Section: Cardiology

Original Research Article

PREDICTIVE VALUE OF THE FRAGMENTED QRS COMPLEX IN 6 MONTH MORTALITY AND MORBIDITY FOLLOWING ACUTE CORONARY SYNDROME

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Abstract

Background: The objective of the study was to determine whether FQRS is associated with increased ventricular arrhythmic event and mortality in patients with CAD and nonischemic cardiomyopathy. **Materials and Methods:** It was prospective observational study conducted in ICCU of a tertiary care hospital. Hundreds of patients who were admitted as acute coronary syndrome and underwent Coronary angiogram are selected. Exclusion criteria is applied in selecting patient. Patients were followed up for 6 month assessing electrocardiogram, echocardiography, risk factor assessed, primary and secondary endpoints are assessed. **Result:** In assessing the risk factors, it was shown no significant difference in development of FQRS at 2 months. 52 patients developed FQRS during 6-month follow-up. Left ventricular dysfunction and sudden cardiac death is most frequent in FQRS complex group. **Conclusion:** Our research showed that those with FQRS had considerably high death rate. The FQRS complex may be used to predict a patient's overall mortality.

INTRODUCTION

Coronary artery disease (CAD) continues to be a major factor in both mortality and morbidity in humans. As a result, risk stratification is a crucial problem in healthcare for the treatment and prevention of CAD.[1,2] Improved electrocardiographic criteria are required for the early diagnosis of myocardial infarction (MI) episodes, including Q wave, persistent ST-segment elevations, QRS disturbances and bundle branch blockages.[3] Yet, the prognostic importance of these findings for adverse outcomes is not well understood.[4]

To identify those who are at high risk and need more extensive treatment, recognised risk stratification techniques are used. However, due to the requirement for further clinical and laboratory data, these techniques have considerable limitations for assessing emergency admissions for CAD. The use of new electrocardiographic parameters, which represent abnormalities in the electrical activity of the myocardial cells and offer accurate prognostic information, is also not included in these tools, which inhibits risk stratification and the evaluation of prognosis beyond conventionally used variables.[5]

Flowers NC et al,[6] were the first researchers to examine the blurring and morphological changes in the QRS complex and to document the presence of f-QRS complexes. A fragmented QRS is defined as the occurrence of an additional (extra) R wave (R′) or notching within the nadir of the S wave, or the presence of more than one R′ (fragmentation) in two adjacent ECG leads, with regard to a significant coronary artery territory. Furthermore, Das MK et al defined wide complex QRS fragmentation as different RSR′ patterns with or without a Q wave, with > 2 R waves (R′) or > 2 notches within the R wave, or > 2 notches within the down-stroke or up-stroke of the S wave, in 2 contiguous leads regarding a significant coronary artery territory in fragmented BBB, as well as the presence of > 2 R′ or > 2 notches within the S waves in 2 contiguous leads in fQRS.[7] Numerous research has evaluated how fragmented QRS (fQRS) may be used clinically to identify those who would have adverse results.

Objectives

The objective of the study was to determine whether fQRS is associated with increased ventricular arrhythmic event and mortality in patients with

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CAD and nonischemic dilated cardiomyopathy (DCM).

MATERIALS AND METHODS

Study Design

This was a prospective observational study conducted in ICCU of a tertiary care hospital, Coimbatore.

Study Population

100 acute coronary syndrome from the inpatient ICCU of a tertiary care hospital, Coimbatore, who underwent coronary artery angiography to evaluate chest pain

Inclusion Criteria

Both male and female patients who were admitted with acute coronary syndrome undergoing coronary angiography

Exclusion Criteria

Patients with a known history of hypertrophic cardiomyopathy as well as those with congenital heart disease, clinically significant valvular disease, cardiomyopathy, chronic obstructive pulmonary disease, renal insufficiency (serum creatinine >1.5 mg dl−1), AV conduction disturbances, atrial fibrillation and were excluded from the present study.

Sample Size

The adequate required sample size was estimated using following formula, n = z2pq / d2 which comes out to be around 90-100, where n = sample size, z = 1.96 (considering 0.05 alpha, 95% confidence limits and 80% beta), p = assumed probability of occurrence or concordance of results, q = 1 – p and d is the marginal error (precession)

Data collection procedure

After obtaining written consent, the patients were studied for following parameters using the study tools.

The Study Tools Comprised of Five Sections

(i) General History: The questionnaire comprises age, sex, history of hypertension, history of diabetes mellitus and any other significant past history.

(ii) Physical examination: The section includes examination of vitals and systemic examination

(iii) Investigation: The section includes study of echocardiography of each patient according to echo guidelines for acute myocardial infarction, other relevant blood investigations and echocardiography (Two-dimensional Echo and Doppler)

Statistical Analysis

Data was analyzed with Statistical Package for Social Sciences (SPSS -IBM) software version 21. For quantitative variables proportions was calculated. Chi square test and Mann -Whitney test was applied to find the association of risk factors among STEMI and NSTEMI patients. P value of <0.05 was considered significant

Ethical consideration and confidentiality: Institutional Ethical Committee approval was obtained before starting of the study. Confidentiality of study participants was maintained in all the phases of the study.

RESULTS

The mean age of the study participants was 59.18 ± 7.33. Majority of the study participants were males (81%).

There was no loss to follow up at 2 months and at 2-months, 41 patients had fragmented QRS. On assessing the potential risk factors, it was shown that no significant difference in the assessed risk factors (hypertension, p- 0.20; diabetes, p- 0.76; smoking, p- 0.23; hyperlipidaemia, p- 0.50; family history of CAD, p- 0.74) or medications (beta blockers, p- 0.31; calcium channel blockers, p- 0.42; angiotensin-converting enzyme inhibitors, p- 0.21; streptokinase, p- 0.28) with the development of fragmented QRS at 2 month follow up. Likewise, there was no significant difference in the readmission rate (p- 0.59), coronary angiography (p- 0.71), per-cutaneous coronary intervention (p- 0.62) or CABG (p- 0.23) among the patients with and without fQRS at 2 months.

Similarly at 6 months follow-up, it has been observed that 52 patients had fragmented QRS. The rate of readmission (p- 0.49) and need for CABG or percutaneous coronary intervention (p- 0.08) showed no significant difference among the patients with and without fQRS at 6 months.

At 6 months, it was shown that the Left ventricular ejection fraction among those with fQRS and those without fQRS was 44.33 ± 1.27 and 52.48 ± 1.13 respectively, which was statistically significant (p- <0.001). Among those with fQRS at 2-months, 14 (31%) developed LVD at 6 months and among those without fQRS at 2 months, 9 (15.3%) developed LVD at 6 months. This difference was statistically significant (p- 0.027). Mortality was seen among 6 patients with fQRS and 2 patients without fQRS with p value of 0.041 (statistically significant). 4 patients with fQRS had sudden cardiac death.

Table 1: Initial presentation of the study participants

S No	Variable	Frequency	Percentage
1	Primary Diagnosis		
	Unstable angina	15	15
	Non-ST elevation MI	16	16
	Anterior/Inferior MI	57	57
	Postero-inferior MI	12	12
2	QRS complex		
	With fQRS	33	33
	Without fQRS	67	67

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3	fQRS location (N=33) Anterior leads Inferior leads	 19 14	 57.6 42.4

Table 2: Probable risk factors for the development of fQRS

S No	Variable	Patients (n=100)	With fQRS (n=33)	Without fQRS (n=67)	p-value
1	Hypertension	34	10	24	0.58
2	Diabetes	21	7	14	0.97
3	Smoking	37	12	25	0.92
4	Hyperlipidaemia	33	10	23	0.68
5	Family history of CAD	18	5	13	0.6
6	Thrombolytic therapy	36	14	22	0.34
7	Elevated CPK	65	19	46	0.27
8	Elevated cardiac troponin I	72	25	47	0.55

Table 3: Patient data with Table and without fragmented QRS at the initial presentation

S No	Variable	Patients (n=100)	With fQRS (n=33)	Without fQRS (n=67)	p-value
1	LVEF (mean)	43.25	43.67	43.04	0.05
2	Elective CAG	79	25	54	0.57
3	CAG findings 1 vessel disease 2 vessel disease 3 vessel disease	 25 33 18	 10 9 10	 15 24 8	 0.39 0.28 0.02
4	LV dysfunction	57	19	38	0.93
5	PCI	55	22	33	0.1
6	CABG	21	9	12	0.28

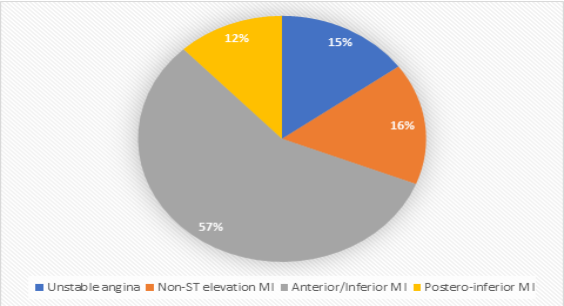

Figure 1: primary diagnosis of study participants

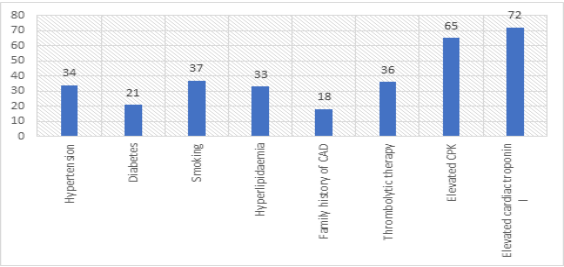

Figure 2: Probable risk factors among the study participants

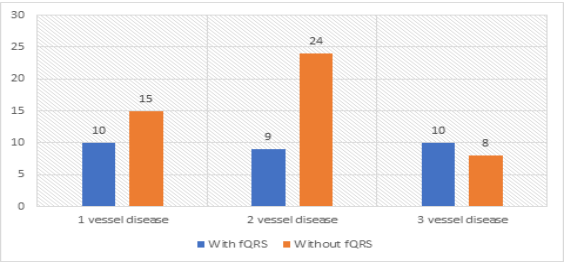

Figure 3: CAG findings at initial presentation

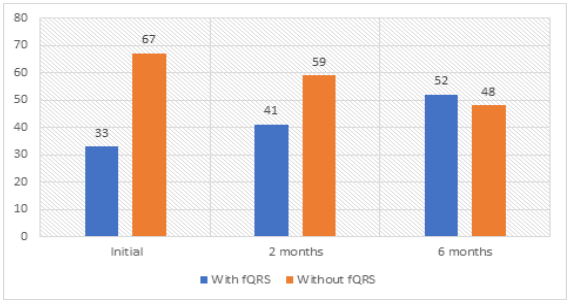

Figure 4: Fragmented QRS during initial presentation, 2 months and 6 months

DISCUSSION

Since the advent of efficient techniques to reduce infarct size and cure residual ischemia, the prognosis for MI has significantly improved both in the short and long terms. However, a significant portion of patients still have progressive heart failure with a negative result, even in the absence of recurrent MI. Age, past MI, and diabetes are among clinical factors that have been linked to the development of heart failure and cardiac mortality. In individuals with coronary artery disease, it has been shown that increased QRS complex fragmentation on a 12-lead ECG may predict cardiac events such arrhythmia, heart failure, and mortality. This study was conducted with the objective to determine whether fQRS is associated with increased ventricular arrhythmic event and mortality in patients with CAD and nonischaemic dilated cardiomyopathy (DCM).

The present study has shown that the mean age of the study participants was 59.18 ± 7.33. Majority of the study participants were males (81%). Similarly in a study done by Akbarzadeh F et al8, it was shown that the mean age of the study participants was 57.7 ± 12.8 and majority (84%) were males.

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Similarly in a study done by Younis AS et al,[9] it was shown that the mean age of the study participants with fQRS and non fQRS was 52.52 and 54.29 respectively and majority of the study participants in both the groups were males.

It has been proposed that cardiac scarring and/or ischemia produce the inhomogeneous activation of the ventricles, which is the explanation behind the QRS complex fragmentation observed on the 12-lead surface ECG.[6] Previous studies have identified the peri-infarction conduction block, also known as fragmented QRS, as the notching of the QRS wave following a MI.[10] Autopsy results in individuals with MI and left ventricular aneurysm that indicate the presence of substantial myocardial necrosis with "islands" of viable myocardium tissue interspersed in fibrous tissue support the putative mechanism of fragmentation.[11] Chronically ischemic myocardium exhibits sluggish activation in its affected parts due to partly depolarized and slowed action potential upstroke, which is likely the cause of the left ventricle's uneven activation.

The present study has shown that 33% of the study participants was with fQRS, among them 57.6% location was in anterior leads. In the study done by Younis AS et al,9 46 out of 84 patients had fQRS, and among them 39% had fQRS in 2 leads. In the present study there was no significant difference in the prevalence of risk factors such as hypertension, diabetes, smoking, hyperlipidaemia, CAD, thrombolytic therapy. It was shown that no significant difference in the assessed risk factors or medications with the development of fragmented QRS at 2 month follow up. Likewise, there was no significant difference in the readmission rate, coronary angiography, per-cutaneous coronary intervention or CABG among the patients with and without fQRS at 2 months. Similarly at 6 months follow-up, it has been observed that 52 patients had fragmented QRS. The rate of readmission and need for CABG or percutaneous coronary intervention showed no significant difference among the patients with and without fQRS at 6 months.

In a study done by Liang Di et al,[12] it was shown that, Patients with anterior wall infarction had a considerably greater frequency of fQRS in the inferior wall leads than in any other lead. At 6 months, it was shown that the Left ventricular ejection fraction among those with fQRS and those without fQRS was 44.33 ± 1.27 and 52.48 ± 1.13 respectively, which was statistically significant (p-<0.001) in the present study. There was no discernible change in ejection fraction between patients with and without fragmented QRS on initial admission and at 2-month follow-up in the current investigation, according to a study by Akbarzadeh F et al8. However, at 6-month follow-up, patients with fragmented QRS had left ventricular ejection fractions that were significantly lower than those of patients without fragmentation, and those who had fragmentation at the 2-month follow-up were at a higher risk of developing left ventricular dysfunction. This variation in left ventricular function has also been seen in previous research, where it was discovered that the ECG's fragmented QRS accurately represented substantial left ventricular dilatation and a decline in ejection fraction.

The present study showed that mortality was seen among 6 patients with fQRS and 2 patients without fQRS with p value of 0.041 (statistically significant). 4 patients with fQRS had sudden cardiac death. Fragmented QRS was shown to be strongly related with a greater risk of in-hospital mortality, long-term mortality, in-hospital MACE, and long-term MACE in a systematic study conducted by Luo G et al.[13] It specifically showed that patients with AMI and patients with ST-segment elevation myocardial infarction (STEMI) had a stronger predictive value for in-hospital cardiovascular death and long-term all-cause mortality. Additionally, fQRS was linked to a higher risk of heart failure and ventricular arrhythmias. Fragmented QRS was favourably related with a high prevalence of coronary artery triple vessel lesions in AMI patients and negatively associated with left ventricular ejection function (LVEF).

The fQRS(+) group had a considerably greater incidence of in-hospital cardiovascular mortality than the fQRS(-) group, according to a research by Akgul O et al.[14] Bozbeyolu E. et al,[15] demonstrated that, with the exception of hyperlipidemia, the demographic features and cardiovascular risk factors in both groups were comparable. Patients with fQRS had higher GRACE risk scores, which were strongly linked with the presence of fQRS. Although 30-day and in-hospital mortality were comparable, the fQRS group had a greater rate of late death. Age, heart rate, and male sex were found to be predictors of late death in addition to fQRS. According to Guo R et al,[16] over a mean follow-up of 12 months, the fQRS group had a greater risk of significant cardiac events and cardiac death. The event-free survival for cardiac events and cardiac mortality was considerably lower, according to a Kaplan-Meier survival analysis. Significant fQRS was shown to be an independent significant risk factor for cardiac events and cardiac death by multivariate Cox regression analysis. Brenyo A et al,[17] observed that inferiorly positioned fQRS complexes were a reliable indicator of sudden cardiac-linked mortality and implanted cardioverter defibrillator shock. In addition, Korhonen P et al,[18] found that post-MI patients had a 40% greater risk of sudden cardiac death.

CONCLUSION

In conclusion, our research showed that those with fQRS had considerably higher death rates. The fQRS complex may be used to predict a patient's overall mortality. The predictive value of scoring

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systems may be increased by include this metric in addition to the typical clinical and paraclinical factors of risk in patients with ACS.

REFERENCES

1. Fox KA, Cokkinos DV, Deckers J, Keil U, Maggioni A, Steg G. The ENACT study: a pan-European survey of acute coronary syndromes. European heart journal. 2000 Sep 1;21(17):1440-9.
2. Kolansky DM. Acute coronary syndromes: morbidity, mortality, and pharmacoeconomic burden. American Journal of Managed Care. 2009 Mar 1;15(2):S36.
3. Nakamura N, Gohda M, Satani O, Tomobuchi Y, Ueno Y, Tanimoto T, Kitabata H, Takarada S, Kubo T, Mizukoshi M, Hirata K. Myocardial salvage for ST-elevation myocardial infarction with terminal QRS distortion and restoration of brisk epicardial coronary flow. Heart and vessels. 2009 Mar;24:96-102.
4. Michael MA, El Masry H, Khan BR, Das MK. Electrocardiographic signs of remote myocardial infarction. Progress in cardiovascular diseases. 2007 Nov 1;50(3):198-208.
5. Bonow RO, Bohannon N, Hazzard W. Risk stratification in coronary artery disease and special populations. The American journal of medicine. 1996 Oct 8;101(4):17S-24S.
6. FLOWERS NC, HORAN LG, Thomas JR, TOLLESON WJ. The anatomic basis for high-frequency components in the electrocardiogram. Circulation. 1969 Apr;39(4):531-9.
7. Das MK, Suradi H, Maskoun W, Michael MA, Shen C, Peng J, Dandamudi G, Mahenthiran J. Fragmented wide QRS on a 12-lead ECG: a sign of myocardial scar and poor prognosis. Circulation: Arrhythmia and Electrophysiology. 2008 Oct 1;1(4):258-68.
8. Akbarzadeh F, Pourafkari L, Ghaffari S, Hashemi M, Sadeghi-Bazargani H. Predictive value of the fragmented QRS complex in 6-month mortality and morbidity following acute coronary syndrome. International Journal of General Medicine. 2013 May 28:399-404
9. Younis AS, El-Halag MI, ElBadry MA, Abbas NI. Fragmented QRS complex frequency and location as predictor of cardiogenic shock and mortality following acute coronary syndrome. The Egyptian Heart Journal. 2020 Dec;72:1-7.
10. Flowers NC, Horan LG, Wylds AC, Crawford W, Sridharan MR, Horan CP, Cliff SF. Relation of peri-infarction block to ventricular late potentials in patients with inferior wall myocardial infarction. The American journal of cardiology. 1990 Sep 1;66(5):568-74.
11. Varriale P, Chryssos BE. The RSR′ complex not related to right bundle branch block: diagnostic value as a sign of myocardial infarction scar. American heart journal. 1992 Feb 1;123(2):369-76.
12. Liang D, Zhang J, Lin L, Zong W. The difference on features of fragmented QRS complex and influences on mortality in patients with acute coronary syndrome. Acta Cardiologica Sinica. 2017 Nov;33(6):588.
13. Luo G, Li Q, Duan J, Peng Y, Zhang Z. The predictive value of fragmented QRS for cardiovascular events in acute myocardial infarction: a systematic review and meta-analysis. Frontiers in Physiology. 2020 Oct 6;11:1027.
14. Akgul O, Uyarel H, Pusuroglu H, Surgit O, Turen S, Erturk M, Ayhan E, Bulut U, Baycan OF, Demir AR, Uslu N. Predictive value of a fragmented QRS complex in patients undergoing primary angioplasty for ST elevation myocardial infarction. Annals of Noninvasive Electrocardiology. 2015 May;20(3):263-72.
15. Bozbeyoğlu E, Yıldırımtürk Ö, Yazıcı S, Ceylan US, Erdem A, Kaya A, Dönmez C, Akyüz Ş, Çetin M. Fragmented QRS on Admission Electrocardiography Predicts Long- Term Mortality in Patients with Non–ST- Segment Elevation Myocardial Infarction. Annals of Noninvasive Electrocardiology. 2016 Jul;21(4):352-7.
16. Guo R, Zhang J, Li Y, Xu Y, Tang K, Li W. Prognostic significance of fragmented QRS in patients with non-ST elevation myocardial infarction. Herz. 2012 Nov 1;37(7):789.
17. Brenyo A, Pietrasik G, Barsheshet A, Huang DT, Polonsky B, McNITT SC, Moss AJ, Zareba W. QRS fragmentation and the risk of sudden cardiac death in MADIT II. Journal of Cardiovascular Electrophysiology. 2012 Dec;23(12):1343-8.
18. Korhonen P, Husa T, Konttila T, Tierala I, Mäkijärvi M, Väänänen H, Ojanen J, Vehtari A, Toivonen L. Fragmented QRS in prediction of cardiac deaths and heart failure hospitalizations after myocardial infarction. Annals of Noninvasive Electrocardiology. 2010 Apr;15(2):130-7.

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