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# A British Cardiac Society survey of the potential for the secondary prevention of coronary disease: ASPIRE (Action on Secondary Prevention through Intervention to Reduce Events) *Principal results*

ASPIRE Steering Group

**Abstract**

***Objective*—To measure the potential for secondary prevention of coronary disease in the United Kingdom.**

***Design*—Cross sectional survey of a representative sample of coronary patients from a retrospective review of hospital medical records and patient interview and examination.**

***Setting*—Stratified random sample of 12 specialist cardiac centres and 12 district general hospitals drawn from 34 specialist cardiac centres and 261 district general hospitals in 12 geographic areas in the United Kingdom.**

***Subjects*—2583 patients ⩽ 70 yr; 25 consecutive males and 25 consecutive females identified retrospectively in each of four diagnostic categories: coronary artery bypass grafting, percutaneous transluminal coronary angioplasty, acute myocardial infarction, and acute myocardial ischaemia without evidence of infarction.**

***Main outcome measures*—Risk factor recording and management in medical records; the prevalence and control of risk factors at interview six months after the procedure or event.**

***Results*—Recording of coronary risk factors in patient's records was incomplete and this varied by risk factor. Smoking habit and blood pressure were most completely recorded, whereas a history of hyperlipidaemia and blood cholesterol concentrations were least complete. Risk factor records were more likely to be complete in cardiac centres than in district hospitals. At interview 10% to 27% of patients were still smoking cigarettes and 75% remained overweight, females more severely so. Up to a quarter of patients remained hypertensive, males more severely so than females. Over three quarters had a total cholesterol > 5·2 mmol/l. In patients on medication for blood pressure, cholesterol or glucose, risk factor profiles were little better than in those who were not. Only about one patient in three was taking a $\beta$ blocker after infarction. Up to a fifth of patients who had had acute myocardial ischaemia were not taking aspirin at follow up.**

***Conclusions*—There is considerable potential to reduce the risk of a further major ischaemic event in patients with established coronary disease. This can be achieved by effective lifestyle intervention, the rigorous management of blood pressure and cholesterol, and the appropriate use of prophylactic drugs.**

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Keywords: coronary disease; secondary prevention; United Kingdom survey

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Since the last British Cardiac Society report[1] on prevention of coronary disease in 1987, a considerable amount of new scientific evidence has been published on interventions—lifestyle,[2–4] the control of coronary risk factors[5–7] and the use of prophylactic drug treatment[8–11]—showing that the risk of a further major ischaemic event in patients with established coronary disease can be reduced. In June 1993, the British Cardiac Society Epidemiology and Prevention Committee convened a Workshop on Preventive Cardiology in London, which was attended by representatives of cardiac centres throughout the United Kingdom. The aim was to discuss strategies beyond symptom relief with medical treatment and revascularisation, which can reduce the risk of (re)infarction and to improve survival. As a result of these discussions, the Epidemiology and Prevention Committee decided to survey the extent to which coronary risk factors are being measured and recorded in clinical practice and how effectively they are managed in coronary patients.

The specific aims of ASPIRE (Action on Secondary Prevention through Intervention to Reduce Events) were:

- To measure the number of coronary patients in the UK who would be eligible for secondary preventive measures, by identifying a retrospective representative sample of such patients
- To determine whether the major coronary risk factors—cigarette smoking, obesity, hypertension, hyperlipidaemia, diabetes, and family history of premature coronary disease—and their management are recorded in the patient's medical notes
- To interview patients at least six months after hospital admission, measure their risk factors and describe their management
- To determine whether family members have, where appropriate, been advised to be screened for coronary risk factors.

## Methods

STUDY POPULATION

The study population was 300 men and 300 women ($\leqslant$ 70 years) in each of four diagnostic categories:

- Elective coronary artery bypass grafting (CABG) as first coronary revascularisation
- Elective percutaneous transluminal coronary angioplasty (PTCA) as first coronary revascularisation
- Admission to a district general hospital for acute myocardial infarction (AMI) (*International Classification of Diseases*, 9th Revision (ICD9) code 410)
- Admission to a district general hospital for acute myocardial ischaemia (M Isc) without evidence of infarction (ICD9 codes 411 and 413).

A total of 1200 men and 1200 women were to be identified (consecutively within each hospital) from a representative sample of specialist cardiac centres and of district general hospitals in the United Kingdom.

SAMPLING FRAME

Stratified random samples of 12 specialist cardiac centres and of 12 district general hospitals were drawn from a list of the 34 specialist cardiac centres and the 261 district general hospitals (non-teaching) in the United Kingdom. These two sampling frames were stratified into 12 geographic regions (the eight English health regions, Northern Ireland, Wales, and Scotland divided into east and west). One cardiac centre and one district general hospital were drawn at random from each geographic stratum and were invited to participate in the survey. All 12 cardiac centres agreed to participate; however, three of the district general hospitals declined. These were replaced in the sample by three district general hospitals randomly selected from the same regions as those hospitals that had declined to participate. All three substitutes agreed to participate.

PATIENT SAMPLE

Administrative records of coronary revascularisation procedures from the cardiac centres and of consultant episodes (deaths and discharges) from the district general hospitals were obtained. Starting from a date six months before the start of the survey, these records were searched chronologically in reverse order, and 25 consecutive males and 25 consecutive females were identified in each of the four diagnostic categories from each of the 12 geographic strata. CABG and PTCA patients were identified only from the cardiac centres and the AMI and myocardial ischaemia patients only from the district general hospitals. This initial sample identified 100 patients per hospital or 200 per geographic region, a total of 2400 for the United Kingdom. The "index event" (district general hospital admission or first coronary revascularisation) qualifying the patient for inclusion in the survey had to be at least six months before the start of the survey.

*Table 1 Number of patients recruited to the study*

| | | *Notes* | | *Interview* | |
|---|---|---|---|---|---|
| *Diagnostic category* | *Sex* | *Notes sought* | *Died before interview (%)* | *Invited for interview* | *Attended interview (%)* |
| CABG | M | 311 | 12 (4) | 299 | 266 (89) |
| | F | 317 | 18 (6) | 299 | 259 (87) |
| PTCA | M | 298 | 3 (1) | 295 | 248 (84) |
| | F | 305 | 7 (2) | 298 | 247 (83) |
| AMI | M | 348 | 51 (15) | 297 | 249 (84) |
| | F | 369 | 70 (19) | 299 | 240 (80) |
| M Isc | M | 327 | 27 (8) | 300 | 239 (80) |
| | F | 308 | 11 (4) | 297 | 234 (79) |
| Total | M | 1284 | 93 (8) | 1191 | 1002 (84) |
| | F | 1299 | 106 (9) | 1193 | 980 (82) |

M Isc, myocardial ischaemia.

DATA COLLECTION

Data collection was conducted in two stages. Firstly, the patients' medical notes were retrieved and information recorded about the patients' coronary risk factors was abstracted in a standardised format, in two subdivisions—earliest risk factor information recorded before the index event and most recent risk factor information recorded after the index event. If a patient's notes could not be traced within the six week period of the survey they were analysed as missing.

Secondly, each patient's general practitioner was contacted to find out whether the patient was still alive. If so, the patient was invited to their cardiac centre or district general hospital for an outpatient appointment at which a research nurse administered a short questionnaire, measured the patient's height, weight, and blood pressure and took a non-fasting blood sample for total cholesterol and glucose. If the patient had died, the next consecutive patient identified retrospectively in that diagnosis and sex specific category from the hospital's administrative records was added to the patient sample. The aim was to identify 2400 consecutive survivors to be invited for hospital interview and examination, while retaining information already collected about patients who had died.

PATIENT NOTES

Data collected from the notes comprised the patient's past history (of cigarette smoking, hypertension, hyperlipidaemia, diabetes mellitus, coronary disease), family history of coronary disease, current medication, and measurements of risk factors (height and weight, blood pressure, and blood lipids and glucose). When available, the three earliest and the three most recent measurements of blood lipids and glucose were abstracted. Information on each risk factor was abstracted hierarchically: firstly whether or not any information was present in the notes, secondly what that information was, and thirdly what action was taken in response. In many cases, no record of the patient's height could be found in their notes, so where available the height recorded at interview was used to calculate the body mass index (BMI).

PATIENT INTERVIEW

Data on history of risk factor exposure and current medication were obtained from patients at interview. In addition, single measurements of the patient's height, weight, blood pressure, blood total cholesterol and

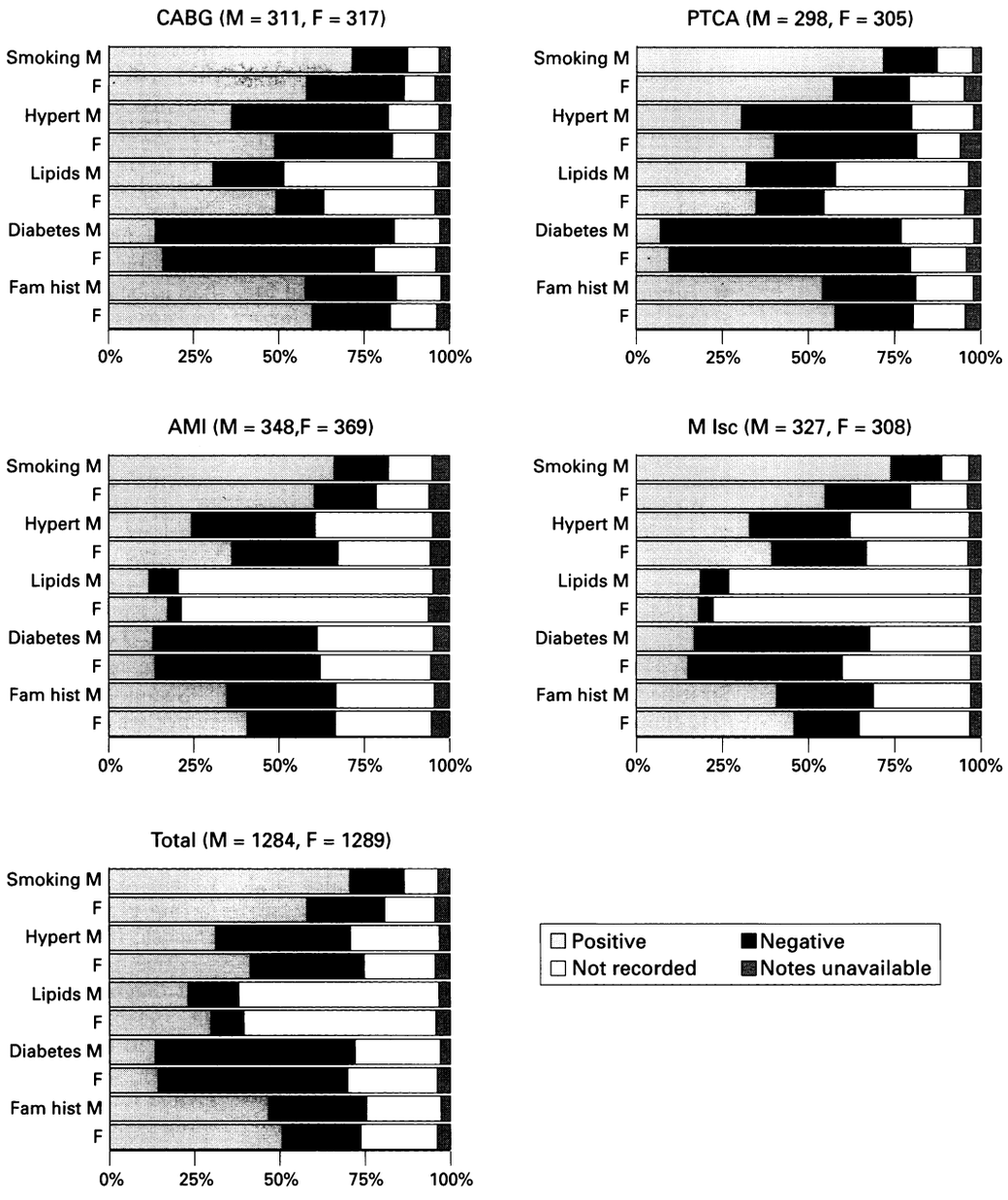


*Figure 1 Proportions of patients on whom risk factor history information was available (either before or after the index event) from medical notes and the proportions in whom that history was positive or negative. Diabetes = history of diabetes; Fam hist = family history of coronary disease; Hypert = history of hypertension; Lipids = history of hyperlipidaemia; Smoking = history of ever having smoked cigarettes.*

*Table 2 Percentage of patients with current coronary risk factor measurements in notes either before or after the index event*

| | | *CABG* | | *PTCA* | | *AMI* | | *M Isc* | | *Total* | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Risk factor* | *Before/after index event** | *M (n = 311)* | *F (n = 317)* | *M (n = 298)* | *F (n = 305)* | *M (n = 348)* | *F (n = 369)* | *M (n = 327)* | *F (n = 308)* | *M (n = 1284)* | *F (n = 1299)* |
| Current smoking | Before | 90 | 88 | 85 | 85 | 61 | 63 | 76 | 71 | 77 | 76 |
| | After | 30 | 29 | 34 | 40 | 73 | 69 | 76 | 72 | 54 | 53 |
| | Ever | 90 | 89 | 86 | 86 | 88 | 88 | 92 | 87 | 89 | 87 |
| Weight | Before | 83 | 80 | 60 | 55 | 44 | 45 | 65 | 61 | 63 | 60 |
| | After | 67 | 60 | 48 | 48 | 69 | 63 | 61 | 61 | 61 | 58 |
| | Ever | 89 | 88 | 74 | 70 | 80 | 75 | 79 | 77 | 81 | 78 |
| Blood pressure | Before | 92 | 91 | 87 | 89 | 63 | 69 | 81 | 81 | 80 | 82 |
| | After | 82 | 81 | 70 | 73 | 92 | 90 | 93 | 91 | 85 | 84 |
| | Ever | 97 | 96 | 91 | 93 | 95 | 94 | 97 | 96 | 95 | 95 |
| Blood glucose | Before | 66 | 65 | 54 | 53 | 45 | 46 | 68 | 61 | 58 | 56 |
| | After | 62 | 61 | 20 | 25 | 69 | 68 | 68 | 69 | 56 | 56 |
| | Ever | 78 | 77 | 59 | 59 | 80 | 80 | 85 | 86 | 76 | 76 |
| Cholesterol | Before | 62 | 64 | 73 | 65 | 19 | 20 | 37 | 31 | 47 | 44 |
| | After | 9 | 18 | 24 | 28 | 53 | 39 | 32 | 31 | 30 | 30 |
| | Ever | 64 | 68 | 77 | 70 | 61 | 47 | 55 | 52 | 64 | 59 |

*Proportions with a measurement recorded in the notes before the index event, after the index event, or ever (either before or after the index event). Denominator includes patients for whom notes were unavailable—as shown in fig 1.

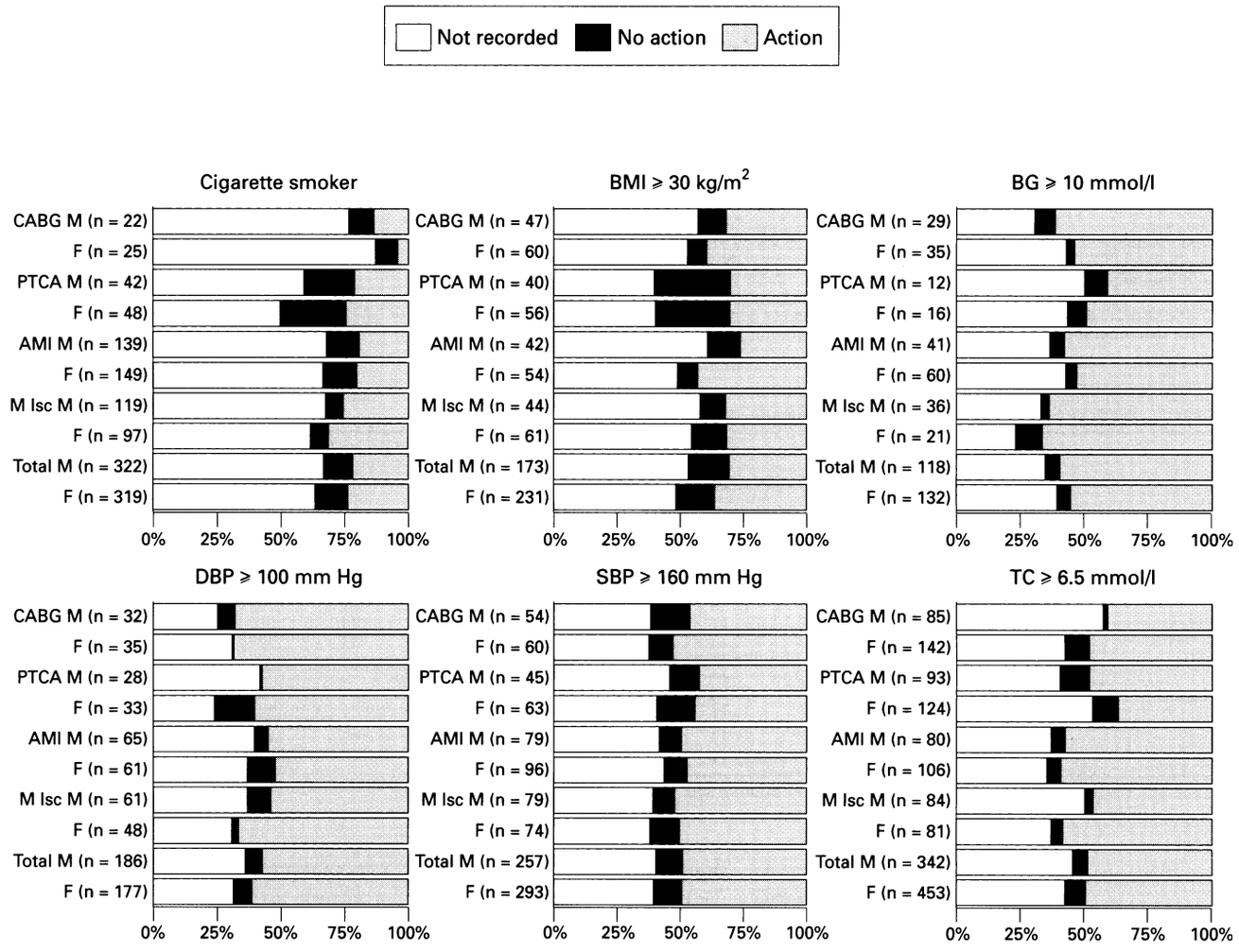


*Figure 2 Doctor's response recorded in medical notes to current smoking and to five different risk factor values when recorded in the notes as being above a specified value. BG, blood glucose; BMI, body mass index; DBP, diastolic blood pressure; SBP, systolic blood pressure; TC, total cholesterol.*

*Table 3 Risk factor distributions (%) at interview**

| | *CABG* | | *PTCA* | | *AMI* | | *M Isc* | | *Total* | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Risk factor* | *M (n = 266)* | *F (n = 259)* | *M (n = 248)* | *F (n = 247)* | *M (n = 249)* | *F (n = 240)* | *M (n = 239)* | *F (n = 234)* | *M (n = 1002)* | *F (n = 980)* |
| Current smoking: | | | | | | | | | | |
| Smoker | 10 | 11 | 17 | 17 | 20 | 27 | 26 | 26 | 18 | 20 |
| Non-smoker | 90 | 89 | 83 | 83 | 80 | 73 | 74 | 74 | 82 | 80 |
| Body mass index (kg/m²): | | | | | | | | | | |
| < 25 | 27 | 31 | 31 | 31 | 30 | 30 | 19 | 23 | 27 | 29 |
| 25–29 | 54 | 39 | 48 | 38 | 49 | 39 | 49 | 39 | 50 | 39 |
| 30–39 | 19 | 29 | 21 | 30 | 20 | 29 | 31 | 32 | 22 | 30 |
| ⩾ 40 | — | 1 | — | 1 | 1 | 3 | 1 | 6 | 1 | 3 |
| Diastolic blood pressure (mm Hg): | | | | | | | | | | |
| < 90 | 69 | 81 | 74 | 80 | 67 | 69 | 72 | 75 | 71 | 77 |
| 90–99 | 21 | 11 | 18 | 14 | 21 | 19 | 17 | 16 | 19 | 15 |
| 100–109 | 9 | 5 | 6 | 4 | 9 | 6 | 8 | 6 | 8 | 6 |
| ⩾ 110 | 2 | 2 | 1 | 1 | 2 | 5 | 3 | 3 | 2 | 3 |
| Systolic blood pressure (mm Hg): | | | | | | | | | | |
| < 160 | 81 | 82 | 84 | 82 | 84 | 79 | 85 | 81 | 84 | 81 |
| 160–199 | 18 | 16 | 15 | 16 | 14 | 18 | 14 | 18 | 15 | 17 |
| ⩾ 200 | 2 | 2 | 1 | 2 | 1 | 3 | 1 | 1 | 1 | 2 |
| Blood glucose (mmol/l): | | | | | | | | | | |
| < 10 | 94 | 91 | 95 | 96 | 93 | 94 | 90 | 94 | 93 | 94 |
| ⩾10 | 6 | 9 | 5 | 4 | 7 | 6 | 10 | 6 | 7 | 6 |
| Cholesterol (mmol/l): | | | | | | | | | | |
| < 5·0 | 23 | 14 | 24 | 14 | 23 | 13 | 18 | 17 | 22 | 14 |
| 5–5·9 | 36 | 26 | 31 | 26 | 27 | 19 | 31 | 22 | 31 | 24 |
| 6–6·9 | 25 | 26 | 33 | 29 | 27 | 28 | 27 | 28 | 28 | 28 |
| 7–7·9 | 12 | 24 | 8 | 19 | 18 | 22 | 14 | 21 | 13 | 22 |
| ⩾ 8·0 | 4 | 10 | 4 | 12 | 6 | 17 | 9 | 13 | 6 | 13 |

*Proportions calculated after excluding missing values due to equipment failure, patient refusal to give blood sample, patient bed-bound, and other reasons. The number of missing values for each risk factor was as follows: smoking (8), body mass index (20), diastolic BP (21), systolic BP (16), glucose (25), cholesterol (15).

*Table 4 Number (%) of patients on and off medication with risk factor levels above specified thresholds at interview.**

| Risk factor | Receiving medication | CABG M | CABG F | PTCA M | PTCA F |
|---|---|---|---|---|---|
| Diastolic BP | Yes | 14/109 (13%) | 8/138 (6%) | 12/174 (7%) | 11/202 (5%) |
| ⩾ 100 mm Hg | No | 13/138 (9%) | 11/115 (10%) | 7/71 (10%) | 3/41 (7%) |
| Diastolic BP | Yes | 3/109 (3%) | 3/138 (2%) | 2/174 (1%) | 3/202 (1%) |
| ⩾ 110 mm Hg | No | 1/138 (1%) | 3/115 (3%) | 1/71 (1%) | 0/41 (–) |
| Cholesterol | Yes | 24/44 (55%) | 49/73 (67%) | 25/43 (58%) | 39/54 (72%) |
| ⩾ 5·5 mmol/l | No | 120/202 (59%) | 146/179 (82%) | 123/195 (63%) | 148/181 (82%) |
| Cholesterol | Yes | 1/44 (2%) | 2/73 (3%) | 1/43 (2%) | 3/54 (6%) |
| ⩾ 8·0 mmol/l | No | 10/202 (5%) | 25/179 (14%) | 9/195 (5%) | 25/181 (14%) |
| Blood glucose | Yes | 11/23 (48%) | 18/37 (49%) | 10/15 (67%) | 4/13 (31%) |
| ⩾ 10 mmol/l | No | 3/220 (1%) | 4/214 (2%) | 3/222 (1%) | 5/220 (2%) |

*Table entries take the form n/d (%) where d is the number of patients on or off medication for the given risk factor, and n is the number of patients among these with a risk factor level at or above the specified threshold value.

*Table 5 Reported family history of coronary heart disease at interview*

| Diagnostic category | Sex | Whether there is a family history of CHD: n | Yes (%) | Yes and < 65 yr* (%) | No (%) | Not known (%) | Whether family advised they should be screened for coronary risk factors — Overall: n | Yes (%) | No (%) | Not known (%) | Where patient < 50 yr: n | Yes (%) | No (%) | Not known (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CABG | M | 266 | 65 | 46 | 9 | 26 | 266 | 17 | 19 | 64 | 37 | 30 | 32 | 38 |
| | F | 259 | 70 | 54 | 8 | 22 | 259 | 25 | 12 | 64 | 17 | 29 | 29 | 41 |
| PTCA | M | 248 | 63 | 48 | 11 | 26 | 248 | 15 | 11 | 74 | 59 | 14 | 15 | 71 |
| | F | 247 | 72 | 54 | 8 | 19 | 247 | 23 | 12 | 64 | 37 | 22 | 16 | 62 |
| AMI | M | 249 | 59 | 41 | 15 | 26 | 249 | 14 | 18 | 68 | 42 | 29 | 29 | 43 |
| | F | 240 | 64 | 48 | 16 | 20 | 240 | 17 | 18 | 66 | 18 | 39 | 11 | 50 |
| M Isc | M | 239 | 60 | 44 | 18 | 21 | 239 | 13 | 20 | 67 | 38 | 21 | 13 | 66 |
| | F | 234 | 73 | 53 | 11 | 16 | 234 | 23 | 17 | 61 | 34 | 24 | 21 | 56 |
| Total | M | 1002 | 62 | 45 | 13 | 25 | 1002 | 15 | 17 | 68 | 176 | 22 | 22 | 56 |
| | F | 980 | 70 | 52 | 11 | 19 | 980 | 22 | 14 | 64 | 106 | 26 | 19 | 55 |

*Proportion of patients with a history of CHD in a family member aged < 65.

glucose were made, the latter two on a Reflotron (Boehringer Mannheim) using dry chemistry.

To ensure uniformity of method all data were recorded directly onto notebook computers by 14 research nurses who had attended a three-day training course held at the National Heart and Lung Institute. All the nurses used Takeda Medical (Oxford) automatic (UA731) digital sphygmomanometers, SECA (Birmingham) digital (707) scales, and Bedfont Scientific (Upchurch, Kent) (EC50) portable, breath carbon monoxide monitors which, together with the Reflotrons, had all been calibrated by the manufacturers before the survey. Data were downloaded from each notebook computer every two weeks, returned to the National Heart and Lung Institute, checked for completeness and errors, and then collated.

PILOT STUDY

A pilot study to test patient sampling and data collection methods was undertaken at the Northern General Hospital in Sheffield and Doncaster Royal Hospital.

POWER AND SAMPLE SIZE

Use of a sample size of 300 subjects in each sex-specific diagnostic category allows prevalence of 50% to be estimated with a 95% confidence interval of 44% to 56%: prevalences above or below 50% are estimated increasingly more precisely.

## Results

PATIENTS

Information on a total of 2583 patients (male median age 59 (range 27–70), female median age 62 (range 26–70)) was collected (table 1). One hundred and ninety nine patients had died by the time of interview and were replaced in the sample with the object of achieving the target quota of 300 living patients in each of the eight sex and diagnosis specific subgroups. All 2384 survivors were invited for interview and 83% attended.

PATIENT NOTES

*Risk factor histories*

In a small percentage of each subgroup (1·3% to 4·9%, median 2·9%) the patient's notes

*Table 6 Proportion of patients receiving drug therapy at interview*

| Diagnostic category | Sex | n | Aspirin (%) | β Blockers (%) | ACE inhibitors (%) | Lipid lowering drugs (%) | Calcium channel blockers (%) |
|---|---|---|---|---|---|---|---|
| CABG | M | 266 | 91 | 18 | 17 | 18 | 12 |
| | F | 259 | 92 | 25 | 18 | 29 | 19 |
| PTCA | M | 248 | 94 | 43 | 13 | 18 | 42 |
| | F | 247 | 93 | 50 | 10 | 23 | 49 |
| AMI | M | 249 | 85 | 35 | 28 | 6 | 28 |
| | F | 240 | 86 | 41 | 24 | 10 | 32 |
| MI | M | 239 | 78 | 39 | 20 | 9 | 43 |
| | F | 234 | 71 | 37 | 13 | 11 | 50 |

*Table 4 continued*

| AMI | | M Isc | | Total | |
|---|---|---|---|---|---|
| M | F | M | F | M | F |
| 19/178 (11%) | 17/177 (10%) | 18/172 (10%) | 12/176 (7%) | 63/633 (10%) | 48/693 (7%) |
| 9/65 (14%) | 8/58 (14%) | 7/59 (12%) | 9/52 (17%) | 36/333 (11%) | 31/266 (12%) |
| 3/178 (2%) | 7/177 (4%) | 4/172 (2%) | 4/176 (2%) | 12/633 (2%) | 17/693 (2%) |
| 2/65 (3%) | 4/58 (7%) | 3/59 (5%) | 2/52 (4%) | 7/333 (2%) | 9/266 (3%) |
| 7/14 (50%) | 18/23 (78%) | 12/19 (63%) | 16/26 (62%) | 68/120 (57%) | 122/176 (69%) |
| 149/233 (64%) | 172/212 (81%) | 147/213 (69%) | 156/206 (76%) | 539/843 (64%) | 622/778 (80%) |
| 1/14 (7%) | 1/23 (4%) | 1/19 (5%) | 0/26 (–) | 4/120 (3%) | 6/176 (3%) |
| 14/233 (6%) | 40/212 (19%) | 21/213 (10%) | 30/206 (15%) | 54/843 (6%) | 120/778 (15%) |
| 11/17 (65%) | 9/22 (41%) | 16/23 (70%) | 8/15 (53%) | 48/78 (62%) | 39/87 (45%) |
| 7/230 (3%) | 4/213 (2%) | 7/208 (3%) | 7/216 (3%) | 20/880 (2%) | 20/863 (2%) |

could not be retrieved (fig 1). Figure 1 shows the proportion of patients with risk factor histories of smoking, hypertension, hyperlipidaemia, diabetes, and family history recorded in the medical notes.

*Risk factor measurements*

Table 2 shows the proportions of patients with coronary risk factor measurements recorded in the medical notes, either before or after the index event.

Figure 2 displays the doctor's response recorded in the medical notes to current smoking and to five risk factor values above a specified threshold: BMI $\geqslant$ 30 kg/m$^2$, systolic blood pressure $\geqslant$ 160 mm Hg, diastolic blood pressure $\geqslant$ 100 mm Hg, total cholesterol $\geqslant$ 6·5 mmol/l, and blood glucose $\geqslant$ 10 mmol/l. For all four diagnostic groups, the risk factor measurement used was the first available in the notes. For each subgroup, the denominator given in fig 2 is the number of patients recorded as having a value above the specified threshold. The action taken was defined as any of the following—further measurements made, general lifestyle advice given, specific advice given by nutritionist, medication started.

PATIENT INTERVIEWS

*Risk factors reported and measured*

Table 3 shows the prevalence of risk factor values measured at interview. Current smoking habit was validated by breath carbon monoxide concentrations > 10 ppm.

*Therapeutic control of risk factors by medication*

Table 4 shows the control of blood pressure, total cholesterol, and glucose in those on and not on medication at interview.

*Family history and screening of blood relatives*

Table 5 shows the reported family history and screening of blood relatives.

*Reported drug treatment*

Table 6 shows the prevalence of reported drug treatment at interview.

## Discussion

This national survey of coronary patients found that recording and management of risk factors—lifestyle, blood pressure, cholesterol, glucose—and the use of prophylactic drug treatment were less than optimal. This finding demonstrates the real clinical potential to reduce further the subsequent risk of morbidity and mortality. Because consecutive patients were identified from a random sample of specialist cardiac centres and district general hospitals, these results are likely to be representative of hospital risk factor recording for coronary patients throughout the country. For practical reasons, the review of patients' records was restricted to hospital notes. This may underestimate the real extent to which coronary risk factors are recorded in all parts of medical practice. However, the results of interviewing patients at least six months after the hospital procedure or admission, summate the contributions to risk factor management of hospitals and general practice and the responses of patients.

Recording of the history of risk factor exposure and of risk factor measurements varied considerably between and within diagnostic groups. Smoking history was most frequently recorded and hyperlipidaemia history least frequently: the latter being absent in over 40% of cases. This pattern was similar across diagnostic groups and by gender. However, except for smoking history, the proportion of absent risk factor histories was much greater in the groups with AMI and myocardial ischaemia than in the revascularisation groups, for both men and women. Risk factor measurements showed a similar variation, with blood pressure most frequently recorded and total cholesterol least frequently. Again risk factor measurements in the CABG and PTCA patients were more complete than in the other groups but this consistent observation must partly reflect the length of time these patients had been under medical care compared with AMI and myocardial ischaemia patients.

A record of action in response to a patient's risk factor measurements also showed considerable variation. This was true whether the analysis was based on the first observed risk factor measurement, or on the highest risk factor value recorded in the notes. Action was most frequently recorded in response to blood pressure, then to blood glucose, total cholesterol, body mass index and least frequently in response to current cigarette smoking. The absence of a written record of action is not synonymous with no action because, for example, it seems most unlikely that current smokers were not advised to stop but rather that such action was not regarded as sufficiently important to record in the patient's notes. With some exceptions there was a tendency for action to be recorded more frequently for women than for men. However, by the time of interview, up to a quarter of patients were still smoking cigarettes, validated by breath carbon monoxide, and

most were still overweight and some were severely so. The proportion of women who continued to smoke after AMI was greater than the proportion of men, and in every diagnostic group the severity of obesity (BMI $\geqslant$ 30 kg/m$^2$) was greater in women. Stopping smoking,[12] modifying diet (decreasing saturated fats and increasing polyunsaturated fats particularly from omega 3 sources),[2 3 13] and taking more aerobic exercise[4] are all important steps towards reducing the risk of further morbidity and mortality. In making these lifestyle changes, patients also reduce the need for physicians to intervene with drugs in relation to blood pressure, lipoproteins, and glucose.

The British Hypertension Society (BHS), in its management guidelines for essential hypertension,[14] recommends treatment of a diastolic blood pressure $\geqslant$ 90 mm Hg for coronary patients. About a quarter of patients in this survey were above this threshold, and about a fifth were $\geqslant$ 100 mm Hg. About 7% of patients in each diagnostic category were eligible for treatment according to the BHS combination of a systolic blood pressure between 160 and 200 mm Hg, combined with a diastolic pressure of 95 mm Hg or more. Of those on antihypertensive treatment at interview up to a third still had diastolic blood pressures $\geqslant$ 90 mm Hg. As the recommended treatment goal is to reduce diastolic blood pressure to less than 90 mm Hg these results represent inadequate antihypertensive control.

In the British Hyperlipidaemia Association's (BHA) guidelines,[15] patients with existing coronary disease are defined as the first priority for action if their total cholesterol is > 5·2 mmol/l on optimal diet. 72% of the men and 83% of the women in this survey had a total cholesterol > 5·2 mmol/l at least six months after the procedure or event. In women the distribution of cholesterol was skewed towards higher values, as a total cholesterol $\geqslant$ 7·0 mmol/l was more frequent in women for each diagnostic category. However, this is partly a reflection of the older age of female patients and their higher proportion of HDL cholesterol compared with men. According to the BHA guidelines, the therapeutic objective in patients with coronary disease is an LDL cholesterol < 3·4 mmol/l. So most patients in this survey would require specific dietary intervention to reduce blood cholesterol, and where total cholesterol did not fall below 5·2 mmol/l, drug treatment would also be indicated. Of the minority of patients on lipid lowering treatment at interview over half were not adequately controlled according to the BHA treatment target. Following this survey the Scandinavian Simvastatin Survival Study reported that cholesterol lowering in coronary patients with a concentration of $\geqslant$ 5·5 mmol/l by diet and simvastatin reduced coronary morbidity and mortality and improved survival.[7]

At interview, up to one in 10 patients had a random glucose $\geqslant$ 10·0 mmol/l, which is consistent with carbohydrate intolerance and, as with blood pressure and cholesterol treatment, about half of those on antidiabetic drugs at interview still had values above this recommended threshold.

In addition to blood pressure, lipid, and glucose management, the prophylactic use of drugs—aspirin,[8] $\beta$ blockers,[16] angiotensin converting enzyme (ACE) inhibitors[9 10] and anticoagulants[11]—which reduce risk of coronary death and improve survival are indicated in selected coronary patients. Aspirin is appropriate for all patients, unless specifically contraindicated, and such reasons are unlikely to vary between diagnostic groups. Yet in this survey, reported aspirin use ranged from over 90% in those revascularised down to 71% in females with acute myocardial ischaemia. After acute myocardial infarction, about a third of patients reported taking a $\beta$ blocker, which is not very different from the proportion using this class of drug for myocardial ischaemia, although it is not known whether the $\beta$ blocker was being given for angina, blood pressure control, or prophylactically. Without knowing the patients' clinical characteristics, it is not possible to judge whether this is an appropriate level of prescribing. Similarly, about a quarter of post-AMI patients reported taking ACE inhibitors, and the same issues of interpretation apply. Interestingly, calcium channel blockers were as commonly prescribed in patients after PTCA as for those with myocardial ischaemia and, unless they were prescribed for symptomatic relief, the reason for this is not clear because there is no trial evidence that such drugs modify the clinical course of the disease after this intervention.

About three quarters of patients knew their family history and about half had first degree relatives in whom coronary disease had developed before the age of 65. Coronary disease runs in families and blood relatives of patients with premature coronary disease are themselves at increased risk of developing the disease. Yet two thirds of patients did not know whether their family had been advised to be screened for coronary risk factors. Of patients who were under 50 years of age at the time of their index event, only a quarter knew that family screening advice had actually been given.

The results of this survey may also be influenced by losses due to death and to non-response among survivors. Although 199 patients had died by the time of interview (most were from the AMI group), their data are included in the results whenever medical notes were available. Over four fifths of the survivors attended for interview, a satisfactory response rate, but non-attendees may have different risk factor characteristics from attendees. Nevertheless, the medically recorded data of the non-attendees are included in the results.

A hospital survey is appropriate for patients who have had revascularisation procedures and for those admitted with acute myocardial infarction but for those with acute myocardial ischaemia without evidence of infarction, hospital admissions will not be representative of the generality of patients with angina in the community. Angina patients are for the most part looked after in general practice and, because a representative sample of such patients was not available, hospital admissions for acute myocardial ischaemia were used. While the diagnostic accuracy of patients having revascularisation procedures is not in doubt, the use of ICD codes for AMI and acute

myocardial ischaemia without evidence of infarction is unlikely to be completely accurate. Although cases of obvious mis-coding were eliminated from the survey, some patients coded as AMI may not have had infarctions and likewise some labelled as acute myocardial ischaemia may have had other causes for their symptoms. However, this does not matter for this survey because a patient with AMI, whether diagnosed correctly or not, should have been managed accordingly.

This survey was conducted at one point in the clinical course of the disease which varied between diagnostic groups and between patients within groups. Nearly two thirds of the AMI patients were incident cases, with no history of coronary disease before their index admission, whereas over two thirds of patients with myocardial ischaemia had a previous history of coronary disease. Thus, this survey does not underestimate recording and management of coronary risk factors, as the longer the interval between disease onset and patient interview, the more opportunity there was for intervention. A minimum period of six months after the index procedure or event was set before records were abstracted and patients interviewed, as this was deemed a sufficiently long interval in which to assess and manage the major coronary risk factors. For most patients in this survey, the interval between disease onset and patient interview was considerably longer.

In the recently published European recommendations on prevention of coronary disease in clinical practice,[17] coronary patients are given top priority for action. By undertaking this survey the British Cardiac Society has taken the first step in defining the potential for secondary prevention in such patients in the United Kingdom. By advising lifestyle changes in relation to smoking, diet, and exercise; by measuring and effectively managing blood pressure and lipids; and by using appropriate drug treatment in selected patients, cardiologists can contribute towards reducing morbidity, hospital admissions, and revascularisation procedures, as well as postponing mortality from this disease. To translate scientific evidence into clinical practice, cardiologists must work in collaboration with other specialties in the management of hypertension, hyperlipidaemia, and diabetes and with general practitioners and other health care professionals, who are responsible for the day to day care of coronary patients and their families. A comprehensive prevention strategy is called for which brings together all health care professionals who can help patients to change the way they live, and which ensures effective long term management of risk factors and the selective use of drug treatments of proven benefit.

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## SHORT CASES IN CARDIOLOGY

# Retained surgical swab misinterpreted as epicardial pacing wire on chest *x* ray

G McKillop, J H Reid

Retained surgical swabs remain a source of concern, possible morbidity, and potential litigation in postoperative patients.[1] Retained swabs are usually visible on radiographs because they contain a radio-opaque marker.[2] This case shows that these markers can be mistaken for epicardial pacing wires.

A 50 year old man presented with recurrent breathlessness and palpitation including documented ventricular tachycardia. He had a complex medical history including renal transplant, femoral capital aseptic necrosis, iron deficiency anaemia, and macrocytosis.

The relevant cardiovascular history included hypertension, hypercholesterolaemia, myocardial infarction (1980), and bilateral intermittent claudication. At coronary angiography, in May 1984, triple vessel disease was identified and in November 1984 triple vessel coronary artery bypass grafting was performed. Immediate postoperative complications of palpitation, persistent sinus tachycardia, and pyrexia eventually settled. From December 1984 to September 1989 he had repeated palpitation, including two admissions with documented ventricular tachycardia, despite treatment with amiodarone. In 1989 a further chest *x* ray was ordered. This showed a linear opacity of metallic density projected through the cardiac shadow and an increased retrocardiac density (fig 1). The metallic opacity on previous chest *x* rays had been assumed to be a retained epicardial pacing wire; however, the possibility of a retained swab was raised at this stage. A left lateral chest *x* ray was obtained (fig 2). This showed a well defined opacity (diameter 5 cm) continuous with the posterior cardiac silhouette that contained the swab markers. Thoracotomy confirmed an abscess secondary to a retained swab at this site.

The patient had no further episodes of ventricular tachycardia until two years later when he re-presented with palpitations and amiodarone was restarted. He has been symptom free since.

Despite the long and complicated general medical and cardiovascular history in this patient we believe that the onset of palpitation and ventricular tachycardia immediately after the initial coronary artery bypass grafting and their cessation after diagnosis and removal of the swab with a subsequent, prolonged symptom free period suggests that the retained swab may have played a part in initiating the arrhythmias.

Though swab markers have a distinct appearance it is understandable that a linear metallic opacity in a post-cardiac surgery patient was mistaken for epicardial pacing wires. Cardiologists, cardiothoracic surgeons, and radiologists should be aware of this source of confusion.

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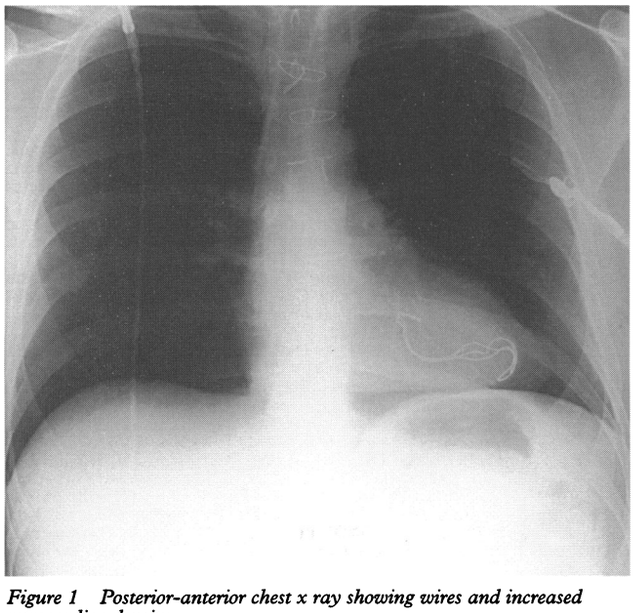

*Figure 1 Posterior-anterior chest x ray showing wires and increased retrocardiac density.*

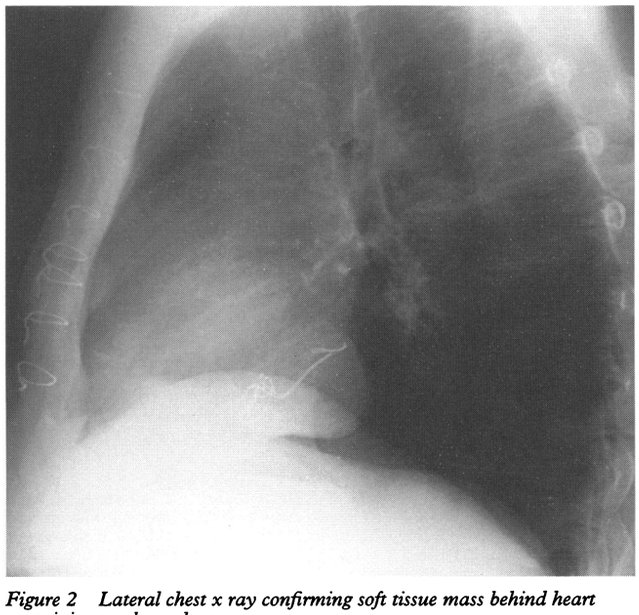

*Figure 2 Lateral chest x ray confirming soft tissue mass behind heart containing swab markers.*