Statistical analysis:-

All results were tabulated and statistical analysis was performed on computer by means of statistical software package "Microstate", copyright of eco-soft Incorporation. The results were analyzed by the suitable statistical methods which include:

1. **Mean.**
2. **Standard deviation.**
3. **Student's T-test.**
   - **Paired student T-test to analyze data within a group.**
   - **Unpaired T-test to analyze data in different groups.**
   - **Data were considered significant at a P-value < 0.05.**
4. **Correlations were calculated by the linear regression method.**

Results

Study Populations:-

This study included three groups, Group (1) included 20 patients with old anterior wall myocardial infarction (19 male, 1 female) there ages ranged from 35 to 60 years (mean age 47.75 ± 6.57), Group (2) included 20 patients with old inferior wall myocardial infarction (17 male, 3 females) there ages ranged from 35 to 60 years (mean age 47.6 ± 6.34) and Group (3) included 10 normal healthy subjects (8 males, 2 females) there ages ranged from 35 to 60 years (mean age 45.2 ± 6.3) . table (1).

Cardiac catheterization:-

1. **Left ventriculogram in patients with old anterior wall myocardial infarction (group 1) was normal in one patient (5%) and hypokinesia in anterior wall was found in 14 patients (70%) and akinesia in anterior wall was found in 5 patients (25%).**
2. **Left ventriculogram in patients with old inferior wall myocardial infarction (group 2) was normal in 3 patients (15%) and hypokinesia in inferior wall was found in 12 patients (60%) and akinesia in inferior wall was found in 5 patients (25%). Table (2).**

Conventional 2D Echocardiography of the study groups:-

2. **Assessment of wall motion abnormalities in patients with old anterior wall MI.**
   a) **Patients with anterior wall motion abnormalities were 9 (45%) in the apical part, 8 (40%) in the mid part and 11 (55%) in the basal part.**
   b) **Patients with normal anterior wall motion were 11 (55%) in the apical part, 12 (60%) in the mid part and 9 (45%) in the basal part. Table (3)**

Table 1: Showing the age and sex distribution among the studied patients

S.	Studied Patients	No. of Patients	Age (Years			Sex		
			Range	Mean	± S.D.	Males	Females	Ratio [M:F]
1	Old Ant. MI.	20	35 - 60	47.75	± 6.57	19	1	19:1
2	Old Inf. MI.	20	35 - 60	47.60	± 6.34	17	3	5.67:1
3	Control	10	35 - 60	45.20	± 6.30	8	2	4:1
	Total	50	35 - 60			44	6	7.33:1

Table 3: 2D Echo study of Anterior wall motion abnormality in Group (1)

Description			Normal Wall Motion		Wall Motion Abnormalities	
			No.	%	No.	%
2D Echo	Anterior Wall	Apical Part	11	55.0%	9	45.0%
		Mid Part	12	60.0%	8	40.0%
		Basal Part	9	45.0%	11	55.0%

3. **Assessment of wall motion abnormalities in patients with old inferior wall MI.**
   a) **Patients with inferior wall motion abnormalities were 6 (30%) in the apical part, 9 (45%) in the mid part and 8 (40%) in the basal part.**
   b) **Patients with normal inferior wall motion were 14 (70%) in the apical part, 11 (55%) in the mid part and 12 (60%) in the basal part. Table (4).**

2D Tissue Doppler Imaging:-

Quantitative Assessment of myocardial velocity and myocardial velocity gradient in healthy subjects (control group):

In controls, the left ventricular wall was contracting towards the center of the apical views. In tissue Doppler imaging during systole the anteroseptal wall was color-coded blue and the posterior wall red especially along the endocardium corresponding to the direction of the wall motion against the transducer . figure (12).

There was a regional heterogeneity in myocardial wall motion, with peak velocities that were greater in the posterior wall than in the anteroseptum (median was 0.055 ranged 0.040 ~ 0.110 in the mid part versus median was 0.050 ranged 0.040 ~ 0.090 of anteroseptum). Where (median was 0.060 ranged 0.050 ~ 0.100 in the basal part versus median was 0.050 ranged 0.040 ~ 0.070 of anteroseptum). table (5).

The peak myocardial velocity gradient was lower in the anteroseptum when compared with that obtained in the posterior wall (Systolic velocity gradient) (median was 1.690 ranged 1.100 ~ 2.840 in the mid part versus median was 1.810 ranged 1.210 ~ 2.420 of posterior wall). Where (median was 1.670 ranged 1.350 ~ 2.860 in the basal part versus median was 1.720 ranged 1.100 ~ 2.400 of posterior wall). figure (7).

Table 4: 2D Echo Study of Inferior wall motion abnormality in Group (2)

Description			Normal Wall Motion		Wall Motion Abnormalities	
			No.	%	No.	%
2D Echo	Inferior Wall	Apical Part	14	70.0%	6	30.0%
		Mid Part	11	55.0%	9	45.0%
		Basal Part	12	60.0%	8	40.0%

Table 5: Comparision of MV & MVG in control group

Description			Control	
			Median	Range
Anteroseptum	MV	Mid Part	0.050	(0.040 - 0.090)
		Basal Part	0.050	(0.040 - 0.070)
	MVG	Mid Part	1.690	(1.100 - 2.840)
		Basal Part	1.670	(1.350 - 2.860)
Posterior Wall	MV	Mid Part	0.055	(0.040 - 0.110)
		Basal Part	0.060	(0.050 - 0.100)
	MVG	Mid Part	1.810	(1.210 - 2.420)
		Basal Part	1.720	(1.100 - 2.400)
Anterior Wall	MV	Apical Part	0.040	(0.020 - 0.080)
		Mid Part	0.050	(0.040 - 0.080)
		Basal Part	0.060	(0.050 - 0.090)
	MVG	Apical Part	1.450	(1.200 - 3.420)
		Mid Part	1.635	(1.240 - 2.660)
		Basal Part	1.550	(1.160 - 1.700)
Inferior Wall	MV	Apical Part	0.040	(0.030 - 0.110)
		Mid Part	0.050	(0.040 - 0.070)
		Basal Part	0.060	(0.040 - 0.090)
	MVG	Apical Part	1.640	(1.240 - 2.740)
		Mid Part	1.570	(1.380 - 2.130)
		Basal Part	1.550	(1.140 - 1.840)

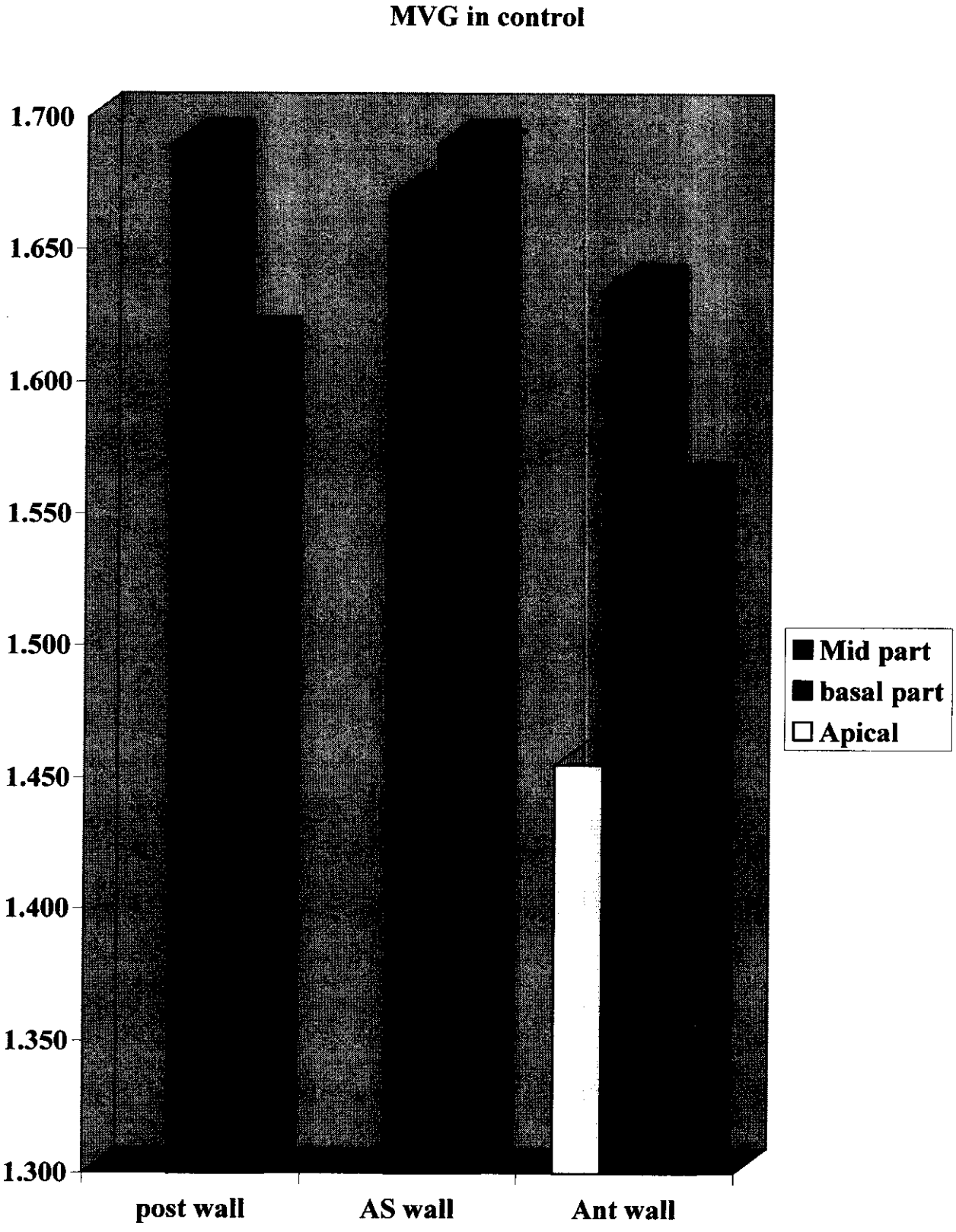

Figure (7)
MVG in the posterior wall is higher than antroseptum and anterior wall

Quantitative assessment of myocardial velocity and myocardial velocity gradient in patient with old myocardial infarction.

We obtained MV & MVG in patients who demonstrated LV regional wall motion abnormalities by left ventriculogram.

Representative images from patients with old anterior wall MI and inferior wall MI are shown in figure (15 & 16) (17 & 18).

By tissue Doppler imaging the infracted region were also color-coded but there was little change in color brightness between endocardium and epicardium with that in non infarct region.

- **Patient with old anterior MI (group 1):-**

The peak myocardial velocity and myocardial velocity gradient in patient with old anterior MI (group 1) were significantly lower when compared with controls. In this wall as shown in figure (8 & 9), peak MV & MVG were dramatically decreased and significantly lower than in the control group.

- ❖ **Apical Part:** **MV was 0.020 versus 0.040 in control.**
  MVG was 0.410 versus 1.450 in control.
- ❖ **Mid Part:** **MV was 0.030 versus 0.050 in control.**
  MVG was 0.655 versus 1.635 in control.
- ❖ **Basal part:** **MV was 0.040 versus 0.060 in control.**
  MVG was 0.660 versus 1.550 in control.

MVG in patients with anterior wall infarction was significantly lower in the infracted region than in non infracted region . figure (8 & 9) and was also significantly lower than in the corresponding wall in normal subjects.

- **Patient with old inferior MI (group 2):-**

In inferior wall infarction although peak systolic velocities were not significantly different from controls, the peak MVG was significantly higher.

Similarly, MVG were lower in infracted region than in non infracted region or in corresponding wall in normal subject . figure (10 & 11).

- **Apical Part:** **MV was 0.030 versus 0.040 in control.**
  MVG was 0.580 versus 1.640 in control.
- **Mid Part:** **MV was 0.030 versus 0.050 in control.**
  MVG was 0.620 versus 1.570 in control.
- **Basal part:** **MV was 0.030 versus 0.060 in control.**
  MVG was 0.620 versus 1.550 in control.

1. **Tissue Doppler parameters (MV & MVG) in detection of wall motion abnormality:**

- **Patients with old anterior MI (group 1):-**

  - **Apical part:-**

Myocardial velocity in patients with old anterior MI was significantly lower in the apical part (0.020 with range 0.001 ~ 0.040) than in the control group (0.040 with range 0.020 ~ 0.080). P < 0.001. Table (6).

Myocardial velocity gradient in patients with old anterior MI was significantly lower in the apical part (0.410 with range 0.150 ~ 0.990) than in the control group (1.450 with range 1.200 ~ 3.420). P < 0.001. Table (6).

  - **Mid part:-**

Myocardial velocity in patients with old anterior MI was significantly lower in the mid part (0.030 with range 0.010 ~

0.060) than in the control group (0.050 with range 0.040 ~ 0.080). P < 0.001.

Myocardial velocity gradient in patients with old anterior MI was significantly lower in the mid part (0.655 with range 0.170 ~ 3.610) than in the control group (1.635 with range 1.240 ~ 2.660). P < 0.001. Table (6).

- **Basal part:-**

Myocardial velocity in patients with old anterior MI was significantly lower in the basal part (0.040 with range 0.020 ~ 0.100) than in the control group (0.060 with range 0.050 ~ 0.090). P < 0.001.

Myocardial velocity gradient in patients with old anterior MI was significantly lower in the basal part (0.660 with range 0.260 ~ 3.640) than in the control group (1.550 with range 1.160 ~ 1.700). P < 0.001. Table (6).

- **Patients with old inferior MI (group 2):-**

  - **Apical part:-**

Myocardial velocity in patients with old inferior MI was significantly lower in the apical part (0.030 with range 0.006 ~ 0.090) than in the control group (0.040 with range 0.030 ~ 0.110). P < 0.001.

Myocardial velocity gradient in patients with old inferior MI was significantly lower in the apical part (0.580 with range 0.190 ~ 1.600) than in the control group (1.640 with range 1.240 ~ 2.740). P < 0.001. Table (7).

Table 6: Peak myocardial velocity and myocardial velocity gradient in pateints with old anterior wall MI and control

Description			Old Anterior MI		Control		P. Value	
			Median	Range	Median	Range		
nterior Wall	MV	Apical Part	0.020	(0.001 - 0.040)	0.040	(0.020 - 0.080)	<	0.001
		Mid Part	0.030	(0.010 - 0.060)	0.050	(0.040 - 0.080)	<	0.001
		Basal Part	0.040	(0.020 - 0.100)	0.060	(0.050 - 0.090)	<	0.001
	MVG	Apical Part	0.410	(0.150 - 0.990)	1.450	(1.200 - 3.420)	<	0.001
		Mid Part	0.655	(0.170 - 3.610)	1.635	(1.240 - 2.660)	<	0.001
		Basal Part	0.660	(0.260 - 3.640)	1.550	(1.160 - 1.700)	<	0.001

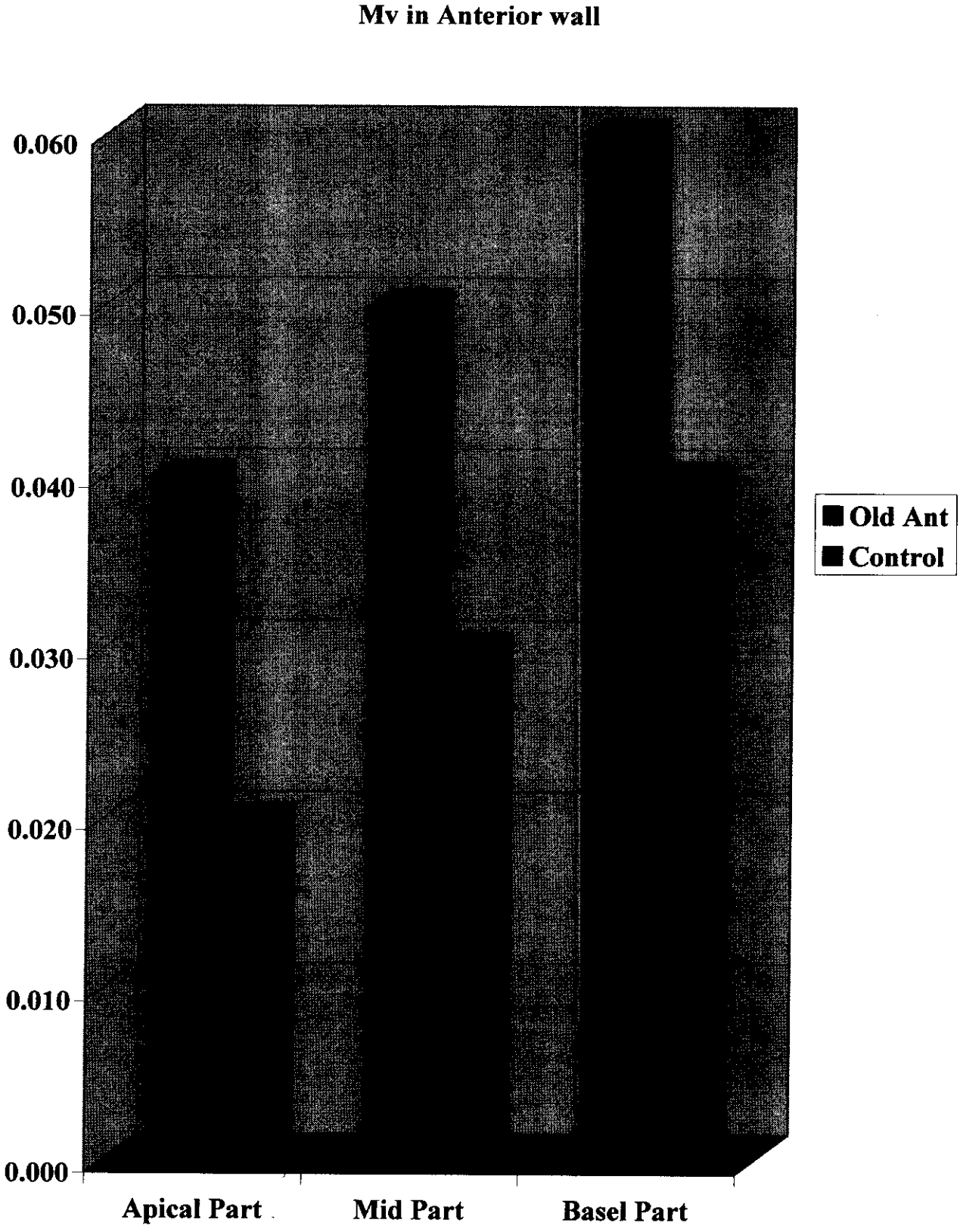

Figure (8)

MV in Anterior wall MI is lower than control

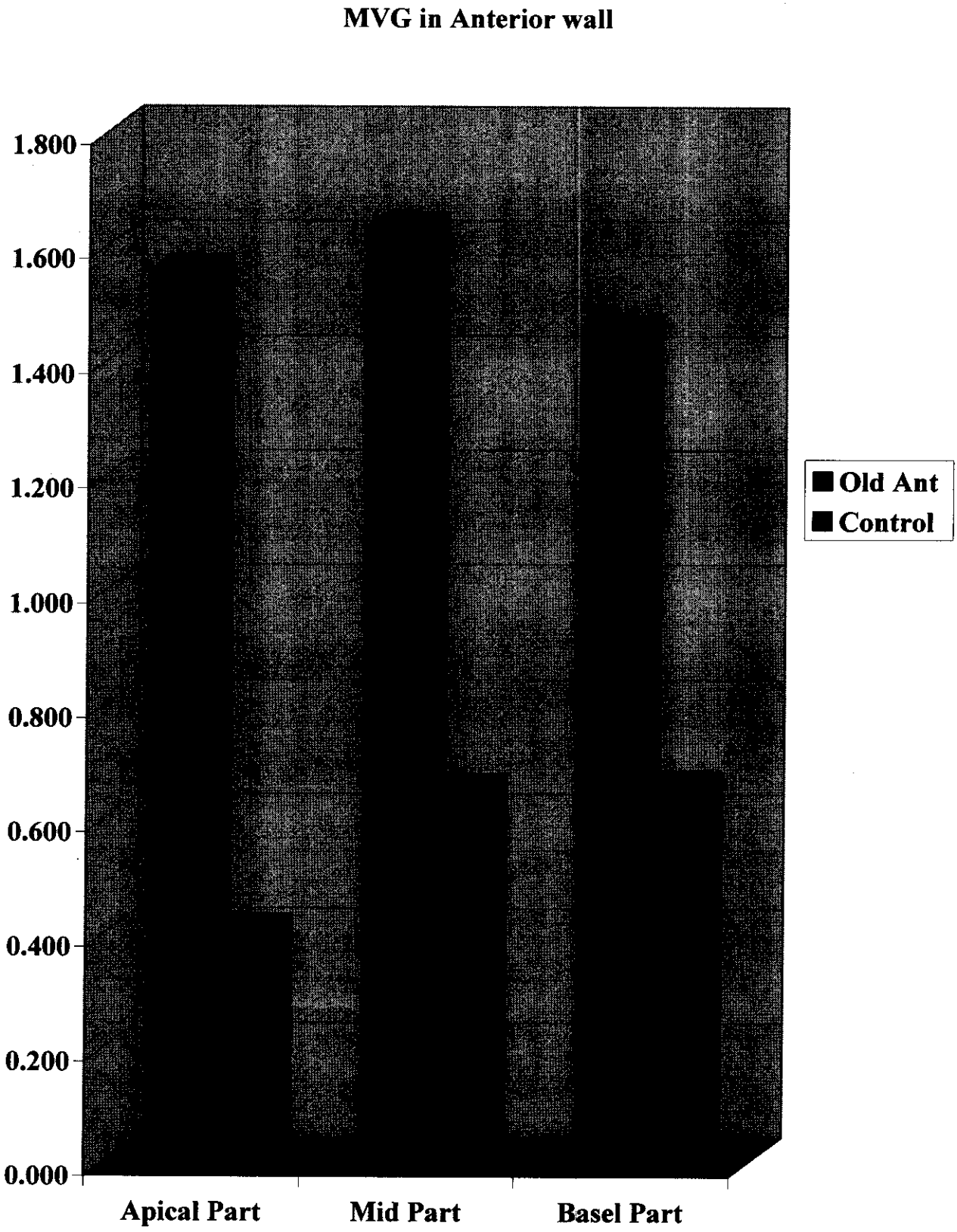

Figure (9)

MVG in the Anterior wall MI is lower than control

- **Mid part:-**

Myocardial velocity in patients with old inferior MI was significantly lower in the mid part (0.030 with range 0.010 ~ 0.060) than in the control group (0.050 with range 0.040 ~ 0.070). P < 0.001.

Myocardial velocity gradient in patients with old inferior MI was significantly lower in the mid part (0.620 with range 0.200 ~ 1.710) than in the control group (1.570 with range 1.380 ~ 2.130). P < 0.001. Table (7).

- **Basal part:-**

Myocardial velocity in patients with old inferior MI was significantly lower in the basal part (0.030 with range 0.010 ~ 0.080) than in the control group (0.060 with range 0.040 ~ 0.090). P < 0.001.

Myocardial velocity gradient in patients with old inferior MI was significantly lower in the basal part (0.620 with range 0.190 ~ 1.780) than in the control group (1.550 with range 1.140 ~ 1.840). P < 0.001. Table (7).

Table 7: Peak myocardial velocity and myocardial velocity gradient in pateints with old inferior wall MI and control

Description			Old Inferior MI		Control		P. Value
			Median	Range	Median	Range	
Inferior Wall	MV	Apical Part	0.030	(0.006 - 0.090)	0.040	(0.030 - 0.110)	< 0.001
		Mid Part	0.030	(0.010 - 0.060)	0.050	(0.040 - 0.070)	< 0.001
		Basal Part	0.030	(0.010 - 0.080)	0.060	(0.040 - 0.090)	< 0.001
	MVG	Apical Part	0.580	(0.190 - 1.600)	1.640	(1.240 - 2.740)	< 0.001
		Mid Part	0.620	(0.200 - 1.710)	1.570	(1.380 - 2.130)	< 0.001
		Basal Part	0.620	(0.190 - 1.780)	1.550	(1.140 - 1.840)	< 0.001

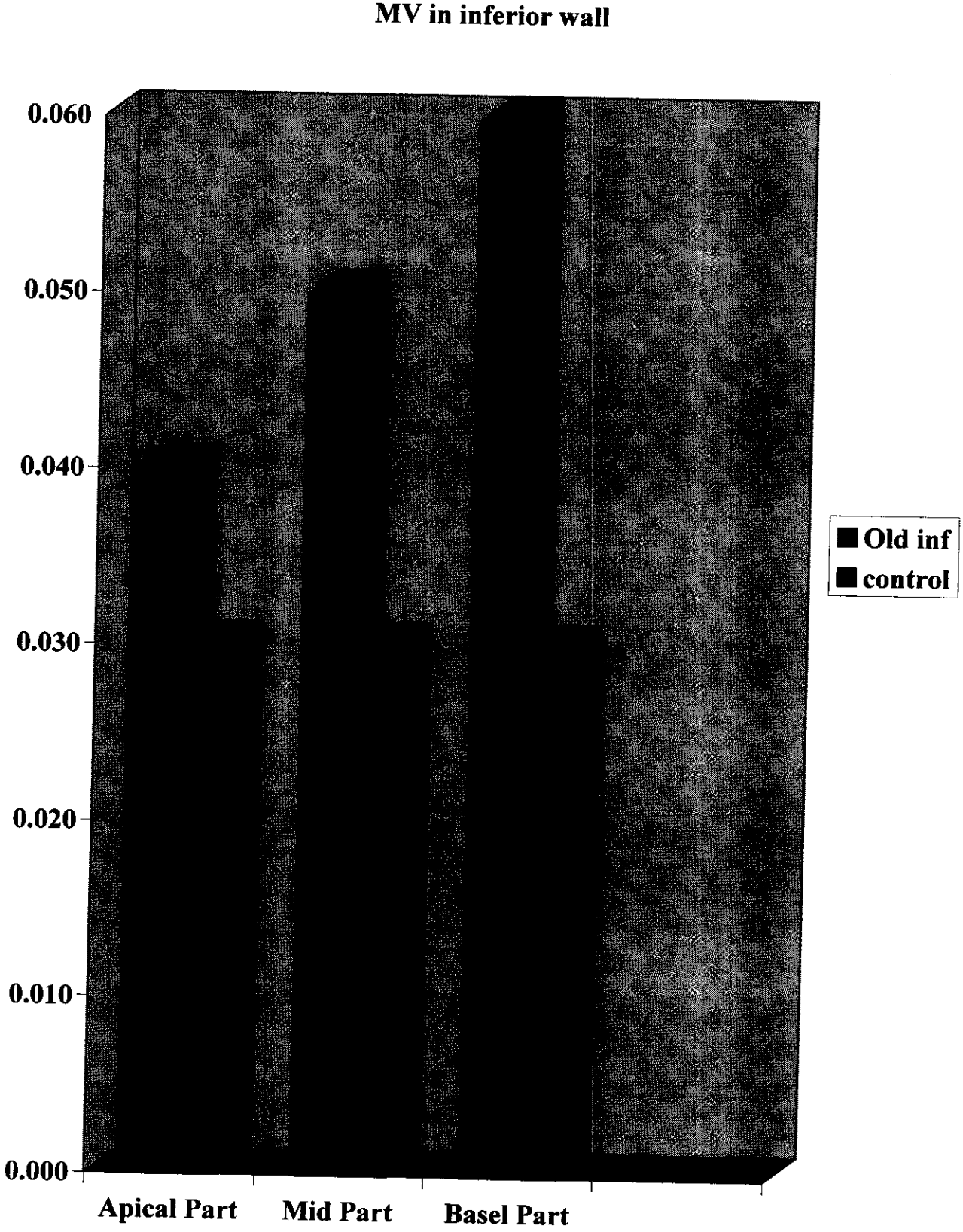

Figure (10)
MV in the Inferior wall MI is lower than control

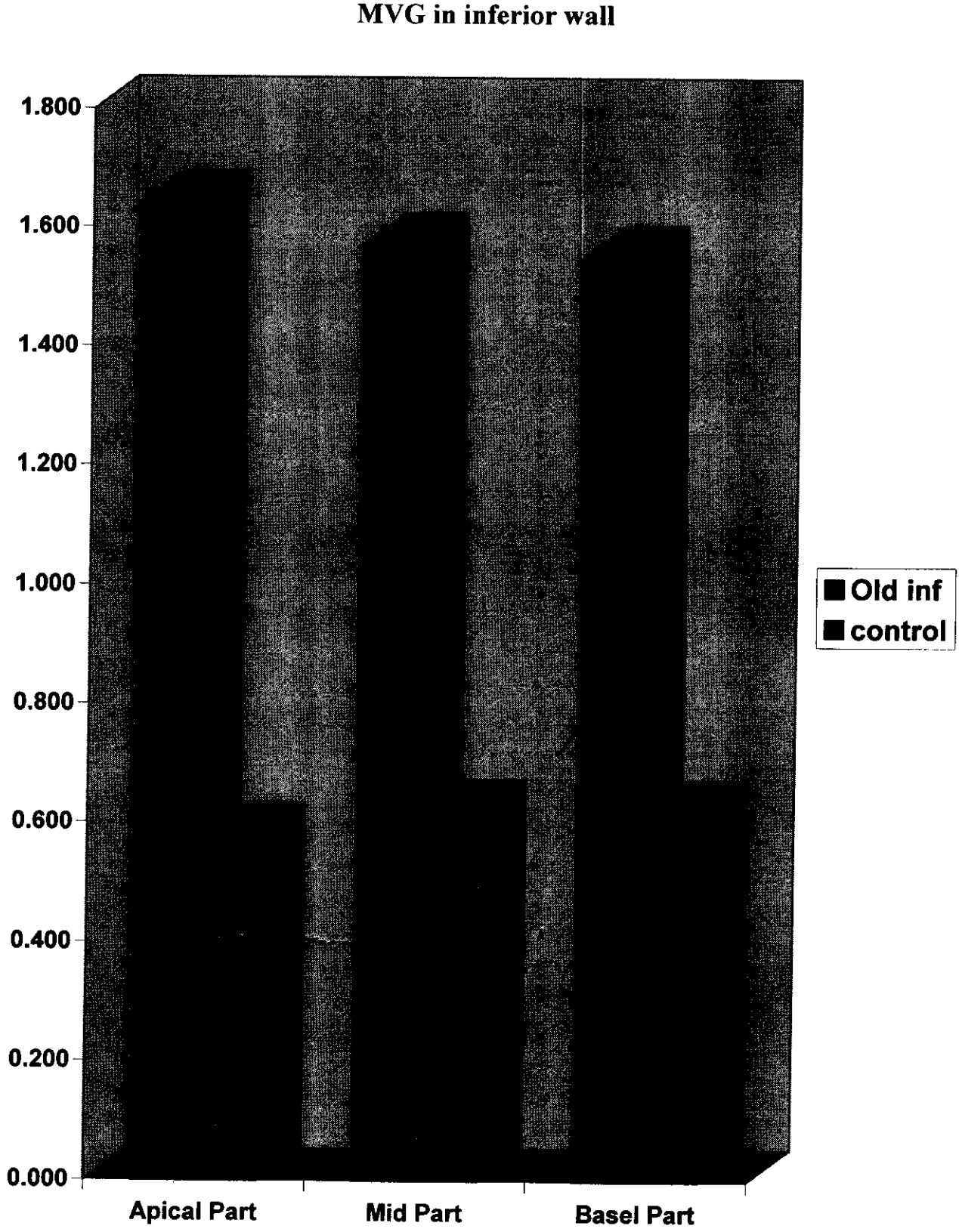

Figure (11)

MVG is lower in the inferior wall MI than control

2) **Comparison of validity of 2D Echo and Tissue Doppler Parameters in detection of normal wall motion in Anterior wall in old anterior MI (Group 1):-**

a) **2D Echocardiograph found that:-**

- **Apical part:-**
  - **11 patients with a percentage of 55% had normal wall motion where the myocardial velocity 1 patient with a percentage of 5%, $P < 0.001$ and myocardial velocity gradient 0 patient with a percentage of 0%, $P < 0.001$.**
- **Mid part:-**
  - **12 patients with a percentage of 60% had normal wall motion where the myocardial velocity 3 patients with a percentage of 15%, $P < 0.001$ and myocardial velocity gradient 2 patients with a percentage of 10%, $P < 0.001$.**
- **Basal part:-**
  - **9 patients with a percentage of 45% had normal wall motion where the myocardial velocity 11 patients with a percentage of 55%, $P > 0.05$ and myocardial velocity gradient 8 patients with a percentage of 40%, $P > 0.05$.**

Table 8: Comparison of validity of 2D Echo and Tissue Doppler Parameters in detection of normal Anterior wall motion in old anterior MI (Group 1)

Normal Wall Motion

Description		2D-Echo		MV			MVG		
		No.	%	No.	%	P.Value	No.	%	P.Value
Anterior Wall	Apical Part	11	55.0%	1	5.0%	< 0.001	0	0.0%	< 0.001
	Mid Part	12	60.0%	3	15.0%	< 0.001	2	10.0%	< 0.001
	Basal Part	9	45.0%	11	55.0%	> 0.05	8	40.0%	> 0.05

3) **Comparison of validity of 2D Echo and Tissue Doppler Parameters in detection of Anterior wall motion abnormality in old anterior MI (group 1):-**

a) 2D Echocardiograph found that:-

- **Apical part:-**
  - **9 patients with a percentage of 45% had abnormal wall motion where the myocardial velocity 19 patients with a percentage of 95%, $P < 0.001$ and myocardial velocity gradient 20 patients with a percentage of 100%, $P < 0.001$.**
- **Mid part:-**
  - **8 patients with a percentage of 40% had abnormal wall motion where the myocardial velocity 17 patients with a percentage of 85%, $P < 0.001$ and myocardial velocity gradient 18 patients with a percentage of 90%, $P < 0.001$.**
- **Basal part:-**
  - **11 patients with a percentage of 55% had abnormal wall motion where the myocardial velocity 9 patients with a percentage of 45%, $P > 0.05$ and myocardial velocity gradient 12 patients with a percentage of 60%, $P > 0.05$.**

Table 9: Comparison of validity of 2D Echo and Tissue Doppler Parameters in detection of Anterior wall motion abnormality in old anterior MI (Group 1)

There is Wall Motion Abnormalities

Description		2D-Echo		MV			MVG		
		No.	%	No.	%	P.Value	No.	%	P.Value
Anterior Wall	Apical Part	9	45.0%	19	95.0%	< 0.001	20	100.0%	< 0.001
	Mid Part	8	40.0%	17	85.0%	< 0.001	18	90.0%	< 0.001
	Basal Part	11	55.0%	9	45.0%	> 0.05	12	60.0%	> 0.05

4) **Comparison of validity of 2D Echo and Tissue Doppler Parameters in detection of normal wall motion in Inferior wall in old inferior MI (Group 2):-**

a) 2D Echocardiograph found that:-

- **Apical part:-**
  - **14 patients with a percentage of 70% had normal wall motion where the myocardial velocity 4 patients with a percentage of 20%, $P < 0.001$ and myocardial velocity gradient 3 patients with a percentage of 15%, $P < 0.001$.**
- **Mid part:-**
  - **11 patients with a percentage of 55% had normal wall motion where the myocardial velocity 4 patients with a percentage of 20%, $P < 0.05$ and myocardial velocity gradient 4 patients with a percentage of 20%, $P < 0.05$.**
- **Basal part:-**
  - **12 patients with a percentage of 60% had normal wall motion where the myocardial velocity 6 patients with a percentage of 30%, $P < 0.05$ and myocardial velocity gradient 4 patients with a percentage of 20%, $P < 0.05$.**

5) **Comparison of validity of 2D Echo and Tissue Doppler Parameters in detection of Inferior wall motion abnormality in old inferior MI (Group 2):-**

a) 2D Echocardiograph found that:-

- **Apical part:-**

- **6 patients with a percentage of 30% had abnormal wall motion where the myocardial velocity 16 patients with a percentage of 80%, $P < 0.001$ and myocardial velocity gradient 17 patients with a percentage of 85%, $P < 0.001$.**

- **Mid part:-**

  - **9 patients with a percentage of 45% had abnormal wall motion where the myocardial velocity 16 patients with a percentage of 80%, $P < 0.05$ and myocardial velocity gradient 16 patients with a percentage of 80%, $P < 0.05$.**

- **Basal part:-**

  - **8 patients with a percentage of 40% had abnormal wall motion where the myocardial velocity 14 patients with a percentage of 70%, $P < 0.05$ and myocardial velocity gradient 16 patients with a percentage of 80%, $P < 0.05$.**

Table 10: Comparison of validity of 2D Echo and Tissue Doppler Parameters in detection of normal Inferior wall motion in old inferior MI (Group 2)

Normal Wall Motion

Description		2D-Echo		MV			MVG		
		No.	%	No.	%	P.Value	No.	%	P.Value
Inferior Wall	Apical Part	14	70.0%	4	20.0%	< 0.001	3	15.0%	< 0.001
	Mid Part	11	55.0%	4	20.0%	< 0.05	4	20.0%	< 0.05
	Basal Part	12	60.0%	6	30.0%	< 0.05	4	20.0%	< 0.05

Table 11: Comparison of validity of 2D Echo and Tissue Doppler Parameters in detection of Inferior wall motion abnormality in old inferior MI (Group 2)

There is Wall Motion Abnormalities

Description		2D-Echo		MV			MVG		
		No.	%	No.	%	P.Value	No.	%	P.Value
Inferior Wall	Apical Part	6	30.0%	16	80.0%	< 0.001	17	85.0%	< 0.001
	Mid Part	9	45.0%	16	80.0%	< 0.05	16	80.0%	< 0.05
	Basal Part	8	40.0%	14	70.0%	< 0.05	16	80.0%	< 0.05

Case demonstration

Normal Colour coding (Red colouration) during contraction towards the transducer

Normal Colour coding (Blue colouration) during contraction away from the transducer

Fig (12) Normal colour coding of one of our patients of control group case No. (4)

2D echo in control group (group 3)

Normal MV and MVG in the apical part in control group (Group 3)

Fig (13) Normal MV & MVG in one of our patients of control group case No. (4)

Normal MV and MVG in the mid part in control group (Group 3)

Normal MV and MVG in the basal part in control group (Group 3)

Fig (14) Normal MV & MVG in one of our patients of control group case No. (4)

2D echo in old anterior MI (group 1)

MV and MVG in the apical part in old anterior MI (Group 1)

Fig (15) MV & MVG in the anterior wall in old anterior MI in one of our patients of group 1 case No. (19)

MV & MVG in the mid part in old anterior MI (Group 1).

MV and MVG in the basal part in old anterior MI (Group 1)

Fig (16) MV & MVG in the anterior wall in old anterior MI in one of our patients of group 1 case No. (19)

2D echo in old inferior MI (group 2)

MV and MVG in the apical part in old inferior MI (Group 2)

Fig (17) MV & MVG in the inferior wall in old inferior MI in one of our patients of group 2 case No. (13)

MV & MVG in the mid part in old inferior MI (Group 2).

MV and MVG in the basal part in old inferior MI (Group 2)

Fig (18) MV & MVG in the inferior wall in old inferior MI in one of our patients of group 1 case No. (13)

Fig (19) Coronary angiogram showing total LAD in RAO – cranial case No. (19) in old anterior MI group (1)

Fig (20) Coronary angiogram showing total RCA in LAO – cranial case No. (13) in old inferior MI group (2)