



## Frequency of fragmented QRS in patients with acute Non ST elevation Myocardial Infarction (NSTEMI).

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**ABSTRACT... Objective:** To determine the frequency of fragmented QRS complex in patients with acute non-ST elevation myocardial infarction (NSTEMI). **Study Design:** Cross-Sectional Study. **Setting:** Department of Cardiology, Faisalabad Institute of Cardiology, Faisalabad. **Period:** July 15, 2019 to January 15, 2020. **Material & Methods:** One hundred and forty five diagnosed patients of NSTEMI on the basis of chest pain and positive troponin-I were included in this study. The electrocardiography (ECG) was performed to document the presence or absence of f QRS complex in these patients. A 12-lead ECG with paper speed of 25 or 50 mm per second and a voltage of 10 mm/mv was used. fQRS was labeled (as per operational definition). The collected data were entered and analyzed statistically by using SPSS v25.0. Data were stratified for age, gender, diabetes, smoking and hypertension. Post-stratification, f QRS complex was compared by Chi-Square test in stratified groups. A p-value  $\leq 0.05$  was taken as significant. **Results:** Total 145 patients presenting with NSTEMI were selected for this study. Mean age of the patients was  $48.2 \pm 12.3$  year. Among these patients, 90(62.1%) were males, while 55(37.9%) were females. Overall frequency of fQRS complex in patients with NSTEMI was 64(44.1%). **Conclusion:** There is an association of fQRS among patients with acute non-ST elevation myocardial infarction (NSTEMI). Further prospective studies are needed to determine the clinical significance of fQRS complex and identify its correlation with the incidence of possible complications.

**Key words:** Fragmented QRS Complex, Non-ST Elevation Myocardial Infarction.

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## INTRODUCTION

Acute coronary syndrome (ACS) is a frequent reason of hospital admission and mortality worldwide. ACS is a spectrum of ST segment elevation MI (STEMI), non-ST segment elevation MI (NSTEMI) and crescendo angina. ECG is the initial investigation in the diagnosis of ACS. In the absence of ST segment elevation, raised cardiac biomarkers differentiate NSTEMI from unstable angina.<sup>1</sup> NSTEMI results from acute atheromatous plaque change in coronary arteries resulting in subtotal or near complete occlusion of coronary artery and necrosis of myocardium which result in the raised cardiac biomarkers i.e. troponin.

Unlike STEMI with poor short term prognosis, NSTEMI is associated with poor long term prognosis.<sup>2</sup> ECG can be normal or may show

grave changes (i.e. temporary ST segment elevation or ST segment depression and T wave inversion), so raised serum cardiac biomarkers (i.e. troponin) help us to diagnose NSTEMI.

Electrocardiogram (ECG) is an easily accessible, non-invasive and cheap tool used by doctors working in emergency department for diagnosis of ACS. ECG is not only used for the diagnosis but also for prognostic stratification of ACS patients. Anything that can be predicted on ECG is much helpful for immediate and timely management decisions.

Fragmented QRS (f QRS) is a new concept. It means an additional spike in QRS complexes detected on ECG. It is a new and novel marker of cardiac ischemia and fibrosis due to disturbed

conduction during myocardial infarction and ischemia. Studies have shown the relation between increased rate of ventricular arrhythmias and mortality in acute coronary syndrome with fragmented QRS in ECG as compared to those patients who have no fragmented QRS.<sup>3</sup>

Studies have also revealed that the frequency of poor cardiac, vascular outcomes and recurrent angina are much greater in patients with fragmented QRS in ACS.<sup>2</sup> Worldwide Studies showed the variable results about the frequency of fragmented QRS in NSTEMI group of patient and results from studies in term of frequency of f QRS in NSTEMI patients were different.

One study by Eyuboglu M showed the frequency of f QRS as 23.5%<sup>4</sup> in NSTEMI patients versus another study by Min Li showing the frequency of 55.56%.<sup>2</sup> But no published study available in local setting to tell us about the prevalence of this finding in our local population.

## OBJECTIVE

To determine the frequency of fragmented QRS (f QRS) complex in patients presented with acute non-ST elevation myocardial infarction (NSTEMI) in emergency department.

## OPERATIONAL DEFINITIONS

### NSTEMI

It was labeled if the presence of chest pain of cardiac origin for more than 20 min, with troponin >100 IU or >0.30 ng/ml after at least 6 hours of onset of symptoms.<sup>5</sup>

### Fragmented QRS complex

F QRS included various morphologies of the QRS (<120 ms), which included an extra R wave (R'), an indentation in the lowest part of the R wave or of the S wave, or the existence of more than one R prime (fragmentation) in two neighboring leads, pointing towards a major coronary artery area.<sup>6</sup>

## MATERIAL & METHODS

The study was conducted at Department of Cardiology, Faisalabad Institute of Cardiology,

Faisalabad. From July 15, 2019 to January 15, 2020. It was Descriptive Cross Sectional Study. Sample size of 145 patients was considered with 95% confidence level with 7% margin of error and taking probable percentage of f QRS as 23.5%<sup>4</sup> in NSTEMI patients. Non-Probability Consecutive Sampling was used.

### Selection Criteria

- Patients of ages between 18-70 years
- Patients of either gender
- Patients presenting in Faisalabad Institute of Cardiology with NSTEMI (as per operational definition)

### Exclusion Criteria

- Patients presenting with STEMI
- Patient with typical bundle branch block with QRS > 120 msec
- Patients with valvular or structural heart disease (on medical record)
- Patients with renal failure (creatinine > 1.2mg/dl), (on medical record)
- Patients with deranged liver function tests (AST>40IU/dl, ALT>40IU/dl, bilirubin > 1mg/dl), (on medical record)
- Patients with Sepsis, muscle injury or trauma (on medical record)

One hundred and forty five diagnosed patients of NSTEMI on basis of chest pain and positive troponin-I were included in this study from the ER Department of Cardiology,

Faisalabad Institute of Cardiology, Faisalabad. Before data collection, Informed consent was taken from all the selected patients.

Patient's name, age, gender, duration of symptoms, history of smoking, diabetes and hypertension were documented in proforma. Then the electrocardiography (ECG) was performed to document the existence or nonexistence of fragmented QRS complex in these patients.

A 12-lead ECG with paper speed of 25-50mm/sec and a current voltage of 10 mm/mv was used. ECG analysis were done by two cardiologists. Any disagreement was adjusted by a third reviewer

(cardiologist).

If any QRS (<120 ms), which has an extra R wave (R') or indentation in the lowest part of the S wave, or >1 R' (fragmentation) in 2 neighboring leads, f QRS was labelled (as per operational definition). The collected data were documented in proforma.

The collected data were entered and analysed statistically by using SPSS v25.0. Quantitative variables like age and symptoms time period were presented in the form of mean and standard deviation (SD). Qualitative variables like gender, diabetes, hypertension, smoking and f QRS complex were presented in the form of frequency and percentage. Data were stratified for age, gender, diabetes, smoking and hypertension. Post-stratification, f QRS complex was compared by Chi-Square test in stratified groups. A p-value  $\leq 0.05$  was considered to be of significant value.

## RESULTS

Total 145 patients presenting with NSTEMI were selected for this study. Mean age of the patients was  $48.2 \pm 12.3$  year. Among these patients, 90(62.1%) were males, while 55(37.9%) were females.

Majority of the patients 84(57.9%) had ages between >45 years. While 13(9.0%) and 48(33.1%) patients were between 18-30 years and 31-45 years of age groups respectively.

In this study, 74(51.0%) patients were hypertensive and 81(55.9%) as diabetic. Among NSTEMI patients, 33(22.8%) were smokers.

Overall frequency of fQRS complex in patients with NSTEMI was 64(44.1%). By stratification of fQRS complex, it was concluded that, there is a significant relationship between fQRS complex and hypertension, smoking and type II diabetes mellitus ( $p=0.000001$ ,  $p=0.030$ ,  $p=0.000001$ ).

| Gender | N (%)        |
|--------|--------------|
| Male   | 90 (62.1%)   |
| Female | 55 (37.9%)   |
| Total  | 145 (100.0%) |

**Table-I. Frequency distribution of gender.**

| Age groups  | N (%)        |
|-------------|--------------|
| 18-30 years | 13 (9.0%)    |
| 31-45 years | 48 (33.1%)   |
| >45 years   | 84 (57.9%)   |
| Total       | 145 (100.0%) |

**Table-II. Frequency distribution of age groups.**

| Smoking | N (%)        |
|---------|--------------|
| Yes     | 33 (22.8%)   |
| No      | 112 (77.2%)  |
| Total   | 145 (100.0%) |

**Table-III. Frequency distribution of smoking.**

| Diabetes Mellitus | N (%)        |
|-------------------|--------------|
| Yes               | 81 (55.9%)   |
| No                | 64 (44.1%)   |
| Total             | 145 (100.0%) |

**Table-IV. Frequency distribution of diabetes mellitus.**

| Hypertension | N (%)        |
|--------------|--------------|
| Yes          | 74 (51.0%)   |
| No           | 71 (49.0%)   |
| Total        | 145 (100.0%) |

**Table-V. Frequency distribution of hypertension.**

| fQRS Complex | N (%)        |
|--------------|--------------|
| Present      | 64 (44.1%)   |
| Absent       | 81 (55.9%)   |
| Total        | 145 (100.0%) |

**Table-VI. Frequency distribution of FQRS complex.**

| Gender | FQRS Complex |            | Total        | P-Value |
|--------|--------------|------------|--------------|---------|
|        | Present      | Absent     |              |         |
| Male   | 39 (43.3%)   | 51 (56.7%) | 90 (100.0%)  | 0.803   |
| Female | 25 (45.5%)   | 30 (54.5%) | 55 (100.0%)  |         |
| Total  | 64 (44.1%)   | 81 (55.9%) | 145 (100.0%) |         |

**Table-VII. Stratification of fQRS complex with respect to gender.**

| Age Groups  | FQRS Complex |            | Total        | P-Value |
|-------------|--------------|------------|--------------|---------|
|             | Present      | Absent     |              |         |
| 18-30 years | 3 (23.1%)    | 10 (76.9%) | 13 (100.0%)  | 0.276   |
| 31-45 years | 22 (45.8%)   | 26 (54.2%) | 48 (100.0%)  |         |
| >45 years   | 39 (46.4%)   | 45 (53.6%) | 84 (100.0%)  |         |
| Total       | 64 (44.1%)   | 81 (55.9%) | 145 (100.0%) |         |

**Table-VIII. Stratification of FQRS complex with respect to age.**

| Smoking | FQRS Complex |            | Total        | P-Value |
|---------|--------------|------------|--------------|---------|
|         | Present      | Absent     |              |         |
| Yes     | 20 (60.6%)   | 13 (39.4%) | 33 (100.0%)  | 0.030   |
| No      | 44 (39.3%)   | 68 (60.7%) | 112 (100.0%) |         |
| Total   | 64 (44.1%)   | 81 (55.9%) | 145 (100.0%) |         |

**Table-IX. Stratification of fQRS complex with respect to smoking.**

| Diabetes Mellitus | FQRS Complex |            | Total        | P-Value  |
|-------------------|--------------|------------|--------------|----------|
|                   | Present      | Absent     |              |          |
| Yes               | 51 (63.0%)   | 30 (37.0%) | 81 (100.0%)  | 0.000001 |
| No                | 13 (20.3%)   | 51 (79.7%) | 64 (100.0%)  |          |
| Total             | 64 (44.1%)   | 81 (55.9%) | 145 (100.0%) |          |

**Table-X. Stratification of FQRS complex with respect to diabetes mellitus.**

| Hypertension | FQRS Complex |            | Total        | P-Value  |
|--------------|--------------|------------|--------------|----------|
|              | Present      | Absent     |              |          |
| Yes          | 47 (63.5%)   | 27 (36.5%) | 74 (100.0%)  | 0.000001 |
| No           | 17 (23.9%)   | 54 (76.1%) | 71 (100.0%)  |          |
| Total        | 64 (44.1%)   | 81 (55.9%) | 145 (100.0%) |          |

**Table-XI. Stratification of FQRS complex with respect to hypertension.**

## DISCUSSION

QRS complex (representation of ventricular depolarization) and ST-T wave (ventricular repolarization) changes are easily and quickly accessible on the ECG which is cheap and readily available tool everywhere). In this way any changes in the Electrocardiogram can be picked and managed early.<sup>7-8</sup>

Presence of subtle abnormality within the QRS complex is associated with myocardial scarring, ischemia and fibrosis which is due to the signal conduction disturbance and ventricular depolarization abnormalities.<sup>9</sup>

When assessing results, fQRS was linked with higher risk of death due to any cause after correction for age, ejection fraction (EF) and presence of type II diabetes mellitus.<sup>10</sup>

Fragmentation results from damaged cells close to an infarcted area where ventricular activation is slow and lacks synchrony leading to RSR' shape of the QRS in 12-lead Electrocardiography.<sup>11</sup>

In a cohort of 56 patients, fragmented QRS appears to have relationship with chronic total coronary occlusion with poor retrograde supply from collaterals in patients who did not have history of myocardial infarction in the past.<sup>12</sup>

Das et al.,<sup>9</sup> showed that wide QRS is linked with a significantly more chances of death when measured with normal QRS (P=0.017) when these patients were followed for 29 months. The study outcomes are in coherence with the death rates published in patients with a fragmented QRS of <120 ms duration.<sup>13</sup>

The incidence of ST elevation myocardial infarction has decreased from 66.6% to 37.5%, and the incidence of NSTEMI has increased considerably.<sup>14</sup>

The changed pattern of ventricular depolarization, most likely represents fragmentation in the QRS complex on ECG.<sup>15</sup>

fQRS has shown relationship for death due to cardiac causes and admission in hospital with heart failure in patients who suffered MI in the past.<sup>16</sup>

Among the 145 patients who had NSTEMI, 62.1% were male whereas 37.9% were females. The patients of fQRS group in the present study had a higher mean age as compared with non-fQRS, but this was not statically significant (0.276).

However, Cetin et al.,<sup>17</sup> Guo et al.,<sup>7</sup> and Dabbagh Kakhkiet al.,<sup>18</sup> showed in their study that age has significant relationship with fQRS. Because of this difference age may not be an important factor. The fQRS was found in 44.1% patients.

In other studies, like Guo et al.<sup>7</sup> fQRS was 54% whereas in another study by Li et al.<sup>2</sup> fQRS was 46% and this is almost similar to our study. fQRS complex indicates scar formation of the myocardium, but if somebody has angina it is a sign of ongoing ischemia and alive myocardium which should be treated with early invasive approach to avoid damage to left ventricular function.

The fragmented QRS complex whether narrow or wide QRS complex is a common finding recorded in an ECG. Studies done in the past have shown that the fQRS is an important indicator of bad cardiac and vascular outcomes, death and heart failure.<sup>3</sup>

The fQRS complex is seen more commonly in those patients who have dilatation of both ventricles and history of infarction. Also if an ischemic heart disease patient has fQRS in ECG he is less likely to have successful reperfusion.<sup>4</sup>

fQRS complexes are a new ECG indicator, which shows delay in conduction of electrical current in coronary artery disease patients.<sup>2-19</sup> One study found that 23.5% cases of NSTEMI patients had fQRS.<sup>3</sup> But another study revealed that fQRS complex was seen in 66.5% cases of NSTEMI.<sup>4</sup>

HTN and DM were important risk factors in both groups and this resembles with the study by Li et al.<sup>2</sup> The findings by Guo et al.<sup>7</sup> and Dabbagh Kakhkiet al.<sup>18</sup> are in contrast with ours have no significant diabetic patients in the fQRS group.

The cardiac biomarkers were elevated in the fQRS group which indicates the ongoing ischemia and was significant, similar to the Çetinet al.<sup>17</sup> In Guo et al.<sup>7</sup> study, troponin T-value is not significant ( $P = 0.049$ ), which was in contrast with our results. The explanation of this is the presence of chest pain in our study, which was not present in previous studies.

## CONCLUSION

There is an association of fQRS among patients with acute non-ST elevation myocardial infarction (NSTEMI). Further prospective studies are needed to determine the clinical significance of fQRS complex and identify its correlation with the incidence of possible complications.






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| 2     | Muhammad Usman      | Data collection.          |  |
| 3     | Munir Ahmed         | Data analysis.            |  |
| 4     | Rehan Riaz          | Editing.                  |  |
| 5     | M Hamid Saeed       | Proof reading.            |  |