

# Cardiological intervention in elderly patients

## REPORT OF A WORKING GROUP OF THE ROYAL COLLEGE OF PHYSICIANS

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### 1. Introduction

1.1. In the fourth Report of the Joint Cardiology Committee of the Royal College of Physicians of London and the Royal College of Surgeons of England, the provision of services for the diagnosis and treatment of heart disease was examined in detail. Coronary heart disease accounts for over 150,000 deaths in England and Wales each year, three-quarters of those affected being 65 years of age or older. Above that age, the Report notes at least a tenfold rise in the prevalence of heart failure, attributed to coronary artery disease in over half and to valvar disease in one in five of those in whom a cause could be identified [1].

1.2. The large reduction in death from coronary heart disease which has been seen in North America and several European countries is only just being seen in the United Kingdom, where the mortality rate from this cause is among the highest in the world and, by the age of 40–59, 25% of men are reported to have electrocardiographic or other evidence of coronary heart disease [2]. Whereas there is thus a need to emphasise preventive measures and to draw further attention to smoking, diet and other risk factors, success in the prevention of early death might not prevent the exponential increase in cardiovascular disease that occurs with increasing age. In the foreseeable future, preventive measures are unlikely to diminish the scope for cardiological intervention in elderly people. Difficulties in planning the necessary facilities for cardiological services have, however, been compounded by the fact that advances in treatment methods for cardiac disease have been accompanied by escalating costs.

1.3 In North America the British National Health Service has the reputation of having institutionalised

the exclusion of people above a specified age from expensive life-saving or life-enhancing procedures such as renal dialysis [3]. While not generally true, there is little doubt that some forms of age discrimination of this kind do occur in some health districts in Britain. Examples include age-related admission policies in coronary care units, the withholding of thrombolytic therapy, and even denying access to echocardiography to patients above an arbitrary age. There has been some debate about whether the exclusion of patients from such interventions on the grounds of age alone can be ethically justified [4,5]. These issues are not resolved easily, and the difficulty in reaching a consensus on health care priorities has been underlined by the Oregon study [6]. Nevertheless, a moral dilemma is evident if the state claims to provide a comprehensive system of health care yet fails to provide some of the available services to those least able to provide for themselves.

1.4 Current concerns about fiscal pressure and the need for cost-saving are likely to increase any tendency to give cheaper care to less influential sections of the population such as elderly people. This will be facilitated by the administrative separation of departments of geriatric and general medicine, implying that in many hospital centres cardiac patients above an arbitrary age are looked after by geriatricians rather than by specialist cardiologists, for whom interventional techniques might be more easily available. In such circumstances, the older cardiac patients are likely to be cared for in poorer facilities than those provided for younger people.

1.5 It is neither humane nor rational to undertake dangerous and unpleasant interventions in patients, whatever their age, in whom the benefits may be marginal. While age, through its statistical association with various forms of reduced physiological reserve, is a predictor of average outcome from medical interventions in groups, it cannot be used as a predictor of outcome for an individual. There is therefore a need to review the physiological and other criteria by which to judge the ability of an individual patient to benefit from procedures ranging from thrombolysis and angioplasty to cardiac surgery.

1.6 The facilities available for cardiological intervention are considerably fewer in the United Kingdom than in the United States, but the fourth Joint Colleges Report [1] recommends that there should be



provision for 400–500 coronary bypass operations and 250 angioplasties per year per million population and that there should be designated budgets and planning facilities for both approaches. Presently available facilities fall far short of these goals and are inadequate to provide for the patients of all ages who could benefit from these procedures.

1.7 Patients are usually referred for cardiac surgery by cardiologists, who are therefore the main agents who determine priorities. Under arrangements which involve a purchasing authority and a provider of services, there will be new opportunities to reassess the need of the population, and the flow of elderly patients for cardiac surgery will also have to take into account the decisions and judgements of purchasing authorities. Without a careful assessment of needs, it seems unlikely that these authorities will be in a position to authorise the provision which will be appropriate for those with cardiac disease either now or in the future as the age structure of the population changes. It is therefore important to discuss the basis on which to develop policy and agree the scale of provision which is appropriate.

## 2. Epidemiology of cardiovascular disease in elderly people with respect to cardiological interventions

2.1 The proportion of the population of England and Wales aged 65 years and over is now 16% of the total or approximately 7.8 million persons. It is projected to increase to 20%, or 9 million persons, by 2020 (Table 1). Cardiovascular disease mortality increases exponentially with increasing age (Table 2), and cardiovascular disease is the leading cause of death in elderly people, accounting for about half the deaths. It is also a leading cause of disability and morbidity, at least as measured by National Health Service utilisation: diseases of the circulatory system are important causes of hospital discharges and deaths (Table 3) and general practice consultations (Fig. 1). Of the specific causes, coronary heart disease is the commonest.

**Table 1.** Projected numbers of elderly people (in thousands) in England and Wales

Ages (years)		Years					
		1987	1991	2001	2011	2021	2031
65–74	M	2,224	2,255	2,216	2,421	2,831	3,252
65–74	F	2,814	2,770	2,571	2,756	3,249	3,671
75+	M	1,271	1,364	1,587	1,699	1,899	2,214
	F	2,505	2,642	2,811	2,767	2,906	3,355

Source: Office of Population Censuses and Surveys (OPCS) Population Projections Series PP2 no. 16.

**Table 2.** Annual mortality rates per 1,000 for diseases of the circulatory system by age and sex, England 1985

	Ages (years)				
	45–54	55–64	65–74	75–84	85+
Diseases of the circulatory system (ICD 390–459)					
M	2.6	8.4	22.2	55.7	106.1
F	0.8	3.2	11.3	35.5	98.0
Ischaemic heart disease (ICD 410–414)					
M	2.1	6.6	15.4	30.4	51.8
F	0.4	2.0	6.7	17.3	39.0
Stroke (ICD 430–438)					
M	0.3	1.0	3.9	12.8	29.9
F	0.2	0.8	2.9	11.5	33.0

ICD = International Coding of Diseases category  
Source: OPCS Mortality Statistics Series DH1 no. 17.

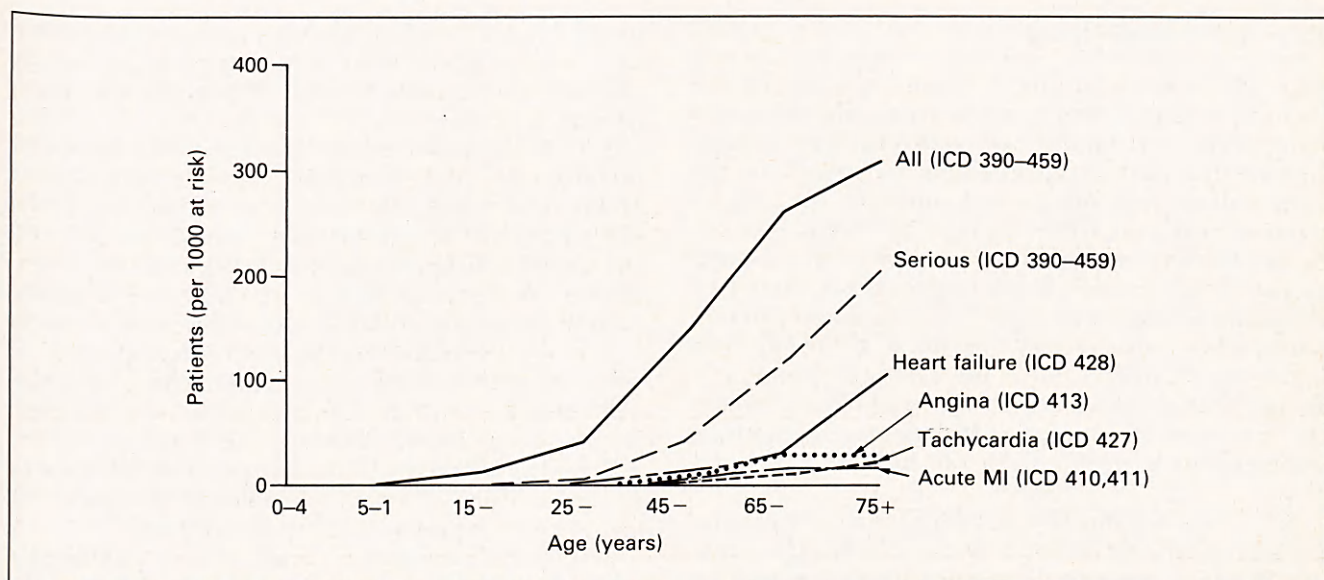
2.2 While routine health statistics may provide some surrogate figures, less is known about the actual incidence and prevalence of cardiovascular disease, in particular of disabling conditions in elderly people such as angina and cardiac failure. Estimates have often been based on population studies in different countries. General practice statistics report a yearly consultation rate for angina of approximately 3% for those aged 65 years and over. A British population based study found a 19% prevalence of angina in this age group [7], while a US study reported a 19% prevalence of non-exertional chest pain but 7% prevalence of exertional chest pain or angina; the US study found exertional chest pain associated with a 2.5-fold

**Table 3.** Hospital discharges and deaths: rates per 1,000 by age and sex, England 1985

	Ages (years)			
	45–64	65–74	75–84	85+
Diseases of the circulatory system (ICD 390–459)				
M	24.0	46.0	68.4	90.1
F	12.0	28.0	51.0	75.0
Ischaemic heart disease (ICD 410–414)				
M	12.1	17.1	18.5	20.3
F	3.5	8.5	12.5	15.2
Cerebrovascular disease (ICD 430–438)				
M	2.7	9.4	19.3	29.0
F	1.6	6.7	17.0	25.4
Other heart disease (ICD 415–429)				
M	3.7	10.9	19.9	33.4
F	2.0	6.6	15.4	26.7

ICD = International Coding of Diseases category  
Source: OPCS Hospital Inpatient Enquiry Series MB4 no. 27.





**Fig. 1.** Patients consulting general practitioners for disease of circulatory system and their specific diagnoses, rates per 1,000 persons at risk by age group. Morbidity statistics from general practice 1981-2. Source: OPCS General Practice Morbidity Series MB5 no. 1.

increased fatality risk [8]. For cardiac failure, general practice statistics report a consultation rate of 3% for those aged 65-74 years, rising to 10% for those aged 75 years and over. The Framingham study reports an annual incidence of 1% in persons aged 65 years and over. When the period prevalence was estimated it was about six times as high [9]. The Gothenburg study of men aged 67 years reported a 13% prevalence of overt congestive cardiac failure [10]. The differing rates are probably due to varying definitions of cardiac failure.

2.3 Precisely how much cardiovascular disease might be amenable to cardiological intervention is not known. The goals of medical intervention are improvement in function and postponement of disability, so extending the period of active independent life. Most clinical practice is based on information from studies in younger populations, but the extrapolation of such findings to older persons may not be appropriate. Nevertheless, even if a given treatment has a lower relative benefit in older persons, but absolute fatality rates are higher in this group, the benefit in terms of deaths prevented may be greater [11]. For example, in thrombolytic treatment in myocardial infarction, it has been calculated in one Health Region that a 10% reduction in fatality in the over-75 age group would save 72 lives each year. In the 45-64 years age group, even a 20% reduction would save only 47 lives a year [12]. The outcome of interventional cardiology and cardiac surgery in elderly people suggests that, while age is one prognostic factor, other factors such as concurrent disease may be more important predictors of outcome [13].

2.4 Elderly people, arbitrarily defined as those aged 65 years and over, encompass a heterogeneous

group, not just because of a chronological age span of over thirty years, but also when considered from the point of view of biological ageing. In addition, the changes in health and survival over the past few decades have resulted in elderly cohorts with different health status and expectations from previous cohorts; similarly, the effectiveness and efficacy of various interventions are also improving. Decisions on intervention are based on judgements of the balance between possible benefits and the risks and costs of treatment. The risk/benefit balance needs to be assessed carefully and re-evaluated in the light of improved therapy and changing attitudes.

2.5 In summary, estimates of future service needs should take into account the projected increase in the numbers of elderly people. It is inappropriate to regard age alone as a barrier to treatment.

### 3. Non-invasive cardiological investigations in elderly people

3.1 Many cardiological conditions have a greater incidence with age, examples being coronary heart disease, calcific aortic stenosis and degenerative conducting tissue disease. Treatment of these conditions may well have a less favourable immediate outcome in elderly people but, in assessing the ability to benefit from treatment, chronological age is less important than other factors concerned with the biological ageing process and the presence of associated disease. Decisions with regard to management must therefore depend both on the results of investigation in each individual case and the balance between risk and benefit.



*Exercise electrocardiography*

3.2 The manifestations of coronary heart disease include angina pectoris, myocardial infarction and congestive heart failure due to myocardial damage. Invasive investigation and attempts to revascularise the myocardium may not be welcomed by the elderly patient but can nevertheless be indicated for intractable angina pectoris or in cases in which there might be an improvement in prognosis. Relief of symptoms of angina pectoris following surgery in one study, which involved 91 months of follow-up, was highly significantly better in the older age group [14], so age need not be a reason for withholding surgery for the relief of symptoms. If patients are carefully selected, the expectation of life may be prolonged [15].

3.3 The identification of such patients is most simply and accurately initiated by exercise electrocardiography which has both diagnostic [16] and prognostic [17] value. The one-year fatality rate is ten times higher in elderly patients with myocardial infarction who, for whatever reason, are unable to carry out the test [18]. Exercise should preferably be continued until symptoms develop, following a standard treadmill protocol such as that of Bruce. Where limitations are imposed by arthritis, difficulty with balance or co-ordination, or a lack of confidence, a bicycle protocol may be more attractive.

*Ambulatory electrocardiographic (Holter) monitoring*

3.4 The resting electrocardiogram is a cheap, simple and reliable technique but has both strengths and weaknesses. It is good at detecting disturbances of rhythm and conduction if they are permanent but not if they are intermittent. It is also helpful in demonstrating significant myocardial deficiencies, notably in the inferior and anterior myocardium. In the detection of coronary heart disease before damage has occurred, however, exercise electrocardiography is often the investigation of first choice. Twenty-four-hour ambulatory monitoring can identify 'silent' myocardial ischaemia and lends itself to the elucidation of symptoms such as dizziness or palpitations which may be caused by disturbances of conduction or rhythm. Both symptoms occur increasingly with age.

3.5 Holter monitoring is a particularly suitable technique for the investigation of elderly patients. It requires little co-operation on the part of the patient but it has certain drawbacks, some of which are technical. Infrequent events are not easily registered, and occasional abnormal rhythms of the heart may be detected more reliably by the CardioMemo system, in which the patient starts the recording system at the time of the event. This, however, requires patient co-operation which some elderly patients may not be able to manage. The recording apparatus at present available is neither bulky nor intrusive. Most systems in use

in the United Kingdom use tape cassettes rather than reel-to-reel systems. Solid state systems are becoming available but at present these are larger and about twice as heavy.

3.6 Bradycardias which are detectable by Holter monitoring include complete atrio-ventricular block, Mobitz type I and type II atrio-ventricular block, the sick sinus and the carotid sinus syndromes, and also the infrequently recognised 'malignant vagal syndrome'. Bradycardia may be accompanied by symptoms in the ageing population and present with attacks of loss of consciousness of the Adams-Stokes variety, or with less specific symptoms including fatigue, dizziness, breathlessness or angina pectoris. Atrio-ventricular block may be either intermittent or established, and sino-atrial node dysfunction can lead to episodes of supraventricular tachycardia followed by sinus arrest and sometimes prolonged asystolic intervals.

3.7 In 1987 the British Cardiac Society published a report of its working group on cardiology in the district hospital [19]. It was suggested that the annual workload appropriate to a district hospital would be 5,000–6,000 resting electrocardiograms, 300 exercise electrocardiograms, up to 250 echocardiograms and 200 ambulatory electrocardiograms per 100,000 population. These recommendations were based on data provided by 50–60 responding hospitals, in some of which it was noted that the departments of medicine for the elderly seemed to require an unexpected proportion of the available facilities. Whether this represented economic use or overzealous investigation was not clear. Even so, the most active hospitals were carrying out at least twice as many investigations as were recommended in the conclusion to the report.

3.8 In summary, there is a strong case for investigating those elderly cardiac patients who might benefit from appropriate interventions. The facilities for cardiac investigation in district hospitals may need to be improved further as the population ages.

**4. Acute myocardial infarction**

4.1 In view of the trend towards an increasing number of elderly people in the population, an increase in coronary heart disease is inevitable. If a management policy is to be developed, there is a need for a comparison of the results of cardiological interventions in younger age groups and in patients who are above the arbitrary ages of 65 or 70 years.

4.2 Acute myocardial infarction may present in a variety of ways in older people. Chest pain is the most common presenting symptom but atypical or silent presentations are well recognised and the incidence of painless infarction increases with advancing years. Hospital studies have demonstrated that the severity and fatality of acute myocardial infarction increases with age in both sexes. Elderly females have more severe infarcts and the highest fatality.



*Coronary care units*

4.3 In the development of coronary care units, the first treatment strategies were directed towards the recognition and management of ventricular fibrillation and pump failure. Modern management of acute myocardial infarction now includes thrombolytic regimens to limit myocardial damage. Older patients benefit as much as their younger counterparts. The acknowledged success and widespread availability of haemodynamic monitoring and modern treatment techniques for suspected acute myocardial infarction should encourage admission of patients of all ages for cardiac monitoring and specific therapy. In the absence of coronary care facilities, monitoring can be accomplished in medical wards provided that adequate numbers of trained medical and nursing personnel are immediately available.

*Thrombolytic treatment*

4.4 The majority of patients with myocardial infarction have thrombotic occlusion of a coronary artery. Thrombolytic agents lyse thrombus thereby restoring tissue perfusion, which limits infarct size and enhances left ventricular function and patient survival. Several large-scale studies of thrombolytic treatment have recruited considerable numbers of patients up to 75 years of age.

4.5 The first major streptokinase trial (GISSI-1) [20] showed no difference in terms of survival in older patients suffering myocardial infarction.

4.6 The AIMS trial [21,22] was a randomised, double blind study comparing anistreplase (anisoylated plasminogen streptokinase activator complex) with placebo within six hours of the onset of suspected acute myocardial infarction. Of the 1,004 trial subjects, 40% were aged between 60 and 70 years. Significant reductions in fatality at 30 days and one year were achieved on active treatment (Table 4). Minor bleeding complications were more common on active treatment but the absolute benefits were greater in those at high risk including older patients.

4.7 The ISIS-2 study [23] was a randomised placebo controlled trial comparing streptokinase, aspirin and both agents combined within 24 hours of the onset of suspected acute myocardial infarction. Twenty per cent of the 17,187 trial patients were over 70 years of age. Significant reduction in vascular fatality was obtained at five weeks treatment with streptokinase or aspirin, and the combination of both of these agents produced the greatest benefit (Table 5). Absolute reduction in fatality was greatest in elderly patients and there was no evidence that the risk of bleeding complications of thrombolytic treatment was related to age.

4.8 The ASSET trial [24] was a randomised, double blind study comparing recombinant tissue-type plasminogen activator (rt-PA) with placebo within five

**Table 4.** Deaths after acute myocardial infarction.

Age (years)	Treatment	Death after	
		30 days	1 year
<65	Placebo	8.5%	16.5%
	Anistreplase	5.2%	9.4%
≥65	Placebo	30.2%	34.4%
	Anistreplase	12.2%	17.4%

Source: AIMS Trial Study Group [21]

**Table 5.** Vascular fatality five weeks post-infarction.

Age (years)	Treatment					
	Strepto-kinase	Placebo	Aspirin	Placebo	Aspirin + strepto-kinase	Placebo
<60	4.2%	5.8%	4.5%	5.5%	3.7%	6.2%
60-69	10.6%	14.4%	10.9%	14.0%	9.1%	16.0%
≥70	18.2%	21.6%	17.6%	22.3%	15.8%	23.8%

Source: ISIS-2 [23]

hours of the onset of suspected acute myocardial infarction. Of the trial subjects, 33% were aged between 65 and 74 years. Significant reduction in one-month fatality was achieved with active treatment (Table 6). Benefit increased with age.

4.9 It should therefore be concluded that age alone does not militate against the success of thrombolytic treatment in suspected acute myocardial infarction. The benefits of thrombolysis are most apparent in those patients at greatest risk.

4.10 In patients with suspected acute myocardial infarction within 24 hours of the onset of symptoms, thrombolytic treatment is nearly always indicated under 70 and may be of benefit over 75 years of age [25]. Greatest benefit will be obtained if treatment is given with least possible delay. The treatment options are all effective in older patients. Streptokinase is the most widely used and least expensive thrombolytic

**Table 6.** Fatality at one month post-infarction.

Age (years)	rt-PA	Placebo
<55	3.8%	4.4%
56-65	6.5%	7.9%
66-75	10.8%	16.4%

Source: Wilcox *et al.* ASSET trial [24]



agent and costs about £70 per treatment at present. It has to be given by infusion and can produce allergic side effects. Anistreplase can be given as a single injection but costs about five times as much as streptokinase, whereas alteplase (rt-PA) is free of antigenicity but costs about eight times as much as streptokinase at the time of writing. Its use may be limited to the treatment of patients who have previously received streptokinase.

4.11 In summary, older patients with myocardial infarction benefit as much as younger people from thrombolytic treatment and from modern methods of management of cardiac arrhythmias and pump failure.

## 5. Non-surgical intervention for heart disease in elderly patients

5.1 Permanent endocardial pacemaking has an established place in the treatment of cardiac arrhythmias. The development of more sophisticated systems has increased the effectiveness of this technique. New opportunities have also been ushered in by the development of techniques and instrumentation for the treatment of coronary heart disease and valve stenosis by percutaneous catheterisation. There is therefore a need to assess those categories of patients who can benefit from these procedures, including those who are unfit for cardiac surgery.

### *Permanent endocardial pacemaking*

5.2 Pacemaking may be carried out at any time of life from the first few hours to extreme old age. The oldest surviving pacemaker recipient in the United Kingdom at present is believed to be 101 years old and, although patients with sino-atrial disease are now being paced at younger ages, the majority of patients requiring pacemakers are over 65 years of age. At this age there are risks of increasing invalidism and helplessness, not only because of the direct effects of heart disease but also because of the falls and skeletal injuries to which patients with cardiac arrhythmias are prone.

5.3 In the United Kingdom about 160 pacemakers are inserted annually per million population, contrasting unfavourably with several other Western countries in which about 500 pacemakers are inserted per million population. Those that are inserted in the UK are less sophisticated [26]. There appear to be clear advantages when dual chamber or single chamber 'rate adaptive' systems are compared with fixed rate pacemakers. In the United Kingdom, however, only about 15% are dual chamber, 10% single chamber 'rate adaptive', and 3% atrial. The remainder are single chamber ventricular pacemakers, many of which are not programmable [27]. Anti-tachycardia devices and automatic implantable cardiac defibrillators are being inserted in only small numbers at present. While the cost of the more complex systems may be difficult to justify in those inactive patients who have failing fac-

ulties and a limited prognosis, the functional benefit for most patients can be considerable.

### *Percutaneous transluminal coronary angioplasty (coronary angioplasty)*

5.4 The less invasive nature of coronary angioplasty as compared with coronary bypass surgery would suggest it as an ideal treatment option for elderly patients. The use of coronary angioplasty has continued to expand throughout the 1980s, including its use in elderly patients. A number of reports indicate that the success and complication rates in general are not as good for elderly as for younger patients. Interpreting the results of coronary angioplasty requires, however, a consideration of factors other than numerical age.

5.5 Differences in success and complication rates may reflect differences in patient selection, the extent, severity and stage of coronary disease, left ventricular function, and operator and centre experience. For these reasons, it is difficult to extract the effect of age on outcome from a comparison of results obtained in different centres. Nevertheless, evidence is accumulating that age alone should not be regarded as a contraindication to coronary angioplasty.

5.6 Studies [28-30] of older patients undergoing coronary angioplasty have demonstrated angiographic success rates of 90%, fatality rates of 0-4% and major complication rates (myocardial infarction, coronary occlusion, or bypass surgery) of 9-12%. In contrast, coronary angioplasty undertaken in patients over 70 years of age as an emergency procedure following acute myocardial infarction had an immediate angiographic success rate of 74% but a fatality rate of 34% in one series [31].

5.7 There are two reports available in which the results of coronary angioplasty in young and older patients were compared within the same institution. Comparisons of results for all patients over 75 years who underwent coronary angioplasty over a 3-year period with those of an equal number of younger patients revealed angiographic success in 68% of older patients and 84% in the younger group [32]. Complications were also considerably higher in the older patients; of the 29% (versus 7%) who had major complications, 9.3% died. The extent of coronary disease and left ventricular function were not compared between the groups, so matching of patients for factors other than age could not be assessed. Angioplasty failure however was associated with angiographic evidence of coronary calcification and severe stenosis. In a similar study, Cook and Hubner [33] examined the effect of age on the outcome of angioplasty for all procedures over a specified period in their hospital. Of 289 patients, 29 were over 65 years. Angioplasty was successful to a similar extent in older (76%) and younger patients (79%). In addition, major complications (vessel occlusion, myocardial infarction, emergency surgery and re-stenosis) were also similar for



both groups (19% versus 17%). Older patients tolerated complications less well, however, resulting in a higher fatality rate (7% versus 0.4%). An important feature of this study is that the distribution and extent of coronary disease were compared and shown to be fairly similar between the groups.

5.8 These studies taken together indicate that coronary angioplasty may be undertaken successfully in older patients. Selection of the patients on the basis of coronary anatomy and acknowledged risk factors (general health, renal, hepatic, respiratory and cardiovascular function) should result in similar initial angiographic success, independent of age. Nevertheless, patients who do experience complications are more likely to die if older. Further work is needed to explain the mechanisms responsible for this. Although the risks are somewhat higher in older patients, the operation of an age cut-off would exclude many patients from effective and worthwhile treatment.

#### *Percutaneous transluminal valvuloplasty (percutaneous valvuloplasty)*

5.9 Percutaneous transluminal valvuloplasty is a technique in which catheter mounted balloons, introduced percutaneously, are used to disrupt stenotic valves. The aortic and mitral valves are most frequently treated using the technique. Since general anaesthesia and thoracic surgery are avoided, it would appear ideally suited for patients in whom these might carry an unduly high risk, including some elderly patients.

5.10 The primary aim of percutaneous valvuloplasty is to increase the functional valve area without inducing regurgitation by splitting commissure adhesions. There is good evidence that this may be achieved, as shown by post-mortem, intra-operative, and percutaneous studies [34]. The results include a reduction in valve gradient and improved haemodynamic effect [35–38], a reduction in pressure gradient, left atrial and pulmonary pressures.

5.11 Although clinical experience with valvuloplasty lags far behind that for coronary angioplasty, initial studies indicate that it may have an important place in the management of some patients, particularly those considered at high risk for valve surgery. Age should not be regarded as a contraindication in itself, but patients with heavily calcified and rigid valves or poor ventricular function are at greater risk and less likely to have a successful outcome. Much further work is needed to establish the final place of valvuloplasty in the management of heart disease.

5.12 In summary, non-surgical interventions, including permanent endocardial pacemaking, percutaneous coronary angioplasty and valvuloplasty, are carried out at a lower rate in the United Kingdom than in many Western countries. Elderly patients can benefit from these procedures and should not be denied them.

## 6. Cardiac surgery in elderly patients

6.1 As in the case of non-surgical interventions, there is a need to consider the current and future indications for cardiac surgery in elderly people. This applies particularly to coronary surgery and heart valve operations. Cardiac transplantation is unlikely to be available in this age group owing to a lack of donors.

#### *Current activity and trends in cardiac surgery*

6.2 There has been a sustained increase in total numbers of cardiac surgical operations performed in the United Kingdom in the 1970s and 1980s [39] (see Table 7). This experience is similar to that reported in other countries (eg USA, Germany, Australia). A steady increase in coronary artery surgical procedures is noteworthy whereas valvar surgery has remained constant in the 1980s.

6.3 The increasing proportion of elderly patients within the total cardiac surgical workload is seen both for coronary artery surgery and for valvar procedures. Between 1971 and 1980, elderly patients accounted for 2–8% of all patients undergoing coronary artery bypass surgery, compared with 17–30% between 1981 and 1988 [40,41]. In one recent UK study, there was an increase of 7.5 years in the mean age of patients undergoing coronary artery surgery over a 10-year period [42]. It may, however, require the establishment of a UK registry for coronary artery surgery if more precise data are to be obtained. Data for the UK Heart Valve Registry indicate that, in 1986, 30% of heart valve operations were carried out in elderly patients compared with 37% in 1989 [43].

#### *Results of cardiac surgery in elderly patients*

6.4 In general, operative fatality and morbidity increase with increasing age in elderly patients. Operative fatality for coronary surgery procedures is lower than for valvar surgery for all ages. In recent reported series [40,41,44,45], operative fatality for coronary surgery in elderly patients is 3–9% above 70 years and

**Table 7.** Number of operations for valvar disease and for coronary heart disease in the UK 1977–87 (Data from UK Cardiac Surgical Register) Cumulative statistics 1977 to 1988

Year	Valvar disease		Coronary heart disease	
	No.	†%*	No.	†%*
1977	4832	8.9	3040	9.3
1982	4652	6.7	7403	5.2
1987	4755	5.8	13,103	3.6

\* Operative fatality (%)



10–13% above 75 years, compared with 1–3% for the total coronary surgery in the same institution. Nevertheless, coronary artery surgery can provide excellent symptomatic relief and may enhance prognosis in elderly patients with angina unresponsive to medical treatment. Factors associated with higher fatality rates include emergency procedures and the presence of coexistent vascular disease. Perioperative morbidity for coronary surgery (including stroke, renal failure, myocardial infarction) is also more common in elderly patients and lies between 15% and 25% compared with 6–7% for all ages [40,41,45].

6.5 Operative fatality rates for heart valve surgery in elderly patients are reported to vary between 10% (>65 years) and 25% (>80 years) compared with around 5–8% for all ages [43,44]. Re-operation is less frequently carried out in those over 70 but, in the few studies that have been carried out, perioperative morbidity for heart valve surgery is high in elderly patients, ranging from around 20% to over 35%. As with coronary surgery, stroke, renal failure and myocardial infarction are relatively more common after valve surgery in elderly patients.

6.6 Few data are available on the length of stay in intensive care units and in hospital generally for elderly cardiac surgery patients. The average stay for all ages is 10 days and such data as exist suggest that the total hospital stay for elderly patients may be increased by 1–2 days. Although long-term survival after cardiac surgery in elderly patients is less than in younger patients who have an 80–95% survival rate after 7–8 years, survival rates of around 65–80% have been reported after 7–8 years in an age group in which the expectation of life might be expected to be reduced for other reasons.

6.7 In summary, excellent results can be achieved with cardiac surgery in elderly patients, and this practice has increased substantially in recent years. These factors, together with our changing demography, need to be considered in planning future needs.

### Summary and Recommendations

Heart disease is the most important single cause of death in old age, and potentially treatable cardiac disease is a major contributory factor leading to a loss of independence in elderly people living at home. Coronary heart disease accounts for over 150,000 deaths in England and Wales each year. Three-quarters of those dying are 65 years of age or older. The number of people in this age group is rising towards a projected figure of 9 million by the year 2020. There is a need for promotion of preventive measures and also adequate facilities for the investigation and treatment of the types of heart disease that are prevalent in the ageing population. Doctors should recognise the fact that age alone does not necessarily diminish the benefits that can result from appropriate treatment.

Increasing use of investigative facilities, including

exercise testing, 24-hour ECG tape monitoring and imaging techniques, and treatment opportunities provided by cardiac pacing, thrombolysis, percutaneous angioplasty, percutaneous valvuloplasty and cardiac surgery have produced significant benefits. These forms of management are expensive and not without risks. This has led to fiscal and other pressures to ensure that clinical management decisions take into account the balance of risk and benefit as well as cost. Arguments for restricting treatment because of age alone can no longer be sustained on clinical grounds.

### RECOMMENDATIONS

1. Purchasing authorities and others who are estimating future service needs must take account of the steadily increasing number of elderly people who will require access to specialist cardiological services.
2. There is a need for adequate non-invasive diagnostic facilities regardless of age, and cardiac pacing and thrombolytic therapy should be available for all age groups.
3. Invasive cardiological investigations, eg cardiac catheterisation, are indicated in patients who are fit for surgical or angioplastic intervention, bearing in mind the increasing safety and effectiveness of these procedures. Provision is required for the 7,000 coronary and 1,000 valve operations which will be needed annually in the 1990s for patients over 70 years of age.
4. Provision is also needed for percutaneous transluminal coronary angioplasty, which should be considered for elderly patients with symptomatic coronary heart disease that is unresponsive to medical treatment. Percutaneous valvuloplasty is still being evaluated but may be considered for patients with valvar stenosis who would be exposed to a high risk if treated surgically.
5. Further research is needed to clarify the mechanisms through which age is associated with perioperative morbidity and mortality, in order to provide a better understanding of risk/benefit ratios in elderly patients.

### References

- 1 Fourth Report of a Joint Cardiology Committee. Provision of services for the diagnosis and treatment of heart disease. *Br Heart J* 1991; in press.
- 2 Shaper AG, Cook DG, Walker K, MacFarland PW. Prevalence of ischaemic heart disease in middle-aged British men. *Br Heart J* 1984;51:595–605.
- 3 Aaron HJ, Schwartz WB. *The painful prescription: rationing hospital care*. Washington DC: Brookings Institution, 1981.
- 4 Callahan D. Aging and the ends of medicine. *Ann N Y Acad Sci* 1988;530:125–32.
- 5 Grimley Evans J. Age and equality. *Ann N Y Acad Sci* 1988;530:118–24.



- 6 Welch HG, Larson EB. Dealing with limited resources: the Oregon decision to curtail funding for organ transplantation. *N Engl J Med* 1988;**319**:171-3.
- 7 Grimley Evans J, Prudham D, Wandless I. Risk factors for stroke in the elderly. In: Barbagallo-Sangiorgi G, Exton-Smith AN, eds. *The ageing brain: neurological and mental disturbances*. New York: Plenum, 1980:113-26.
- 8 LaCroix AZ, Guralnik NM, Curb JD, Wallace RB, Ostfeld AM, Hennekens CH. Chest pain and coronary heart disease mortality among older men and women in three communities. *Circulation* 1990;**81**:437-46.
- 9 Kannel WB. Epidemiological aspects of heart failure. *Cardiol Clin* 1989;**7**:1-9.
- 10 Eriksson H, Swardsudd K, Caidahl K, et al. Early heart failure in the population. *Acta Med Scand* 1988; **223**:197-209.
- 11 Khaw KT, Rose G. Cholesterol screening programmes: how much potential benefit? *Br Med J* 1989;**299**:606-7.
- 12 Greenbaum R. Streptokinase in the management of acute myocardial infarction. *Cardiology* 1990;**8**:15-9.
- 13 Ormerod OJ, Westaby S. Interventional cardiology and cardiac surgery in the elderly. In: Grimley Evans J, Caird FI, eds. *Advanced geriatric medicine*, 7. London: Wright, 1988:38-49.
- 14 Loop FD, Lytle BW, Cosgrove DM, et al. Coronary artery bypass graft surgery in the elderly: indications and outcome. *Cleve Clin J Med* 1988;**55**:23-4.
- 15 Califf RM, Havell FE, Lee KL, et al. The evolution of medical and surgical therapy for coronary artery disease. A fifteen year perspective. *JAMA* 1989;**261**:2071-86.
- 16 Detry JMR, Kapita BM, Cosyns J, Scottiaux-Brasseur LA, Rousseau MF. Diagnostic value of history and maximal exercise electrocardiography in men and women suspected of coronary artery disease. *Circulation* 1977;**56**:756-61.
- 17 Bonow RO, Kent KM, Rosing DR, et al. Exercise-induced ischaemia in mildly symptomatic patients with coronary artery disease and preserved left ventricular function. Identification of subgroups at risk of death during medical therapy. *N Engl J Med* 1984;**311**:1339-45.
- 18 Fioretti P, Deckers JW, Brower RW, Simmonds ML, Beelen JAJM, Hugenholz P. Predischarge stress test after myocardial infarction in old age: results and prognostic value. *Eur Heart J* 1984;**5**(Suppl 5):101-4.
- 19 Report of a working party of the British Cardiac Society. Cardiology in the district hospital. *Br Heart J* 1987;**58**:537-46.
- 20 GISSI (Gruppo Italiano per lo Studio della Streptochinasi nell'Infarto Miocardico). Effectiveness of intravenous thrombolytic treatment in acute myocardial infarction. *Lancet* 1986;**1**:397-402.
- 21 AIMS Trial Study Group. Effect of intravenous APSAC on mortality after acute myocardial infarction: preliminary report of a placebo-controlled clinical trial. *Lancet* 1988;**1**:545-9.
- 22 AIMS Trial Study Group. Long-term effects of intravenous anistreplase in acute myocardial infarction: final report of the AIMS study. *Lancet* 1990;**335**:427-31.
- 23 ISIS-2 (Second International Study of Infarct Survival Collaborative Group). Randomised trial of intravenous streptokinase, oral aspirin, both or neither among 17187 cases of suspected acute myocardial infarction. *Lancet* 1988;**2**:349-60.
- 24 Wilcox RG, Olsson CG, Skene AM, Von Der Lippe G, Jensen G, Hampton JR. Trial of tissue plasminogen activator for mortality reduction in acute myocardial infarction. Anglo-Scandinavian Study of Early Thrombolysis (ASSET). *Lancet* 1988;**2**:525-30.
- 25 American College of Cardiology/American Heart Association Task Force. Guidelines for the early management of patients with acute myocardial infarction. *Circulation* 1990;**82**:664-707.
- 26 Feruglio GA, Steinbach K. World survey on cardiac pacing. In: Steinbach K. *Cardiac pacing*. Darmstadt: Steinkopff, 1983:953-68.
- 27 Siemens Pacesetter Commercial Report. Sunbury on Thames, 1990.
- 28 Simpfendorfer C, Raymond R, Schraider J, et al. Early and long-term results of percutaneous transluminal coronary angioplasty in patients 70 years of age and older with angina pectoris. *Am J Cardiol* 1988;**62**:959-61.
- 29 Holt GW, Sugrue D, Bresnahan J, et al. Results of percutaneous transluminal coronary angioplasty for unstable angina pectoris in patients 70 years of age and older. *Am J Cardiol* 1988;**61**:994-7.
- 30 Danchin N, Joseph M, Juilliere Y, et al. L'Angioplastie coronaire chez le sujet agé. *Ann Cardiol Angeiol* 1988;**37**:297-9.
- 31 Holland KJ, O'Neill WW, Bates ER, et al. Emergency percutaneous transluminal coronary angioplasty during acute myocardial infarction for patients more than 70 years of age. *Am J Cardiol* 1989;**63**:399-403.
- 32 Imburgia M, King TR, Soffer AD, et al. Early results and long-term outcome of percutaneous transluminal coronary angioplasty in patients aged 75 years or older. *Am J Cardiol* 1989;**63**:1127-9.
- 33 Cook C, Hubner PJB. Percutaneous transluminal coronary angioplasty in elderly patients: a comparison with younger patients. *Age Ageing* 1989;**18**:219-22.
- 34 Jackson G, Thomas S, Monaghan M, et al. Inoperable aortic stenosis in the elderly: benefit from percutaneous transluminal valvuloplasty. *Br Med J* 1987;**294**:83-6.
- 35 Stoddard MF, Vandormael MG, Pearson AC. Immediate and short-term effects of aortic balloon valvuloplasty on left ventricular diastolic function and filling in humans. *J Am Coll Cardiol* 1989;**14**(5):1218-28.
- 36 McKay RG, Safian RD, Lock JE. Assessment of left ventricular and aortic valve function after aortic balloon valvuloplasty in adult patients with critical aortic stenosis. *Circulation* 1987;**75**:192-203.
- 37 McKay CR, Kawanishi DT, Kotlewski A, et al. Improvement in exercise capacity and exercise hemodynamics 3 months after double-balloon, catheter balloon valvuloplasty treatment of patients with symptomatic mitral stenosis. *Circulation* 1988;**77**:1013-21.
- 38 Abascal VM, Wilkins GT, O'Shea PJ, et al. Prediction of successful outcome in 130 patients undergoing percutaneous balloon mitral valvotomy. *Circulation* 1990;**82**(3):448-56.
- 39 Society of Cardiothoracic Surgeons of Great Britain and Ireland. UK cardiac surgical register—1988 report.
- 40 Acinapura AJ, Rose DM, Cunningham JN Jr, Jacobowitz IJ, Kramer MD, Zisbrod Z. Coronary artery bypass in septuagenarians: analysis of mortality and morbidity. *Circulation Suppl* 1. 1988;**78**(3):179-84.
- 41 Grondin CM, Thornton JC, Engle JC, Schreiber H, Cross FS. Cardiac surgery in septuagenarians: is there a difference in mortality and morbidity? *J Thorac Cardiovasc Surg* 1989;**98**:908-14.
- 42 Macrae CA, Marber MS, Keywood C, Joy M. The need for invasive cardiological assessment and intervention: a ten year review. *Br Heart J* 1990;in press.
- 43 Department of Health. UK heart valve registry—1988 report.
- 44 Horvath KA, DiSesa VJ, Peigh PS, Couper GS, Collins JJ Jr, Cohn LH. Favorable results of coronary artery bypass grafting in patients older than 75 years. *J Thorac Cardiovasc Surg* 1990;**99**:92-6.
- 45 Naunheim KS, Dean PA, Fiore AC, et al. Cardiac surgery in the octogenarian. *Eur J Cardiothorac Surg* 1990;**4**:130-5.

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