Non Q wave infarction: exercise test characteristics, coronary anatomy, and prognosis

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Abstract

The exercise test characteristics, coronary anatomy, and prognosis of patients discharged after non Q wave myocardial infarction were compared with those in whom Q wave infarction occurred. Of the 339 patients studied, all of whom were ≤ 70 years, 87 (26%) had had a non Q wave infarction. There were no significant differences in the exercise test characteristics between the two groups, and in those 149 patients in whom angiography was performed triple vessel disease was present in 36/114 (32%) of the Q wave group and 9/35 (26%) of the non Q wave group. The infarct related artery was more often patent in the non Q wave group (27/35 (77%)) than in the Q wave group (53/114 (46%)). The one year mortality and the reinfarction and angina rates were similar in the two groups and the exercise test remained a good discriminator for predicting patients at risk of future cardiac events in both groups.

In view of the similar outcome and severity of coronary disease in those aged ≤ 70 with non Q wave infarcts, the distinction between Q and non Q wave infarction need not influence management decisions in patients after myocardial infarction.

The short term prognosis for patients with a non Q wave myocardial infarction is excellent¹ with an in hospital mortality of approximately 2%.^{2,3} However, recent reports have suggested that patients sustaining a non Q wave infarct may be at a higher risk of late complications—death,⁴ reinfarction,⁵ and angina²—than those with a Q wave infarction. After myocardial infarction, early exercise testing has been shown to be of value in predicting patients at risk from future cardiac events⁶⁻⁸ and thus might be useful in identifying which patients with non Q wave infarction are likely to benefit from appropriately timed intervention. This study was performed to investigate and compare the exercise test characteristics, coronary anatomy, and prognosis of patients after non Q wave infarction and after Q wave infarction.

Patients and methods

We studied 339 patients aged 34–70 who were able to perform a pre-discharge exercise test after a confirmed myocardial infarction. No patient had been treated by thrombolysis. Myocardial infarction was defined as the

presence of at least two of the following features: (a) typical history of ischaemic pain, (b) a serum concentration of aspartate transaminase of at least twice normal, (c) development of new Q waves (with a duration of at least 0.04 s) or persistent ST/T wave changes.

After the exercise test all patients were put on β blockers before discharge (unless contra-indicated) and this treatment was continued for at least one year. During that time full follow up was maintained and the cardiac events of death, reinfarction, and angina were recorded. Coronary artery bypass surgery was only undertaken in those patients whose symptoms were not controlled by medical treatment.

EXERCISE TESTS

Submaximal exercise tests (modified Naughton protocol) were performed in the immediate pre-discharge period on a treadmill (Medtronics IMC model 210). Blood pressure and 12 lead electrocardiogram (Siemens-Elema Mingocard 7) were recorded while patients were supine and erect before exercise, every 3 minutes during exercise, and at the end of the test. Continuous electrocardiographic monitoring, displayed on an oscilloscope, was performed throughout the test.

Tests were stopped if angina developed or if one of the following pre-defined criteria occurred: (a) attainment of 85% of maximum predicted heart rate, (b) development of > 0.4 mV horizontal ST segment depression, (c) occurrence of complex ventricular arrhythmias, (d) exercise hypotension: defined as a > 10 mm Hg fall in systolic blood pressure from the previous reading, (e) completion of the 18 minute protocol.

Exercise tests were defined as positive if downsloping or horizontal ST segment depression ≥ 0.1 mV, measured 80 ms after the J point, occurred during exercise. Positive tests were further designated as “silent” if no angina occurred and as “painful” if they were accompanied by angina. The final double product achieved was the product of the systolic blood pressure and heart rate at maximal exercise.

CORONARY ANGIOGRAPHY

Cardiac catheterisation was performed from either the femoral or brachial approach within three months of infarction. Selective coronary angiography was undertaken and angiograms were recorded in multiple views to allow adequate visualisation of the entire coronary tree. The coronary vasculature was divided into three main trunks: left anterior descending artery, circumflex artery, and right coronary

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artery. Each trunk was examined for the presence of important disease, which was considered to be present if the luminal diameter of a vessel was reduced by $\geq 75\%$. This criterion was used to classify single, double, or triple vessel disease. In addition, the infarct related artery was identified in each patient from the admission electrocardiogram and its patency or otherwise was determined.

STATISTICAL ANALYSIS

Continuous variables were expressed as mean (SEM) and differences between groups were assessed by a Student's unpaired *t* test. Differences between discrete variables were assessed by χ^2 tests with Yates's correction. In all cases a value of $p < 0.05$ was regarded as significant.

Results

Of the 339 patients in the study 87 (26%) were classified as having sustained a non Q wave infarction on the basis of their electrocardiographic changes. Table 1 shows the baseline characteristics of these patients and those with Q wave infarctions. The mean ages of the groups were similar but there were more female patients in the non Q wave group (23%) than in the Q wave group (11.5%; $p < 0.02$). In addition, anterior infarction was more common in the non Q wave group (63% *v* 44%; $p < 0.01$).

EXERCISE TESTS

Table 2 summarises the exercise test characteristics of the patients with non Q wave and Q wave infarcts. The mean exercise time was similar in the two groups as was the final double product. Negative tests were as common in the group with Q wave infarction as in the group with non Q wave infarction (49% and 45% respectively) and among those with positive tests silent and painful ischaemia were distributed equally between the two groups.

CORONARY ARTERIOGRAPHY

Coronary arteriography was undertaken in 149 patients, 114 from the Q wave group and 35 from the non Q wave group, representing 45%

Figure 1 Distribution of coronary artery disease.

and 43% of the groups respectively. Figure 1 shows the frequencies of single, double, and triple vessel disease. The trend towards more single (54%) and less double vessel disease (20%) in the non Q wave group compared with the Q wave group (39% and 30% respectively) did not reach statistical significance. Triple vessel disease was equally common in the two groups (26% *v* 32%).

Significantly more patients in the group with non Q wave infarction had a patent infarct related artery (27 (77%)) than those in whom a Q wave infarct occurred (52 (46%)) ($p < 0.01$).

SUBSEQUENT CARDIAC EVENTS

Figure 2 shows the mortality and reinfarction and angina rates at one year for the two groups. Two patients from the group with non Q wave infarction died (2%) and 14 (5%) from the group with Q wave infarction (NS). Reinfarction rates were also similar (8% and 9% respectively) as was the subsequent development of angina pectoris (38% and 43% respectively). In the group with non Q wave infarction seven patients either died or had reinfarctions in the first year and five of them had a positive exercise test (71%) compared with 28 patients in the Q wave group with either complication of whom 23 (82%) had a positive exercise test.

Table 1 Baseline variables

Variable	Non Q wave (n = 87)	Q wave (n = 252)
Age (years) (mean (SD))	52.3 (0.5)	53.8 (0.3)
Female (No (%))	20 (23)	29 (11.5)*
Anterior site (No (%))	55 (63)	110 (44)**
Inferior site (No (%))	32 (37)	142 (56)**

* $p < 0.02$; ** $p < 0.01$.

Table 2 Exercise test characteristics

Characteristic	Non Q wave (n = 87)	Q wave (n = 252)
Exercise time (min)	12.4 (0.6)	11.8 (0.3)
Double product (HR $\times$ SBP $\times 10^{-2}$)	177 (5.3)	176 (3.3)
Negative test (No (%))	43 (49)	113 (45)
Silent ischaemia (No (%))	22 (25)	60 (24)
Painful ischaemia (No (%))	22 (25)	79 (31)

HR, heart rate; SBP, systolic blood pressure.

Figure 2 One year mortality and reinfarction and angina rates.

CORONARY ARTERY SURGERY

Coronary artery bypass surgery was only undertaken in those patients in whom symptoms could not be controlled by medical treatment. Twelve (14%) patients with non Q wave infarction and 32 (13%) of those with Q wave infarcts had coronary artery surgery.

Discussion

In this study non Q wave infarction was common. It was found in 26% of patients who performed a pre-discharge exercise test. Others have reported a similar incidence with figures ranging from 16% to 29%.^{14,9} Thus patients with non Q wave infarction make up a substantial group.

We showed similar exercise test characteristics in Q wave and non Q wave groups, with just under half of the patients in each group having a negative test. It could be argued that a submaximal test might have understressed the group with non Q wave infarction but Sia *et al* using a symptom limited test at 6 days found negative tests in 41% of patients with non Q wave infarcts.¹⁰ In addition, Sia *et al* found a negative test to have been highly predictive of the absence of triple vessel disease or a critical stenosis.

The finding of similar disease severity at angiography in the two groups in this study accords with their exercise test findings and confirms the work of Ogawa *et al* who found frequencies of multivessel disease to be equal in Q wave and non Q wave infarcts (51% and 53% respectively).¹¹ Similar findings were also reported by Madigan *et al*.¹² The demonstration of a significantly higher patency rate of the infarct related artery in the patients with non Q wave infarcts in this study accords with the current hypothesis that many non Q wave infarcts are the result of either a subtotal occlusion of the relevant artery or caused by spontaneous reperfusion. DeWood and colleagues reported a similar finding in patients with non Q wave infarcts studied one week after admission.³

We did not find that the incidence of subsequent cardiac events was higher in those with non Q wave infarcts than in those with Q wave infarcts; unlike Hutter *et al* who reported a significantly increased reinfarction rate nine months after discharge in patients with non Q wave infarcts.⁵ In that study, however, the 18 month survival rate was identical in the two groups, suggesting that the overall prognosis was similar—as we report. In addition, there was no increase in the number of patients with angina at two years although Cannom and workers reported an increased frequency of angina in survivors of non Q wave infarction.¹³ Ogawa *et al* also reported an increased reinfarction rate in those with non Q wave infarcts.¹¹ In a study of 593 patients Krone *et al* reported a two year mortality of 3.2% after non Q wave infarction and noted a particularly favourable outcome in those under 60 years.⁹ This was again reported in a large recent study by Nicod and colleagues who showed that the prognosis in patients with non Q wave infarcts who were

aged less than 70 years was similar to that found in those with Q wave infarctions.¹⁴ Our data seem to confirm these reports, because all our patients were ≤ 70 . Finally, Boden *et al* showed that patients in whom the features of non Q wave infarction do not fit a defined anatomical pattern have an improved short term and long term prognosis,¹⁵ further emphasising the point that non Q wave infarction is not necessarily associated with a high incidence of subsequent cardiac events.

We showed that non Q wave infarction was common; we found it in a quarter of patients undertaking a pre-discharge exercise test. In such patients the exercise test characteristics and coronary anatomy were similar to those in patients with Q wave infarction. In addition, the one year prognosis and incidence of recurrent infarction and angina were similar in the two groups, suggesting that in patients aged ≤ 70 years a non Q wave infarction could be managed the same way as a Q wave infarct. After a non Q wave infarction the pre-discharge exercise test remains a good discriminator of patients at risk of subsequent cardiac events.

None of our patients were treated by thrombolysis, however; and because its frequent use may change the course of non Q wave infarction further studies will be needed in patients with non Q wave infarcts.

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