Table 6–6

Lifestyle Modifications to Manage Hypertension[a,2]

Modification	Recommendation	Approximate Systolic BP Reduction (Range)
Weight reduction	Maintain normal body weight (body mass index: 18.5–24.9 kg/m^2)	1 mm Hg/1 kg
Adopt DASH eating plan	Consume a diet rich in fruits, vegetables, and low-fat dairy products with a reduced content of saturated and total fat	11 mm Hg
Dietary sodium restriction	Reduce dietary sodium intake to no more than 2.4 g sodium or 6 g sodium chloride (100 mmol/day). If these targets cannot be achieved, an absolute reduction in 1 g sodium/day is recommended	5–6 mm Hg
Physical activity	Engage in regular aerobic physical activity such as brisk walking (at least 30 min/day, most days of the week)	5–8 mm Hg
Moderation of alcohol consumption	Limit consumption to no more than two standard drinks per day in most men and to no more than one standard drink per day in women and lighter weight persons[b]	4 mm Hg

Table 6–7

Commonly Used Oral Antihypertensive Drugs by Pharmacologic Class[2,26,27]

Class	Brand	Usual Dose, Range (mg/day)	Frequency	Select Adverse Events	Comments[a]
Diuretics					
Thiazides and thiazide-like	Chlorthalidone (Hygroton)	12.5–25	QDay	Hypokalemia and other electrolyte imbalances Negative effect on glucose and lipids	Thiazide diuretics are generally more effective antihypertensive agents than loop diuretics Ineffective in patients with estimated CrCl < 30 mL/min (0.5 mL/s), except metolazone Not first-line agents in pregnancy, but may be used with close monitoring for hypokalemia Monitor electrolytes (ie, decreased serum potassium) and metabolic abnormalities (ie, dyslipidemia, hyperglycemia) Use caution in patients with gout and severe renal impairment Contraindications include hypersensitivity and anuria
	Hydrochlorothiazide (Esidrix, HydroDiuril, Microzide, Oretic)	12.5–50	QDay		
	Indapamide (Lozol)	1.25–2.5	QDay		
	Metolazone (Zaroxolyn)	2.5–10	QDay		
Loops	Bumetanide (Bumex)	0.5–2	QDay or BID	Hypokalemia and other electrolyte imbalances	Preferred diuretic class in patients with estimated CrCl < 30 mL/min (0.5 mL/s) Monitor electrolytes (ie, decreased potassium) and metabolic abnormalities (ie, dyslipidemia, hyperglycemia) Use with caution in patients with gout Contraindications include hypersensitivity, anuria, acute renal insufficiency
	Furosemide (Lasix)	20–80	BID		
	Torsemide (Demadex)	5–10	QDay		
Potassium-sparing	Amiloride (Midamor)	5–10	QDay or BID	Potassium-sparing diuretics may enhance hyperkalemic effects of drug therapies (eg, ACE inhibitor, aldosterone antagonist)	Reserved for patients with diuretic-induced hypokalemia Monitor electrolytes (ie, potassium) Contraindications include hypersensitivity, acute renal insufficiency, hyperkalemia Avoid in patients with estimated CrCl < 30 mL/min (0.5 mL/s)
	Triamterene (Dyrenium)	50–100	QDay or BID		
Aldosterone antagonists	Eplerenone (Inspra)	50–100	QDay or BID	Hyperkalemia Gynecomastia (spironolactone)	Eplerenone contraindicated as an antihypertensive in patients with estimated CrCl < 50 mL/min (0.83 mL/s) or serum creatinine > 1.8 mg/dL (159 µmol/L) for women or 2 mg/dL (177 µmol/L) in men as well as type 2 diabetes mellitus with microalbuminuria. Also contraindicated in patients concomitantly receiving strong CYP3A4 inhibitors or a serum potassium > 5.0 mEq/L (mmol/L) at initiation
	Spironolactone (Aldactone)	25–100	QDay		
β-Blocker					
Cardioselective	Atenolol (Tenormin)	25–100	QDay or BID	Bradycardia Heart block Heart failure Dyspnea, bronchospasm Fatigue, dizziness, lethargy, depression	Caution with heart rate < 60 and respiratory disease Selectivity of β, agents is diminished at higher doses Abrupt discontinuation may cause rebound hypertension May mask signs/symptoms of hypoglycemia in diabetic patients
	Bisoprolol (Zebeta)	2.5–10	QDay		
	Metoprolol tartrate (Lopressor)	100–200	BID		
	Metoprolol succinate (Toprol XL)	50–200	QDay		
Nonselective	Nadolol (Corgard)	40–120	QDay	Hyper-/hypoglycemia, hyperkalemia, hyperlipidemia	Contraindicated in hypersensitivity, sinus node dysfunction or severe sinus bradycardia (in the absence of a pacemaker), heart block (greater than first degree), cardiogenic shock, acute decompensated heart failure
	Nebivolol (Bystolic)	5–20	QDay		
	Propranolol (Inderal)	80–160	BID		
	Propranolol long-acting (Inderal LA, InnoPran XL)	80–160	QDay		
	Timolol (Blocadren)	10–40	QDay		
Mixed α- and β-blocker	Carvedilol (Coreg)	12.5–50	BID		
	Carvedilol CR (Coreg CR)	20–80	QDay		
	Labetalol (Trandate)	200–800	BID		

CCB					
Nondihydropyridines	Diltiazem long-acting (Cardizem SR, Cardizem CD, others)	120–360	QDay	Bradycardia, heart block (nondihydropyridines)	Caution with heart rate < 60 (verapamil, diltiazem)
	Verapamil sustained-release (Calan SR, Isoptin SR, Verelan)	120–360	QDay	Constipation (nondihydropyridines)	Use caution in concomitant use with β-blocker; may potentiate heart block
				Peripheral edema, headache, flushing	Extended-release formulations are preferred for once- or twice-daily medication administration
Dihydropyridines	Amlodipine (Norvasc)	2.5–10	QDay	Gingival hyperplasia (dihydropyridines)	Contraindicated in hypersensitivity, sinus node dysfunction, or severe sinus bradycardia (in the absence of a pacemaker) (nondihydropyridines), heart block (greater than first degree) in the absence of a pacemaker (nondihydropyridines), atrial fibrillation/flutter associated with accessory bypass tract (nondihydropyridines), reduced ejection fraction (most CCBs except amlodipine)
	Felodipine (Plendil)	2.5–10	QDay		
	Isradipine SR (DynaCirc SR)	5–10	BID	Reflex tachycardia (dihydropyridines)	
	Nicardipine SR (Cardene SR)	60–120	BID		
	Nifedipine long-acting (Adalat CC, Procardia XL)	30–90	QDay		
	Nisoldipine (Sular)	17–34	QDay		
ACE inhibitors	Benazepril (Lotensin)	10–40	QDay or BID	Cough	Monitor electrolytes (ie, serum potassium)
	Captopril (Capoten)	25-150	BID or TID	Hyperkalemia	Monitor renal function
	Enalapril (Vasotec)	10–40	QDay or BID	Renal insufficiency	Initial dose may be reduced in renal impairment, the elderly, patients who are volume depleted or maintained on diuretic therapy
	Fosinopril (Monopril)	10–40	QDay	Angioedema	Use with caution in patients with baseline hyperkalemia
	Lisinopril (Prinivil, Zestril)	10–40	QDay		Contraindicated in pregnancy and hypersensitivity
	Moexipril (Univasc)	7.5–30	QDay or BID		
	Perindopril (Aceon)	4–16	QDay		
	Quinapril (Accupril)	10–80	QDay or BID		
	Ramipril (Altace)	2.5–10	QDay or BID		
	Trandolapril (Mavik)	1–4	QDay		
ARBs	Azilsartan (Edarbi)	40–80	QDay	Hyperkalemia	Above comments to ACE inhibitors also apply to ARBs
	Candesartan (Atacand)	8–32	QDay or BID	Renal function deterioration	
	Eprosartan (Teveten)	600–800	QDay or BID	Angioedema	
	Irbesartan (Avapro)	150–300	QDay	Hypotension/syncope	
	Losartan (Cozaar)	50–100	QDay or BID		
	Olmesartan (Benicar)	20–40	QDay		
	Telmisartan (Micardis)	20–80	QDay		
	Valsartan (Diovan)	80–320	QDay		
Direct renin inhibitors	Aliskiren (Tekturna)	150–300	QDay	Hyperkalemia Hypotension	Use caution in patients with severe renal impairment and in patients with deteriorating renal function or renal artery stenosis, both bi- and unilateral Contraindicated in combination with ACE-Is or ARBs in patients with diabetes
Central α_2-agonists	Methyldopa (Aldomet)	250–500	BID	Transient sedation initially	First-line agent in pregnancy (methyldopa)
	Clonidine oral (Catapres)	0.1–0.8	BID	Hepatotoxicity, hemolytic anemia, peripheral edema (methyldopa)	Tolerance may occur 2–3 months after initiation of methyldopa; increase dose or add thiazide
	Clonidine patch (Catapres TTS)	0.1–0.3	Once weekly		Contraindications include hypersensitivity, concurrent use of MAO inhibitor (methyldopa), hepatic disease (methyldopa), pheochromocytoma (methyldopa)
	Guanfacine (Intuniv)	0.5–2	QDay	Orthostatic hypotension (methyldopa, clonidine) Dry mouth, muscle weakness (clonidine)	

(*Continued*)

Table 6–7

Commonly Used Oral Antihypertensive Drugs by Pharmacologic Class[2,26,27] (*Continued*)

Class	Brand	Usual Dose, Range (mg/day)	Frequency	Select Adverse Events	Comments[a]
α_1-Blockers	Doxazosin (Cardura)	1–16	QDay	Syncope, dizziness, palpitations, orthostatic hypotension	Contraindicated in hypersensitivity
	Prazosin (Minipress)	2–20	BID or TID		
	Terazosin (Hytrin)	1–20	QDay or BID		
Direct vasodilator	Isosorbide dinitrate 20 mg and hydralazine 37.5 (BiDil)	20–120/ 37.5–225	TID	Edema, hypertrichosis (minoxidil) Tachycardia	Give minoxidil with diuretic and β-blocker to mitigate side effects Contraindicated in hypersensitivity, pheochromocytoma (minoxidil), increased intracranial pressure (isosorbide dinitrate + hydralazine)
	Hydralazine (Apresoline)	100–200	BID	Lupus-like syndrome (hydralazine)	
	Minoxidil (Loniten)	5–100	QDay or BID		
Peripheral sympathetic inhibitors	Reserpine (generic only)	0.05–0.25	QDay	Depression Orthostatic hypotension Nasal congestion, fluid retention, peripheral edema Diarrhea, increased gastric secretion	Contraindications include hypersensitivity, peptic ulcer disease or ulcerative colitis, history of mental depression or electroconvulsive therapy

Table 6–8

Parenteral Antihypertensive Agents for Hypertensive Emergency and Special Conditions [2,27]

Drug	Dose Range[a]	Onset	Duration	Adverse Effects[b]	Special Indications
Adrenergic inhibitors					
Esmolol hydrochloride	500–1000 mcg/kg/min IV over 1 minute, then 50 mcg/kg/min by infusion; may repeat bolus after 5 minutes at 50 mcg/kg/min increment; maximum 200 mcg/kg/min	1–2 minutes	10–20 minutes	Nausea, asthma, first-degree heart block, HF	Preferred agent for acute aortic dissection, ACS and perioperative hypertension. Avoid use in combination with other β-blocker therapy, bradycardia or decompensated HF.
Labetalol hydrochloride	0.3–1 mg/kg (maximum 20 mg) slow IV injection or 0.4–1 mg/kg/hour IV infusion up to 3 mg/kg/hour; may repeat every 4–6 hours; maximum total cumulative dose 300 mg	5–10 minutes	3–6 hours	Vomiting, scalp tingling, dizziness, asthma, COPD, nausea, heart block, orthostatic hypotension, HF	Most hypertensive emergencies, including eclampsia and preeclampsia. Avoid use in reactive airway disease, second- or third-degree heart block or bradycardia.
Phentolamine	5 mg IV bolus, may repeat every 10 minutes	1–2 minutes	10–30 minutes	Tachycardia, flushing, headache, nausea, vomiting	Catecholamine excess such as adrenergic crisis secondary to pheochromocytoma or cocaine or amphetamine overdose or clonidine withdrawal.
Angiotensin-converting enzyme inhibitors					
Enalaprilat	1.25 mg IV over 5 minutes, may increase to 5 mg and repeat every 6 hours	15–30 minutes	6–12 hours	Precipitous fall in pressure in high-renin states; variable response	High plasma renin activity; avoid in acute MI, bilateral renal stenosis, and pregnancy.
Dihydropyridine calcium channel blockers					
Clevidipine	Initial 1–2 mg/hour IV,	2–4 minutes	5–15 minutes;	Atrial fibrillation, fever,	Most hypertensive

Angiotensin-converting enzyme inhibitors					
Enalaprilat	1.25 mg IV over 5 minutes, may increase to 5 mg and repeat every 6 hours	15–30 minutes	6–12 hours	Precipitous fall in pressure in high-renin states; variable response	High plasma renin activity; avoid in acute MI, bilateral renal stenosis, and pregnancy.
Dihydropyridine calcium channel blockers					
Clevidipine	Initial 1–2 mg/hour IV, doubling every 90 seconds until BP at target, then increasing by less than doubling every 5–10 minutes; maximum 32 mg/hour	2–4 minutes	5–15 minutes; maximum 72 hours	Atrial fibrillation, fever, insomnia, nausea, headache, vomiting, postprocedural hemorrhage, acute renal failure, respiratory failure	Most hypertensive emergencies. Avoid use if hypersensitivity to soy or egg products, pathological hyperlipidemia, lipoid nephrosis, or acute pancreatitis. Use low-end dose range for elderly.
Nicardipine hydrochloride	Initial 5 mg/hour IV, increasing by 2.5 mg/hour every 5 minutes; maximum 15 mg/hour	5–10 minutes	15–30 minutes, may exceed 4 hours	Tachycardia, headache, flushing, local phlebitis	Preferred agent for most hypertensive emergencies, pregnancy, except acute pulmonary edema. Avoid use in acute aortic dissection. No dose adjustment needed for elderly.
Dopamine$_1$-receptor agonist					
Fenoldopam mesylate	0.1–0.3 mcg/kg/min as IV infusion[c]	< 5 minutes	30 minutes	Tachycardia, headache, nausea, flushing	Preferred agent in acute renal failure. Avoid use in glaucoma, elevated intracranial pressure, and sulfite allergy.
Vasodilators					
Hydralazine hydrochloride	Initial 10 mg as slow IV push; maximum initial dose 20 mg; repeat every 4–6 hours as needed	10–20 minutes 20–30 minutes	1–4 hours IV	Tachycardia, flushing, headache, vomiting, aggravation of angina	Preferred agent in pregnancy. Not first line in most patients due to unpredictability of response and prolonged duration of action.

Table 6–8

Parenteral Antihypertensive Agents for Hypertensive Emergency and Special Conditions [2,27] (*Continued*)

Drug	Dose Range[a]	Onset	Duration	Adverse Effects[b]	Special Indications
Nitroglycerin	Initial 5 mcg/min as IV infusion; increase in increments of 5 mcg/min to achieve BP target; maximum dose 20 mcg/min	2–5 minutes	5–10 minutes	Headache, vomiting, methemoglobinemia, tolerance with prolonged use	Preferred agent in ACS, acute pulmonary edema, and perioperative hypertension. Use caution if use of phosphodiesterase type-5 inhibitors (see package inserts for formal recommendations)
Sodium nitroprusside	Initial 0.3–0.5 mcg/kg/min as IV infusion[d]; increase in increments of 0.5 mcg/kg/min to achieve BP target; maximum dose 10 mcg/kg/min	Immediate	1–2 minutes	Nausea, vomiting, muscle twitching, sweating, thiocyanate, and cyanide intoxication	Use low-dose range for elderly.