
UNIT 1 CONGESTIVE CARDIAC FAILURE, HYPERTENSION AND HYPOTENSION

Congestive Cardiac Failure,
Hypertension and
Hypotension

Structure

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1.0 OBJECTIVES

After going through this unit, you will be able to:

- describe aetiopathogenesis, clinical manifestations, diagnosis and treatment of heart failure;
- outline evaluation and patient approach to hypertension; and
- recognise the complications of hypotension, its causes, diagnosis and treatment in elderly.

1.1 INTRODUCTION

Changes in cardiovascular system with age, increasingly sedentary life style in the elderly and associated co-morbid conditions, would account for the increased prevalence of congestive cardiac failure, hypertension, and hypotension in the elderly.

In this unit we shall be learning about heart failure, hypertension and hypotension. Heart failure is the leading cause of hospitalisation in the elderly. It often presents with atypical symptoms and signs and frequently occurs in setting of multiple co-morbid

conditions. Optimal management of elderly heart failure patients is often best accompanied through the use of a multi-disciplinary team approach. Postural hypotension is another frequent problem encountered in the elderly, the significance of which is that it may lead to increased incidence of falls and fractures in the elderly. Hence this unit will deal with aetiopathology of hypertension, significance of isolated systolic hypertension, ideal drug to be used in the management of hypertension and cut-off value for the management of hypertension. This unit also focuses on signs and symptoms of cardiac failure and hypotension, pathophysiology, difference between systolic and diastolic heart failure, and the management of cardiac failure and hypotension in detail.

1.2 CONGESTIVE CARDIAC FAILURE

Congestive cardiac failure is predominately a disorder of the elderly and the overall prevalence of cardiac failure is estimated to be around 0.3%. The prevalence rate doubles every decade to reach approximately 10% of people in their eighties.

1.2.1 Pathophysiology

You must be already aware of the cardiovascular changes of aging in Unit 1, Block 2 of Course 1. The physiological age related changes in cardiovascular system are mentioned in Table 1.1.

Table 1.1: Physiological Changes in Cardiovascular Function

— Heart rate
• resting (no change)
• exercise ↓↓
— Myocardial compliance ↓ (slight decrease)
— Systolic function
— Diastolic function ↓↓ (moderate decrease)
— Stroke volume ↓
— Cardiac output ↓↓
— Oxygen consumption ↓
— A-aO ₂ difference ↑ (slight decrease)

Recall that cardiac output is determined by four principal factors—heart rate, contractibility, pre-load and after load.

i) Decreased Maximum Heart Rate

As mentioned in the Table 1.1, the resting heart rate does not change as much in age, but the ability of the heart to increase during exercise and any hemodynamic stress is impaired due to decreased responsiveness of both beta-1 and beta-2 adrenergic receptors. The decrease in maximum heart rate starts by the age of 40 years and proceeds linearly.

ii) Cardiac Contractibility

Though systolic function is impaired grossly in elderly, still it may be affected in the presence of coronary artery disease, hypertension, dilated cardiomyopathy, diabetes mellitus etc.

iii) ↓ Pre-load

Pre-load may be decreased due to the ineffective circulating blood volume in the elderly. It may also be decreased due to impaired ventricular diastolic relaxation

and compliance. Ventricular weight may be increased due to the accumulation of fat, fibrous tissue, lipofuscin and amyloid. The net result of all these changes is to decrease ventricular compliance and impaired diastolic filling of the heart.

iv) **↑ After-load**

After-load is increased due to the increase in systemic vascular resistance due to atherosclerosis and co-existent hypertension. Due to the increase in after-load left ventricular ejection is decreased.

The aging heart is often incapable of increasing cardiac output commensurate with increased demands and that heart failure often ensue.

1.2.2 Aetiology and Clinical Presentation

The cause of heart failure is similar in older and younger patients but is more often multifactorial in the elderly. In United States, at least 70-80 per cent of all heart failure patients have hypertension or coronary heart disease. Valvular heart disease, especially calcific aortic stenosis and severe mitral regurgitation, are more common in the elderly than in younger patients, but idiopathic non-ischemic dilated cardiomyopathy occurs less frequently. Hypertensive hypertrophic Cardiomyopathy, is primarily a disorder of the elderly. Cardiac amyloidosis is a rare cause of heart failure in younger patients, but it becomes increasingly more prevalent at advance age, particularly in individuals over age 90. Infective endocarditis and high output cardiac failure are rare in the elderly. These include hyperthyroidism; chronic anaemia; shunting due to arteriovenous malformations, a fistula, cirrhosis, or Paget's disease; and thiamine deficiency related to alcoholism or prolonged use of diuretics.

Table 1.2: Precipitating Factors of Heart Failure in the Elderly

Heart failure is both overdiagnosed and underdiagnosed in the elderly. The reason for this apparent paradox is that the cardinal symptoms and signs of heart failure— exertional dyspnoea and fatigue, orthopnea, edema, pulmonary rales and a S3 gallop are neither sensitive nor specific markers of heart failure in the elderly. Thus exertional dyspnoea and fatigue may be caused by such diverse noncardiac processes such as acute or chronic lung disease, anaemia, thyroid dysfunction, depression, obesity or poor physical conditioning, all of which occur commonly in the elderly. Similarly, rales may be caused by underlying lung disease or atelectasis, whereas peripheral edema may be caused by venous insufficiency, hypoalbuminemia, liver disease or renal insufficiency. Moreover a S4 gallop may reflect age-related diastolic dysfunction and is of little value in the diagnosis of heart failure in the elderly. Conversely, sedentary elderly patient may not report exertional symptoms, and atypical manifestations, such as confusion, irritability lassitude, anorexia, nausea or altered breathing may be the only clinical indicators of heart failure. In patients with significant cognitive dysfunction, the diagnosis may be especially difficult to establish.

For these reasons, it is incumbent that the physician maintain a high index of suspicion for the diagnosis of heart failure in the elderly with a variety of unexplained systemic complaints, while at the same time considering a wide range of diagnostic possibilities in all but the most overt cases of heart failure.

1.2.3 Diagnostic Evaluation

Chest x-ray is of considerable value in diagnosis of heart failure in the elderly. Although chest x-ray is straight forward when cardiomegaly, pulmonary vascular congestion, interstitial edema and pleural effusions are present, the examination may be difficult to interpret in the presence of chronic lung disease, obesity etc. In addition cardiomegaly need not be present and pulmonary congestion may be visible or absent.

Echocardiography plays a crucial role in the evaluation of elderly patients with heart failure and it is recommended as part of the initial diagnostic assessment in virtually all cases. Echocardiography reveals left ventricular, left atrial, right-ventricular and right atrial size, ejection fraction, valvular function and pericardium. Besides other tests including blood count, renal parameters, blood sugar and lipid profile and thyroid profile may reveal other co-morbid conditions.

Heart Failure with Normal Systolic Function

An important feature of heart failure in the elderly is that it often occurs in the setting of normal or near normal systolic function with ejection fraction greater than 50 per cent. This is called diastolic heart failure and its frequency increases about 50 per cent after the age of 65 years. Most of these patients have underlying hypertension, no coronary heart disease or vascular heart disease, age-related changes in left ventricular diastolic filling is an important factor that predisposes to the development of diastolic heart failure.

Though diastolic dysfunction is common in the elderly, as heart failure progresses systolic dysfunction also sets in. Hence it is very common to see a case of mixed failure rather than pure systolic or poor diastolic failure.

Causes of Pure Systolic Failure

- Dilated cardiomyopathy
- Pulmonary embolism

Causes of Pure Diastolic Failure

- Hypertrophic restrictive cardiomyopathy
- Endomyocardial fibrosis/fibroelastosis
- Amyloidosis

Mixed Failure

- Coronary atherosclerosis
- Hypertension
- Diabetes

1.2.4 Management

Primary and secondary goals of treatment are outlined in Table 1.3.

Table 1.3: Primary and Secondary Goals of Heart Failure Management

<p>Primary Goals</p> <ul style="list-style-type: none">— Improve quality of life— Reduce the frequency of heart failure exacerbations— Extend survival <p>Secondary Goals</p> <ul style="list-style-type: none">— Maximizing independence— Improving exercise capacity— Enhance emotional well being— Reducing resource use and cost of care

Based on these goals the treatment of heart failure in the elderly is aimed as suggested in Table 1.4.

Table 1.4: Treatment of Heart Failure

<ol style="list-style-type: none">1) Removal of the precipitating cause e.g. treatment of pneumococcal pneumonia2) Correction of the underlying cause e.g. treating mitral stenosis with mitral valvotomy3) Control of the congestive heart failure state<ul style="list-style-type: none">— Reduction of cardiac workload including both pre-load and after-load— Control of excessive retention of salt and water— Enhancement of myocardial contractility
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Systolic Failure

Systolic failure generally requires pharmacological treatment. The usual drugs prescribed in the elderly are depicted in Table 1.5.

Table 1.5: Drugs Used in Management of Systolic Heart Failure

<ul style="list-style-type: none">— ACE inhibitors— Angiotension II receptor antagonist (Losartan)— Vasodilators— Hydralazine/Nitrate combination— Digoxin— Diuretics— Beta-blockers— Calcium channel blockers— Aspirin and antithrombotic agents

ACE Inhibitors

Initially ACE inhibitors were not frequently used in elderly because of the risk of systolic dysfunction and hyperkalemia. However various studies have shown that age is not a contraindication for its usage if properly selected. NSAIDs which antagonize the ACE inhibitors and potassium sparing diuretics increase the risk of hyperkalemia should be avoided whenever possible.

Doses

- Captopril 50 mg tds.
- Enalapril/Lisinopril 20 mg once daily
- Ramipril 5 mg twice daily

It is now well known that ACE will replace digoxin in the treatment of chronic CHF because of its efficacy and safety compared to digoxin. However you must know that some of the ACE drug interactions occur and have some side effects as shown in Table 1.6.

Table 1.6: Cardiovascular Interaction of ACE

Aspirin	Fluid retention
Antacids	Reduced Bioavailability
NSAIDs	Fluid retention
Alcohol	Enhanced hypotension
SSRIs	Enhanced hypotension

Angiotension Receptor Antagonists (Losartan)

This is a better alternative for those who would not tolerate ACE inhibitor.

Dose: 50 mg once daily.

Side effect: Hypotension and renal dysfunction.

Vasodilators

These are used for acute or intractable CHF and especially cardiogenic shock. There is improvement by reduction of pre-load and after-load. Morphine has vasodilatory properties within pulmonary circulation and has successfully been used. Workers have shown that nitrates, prazosin, hydralazine and minoxidil are ineffective in the management of long term CHF in elderly and should be used in those unable to tolerate ACE inhibitors.

Digoxin

The therapeutic range of digoxin is lower in the elderly because of lean body mass and changes in renal function. Side effects include, nausea, vomiting, diarrhoea, yellow vision and supraventricular and ventricular arrhythmias.

Table 1.7: Manifestation of Digoxin Toxicity in Elderly

— Lethargy and/or weakness
— Confusion
— Anorexia
— Depression
— Nausea/Vomiting
— Diarrhoea
— Head ache/Dizziness
— Any Cardiac arrhythmias

Elderly patients may be more susceptible to neurologic and cardiotoxic effects of digoxin. It is important, therefore to avoid hypokalemia, hypomagnesemia, which potentiate the toxic effects of digoxin and to measure the serum digoxin concentration if toxicity is suspected.

Diuretics

Diuretics remain a cornerstone of heart failure therapy because they are the most effective agents for relieving pulmonary congestion and edema. The common side effects in elderly include diuretic induced electrolyte disturbances like hyponatremia. In case of mild failure thiazides may be adequate, but in moderate to severe heart failure loop diuretics such as furosemide, bumetanide may be required.

Beta-blockers

Carvedilol is used in the management of heart failure. The starting dose is 3.125 mg twice daily, and the dose should be gradually increased at 2 week intervals to a target dose of 25 to 50 mg twice a day. Contraindication to beta-blockers include marked bradycardia, hypotension, severe decompensated heart failure, bronchial asthma, advanced atrioventricular block. Common side-effects include fatigue and reduced exercise tolerance especially during the titration phase, but these symptoms frequently resolve with continued therapy or dose reduction.

Calcium Channel Blockers

Short-acting, calcium channel blockers such as nifedepine, diltiazem and verapamil have been associated with adverse outcome in patients with systolic heart failure and these agents are, therefore, contraindicated. The newer agents, amlodipine and felodipine are associated with a more favourable safety profile. Amlodipine may reduce mortality in patients with non-ischemic dilated cardiomyopathy.

Aspirin and Antithrombotic Agents

As you may have realized, older patients with systolic heart failure should be managed in a similar fashion as younger patients. ACE inhibitors are the cornerstone of therapy, and the dose should be gradually titrated upward until an optimal dosage is achieved. If patients are unable to tolerate ACE inhibitors, losartan or the combination of hydralazine and nitrates are suitable alternatives. Digoxin is an important adjunctive in patients whose symptoms are not adequately controlled with vasodilators and diuretics and patients with severe left ventricular dysfunction. The role of beta-blockers such as carvedilol, continues to evolve, but such agents should be considered in suitable patients with class I to III heart failure and with no contraindications.

Diastolic Dysfunction Management

The management of diastolic dysfunction includes:

- 1) Diuretics
- 2) B-blocker
- 3) Calcium Channel Blocker
- 4) ACE inhibitors
- 5) Nitrites
- 6) Digoxin

The goal of management is listed in Table 1.8.

Non-pharmacologic Aspects of Heart Failure Management

This includes the following:

- Patients education regarding symptoms, drug compliance
- Dietary consultation
 - Sodium restriction
 - Low fat
 - Adequate calorie intake

Table 1.8: Management of Diastolic Dysfunction

- 1) Reduce the congestive state—reduce salt intake, diuretics, ACE inhibitors
- 2) Maintain atrial contraction
 - DC shock/Pharmacological cardioversion
- 3) Prevent tachycardia
 - Beta-blockers
- 4) Treat myocardial ischemia
 - Nitrates, beta-blockers, calcium channel blockers
- 5) Control hypertension
 - Antihypertension agents
- 6) Attenuate neurohormonal activation
 - Beta-blockers, ACE inhibitors
- 7) Improve ventricular relaxation
 - Systolic unloading
 - Treat ischemia
 - Calcium channel blockers (in hypertrophic cardiomyopathy)

- Medication review
- Eliminate unnecessary drugs
- Consolidate dosing schedule
- Social service
- Daily weight chart
- Support stockings to reduce edema
- Intensive follow-up
 - Telephone contacts
 - Home visits
 - Outpatient clinic
- Contact information

Exercise Prescription for Elderly with Heart Failure

Following are the exercises frequently given to elders with heart failure:

Components of Conditioning Programme

- Flexibility exercise
- Strengthening exercise
- Aerobic conditioning

Frequency of Exercise

- Daily if possible

Duration of Exercise

- Individualised, start low, go slow

Intensity of Exercise

- Low to moderate

Rate of Progression

- Gradual over weeks to months

Monitoring

- Heart rate, perceived exertion

Factors Confounding Heart Failure Management

The following factors have significant effects regarding heart failure management:

- Multiple comorbid illnesses and other conditions
- Polypharmacy
- Psychosocial and financial concerns
- Depression
- Social isolation
- Physical limitations
 - Arthritis
 - Neuromuscular disorders
 - Sensory defects (e.g. visual, auditory)
- Cognitive dysfunction

Check Your Progress 1

- 1) State True (T) or False (F):
 - a) Systolic heart failure is the commonest type of heart failure in the elderly. (T/F)
 - b) S4 gallop in elderly is highly suggestive of cardiac failure. (T/F)
- 2) Mention three important physiological age-related changes in cardiovascular function.

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1.3 HYPERTENSION IN ELDERLY

There was uncertainty as to whether hypertension, from elevated systolic or diastolic blood pressure levels or both, should be treated in older persons. Various epidemiologic studies had consistently demonstrated that increasing levels of systolic blood pressure correlate directly with the risk of developing cardiovascular events and mortality. In the elderly, systolic blood pressure becomes a stronger predictor of risk than diastolic blood pressure or other standard risk factors besides age. Until 1991, there were no

prospective clinical trial data using systolic blood pressure entry criteria to define whether treatment of hypertension based on systolic blood pressure levels is beneficial and limited evidence on treating any elderly individuals with a diastolic hypertension. The decade of 1990s has clarified the perspective on treating hypertension in the elderly and provided a wealth of evidence to assist in the treatment of elevated blood pressure in older persons.

1.3.1 Incidence and Classification

The incidence in western population ranges from 30-60 per cent depending on their definition. Based on WHO definition the incidence in our own study in urban population, is around 40 per cent and rural around 18 per cent. Such a low incidence in our rural elderly population may be due to their life style with less stress and strain, lower incidence of obesity and their physical activity.

Hypertension can be classified according to JNC VI (Joint National Commission). This classification is given in Table 1.9.

Table 1.9: JNC Classification of Hypertension

	Systolic B.P.	Diastolic B.P.
Optimal B.P.	<120	<80
Normal B.P.	<130	<85
High Normal	130-139	85-89
Stage 1 H.T.	140-159	90-99
Stage 2 H.T.	160-179	100-109
Stage 3 H.T.	180	≤110

1.3.2 Aetiopathology

Primary hypertension or essential hypertension is the commonest cause in the elderly. The various secondary hypertension like renal, endocrine, drugs and coarctation of aorta are extremely uncommon in elderly. Among the secondary hypertension, renovascular hypertension, especially bilateral atheromatous renal vascular disease, do occur in our country. Whenever there is an accelerated hypertension with poor control, renal hypertension should be considered. It is advisable to avoid invasive and expensive investigatory procedures in elderly hypertensives.

Pathophysiological mechanism is essentially an increase in peripheral vascular resistance, secondary to arteriolar smooth muscle vaso-constriction. Though this is similar to essential hypertension of younger age group, the differences are the lower plasma-renin activity and low aldosterone level. This explains the choice of calcium channel blockers over the beta-blocker in geriatric group.

Hypertension is not a simple physiological accompaniment of aging. This is clearly shown by the population study in non-western society where B.P. tends to be normal or even low in the aged population. When these people migrate to western society, hypertension tends to develop in their community. Also, as seen in our rural study, development of hypertension more depends, on environmental factors, rather than simple aging.

Pseudo-hypertension

Elderly patients may have rigid brachial arteries which are calcified and not readily occluded by the sphygmomanometer cuff. As a result, blood pressure may be over-estimated. This possibility is suggested by the presence of Osler's sign. This is produced by inflating the blood pressure cuff above the systolic blood pressure. Although the radial pulse is not pulsatile in the situation it can still be readily palpated indicating a thickened calcified arterial wall. Under these circumstances, diastolic blood pressure may be over-estimated by 10-50 mm Hg.

1.3.3 Isolated Systolic Hypertension

Isolated systolic hypertension is defined as systolic blood pressure of over 160 mm Hg with diastolic blood pressure below 90 mm Hg. It is common in elderly and incidence ranges from 20-30 per cent in patients over 70 years. The pathophysiology of isolated systolic hypertension is the loss of elasticity of vessel wall of large caliber vessels. It is an important predictor and predisposing factor of ischemic heart disease and cerebrovascular disease. The Systolic Hypertension in the Elderly Programme (SHEP) indicates that treatment of isolated hypertension in 65-85 year old patients, significantly reduces the risk of stroke, coronary artery disease and heart failure. In the SHEP study, treated patients aged 65-85 year, showed a 36 per cent decrease in risk of stroke, a 27 per cent decrease in CHD event rates, and a 54 per cent reduction in risk of heart failure. In patients with systolic B.P. 180-240 mm Hg, a 20-25 per cent decrease in B.P. is recommended. Drug therapy is not usually recommended for patients with systolic B.P. 140-160 mm Hg. Isolated systolic hypertension in the 160-200 mm Hg range represents the most common form of hypertension in the elderly and drug treatment is expected to produce satisfactory effects.

Special situations that require drug therapy of mild systolic hypertension 140-160 mm Hg include:

- 1) The patient with heart failure, present or past and or cardiomegaly.
- 2) Angina pectoris, past myocardial infarction, aortic aneurysm or diabetes.
- 3) Previous cerebral ischaemic attacks, stroke or renal failure.

1.3.4 Diagnosis of Hypertension

There are some basic requirements in diagnosing and investigation of hypertension in elderly. Since the B.P. readings are variable, multiple recordings at various timings should always be done. This will avoid the error of diagnosing hypertension. Conditions like fever, full bladder, pain etc. can cause transitory rise in B.P. In doubtful borderline cases, special investigations like 24 hour ambulatory B.P. monitoring can be done, to establish the presence and need for treatment to hypertension.

Once hypertension is established investigations to assess end organ damage, are to be done like, urine analysis, blood urea, serum creatinine, serum electrolytes, blood sugar, lipid profile, ECG, chest x-ray.

In selective cases, special procedures like 24 hour urinary vma (vinyl mandelic acid), 24 hour urine ketogenic steroids, IVP, renal arteriogram, plasma renin activity, can be done.

1.3.5 Sequelae of Untreated Hypertension

Common clinical sequelae of untreated, long standing hypertension include—chronic and acute complications. Acute complications include:

- a) hypertensive encephalopathy
- b) malignant hypertension

However, both are extremely uncommon in elderly.

Chronic complications include congestive cardiac failure, ischemic heart disease, cerebral vascular accident, multi infarct dementia, peripheral arterial insufficiency and renal insufficiency.

The clinical features of hypertension encephalopathy includes accelerated hypertension of diastolic blood pressure over 130 mm Hg with altered sensorium leading to stupor and coma. It is usually associated with hypertensive retinopathy and renal insufficiency. Vasodilators are the drug of choice in management, which require intensive monitoring.

1.3.6 Management

Controversy still exists, in defining the level of blood pressure to be considered in elderly. Systolic pressure ranges between 160 to 180 and diastolic pressure ranges from 95 to 105, were taken as upper limits of normal in various studies. But as per WHO definition, systolic B.P. of more than 160 and diastolic B.P. of more than 95 is taken as standard level in most of the current studies. Till a decade ago, hypertension in elderly was considered in a different perspective. It was considered more harmful to treat hypertension. Concepts have been completely changed in the last 10 years, as data emerging from the various world-wide trials clearly indicate a higher incidence of morbidity and mortality in untreated hypertension in elderly.

Once hypertension is established one must decide what should be done : (1) to ignore, (2) to prescribe salt free diet, (3) to advice rest and sedation, and (4) to prescribe reserpine.

If the hypertension is mild to moderate, non drug therapy should be tried in every case. This includes dietary salt reduction, supplementation of potassium, calcium and magnesium, in diet, weight reduction, exercise, alteration in life style, avoiding cigarette smoking.

The elderly hypertensive is salt sensitive, due to age related loss of renal function. A reduction in dietary sodium intake of 1.5 to 2.5 gm per day and supplementation of potassium, calcium, magnesium may help in mild cases.

Weight reduction, regular exercise and cessation of smoking are recommended. Biofeed back or relaxation therapy may also help. In moderate to severe hypertension, in addition to these measures, drug therapy should be started.

Drug Therapy

Diuretics are the first line of treatment as shown in Table 1.10. Their mode of action is by volume depletion.

Table 1.10: Details of Diuretics Therapy

	Drug	Dose	Adverse effects	Advantages
Thiazide group	Hydrochlor thiazide	25-100 mg	Dehydration Hypokalemia Hyperglycemia Hyperlipidemia Impotence Hypotension Hyperuricemia Gout	No CNS effect Single dose Useful in CCF Edematous state Low cost
Loop diuretic	Frusemide	40-120 mg	Short acting Severe volume depletion Acute retention of urine. Urinary incontinence	In resistant HT with renal insufficiency
K sparing diuretic	Spironolactone	25-200 mg	Antiandrogenic effect Gynaecomastia	Useful in K depleted state and hyperaldosteronism

If no improvement then add beta-blockers, their advantages and disadvantages are shown in Table 1.11.

Table 1.11: Details of Beta-blocker

Drug	Dose	Adverse effects	Advantages
Propranolol	40-320 mg	Bronchospasm Fatigue, depression Heart failure, brady arry. Intermittent claudication	I.H.D., SVT, Vent. arrhythmias Anxiety state/tremor
Metoprolol	50-200 mg	On Lipid/diabetic state. Impotence	Primary prev. of IHD Regression of LV mass
Atenelol	25-150 mg	On Lipid/diabetic state.	
Labetol	600-800 mg	Impotence	
Alpha-blocker		Postural hypotension	BHP
Terazocin	2-6 mg	Increase in heart rate	BHP

Calcium Channel Blockers

Calcium channel blockers are peripheral as well as coronary vasodilators and more effective in the elderly (Table 1.12)

Table 1.12: Details of Calcium Channel Blockers

Drug	Dose	Adverse effects	Advantages
Verapamil	120-240 mg	Bradycardia A.V. block. Heart failure Hypotension	IHD, SVT
Diltiazem	60-120 mg	Bradycardia A.V. block. Heart failure Hypotension	Angina, DM Hyperlipidemia
Nifedipine	20-60 mg	Tachycardia Headache Peripheral oedema in the absence of heart failure Hypotension Gingival hyperplasia Flatulence, heart burn Constipation	Coronary artery spasm. Peripheral vascular disease Antiatherosclerotic effect. Oesophageal spasm
Amlodipine	5-10 mg	— do —	Single dose
Nimodipine	60-240 mg		Cerebral artery spasm following subarachnoid haemorrhage.

ACE inhibitors

These are to be used with caution as they may cause systolic dysfunctions and hyperkalemia. Hyperkalemia is more common if given along with NSAIDs and potassium sparing diuretics. They also should not be given in patients with renal insufficiency and/or renal artery stenosis as this can worsen the uraemic symptoms. These elderly who do not tolerate ACE inhibitors may be given Losartan an angiotensin-2 receptor antagonist to control the hypertension (Table 1.13).

Table 1.13: Details of ACE Inhibitors

Drug	Dose	Adverse effects	Advantages
Captopril	25-150 mg	Hypotension	Cardiac failure
Enalapril	2.5-40 mg	Renal failure	Lipid/Diabetic state
Lisinopril	5-40 mg	Hyperkalemia Dry cough Loss of taste	Prevent LVH Does not under go hepatic metabolism

How to Choose Appropriate Drug?

In selecting the drug, in an individual patient one has to consider the concomitant disease like diabetes, cardiac disease, hyperlipidemic state, renal disease. Since multiple diseases are common in elderly, the associated disease may be the major deciding factor in drug selection.

Diuretics are drug of choice, when hypertension is associated with oedematous state, cardiac failure, renal failure, as they reduce fluid overload.

Calcium channel blockers are useful when hypertension is associated with diabetes, hyperlipidemia as they, unlike diuretics and beta-blockers have no adverse action on these metabolic states. They are also useful in IHD, renal failure, CVA, peripheral vascular disease as they improve coronary, renal, cerebral and peripheral blood flow. They are specially useful when COPD is associated with hypertension, as beta-blockers and diuretics are contraindicated.

Beta-blockers are useful when hypertension is associated with IHD as they are helpful in secondary, and even in primary prevention of infarction and angina. They improve long-term survival in these patients. They can be effectively employed when hypertension is associated with tachyarrhythmias, anxiety state, essential tremor. ACE inhibitors are useful when hypertension is associated with mild CCF, proteinuric conditions without renal insufficiency. As they lack adverse metabolic effects, they are useful in diabetic and hyperlipidemic state as well as in COPD.

The goal of achieving the good control depends on ideal drug selection given in adequate doses and also on compliance of drug therapy.

1.3.6 Resistant Hypertension

It is rare in elderly. Inadequate volume control due to salt excess in diet, drug interaction, smoking or renovascular disease may be responsible for this problem. Combination drugs, acting at different sites, may help to control resistant hypertension.

Check Your Progress 2

- 1) To diagnose isolated systolic hypertension, systolic B.P. should be more than mm Hg and diastolic should be less than mm Hg.
- 2) Isolated systolic hypertension in elderly need not be treated. True/False
- 3) Drug of choice in treating hypertension with benign prostatic enlargement:
 - a) Terazosin
 - b) Atenolol
 - c) Nifedepine
 - d) Diuretics

1.4 ORTHOSTATIC HYPOTENSION

Orthostatic or postural hypotension is arbitrarily defined as either a 20 mm Hg fall in systolic blood pressure or a 10 mm fall in diastolic blood pressure on assuming an upright posture from a supine position.

1.4.1 Physiology of Orthostasis

Orthostasis is a physiologic stress related to upright posture on standing, the force of gravity causes pooling of around 700 ml of blood in the lower limbs leading to decreased venous return and cardiac output and a consequent fall in arterial blood pressure. However, cardiac output and blood pressure are maintained by powerful compensatory mechanisms involving a rise in heart rate in normal people. These compensatory phenomena are initiated by the baroreceptors located at the aortic arch and carotid bifurcation. Baroreceptors are stimulated when blood pressure rises and these afferent impulses are carried by 9th and 10th nerve to the nucleus of tractus solitarius located in the brain stem. These impulses then inhibit the sympathetic nerve endings causing a decrease in heart rate and blood pressure. Conversely, when blood pressure falls, as one assumes erect posture, baroreceptors are not stimulated which causes disinhibition of sympathetic nerve fibres, which increases the blood pressure. Orthostatic hypotension results from failure of the arterial baroreflex, most commonly due to disorders of the autonomic nervous system, and also aging is associated with sluggishness of baroreflex mechanism.

1.4.2 Aetiology

Aging is associated with increased chance of orthostatic hypotension due to the following factors:

- 1) Aging is associated with blunted baroreflex response accounting for decrease in heart rate and B.P. on standing.
- 2) Elderly are prone to reduced blood volume due to excessive salt wasting by the kidneys as a result of a decline in plasma renin and aldosterone, a rise in atrial natriuretic peptide and concurrent diuretic therapy.
- 3) Impaired cerebral autoregulation
- 4) Multiple age-related diseases
- 5) Polypharmacy

Of these above mentioned causes primary autonomic failure is very rare and secondary autonomic failure and drug induced hypotension are the commonest cause.

1.4.3 Clinical Manifestations

Clinical manifestations are due to hypoperfusion of brain and other organs. Depending on the degree of fall in blood pressure and cerebral hypoperfusion, symptoms can vary from dizziness to syncope associated with a variety of visual defects, from blurred vision to black-out. Other symptoms include non-specific lethargy and weakness, sub occipital and paravertebral muscle pain, low backache, calf claudication and angina. Precipitating factors include sudden change of posture, prolonged recumbency, warm environment, raised intrathoracic pressure (coughing, defecation, micturition), physical exertion and vasoactive drugs.

Orthostatic hypotension is an important cause of syncope in elderly.

Diagnosis

- 1) Recording of B.P. on erect posture after remaining on supine posture for 10 minutes. B.P. is measured mainly in the morning in an empty stomach. A blood pressure fall of 30/15 mm Hg or fall in systolic pressure below 80 mm Hg is diagnostic.

The causes of orthostatic hypotension are given in Table 1.14.

Table 1.14: Causes of Orthostatic Hypotension

<p>I) Primary autonomic failure syndromes</p> <ol style="list-style-type: none">1) Pure autonomic failure or Idiopathic orthostatic hypotension2) Parkinson's disease and Autonomic failure (Shy Drager Syndrome)3) Multiple system atrophy which includes striatonigral degeneration, olivopontocerebellar degeneration. <p>II) Secondary Autonomic dysfunction (secondary to systemic disorders)</p> <ul style="list-style-type: none">— Diabetes mellitus— Multiple sclerosis— Gullian Barre syndrome— Spinal cord lesions— Chronic renal failure— Chronic liver disease— Connective tissue disorder <p>III) Drug induced</p> <ol style="list-style-type: none">1) Antihypertensives<ul style="list-style-type: none">— Calcium channel blockers— ACE inhibitors— Clonidine— Alpha methyl dopa2) Nitrates3) Diuretics4) Tricyclic antidepressants5) Antiparkinson's medications<ul style="list-style-type: none">— L. Dopa— Bromocriptine6) Psychotropics<ul style="list-style-type: none">— Phenothiazine7) Alcohol <p>IV) Miscellaneous causes</p> <ul style="list-style-type: none">— Myocarditis— Aortic stenosis— Any condition produce fluid loss<ul style="list-style-type: none">● Diarrhoea, vomiting, burns— Diabetes insipidus— Adrenal insufficiency— Fever— Extensive varicose veins
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2) Tilt-table test which keeps the patient in the upright posture at an angle of 80° for 30-60 minutes.

- 3) Ambulatory blood pressure monitoring.
- 4) Provocative tests like injection of isoproterenol, coupled with tilt-table test.

1.4.4 Management

- 1) Avoidance of precipitating factors for low blood pressure, elevation of the head of the bed at night, and application of graduated pressure from a support garment to the lower limbs to reduce venous pooling.
- 2) Drugs
 - i) Fludrocortisone—0.1 to 0.2 mg
 - ii) Midodrine is a directly acting sympathomimetic vasoconstrictor of resistance vessels.

Dose: 2.5 mg three times daily
 - iii) Intranasal Desmopressin

Dose: 5 to 40 microgram at bed time
 - iv) Parenteral anabolic steroids.

Check Your Progress 3

- 1) Orthostatic hypotension is diagnosed if the fall in systolic blood pressure is more than mm Hg or fall in diastolic blood pressure is more than mm Hg on assuming upright posture.
- 2) Primary autonomic failure is the commonest cause of orthostatic hypotension in the elderly. (True/False)
- 3) Mention a few investigative procedures done for the evaluation of postural hypotension.

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1.5 LET US SUM UP

Thus to summarise, heart failure is predominantly a disorder of older adults, and to a large extent the epidemiology of heart failure reflects the convergence of age-related changes in the cardiovascular system and the rising prevalence of age-related cardiovascular diseases. Hence optimal treatment frequently poses a therapeutic challenge because of the high prevalence of confounding medical, behavioural, psychosocial, and economic factors. Despite these difficulties, a number of therapeutic options, including ACE inhibitors, digoxin and possibly beta-blockers and angiotension receptor antagonists have been shown to favourably affect the clinical course of heart failure in elderly patients. Regarding management of hypertension, before initiating the therapy, multiple readings are essential. Non-drug therapy is useful in mild to moderate cases.

In choosing the antihypertensives, consider the concomitant diseases and blood pressure above 160/95 needs reduction and active antihypertensive therapy may be required up

to the age of 80 years. As far as hypotension is concerned, one must rule out autonomic neuropathy due to diabetes, which is the commonest cause of postural hypotension. Increasing the fluid and salt intake apart from drugs like Fludrocortisone, Midodrine may help to solve the problem.

1.6 KEY WORDS

- Orthostatic hypotension** : Postural hypotension occurs when person stands from lying position due to pooling of blood in the lower limb.
- Pseudohypertension** : False recording of blood pressure due to partial occlusion of rigid brachial arteries.
- Vasodilators** : Substances that reduce preload and afterload.

1.7 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

- 1) a) F
b) F
- 2) ↓ Exercise induced heart-rate
↓ Stroke volume
↓ Diastolic function

Check Your Progress 2

- 1) 160, 90
- 2) False
- 3) a)

Check Your Progress 3

- 1) 20, 10
- 2) F
- 3) Tilt table-test
 - Ambulatory B.P. monitoring
 - Provocative tests with Isoproterenol

1.8 FURTHER READINGS

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