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Study of Prognostic Significance of Terminal QRS Complex Distortion in Acute ST Elevated Myocardial Infarction (STEMI) At a Tertiary Care Centre

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Abstract

Background: To Study the Prognostic Significance of Distortion of Terminal QRS Complex in Acute ST Elevated Myocardial Infarction (STEMI) at a tertiary care centre. **Subjects and Methods:** All patients diagnosed with Acute STEMI were screened and divided into two group QRS distortion (Group 1) and without QRS distortion (Group 2) based on admission ECG findings. 2D ECHO findings were noted in view of LVEF & WMSI Index and Comparison of parameters was done. **Results:** There were more males as compared to females. Mean age among Group I subjects was 54.07 ± 5.38 years and among group II subjects was 52.19 ± 4.92 years. Amongst the group I subjects the mean time of presentation at Hospital (window period) was 151.58 ± 7.64 minutes while among group II subjects, the mean time of presentation at Hospital (window period) was 184.24±6.81 minutes. Moderate dysfunction was more in group I while mild dysfunction was more in group II with statistically significant difference as p<0.01. Mean stay at hospital was 10.82 ± 8.93 days. The mean WMSI index comparatively higher in group I (2.98 ± 0.32) as compared to Group II (2.04 ± 0.47). **Conclusion:** Presence of terminal Q.R.S distortion on E.C.G was linked to L.V.S dysfunction of S.T.E.M.I patients.

Keywords: QRS Complex, Acute ST Elevated Myocardial Infarction, STEMI

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Introduction

Acute myocardial infarction remains a major public health hazard in the industrialised world, despite significant breakthroughs in diagnosis and care. According to the World Health Organization (2012), 17.5 million individuals died from cardiovascular diseases (C.V.Ds), accounting for 31% of all fatalities worldwide.[1] The combined economic burden of C.H.D stroke and diabetes is expected to reduce India's G.D.P growth by 1%.[2]

Thrombolytic therapy (T.T) fails in major proportion of cases. Subjects are "nonresponsive" have a high death risk and may be candidates for emergency angioplasty or coronary artery bypass surgery (C.A.B.S).[3,4] As a result, we need to develop some basic non-invasive bedside markers in S.T.E.M.I patients receiving T.T. So that patients might be referred to a P.C.I clinic as soon as possible.[5]

The Q.R.S complex as well as the ST segment may be affected by acute myocardial infarction. As a result, several QRS complex abnormalities on admission ECG, such as fragmented QRS, can provide crucial prognostic information on reperfusion success.[6,7,8,9] Thenonexistence of terminal QRS distortion in individuals with acute STEMI, according to Birnbaum, is a sign of myocardial protection due to extended perfusion or preconditioning by ischemia or medications.[10] The A.A.R and infarct size are all higher among subjects having terminal Q.R.S distortion.[11]

In S.T.E.M.I patients, terminal Q.R.S distortion found to be threat of mortality in several studies.

Prognosis of ST- elevation MI varies from place to place because of differences in socio-economic and cultural attributes, prevalence of various diseases in a particular area and differential importance of risk factors. As the QRS distortion [in the ECG] is the representative of the ventricular depolarization [in the action potential], the changes in ventricular depolarization can be measured using the ECG which is quick, cheap and easily available tool everywhere. This Research prognosis of acute S.T segment elevation myocardial infarction with Q.R.S distortion was evaluated at hospital Moradabad region of western Uttar Pradesh.

Aim:

To Study the Prognostic Significance of Distortion of Terminal QRS Complex in Acute ST Elevated Myocardial Infarction (STEMI) at a tertiary care Centre.

Objective:

1. To analyze the initial ECG in patients of STEMI for morphology of QRS complex.
2. To classify the patient into groups based on Birnbaums criteria.
3. To calculate Wall Motion Score Index of the patients.
4. To compare WMSI in the patient groups

WMSI Index[12]

- Wall motion score index.
- Calculation of the left ventricular wall motion score index (WMSI) with transthoracic echocardio Figurey allows the semi-quantification of left ventricular ejection fraction (LVEF).
- The 16 segment model of myocardial segmentation is recommended, as the apical cap of the 17 segment model is acontractile and therefore more appropriate for perfusion imaging.

➢ **Normokinesia (1 point)**

- Normal wall thickening and endocardial excursion

➢ **Hypokinesia (2 points)**

- Reduced wall thickening, reduced endocardial excursion

➢ **Akinesia (3 points)**

- Absence of either wall thickening or endocardial excursion

➢ **Dyskinesia (4 points)**

- Systolic outward stretching or thinning includes "aneurysmal" wall motion, which bulges eccentrically during both systole and diastole
- The original WMSI used a 16-segment paradigm for the division of the LV, as proposed by the ASE.[13]
- Each segment is given a score based on its systolic function (normal = 1, hypokinesis = 2, akinesis = 3).
- The index (WMSI) is calculated by dividing the total of the wall motion scores of each segment by 16.
- We have previously reported the linear regression model predicting RNV LVEF by WMSI and several other studies have documented the good correlation of WMSI to LVEF.[14,15,16,17,18,19]

Subjects and Methods

Study Design and Place

It was a prospective hospital based observational study at Teerthanker Mahaveer Medical College and Research Centre.

Study Population

STEMI patients admitted to Department of Medicine during the study period were included in the study after applying inclusion/exclusion criteria.

Study Period

The period of the study was 12 months after the approval of the College Research Committee and the Ethical Committee.

Sample Size[16]

Minimum of 93 MI patients admitted to Department of Medicine during the study period were included in the study.

$$\frac{[(Z\alpha/2)2 \times P(100-P)]}{E2}$$

Where

$Z2\alpha/2$=Standard normal variate;

P=Expected proportion in population based on previous study or pilot study;

E=Absolute error.

Inclusion criteria

1. All patients fulfilling the universal definition of acute myocardial infarction criteria but having ST segment elevation

Criteria for Acute Myocardial Infarction.[20]

Detection of a rise and/or fall of cardiac biomarker values (preferably cardiac troponin) with at least one value above the 99th percentile upper reference limit (URL) and with at least one of the following:

Symptoms of ischemia (include various combinations of chest, upper extremity, jaw or epigastric discomfort with exertion or at rest; the discomfort usually lasts ≤20 min, often is diffuse, not localized, not positional, not affected by movement of the region and it may be accompanied by dyspnoea, diaphoresis, nausea or syncope)

New or presumed new significant ST-segment T-wave (ST-T) changes or new left bundle branch block (LBBB)

- Development of pathologic Q waves in the electrocardiogram (ECG)
- Imaging evidence of new loss of viable myocardium or new regional wall
- Motion abnormality
- Identification of an intracoronary thrombus by angioFigurey

Exclusion criteria

- Known cases of Old MI, Atrial flutter/fibrillation, Wandering pacemaker, Bundle branch blocks, Ventricular tachycardia, Complex VPCs, A V blocks distorting T waves.
- Medications that could affect QRS segment interval.

- Patients with electrolyte imbalance, post PCI status, post CABG status, CVA, cardiomyopathy, valvular heart disease.

All those who do not consent.

Results

The present prospective hospital based observational study at Teerthanker Mahaveer Medical College and Research Centre was conducted among 100 admitted to Department of Medicine. [Table 1] showed the gender distribution according to the groups. It was seen that among group I, 86% were males and 14% were females. Among the group II subjects 82% were males and 18% were females. Hence there was more males as compared to females [Table 1, Figure 1].

Table 1: Gender distribution according to QRS distortion (Group I) and without QRS distortion (Group II)

Gender	Group I		Group II		p value
	N	%	N	%	
Male	43	86	41	82	0.79
Female	7	14	9	18	
Total	50	100	50	100	

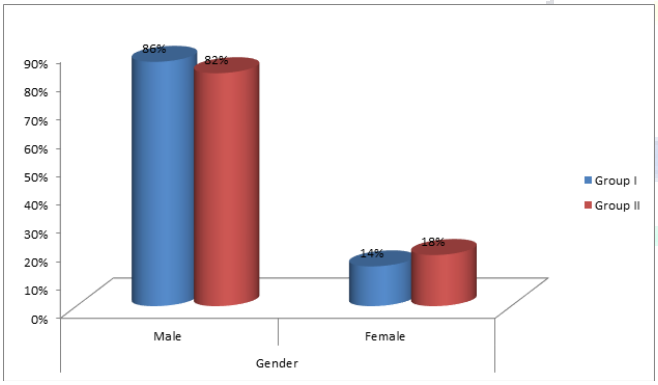

Figure 1: Gender distribution

Table 2: Mean age among the study groups

Group	Age (in years)		p value
	Mean	SD	
Group I	54.07	5.38	0.67
Group II	52.19	4.91	

[Table 2] showed the mean age among the study groups. It was seen that the mean age among Group I subjects was 54.07 ± 5.38 years and among group II subjects was 52.19 ± 4.92 years. The findings were not statistically significant.

Table 3: Co-morbidities and smoking among the study groups

Variables	Group I		Group II		p value
	N	%	N	%	
Diabetes Mellitus	6	12	8	16	0.63
Hypertension	11	22	7	14	0.42
Smoking	24	48	21	42	0.74
Family History	13	26	9	18	0.47

[Table 3, Figure 2] demonstrated the Co-morbidities and smoking among the study groups. It was seen that among group I ,12% had diabetes mellitus, 22% had hypertension, 48% had smoking habit, and 26% had family history whereas in group II, 16% subjects had diabetes mellitus, 14% had hypertension, 42% had smoking habit, and 18% had family history. These findings were not statistically significant.

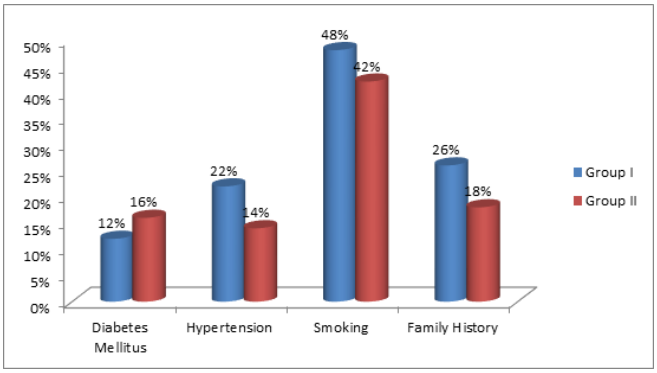

Figure 2: Co-morbidities and smoking among the study groups

Table 4: Mean Time of presentation at Hospital (window period) among the study groups

Group	Time of Presentation at Hospital (in min)		p value
	Mean	SD	
Group I	151.58	7.64	0.031*
Group II	184.24	6.81	

*: statistically significant

Amongst the group I subjects the mean time of presentation at Hospital (window period) was 151.58 ± 7.64 minutes while among group II subjects, the mean time of presentation at Hospital (window period) was 184.24±6.81 minutes. The findings were statistically significant (p= 0.031) as shown in [Table 4].

Table 5: Killip-class on admission among the study groups

Killip-Class	Group I		Group II		p value
	N	%	N	%	
1	33	66	31	62	0.36
2	11	22	15	30	
3	4	8	3	6	
4	2	4	1	2	

In [Table 5] Killip-class on admission among the study groups was seen. Killip-Class 1 was seen in 66% and 62% of group I and II subjects respectively. Killip-Class 4 was seen only in 4% of group I and 2% of group II subjects. The findings were not statistically significant.

Table 6: LVEF (%) among the study groups

LVEF (%)	Group I		Group II		p value
	N	%	N	%	
≤35 (Severe Dysfunction)	4	8	2	4	<0.01*
36 –44 (Moderate dysfunction)	23	46	9	18	
45 – 54 (Mild dysfunction)	19	38	31	62	
≥55 (Normal LV function)	4	8	8	16	

[Table 6, Figure 3] showed the LVEF (%) among the study groups. It was seen that severe dysfunction was seen among 8% (group I) and 4% (group II) subjects. Moderate dysfunction was seen among 46% (group I) and 18% (group II) subjects. Hence moderate dysfunction was more in group I while mild dysfunction was more in group II with statistically significant difference as p<0.01.

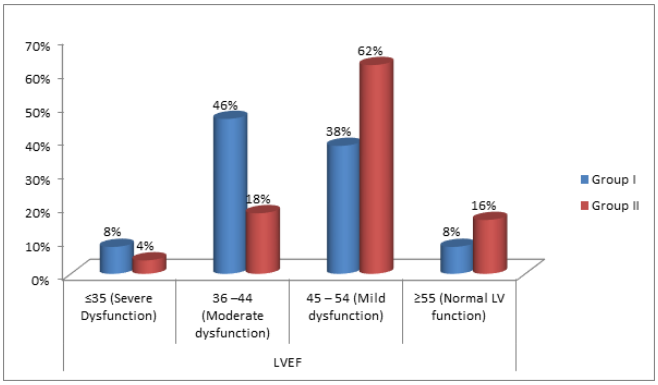

Figure 3: LVEF (%) among the study groups

Table 7: Mean stay Hospital (in days) among the study groups

Group	Mean Stay at Hospital (in days)		p value
	Mean	SD	
Group I	6.04	4.64	0.048*
Group II	10.82	8.93	

*: statistically significant

[Table 7] showed the mean stay Hospital (in days) among the study groups. It was seen that the mean stay at hospital was 6.04 ± 4.64 days among group I subjects while the mean stay at hospital was 10.82 ± 8.93 days among group II subjects with statistically significant difference as p<0.05.

Table 8: WMSI Index among the study groups

Group	WMSI		p value
	Mean	SD	
Group I	2.98	0.32	0.006*
Group II	2.04	0.47	

*: statistically significant

WMSI index among the study subjects was seen in [Table 8, Figure 8]. The mean WMSI index comparatively higher in group I (2.98 ± 0.32) as compared to Group II (2.04 ± 0.47) and the findings were statistically significant [Table 8].

Discussion

The present prospective hospital based observational study at Teerthanker Mahaveer Medical College and Research Centre was conducted among 100 admitted to Department of Medicine during the study period. Subjects divided in two groups i.e. group I and Group II and the study was performed to evaluate the prognostic significance of distortion of terminal Q.R.S complex. It was seen that among group I, 86% were males and 14% were females. Among the group II subjects 82% were males and 18% were females. Hence there was more males as compared to females in our study. Dnyaneshwar V. Mulayet al,[21] in their study showed that 76.7% and 2.33% of the subjects were male and female respectively, which is similar to our study. It was seen that the mean age among Group I subjects was 54.07 ± 5.38 years and among group II subjects was 52.19 ± 4.92 years. Ahsanet al,[22] in their study similarly revealed that the mean age among subjects with Q.R.S distortion 55.31±11.81years and 52.60±10.45 years without Q.R.S distortion group (p>0.05). These findings were similar to our study. It was seen that among group I, 12% had diabetes mellitus, 22% had hypertension, 48% had smoking habit, and 26% had family history whereas in group II, 16% subjects had diabetes mellitus, 14% had hypertension, 42% had smoking habit, and 18% had family history.

Mulayet al,[21] in their study too found similar distribution of diabetes mellitus, hypertension, smoking habit and family history. Amongst the group I subjects the mean time of presentation at Hospital (window period) was 151.58 ± 7.64 minutes while among group II subjects, the mean time of presentation at Hospital (window period) was 184.24±6.81 minutes. The findings were statistically significant (p= 0.031). Moderate dysfunction was more in group I while mild dysfunction was more in group II with statistically significant difference as p<0.01. According to Ahsanet al,[22] terminal Q.R.S distortion is associated with lower ejection fraction and L.V.E.F was significantly lower in terminal Q.R.S distortion patients, which is similar to our study. It was seen that the mean stay at hospital was 6.04 ± 4.64 days among group I subjects while the mean stay at hospital was 10.82 ± 8.93 days among group II subjects with statistically significant difference as p<0.05. The mean WMSI index comparatively higher in group I (2.98 ± 0.32) as compared to Group II (2.04 ± 0.47) and the findings were statistically significant. Group I has more mortality then group II with highly significant difference as p<0.01.QRS distortion on the admission E.C.G was also linked to a poor prognosis, according to Ahsanet al.[22] Birnbaum et al,[23] colleagues hypothesised that the lack of 'final Q.R.S distortion' is a sign of infarcted area residual perfusion via antegrade or collateral circulation, which is currently unknown.

Conclusion

It was found that presence of terminal Q.R. Sdistortion on E.C.G is linked to L.V.S dysfunction of S.T.E.M.I patients. Additionally, E.C.G on admission is a straightforward, inexpensive, and widely available test. As a result, it aids our grass-roots doctors in making early decisions about referral to a higher centre. To confirm this idea, more research with a large number of patients is recommended.

References

1. Mozaffarian D, Benjamin JE, Go AS, Arnett KD, Blaha MJ, et al. Executive Summary: Heart Disease and Stroke Statistics-2016 Update. Jr Circ. 2016; 133: 447–454.
2. Global, regional, and national disability-adjusted life-years (DALYs)

for 315 diseases and injuries and healthy life expectancy (HALE), 1990-2015: a systematic analysis for the Global Burden of Disease Study. Lancet. 2015; 388: 1603–1658.
3. Kennedy JW, Ritchie JL, Davis KB, Fritz JK. The western Washington randomized trial of intracoronary streptokinase in acute myocardial infarction, A 12 month follow up report. N Eng J Med. 1985; 312: 1073-1078.
4. Topol EJ, Califf RM, Kereiakes DJ, George BS. Thrombolysis and angioplasty in myocardial infarction. J Am Coll Cardiol. 1987; 10: 65B-74B.
5. Kothi ZS, Athar AM, Yenkanchi AP, Siddiqua begum.GA, Hussaini SM. The usefulness of fragmented QRS in predicting the successful reperfusion by using non invasive criteria of reperfusion in STEMI after thrombolytic therapy. International Journal of Contemporary Medical Research 2016; 3(10): 2965-2968.
6. Das MK, Michael MA, Suradi H, Peng J, Sinha A, Shen C, et al. Usefulness of fragmented QRS on a 12- lead electrocardiogram in acute coronary syndrome for predicting mortality. Am J Cardiol. 2009; 104: 1631-7.
7. Korhonen P, Husa T, Konttila T, Tierala I, Mäkijärvi M, Väänänen H, et al. Fragmented QRS in prediction of cardiac deaths and heart failure hospitalizations after myocardial infarction. Ann Noninvasive Electrocardiol. 2010; 15: 130-7.
8. Das MK, Saha C, El Masry H, Peng J, Dandamudi G, Mahenthiran J, et al. Fragmented QRS on a 12-lead ECG: a predictor of mortality and cardiac events in patients with coronary artery disease. Heart Rhythm. 2007; 4: 1385-92.
9. Pietrasik G, Goldenberg I, Zdzienicka J, Moss AJ, Zareba W. Prognostic significance of fragmented QRS complex for predicting the risk of recurrent cardiac events in patients with Q-wave myocardial infarction. Am J Cardiol. 2007; 100: 583-6.
10. Birnbaum Y, Sclarovsky S, The grades of ischemia on the presenting electrocardiogram of patients with ST elevation acute myocardial infarction. Journal of Electrocardiology 2001b; 34 (4): 17 - 26.
11. Fernandez JR, Valle CMJ, Diaz MR, Pizarro G, Fernandez FL, Garcia RJM, et al. Terminal QRS distortion is an independent predictor of large area at risk and infarct size in patients with anterior stemi. J Am Coll Cardiol 2015; 65(10): 196.
12. Heidi M, Connolly, Oh JK. Echocardiography. Braunwald's Heart Disease A Textbook of Cardiovascular Medicine VIIIth Edition. 2008: 227-256.
13. Schiller NB, Shah PM, Crawford M, DeMaria A, Devereux R, Feigenbaum H, et al. Recommendations for quantification of the left ventricle by two-dimensional echocardiography. American society of echocardiography committee on standards, subcommittee on quantitation of two-dimentional echocardiograms. Journal of the American Society of Echocardiography: 1989: 2(5):358–367.
14. Lebeau R, Lorenzo MD, Amyot R, Veilleux M, Lemieux R, Sauve C. A new tool for estimating left ventricular ejection fraction derived from wall motion score index. Canadian Journal of Cardiology: 2003: 19(4):397-404.
15. Rifkin RD, Koito H, Farmelant H, Skowronski M. Segmental model for estimating left ventricular ejection fraction by two-dimensional echocardiography: comparison with gated blood pool scanning. American Journal of Non-invasive Cardiology: 1990: 4(4):193–202.
16. Rifkin RD, Koito H. Comparison with radionuclide angiography of two new geometric and four nongeometric models for echocardiographic estimation of left ventricular ejection fraction using segmental wall motion scoring. American Journal of Cardiology: 1990: 65(22):1485–1490.
17. Berning J, Hoilund-Carlsen PF, Nielsen GG, Gadsboll N, Marving J, Jensen BH. Critical reappraisal of bedside echocardiographic parameters for estimation of left ventricular ejection fraction in acute myocardial infarction. Importance of the wall motion index. American Journal of Noninvasive Cardiology: 1992: 6(5):269–278.
18. Berning J, Nielsen JR, Launbjerg J, Fogh J, Mickley H, Andersen PE. Rapid estimation of left ventricular ejection fraction in acute myocardial infarction by echocardiographic wall motion analysis. Cardiology: 1992: 80(3-40):257–266.
19. Møller JE, Hillis GS, Oh JK, Reeder JS, Gersh BJ, Pellikka PA. Wall motion score index and ejection fraction for risk stratification after acute myocardial infarction. American Heart Journal: 2006: 151(2):419–425.
20. Thygesen K, Alpert JS, White HD, Jaffe AS, Katus HA, Apple FS, et al. Third Universal Definition of Myocardial Infarction. European Heart Journal: 2012: 33(20):2551-2567.
21. Mulay DV, Mukhedkar SM. Prognostic significance of the distortion of terminal portion of QRS complex on admission electrocardiogram in ST segment elevation myocardial infarction. Indian heart journal. 2013; 65(6): 671-7.
22. Ahsan MM, Akanda MA, Hashem S, Rahman MZ, Siddiqui MK, Sultana S, Reza AT, Datta RK, Mahmood K, Karmaker P. Terminal QRS Distortion on Admission Electrocardiogram as a Predictor of Left Ventricular Systolic Dysfunction in Patients with ST Elevation Myocardial Infarction. Cardiovascular Journal. 2018; 11(1): 42-9.
23. Birnbaum Y, Mahaffey K, Criger D, et al. Grade III ischemia on presentation with acute myocardial infarction predicts rapid progression of necrosis and less myocardial salvage with thrombolysis. Cardiology 2002; 97:166e-174.

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