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Background: Coronary heart disease is associated with increased B-type natriuretic peptides (BNPs), and, although controversial, may cause exaggerated exercise-induced BNP secretion. We investigated BNP in relation to reversible myocardial ischaemia.

Materials and methods: Serum N-terminal proBNP (NT-proBNP) was measured before and after an exercise electrocardiogram test (ETT) in 14 patients with and 45 patients without exercise-induced myocardial ischaemia. Statistical analysis was carried out on logistically transformed data. Results, however, are pre-transformed data.

Results: NT-proBNP increased with exercise both in ETT-positive patients (mean (SD) 71.4 (41.2) v 76.8 (44.0) ng/l; p<0.001) and ETT-negative patients (54.0 (61.2) v 60.1 (69.0) ng/l; p<0.001). Pre-exercise and post-exercise NT-proBNP were higher (p<0.05) in ETT-positive than in ETT-negative patients. Incremental NT-proBNP was similar in ETT-positive (4.7 (4.2) ng/l) and ETT-negative (6.2 (8.6) ng/l) patients.

Conclusion: Serum NT-proBNP concentrations are higher in patients with exercise-induced myocardial ischaemia than in those without. Exercise-induced electrocardiographic myocardial ischaemia, however, is not associated with exaggerated BNP secretion.

RESULTS
We studied 14 patients with a positive ETT and 45 patients with a negative ETT, who served as controls. Those with a positive ETT developed chest pain during the ETT. Table 1 shows the clinical characteristics and serum NT-proBNP results of both groups.

In summary, although matched for age, there were more women in the ETT-negative group. Serum NT-proBNP concentrations before and after exercise were higher (p<0.05) in patients with positive ETT than patients with negative ETT. After exercise, serum NT-proBNP concentrations increased (p<0.001) in both groups, but the incremental increase in serum NT-proBNP concentrations were similar in both groups.

DISCUSSION
The higher baseline and post-exercise serum NT-proBNP concentrations in patients with positive ETT than in controls confirms increased BNP secretion in patients with CHD.14 In this study, however, exercise-induced NT-proBNP secretion was similar in patients with positive ETT and in patients with negative ETT.

Abbreviations: BNP, B-type natriuretic peptide; CHD, Coronary heart disease; ETT, electrocardiogram test; NT-proBNP, N-terminal proBNP
Our study is in agreement with that reporting higher BNP concentrations but similar incremental BNP concentrations in patients with myocardial ischaemia compared with controls, but differs from that reporting similar NT-proBNP concentrations in patients with and without electrocardiographic myocardial ischaemia, and also differs from those reporting increased incremental BNP responses in those with myocardial ischaemia compared with controls. The results in our study are partly different from those reported in the only other comparable study. Similarly reported no difference in incremental serum NT-proBNP concentrations between patients with and without electrographic myocardial ischaemia, but unlike us they also reported similar baseline and post-exercise NT-proBNP concentrations in both study groups.

The differences in these studies could be because of different study groups, different durations and intensities of exercise, different techniques for diagnosing myocardial ischaemia, different analytical techniques and type-1 and type-2 statistical errors.

Serum NT-proBNP may be affected by age, sex and heart rate. In our study, groups were matched for age and heart rate, but 21% of patients with a positive ETT were women compared with 36% in the control group. The higher NT-proBNP in those with symptomatic myocardial ischaemia is not explained by sex, as NT-proBNP is higher in women than men. In this study, compared with controls, patients with a positive ETT had reduced exercise capacity limited by angina pectoris. The differences in these studies could be because of different study groups, different durations and intensities of exercise, different techniques for diagnosing myocardial ischaemia, different analytical techniques and type-1 and type-2 statistical errors.

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Our study is in agreement with that reporting higher BNP concentrations but similar incremental BNP concentrations in patients with myocardial ischaemia compared with controls, but differs from that reporting similar NT-proBNP concentrations in patients with and without electrocardiographic myocardial ischaemia, and also differs from those reporting increased incremental BNP responses in those with myocardial ischaemia compared with controls.

In summary, we confirm that patients with symptomatic CHD have increased serum NT-proBNP concentrations. We found no evidence to support the notion that exaggerated exercise-induced BNP excretion is associated with reversible exertion-induced electrocardiographic myocardial ischaemia.

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Competing interests: None.

Ethical approval: The Wolverhampton District Local Research Ethics Committee approved the study.

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Table 1 Demographics of patients with and without myocardial ischaemia and their serum N-terminal proB-type natriuretic peptide concentrations during an exercise echocardiograph test

<table>
<thead>
<tr>
<th></th>
<th>Positive exercise ECG</th>
<th>Negative exercise ECG</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>14</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Sex, M/F</td>
<td>11/3</td>
<td>16/29</td>
<td>0.030</td>
</tr>
<tr>
<td>Age (years)</td>
<td>60.9 (11.8)</td>
<td>57.2 (13.8)</td>
<td>0.340</td>
</tr>
<tr>
<td>Systolic BP (mm Hg)</td>
<td>145.9 (14.4)</td>
<td>137.0 (19.8)</td>
<td>0.106</td>
</tr>
<tr>
<td>Diastolic BP (mm Hg)</td>
<td>84.1 (12.7)</td>
<td>83.9 (10.6)</td>
<td>0.997</td>
</tr>
<tr>
<td>Resting heart rate</td>
<td>75.5 (12.3)</td>
<td>75.4 (11.6)</td>
<td>0.999</td>
</tr>
<tr>
<td>Maximum heart rate</td>
<td>141.6 (16.9)</td>
<td>149.1 (22.7)</td>
<td>0.266</td>
</tr>
<tr>
<td>Maximum metabolic</td>
<td>5.97 (0.65)</td>
<td>9.17 (3.30)</td>
<td>0.002</td>
</tr>
<tr>
<td>Time exercised (min)</td>
<td>4.1 (2.85)</td>
<td>9.1 (3.2)</td>
<td>0.004</td>
</tr>
<tr>
<td>Pre-exercise NT-proBNP (ng/l)</td>
<td>71.4 (41.2)</td>
<td>54.0 (61.2)</td>
<td>0.013</td>
</tr>
<tr>
<td>Post-exercise NT-proBNP (ng/l)</td>
<td>76.8 (44.0)*</td>
<td>60.1 (69.0)*</td>
<td>0.020</td>
</tr>
<tr>
<td>Increase in NT-proBNP</td>
<td>4.7 (4.2)</td>
<td>6.2 (8.6)</td>
<td>0.619</td>
</tr>
</tbody>
</table>

BP, blood pressure; ECG, electrocardiogram; F, female; M, male; NT-proBNP, N-terminal pro-B-type natriuretic peptide.

*p<0.001 compared with pre-exercise.

Results are raw pretransformed data expressed as mean (SD).