Clinical research

Distinct psychosocial differences between women with coronary heart disease and cardiac syndrome X

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Aims
To compare the impact of oestrogen, gynaecological history, social support, life events and family history of CHD on psychosocial morbidity in syndrome X, CHD patients and healthy controls.

Methods and Results
100 female syndrome X (60 ± 9 years), 100 female CHD (65 ± 9 years) and 100 healthy female volunteers (61 ± 10 years) completed the hospital anxiety and depression scale (HADS), health anxiety questionnaire (HAQ), a demographic information scale, life events scale, family history of CHD, menopausal, menstrual and gynaecological history. A 17β-oestradiol sample was taken. Syndrome X patients had higher levels of life interference (p < 0.05) and HADS anxiety (p < 0.05) than CHD patients, and higher levels of all HADS and HAQ scales than controls (p < 0.01). Syndrome X patients with a large social network had lower HADS anxiety (p < 0.05), health worry (p < 0.05), life interference (p < 0.01) and total HAQ (p < 0.01). Social network (p = 0.003), divorced/separated or widowed status (p = 0.005), HRT (p = 0.008) and HADS anxiety score (p < 0.001) accounted for 41.9% of the variance in HAQ scores in syndrome X. Oestrogen was unrelated to the HADS or HAQ for any group.

Conclusion
Syndrome X patients suffered higher levels of psychological morbidity in comparison to CHD patients and controls. Life events and social network size were related to health anxiety, general anxiety and depression in women with syndrome X.

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KEYWORDS
Syndrome X; Coronary heart disease; Women; Psychology

Introduction
In spite of an excellent prognosis, cardiac syndrome X is associated with debilitating symptomology, ineffective therapeutic interventions and a poor quality of life. First termed cardiac syndrome X by Kemp, the triad of angina pectoris, a positive exercise test for myocardial...
ischaemia and angiographically smooth coronary arteries continues to perplex clinicians.

At the present time, there is no common agreement on the exact cause of the symptoms associated with syndrome X. Suggested mechanisms include coronary microvascular dysfunction (‘microvascular angina’), perfusion abnormalities, a generalised disorder of vascular function, hormonal irregularities, early signs of abnormal left ventricular function, insulin resistance, or abnormal visceral pain perception. It has also been suggested that at the time of angiography, patients with syndrome X have ‘sensitive hearts’ while a central, rather than peripheral, locus for the pain sensation has also been proposed. What is recognised however, is the disabling affect of the symptoms that rob patients of their quality of life.

Cardiac syndrome X occurs most commonly, but not exclusively, in postmenopausal women which has led many to question the role of ovarian hormones in the pathogenesis of the condition. Preliminary investigations have identified a possible link between the development of syndrome X and oestrogen deficiency, while 17β-oestradiol reduced angina frequency and esterified oestrogen improved quality of life in postmenopausal women with syndrome X. Suggested mechanistic pathways include its role as a vasodilator and as an analgesic pertaining to an increased pain sensitivity in women.

Although syndrome X is most commonly found in postmenopausal women, no rigorous, large-scale psychosocial studies have focussed on this population. Psychosocial investigations using the full diagnostic criteria for syndrome X are limited, as previous studies have included a wide range of patients with non-cardiac chest pain. Such samples include patients without angiography, without a positive exercise test for myocardial ischaemia or with abnormal or partially occluded coronary arteries. Impairment, an analgesic with an independent antidepressant effect, has been shown to reduce chest pain symptoms in patients with normal or near normal coronary arteries, while physical symptom have been associated with psychiatric morbidity in patients with non-cardiac chest pain. Studies using the full diagnostic criteria are limited by their relatively small sample size, but have suggested higher levels of neuroticism and anxiety in syndrome X than confirmed coronary disease, which may be related to psychosocial factors. Others have found that relaxation and stress reduction lead to fewer incidence of chest pain in syndrome X patients. However, the same is also true for patients with CHD along with many other conditions and disorders with related chronic pain. Previous studies have not examined a lack of social support, recent life events and family history of heart disease as possible reasons for increased anxiety in syndrome X patients.

Therefore, we hypothesised that women with syndrome X would have higher levels of general anxiety, depression and greater worry about their health than both CHD patients and healthy controls, and that a family history of CHD, reduced social support, experience of stressful life events, oestrogen depletion and gynaecological history could account for this. In order to test this hypothesis, we enrolled a large group of female syndrome X patients and compared them to age-matched female CHD patients and healthy controls.

**Methods**

Consecutive female syndrome X patients aged <80 years with chest pain, positive exercise test for myocardial ischaemia and angiographically smooth coronary arteries were recruited from the Women’s Heart Clinic at the Royal Brompton & Harefield NHS Trust, a specialised clinic for syndrome X patients. Age-matched female coronary heart disease (CHD) patients aged <80 years with angiographically proven disease (>50% stenosis in one or more major coronary arteries) including angioplasty, coronary artery bypass grafting and myocardial infarction were recruited from the Outpatients Department at the Royal Brompton & Harefield NHS Trust. CHD patients were also taken from the recent cardiac catheterisation lists and approached to participate by mail. Female age-matched healthy volunteers with no previous history of chronic illness were recruited from the nursing and ancillary staff of the Royal Brompton & Harefield NHS Trust and from associated women’s groups. CHD patients and controls were recruited from a population within the age-range of the syndrome X patients. All participants gave written informed consent using the consent form approved by the Royal Brompton & Harefield NHS Trust Ethics Committee.

All study visits took place in a quiet, private room where the project was fully explained and any questions answered. The participants were then guided through, and asked to complete, a number of questionnaires (see Experimental measures) which the participants either completed in the clinic or took home and returned by post. Participants were requested to complete the questionnaires alone. Questionnaires were made anonymous by using identification numbers and kept confidentially. Participants also gave a blood sample, which was analysed for 17β-oestradiol, measured by standard radioimmunoassay (Abbott IMX System, Abbott Diagnostics, Berkshire, UK).

**Experimental measures**

The health anxiety questionnaire (HAQ) is comprised of four sub-scales, which measures health worry and preoccupation, fear of illness and death, reassurance-seeking behaviour and interference with life. Developed and validated in medical, psychiatric and healthy volunteers, the 22 questions have a four-point Likert scale response format.

The hospital anxiety and depression scale (HADS) measures clinically significant anxiety and depression in general medical patients. The 14-item questionnaire is split into two sub-scales (anxiety and depression) using a four-point Likert scale response format, with a score of 11 or more on either scale described as clinically significant anxiety or depression. The scale does not include somatic items (e.g., pain), which may result from physical illness. It has been validated with both outpatients and inpatients, and is used extensively in studies with non-psychiatric clinical populations.

The list of threatening experiences is a widely used list of 12 life events which have been shown to have a marked or moderated effect on psychological well-being. Each of the 12 experience questions has a yes/no response format, the total number of events were recorded and classified into three groups: no events, one or two events and three or more events.
A demographic information scale was used to assess social support and isolation by recording the patients' living circumstances, frequency of contact with friends and relatives and size of social network.

Additionally, participants were asked to complete questions regarding their menopausal status, menstrual and gynaecological history, including details of hormone therapy, hysterectomy and last menstrual period, along with any known family history of CHD, their current medications and previous life-long hospitalisations pertaining to their heart or general admission. Hospital admissions for childbirth were disregarded.

Statistics

The data were analysed using Pearson's correlation co-efficient, t-tests, ANOVA and Tukey post hoc tests; overall comparisons of categorical data were performed using Chi-square. Data that did not fulfil the requirements for parametric testing were analysed using the Mann–Whitney test. Statistical significance level was set at \( p < 0.05 \). The study was performed as an independent-subjects design, using two-tailed tests. Post hoc tests were used only following a significant main effect, thus reducing the chance of Type I errors. Data are expressed as means ± SD unless otherwise stated. The first set of analyses compared the three groups of subjects; syndrome X, CHD and healthy controls. The second set of analyses included only the syndrome X patients and sought to identify the social and medical variables that were associated with anxiety, depression and health anxiety scores. The sample size is based on previous large-scale studies of patients with syndrome X and non-cardiac chest pain.

Multiple regression analysis with mean substitution for missing variables was used to identify the variables most closely associated with health anxiety in syndrome X patients. The total HAQ score was the dependent variable; this was normally distributed as assessed by histogram. The following were entered as independent variables: age, marital status (as two dummy variables), the use of HRT, history of hysterectomy, oestrogen level, size of social network (large or small), family history of coronary heart disease under the age of 60 years and number of life events (as 0, 1 - 2, 3+), HADS anxiety score and HADS depression score. Constant variance of the residuals was assessed for an anxiety or depression score. The linearity assumption was assessed by inspecting the normal probability plots which fitted the data. Constant variance of the residuals was assessed for an anxiety or depression score. The linearity assumption was assessed by inspecting the normal probability plots which fitted the data.

Results

Demographics

100 Female syndrome X patients (60 ± 9 years), 100 female CHD patients (65 ± 9 years) and 100 healthy age-matched female volunteers (61 ± 10 years) participated in the study. No syndrome X or CHD patient refused to participate in the project. Age of onset for syndrome X patients (54 ± 8 years) was significantly younger than for CHD patients (60 ± 9 years) (\( p < 0.001 \)). However, there was no significant difference in duration of chest pain between the syndrome X (6 ± 5 years) and CHD (5 ± 5 years) patients. Seventy-two percent of syndrome X patients were married or living as married, in comparison with 60% of CHD patients and healthy volunteers (ns).

Hospital anxiety and depression scale

Syndrome X patients recorded significantly higher anxiety scores (7.17 ± 3.9) than both CHD patients (5.9 ± 3.7, \( p < 0.05 \)) and healthy controls (4.9 ± 3.1, \( p < 0.01 \)). Syndrome X and CHD patients both had higher depression scores (5.0 ± 3.2 and 4.9 ± 3.5, respectively) than the healthy controls (2.8 ± 2.2, \( p < 0.01 \)). Clinical levels of anxiety (\( > 11 \)) were found in 16% of syndrome X patients compared with 10% of CHD patients and 5% of healthy controls (\( p < 0.05 \)). Similar number of syndrome X and CHD patients had clinical levels of depression (9% and 7%, respectively) while no subject in the control group was clinically depressed.

Health anxiety questionnaire

Both syndrome X and CHD patients had higher total HAQ scores than controls (\( p < 0.01 \)) (Table 1). Syndrome X and CHD patients had significantly higher scores than healthy controls on the scales measuring health worry and preoccupation (\( p < 0.001 \)), fear of illness (\( p < 0.01 \)) and life interference (\( p < 0.001 \)). Syndrome X patients had significantly higher scores than the CHD patients on the interference with life scale (\( p < 0.05 \)).

Family history of CHD

Sixty-six percent of syndrome X patients reported some family history of CHD, compared to 65% of CHD patients and 48% of controls (\( p < 0.05 \)). Thirty-four percent of both the CHD and syndrome X patient groups reported a sibling or parent with CHD before the age of 60 compared to 9% of controls (\( p < 0.001 \)). No measure of family history of CHD was significantly associated with HADS anxiety or depression of HAQ health anxiety scores for any group.

Social contact

Data regarding patients' social network were split into two categories: patients who reported having no friends or a small social network (six or fewer friends) and patients with a large social network (seven or more friends). There were no differences between syndrome X, CHD patients and healthy controls in the size of social network (56%, 55% and 47%, respectively with a small social network, \( p = 0.42 \)). No differences were found between the three groups in the frequency of contact with friends, either by phone or in person.

Syndrome X patients who reported a small social network (six or fewer friends) had significantly higher levels of HADS depression (\( p < 0.05 \)), HAQ health worry (\( p < 0.01 \)), interference with life (\( p < 0.01 \)) and total HAQ score (\( p < 0.01 \)) than those who reported a large social network (Fig. 1). CHD patients with a small social network...
network also had higher levels of HADS depression (5.2 ± 3.4 vs. 3.8 ± 3.5, \( p < 0.05 \)) and interference with life (3.5 ± 2.5 vs. 2.1 ± 2.1, \( p < 0.01 \)) than those with a large social network. There were no differences in the HADS or HAQ scores of control group on the basis of their social network. Number or frequency of contact with relatives, either by telephone or visiting was unrelated to sub-scales of the HADS and HAQ for any group.

Life events

There was no significant difference between the number of life events (expressed as none, one to two and three or more,) experienced by syndrome X, CHD patients and controls. Syndrome X patients who reported three or more stressful life events had higher general anxiety (8.8 ± 4.6 vs. 5.7 ± 2.9 and 6.6 ± 3.2, \( p < 0.01 \)), reassurance-seeking (1.72 ± 1.4 vs. 0.8 ± 0.8 and 1.25 ± 0.9, \( p < 0.01 \)) and total HAQ score (17.1 ± 10.7 vs. 11.7 ± 5.6 and 12.7 ± 7.3, \( p < 0.05 \)), while CHD patients who reported three or more life events had higher general anxiety (6.9 ± 3.8 vs. 5.7 ± 3.7 and 3.2 ± 2.1, \( p < 0.01 \)), depression (5.5 ± 3.6 vs. 4.4 ± 3.3 and 2.8 ± 3.3, \( p < 0.05 \)) and total HAQ score (15.9 ± 8.1 vs. 13.3 ± 7.5 and 10.1 ± 6.7, \( p < 0.05 \)). No differences were found among the controls.

Gynaecological factors

Forty-five percent of syndrome X patients had undergone hysterectomy in comparison with 39% of CHD patients and 24% of controls (\( p < 0.01 \)). Sixty-seven percent of syndrome X patients were prescribed hormone replacement therapy compared to 29% each of CHD patients and controls (\( p < 0.001 \)). No difference in the number of patients having undergone oophorectomy was found. Syndrome X and CHD patients experienced their last menstrual period (LMP) at a significantly younger age than controls (\( p < 0.001 \)), however, there was no difference in the age at hysterectomy between the three groups. A history of hysterectomy or current HRT use had no effect on the various scales of the HADS or HAQ for any group.

Oestrogen plasma levels

The independent laboratory range for oestrogen was lowered from a minimum detectable level of <37 to <18 pmol/l during the study. Therefore, patients whose level was found to be less than <37 pmol/l were re-coded as 36 pmol/l for the purpose of standardizing the analysis. 17β-oestradiol samples were not recorded for 2% of syndrome X patients, 12% of CHD patients and 6% of controls due to laboratory or phlebotomy difficulties.

Syndrome X patients had higher 17β-oestradiol levels (199.9 ± 218.3 pmol/l) than CHD patients (112.2 ± 168.2 pmol/l) and controls (137 ± 190.3 pmol/l, \( p < 0.01 \)). However, there were no differences in the levels of plasma oestrogen of the syndrome X, CHD patients or healthy controls when the three groups were compared on the basis of HRT use. Oestrogen level was unrelated to any measure of the HADS or HAQ for any of the three groups. The number of years elapsed since the last menstrual period was also unrelated to either measure within the HADS or HAQ for any group.

Table 1 The median and interquartile range of the health anxiety questionnaire (HAQ) sub-scales for all three groups

<table>
<thead>
<tr>
<th>Sub-scale</th>
<th>Syndrome X</th>
<th>CHD</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health worry</td>
<td>5.0 (4)</td>
<td>4.0 (3)</td>
<td>3.0 (4)</td>
</tr>
<tr>
<td>Fear of illness</td>
<td>4.0 (5)</td>
<td>4.0 (4)</td>
<td>3.0 (4)</td>
</tr>
<tr>
<td>Reassurance-seeking</td>
<td>1.0 (2)</td>
<td>1.0 (2)</td>
<td>1.0 (2)</td>
</tr>
<tr>
<td>Interference with life</td>
<td>3.0 (3)</td>
<td>2.5 (3)</td>
<td>1.0 (1)</td>
</tr>
<tr>
<td>Total HAQ score</td>
<td>13.5 (10)</td>
<td>14.0 (11)</td>
<td>8.0 (9)</td>
</tr>
</tbody>
</table>

Data are expressed as median (interquartile range).

\* \( p = <0.05 \) compared with syndrome X.

\** \( p = <0.01 \) compared with syndrome X.

\*** \( p = <0.01 \) compared with CHD.

Fig. 1 The effect of social network size on the HADS and HAQ scores of syndrome X patients.
(p < 0.05) and healthy controls (p < 0.001). The prevalence of cardiovascular risk factors and concomitant illness in all three groups is illustrated in Table 2.

### Multivariable analysis

The second part of our hypothesis concerned the possible reasons for high levels of health anxiety in syndrome X patients. In the multiple regression analysis, a small social network (p = 0.003), divorced/separated or widowed status (p = 0.005), not taking Hormone Replacement Therapy (p = 0.008) and a high HADS anxiety score (p < 0.001) emerged as the variables independently associated with health anxiety score. They accounted for 41.9% of the variance (Table 3).

### Discussion

In this carefully matched study, syndrome X patients had significantly higher levels of anxiety and felt their health interfered more with their everyday lives than CHD patients and controls. Both syndrome X and CHD patients had much higher levels of health anxiety and were significantly more depressed than controls, suggesting a greater concern about their respective illnesses. However, the higher level of general anxiety (as measured by the HADS) found in syndrome X patients cannot be accounted for by the presence of chest pain, as patients in the CHD and syndrome X groups suffered similar symptoms. This is an important new finding, as previous studies have attributed higher levels of anxiety in patients with non-cardiac chest pain to the anxiety and depression associated with all chronic medical conditions.31

Syndrome X patients had a similar sized social network with a similar frequency of contact as CHD patients and healthy controls. However, syndrome X patients who reported having a large social network were significantly less anxious and depressed, and had lower levels of health related anxiety than those who reported having a small social network. The size of social network had less impact on measures of health related anxiety in CHD patients, and no effect on the psychological health of controls. It therefore appears that a larger support network moderates the levels of depression and health anxiety experienced by patients with syndrome X. Both syndrome X and CHD patients were adversely affected by threatening life events, experiencing increased health anxiety when exposed to three or more life events. However, depression was linked to life events in women with CHD, whereas reassurance was related to life events in women with syndrome X. This may reflect previous research linking depression and CHD, while highlighting the relationship between syndrome X patients and reassurance-seeking behaviour.

Both CHD and syndrome X patients had a similar number of first degree relatives who had developed CHD

### Table 2 Percentage of patients with concomitant medical conditions and cardiovascular risk factors

<table>
<thead>
<tr>
<th>Condition</th>
<th>Syndrome X (%)</th>
<th>CHD (%)</th>
<th>Controls (%)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current smokers</td>
<td>11</td>
<td>11</td>
<td>15</td>
<td>0.630</td>
</tr>
<tr>
<td>Hypertension</td>
<td>33</td>
<td>58</td>
<td>25</td>
<td>0.001</td>
</tr>
<tr>
<td>Hypercholesterolaemia</td>
<td>26</td>
<td>68</td>
<td>9</td>
<td>0.001</td>
</tr>
<tr>
<td>Respiratory</td>
<td>17</td>
<td>14</td>
<td>11</td>
<td>0.474</td>
</tr>
<tr>
<td>Gastric/abdominal</td>
<td>20</td>
<td>16</td>
<td>14</td>
<td>0.511</td>
</tr>
<tr>
<td>Neurological</td>
<td>15</td>
<td>7</td>
<td>7</td>
<td>0.087</td>
</tr>
<tr>
<td>Endocrinological</td>
<td>16</td>
<td>32</td>
<td>4</td>
<td>0.001</td>
</tr>
<tr>
<td>Musculoskeletal</td>
<td>33</td>
<td>29</td>
<td>23</td>
<td>0.287</td>
</tr>
<tr>
<td>Other</td>
<td>17</td>
<td>16</td>
<td>13</td>
<td>0.716</td>
</tr>
</tbody>
</table>

### Table 3 Results of multiple regression analysis showing the variables most closely associated with total health anxiety questionnaire (HAQ) score

<table>
<thead>
<tr>
<th>Variable</th>
<th>Non-standardised β coefficient</th>
<th>Standard error</th>
<th>Standardised coefficient</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>2.193</td>
<td>3.266</td>
<td>0.058</td>
<td>0.50</td>
</tr>
<tr>
<td>Age</td>
<td>-0.022</td>
<td>0.035</td>
<td>-0.089</td>
<td>0.52</td>
</tr>
<tr>
<td>Single</td>
<td>2.010</td>
<td>1.492</td>
<td>0.115</td>
<td>0.18</td>
</tr>
<tr>
<td>Divorced, widowed, separated</td>
<td>-1.980</td>
<td>0.694</td>
<td>-0.246</td>
<td>0.005</td>
</tr>
<tr>
<td>Hormone replacement therapy</td>
<td>1.654</td>
<td>0.694</td>
<td>0.224</td>
<td>0.019</td>
</tr>
<tr>
<td>Oestrogen level</td>
<td>-0.001</td>
<td>0.001</td>
<td>-0.036</td>
<td>0.69</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td>-0.238</td>
<td>0.638</td>
<td>-0.034</td>
<td>0.71</td>
</tr>
<tr>
<td>Social network size</td>
<td>-0.956</td>
<td>0.308</td>
<td>-0.276</td>
<td>0.003</td>
</tr>
<tr>
<td>Stressful life events</td>
<td>0.599</td>
<td>0.397</td>
<td>0.131</td>
<td>0.13</td>
</tr>
<tr>
<td>Family history of coronary heart disease in person (&lt;60 years)</td>
<td>-0.165</td>
<td>0.621</td>
<td>-0.023</td>
<td>0.79</td>
</tr>
<tr>
<td>Anxiety score</td>
<td>0.349</td>
<td>0.086</td>
<td>0.396</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Depression score</td>
<td>0.104</td>
<td>0.106</td>
<td>0.097</td>
<td>0.33</td>
</tr>
</tbody>
</table>
before the age of 60, but a strong positive family history of CHD was unrelated to psychological morbidity in any group. Eifert et al. suggested that direct exposure to heart disease is more likely in patients with chest pain and angiographically smooth coronary arteries than heart disease patients or normal controls, whereas our study identified an almost identical pattern of family history of CHD in the syndrome X and CHD patients. A strong positive family history of CHD may be relevant in the physiological development of syndrome X, but appears to have little effect on the psychological health of the three groups under investigation in this study.

Our study confirms the finding that postmenopausal women with syndrome X have a higher incidence of hysterectomy. Previous studies have reported an average hysterectomy prevalence of 17.4% in British women aged 40–80 years and of 13.6% in a British urban community sample. The higher frequency of hysterectomy found in healthy volunteers in this study (24%) may reflect regional variation, as previous large-scale studies have noted countrywide differences in HRT use and hysterectomy. The greater number of syndrome X patients prescribed HRT may reflect the impact of previous studies advocating the use of HRT as a treatment regime in syndrome X, as the frequency of HRT use in the CHD and control group (29%) reflects the previously documented national average (33%). Hysterectomy and HRT use were unrelated to depression or general anxiety in patients with syndrome X. In the multivariable analysis, not taking HRT was associated with increased health anxiety, though this result must be treated with caution as the univariate result was only at a borderline level of significance (p = 0.055). Recent studies such as women’s health initiative (WHI) and heart and estrogen/progesterin replacement study (HERS) have raised serious concerns regarding the safety of HRT. The administration of HRT and its role for symptomatic relief should therefore be under review.

Evidence to support the suggested oestrogen depletion in syndrome X patients was not found. Oestrogen depletion may be a factor in the development of syndrome X, and therefore a sample taken at the time of diagnosis may be a more accurate marker of possible cause. As our sample only included patients who had been diagnosed with syndrome X for more than one year, this was outside the remit of the current study. An exploration of menopausal symptomology and reason for hysterectomy in women with syndrome X is also worthy of further study.

Syndrome X patients were on average eight years younger than CHD patients at the time of diagnosis, a finding which reflects in the general age disparity between the syndrome X and CHD patients. While every care was taken to age-match the groups as closely as possible, due to the differences in aetiology and age at onset in the two conditions, exact age-matching was not possible. We did not find age was related to levels of anxiety, depression or health anxiety, so this slight age discrepancy cannot explain our findings.

This study has drawn attention to a number of psychosocial factors which should be addressed in order to manage and treat patients with cardiac syndrome X more effectively. As syndrome X patients with small social networks suffer higher levels of psychological morbidity, future research should target treatments involving social interaction, such as support groups and group therapy. Many patients report increased pain frequency and severity during periods of stress, including the cumulative effect of a number of adverse life events, suggesting that a programme of stress identification, management and reduction may also play an important role in the treatment of syndrome X. Research into transcendental meditation and cognitive behavioural therapy should be extended in order to assess their effectiveness and reliability as psychological treatments for syndrome X, as previous small-scale studies have gained positive results.

Our findings may also impact upon research into the modification of illness behaviour through the adjustment of health beliefs, a strategy which has had little success in patients with syndrome X. Leventhal et al. described a number of factors they believed predicted illness behaviour, and while health beliefs were noted, social factors such as social support, modelling behaviour and heritability were all implicated in the formation of health behaviours. It could be argued therefore, that the social environment identified in the current study should be incorporated into any future studies relating to the modification illness behaviours in syndrome X, including the adjustment of health beliefs.

**Study limitations**

The cross-sectional design, sample selection methods used and self-response questionnaire format used during this study may be identified as limiting factors. The limitations of our chosen questionnaires were recognised, along with those of others previously used in similar research, but were implemented as the most appropriate for the study. The control group and a number of the CHD patients were recruited into the study on the basis of their response to a request for volunteers, which may have resulted in selection bias on the basis of previous psychological morbidity or increased health awareness. In an attempt to reduce bias, patients and volunteers were recruited from similar clinics, the same hospital referral area and physical location. No control subject had ever suffered chest pain, however the possibility that some controls may have suffered from subclinical CHD should be noted.

Recent discussions in the medical press have shown that cardiologists and internists continue to dismiss women with syndrome X. The psychosocial and gynaecological components associated with syndrome X will therefore continue to be misunderstood. Treatment modalities that address these elements of the condition may result in clinical improvement of some patients with this syndrome. Until such psychosocial factors as those identified in this study are recognised within the dichotomous pathology of this debilitating condition, we will be no closer to finding a useful and effective treatment armamentarium for patients with cardiac syndrome X.
References


