One-stop chest pain clinic can identify high cardiac risk

ABSTRACT – The aim of this study was to record prognosis for patients with stable chest pain referred for outpatient cardiac assessment. All 660 patients in the study had a normal resting ECG and no history of myocardial infarction, unstable angina or coronary revascularisation. Main outcome measures were all-cause mortality, non-fatal ischaemic events and coronary revascularisation. Cardiac chest pain was diagnosed in 182 patients (28%). It was more frequent in patients with recent onset of symptoms (<6 months), patients over 50, white patients, and patients with hypertension or diabetes. The mean follow-up was 622 ± 338 days. Among survivors, 37% continued to suffer from symptoms (cardiac group: 59 (35.1%); non-cardiac group: 177 (38.4%)). When all hard events were considered, event-free survival (95% confidence interval) for the cardiac group was 90.9% (86.7–95.2%) at six months, 88.9% (84.2–93.6%) at one year, and 83.6% (77.5–89.7%) at two years. Corresponding figures for the non-cardiac group at the same time points were better (*p* <0.0001): 98.5% (97.4–99.6%), 97.5% (96.1–99.0%) and 96.6% (94.7–98.5%), respectively. In conclusion, the use of clinical criteria in a cardiac outpatient clinic, backed up by simple non-invasive investigations, can reliably identify a population at high risk of subsequent cardiac events.

Patients with undiagnosed chest pain comprise a substantial part of the workload of a cardiac clinic. Effective strategies for risk stratification that do not rely upon the indiscriminate application of investigative technology are important in these patients, who can be categorised into cardiac and non-cardiac groups based on simple clinical criteria, supported by non-invasive testing in certain cases.

The clinical history is probably the most important diagnostic criterion, and in patients with chest pain that is typical of angina the prevalence of coronary artery disease (CAD) visible on arteriography is considerably greater than in patients with atypical symptoms[1]. Inclusion of age and sex in the model improves its diagnostic potential, and has provided the basis for probability calculations of the presence of CAD that have been applied clinically[2]. Nevertheless, studies have shown that cardiologists usually consider these criteria intuitively in patients with chest pain, with no apparent loss of diagnostic power[3,4]. When diagnostic uncertainty persists (corresponding to an intermediate probability of CAD), non-invasive stress testing is particularly helpful, a positive test heightening the probability of CAD, and a negative test lowering it[5].

Regardless of the process whereby the diagnosis is achieved, therapeutic implications are clearly important. Prognostic implications, however, are less well defined, in terms both of long-term symptomatic status and of event-free survival. Most previous studies have used angiographic coronary anatomy as a starting point for survival analysis, which limits applicability to patients with stable chest pain referred for outpatient assessment[6,7]. In the present study, the relationship has been evaluated between cardiac diagnosis and clinical outcome in patients with stable chest pain attending a hospital outpatient clinic.

Methods

Study group

A total of 1,880 consecutive new patients referred from primary care to a cardiac outpatient clinic over a period of 40 months from 1 August 1991 were evaluated. Those whose major complaint was chest pain were included in the analysis if the resting ECG was normal and there was no history of myocardial infarction, unstable angina or coronary revascularisation. The 660 patients who fulfilled these criteria were subdivided into those diagnosed as having cardiac or non-cardiac chest pain, based on the initial clinical findings and, in 46% of cases, an exercise ECG.

Outpatient clinic

A once-weekly cardiac outpatient clinic is held in a district general hospital serving a population of approximately 220,000. Between 10 and 20 new patients attend each clinic, all of whom are either seen by or discussed with the consultant cardiologist. All new patients receive a routine 12-lead ECG. It is the clinic's policy to provide an unequivocal diagnosis of chest pain (cardiac or non-cardiac) based principally on clinical history and examination. In keeping with

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common practice, the nature, site and relationship to exertion of the pain are considered; in cases where symptoms are suggestive of angina, but not typical in all aspects, an exercise stress test is performed, usually at the same clinic visit, and always within a week. Horizontal or down-sloping ST-depression (>0.1 mV) at 80 msec after the J-point during exercise or in recovery, or a fall in systolic blood pressure, is taken as abnormal, though all results are assessed in the context of the patients' symptoms. Patients are then referred back to their general practitioner (GP) with a treatment strategy or referred for cardiac catheterisation. A letter, dictated immediately after the consultation, is sent to the patient's GP, with a copy retained on file in the cardiac department

Data collection and follow-up

All data in this study were stored electronically in a purpose-built database. Patients were identified retrospectively by review of the correspondence on file in the cardiac department. Notes were reviewed of all those whose major complaint was chest pain. Patients who fulfilled criteria for inclusion in the analysis were followed up by postal questionnaire and telephone interview for information about continuing symptoms and ischaemic events. Details of ischaemic events and deaths were obtained from case records or, if necessary, the GP. The following end-points were recorded:

- death
- non-fatal ischaemic events (myocardial infarction, hospital admission with unstable angina)
- coronary revascularisation (bypass surgery, percutaneous transluminal angioplasty).

Statistical analysis

Groups were compared using Fisher's exact test. Survival curves were generated by the Kaplan-Meier method, and survival probabilities expressed as percentages with 95% confidence intervals. Subgroups were compared using the log rank test.

Results

Baseline variables (Table 1).

A total of 660 patients (60% male, median age 50 years) was assessed for chest pain (median duration 6 months), of whom 46% underwent a treadmill stress test. Eighty-three per cent (545) of the patients were discharged from further cardiac follow-up, usually after only 1–2 clinic visits, and 115 (17%) were referred for tertiary investigation. The diagnosis, based on the initial clinical assessment, the ECG and, when available, the stress test, was cardiac chest pain in 182 (28%) and non-cardiac chest pain in 478 (72%). Cardiac chest pain was diagnosed significantly more frequently in patients with recent onset of symptoms (<6 months), patients over 50, white patients, and patients with hypertension or diabetes. Neither the number of smokers nor gender distribution was significantly different between the diagnostic groups, although relatively more women than men were aged over 50 (54% vs 46%; $p = 0.04$).

Follow-up

During the follow-up period (mean 622 ± 338 days) cumulative referral rates for cardiac catheterisation and revascularisation were 53% and 19% in the

Table 1. Baseline variables.

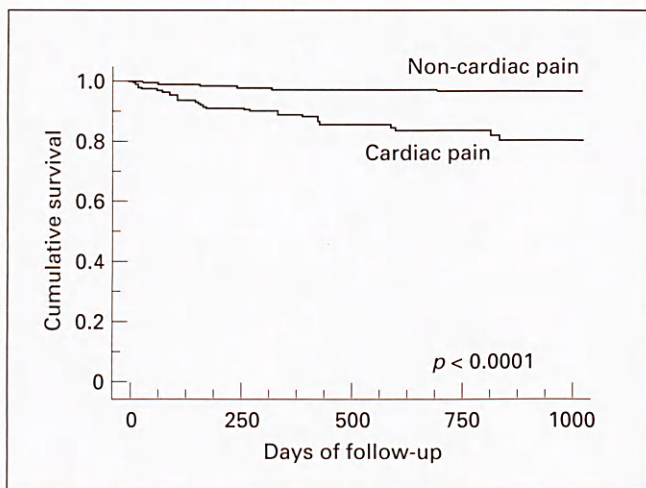|	Patients							
	All (660)		Cardiac (182)		Non-cardiac (478)			
	No.	%	No.	%	No.	%	p	Odds ratio
Age (≤50 years	334	51	33	18	301	63	<0.0001	7.7
Male	395	60	120	66	275	58	0.06	1.45
Racial group:								
Asian	240	36	52	29	188	39	0.04	0.62
African	58	9	11	6	47	10	NS	0.59
White	362	55	119	65	243	51	<0.001	1.83
factors:								
smoking	215	33	64	35	151	32	NS	1.12
diabetes	56	9	24	13	32	7	0.01	2.12
hypertension	134	20	62	34	72	15	<0.0001	2.91
Symptoms <6 months	422	64	129	71	293	61	0.02	1.52

NS = not significant

Fig 1. *Kaplan-Meier event-free survival curves (death, myocardial infarction, unstable angina) for patients diagnosed as having cardiac and non-cardiac chest pain.*
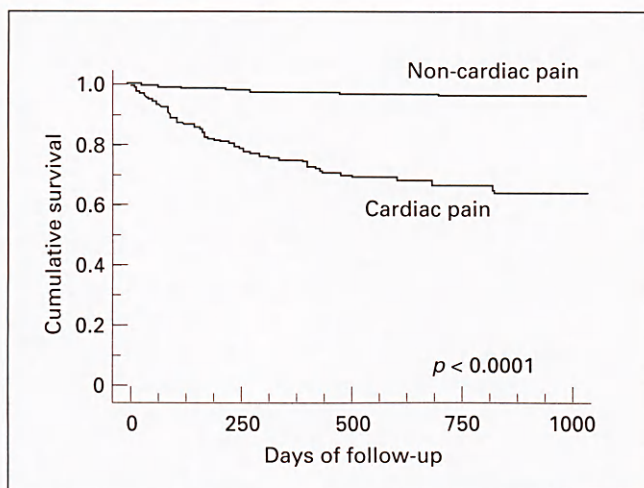

Fig 2. *Kaplan-Meier event-free survival curves (death, myocardial infarction, unstable angina, revascularisation) for patients diagnosed as having cardiac and non-cardiac chest pain.*

cardiac group, and 4% and 0.6% in the non-cardiac group. First hard events (death, myocardial infarction, unstable angina) were recorded. There were 16 deaths, eight myocardial infarctions, and 17 hospital admissions with unstable angina. Of the 644 survivors, follow-up data were available for 629 (98%). Of these, 236 (37%) continued to suffer from symptoms, comprising 59 (35%) among the 168 survivors in the cardiac group and 177 (38%) among the 461 survivors in the non-cardiac group.

Survival analysis (Figs 1 and 2, Table 2).

When all hard events were considered, event-free survival for the cardiac group was 90.9% at six months, 88.9% at one year, and 83.6% at two years. Corresponding figures for the non-cardiac group were significantly better ($p < 0.0001$): 98.5% at six months, 97.5% at one year, and 96.6% at two years. When need for revascularisation was considered, event-free survival figures were 81.3%, 74.3% and 66.0% for the cardiac group, and 98.3%, 97.3% and 96.0% for the non-cardiac group ($p < 0.0001$) at six months, one year and two years, respectively.

Discussion

It is widely recognised that a careful clinical history provides the most useful diagnostic information in the outpatient assessment of chest pain. It permits categorisation of patients into those with high and low probabilities of CAD[1], designated cardiac and non-cardiac groups, respectively, in this study. In patients with an intermediate probability of CAD, stress testing is particularly useful[5], and it was our policy to obtain a stress test, usually during the clinic and always within a

week, whenever the diagnosis was in doubt. In this way, it was possible in every case to provide the GP with a clear diagnostic statement after one or, at the most, two clinic visits.

The application of clinical history to the diagnosis of chest pain is, to some extent, reflected in the data presented in Table 1. Thus, the prevalence of many of the major risk factors for coronary heart disease, particularly advanced age, hypertension and diabetes, tended to be higher in the cardiac group. Although risk is greater in men and South Asians, the excess of men in the cardiac group was not significant, while South Asians were over-represented in the non-cardiac group. These observations may reflect a heightened awareness of coronary risk in South Asian patients by their GPs, resulting in a lower threshold for referral. Awareness of coronary risk in women is also increasing, but the fact that relatively more women than men were aged over 50 is probably sufficient to explain why the excess of men in the cardiac group was small.

Although the diagnostic method summarised above is well validated, we have found no information about its prognostic implications. Patients diagnosed as having cardiac chest pain, based on simple clinical criteria, are a high-risk group with an event rate of nearly 17% in the first two years, rising to 34% when need for revascularisation is also taken into account. This contrasts with patients diagnosed as having non-cardiac chest pain in whom the prognosis is excellent, with an event rate of only 4% in the first two years. These risk assessments apply only to patients with a normal ECG and no previous cardiac history, so it is reasonable to assume that they are conservative assessments and would be appreciably higher if all-comers had been included in the analysis.

The marked difference in prognosis between the

Table 2. Percentage event-free survival (95% confidence intervals) for all-cause mortality and recurrent ischaemic events, and for all-cause mortality, recurrent ischaemic events and revascularisation.

	6 months		1 year		18 months		2 years	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Death and recurrent ischaemia								
All patients	96.4	95.0–97.9	95.2	93.5–96.9	94.0	92.1–96.0	93.0	90.8–95.3
Cardiac group	90.9	86.7–95.2	88.9	84.2–93.6	85.8	80.3–91.3	83.6	77.5–89.7
Non-cardiac group	98.5	97.4–99.6	97.5	96.1–99.0	97.2	95.6–98.8	96.6	94.7–98.5
Death, recurrent ischaemia and revascularisation								
All patients	93.8	91.9–95.6	91.0	88.7–93.2	89.0	86.4–91.5	87.6	84.8–90.5
Cardiac group	81.3	75.5–87.1	74.3	67.7–80.9	68.2	61.0–75.5	66.0	58.3–73.7
Non-cardiac group	98.3	97.1–99.5	97.3	95.8–98.8	97.0	95.3–98.6	96.0	93.9–98.1

Length of follow-up (spanning header)

CI = confidence intervals

cardiac and non-cardiac groups contrasted with symptomatic status during follow-up which showed no significant difference, over a third of both groups reporting continuing chest pain. This is a disappointingly high level of symptoms in the cardiac group, and suggests that the referral rate for cardiac catheterisation and revascularisation may have been too low. In patients with non-cardiac chest pain (usually caused by musculoskeletal, upper gastrointestinal and neurotic disorders), treatment is often difficult and the fact that 37% had continuing symptoms at follow-up is probably not surprising. Because these patients were referred for exclusion of heart disease, our policy was to reassure and discharge them to the care of their GP, with suggestions for non-cardiac investigations where appropriate. Certainly this policy appears safe, judging by the excellent prognosis in this group. Evidence suggests that it may be more therapeutic than a normal coronary arteriogram, particularly when anxiety is contributing importantly to symptoms[8,9].

This study has provided prognostic data for patients attending a cardiology outpatient clinic with chest pain. Although patients were identified retrospectively, the diagnosis of cardiac versus non-cardiac chest pain, based on clinical criteria and simple non-invasive investigations, was available in the clinic correspondence in every case, and all major end-points were objective. Patients diagnosed as having cardiac chest pain have an event rate of 17% in the first two years, whereas those diagnosed as having non-cardiac chest pain have an excellent prognosis and can safely be discharged without further cardiac investigation.

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