TABLE 473e-4 PATHOPHYSIOLOGIC FEATURES AND TREATMENT OF SPECIFIC TOXIC SYNDROMES AND POISONINGS

Physiologic Condition, Causes	Examples	Mechanism of Action	Clinical Features	Specific Treatments
Stimulated				
Sympathetics[a]				
Sympathomimetics	α_1-Adrenergic agonists (decongestants): phenylephrine, phenylpropanolamine β_2-Adrenergic agonists (bronchodilators): albuterol, terbutaline Nonspecific adrenergic agonists: amphetamines, cocaine, ephedrine	Stimulation of central and peripheral sympathetic receptors directly or indirectly (by promoting release or inhibiting reuptake of norepinephrine and sometimes dopamine)	Physiologic stimulation (Table 473e-2). Reflex bradycardia can occur with selective α_1 agonists; β agonists can cause hypotension and hypokalemia.	Phentolamine, a nonselective α_1-adrenergic receptor antagonist, for severe hypertension due to α_1-adrenergic agonists; propranolol, a nonselective β blocker, for hypotension and tachycardia due to β_2 agonists; *either* labetalol, a β blocker with α-blocking activity, *or* phentolamine with esmolol, metoprolol, or another cardioselective β blocker for hypertension with tachycardia due to nonselective agents (β blockers, if used alone, can exacerbate hypertension and vasospasm due to unopposed α stimulation.); benzodiazepines; propofol
Ergot alkaloids	Ergotamine, methysergide, bromocriptine, pergolide	Stimulation and inhibition of serotonergic and α-adrenergic receptors; stimulation of dopamine receptors	Physiologic stimulation (Table 473e-2); formication; vasospasm with limb (isolated or generalized), myocardial, and cerebral ischemia progressing to gangrene or infarction. Hypotension, bradycardia, and involuntary movements can also occur.	Nitroprusside or nitroglycerine for severe vasospasm; prazosin (an α_1 blocker), captopril, nifedipine, and cyproheptadine (a serotonin receptor antagonist) for mild-to-moderate limb ischemia; dopamine receptor antagonists (antipsychotics) for hallucinations and movement disorders
Methylxanthines	Caffeine, theophylline	Inhibition of adenosine synthesis and adenosine receptor antagonism; stimulation of epinephrine and norepinephrine release; inhibition of phosphodiesterase resulting in increased intracellular cyclic adenosine and guanosine monophosphate	Physiologic stimulation (Table 473e-2); pronounced gastrointestinal symptoms and β agonist effects (see above). Toxicity occurs at lower drug levels in chronic poisoning than in acute poisoning.	Propranolol, a nonselective β blocker, for tachycardia with hypotension; any β blocker for supraventricular or ventricular tachycardia without hypotension; elimination enhanced by multiple-dose charcoal, hemoperfusion, and hemodialysis. Indications for hemoperfusion or hemodialysis include unstable vital signs, seizures, and a theophylline level of 80–100 μg/mL after an acute overdose and 40–60 μg/mL with chronic exposure.
Monoamine oxidase inhibitors	Phenelzine, tranylcypromine, selegiline	Inhibition of monoamine oxidase resulting in impaired metabolism of endogenous catecholamines and exogenous sympathomimetic agents	Delayed or slowly progressive physiologic stimulation (Table 473e-2); terminal hypotension and bradycardia in severe cases	Short-acting agents (e.g., nitroprusside, esmolol) for severe hypertension and tachycardia; direct-acting sympathomimetics (e.g., norepinephrine, epinephrine) for hypotension and bradycardia
Anticholinergics				
Antihistamines	Diphenhydramine, doxylamine, pyrilamine	Inhibition of central and postganglionic parasympathetic muscarinic cholinergic receptors. At high doses, amantadine, diphenhydramine, orphenadrine, phenothiazines, and tricyclic antidepressants have additional nonanticholinergic activity (see below).	Physiologic stimulation (Table 473e-2); dry skin and mucous membranes, decreased bowel sounds, flushing, and urinary retention; myoclonus and picking activity. Central effects may occur without significant autonomic dysfunction.	Physostigmine, an acetylcholinesterase inhibitor (see below), for delirium, hallucinations, and neuromuscular hyperactivity. Contraindications include asthma and nonanticholinergic cardiovascular toxicity (e.g., cardiac conduction abnormalities, hypotension, and ventricular arrhythmias).
Antipsychotics	Chlorpromazine, olanzapine, quetiapine, thioridazine	Inhibition of α-adrenergic, dopaminergic, histaminergic, muscarinic, and serotonergic receptors. Some agents also inhibit sodium, potassium, and calcium channels.	Physiologic depression (Table 473e-2), miosis, anticholinergic effects (see above), extrapyramidal reactions (see below), tachycardia	Sodium bicarbonate for ventricular tachydysrhythmias associated with QRS prolongation; magnesium, isoproterenol, and overdrive pacing for torsades des pointes. Avoid class IA, IC, and III antiarrhythmics.
Belladonna alkaloids	Atropine, hyoscyamine, scopolamine	Inhibition of central and postganglionic parasympathetic muscarinic cholinergic receptors	Physiologic stimulation (Table 473e-2); dry skin and mucous membranes, decreased bowel sounds, flushing, and urinary retention; myoclonus and picking activity. Central effects may occur without significant autonomic dysfunction.	Physostigmine, an acetylcholinesterase inhibitor (see below), for delirium, hallucinations, and neuromuscular hyperactivity. Contraindications include asthma and nonanticholinergic cardiovascular toxicity (e.g., cardiac conduction abnormalities, hypotension, and ventricular arrhythmias).

(*Continued*)