Chest pain and subsequent consultation for coronary heart disease: a prospective cohort study

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ABSTRACT

Background
Chest pain may not be reported to general practice but could be an important first sign of coronary heart disease (CHD).

Aims
To determine whether self-reported chest pain predicts future consultation for CHD in those with no history of consultation for CHD.

Design of study
Population-based study, with 7 year's follow up by GP record linkage.

Setting
General practice in North Staffordshire.

Method
A survey, including the Rose angina questionnaire, was mailed to 4002 adults. Linked GP records used to identify responders with no record of CHD (G3 Read code or British National Formulary code for nitrate use) in the 32 months before the survey to form the sample for a 7-year prospective study. 'Survival' was compared in those with and without self-reported chest pain up to the earliest date of GP diagnosis of CHD, death, or end of the study period.

Results
The survey response was 65% and 2348 participants gave permission to access their GP records. Of these, 2229 had no prior consultation for CHD. From the questionnaire, 558 reported chest pain of which 186 reported exertional pain and 103 met the criteria for angina. When followed prospectively, incidence of CHD consultations was higher in those with any chest pain definition, compared with no pain, and continued to be so for 7 years subsequently. Although these associations were strongly age related, self-reported symptoms were found to be an independent risk factor for future consultation for CHD.

Conclusion
This study highlighted that self-reported chest pain is a marker of future CHD. The usefulness of early identification of people with this symptom remains to be established.

Keywords
angina; chest pain; coronary disease; epidemiology; referral and consultation; screening.

INTRODUCTION

Self-reported chest pain in population surveys is a predictor of future coronary heart disease (CHD) mortality in men and women[1–4] and myocardial infarction in men.[1,5] People with the chest pain who have not consulted a doctor or received a diagnosis of coronary heart disease, including those whose pain is typical of angina, appear to carry a similar future coronary mortality risk as those who have consulted.[1,3] Identifying people with chest pain may provide secondary prevention of CHD in the community. Its advantages, however, will partly depend on the future patterns of consultation and diagnosis in this group of people with chest pain who have not yet had a diagnosis of CHD. This study followed up adults who reported chest pain in a postal health survey of an adult general population sample to ascertain whether their subsequent rate of consultation with the GP for symptoms attributed to heart disease was higher than in those who reported no chest pain in the survey.

METHOD

The study took place in a semi-urban four-partner group general practice in North Staffordshire, which has held computerised records of all practice contacts since 1990 and which conducts an annual review to ensure that the presence of all chronic conditions is updated each year. The practice is a recording practice for the Royal College of General Practitioners' (RCGPs') Weekly Returns Service which provides data for the national UK general practice morbidity

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database[6] and, as a member of the North Staffordshire GP Research Network, undergoes regular audits of its recording quality.[7] The software system used for the morbidity and medication recording was VAMP Vision (In Practice Health Systems Ltd). The morbidity recording utilises the Read code system, the most common method for assigning morbidity and treatment codes in UK clinical practice. A self-complete general health survey was mailed to a randomly selected 50% sample (n = 4002) of the adult population aged 18–75 years registered with the study practice. In the UK virtually all the adult population is registered with a general practice, so practice registers provide a convenient frame for sampling a local population. As part of the survey, permission was sought from the mailed population sample to view their medical records for research purposes. Only those survey responders who gave this permission were considered in the current analysis. Demographic information in the questionnaire included age, sex, and current work status.

The Rose questionnaire for angina pectoris,[8] a validated instrument for use in the general population,[9] was included as part of the general health survey. The questionnaire asks first about any chest pain, and then specifically about chest pain brought on by exertion. To meet the definition of 'definite angina' according to the previously established 'Rose' criteria, there must be pain located over the sternum or in both the left chest and arm. This pain comes on with exertion and causes the person to stop or slow down and goes away within 10 minutes. Three groups were identified from the chest pain data in the questionnaire: (i) those with any chest pain, (ii) those with any exertional chest pain, and (iii) those with definite angina according to the Rose criteria. Group (iii) is a subgroup of group (ii), and group (ii) is a subgroup of group (i). Those who had no chest pain at all formed the other group for analysis.

A download from the general practice records of all consenting survey responders was carried out to obtain information concerning both their consultations and prescribed medication. The period of the download extended from January 1994 to December 2003. The postal survey was carried out in September

How this fits in

Chest pain in adults is associated with a higher risk of future cardiovascular mortality. Many adults who report chest pain in population surveys have not been diagnosed with coronary heart disease (CHD). It has been shown that when such adults are followed-up over a 7-year period, although most still will not be diagnosed with CHD during this time, they are still at a higher risk of such a diagnosis throughout this period than people followed up for the same period of time who do not start off with chest pain. Men were shown to have a higher cardiovascular mortality. There may be potential in enquiring about chest pain as part of identifying those at higher risk in the general population who could be the target for preventive strategies.

Table 1. Demographics of the cohort (survey responders with no prior GP record of coronary heart disease) by self-reported chest pain sub-groups.

	Angina[a]	Exertional chest pain	Any chest pain	No chest pain
Frequency	103	186	558	1671
Male (%)	43 (42)	87 (47)	292 (52)	728 (44)
Female (%)	60 (58)	99 (53)	266 (48)	943 (56)
Age, years				
Mean (SD)	56.2 (15.4)	54.0 (15.8)	48.0 (15.3)	46.5 (15.3)

[a]*The angina group (group iii) is a subgroup of exertional chest pain (group ii), which is a subgroup of any chest pain (group i).*

Table 2. Survival functions for the prospective follow-up participants by baseline self-reported chest pain status. Event of interest is 'consultation for CHD'.

Questionnaire group	Population	Consultation	Exit from for IHD[a]	Deaths practice	Survival proportion	Log rank test P-value[b]
Males						
Angina	43	9	6	8	0.7455	
No angina	977	54	140	32	0.9386	0.0029
Exertional chest pain	87	17	11	8	0.7805	
No exertional chest pain	933	46	135	32	0.9449	<0.0001
Any chest pain	292	30	42	16	0.8863	
No chest pain	728	33	104	24	0.9492	0.0001
Females						
Angina	60	10	6	3	0.8247	
No angina	1149	33	182	44	0.9678	<0.0001
Exertional chest pain	99	13	13	8	0.8548	
No exertional chest pain	1110	30	175	39	0.9699	<0.0001
Any chest pain	266	16	44	10	0.9341	
No chest pain	943	27	144	37	0.9680	0.0281

[a]*18 deaths (12 male, 6 female) occurred subsequent to consultation for IHD: 3 angina, 2 exertional chest pain, 2 any chest pain, 11 no chest pain.* [b]*adjusted for age group (18–46, 47–75 years). IHD = ischaemic heart disease.*

Table 3. Cox regression analysis for the prospective follow-up of participants by baseline self-reported chest pain status. Event of interest 'Consultation for CHD'.

	Angina RR (95% CI)	Exertional chest pain RR (95% CI)	Any chest pain RR (95% CI)
Males			
Symptoms			
No	1.00	1.00	1.00
Yes	3.13 (1.5 to 6.4)	3.25 (1.9 to 5.7)	2.33 (1.4 to 3.8)
Age group			
18–46 years	1.00	1.00	1.00
47–75 years	15.7 (4.8 to 51.0)	15.3 (4.7 to 49.5)	16.9 (5.2 to 54.5)
Employment status			
Working	1.00	1.00	1.00
Not working	1.33 (0.8 to 2.2)	1.26 (0.8 to 2.1)	1.37 (0.8 to 2.3)
Females			
Symptoms			
No	1.00	1.00	1.00
Yes	3.79 (1.9 to 7.7)	3.50 (1.8 to 6.7)	1.83 (1.0 to 3.4)
Age group			
18–46 years	1.00	1.00	1.00
47–75 years	11.0 (2.6 to 47.1)	10.9 (2.5 to 47.0)	11.7 (2.7 to 50.0)
Employment status			
Working	1.00	1.00	1.00
Not working	2.72 (1.3 to 5.6)	2.68 (1.3 to 5.5)	2.88 (1.4 to 5.9)

RR = risk ratio.

1996. Thus, the general practice records were used to determine the presence of a diagnosis of CHD in the 32 months prior to the survey (retrospective review). This information was used to identify the study population for the prospective cohort analysis. The records were then used to determine newly diagnosed CHD for this analysis, from the time of the survey up to the end of 2003 (prospective review). GPs in the participating practice were not informed of the survey results, and it is unlikely that the survey could have influenced subsequent GPs' coding.

Participants were assigned a GP diagnosis of CHD if either the G3 Read code (angina, myocardial infarction, other CHD) or the British National Formulary (BNF) code for nitrate use (02060100) was found in their records. This definition of CHD has been used previously in a UK study and was found to have a sensitivity of 73% and a positive predictive value of 79% when compared with diagnosis confirmed by objective diagnostic strategies, such as a positive coronary angiogram, exercise test, or raised cardiac enzyme activity.[10] Deaths from all causes up to December 2003 among responders to the survey who were included in the prospective cohort, were ascertained from the records held at the practice.

Table 4. Survival functions for the prospective follow-up of participants by baseline self-reported chest pain status. Event of interest is 'all cause mortality'.

Questionnaire group	Population	Deaths	Exit from practice	Survival proportion	Log rank test *P*-value[a]
Males					
Angina	43	10	6	0.7200	
No angina	977	42	142	0.9510	0.0001
Exertional chest pain	87	12	12	0.8350	
No exertional chest pain	933	40	136	0.9512	0.0230
Any chest pain	292	22	44	0.9149	
No chest pain	728	30	104	0.9526	0.0172
Females					
Angina	69	4	6	0.9211	
No angina	1149	49	185	0.9528	0.8854
Exertional chest pain	99	9	13	0.8959	
No exertional chest pain	1110	44	178	0.9560	0.1886
Any chest pain	266	11	44	0.9537	
No chest pain	943	42	147	0.9507	0.5853

[a]*Adjusted for age group (18–46 years and 47–75 years).*

Analysis

As symptom frequency, consultation rates, and mortality related to CHD are reported to differ between males and females, all analyses were stratified by sex. Prospective analysis compared the survival of participants with and without chest pain at baseline, according to the three different classifications, from the time of the survey until the earliest of the following: first-time GP diagnosis of angina; death (any cause); exit from the practice; or end of the study period. Results were then presented separately for angina diagnosis and death, and survival proportions were compared using the log-rank test, adjusted for age group. Kaplan–Meier curves were drawn for survival to angina diagnosis. To adjust the associations, between each of the three baseline chest pain groups and subsequent consultation for CHD, for other risk factors for CHD onset and mortality (age and employment status), a Cox regression analysis was performed. In this analysis, age at survey was categorised into two groups (above and below the 'at risk' population median) and employment status was recorded as working or not. Results for this analysis are presented as adjusted risk ratios and 95% confidence intervals. All analyses were carried out using Stata software (version 7.0.)

RESULTS

Response to the postal survey was 65% (n = 2606; 1204 males, 1402 females) with responders more likely to be female and of older age. Of these 2348 (90%) responders (1094 males, 1254 females) gave permission for medical record review. The cohort for the prospective analysis consisted of the 2229 participants with no history of CHD in their medical records (1020 males, 1209 females). These included 558 who reported chest pain in the survey, of whom 186 had chest pain on exertion; 103 of the latter also had definite angina according to Rose criteria (Table 1). Most people who reported chest pain of any sort in the survey were not diagnosed with CHD during the 7 years of follow-up. However the likelihood of subsequent first-time GP diagnosis of CHD, as

calculated by survival analysis, was higher in all three baseline chest pain groups (men and women) compared with those with no chest pain (Table 2). Table 3 presents adjusted risk ratios for the three chest pain groups by sex. In each comparison, self-reported symptoms were independently associated with future consultation for CHD, with similar magnitude of risk in men and women. There was a strong association between age and CHD consultation. The condition 'not working' at baseline was also associated with a greater risk of subsequent consultation for CHD in females. Kaplan–Meier curves for survival to CHD diagnosis indicate that the differences between the chest pain and no chest pain groups persisted during the 7 years of follow-up (Figures 1 and 2). A similar pattern of chest pain predicting outcome was found in men for 7-year all-cause mortality. In women there was no clear or significant differences in mortality between the pain and non-pain groups (Table 4). After adjusting this analysis for the effect of age group and employment status, self-reported symptoms remained independently associated with subsequent all-cause mortality (Table 5).

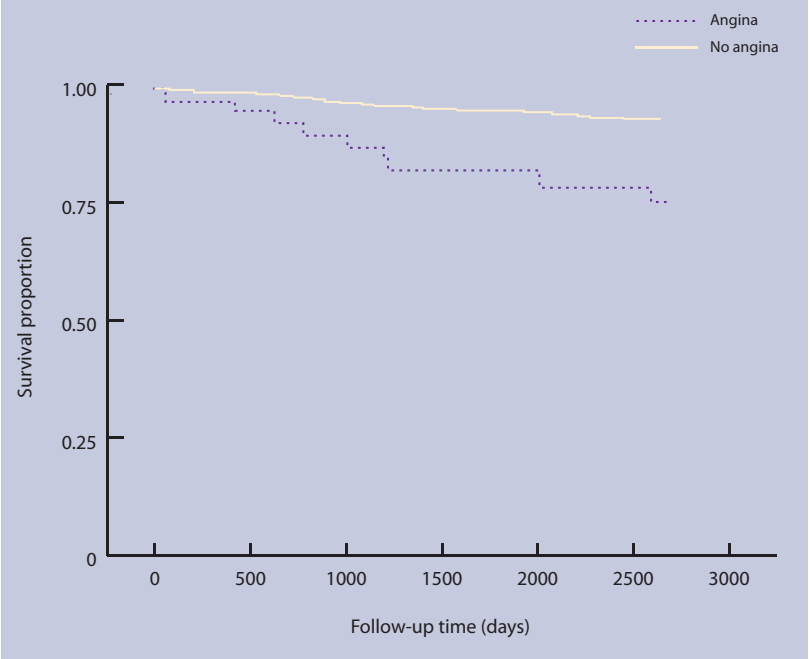

Figure 1. Kaplan–Meier survival curve for comparison of questionnaire-based angina and no angina: Males.

DISCUSSION

Summary of main findings

The main question in this study was what happened to those people reporting chest pain in the survey who had no prior general practice record of CHD. Over 7 years, men with chest pain were more likely to consult for CHD and more likely to die than men without chest pain — this was true for all chest pain and for the more tightly defined subgroups. Survival curves show that this difference was established early on and maintained throughout the 7 years. For women this pattern was true only for consultations and not for deaths, in contrast with the study by Owen-Smith *et al*.[3] However, mortality rate was generally low in women, and it may be that there was insufficient power or not enough follow-up time to rule out an elevated mortality.

Strengths and limitations of the study

This is the first study to follow up primary care consultations in relation to self-reported chest pain. A potential weakness of the study was the use of computerised morbidity data. Some people classified as having no prior CHD may have been diagnosed or treated, but not had it recorded. However, the long history of morbidity recording in the study practice, and regular auditing of the quality and completeness of their computerised records, indicates that major misclassification and bias in the prospective analysis was unlikely.

A second weakness of the study was the lack of information regarding potential cardiovascular confounders, such as smoking status and body mass index. However, the adjusted analysis demonstrated that, although age and (in females) employment status are strongly related to future consultation for CHD, self-reported symptoms remained an independent risk factor. Furthermore, even if self-reported chest pain simply indicated the presence of cardiovascular risk factors at baseline, this may be a helpful marker. Chest pain may also be an early manifestation of symptomatic heart disease and be important to identify and treat in its own right, regardless of whether its link with subsequent CHD consultation is 'explained' by other factors or not.

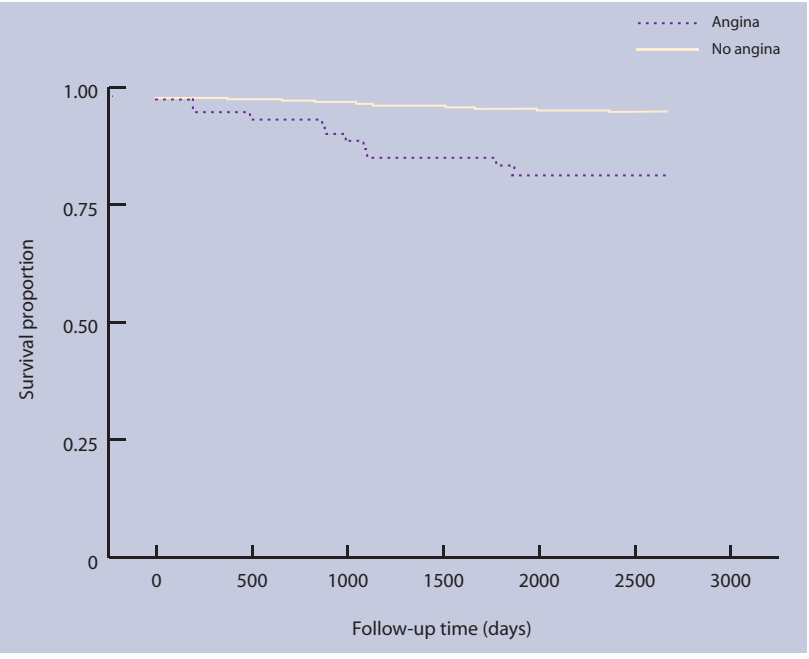

Figure 2. Kaplan–Meier survival curve for comparison of questionnaire-based angina and no angina: Females.

Table 5. Cox regression for the prospective follow-up of participants by baseline self-reported chest pain status. Event of interest is 'all-cause mortality'.

	Angina RR (95% CI)	Exertional chest pain RR (95% CI)	Any chest pain RR (95% CI)
Males			
Symptoms			
No	1.00	1.00	1.00
Yes	4.25 (2.1 to 8.5)	2.14 (1.1 to 4.1)	1.93 (1.1 to 3.4)
Age group			
18–46 years	1.00	1.00	1.00
47–75 years	4.2 (1.5 to 12.2)	4.55 (1.6 to 13.1)	4.92 (1.7 to 14.1)
Employment status			
Working	1.00	1.00	1.00
Not working	7.05 (3.4 to 14.5)	6.79 (3.3 to 13.9)	7.03 (3.4 to 14.4)
Females			
Symptoms			
No	1.00	1.00	1.00
Yes	0.91 (0.3 to 2.5)	1.49 (0.7 to 3.1)	0.79 (0.4 to 1.5)
Age group			
18–46 years	1.00	1.00	1.00
47–75 years	6.09 (2.1 to 17.6)	5.89 (2.0 to 17.0)	6.14 (2.1 to 17.7)
Employment status			
Working	1.00	1.00	1.00
Not working	4.07 (2.0 to 8.3)	3.98 (1.9 to 8.1)	4.07 (2.0 to 8.3)

RR = risk ratio.

Comparison with existing literature

There is good epidemiological evidence that people who report any sort of chest pain in population surveys are at higher risk of subsequent mortality from CHD than those who report no chest pain.[1–3] The RCGP cohort study found higher mortality rates in women with chest pain whether they had consulted for it or not.[3] This was supported in the current study with finding an increased rate of subsequent new diagnosis of CHD in general practice among those with baseline chest pain. This increase was observed for each of the 7 years of follow-up. The increase was found whether the pain was typical of angina or not, and was independent of age, sex and employment status. This suggests that many people with chest pain in the community have diagnosable CHD.

Implications for future research or clinical practice

The consultation findings fit the pattern established from prospective studies of mortality in both men and women. Owen-Smith *et al* suggested screening might be worth considering.[3] Whether these patterns of risk justify opportunistic enquiry about chest pain as part of a routine consultation or health check in practice populations, depends on whether it is more effective to identify everyone with chest pain than to wait and see who consults about it. For this there would need to be a justifiable intervention — a systematic check on other risk factors (chest pain as an indicator for blood pressure or cholesterol measurement) and targeted secondary prevention, such as aspirin advice, for example. This study highlights that most people with chest pain will not present with CHD or die from it. However, it may be effective to target all people with chest pain as a general 'at risk' group. Whether the whole group should be investigated is a separate question, which would need to take into account the fact that substantial numbers of people who have chest pain, but are found to have normal coronary arteries, develop significant levels of persisting pain and disability, as well as psychological problems and other correlates of a chronic pain syndrome.[11]

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Ethics committee

North Staffordshire Health Authority Local Research Ethics Committee, reference number: 571.

Competing interests

The authors have stated that there are none

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