

Assessment of Prognosis in Myocardial Infarction: Norris Coronary Prognostic Index Versus QRS Scoring System

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SUMMARY

40 patients with acute myocardial infarction were studied. They were divided into five subgroups on the basis of Norris Coronary Prognostic Index (CPI), and into two subgroups, i.e., Group A or high risk group and group B or low risk group on the basis of LVEF calculated from QRS scoring system. They were followed up for one year and mortality rate was noted in each subgroup of the two methods. There were total eight deaths (20%) and QRS scoring system was able to predict correctly (100%) to segregate all these patients into group A. While Norris CPI method was unable to segregate clearly these patients into prognostically different subgroups. Mortality rate did not show linear relationship with the CPI score or its individual factors. The prediction of prognosis by QRS scoring system was statistically significant, while by Norris CPI was insignificant. QRS scoring system is superior to Norris CPI and can be used reliably to predict the prognosis after acute myocardial infarction. Hence ECG can provide important indirect quantitative information about left ventricular function.

Myocardial infarction is one of the manifestations of the Coronary artery disease. Contrary to the common belief that coronary artery disease is prevalent only in affluent societies, it is common in developing countries including Pakistan (1,2,3). Acute myocardial infarction strikes people at the prime of their age and thus either carries them away or cripples the more useful members of the society, majority of them being the bread earners for the families

The assessment of prognosis is important in any disease, but it carries a special significance for patients with myocardial infarction because presently there are both medical as well as surgical measures available to prevent an attack of reinfarction. It is thus imperative that we should try to find out those patients who are at increased risk of reinfarction.

The two principal prognostic indicators in myocardial infarction are the state of function of left ventricle and the extent of coronary artery disease. There are a lot of procedures—direct, indirect, invasive, non-invasive—available to assess these parameters and hence prognosis. As the direct methods—invasive or non-invasive—are sophisticated and costly and are not universally available. Thus countries like Pakistan have to fall back upon simple and cheaper measures which can be easily available in most centres.

In this regard recently there has been emphasis on the value of the ordinary 12 lead E.C.G., which can give a fairly accurate idea of left ventricular function. So E.C.G. based QRS scoring system is compared with the commonly practised clinical method, i.e. Norris Coronary Prognostic Index (long term) in 40 patients with the diagnosis of acute myocardial infarction, who were followed up for one year.

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MATERIALS AND METHODS

All patients of acute transmural myocardial infarction, irrespective of age and sex, admitted in Coronary Care Unit of Rawalpindi General Hospital, Rawalpindi, during the period of 1st January to 30th April, 1982, who fulfilled the criteria for selection, as discussed in our previous study (4) were included.

1. QRS-Scoring System

Each E.C.G. was scored according to 29-point QRS scoring system. The criteria for scoring applied to each of 10 leads (I, II, aVL, aVF and VI-V6) are derived from the duration

and amplitude ratios of the deflections of the QRS complex, as discussed previously and shown in Table No. 1 (1,2). Left ventricular ejection fraction (LVEF) at the time of discharge from the hospital was calculated by the following formula (4,5).

$$\text{LVEF \%} = 60 - (3 \times \text{QRS Score})$$

On the basis of LVEF, patients were differentiated into following two groups:-

- Group A or High Risk group which includes patients who have LVEF less than 50%.
- Group B or Low Risk group. Patients who have LVEF more than 50%.

TABLE NO. I
CRITERIA FOR DETERMINING POINT SCORE IN THE QRS SCORING SYSTEM

LEAD	CRITERIA (NO. OF POINTS)		MAXIMUM POINTS
	DURATION	AMPLITUDE RATIO	
I	Q ≥ 30 msec (1)	R/Q ≤ 1 (1)	2
II	Q ≥ 40 msec (2)	—	2
	Q ≥ 30 msec (1)	—	—
aVL	Q ≥ 30 msec (1)	R/Q ≤ 1 (1)	2
aVF	Q ≥ 50 msec (3)	R/Q ≤ 1 (2)	5
	Q ≥ 40 msec (2)	—	—
	Q ≥ 30 msec (1)	R/Q ≤ 2 (1)	—
V1	Any Q (1)	—	4
	R ≥ 50 msec (2)	—	—
	R ≥ 40 msec (1)	R/S ≤ 1 (1)	—
V2	Any Q or R ≤ 20 msec (1)	—	4
	R 60 ≥ msec (2)	—	—
	R 50 ≥ msec (1)	R/S ≤ 1.5 (1)	—
V3	Any Q or R ≤ 30 msec (1)	—	1
V4	Q ≥ 20 msec (1)	R/Q or R/S ≤ 0.5 (2)	3
		R/Q or R/S ≤ 1 (1)	—
V5	Q ≥ 30 msec (1)	R/Q or R/S ≤ 1 (2)	3
		R/Q or R/S ≤ 2 (1)	—
V6	Q ≥ 30 msec (1)	R/Q or R/S ≤ 1 (2)	3
		R/Q or R/S ≤ 3 (1)	—

2. Norris Coronary Prognostic Index (CPI).

Patients were also evaluated on the basis of Coronary Prognostic Index of long term survival for the four clinical variables, i.e. Age, Heart size (on X-ray chest) lung fields congestion (on X-ray chest) and history of previous ischaemia, according to the criteria laid down by Norris, et al (6) as shown in Table No. II.

TABLE NO. II

WEIGHTINGS for the four factors selected for constructing the C.P.I. for long term survival.

Factors	X XY	Y
Age (yr) (X1, Y1)		
< 50	0.2) 0.98	
50-59	0.4) 1.96	
60-69	0.6) 2.94	4.9
70-79	0.8) 3.42	
80-89	1.0) 4.9	
Heart size (X2, Y2)		
Normal) 0)	
Doubtfully or definitely enlarged.) 1)	1.7
) 1.7	
Lung Fields (X3, Y3)		
Normal) 0)	
Pulmonary congestion	0.3) 1.53	
Interstitial or pulmonary Oedema) 1)	5.1
Previous ischaemic (X4, Y4)		
No previous infarction.	0)	3.5
Previous infarction.	1) 3.5	

3. Follow up:

Each patient was followed up for one year and following 5 end points were noted.

1. Death.

2. Recurrence of Myocardial infarction.

3. Angina Pectoris.

4. Left Ventricular Failure.

5. No complication.

4. Statistical Methods

All the variables, i.e. Demographic, Clinical, Laboratory and electrocardiographic, were interpreted and their mean with standard deviation was found. Two groups, based on QRS scoring system were compared in relation to end points by X^2 , X^1 , X^2 methods, and mortality rate was found in patients according to QRS scoring system and C.P.I. method; and statistical significance determined (7).

RESULTS

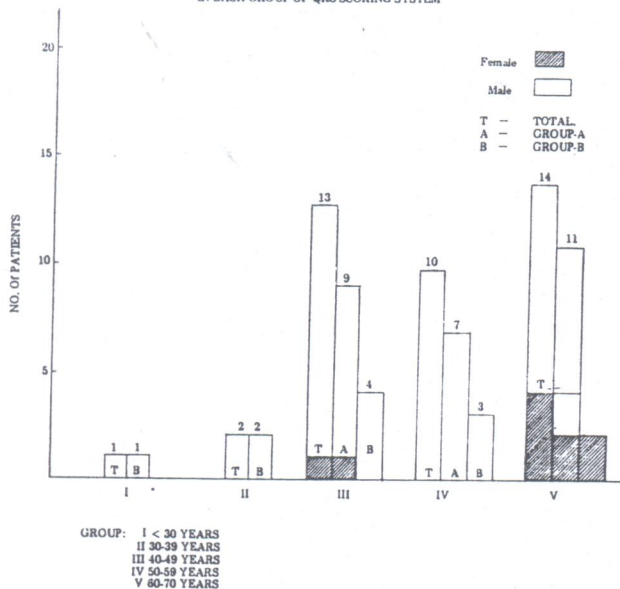
40 Patients fulfilled the criteria for selection and were included in study. The age range in 35 male patients (87.5%) was from 28-71 years and in 5 females (12.5%) it was 48-70 years. The mean age in total, male and female patients was 52.89 ± 10.89 years, 52 ± 10.80 years and 62.6 ± 9.15 years, respectively. 7 patients (17.5%) belonged to rural area and 33 patients (82.5%) were residents of urban area. According to occupation 17 (42.5%) were Government servants, 13 (32.5%) were businessmen or shopkeepers, 5 (12.5%) were housewives, 3 (7.5%) were farmers and 2 (5%) were taxi drivers.

Q.R.S. Scoring System

40 patients were divided into two groups on the basis of QRS scores, i.e. Group A comprising 27 patients and group B comprising 13 patients. The mean age of group A patients was 53.48 ± 11.32 years and in group B was 53.00 ± 11.03 years. The distribution of patients according to age and sex is shown in figure No. 1.

The Q.R.S. scores as determined from E.C.G. obtained a day before hospital discharge was 6.5 ± 4.48 in total, 8.37 ± 4.32 in group A and 2.61 ± 0.76 in group B patients. While QRS scores after one year follow up was 5.4 ± 4.18 , 7.47 ± 4.29 , and 2.38 ± 0.86 respectively in total, group A and group B patients.

FIGURE NO. 1
AGE AND SEX DISTRIBUTION OF PATIENTS
IN EACH GROUP OF QRS SCORING SYSTEM



The LVEF determined from QRS score at the time of discharge from the hospital was $40.5 \pm 13.45\%$ in total, $34.88 \pm 12.97\%$ in group A and $52.15 \pm 2.30\%$ in group B patients. Whereas the LVEF after one year follow up was $42.78 \pm$

12.54% , $37.57 \pm 12.89\%$ and $54.84 \pm 2.60\%$ respectively in total, group A and group B patients.

Norris C.P.I.

The values for each factor of Norris C.P.I. was determined and patients were divided into five groups according to the C.P.I. score as shown in Table No. III, and in each group number of deaths were also noted. The percentage of deaths was 15.4% in group I, 11.1% in group II, 21.4% in group III, 50% in group IV and 50% in group V. Then each prognostic factor of C.P.I. was evaluated individually and mortality rate in relation to each factor was noted as shown in Table No. IV, indicating that none of these factors were associated clearly with poor prognosis except the old age (i.e., 70 years or above) and presence of pulmonary oedema on X-ray chest.

Follow Up

The mean duration of follow up was 9.96 ± 3.41 , 8.95 ± 3.60 and 12.07 ± 1.63 months respectively in total, group A and group B patients. The mortality rate after follow up was 20% in total patients and 29.62% in group A patients.

TABLE NO. III

NORRIS C.P.I. APPLIED TO PATIENTS AND MORTALITY OBSERVED IN EACH GROUP

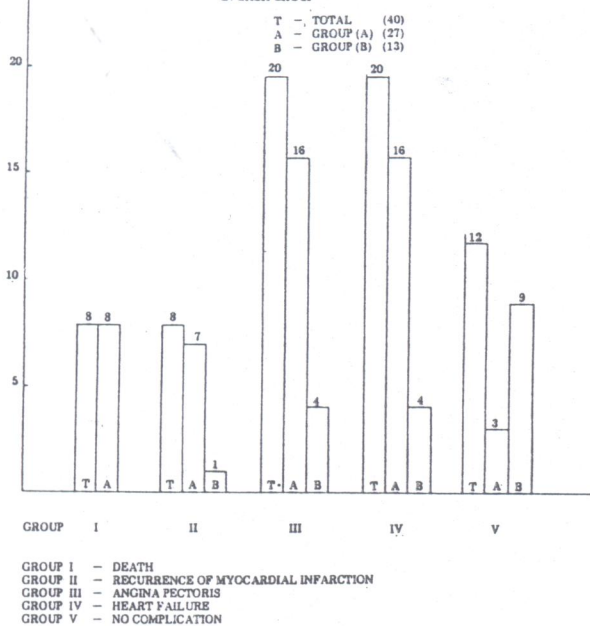
GROUP	TOTAL PATIENTS 40			NORRIS, ET AL TOTAL 530 PATIENTS		
	Patients	Deaths	%	Patients	Deaths	%
GROUP-I (C.P.I. < 3)	13	2	15.4 %	175	21	12 %
GROUP-II (C.P.I. 3-5)	9	1	11.1 %	138	36	26 %
GROUP-III (C.P.I. 6-8)	14	3	20.4 %	118	46	39 %
GROUP-IV (C.P.I. 9-11)	2	1	50 %	71	46	65 %
GROUP-V (C.P.I. 12)	2	1	50 %	28	24	85 %

TABLE NO. IV
 PROGNOSTIC FACTORS INCLUDED IN THE C.P.I.
 FOR LONG TERM SURVIVAL

Prognostic factor and variation.	THIS STUDY		JARRIS ET AL	
	NO. OF PATIENT	MORTALITY %	NO. OF PATIENTS	MORTALITY
A - AGE (YEAR)				
< 50	16	18.75 %	83	14 %
50-59	10	Zero	167	26 %
60-69	8	25 %	163	38 %
70-79	6	50 %	91	43 %
80-89	Zero	Zero	26	58 %
Total	40	20 %	530	33
B - HEART SIZE				
Normal	14	21.42 %	306	23 %
Doubtfully enlarged *	—	—	87	40 %
Definitely enlarged	26	19.23 %	137	50 %
Total	40	20 %	530	33 %
C - LUNG FIELD.				
Normal	22	18.18 %	322	23 %
Pulmonary congestion	12	8.3%	103	32 %
Interstitial Oedema*	—	—	52	61 %
Pulmonary Oedema	6	50 %	53	66 %
Total	40	20 %	530	33 %
D - HISTORY OF PREVIOUS ISCHAEMIA				
None	19	21 %	252	23 %
Only Angina	10	20 %	129	31 %
Infarction	11	18.18 %	149	51 %
Total	40	20 %	530	33 %

* NOT RECORDED

FIGURE NO. 2
END POINTS AFTER ONE YEAR FOLLOW UP
IN EACH GROUP



There was no death in group B patients. Summary of the end points of study after follow up in each group is shown in figure No. 2, while mortality rate in each group of Norris C.P.I. is shown in Table No. III.

χ^2 Test of significance .

When it was calculated for all the five end points then value of χ^2 applied to Group A and Group B was 35.4 which is much higher than the tabulated value of χ^2 (13.28) at 1% level of significance and for four degrees of freedom. Thus there was significant statistical difference between Group A and Group B patients, who were separated on the basis of LVEF determined from QRS scoring system.

While there was no statistically significant difference for prediction of prognosis in various groups of C.P.I. or individual factors.

DISCUSSION

The mean, age, sex and smoking habits of the patients in this study are in accordance to the literature (8,9,10,11). Only 7 patients (17.5%) belong to the rural area, as was observed also in another study (9) while only 3 patients (7.5%) was farmer, indicating the disease association with civilization and sedentary life style, or the representation from the rural population is under-

estimated due to obvious socio-economic factors hindering villagers to get medical advice.

40 patients were divided into two groups, i.e. Group A or High risk group comprising 27 patients and Group B or Low risk group comprising 13 patients, on the basis of QRS scoring system. Although the number of patients were different in each group but both groups were comparable in various demographic, clinical and laboratory parameters (4) which can influence the long term prognosis of the patients after acute myocardial infarction (6, 8, 12, 13, 14, 15, 16).

The QRS scoring system gradually developed from the experimental stage to the stage of clinical utilizations over a period of about 20 years (4, 5, 17, 18). Palmeri S T, et al. (5) evaluated the QRS scoring system in 55 patients and compared with the severity of wall motion abnormality seen on Radionuclide blood pool scanning and Radionuclide determined LVEF. A score more than 3 was 93% sensitive and 88% specific for both these variables. Clinical evaluation of QRS scoring system (4) also exhibits its usefulness as this system was able to differentiate patients at high risk from low risk quite confidently. All the 8 deaths were noted in Group A patients only, while there was no death in Group B patients.

Norris, et. al (6, 19) had constructed Coronary prognostic indices for short-term and long-term prognosis, giving weightings to simple clinical features and noted as the score of C.P.I. increased, mortality rate became higher. Table No. III showed mortality rate noted in this study and in the Norris, et. al. study (6), which pointed out significant differences in mortality rate in same C.P.I. groups in the two series. Table No. IV showed the mortality rate in both series in relation to individual C.P.I. factors exhibiting gross differences. These differences might be due to the facts:

- i) Number of patients in this study are too small. (40 as compared to 530).
- ii) Age of the patients in this study is also low.
- iii) The duration of follow up is only one

TABLE NO. V

NORRIS C.P.I. APPLIED IN EACH GROUP AND OBSERVED MORTALITY

FEATURES	AVERAGE C.P.I.	GROUP-I	GROUP-II	GROUP-III	GROUP-IV	GROUP-V
A—Total patients (40)	5.35					
1. No. of patients		13	9	14	2	2
2. No. of Deaths (%)		2 (15.4%)	1 (11.1%)	3 (20.4%)	1 (50%)	1 (50%)
B—Group A (27)	5.44					
1. No of patients		8	7	9	2	1
2. No. of Deaths (%)		2 (25%)	1 (14.3%)	3 (33.3%)	1 (50%)	1 (100%)
C—GROUP B (13)	5.16					
1. No. of patients		5	2	5	—	1
2. No. of Deaths (%)		—	—	—	—	—

year as compared to three years. So Norris CPI was unable to differentiate patients clearly into prognostically different groups in contrast to QRS scoring system. While QRS scoring system was able to differentiate patients in each group, i.e. Group I to V, who have better prognosis from the patients of same CPI score, as shown in Table No. V. Although the C.P.I. is a good clinical method to predict the mortality in each group but the QRS scoring system is much superior to it for this purpose. Also the C.P.I. can not differentiate patients with very good prognosis, i.e. Zero mortality, as can be differentiated by QRS scoring system, i.e. Group B Patients. So to conclude QRS scoring system is a very useful procedure can predict the prognosis quite accurately and is much superior to the clinical methods like Norris Coronary prognostic index.

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