

Table II. First Line Intravenous Antihypertensive Agents for Hypertensive Emergencies

Medication	Dose	Onset of action	Peak of action	Duration of action	Medication class	Mechanism of action	Advantages	Disadvantages	Comments
Nicardipine	Bolus: 30 mcg/kg up to 2 mg/dose Infusion: 0.5–4 mcg/kg per min Maximum dose: 4 to 5 mcg/kg per minute	1 minute		3 hours after single IV dose	Dihydropyridine calcium channel blocker	Blocks the movement of calcium across vascular smooth muscle cells -> preventing contraction and decreasing total vascular resistance	Unlike other calcium channel blockers, nicardipine has limited effects on chronotropic, inotropic, and dromotropic function of the heart; high vascular selectivity and strong cerebral and coronary vasodilatory activity	Can cause reflex tachycardia, phlebitis	
Labetalol	Bolus: 0.2 to 1 mg/kg Maximum bolus dose: 40mg/dose <i>. Can give bolus doses every 10 minutes as needed, titrating</i>	2-5 minutes	5-15 minutes	2-4 hours	α_1 and β adrenergic blocker	α_1 blockade leads to vasodilatation; overall leads to reduction of peripheral vascular resistance		Bronchospasm, bradycardia, and congestive heart failure	Relative contraindication in asthma, BPD, and heart failure. May mask symptoms of hypoglycemia. The alpha-to-beta blocking ratio of the oral

	<i>dose to effect</i> Infusion: 0.25 to 3 mg/kg/h.								preparation is 1:3, whereas it is 1:7 for the intravenous preparation.
Hydralazine	Bolus: 0.2 to 0.6 mg/kg/dose given every 4-6 hours Maximum dose: 20 mg/dose	5-15 minutes	10-80 minutes	4-6 hours	Direct vasodilator	Unclear; most likely interferes with intracellular calcium movement responsible for initiating or maintaining vasoconstriction	No dosage supplementation is required following hemodialysis or peritoneal dialysis.	Flushing, tachycardia, hypotension, headache and lupus-like syndrome	One of the oldest antihypertensive agents available that has largely been replaced by faster acting, more effective drugs. Leads to sympathetic nervous system stimulation -> tachycardia, increased renin activity, and sodium retention.
Esmolol	Used at continuous infusion following a loading dose. Loading dose: 100 to 500 mcg/kg	Immediate	5 minutes	10-30 minutes	Cardioselective β_1 adrenergic blocker		Immediate onset of action and short duration of action. Agent of choice for: Intraoperative hypertension due to its short	Bronchospasm, bradycardia, and congestive heart failure	

	<p>Infusion: 50 to 300 mcg/kg/min</p> <p>Maximum infusion dose: 1000 mcg/kg/min</p>						<p>onset and duration of action.</p> <p>Critically ill children as it's rapid metabolism is independent of renal and hepatic function.</p> <p>Management of hypertensive crises associated with the repair of congenital heart disease</p>		
Lasix	<p>Bolus: 0.5–2 mg/kg/dose Q6–12 hr</p> <p>Maximum adult dose: 80 mg/dose</p> <p>Infusion: 0.05 mg/kg/hr, titrate to effect.</p> <p>Maximum infusion dose: 0.4 mg/kg/hr</p>	2 - 5 minutes	Within 30 minutes	2 hours	Diuretic	Blocks absorption of sodium and chloride in loop of Henle, proximal and distal tubules		Hypokalemia, alkalosis, hypomagnesemia, dehydration, hyperuricemia, increased calcium excretion, ototoxicity	Contraindicated in anuria and hepatic coma. Avoid simultaneous aminoglycoside therapy.

Not first line:

Sodium Nitroprusside – cyanide toxicity

Fendolapam – less potent

Enalapriat - safe effective pediatric dose unknown, may cause prolonged hypotension and renal insufficiency, particularly in neonates

Diazoxide – no longer recommended because of uncontrolled excessive BP decreases

First Line Oral Antihypertensive Agents									
Medication	Dose	Onset of action	Peak of action	Duration of action	Medication class	Mechanism of action	Advantages	Disadvantages	Comments
Clonidine	Initial: 5–10 mcg/kg/24 hr div. Q8–12 hr; Maximum dose*: 25 mcg/kg/24 hr up to 0.9 mg/24 hr.	15-30 min	6-8 hours	Half life 6–20 hr (adult).	Alpha-adrenergic agonist	Decreases central sympathetic outflow	Minimally removed by hemodialysis, does not require dose adjustment in renal failure.		Somnolence and dry mouth – most common side effects.
Minoxidil	Initial: 0.2 mg/kg/24 hr PO div. Q12-24 hrs; Maximum initial dose*: 5	30-60 minutes	2–8 hours	8-12 hours	Direct vasodilator	Leads to potassium efflux from smooth muscle cells due to opening of potassium channels, resulting in hyperpolarization	Extremely potent oral vasodilator.	Can cause reflex tachycardia and fluid retention – best administered with beta-blocker and	Renally excreted, removed by dialysis (needs to be redosed after dialysis). Contraindicated in acute MI, dissecting aortic aneurysm, and

	mg/24 hr.					and relaxation. Primarily acts on arterioles; does not cause venous dilatation.		diuretic. Can lead to hirsutism with long-term use.	pheochromocytoma.
Isradipine – immediate release tablet	Initial: 0.05–0.1 mg/kg per dose Q8 hours Maximum dose: 20 mg/day in 3-4 divided doses	1 hour	2-3 hours	12 hours	Dihydropyridine Calcium channel blocker	Binds calcium, blocking calcium movement into smooth and cardiac muscles. Also leads to peripheral vasodilation -> increased cardiac output and decreased systemic vascular resistance.	Has diuretic and antihypertensive characteristics		Stable suspension. Can be compounded.
Hydralazine	Initial: 0.75–1 mg/kg/24 hr div. Q6–12 hr Maximum initial dose*: 25 mg/dose.	20–30 min		2–4 hours	Direct vasodilator	Unclear; most likely interferes with intracellular calcium movement responsible for initiating or maintaining vasoconstriction	No dosage supplementation is required following hemodialysis or peritoneal dialysis.	Flushing, tachycardia, hypotension, headache and lupus-like syndrome	Leads to sympathetic nervous system stimulation - > tachycardia, increased renin activity, and sodium retention.

*Can increase oral dose over several days if needed for more long term blood pressure control.

Other oral antihypertensive medications: captopril, labetalol, and prazosin.