6%) was the most common than Normal (30.1%) and Akinesia (17.3). Table 9

*Table 9. Comparison between resting, dobutamine and dobutamine + NTG (N= 80).*

| | WALL MOTION (RESTING) | | WALL MOTION WITH DOBUTAMINE ECHOCARDIOGRAPHY | | WALL MOTION WITH DOBUTAMINE- NTG ECHOCARDIOGRAPHY | | $X^2$ TEST | P VALUE |
|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | | |
| AKINESIA | 270 | 19.9 | 255 | 18.8 | 235 | 17.3 | 102.332 | <0.001 |
| HYPOKINESIA | 865 | 63.6 | 880 | 64.7 | 715 | 52.6 | | |
| NORMAL | 225 | 16.5 | 225 | 16.5 | 410 | 30.1 | | |

X2: Chi-square test, **: high Significant

## 4. Discussion

In the current study, There were no significant differences between the two groups regarding DBP, SBP, Number of vessels Affected, and Heart rate (P>0.05). Another study by Helfant et al.[7] demonstrated the validity of nitroglycerin in assessing myocardial viability was verified by the observation that three persistently dysfunctional segments remained unchanged after nitroglycerin administration, while the other 15 out of 18 segments that initially showed impaired function improved after sublingual nitroglycerin and continued to improve after revascularization. Moreover, a study by Mohamed et al.[8] was in favor of the use of nitroglycerin to detect viable myocardium, which is consistent with the idea of our thesis, which shows that, in contrast to the LDDE group, Out of the eleven patients who underwent a viability test utilizing NTG, only five showed real improvement. However, seven out of the eleven patients with viable akinetic regions displayed improvement in the follow-up echo. The WMSI has decreased by

more than 20% from its resting value. In the present study, the Pathological Q wave was significantly increased in the Failure group (62.7%) than in the Success group (23.8%) (P= 0.002). No significant differences were seen between the two groups tested in terms of ST-T anomalies. In a study by Kranidis et al.[9], During the administration of the NTG combination, there was a noticeable increase in the ST segment elevation in the ECG leads, accompanied by the presence of Q waves. However, this revelation did not provide evidence for the practicality of the heart. Experts have not yet agreed upon the association between myocardial viability and ST-segment elevation on ECG leads with Q wave during LDDE infusion. Salustri et al.[10]; McNeill et al.[11] Despite recent hurdles, it has been shown that ST segment elevaST-segmentG leads with Q wave during LDDE infusion is related to cardiac survivability. The results of our investigation validate the findings of Coma-Canella et al.[12], who failed to discover a connection between the existence of viability and the ST segment elevation on ECG leads with Q wave under LDDE infusion. The researchers concluded that the LV asynergy induced by D infusion is associated with ST-segment elevation. Our findings indicate that there were no statistically significant differences between the two groups under study in terms of EF (%) at resting and MR under stress (P> 0.05).In a study by Mohamed et al.[8], The average WMSI and EF at rest was found to be 2.76 ± 0.22 and 31.60 ± 7.92, respectively, for the augmented occurrences of the LDDE group, which consisted of 5 patients. The findings demonstrated a statistically significant disparity. The following echocardiography yielded an average EF of 1.91 ± 0.03 and a mean EF of 45.00 ± 7.91, with a P-value less than 0.01. The mean resting EF and WMSI for the seven patients in the NTG group who had improvement were 35.43 ± 5.13 and 2.33 ± 0.31, respectively. The next echocardiography showed an average EF of 55.57 ± 5.94 and a wall motion score index (WMSI) of 0.97 ± 0.22. Both of these measurements showed statistical significance. In this research, the WMSI (Wall et al.) was shown to be substantially higher in the Failure group (1.94 ± 0.14) compared to the Success group (1.68 ± 0.19), with a p-value of 0.000. No difference was seen between the two groups investigated regarding Resting and LDDE (P> 0.05). In this concern, a study by Solimana et al.[13] The analysis determined that SPECT sestamibi imaging of segments with impaired blood flow indicates that NTG enhances wall motion by increasing regional blood flow during thallium 201 reinjection imaging. Tadamura et al.[14] conducted research that provides substantial evidence for using nitrate-enhanced imaging to detect live cardiac tissue. After administering nitroglycerin spray, the MBF (myocardial blood flow) and CVR were assessed in eleven healthy volunteers and twenty-three patients with CAD. Nitroglycerin sprays effectively reduced the CVR of the ischemia-viable myocardium. The tracer uptake was much greater in the ischemic myocardium after applying nitroglycerin spray compared to the non-ischemic and non-viable myocardium. a study by Mohamed et al.[8] is in line with these investigations because, following revascularization, the follow-up echocardiography revealed a statistically significant improvement in the myocardial function and wall motion abnormalities recorded at resting echocardiography for the NTG group as opposed to the LDDE group. In the present study, regarding the Number of kinetic segments, LDDE + NTG was significantly increased in the Failure group (3.22 ± 0.97) than in the Success group (2.14 ± 0.85) (P= 0.000). While there was no significant difference between the two studied groups regarding Resting and LDDE (P> 0.05). Consistent with our findings, Mohamed et al.[8] research revealed that of the 21 patients in the NTG group, 11 had valid akinetic segments. Conversely, among the 24 individuals in the LDDE group, 11 patients had viable akinetic regions. There was no discernible disparity between the two groups. Also, La Canna et al.[15] stated that while dobutamine echo is useful for identifying cardiac hibernation, it can sometimes overestimate viability. Thirteen percent of the segments that did not demonstrate a change in wall motion after angioplasty responded to dobutamine. Most of these segments were akinetic at rest, and most of them had no change in wall motion during dobutamine infusion. Our patients who had nitroglycerin infusion did not have any hypotension, arrhythmia, or chest pain; hence, NTG echocardiography poses no danger whatsoever. None of the individuals in our trial who received either LDDE or LDDE with NTG experienced hypotension. Additionally, no patient reported chest discomfort with LDDE + NTG. The Success group reported considerably higher rates of chest discomfort after LDDE (28.6% vs. 3.4%), with a p-value of 0.001. Arrhythmia after LDDE and after LDDE + NTG did not differ substantially (P> 0.05) between the two evaluated groups. Consistent with our findings, a study by Mohamed et al.[8] concluded that NTG echocardiography is completely safe when infused with nitroglycerin. The study found no chest pain, hypotension, or arrhythmia cases in their patients. This finding is corroborated by Pontillo et al.[16], who speculated that the researchers may

have prevented adverse effects by titrating and injecting NTG stepwise because they could treat patients without interrupting the exam. More research is needed before extrapolating the study's results to all CAD patients. However, the same investigators did discover that NTG echocardiography would be a good alternative to dobutamine echocardiography. Accordingly, NTG echocardiography may be reliable for assessing the heart's health.

In this study, viability was assessed by two observers without MRI as the gold standard due to limited resources.

### *4.1.Conclusion*

Dobutamine-NTG echocardiography is a safer and more sensitive diagnostic technique for determining the presence of a viable myocardium compared to dobutamine echocardiography.

### 4.2. *List Of Abbreviations*

MI, myocardial infarction; BB, beta-blockers; ACE-I, angiotensin-converting enzyme inhibitor; SBP, Systolic blood pressure; DBP, Diastolic blood pressure; LVEDD, left ventricular end-diastolic diameter; LVESD, left ventricular end-systolic diameter; EF, Ejection fraction; LV, left ventricular; MR, mitral regurgitation; WMSI, Wall motion score index; LDDE, low dose dobutamine echo; NTG, nitroglycerin.

## Disclosure

The authors have no financial interest to declare in relation to the content of this article.

## Authorship

All authors have a substantial contribution to the article

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