delay for all patients admitted with myocardial infarction has fallen from nearly eight hours to less than three hours following the introduction of the coronary ambulances, and the trend toward earlier referral is continuing.

We found a very great difference between the median delay for patients presenting after 999 calls and those referred from general practitioners. The type of case tended to be quite different from the two sources, for most of the 999 calls were made after patients had collapsed or been taken ill in the street. The additional delay for patients referred from home was due in large measure to the patients themselves, either because they did not appreciate the significance of the symptoms or because they wished to avoid calling a doctor at night.⁸ This problem cannot easily be overcome without the risk of creating misplaced anxiety in the community and possibly overloading the medical services with unnecessary calls. We therefore face a dilemma because most potentially reversible cases of ventricular fibrillation occur within an hour or so of the onset of symptoms. The problem would be resolved at least to a small degree if patients with *diagnosed* ischaemic heart disease were advised by their general practitioners to seek help at once if cardiac pain at rest persisted for more than 10 minutes without relief from trinitrin.

We do not claim that a coronary ambulance manned only by

ambulance personnel can be as successful as a conventional system. Nevertheless, our experience over a 12-month period of operation leads us to believe that it offers a worth-while and inexpensive alternative for the many areas in which a shortage of skilled medical and nursing staff has so far precluded the advantages of mobile coronary care.

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Medicine in Old Age

Cardiovascular Disease in the Old

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In many cases cardiovascular disease in the old is similar to the disease in the young and middle aged, except that its pathology is weighted towards conditions such as ischaemic heart disease rather than congenital or rheumatic heart disease. This point, though perhaps obvious, needs to be made to emphasize that most forms of heart disease in the young which do not cause early death may be found in old age.

In other cases, particularly those presenting to the geriatric physician, and in patients over 75 or 80 years, the aetiology, symptoms, course, and response to treatment are all considerably modified, and need separate consideration. The present paper is concerned with this group of patients and will deal with the commoner conditions in which the differences are most appreciable, and which present particular problems to the general practitioner. Congestive heart failure is a common condition covering most aspects of heart disease, and so this paper will be limited to a discussion of this condition.

The most outstanding feature of congestive heart failure is the ease with which elderly patients develop it and the relatively good response to treatment.¹ Congestive failure may develop in patients with less clinical evidence of heart disease than would be expected in younger patients. Though there is usually evidence

of myocardial or valvular heart disease, precipitating factors are particularly important and need to be recognized before the condition can be adequately treated.

Precipitating Factors

CHEST INFECTION

Chest infection is a particularly important factor to bear in mind. Signs of bronchopneumonia may be difficult to detect, and relatively slight infection is often sufficient to precipitate failure. The combination of chest infection and heart failure in which it is difficult to decide the relative contribution of pulmonary and cardiac factors is common.

ATRIAL FIBRILLATION

Atrial fibrillation is common in the elderly, and may be paroxysmal. When the ventricular rate is rapid it is a common cause of failure. A more serious arrhythmia is atrial flutter or atrial tachycardia with atrioventricular block. This condition is difficult to detect clinically except by inspection of the venous pulse. When atrioventricular block is present with a 2:1 ventricular response the ventricular rate may be relatively slow and regular. It is particularly likely to occur in a patient who is being treated with digitalis for atrial fibrillation. It is a serious complication of digitalis toxicity, easily missed, and liable to be fatal.²

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HEART BLOCK

When the ventricular rate is slow, heart block may be a cause of congestive failure; this responds to measures which increase the ventricular rate. Stokes Adams attacks are the more dramatic effects of heart block, but congestive failure, chronic ill health, and confusional states may also be features of the slow ventricular rate. Artificial pace-making is of value in these cases, and their age should not prevent its use.

CARDIAC INFARCTION

Silent cardiac infarction is common in the old or may present with minor symptoms of confusion, weakness, or syncope, without chest pain (fig. 1).³ It may also present with congestive failure and should be suspected in patients who develop failure without obvious cause. Clinical support for this diagnosis may be obtained from the sudden development of a gallop rhythm, which is often most easily heard over the lower sternum or xiphoid process in the old when auscultation is difficult.⁴

FIG. 1—Acute anterior infarction in an 89-year-old woman without symptoms. (By kind permission of the publishers, Pitman Medical Publishing Co. Ltd. Wedgwood, J., in *Medicine in Old Age*, ed. J. Agate, p. 216. London, Royal College of Physicians, 1966.)

SUBACUTE BACTERIAL ENDOCARDITIS

Between 20 and 30% of the cases of subacute bacterial endocarditis occur in patients over the age of 60.⁵ The condition is easily missed in old age,^{6 7} but its insidious onset in the old may be associated with congestive failure and it should be suspected in patients with congestive failure, a heart murmur, and disproportionate constitutional symptoms; particularly if fever is present (fig. 2).

OTHER CONDITIONS

Other conditions which precipitate failure and may easily be missed are anaemia, thyrotoxicosis, myxoedema, and salt retention due to treatment with steroids or with stilboestrol for carcinoma of the prostate. Pulmonary embolism is a fairly frequent cause of failure. Deep vein thrombosis is common and easily missed. Recurrent pulmonary embolism as a cause of

FIG. 2—Unexpected fever in a woman, aged 69, with subacute bacterial endocarditis.

failure may cause difficulty in diagnosis. Thiamine (aneurin, Vitamin B1) deficiency has been reported as a cause of congestive failure without the characteristic high output signs associated with beri-beri.⁸ This condition does not appear to be common but may be being missed because it is not being suspected. Confirmation of thiamine deficiency may be obtained by estimating the red cell transketolase, but facilities for this are not often available. Treatment with thiamine is effective and may be diagnostic, but presents difficulties,^{9 10} so that its use as a diagnostic test is complicated.

Underlying Factors

In most elderly patients myocardial disease is the underlying cause of failure. In about a quarter of the cases evidence of previous cardiac infarction or the presence of hypertension supports a diagnosis of ischaemic heart disease (table).¹¹ The remaining cases are usually considered to have ischaemic heart disease on rather less evidence. The precision of this diagnosis may be questioned but it remains a useful term and preferable to the obsolete "senile myocardial degeneration" which it replaced.

Heart Disease on Discharge or Death in Patients Aged 80 Years and Over 1962-1964

	M	F	Total	Total %
Ischaemic Heart Disease—Without Infarction ..	75	69	144	73
Ischaemic Heart Disease—With Infarction ..	19	20	39	20
Ischaemic Heart Disease—With Hypertension ..	0	6	6	3
Valvular Heart Disease	3	3	6	3
Cor Pulmonale	2	1	3	1
	99	99	198	100

(By kind permission of the publishers, Pitman Medical Publishing Co. Ltd. Wedgwood, J., in *Medicine in Old Age*, ed. J. Agate, p. 216. London, Royal College of Physicians, 1966.)

The post-mortem finding of brown atrophy of the myocardium is not related to the presence of failure. Necropsy finding of amyloid deposits in the heart muscle of elderly patients dying of congestive failure deserves more attention.^{12 13} This condition, known as senile cardiac amyloidosis, is at present a post-mortem diagnosis. Its incidence varies considerably in published series, but is particularly high in those over 90 years. It is associated clinically with extreme sensitivity to digitalis.

Valvular and Congenital Heart Disease, Cor Pulmonale

Nearly all forms of congenital heart disease, except those associated with an early mortality, and of rheumatic and syphilitic heart disease have been found in old age (figs. 3 and 4).¹⁴ Cor pulmonale occurs in elderly patients but is rare in the type of patient discussed here; though combinations of failure, chest infection, and emphysema, in which the aetiology is mixed, are common. Probably patients with congenital lesions or valvular heart disease acquired in earlier adult life who survive to these late ages do not develop failure until a myocardial factor is introduced.

Some forms of valvular heart disease, particularly mitral incompetence, may develop in old age as a result of cardiac infarction, ischaemic heart disease, calcification, or degenerative changes. Calcification of the mitral valve ring, calcium deposits

FIG. 5—Necropsy specimen showing degenerative changes in the mitral valve in a 90-year-old woman with mitral incompetence and intractable failure. (By courtesy of Dr. G. Farrer-Brown, Bland-Sutton Institute, Middlesex Hospital Medical School.)

FIG. 3—Chest x-ray film. Woman aged 79 years with a ventricular septal defect. Confirmed at necropsy. (By kind permission of the publishers of the *Practitioner* and of Dr. K. M. MacKenzie, Wedgwood, J., *Practitioner*, 1968, 200, 778).

FIG. 4—Chest x-ray film. Woman aged 75 years with an atrial septal defect.

near the ring, mucosal degeneration,¹⁵ and changes in the chordae tendineae or papillary muscles may all cause mitral incompetence (fig. 5), which is sometimes severe and leads to intractable failure. Similar changes may occur in the aortic valve leading to mild stenosis or aortic incompetence from aortic ectasia.¹⁴

The difficulty of auscultation, and the fact that investigation is often not practicable or justified, means that our understanding of heart murmurs in these patients is inadequate. Systolic murmurs are difficult to assess, they may vary in length with the cardiac output, originate from more than one valve, or originate in an extracardiac arterial bruit in the abdomen or neck.

It is often difficult to estimate the haemodynamic significance of a suspected valvular lesion, but the importance of mitral incompetence of late onset as a cause of failure is easy to underestimate. The presence of a heart murmur should also be taken seriously because of the risk of bacterial endocarditis.

Hypertension

Hypertensive heart disease is rare in the type of patient discussed here, though some degree of hypertension with ischaemic heart disease is common. The indication for using hypotensive drugs either for the relief of failure or on general principles is infrequent, and these drugs should hardly ever be used because of the risks of reducing the cerebral blood flow.

Diagnosis

It is necessary to emphasize the importance of accurate diagnosis in congestive failure. The term is often used imprecisely to explain weakness, shortness of breath, or oedema of the ankles—for which there are many causes other than heart failure. Correct diagnosis is difficult but important since an incorrect diagnosis of heart failure may cause cardiac neurosis and greatly restrict the patient's rehabilitation and independence.

The diagnosis of congestive heart failure rests on careful examination of the venous pulse in the internal jugular vein. This is difficult in the old because of senile kyphosis and of the problem of positioning the patient. Arterial abnormalities in the neck may cause unusual pulsations or on the left side cause pressure effects which mimic a raised venous pressure.^{16 17} Inspection should therefore be made of the right-hand side of the neck and, if there is difficulty in distinguishing an arterial from a venous pulse, pressure over the liver will elevate an abnormal venous pulse and over the lower part of the neck obliterate it.

Other signs of heart failure in the elderly tend to have equivocal significance. Rales at the lung bases can be found in many elderly patients who have been in bed.¹⁸ The liver edge may be palpable owing to a low diaphragm or deformed rib cage. Oedema of the legs is common in the elderly without heart failure, though a sacral pad of oedema is perhaps more significant.

These difficulties emphasize the need for negative diagnosis. If the heart is not enlarged, there are no abnormal heart sounds, and the electrocardiogram is normal, heart failure is unlikely to be present. Palpation of the apex beat, auscultation, a chest x-ray film, and an electrocardiogram may be helpful in a negative way, though themselves may raise problems.

Treatment

The importance of precipitating factors in heart failure in the old has been mentioned and their recognition and treatment are of great importance. The diagnosis and treatment of concomitant chest infection with an appropriate antibiotic need particular emphasis. Signs in the chest may be minimal, and it is often justifiable to give an antibiotic on the suspicion that infection may be present if the response to treatment has otherwise been poor.

DIURETICS

In the absence of atrial fibrillation, diuretics and the treatment of the precipitating cause are usually all that is needed. Digitalis should be kept in reserve unless atrial fibrillation is present. The choice and method of giving diuretics must take into account the problem of incontinence, and, in men, retention of urine if there is some prostatic obstruction. Elderly people may be weakened by the effort required to deal with a massive diuresis and do not stand up well to rapid changes in fluid and electrolyte balance. In most cases there is no need for the vigorous use of diuretics or for the more complex potent diuretics required in younger patients with severe or resistant failure.

The method and frequency of administration need thought. Elderly patients may not take tablets regularly or may spit them out after the nurse has left; in them the parenteral route may be better than the oral. After the acute phase is over diuretics may not need to be given daily. In maintenance therapy the diuretic can be given intermittently on the most convenient days. The patient should be regularly assessed and maintenance diuretics stopped as soon as possible. Diuretics tend to be continued after the problem of congestive failure has receded, from habit and because of difficulty in deciding that heart failure has ceased in the presence of factors such as leg oedema. If diuretics are given in small doses, intermittently, and for short periods, their complications such as potassium deficiency, gout, and (in the case of the thiazides) the provocation of diabetes, are less likely to occur and the patient's regimen is more easily managed.

Choice of Diuretic

Many of the above principles may seem obvious but are often neglected and more attention given to the nature of the diuretic itself. The choice of diuretic is of less importance except that the more potent and complex diuretic programmes are rarely needed. In the more serious or acute conditions frusemide has the advantage of powerful action, flexibility of dosage, and oral or parenteral administration. Given by mouth it acts within one hour and lasts for about eight hours. Its disadvantage is that it may be too effective—a problem that may be diminished by giving it in the smallest possible dose. In less serious states and for maintenance the thiazides are satisfactory. They act more slowly (within four hours) and last longer (for about twelve hours). Their prolonged action may be a handicap, as may their diabetogenic tendencies. Mersalyl is little used now but has advantages when a single weekly injection is required, and it

does not produce potassium deficiency. Moduretic (amiloride hydrochloride with hydrochlorothiazide) has recently been used in the elderly. It is said not to produce potassium deficiency.

POTASSIUM SUPPLEMENTS

Potassium deficiency may be troublesome in the old and aggravate digitalis toxicity. Its occurrence is reduced if the general principles outlined are adhered to, but some form of potassium supplement is usually needed if the thiazides or frusemide are given. Such supplements do not obviate the need for regular assessment of patients on long-term diuretics. Though extra tablets are a nuisance for elderly patients, potassium supplements are more easily controlled if given separately. Slow K (Ciba) contains 600 mg of potassium chloride or 8 mEq of potassium. Two to six tablets a day may be given. Sando K (Sandoz) contains 12 mEq potassium as the chloride in effervescent tablets. The dose usually given is two to four tablets daily. The thiazide diuretics with slow release potassium offer the advantages of ease of administration but the disadvantage of a relatively small dose of potassium.

DIGITALIS

Digitalization is a considerable problem in elderly patients: thus digitalis intoxication is easily produced with small doses of the drug.¹⁹ Mental confusion²⁰ is often the first indication of overdose, or the patient may look or feel ill. Nausea and vomiting may occur later. These symptoms are insidious and easily missed. The illness produced by digitalis in elderly patients has a most deleterious effect on their recovery, apart from the danger of atrial or ventricular arrhythmias—which are common (fig. 6), more difficult to treat in the elderly than in the young, and often fatal. Digitalis needs to be given cautiously and the individual's response to it assessed by giving low doses in the first instance. Digoxin has the advantage of relatively quick action and excretion. Digoxin 0.25 mg three times a day is a large dose in old age, and 0.25 mg once or twice a day is often sufficient for the initial period. The maintenance dosage needs to be much smaller—0.125 mg or 0.0625 mg daily.

FIG. 6—Ectopic arrhythmia due to digitalis. E.C.G. Lead II. Woman aged 90 years. (By kind permission of the publishers of *Modern Medicine*.)

Frequent observation of the patient is needed in the early stages of treatment for early symptoms or signs, particularly arrhythmias, of digitalis overdose. These should be taken seriously and the drug stopped at once if they occur. The danger of a large diuresis, or of potassium deficiency, aggravating the effects of digitalis should be borne in mind. Patients on long-term digitalis should be reviewed regularly and unless there is a good reason for continuing to give the drug it should be stopped.

The treatment of the elderly with digoxin has been further complicated by the discovery that the biological availability of the

drug to the myocardium is influenced by the method of preparation.^{21 22} Different tablets of digoxin may have varying effects, though they contain the same amount of digoxin. At present the simplest solution to this problem is to digitalize and maintain each individual on the same brand of digoxin.

Conclusion

The symptomatology and course of cardiovascular disease is modified by age and there are several forms of heart disease specific to old age. Congestive failure is a common and often complex problem. With accurate diagnosis and careful treatment the prognosis is relatively good. The paradox of cardiovascular disease in the old is that, though heart disease is common in patients who survive to advanced old age, they are a selected group, a biological élite, whose general health and hearts might be expected to be unusually good.

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New Inventions

Marsupial Principle in Maintenance of Personal Hygiene in Urinary Incontinence

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Summary

A garment has been designed for the management of urinary incontinence, with the objective of maintaining dryness of the skin and clothing, while reducing odour. Trials of this garment in various hospitals and age groups have shown them to be effective and practical.

Introduction

The importance of incontinence lies in the crippling social complications in child and adult age groups, though there may be vital medical considerations. This can be seen by the existence of local authority enuresis clinics, the dominating importance of continence in the geriatric age groups, and the existence of a European continence society.

Whereas the numbers of primary or secondary enuretics have been assessed¹ and the numbers of spastic children or spina bifida cases with incontinence are likely to be known, the total numbers in the middle and older age groups in the

community have never been satisfactorily estimated. From a social and nursing standpoint, the over-riding need of these patients for whom effective treatment is not possible, is for an aesthetically satisfactory and effective means of prevention of wetting so that the patient can lead a relatively normal life.

Method

A review of existing garments was undertaken in 1967 and their common factors were assessed. All tended to rely on the containment of fluid within an impermeable barrier, so that the urine was kept in contact with the skin. Skin lesions were prominent and odour was troublesome for this reason. The efficacy of the garments in preventing leakage of urine varied with design. All had shortcomings but none overcame the basic mechanics of the situation; when the patient was erect, or sitting, fluid, however contained, would gravitate to the lowest part of the garment, usually the crotch. All shared the objective of treating the clothes rather than the patient. Because of the difficulties in changing the garments all tended to produce dependence and not independence.

The fundamental objective must be to treat the patient rather than the clothes or the bed; and his treatment must keep him warm and dry, even though he is incontinent of urine. The secondary objective is independence. This can be achieved by designing a garment which can be used by a single-handed patient such as a hemiplegic. It must reduce

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