

Need for invasive cardiological assessment and intervention: a ten year review

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Abstract

The uptake of invasive cardiological investigation and cardiopulmonary bypass procedures by the North West Surrey Health District was audited over the years 1979-88. Growth was almost continuous throughout the ten year period. The need within the district each year for coronary angiography seemed to be between 111 and 171 and for surgical revascularisation of the myocardium between 63 and 96 procedures; the first figure is the mean of the second quinquennial period (1984-88) and the second figure the total for 1988. After correction for the standardised mortality ratio and catchment area, the national requirement should lie between 690 and 1070 coronary angiograms and 390 and 600 coronary artery bypass graft operations per million population each year. There is a further national requirement for 70 valvar heart operations and 30 miscellaneous procedures per million population each year. Owing to delays in the provision of services, 20 patients died of a cardiovascular cause while they were on the waiting list for investigation or surgery. In the United Kingdom the annual target to be achieved by 1990 was 300 coronary artery bypass procedures per million population.

There is a widely held consensus about the need for information in the medical specialities upon which to base planning for health care provision, but there are few objective data available. In cardiology this is despite well-defined end points.¹ Our unit has previously reported on its uptake of invasive cardiological services and projections were made towards the United Kingdom national requirement.² Between 1979 and 1984 a significant increase in uptake of resource was demonstrated, a trend that has continued. This report, while containing some of the earlier data, relates to the substantially expanded data base which now covers the years 1979 to 1988 inclusive.

Patients and methods

St Peter's Hospital, Chertsey, is the district hospital serving the North West Surrey Health District (South West Thames Regional Health Authority). The mean population of the dis-

trict during the ten year study period was 205 000, there was a skew in social distribution towards classes I and II, and a younger than average age distribution. The standardised mortality ratio for ischaemic heart disease (ICD 410-414) for the district was 0.78 and for valvar heart disease (ICD 393-398) it was 1.0.³

Patients from the health district (whether within the National Health Service or the private sector) requiring invasive cardiological assessment or investigation or both are referred by the district cardiological unit. Two audits (1983, 1986)² indicated that referral of "in district" patients made by other means was closely matched by cross boundary inflow of patients from without the district. Information on demography, symptoms, medication, non-invasive assessment, and the date and outcome of invasive investigation or intervention on patients referred is recorded on an ongoing data base.

"Ischaemic heart disease" in this study includes chronic stable angina, the acute coronary syndromes, atypical chest pain requiring angiography, and heart failure secondary to coronary artery disease with or without non-rheumatic mitral valve regurgitation. "Valvar heart disease" includes isolated aortic valve disease with or without coronary artery disease, chronic rheumatic heart disease affecting at least one heart valve, and mitral leaflet prolapse requiring investigation/surgery. Conditions falling outside these broad categories are grouped together as "other".

Symptoms are classified according to the New York Heart Association criteria.⁴ Invasive data are recorded as reported by the investigating cardiologist at the regional cardiac centre, with the severity, number, and site of coronary artery stenoses being noted and classified according to the European trial criteria.⁵ The presence or absence of left ventricular impairment at angiography is recorded. All deaths including those of patients on the waiting lists,⁶ at operation, or up to 28 days after operation are recorded and the cause established.

The indications for referral for invasive investigation are influenced to some extent by patient age. Over the ten year study period there was a trend to operate on increasingly older patients, which reflects the improved outcome and appreciation of the considerable symptomatic benefit that revascularisation may bring in the older patient.⁷ In addition, the initial enthusiasm for surgical intervention

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Accepted for publication
11 June 1991

to improve prognosis was tempered during this period which also saw the emergence of improved pharmacological agents.⁸ It is the policy within the unit for all patients with stable angina pectoris to have a symptom limited exercise electrocardiogram unless there is some absolute contraindication.⁹ Medical treatment is considered to have failed if patients still have New York Heart Association grade II symptoms of angina while being treated with at least two of the three major groups of pharmacological agents available in adequate dosage.¹⁰ Aspirin was normally given from 1985 onwards.

Patients who need investigation of unstable angina (NYHA grade IV) are referred directly to a regional centre usually after not less than 48 hours of administration of antianginal agents including a β adrenoceptor blocking agent, intravenous nitrates, and heparin or aspirin or both. If patients with a very low threshold for symptoms have electrocardiographic changes on submaximal exercise they may be transferred for invasive investigation. It is departmental policy that after suspected or proven myocardial infarction all patients aged less than 60 have symptom limited exercise electrocardiography. Most patients aged > 60 but < 65 as well as selected older patients with no upper age limit are also investigated unless there is a contraindication.

Results

Figure 1 shows the total number of patients referred by the district unit for invasive investigation and intervention during the period 1979–88. There was a sustained growth in the number of patients referred for investigation of ischaemic heart disease, which was paralleled

by the numbers undergoing subsequent coronary artery bypass grafting. The downturn in 1984–85 coincided with a change in main referral centre from St Thomas's Hospital, Lambeth, to St George's Hospital, Tooting.

Of 823 patients referred with suspected ischaemic heart disease, 11 were never investigated (refused, died), 31 were reclassified on account of other cardiac abnormalities (valvar heart disease, transplantation, malignant rhythm disturbance, conducting tissue disease) and of the 781 remaining, 495 (63.4%) subsequently underwent coronary artery bypass grafting and 40 (5.1%) percutaneous transluminal coronary angioplasty. The mean age of patients referred for coronary artery bypass grafting increased during the study period (fig 2). The ratio of males to females fell from approximately 6:1 to 4.5:1 in the second half of the study period. Of patients referred, 15.9% had unstable symptoms and this included patients referred for routine investigation in whom symptoms subsequently became unstable. Symptoms were still significant in over three quarters of all patients (NYHA grade I, 16%; grade II/III, 68%; grade IV, 16%) despite treatment. Previous myocardial infarction had been documented in 46% of all patients and 49% were shown to have an abnormal left ventriculogram.

Six patients died while they were on the waiting list for angiography (table 1). All had NYHA grade II/III angina. There were nine cardiac deaths in patients on the waiting list for bypass grafting (table 2). All but one were known to have both triple vessel disease and impaired left ventricular function. These figures do not include two deaths that occurred within 24 hours of angiography or four non-cardiac deaths. The distribution of coronary disease according to the European Coronary Surgery study criteria⁵ was: nil significant, 30; single vessel, 163; two vessel, 206; three vessel, 355; and left main stem, 27. The operative mortality for coronary artery surgery fell from 6.5% in the first five years to 2.0% in the second five years.

The mean age of patients undergoing surgery for valvar heart disease rose slightly during the study period to 64.6 years. There was no

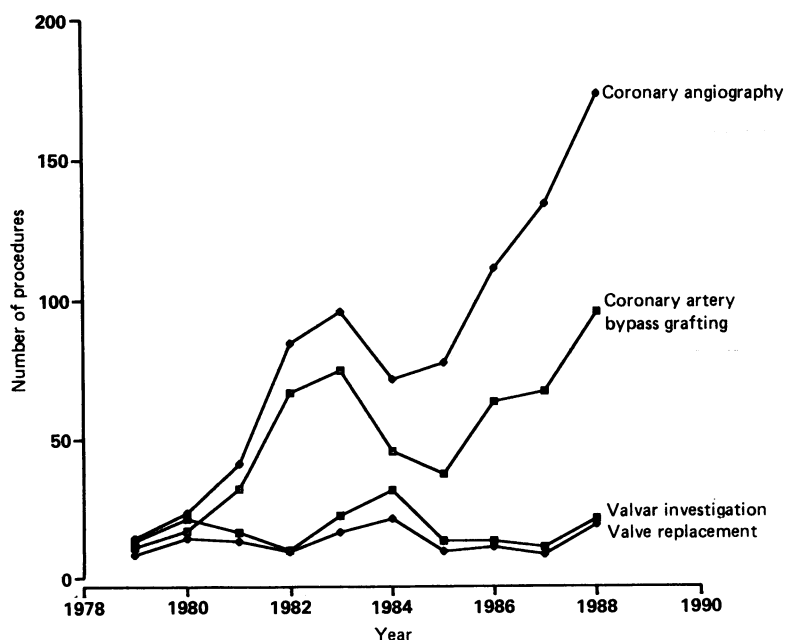


Figure 1 Growth in referral of patients for cardiac catheterisation, coronary angiography, valvar surgery, and coronary artery bypass grafting over the ten years 1979–88.

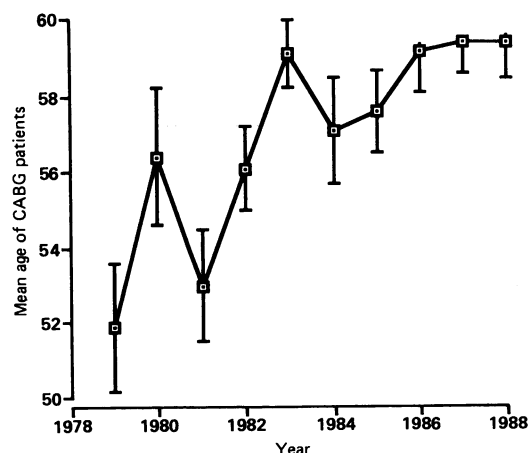


Figure 2 Mean (SEM) age of patients undergoing surgery during the years 1979–88.

Table 1 Length of time on waiting list (WL) for investigation and severity of angina in those who died while on the waiting list

Case	Time (days) on WL	NYHA grade
1	28	III
2	30	III
3	56	III
4	63	III
5	120	II
6	180	II

Table 2 Length of time on waiting list (WL) for surgery and severity of disease in those who died while on the waiting list

Case	Time (days) on WL	Disease extent	
1	28	3VD	Impaired LV
2	29	2VD	Normal LV
3	50	3VD	Impaired LV
4	55	3VD	Impaired LV
5	160	3VD	Impaired LV
6	208	3VD	Impaired LV
7	260	3VD	Impaired LV
8	291	3VD	Impaired LV
9	400	3VD	Impaired LV

3VD, three vessel disease; LV, left ventricle.

difference in representation of the sexes. Of 177 patients referred for investigation, 139 (78.5%) subsequently underwent surgery. Aortic valve disease was present in 88 patients (49.7%) and 15 of these had coexistent coronary artery disease requiring grafting. The overall operative mortality for valvar surgery was 4.3%. There was one death among patients on the waiting list for investigation. Two patients, both with severe aortic stenosis, died within 24 hours of cardiac catheterisation and there were three cardiac deaths on the surgical waiting list.

Of 184 permanent pacemaker units implanted, 94.6% were ventricular demand systems. The waiting time to unit implantation for symptomatic complete atrioventricular block rose from a mean (SEM) of 2.6 (0.5) days in 1982 to 47.5 (12.0) days in 1988. One patient on the waiting list for permanent pacing died.

Table 3 shows the patients referred for miscellaneous procedures. The numbers in each category are too small for further analysis.

Discussion

There is a consensus on the assessment of prognosis of ischaemic heart disease,¹¹ on the role of invasive investigation,¹² and on the part played by revascularisation of the myocardium and its management.^{13,14} Symptoms of angina that do not respond to medical treatment and a high risk of myocardial ischaemic events

demand angiography. Surgical revascularisation may improve both the symptoms and the prognosis in certain patterns of disease,¹¹ although the benefits of surgery may not be long lasting.¹⁴ A sixth of all our referred patients had unstable angina, and a further two thirds had grade II/III symptoms while receiving treatment. Left main stem and three or two vessel coronary artery disease was present in three quarters of all patients investigated.

There was an almost continuous growth in the uptake of invasive cardiological services over the ten year period 1979–88 in North West Surrey, which has shown no sign of abating. The downturn in patient referral in 1984–85 that coincided with the change in referral centre reflected to some extent re-evaluation of the benefits of surgical intervention in terms of prognosis. In the five years 1984–88 the mean (SEM) number of patients referred for coronary angiography and surgical revascularisation of the myocardium was 110.0 (22.7) and 62.8 (13.6) respectively. After adjustment for the catchment population, this represents a mean of 540 and 306 procedures per million population a year respectively. In 1988 the district uptake was 171 coronary angiographic and 96 coronary artery bypass procedures (830 and 470 respectively per million population a year). In sharp contrast valvar investigation and intervention remained constant throughout the ten year period, with a mean annual requirement for 18 investigations and 14 valvar operations (88 and 70 per million population) respectively.

But North West Surrey has a lower than average death rate from coronary heart disease.³ By taking into account the standardised mortality ratios for the health district for ischaemic heart disease (0.78) and for valvar heart disease (1.0), we projected the national need by dividing the district population requirement by the mortality ratios. Based on our experience, therefore, there appears to be a national annual requirement for at least 690 coronary angiographic procedures and 390 coronary artery bypass procedures per million population, the valvar figure remaining unmodified. Because the numbers are tending to rise, this is likely to be an underestimate. If one were to rely on the 1988 experience alone, then the relevant figures would be 1070 coronary angiographic procedures and 600 coronary artery bypass procedures per million population per annum. The number of patients undergoing percutaneous transluminal angioplasty was too small for such analysis.

In the United Kingdom, in 1986 the

Table 3 Miscellaneous procedures in patients referred to the regional cardiac centre 1979–88

Procedure	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	Total
EPS	5	1	2	0	3	2	0	5	5	2	25
Cardiomyopathy	1	4	0	1	2	3	1	2	2	1	17
Transplant	0	0	0	0	0	0	0	1	0	4	5
Congenital	4	1	0	4	0	1	1	0	1	1	13
Aortic dissection	1	1	1	2	0	0	1	0	0	1	7
Pulmonary embolism	0	0	3	0	0	1	0	0	0	0	4
Pericardial	0	0	2	1	1	1	0	1	1	0	7
Permanent pacing	5	15	8	21	18	13	18	32	22	35	187
Total	16	22	16	29	24	21	21	41	31	44	265

EPS, electrophysiological study.

Secretary of State announced an annual target of 300 coronary artery bypass graft operations per million population in England by 1990 from within planned resources.¹ This target compares unfavourably with Australia (600) and the United States of America (1000),¹ where the incidence of coronary artery disease is roughly similar. We have previously commented that this target² appears to be a serious underestimate unless our experience is unrepresentative and this seems unlikely from our analysis of the pattern of disease encountered. The demonstrated shortfall in available care has consequences in economic terms and in terms of morbidity and of mortality for those patients who are not privately insured. In the North West Surrey Health District there appears to be a two tier system with unacceptable and increasing delays in the public sector.⁶ This may be attributed to inadequate provision related to funding in this sector.

Resources are finite but it is to be hoped that the demonstrated need will permit fairer and more objective decision making in terms of health care policy.¹⁵

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