Drug therapy for Emergency Medicine

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Although all of the entries were reviewed by practising emergency physicians any errors and omissions are solely my responsibility.

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Introduction

Drug Therapy for Emergency Medicine is a problem-oriented formulary for emergency physicians. It covers over 140 clinical problems and is intended to help clinicians choose the most appropriate drug therapy once it has been determined that drug therapy is a necessary intervention. The recommendations have been chosen for their relevance to emergency medicine.

It would be impossible to make recommendations for every condition that emergency physicians might see. The choice of which problems to include was dictated by considerations of frequency and seriousness. I have tried to identify the common problems seen in an emergency department and also the ones where a failure to deliver the most appropriate treatment might result in serious morbidity or mortality.

The recommendations incorporate general issues of comparative safety, efficacy, and cost. Treatments that are considered to be of equal safety and efficacy are separated by "or" and are listed in order of increasing cost. Issues of patient compliance or convenience were incorporated into the recommendations only if there was evidence to indicate an effect on clinical outcome.

In addition to recommending drugs to use, this manual also advises against using drugs where there is good evidence for not doing so. Although the focus of this manual is pharmacotherapy, non-drug treatments are also mentioned when they are the most appropriate ones.

This formulary is not a manual of therapeutics. When a clinician uses a drug recommended here, it is expected that the prescriber will already be familiar with the requirements for the safe use of that drug (contraindications, adverse effects, drug interactions, etc.) and the conditions under which dosing adjustments might be necessary. Practitioners lacking this information should consult a pharmacology and therapeutics resource before using the product. It is also assumed that the physician has made the appropriate diagnosis and, therefore, diagnostic advice is generally not included. Doctors are expected to be familiar with other aspects of managing a problem in an emergency setting, such as monitoring cardiac rhythms and assessing an airway or level of dehydration.

Levels of evidence

The most recent and highest levels of evidence were used in preparing this formulary. A MEDLINE search was conducted (in English) on each topic. In generating the recommendations, meta-analyses, high-quality systematic overviews, and consensus guidelines developed using an explicit evidence-based approach were given the highest priority. Where this type of evidence was not available, and in most cases it was not, then the following hierarchy of information was used: randomized clinical trials, other clinical trials, nonsystematic reviews, and case studies. The goal was not to do a systematic review of all of the evidence for each topic, but to gather sufficient evidence, of the highest quality possible, to allow treatment recommendations to be made with confidence. The references for each topic are listed for those who wish to consult them directly.

Although this manual is evidence based, there is always an element of subjectivity involved in making recommendations. Studies of the same condition use different doses of the same drugs or use drugs for different periods of time and comparative trials are often lacking. In these circumstances, there can be legitimate differences of opinion. In an attempt to reach a consensus and to ensure that the recommendations are acceptable to Canadian doctors, each of the topics was reviewed by one or more members of the editorial board, each of whom is a practising Canadian

emergency physician. Wherever possible, an attempt was also made to harmonize the recommendations here with those in other widely used Canadian sources.

Dosing

Unless otherwise stated, the route of administration is oral. Children's doses are given where appropriate. Clinicians should remember that the maximum dose for children should never exceed the adult dose. Time intervals between doses are usually given as b.i.d., t.i.d. or q.i.d. However, when medications must be given intravenously at regular intervals, to emphasize this point, dosing intervals are given as q6h, q8h, etc.

Total treatment durations are given when outpatient therapy is appropriate. However, when patients are admitted to hospital for intravenous therapy, the length of time they are treated will not be determined by the emergency physician. Therefore, treatment times are not given in these instances.

Product listing

In general, when there are more than three drugs in a class that are considered to be equivalent in terms of safety and efficacy, then only the three least expensive are listed. The decision as to which are the three least expensive is based on cost for the average daily dose.

Drug prices

If a product was listed in the Ontario Drug Benefit Formulary (issue 37), the "drug benefit price" was used. Some products are being sold at much higher prices than those quoted in the ODB formulary; these products were priced at the actual acquisition cost and not the ODB cost. If a product was not listed in the ODB formulary the manufacturer was contacted directly. Some manufacturers sell only through a wholesaler and not directly to individual pharmacies. In these cases, the price charged by the largest wholesaler (Medis) was used. The Medis catalogue was also used for over-the-counter products. Prices for products used exclusively in hospitals may vary depending on negotiations between hospitals and manufacturers. The prices for these products are meant as a guide only.

Where drugs are available only in single-use vials, the price of a vial is reported.

Prices are for the drug only and do not include any distribution costs, mark-ups or dispensing fees.

Prices for pediatric doses may vary depending on whether a liquid or solid preparation is used.

Drug names

Generic names are used throughout the formulary. Brand names for all products can be found in the index at the back.

Feedback

The intention is to revise this manual periodically to keep it up to date with clinical practice. To improve the book and make it relevant to emergency physicians, feedback from its users is particularly important. Comments regarding the utility of the book and suggestions for

improvement will be appreciated. Any suggestions to modify the list of recommended drugs or to add or remove topics will also be greatly appreciated and given serious attention. Feedback can be sent to the CAEP office.

Joel Lexchin, MD, CCFP(EM), DABEM
September 2001

AIRWAY MANAGEMENT, ANESTHESIA AND ANAPHYLAXIS

Anaphylactic reactions

Drugs of choice[1-4]

1. All patients

i. For mild anaphylaxis (urticaria, rhinitis, conjunctivitis, mild bronchospasm)

epinephrine

Adults and children	0.3–0.5 mg (0.3–0.5 mL), S.C. (diluted 1:1000 w/v)	$1.44/1-mL vial

ii. For moderate anaphylaxis (generalized urticaria, angioedema, early laryngeal edema, hypotension but systolic blood pressure greater than 80 mmHg)

epinephrine

Adults and children	0.3–0.5 mg, I.M. (diluted 1:1000 w/v); repeat after 5–10 min as necessary	$1.44/1-mL vial

iii. For severe anaphylaxis (laryngeal edema, respiratory failure, shock)

epinephrine

Adults and children	0.1–0.5 mg (1–5 mL), I.V. (diluted 1:10 000 w/v) over 5 min; repeat every 5–10 min as necessary	$13.75/10-mL vial
or	1–4 μg/kg per min	

AND for all patients

oxygen at high flow rates

2. Patients who are hypotensive

sodium chloride 0.9%

Adults	1–2 L, I.V. bolus; repeat as needed
Children	20 mL/kg, I.V. bolus; if no response administer an additional 20 mL/kg

3. Patients in whom bronchospasm is a major feature

salbutamol

Adults	from 400–800 μg (4–8 puffs) by MDI with spacer every 15–20 min x 3 to as much as 100 μg (1 puff) every 30–60 s (4–20 puffs); then decrease frequency as symptoms improve	$0.02/puff
or	from 5 mg (1 mL), diluted to 4 mL with normal saline,	$0.59/dose

		by nebulizer, every 15–20 min to continuous; then decrease frequency as symptoms improve	
Children		from 30 µg/kg (0.3 puffs/kg) by MDI with spacer every 15–20 min to 30 µg/kg every 30 s (maximum 300 µg); then decrease frequency as symptoms improve	$0.02/puff
	or	from 0.15 mg/kg (0.03 mL/kg), diluted to 4 mL with normal saline, by nebulizer, every 15–20 min to continuous; then decrease frequency as symptoms improve	$0.02/puff

Second-line therapies[1–4]

1. All patients (as a supplement to epinephrine), antihistamines[5]

i. Mild and moderate anaphylaxis

diphenhydramine			
Adults		25–50 mg, oral or I.M.	$0.11–0.22/dose (oral) $1.50–3.00/dose (I.M.)
Children		1–2 mg/kg, oral or I.M.	$0.01–0.02/kg per dose (oral) $0.06–0.12/kg per dose (I.M.)

AND one of the following

	cimetidine			
	Adults		300 mg	$0.09/dose
	Children		5–7 mg/kg	$0.01–0.02/kg per dose
or	ranitidine			
	Adults		150 mg, oral	$0.40/dose
		or	50 mg, I.M.	$2.55/dose
	Children		3 mg/kg, oral	$0.04/kg per dose
		or	1 mg/kg, I.M.	$0.05/kg per dose
or	nizatidine			
	Adults		150 mg	$0.53/dose
or	famotidine			
	Adults		20 mg, oral	$0.59/dose

ii. Severe anaphylaxis

diphenhydramine		
Adults	25–50 mg, I.V.	$1.50–3.00/dose

	Children	1–2 mg/kg, I.V.	$0.06–$0.12/kg per dose

AND one of the following

	ranitidine		
	Adults	50 mg, I.M. or I.V.	$2.55/dose
	Children	1 mg/kg, I.M. or I.V.	$0.05/kg per dose
or	famotidine		
	Adults	20 mg, I.V.	$3.73/dose

2. Patients with persistent hypotension and bronchospasm, and to blunt the biphasic reaction of anaphylaxis

	prednisone		
	Adults	50 mg, single dose	$0.10/dose
	Children	1–2 mg/kg, single dose per	$0.09–0.18/kg dose (liquid)
or	hydrocortisone		
	Adults	200 mg, I.V. bolus	$3.92/dose
	Children	5–7 mg/kg, I.V. bolus	$0.10–0.14/kg per dose
or	methylprednisolone		
	Adults	125 mg, I.V. bolus	$12.87/dose
	Children	1–2 mg/kg, I.V. bolus	$0.12–0.23/kg per dose

3. Patients with epinephrine-resistant anaphylaxis, who are taking beta-adrenergic blockers

	glucagon		
	Adults and children >20 kg	1–2 mg, I.M. or I.V.; repeat every 5 min according to symptoms	$24.38–48.76/dose
	or	1–5 µg/min	
	Children <20 kg	0.5–1 mg, I.M. or I.V.; repeat every 5 min according to symptoms	$12.19–24.38/dose
	or	1–5 µg/min	

4. Patients with bronchospasm, who are taking beta-adrenergic blockers

	ipratropium		
	Adults	from 80–160 µg (4–8 puffs) by MDI with spacer every 15–20 min x 3 to 20 µg (1 puff) every 30–60 s (4–20 puffs); then decrease frequency as symptoms improve	$0.08/puff

	or	from 0.25–0.5 mg (1–2 mL) diluted to 4 mL with normal saline, by nebulizer, every 15–20 min (3 to continuous; then decrease frequency as symptoms improve	$0.76–1.51/dose
Children		60–120 µg (3–6 puffs) every 20–120 min; then decrease frequency as symptoms improve	$0.08/puff
	or	0.25 mg (1 mL) diluted to 4 mL with normal saline, by nebulizer, every 20–120 min; then decrease frequency as symptoms improve	$0.76/dose

Additional instructions and notes

- Epinephrine is the mainstay for managing patients with anaphylaxis. Antihistamines have a supportive role in severe or persistent anaphylaxis. Although steroids are not of value in the initial acute treatment phase, they should be given early as they take 4–6 h to have an effect.
- In addition to the subcutaneous, intramuscular, and intravenous routes, epinephrine can also be given by intraosseous, sublingual, or endotracheal injection. The dose for these routes is the same as for the intravenous route.
- Avoid subcutaneous administration of epinephrine if the patient is hypotensive, as absorption will be erratic.
- 20% of patients with true anaphylaxis relapse 4–8 h after initial response to treatment (biphasic reaction).
- The use of an EpiPen should be discussed with patients before their discharge, and either a prescription for one should be provided or the patients should be referred to their general practitioner for a prescription.
- See also *Allergic reactions (urticaria and pruritus), acute*.

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Procedural sedation — adults

Drugs of choice[1]

1.	fentanyl		1–1.5 µg/kg, I.V. over 1 min; then boluses of 50 µg every 2–3 min to effect (usual total dose 2–3 µg/kg)	$0.03–0.04/kg per dose $1.42/50-µg dose
AND	midazolam		1–2 mg, I.V. over 1–2 min; then boluses of 1 mg every 2–3 min to effect (usual total dose 0.02–0.1 mg/kg)	$0.71–1.43/dose
2.	ketamine		25 mg, I.V., every 3–5 min to a total of 1–2 mg/kg	$2.59/dose
		or	0.5 mg/kg per min, I.V., to a total of 1–2 mg/kg	$0.05/kg per dose
		or	4 mg/kg, I.M.	$0.41/kg per dose
3.	propofol[2]		0.5–1.0 mg/kg, I.V., over 3–5 min; then repeat boluses of 0.1–0.5 mg, I.V., every 5 min	$0.02–0.04/kg per dose $0.005–$0.02/dose
		or	infusion at 25–125 µg/kg per min, I.V.	$0.001–0.005/kg per dose
4.	nitrous oxide 50%		inhalation to effect	

Second-line therapies

If ketamine is used, to prevent emergence reactions consider

	midazolam	1–2 mg/kg, I.V., over 1–2 min	$0.71–1.43/kg per dose

Additional instructions and notes

- The goal of procedural sedation is a patient who is drowsy and falls asleep if not frequently stimulated, but who still responds to loud verbal or manual stimuli and has an intact airway and no respiratory depression. Procedural sedation should also ensure analgesia, anxiolysis, and amnesia; minimize adverse psychological responses during frightening procedures; and return the patient to a state in which safe discharge from the emergency department is possible.
- It is important to wait at least 2–3 min between doses of fentanyl and midazolam to fully appreciate the effects of the previous dose and avoid overdosing. A rational approach to the use of fentanyl and midazolam is to give the midazolam initially to achieve sedation and anxiolysis followed by fentanyl for analgesia.
- Ketamine has the advantage of being an effective analgesic.

- The combination of ketamine (2 mg/kg I.V.) and midazolam (0.07 mg/kg I.V.) has been used successfully.[3]
- Propofol has no analgesic properties; if a painful procedure is going to be preformed the patient should also be given an appropriate analgesic.
- All patients who have been given ketamine should be allowed to recover in a quiet, dark room with minimal external stimulation to minimize emergence reactions. Midazolam can also be used to treat emergence reactions.
- The Canadian Association of Emergency Physicians has produced consensus guidelines on procedural sedation.[4]

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AIRWAY MANAGEMENT, ANESTHESIA AND ANAPHYLAXIS

Procedural sedation — children

Drugs of choice[1–6]

1. For noninvasive procedures (e.g., imaging procedures)

	midazolam		0.05–0.2 mg/kg I.V., over 1–2 min (maximum 5 mg)	$0.04–0.14/kg per dose
		or	0.2 mg/kg I.M. (maximum 5 mg)	$0.14/kg per dose
		or	0.25–0.4 mg/kg, dripped slowly onto turbinates (maximum 5 mg)	$0.18–0.28/kg per dose
		or	0.5 mg/kg oral (maximum 15 mg)	$0.36/kg per dose
or	pentobarbital		1–3 mg/kg I.V. over 1–2 min	$0.03–0.04/kg per dose
		or	2–6 mg/kg oral or I.M. (maximum 100 mg)	$0.06–0.09/kg per dose
or	chloral hydrate[7]		25–100 mg/kg (maximum 2 g or 100 mg/kg, whichever is lower)	$0.03/500 mg

2. For procedures associated with a low level of pain but high anxiety

	midazolam	doses as above	
or	nitrous oxide 50%	inhalation to effect	

3. For procedures associated with a high level of pain, high anxiety, or both

	i. ketamine		0.5–2 mg/kg, I.V. over 1 min	$0.05–0.21/kg per dose
		or	4 mg/kg, I.M.	$0.41/kg per dose
AND	atropine		0.01 mg/kg, I.V. in the same syringe as the ketamine	$0.01/kg per dose
or	ii. midazolam		0.05–0.2 mg/kg, I.V.	$0.04–0.14/kg per dose
		or	0.2 mg/kg, I.M.	$0.14/kg per dose
AND	fentanyl		1–3 µg/kg, I.M. or I.V. (I.V. dose is over 3–5 min)	$0.03–0.09/kg per dose
or	iii. morphine		0.05–0.2 mg/kg, I.M. or I.V. (maximum 15 mg) (I.V. dose is over 4–5 min)	$0.37/15 mg or $3.14/50 mg

Additional instructions and notes

- The goal of procedural sedation is a patient who is drowsy and falls asleep if not frequently stimulated, but who still responds to loud verbal or manual stimuli and has an intact airway and no respiratory depression. Procedural sedation should also ensure analgesia, anxiolysis, and amnesia; minimize adverse psychological responses during frightening procedures; and return the patient to a state in which safe discharge from the emergency department is possible.
- It is important to wait at least 2–3 min between doses of fentanyl and midazolam to fully appreciate the effects of the previous dose and avoid overdosing. A rational approach to the use of fentanyl and midazolam is to give the midazolam initially to achieve sedation and anxiolysis followed by fentanyl for analgesia.
- Ketamine has the advantage of being an effective analgesic.
- Most children do not appear to develop emergence reactions associated with ketamine, thus do not require administration of a benzodiazepine.[8] Midazolam has not been shown to alter the incidence of emergence reactions but is useful for their treatment.[9]
- Continuous-flow nitrous oxide is more effective than oral midazolam for the relief of anxiety and is associated with fewer adverse effects and shorter recovery times.[10]
- Oral midazolam has a bitter taste, which should be masked by combining it with orange juice or flavoured drinks.
- The Canadian Association of Emergency Physicians has produced consensus guidelines on procedural sedation.[11]

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AIRWAY MANAGEMENT, ANESTHESIA AND ANAPHYLAXIS

Rapid-sequence intubation

Drugs of choice[1]

1. All patients
   Pre-oxygenation with 100% oxygen for 5 min

2. Patients without special circumstances

   i. Induction agent

	thiopental	3–5 mg, I.V.	$0.06–0.10/dose
or	ketamine	1–2 mg, I.V.	$0.10–0.20/dose
or	midazolam	0.2 mg, I.V.	$0.14/dose

AND ii. Neuromuscular blockade

succinylcholine		
Adults	1.5 mg/kg, I.V.	$0.03/kg per dose
Children <10 years	2 mg/kg, I.V.	$0.04/kg per dose
Infants	3 mg/kg, I.V.	$0.06/kg per dose

3. Patients with raised intracranial pressure or penetrating globe injuries

   i. Pretreatment with defasciculating agent; administer 3 min before airway manipulation

	vecuronium	0.01 mg/kg, I.V.	$0.01/kg per dose
or	pancuronium	0.015 mg/kg, I.V.	$0.02/kg per dose
or	rocuronium	0.1 mg/kg, I.V.	$0.03/kg per dose

AND ii. Pretreatment to reduce the rise in intracranial pressure and suppress the cough reflex that accompanies laryngoscopy and intubation; administer 3 min before airway manipulation

lidocaine	1.5 mg/kg, I.V.	$0.21/kg per dose

AND iii. Pretreatment to control the reflex hemodynamic stimulation resulting from intubation; administer 3 min before airway manipulation

fentanyl	3 µg/kg, I.V. over 1 min	$0.09/kg per dose

AND iv. As an induction agent

thiopental		
Euvolemic	3–5 mg/kg, I.V.	$0.06–0.10/kg per
Hypovolemic	1–3 mg/kg, I.V.	$0.02–0.06/kg per

AND v. For neuromuscular blockade

succinylcholine	doses as above

4. Patients with bronchospasm due to asthma or chronic obstructive airways disease

   i. Pretreatment to suppress the coughing that accompanies airway manipulation; administer 3 min before airway manipulation

	lidocaine	dose as above	
AND	ii. As an induction agent with bronchodilating properties		
	ketamine	1–2 mg/kg, I.V.	$0.10–0.20/kg per dose
AND	iii. For neuromuscular blockade		
	succinylcholine	dose as above	

5. Patients with a history of severe cardiovascular disease, including cerebrovascular insufficiency, aortic dissection, pulmonary edema and ischemic heart disease[2]

i. Pretreatment to blunt the reflex sympathetic response to laryngoscopy and stabilize heart rate and blood pressure during intubation; administer 3 min before airway manipulation

fentanyl		
Hypertensive	3 µg/kg, I.V.	$0.09/kg per dose
Normotensive	1–1.5 mg/kg, I.V.	$0.03–0.04/kg per dose
Hypotensive	omit	

AND	ii. Induction agent		
	in patients who are hemodynamically unstable, but with no ischemic heart disease		
	ketamine	1–2 mg/kg, I.V.	$0.10–0.20/kg per dose
	in patients with ischemic heart disease		
	thiopental	dose as above	
AND	iii. Neuromuscular blockade		
	succinylcholine	dose as above	

Second-line therapies[1]

1. For children <10 years, administer as part of pretreatment to blunt excessive bradycardia due to succinylcholine

atropine	0.02 mg/kg, I.V. (minimum dose 0.1 mg; maximum dose 1 mg)	$0.09/kg per dose

2. For adults who receive a second dose of succinylcholine and develop bradycardia

atropine	2 mg, I.V.	$1.73/dose

3. Where the use of succinylcholine is contraindicated

	rocuronium	1 mg/kg, I.V.	$0.03/kg per dose
or	vecuronium	0.3 mg/kg, I.V.	$0.03/kg per dose

4. With ketamine to promote a drying effect

	atropine		
	Adults and children	0.02 mg/kg, I.V.	$0.02/kg per dose
or	glycopyrrolate		
	Adults and children	0.005 mg/kg, I.V.	$0.06/kg per dose

Additional instructions and notes

- Proper preoxygenation of a healthy adult permits at least 3 min of apnea before significant desaturation occurs.
- Rocuronium produces intubation paralysis in 45–60 s, as does succinylcholine; vecuronium takes 90 s. Neither rocuronium nor vecuronium produces fasciculations.
- For midazolam, onset is slower and dosing variability among patients is greater than for the other induction agents.
- When fentanyl is given as a pretreatment medication, significant respiratory depression and hypotension can occur.

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CARDIOVASCULAR SYSTEM

Angina, unstable

Drugs of choice[1–3]

1. All patients

	aspirin	160 mg to chew, single dose	$0.20/dose
AND	supplemental oxygen		
AND	beta-adrenergic blockers		
	i. High-risk patients		
	metoprolol	5 mg, I.V., every 5 min x 3; then starting 1–2 h later, 25–50 mg q.i.d.	$4.98/5 mg (I.V.) $0.12/50 mg (oral)
	ii. Intermediate- and low-risk patients		
	metoprolol	25–50 mg b.i.d.	$0.12/50 mg
or	atenolol	50–100 mg once daily	$0.35–0.58/dose

2. Patients with ongoing pain in the emergency department

nitroglycerin	0.3–0.6 mg sublingual tablets, every 5 min x 3	$0.03/dose
or	0.4 mg sublingual spray, every 5 min x 3	$0.06/spray

If pain continues after sublingual nitroglycerin or if patient is high-risk or hypertensive or in pulmonary edema

nitroglycerin	5–10 µg/min, I.V.; increase by 10 µg every 5–10 min until symptoms relieved or systolic blood pressure <90 mmHg or severe headaches (usual range 5–40 µg/min)	$21.75/25-mg vial

3. High- or intermediate-risk patients[4,5]

	enoxaparin	1 mg/kg, S.C., b.i.d.	$0.21/kg per dose
or	dalteparin	1200 units/kg, S.C., b.i.d.	$0.72/kg per dose
or	heparin	5000 units, I.V. bolus; then (bolus);	$1.35/dose
		1000 units/h	$0.27/h (infusion)
	or	80 units/kg I.V. bolus; then 18 units/kg per h	$0.02/kg (bolus); $0.004/kg per h (infusion)

4. High-risk patients

	tirofiban[6]		
	If creatinine clearance rate ≥30 mL/min	0.4 μg/kg per min, I.V., for 30 min; then 0.1 μg/kg per min, I.V.	$0.01/kg per dose $0.002/kg per min
	If creatinine clearance rate <30 mL/min	0.2 μg/kg per min, I.V., for 30 min; then 0.05 μg/kg per min, I.V.	$0.005/kg per dose $0.001/kg per min
or	eptifibatide[7]	180 μg/kg, I.V. (maximum 22.6 mg or 11.3 mL) over 1–2 min; then 2 μg/kg per min (maximum 15 mg/h or 20 mL/h), I.V.	$38.00/20-mg (10-mL vial (bolus) $111.25/75-mg (100-mL) vial (infusion)

Second-line therapies[2,3]

If pain is not relieved with adequate anti-ischemic therapy

	morphine	2.5 mg, I.V., every 5–10 min	$0.06/dose

If patient is unable to tolerate adequate doses of beta-adrenergic blockers or nitrates or has ongoing pain despite aggressive treatment with aspirin, nitrates, and beta-adrenergic blockers

	verapamil	80 mg t.i.d.	$0.81/day
or	diltiazem	30 mg q.i.d.; increase as necessary to 180–240 mg daily, divided q.i.d.	$0.84/day (30 mg) $1.08–1.44 /day (60 mg)

Additional instructions and notes

- Patients at high short-term risk of death or nonfatal myocardial infarction (MI) should have at least one of the following features: prolonged ongoing rest pain (>20 min); pulmonary edema most likely related to ischemia; angina at rest with dynamic ST-segment changes ≥1 mm; angina with new or worsening mitral regurgitation murmur; angina with S3 or new or increasing rales; angina with hypotension; MI less than 4 weeks previously.
- Patients at intermediate short-term risk of death or nonfatal MI should not have any high-risk features and should have at least one of the following features: prolonged rest angina (>20 min), now resolved, with moderate or high likelihood of coronary disease; rest angina (>20 min or relieved with rest or sublingual nitroglycerin); nocturnal angina; angina with dynamic T-wave changes; new-onset class III or IV* angina in the past 2 weeks with moderate or high likelihood of coronary disease; pathologic Q waves or resting ST-segment depression ≥1 mm in multiple lead groups; age >65 years.
  *Canadian cardiovascular classifications system class III: marked limitation of ordinary physical activity; class IV: inability to carry on any physical activity without discomfort; angina symptoms may be present at rest.
- Patients at low short-term risk of death or nonfatal MI should not have any high- or intermediate-risk features and should have at least one of the following features: increased frequency, severity, or duration of angina; angina provoked at a lower threshold; new-onset angina with onset 2 weeks to 2 months before presentation; normal or unchanged electrocardiogram.

- Tolerance to I.V. nitrates develops after 24 h.
- If angiography or angioplasty is expected within 12 h, use unfractionated heparin instead of low molecular weight heparin.

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CARDIOVASCULAR SYSTEM

Atrial fibrillation, stable

Drugs of choice[1]

1. For conversion to sinus rhythm

Electrical conversion[2]

or Chemical conversion

propafenone[3–5]		450–600 mg, single dose	$2.04–2.39/dose
or flecainide[4,6]		300 mg, single dose	$2.96/dose
amiodarone[4,7,8]		30 mg/kg, orally, single dose	$0.19/kg per dose
	or	5 mg/kg, I.V., over 30 min; then 75 mg/h, I.V. x 24 h	$1.50/kg per dose $22.50/h
	or	125 mg/h, I.V. x 24 h	$37.50/h

2. For rate control

i. Patients not in congestive heart failure

metoprolol	5 mg, I.V., over 2 min; repeat every 5 min x 2 (maximum dose 15 mg)	$4.98/5 mg
or verapamil		
Adults ≤65 years	5–10 mg, I.V., over 2 min; if no effect, repeat after 15–30 min (maximum dose 20 mg)	$15.41–30.83/dose
Adults >65 years	2.5–5 mg, I.V., over 2 min; if no effect, repeat after 15–30 min (maximum dose 10 mg)	$7.71–15.41/dose

ii. Patients in congestive heart failure

diltiazem[9]	0.25 mg/kg, I.V., over 2 min; if no effect after 15 min, 0.35 mg/kg, I.V., over 2 min; then consider infusion at 5–15 mg/h	$11.00/25-mg vial

Second-line therapies[1]

1. For conversion to sinus rhythm

quinidine[10]	200 mg, q2h, up to 600 mg	$0.06/dose
or procainamide[11]	17 mg/kg, I.V., at rate of dose 20 mg/min; then 2 mg/min	$0.15/kg per

		for 1 h	
2.	For rate control		
	digoxin[12]		
	Adults ≥65 years	0.25–0.5 mg, oral or I.V.; repeat q4h to total of 1 mg	$0.19–0.38/dose (oral); $4.20–8.40/dose (I.V.)
	Adults >65 years	0.125–0.25 mg, oral or I.V.; repeat q4h to total of 0.5 mg	$0.19/dose (oral); $2.10–4.20/dose (I.V.)
or	magnesium sulfate[13]	2 g, I.V., over 2 min	$0.59/dose

Additional instructions and notes

- Conversion should not be attempted if atrial fibrillation has been present for longer than 48 h.
- Electrical conversion should be used in unstable patients.
- A high spontaneous conversion rate has been observed during prolonged follow-up (>24 h), suggesting that the main effect of drugs may be a faster conversion rate.[3,7]
- Asymptomatic patients with ventricular rates under 120 beats/min generally do not need emergency rate control.
- The question of whether diltiazem has a less-negative inotropic effect than verapamil has not been settled.[14]
- Digoxin is a second-line agent for ventricular rate control because of its relatively slow onset of action.
- Calcium channel blockers, beta-adrenergic blockers, and digoxin should not be administered in patients with atrial fibrillation and an accessory conduction pathway (e.g., in Wolff-Parkinson-White syndrome) because of the risk of precipitating ventricular fibrillation.

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CARDIOVASCULAR SYSTEM

Congestive heart failure

Drugs of choice[1]

1. All patients
   Supplemental oxygen

2. Patients with adequate perfusion

	i. morphine	2.5–5 mg, I.V., every 5–10 min	$0.06–0.12/dose
AND	ii. nitroglycerin	0.3–0.6 mg, sublingual tablets every 5 min x 3	$0.03/dose
	or	0.4 mg spray, every 5 min x 3	$0.06/spray

If patients still symptomatic then

	nitroglycerin	10–20 μg/min; increase by 5–10 μg every 3–5 min to usual maximum of 50–80 μg/min	$21.75/25-mg vial
AND	iii. furosemide	40–80 mg, I.V.; repeat as necessary depending on clinical condition	$1.47–2.94/dose

3. Patients in hypertensive crisis with acute pulmonary edema

nitroprusside	0.25–1 μg/kg per min, I.V.; titrate to 3 μg/kg per min as necessary	$14.87/50-mg vial

4. Patients who are hypotensive

sodium chloride 0.9%	250 mL, I.V. over 5–10 min; if no deterioration in respiratory status repeat x 1	

If respiratory status deteriorates or patient remains persistently hypotensive, then administer

	dopamine	5–20 μg/kg per min, I.V.	$2.78/200-mg vial
or	norepinephrine	0.5–1 μg/min, I.V.; increase to hemodynamic effect in steps of 2–4 μg/min to 30 μg/min	$4.29/4-mg vial

Once blood pressure is restored, to increase myocardial contractility, administer

dobutamine	2–5 μg/kg per min, I.V.; increase to 10–20 μg/kg per min	$31.33/250-mg vial

5. Patients with severe disease[2,3]

Continuous positive airway pressure (CPAP)
or Biphasic positive airway pressure (BIPAP)

Second-line therapies

Patients with adequate perfusion			
	captopril[4]	12.5 mg, sublingual	$0.21/dose
or	enalaprilat[5]	1.25 mg, I.V. over 5 min	$10.40/dose

Additional instructions and notes

- The use of morphine as first-line agent has become controversial: there is some evidence that morphine use is associated with higher intubation rates and a higher rate of admission to intensive care units, probably due to respiratory depression.[6]
- Patients with acute pulmonary edema are often diaphoretic and have poor skin perfusion, making the cutaneous route for administration of nitrates less attractive. Absorption may be erratic, and ointment might be absorbed later when skin perfusion is improved resulting in ''unexplained'' hypotension. Cutaneous nitroglycerine patches may ignite during defibrillation or cardioversion.
- Patients with abrupt-onset acute pulmonary edema who did not have underlying chronic congestive cardiac failure may have low plasma volume at the time of presentation. Diuresis in this group of patients may be unnecessary.
- Use of high-dose nitrates combined with low-dose diuretics appears to be more effective than low-dose nitrates and high-dose diuretics, and it may be possible to manage patients initially with nitrates only (without diuretics or morphine).[7,8]
- Although BIPAP and CPAP reduce the need for intubation, they have not been shown to reduce in-hospital mortality.[3,9]
- Dobutamine alone can lead to a drop in blood pressure and, therefore, should only be added after adequate blood pressure has been restored with norepinephrine or dopamine.

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CARDIOVASCULAR SYSTEM

Hypertension emergency

Drugs of choice[1–4]

1. Hypertensive encephalopathy or hypertension with renal failure

	nitroprusside	0.25–1 μg/kg per min, I.V.; increase to 3 μg/kg per min	$14.87/50-mg vial
or	labetalol[5]	20 mg, I.V., over 2 min; then 20–80 mg, I.V. every 10 min to a maximum of 300 mg over 24 h	$3.24/dose $3.24–12.96/10 min
	or	0.5–2 mg/min	$0.08–0.32/min

2. Hypertension and aortic dissection

	i. nitroprusside	doses as above	
	AND to control reflex tachycardia		
	esmolol	0.5 mg, I.V., for 1 min; then 25–50 μg/kg per min, increasing by 25 μg/kg per min every 10–20 min to a maximum of 200 μg/kg per min	$18.95/10-mg vial
or	ii. labetalol[5]	doses as above	

3. Hypertension with angina or myocardial infarction (MI)

	nitroglycerin	initial dose: 3–5 μg/ min; increase by 5 μg every 3–5 min until blood pressure is controlled (maximum dose 100 μg/ min)	$21.75/25-mg vial

4. Hypertension and stroke
   See *Ischemic stroke and transient ischemic attacks*

5. Emergency hypertension in pregnancy
   See *Hypertension emergency in pregnancy*

6. Hypertension and pulmonary edema
   See *Congestive heart failure*

Second-line therapies

1. Hypertension with angina or myocardial infarction[4]

If nitroglycerin alone proves ineffective add

	esmolol	doses as above	
or	labetolol	doses as above	

2. Hypertension urgencies[2,3] (marked hypertension associated with retinal hemorrhages and exudates but without papilledema; marked hypertension in patients requiring emergency surgery; or marked hypertension associated with mild to moderate congestive cardiac failure)

	clonidine	0.1–0.2 mg	$0.18–0.31/dose
or	captopril	25 mg	$0.30/dose

Additional instructions and notes

- The following conditions constitute hypertension emergencies: hypertensive encephalopathy; malignant hypertension accompanied by acute MI, unstable angina, acute renal failure, intracranial bleeding or acute left-ventricular failure; and severe hypertension associated with aortic dissection, postoperative bleeding, head trauma or extensive burns.
- In most patients with hypertension and pulmonary edema, the hypertension is secondary and blood pressure will fall with treatment of the pulmonary edema.
- The degree to which blood pressure should be lowered and how rapidly will depend on the associated pathology. In aortic dissection, pressure should be lowered as rapidly as possible to a systolic pressure of 100–120 mmHg. Pressure should also be lowered as quickly as possible in cases of severe hypertension and angina or MI. The target goal in nitroprusside or labetolol treatment is a 30% drop from pretreatment levels.
- Hypertension, even as high as 240/140 mmHg in an asymptomatic patient with no evidence of organ damage does not require parenteral therapy and the patient may not have to be admitted to hospital if he or she can be followed closely as an outpatient. Hypertensive urgencies (see *Second-line therapies*) can be managed with oral medications and blood pressure can be reduced over 24 h. These patients can be discharged with follow-up the next day.[1,2]
- Oral nifedipine should not be given for hypertension emergencies.[6]

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CARDIOVASCULAR SYSTEM

Myocardial infarction with ST-segment elevation

Drugs of choice[1]

1.	All patients		
	aspirin	160 mg to chew, single dose	$0.20/dose
AND	supplemental oxygen		
AND	beta-adrenergic blockers		
	metoprolol	5 mg, I.V., over 2 min; repeat every 5 min x 2 (maximum dose 15 mg);	$4.98/5 mg (I.V.)
		1–2 h later, 25–50 mg, q.i.d.	$0.12/50 mg (oral)
2.	Patients with ongoing pain in the emergency department		
	nitroglycerin	0.3–0.6 mg, sublingual tablet, every 5 min x 3	$0.03/dose
	or	0.4 mg, sublingual spray, every 5 min x 3	$0.06/spray
	If pain continues after sublingual nitroglycerin or patient is at high risk		
	nitroglycerin	5–10 μg/min, I.V.; increase by 10 μg every 5–10 min until relief of symptoms or systolic BP < 90 mmHg or patient experiences severe headaches (usual range 5–40 μg/min)	$21.75/25-mg vial
	If pain is unrelieved with adequate anti-ischemic therapy		
	morphine	2.5 mg, I.V., every 5–10 min	$0.06/dose
3.	For patients with ST-segment elevation who present within 12 h of the onset of pain		
	streptokinase	1.5 million units, I.V., over 60 min	$357.00/dose
or	reteplase	10 units, I.V., over 1–2 min; repeat in 30 min	$1350.00/10 units
or	alteplase	15 mg, I.V. bolus; then 0.75 mg/kg, I.V., over 30 min (maximum 50 mg); then 0.5 mg/kg, I.V., over 60 min (maximum 35 mg)	$1373.00/50-mg vial

4. For patients who receive either alteplase or reteplase

heparin	60 units/kg, I.V. bolus (maximum 4000 units);	$0.02/bolus
	then 12 units/kg per h, I.V. (maximum 1000 units/h)	$0.003/kg /h

Additional instructions and notes

- It is extremely important to treat patients as early as possible.
- Primary percutaneous revascularization or stenting, if available, is preferable to using thrombolytics.[2]
- The evidence for increased benefit from adding heparin to aspirin, when fibrinolytic therapy is provided, is weak.[3,4]
- Calcium channel blocking agents may be added as an alternative or additional therapy if beta-adrenergic blockers are contraindicated or if the maximum dose has been achieved. In a recent trial, diltiazem did not reduce the cumulative occurrence of cardiac death, nonfatal reinfarction or refractory ischemia during a 6-month follow-up, but did reduce all composite endpoints of nonfatal cardiac events, especially the need for myocardial revascularization.[5]
- At present, magnesium has no role in the management of acute myocardial infarction.[1]
- Avoid nitrates and beta-adrenergic blockers in right-ventricular infarction.

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CARDIOVASCULAR SYSTEM

Supraventricular tachycardia, narrow-complex and stable

Drugs of choice[1]

If vagal maneuvers such as carotid sinus massage and Valsalva's maneuver are unsuccessful, then

adenosine[2,3]	6 mg, I.V., bolus	$39.00/dose

If no effect after 1–2 min,

adenosine	12 mg, I.V., bolus; if still no effect, repeat once after 1–2 min (maximum dose 30 mg)	$78.00/dose

If unsuccessful after maximum dose of adenosine, then make a specific diagnosis:

1. Paroxysmal supraventricular tachycardia and normal left ventricular function

verapamil[2,3]		
Adults ≥65 years	5–10 mg/kg, I.V., over 2 min; repeat in 15–30 min if no effect (maximum dose 20 mg)	$15.41–30.83/dose
Adults >65 years	2.5–5 mg/kg, I.V., over 2 min; repeat in 15–30 min if no effect (maximum dose 10 mg)	$7.71–15.41/dose

2. Multifocal atrial tachycardia and normal left ventricular function

	metoprolol	5 mg, I.V., over 2 min; repeat every 5 min x 2 (maximum dose 15 mg)	$4.98/5 mg
or	verapamil	doses as above	
or	amiodarone	15 mg/min x 10 min;	$4.50/min
		then 1 mg/min x 6 h;	$0.30/min
		then 0.5 mg/min x 18 h	$0.15/min

3. Junctional tachycardia and normal left ventricular function

   Treat as Multifocal atrial tachycardia (above).

Second-line therapies[1]

Paroxysmal supraventricular tachycardia and normal left ventricular function

digoxin		
Adults ≥65 years	0.25–0.5 mg, oral or I.V.; (oral)	$0.19–0.38/dose
	repeat q4h to total of 1 mg	$4.20–8.40/dose (I.V.)

	Adults >65 years	0.125–0.25 mg, oral or I.V.; repeat q4h to total of 0.5 mg	$0.19/dose (oral) $2.10–4.20/dose (I.V.)
or	metoprolol	doses as above	

If drug therapy unsuccessful,

Cardioversion

Additional instructions and notes

- Adenosine acts more rapidly than verapamil and is associated with fewer side effects. Because of the short duration of action of adenosine, tachycardia recurs in about 25% of patients.[4]
- Before adenosine is administered, patients should be warned that it will make them feel extremely uncomfortable.
- Calcium chloride, 500–1000 mg (5–10 mL of a 10% solution), can be used for prophylaxis or treatment of verapamil-induced hypotension.[4]
- Unstable patients should be electrically cardioverted. Cardioversion is not indicated in multifocal atrial tachycardia or in junctional tachycardia.
- If patients fail to respond to treatment, consider other diagnoses such as ventricular tachycardia. (See *Ventricular tachycardia, stable*.)

References

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Torsades de pointe

Drugs of choice[1]

magnesium sulfate	2–4 g, I.V., over 1–2 min	$0.59–1.18/dose

Second-line therapies

isoproterenol[2]	2–10 µg/min, I.V., to achieve a heart rate of 100–120 beats/min	$2.65/mL (1:5000 amp)

Additional instructions and notes

- If medications fail, then external pacing should be used to achieve a heart rate of 100–120 beats/min.

References

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2. Morrison Y, Thompson DF. Isoproterenol treatment of torsades de pointes. *Ann Pharmacother* 1993;27:189-90.

CARDIOVASCULAR SYSTEM

Ventricular tachycardia, stable

Drugs of choice[1]

1. Monomorphic and normal left ventricular function

	procainamide[2]	17 mg/kg, I.V. at rate of 20 mg/min; then 1–4 mg/min	$0.15/kg per dose

2. Monomorphic and poor left ventricular function

	lidocaine	0.5–0.75 mg/kg, I.V. bolus; repeat every 5–10 min x 3; then 1–4 mg/min (maximum 3 g over 1 h)	$13.75/100-mg vial
or	amiodarone[3,4]	150 mg I.V. over 10 min then 1 mg/min x 6 h; then 0.5 mg/min x 18 h	$4.50/min $0.30/min $0.15/min

AND, with either drug
Cardioversion

3. Polymorphic, normal QT interval and normal ventricular function

	metoprolol	5 mg, I.V., over 2 min; repeat every 5 min x 2 (maximum dose 15 mg)	$4.98/5 mg
or	procainamide	doses as above	
or	lidocaine	doses as above	
or	amiodarone	doses as above	

4. Polymorphic, normal QT interval and poor ventricular function

	lidocaine	doses as above
or	amiodarone	doses as above

AND, with either drug
Cardioversion

Second-line therapies

Monomorphic and normal left ventricular function

	lidocaine[1]	doses as above
or	amiodarone	doses as above

Additional instructions and notes

- Unstable ventricular tachycardia should be treated by cardioversion. Stable ventricular tachycardia can be primarily cardioverted.

References

1. Guidelines 2000 for cardiopulmonary resuscitation and emergency cardiovascular care: international consensus on science. *Circulation* 2000;102(8 suppl):I1-384.
2. Gorgels APM, van den Dool A, Hofs A, Mulleneers R, Smeets JLRM, Vos MA, et al. Comparison of procainamide and lidocaine in terminating sustained monomorphic ventricular tachycardia. *Am J Cardiol* 1996;78:43-6.
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4. Desai AD, Chun S, Sung RJ. The role of intravenous amiodarone in the management of cardiac arrhythmias. *Ann Intern Med* 1997;127:294-303.

EAR, NOSE AND THROAT

Candidiasis, oral

Drugs of choice

1. Immunocompetent patients[1]

nystatin oral suspension (100 000 units/mL)		
Children and adults	1–5 mL, q.i.d. x 10 days; hold in mouth before swallowing	$2.37–11.84/10 days
Infants	1 mL, q.i.d. x 10 days; dropped into the mouth and swallowed	$2.37/10 days

2. Immunocompromised patients[2,3]

	ketoconazole	200–400 mg, once daily after meals x 1–2 weeks	$8.26–16.59/7 days
or	fluconazole	50–100 mg, once daily after meals x 1–2 weeks	$24.29–43.12/7 days
or	itraconazole	200 mg, once daily after meals x 1–2 weeks	$49.00/7 days

Second-line therapies

Alternative regimen, if others not tolerated[1]

clotrimazole vaginal tablets	100 mg tablet, sucked q.i.d. x 10 days	$60.40/10 days

Additional instructions and notes

- As clotrimazole lozenges are not marketed in Canada, clotrimazole vaginal tablets may be an effective alternative therapy, although they are not approved for this indication and there is only limited objective evidence to support their use.[4]
- The unpleasant taste of nystatin can occasionally cause nausea and reduce compliance.

References

1. Hoppe JE. Treatment of oropharyngeal candidiasis and candidal diaper dermatitis in neonates and infants: review and reappraisal. *Pediatr Infect Dis J* 1997;16:885-94.
2. British Society for Antimicrobial Chemotherapy Working Party. Antifungal chemotherapy in patients with acquired immunodeficiency syndrome. *Lancet* 1992;340:648-51.
3. de Repentigny L, Ratelle J, Human Immunodeficiency Virus Itraconazole Ketoconazole Project Group. Comparison of itraconazole and ketoconazole in HIV-positive patients with oropharyngeal or esophageal candidiasis. *Chemotherapy* 1996;42:374-83.
4. Lalor E, Rabeneck L. Esophageal candidiasis in AIDS. Successful therapy with clotrimazole

vaginal tablets taken by mouth. *Dig Dis Sci* 1991;36:279–81.

EAR, NOSE AND THROAT

Cold, common

Drugs of choice

No medical therapy has been shown to shorten the duration of illness. See *Second-line therapies* for treatment of symptoms only.

Second-line therapies

1. General symptom relief (cough, hoarseness, nasal congestion, nasal drainage and sore throat)

	sodium cromoglycate[1] 2% nasal solution (2.6 mg per mist)	5.2 mg to each nostril, q2h x 2 days; then q.i.d.	$13.76/bottle
AND	sodium cromoglycate MDI (1 mg per puff)	2 mg, q2h x 2 days; then q.i.d.	$0.22/puff

2. For nasal congestion[2,3]

i. Topical

	xylometazoline nasal spray or drops		$4.17/25-mL bottle
	Adults	0.1% spray or drops at rate of 1 spray or 2–3 drops in each nostril t.i.d.	
	Children 7–12 years	0.05% spray or drops at rate of 2–3 sprays or drops in each nostril t.i.d.	
	Children 6 months to 6 years	0.05% spray or drops at rate of 1 spray or 1 drop in each nostril t.i.d.	
or	oxymetazoline nasal spray or drops		$3.88/15-mL bottle
	Adults and children >5 years	0.05% spray or drops at rate of 1–2 sprays or drops in each nostril b.i.d.	
	Children 2–5 years	0.025% drops at rate of 1–2 drops in each nostril b.i.d.	

ii. Oral

pseudoephedrine		
Adults	60 mg, q.i.d.	$0.44/day
Children	1 mg/kg, q.i.d.	$0.08/kg per day (15-mg chewable tablet)

3. For rhinorrhea and sneezing (doses are per nostril)

	ipratropium nasal spray[4] (20 μg per spray)	20 μg, t.i.d. to q.i.d.	$0.06/spray

4. Nasal lubricant: normal saline nasal spray or drops (especially for infants in combination with a suction device)

5. Analgesic–antipyretic

	acetaminophen		
	Adults	325–650 mg, q4h	$0.01–0.02/dose
	Children	10–15 mg/kg, q4h	$0.02–0.03/kg per dose
or	ibuprofen		
	Adults	200–400 mg, q4h	$0.02–0.04/dose
	Children	10 mg/kg, q6h	$0.02/kg per dose
or	ASA		
	Adults only	325–650 mg, q4h	$0.01–0.02/dose

Additional instructions and notes

- See also *Cough, acute*.
- Antibiotics are not recommended unless a secondary bacterial infection is suspected. Purulent rhinitis or discoloured nasal discharge is not grounds for antibiotic therapy.[5]
- Decongestants are of unproven benefit in preschool children.[6]
- Topical decongestants may be preferred for short-term relief and minimization of systemic side effects.
- Use topical decongestants for a maximum of 72 h, because tolerance and rebound congestion may develop; and rebound congestion may take several weeks to reverse. Inhaled corticosteroids are of benefit in relieving this problem if it occurs.
- Do not use topical decongestants for infants under 6 months of age, because rebound congestion may cause obstructive apnea.
- Antihistamines are not recommended for the relief of symptoms associated with the common cold.[7]
- Evidence for the effectiveness of zinc salt lozenges in reducing the duration of common colds is lacking.[8,9]
- To avoid unnecessary side effects, use single-entity products according to symptoms present.

References

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EAR, NOSE AND THROAT

Cough, acute

Drugs of choice

Codeine and dextromethorphan have not been shown to be effective in suppressing acute cough due to an upper respiratory tract infection in children but dextromethorphan may be mildly helpful in adults.[1–6]

Additional instructions and notes

- In addition to upper respiratory tract infection, consider other causes of acute cough, such as asthma.
- Guaifenesin has no proven efficacy (other than a placebo effect) in treating any type of cough.[7,8]
- In upper respiratory tract infections, treatment with antibiotics does not affect resolution of cough or alter the course of illness.[9]
- First-generation antihistamines (those with weak anticholinergic activity) may help to relieve cough due to postnasal drip.[10]

References

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EAR, NOSE AND THROAT

Dental abscess

Drugs of choice

penicillin V[1–3]		
Adults	300–600 mg, q.i.d. x 5 days	$0.75–1.50/5 days
Children <12 years	5–12.5 mg/kg, q.i.d. x 5 days	$0.10–0.24/kg per 5 days

If patient is allergic to penicillin

erythromycin[1,2] base		
Adults	1 g/day, divided b.i.d. to q.i.d. x 5 days	$0.91/5 days
Children	30–50 mg/kg per day, divided b.i.d. to q.i.d. x 5 days	$0.25–$0.40/kg per 5 days (40 mg/mL) $0.15–0.25/kg per 5 days (80 mg/mL)
or clarithromycin		
Adults	250–500 mg, b.i.d. x 5 days	$14.79–29.58/5 days
Children <12 years	15 mg/kg per day, divided b.i.d. x 5 days	$0.80/kg per 5 days
or clindamycin[4]		
Adults	300 mg, t.i.d. x 5 days	$16.30/5 days
Children	10 mg/kg, t.i.d. x 5 days	$1.10/kg per 5 days

Second-line therapies[1,2]

1. For severe or unresponsive cases or chronic infection

i. amoxicillin/clavulanate		
Adults	500-mg/125-mg tablet, t.i.d. x 5 days	$20.02/5 days
Children	15 mg/kg of amoxicillin, t.i.d. x 5 days	$0.93/kg per 5 days (125 mg/5 mL) $0.78/kg per 5 days (250 mg/5 mL)
or ii. clindamycin		
Adults	300 mg, t.i.d. x 5 days	$16.30/5 days
Children	10 mg/kg, t.i.d. x 5 days	$1.10/kg per 5 days
or iii. penicillin V		
Adults	300–600 mg, q.i.d. x 5 days	$0.75–1.50/5 days
Children <12 years	5–12.5 mg/kg, q.i.d. x 5 days	$0.10–0.24/kg per 5 days
AND metronidazole		
Adults	500 mg, t.i.d. x 5 days	$0.90/5 days (250-mg

		tablet) $12.75/5 days (500-mg capsule)
Children	7.5 mg/kg, t.i.d. x 5 days	$0.03/250-mg tablet $0.85/500-mg tablet

2. For immunocompromised patients

clindamycin		
Adults	300 mg, t.i.d. x 5 days	$16.30/5 days
Children	10 mg/kg, t.i.d. x 5 days	$1.10/kg per 5 days

Additional instructions and notes

- The primary method of treatment of dental abscess is surgery to remove the cause. Adjunctive antibiotic therapy is useful to help resolve or prevent local or systemic spread of infection where surgery alone may not be adequate.[5]
- Initial antibiotic therapy for acute orofacial infections may begin with a loading dose of twice the maintenance dose.
- Other erythromycins, including modified-release preparations, may be 2–7 times more expensive than erythromycin alone.

References

1. Newman M, Kornman K. *Antibiotic/antimicrobial use in dental practice*. Chicago: Quintessence Publishing; 1990.
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EAR, NOSE AND THROAT

Ear wax

Drugs of choice[1]

docusate sodium drops	1 mL into ear canal, 15 min before syringing	$3.52/25-mL bottle

Second-line therapies[1]

triethanolamine polypeptide oleate condensate 10%	1 mL into ear canal, 15 min before syringing	$5.08/8-mL bottle

Additional instructions and notes

- Triethanolamine can cause contact dermatitis.

Reference

1. Singer AJ, Sauris E, Viccellio AW. Ceruminolytic effects of docusate sodium: a randomized, controlled trial. *Ann Emerg Med* 2000;36:228-32.

EAR, NOSE AND THROAT

Epiglottitis

Drugs of choice[1]

	cefotaxime		
	Adults	2 g, I.V., q6h	$73.44/day
	Children	50 mg/kg, I.V., q6h	$2.40/kg per day
or	ceftriaxone		
	Adults	2 g, I.V., q12h	$134.00/day
	Children	50 mg/kg, I.V., q12h	$4.30/kg per day

Second-line therapies[1]

For patients allergic to cephalosporins

	ampicillin		
	Adults	1–2 g, I.V., q6h	$10.60–21.24/day
	Children	25–50 mg/kg, I.V., q6h	$0.28–0.76/kg per day
AND	chloramphenicol		
	Adults and children	12.5 mg/kg, I.V., q6h	$0.24/kg per day

Additional instructions and notes

- In children who have been immunized against *Hemophilus influenzae* type B, consider treating for gram-positive organisms until culture results are known.
- Humidified oxygen should be given by mask if it does not disturb the child.
- Contacts should be treated with rifampin.
- If epiglottitis is a definite possibility in children, therapeutic trials of epinephrine should not be undertaken. There is conflicting evidence as to whether epinephrine helps adults.
- There are no prospective trials examining the effectiveness of steroids in adult or pediatric epiglottitis.

Reference

1. Rosen P, Barkin RM, Hockberger RS, Ling LJ, Markovchick VJ, Marx JA, editors. *Emergency medicine concepts and clinical practice*. 4th ed. St. Louis: Mosby; 1997.

EAR, NOSE AND THROAT

Hiccups, persistent

Drugs of choice[1]

	chlorpromazine	25–50 mg, I.V. or I.M.; then 25–50 mg, t.i.d. to q.i.d. x 10 days	$0.49–0.97/dose (I.M. or I.V.) $0.28–0.56/10 days

Second-line therapies[1]

	metoclopramide	10 mg, I.V. or I.M.; then 10–20 mg, q.i.d. x 10 days	$2.10/dose (I.M. or I.V.) $2.33–4.66/10 days (oral)
or	baclofen	10–20 mg, b.i.d. to t.i.d. x 10 days	$5.82–17.00/10 days
or	nifedipine	20 mg, t.i.d. x 10 days	$11.15/10 days
or	valproic acid	15 mg/kg per day, divided b.i.d. 10 days x 10 days	$0.20/kg per

Additional instructions and notes

- The first line of treatment is to reverse or treat any underlying cause, including relieving esophageal obstruction or gastric distention.
- Chlorpromazine is most effective when given intravenously. To prevent hypotension, give patients 1 L of normal saline before chlorpromazine.
- Numerous nonpharmacologic methods have been recommended for the treatment of hiccups including forcible traction of the tongue, gargling with water, sipping ice water, swallowing granulated sugar, biting on a lemon, inhaling noxious agents (e.g., ammonia), drinking from the far side of a glass, stimulation of dermatomal area C5 by tapping or rubbing the back of the neck, direct pharyngeal stimulation either orally or nasally with a rubber catheter, direct uvular stimulation by “lifting of the uvula” with a spoon or cotton-tip applicator and breathing into a paper bag. However, there is only anecdotal evidence to support these recommendations.

Reference

1. Friedman NL. Hiccups: a treatment review. *Pharmacotherapy* 1996;16:986-95.

EAR, NOSE AND THROAT

Otitis externa

Drugs of choice

For diffuse otitis externa, use a topical antiseptic and anti-inflammatory[1,2]

	aluminum acetate/ benzethonium chloride	5 drops, q.i.d.	$0.70/sachet $3.09/15-mL bottle
or	betamethasone disodium phosphate[3] otic solution	2–3 drops, t.i.d. to q.i.d.	$3.37/5-mL bottle

Additional instructions and notes

- A wick or stent may be necessary to relieve severe swelling of external canal.
- Otic drops containing an aminoglycoside should not be used for more than 7 days in the presence of a tympanic membrane perforation. Longer periods of treatment have been associated with ototoxicity.
- Involvement of cartilage or perichondrium of canal (i.e., malignant otitis externa) is usually due to pseudomonal infection and requires intravenous administration of antibiotics either in hospital or on an outpatient basis.

References

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3. Ruth M, Ekstrom T, Aberg B, Edstrom S. A clinical comparison of hydrocortisone butyrate with oxytetracycline/hydrocortisone acetate-polymyxin B in the local treatment of acute otitis externa. *Eur Arch Otorhinolaryngol* 1990;247:77-80.

EAR, NOSE AND THROAT

Otitis media

Drugs of choice

For children over 2 years of age, who have little pain or fever, clinicians may choose to treat otitis media symptomatically initially and begin antibiotic treatment if symptoms have not improved after 48–72 h. Further randomized controlled trials are necessary in children under 2 to establish whether routine antibiotic treatment is necessary. Until these trials have been conducted, children in this age group should receive antibiotics.[1,2]

1. Acute

   i. Antibiotic therapy[3,4]

amoxicillin		
Adults	500 mg, t.i.d. x 5 days	$3.01/5 days
Children	15 mg/kg, t.i.d. x 5 days	$0.15/kg per 5 days

   ii. Relief from pain and fever

	acetaminophen		
	Adults	325–975 mg, q4h	$0.01–0.03/dose
	Children	15 mg/kg, q4h	$0.03/kg per dose
or	ibuprofen		
	Adults	200–400 mg, q4h	$0.02–0.03/dose
	Children	10 mg/kg, q6h	$0.02/kg per dose
or	aspirin		
	Adults only	325–975 mg, q4h	$0.01–0.03/dose

   AND, if pain relief is inadequte with acetaminophen, ibuprofen or aspirin, add

antipyrine/benzocaine[5]	5 drops t.i.d. to q.i.d.	$5.53/14-mL bottle

2. Bullous myringitis[6]

   Treatment is the same as for typical otitis media.

3. Serous otitis media

   No antibiotic therapy is necessary

Second-line therapies[3,4]

1. For verified penicillin allergy

trimethoprim/sulfamethoxazole		
Adults	160 mg/800 mg, b.i.d. x 5 days	$1.22/5 days
Children	4 mg/20 mg per kg, b.i.d. x 5 days	$0.10/kg per 5 days

or	clarithromycin[7]		
	Adults	250 mg, b.i.d. x 10 days	$29.58/10 days
	Children	15 mg/kg per day, divided b.i.d. x 10 days	$1.60/kg per 10 days
or	azithromycin[8]		
	Children	10 mg/kg single dose, on first day; then 5 mg/kg once daily x 4 days	$1.61/kg per 5 days (20 mg/mL) $1.14/kg per 5 days (40 mg/mL)

2. For patients who are unresponsive to lower doses of amoxicillin or children who are in daycare or who have received antibiotics within the past 3 months

	i. amoxicillin[9]		
	Adults	1 g, t.i.d. x 5 days	$6.03/5 days
	Children	30 mg/kg, t.i.d. x 5 days	$0.27/kg per 5 days
or	ii. amoxicillin/clavulanate		
	Adults	500-mg/125-mg tablet, t.i.d. x 5 days	$20.02/5 days
	Children	15 mg of amoxicilllin/kg, t.i.d. x 5 days	$0.93/kg per 5 days (125 mg/5 mL) $0.78/kg per 5 days (250 mg/5 mL)

3. For more severe pain

Adults			
	acetaminophen/caffeine/codeine		
or	ASA/caffeine/codeine		
	codeine dose	60 mg (2 30-mg tablets), q4h	$0.06/dose
Children			
	codeine	1–1.5 mg/kg, q4h	$0.004–0.006/kg per dose

Additional instructions and notes

- Antibiotics do not affect resolution of pain in the first 24 h after presentation. By days 2–7, early use of antibiotics reduces the risk of pain by 40%, although at that time only 14% of untreated children have pain. To prevent 1 child from experiencing pain by 2–7 days after presentation, 17 children must receive early antibiotic therapy.[10]
- Five days of treatment is effective for uncomplicated acute otitis media.[11]
- There is no evidence that improved clinical cure rates are associated with a broader spectrum of antibiotic therapy.[2,12]
- Antihistamines and decongestants have not been demonstrated to be effective in treatment of symptoms or to prevent the development of complications.[13,14]

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EAR, NOSE AND THROAT

Pharyngitis

Drugs of choice[1,2]

1. Viral

   No antibiotic therapy

2. Bacterial

	penicillin V		
	Adults and children ≥12 years	600 mg, b.i.d. x 10 days	$1.50/10 days
	Children <12 years	25 mg/kg, b.i.d. x 10 days	$0.49/kg per 10 days
or	penicillin G benzathine		
	Adults	1.2 million units, I.M., single dose	$6.34/dose
	Children >27 kg	900,000 units, I.M., single dose	$4.76/dose
	Children <27 kg	300,000–600,000 units, I.M., single dose	$1.59–3.17/dose

Second-line therapies

1. If patient is allergic to penicillin

	erythromycin base[1]		
	Adults	1 g, divided b.i.d. to q.i.d. x 10 days	$1.81/10 days
	Children	30–50 mg/kg per day, divided b.i.d. to q.i.d. x 10 days	$0.50–0.80/kg for 10 days (40 mg/mL) $0.30–0.50/kg for 10 days (80 mg/mL)
or	clarithromycin[3]		
	Adults	250 mg, b.i.d. x 10 days	$29.58/10 days
	Children	15 mg/kg per day, divided b.i.d. x 10 days	$1.60/kg for 10 days
or	azithromycin		
	Adults	500 mg, single dose on day 1; then 250 mg once daily x 4 days	$29.60/5 days
	Children	12 mg/kg once daily x 5 days	$3.20/kg for 5 days (20 mg/mL) $2.25/kg for 5 days (40 mg/mL)

2. If treatment with penicillin fails[4,5]

	cephalexin		
	Adults	250 mg, q.i.d. x 10 days	$5.97/10 days

Children	6.25–12.5 mg/kg, q.i.d. x 10 days	$0.40–0.80/kg for 10 days

Additional instructions and notes

- To determine whether beta-hemolytic group A streptococcal (GAS) infection is present, the following scoring system should be used: temperature above 38%C, 1 point; no cough, 1 point; tender anterior cervical adenopathy, 1 point; tonsillar swelling or exudate, 1 point; age 3–14 years, 1 point; age 15–44 years, 0 points; age >45 years, –1 point. Patients with 4 or more points have a 38–63% chance of streptococcal infection in a community with the usual level of infection. This score does not apply in a community where an outbreak of GAS is occurring.[6]
- Treatment of GAS does not prevent the development of glomerulonephritis. During an epidemic, the risk of developing rheumatic fever from untreated GAS is 3%; at other times the risk is 0.3%. Treatment with penicillin will reduce this risk by about 75%.[7]
- Other erythromycins, including modified-release preparations, may be 2–7 times more expensive than erythromycin base.

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EAR, NOSE AND THROAT

Sinusitis, acute

Drugs of choice

In unselected primary care patients with maxillary sinusitis diagnosed by x-ray film, amoxicillin does not improve the clinical course compared with placebo. Primary treatment should be with decongestants and saline irrigation.[1–3]

1.	Decongestants			
	i. Topical			
		xylometazoline nasal spray or drops		$4.17/25-mL bottle
		Adults	0.1% spray or drops; 1 spray or 2–3 drops in each nostril, t.i.d.	
		Children 7–12 years	0.05% spray or drops; 2–3 sprays or drops in each nostril, t.i.d.	
		Children 6 months to 6 years	0.05% spray or drops; 1 spray or 1 drop in each nostril, t.i.d.	
	or	oxymetazoline nasal spray or drops		$3.88/15-mL bottle
		Adults and children >5 years	0.05% spray or drops; 1–2 sprays or drops in each nostril b.i.d.	
		Children 2–5 years	0.025% drops; 1–2 drops in each nostril, b.i.d.	
or	ii. Oral			
		pseudoephedrine		
		Adults	60 mg, q.i.d.	$0.44/day
		Children >2 years	1 mg/kg, q.i.d.	$0.08/kg per day (15-mg chewable tablet)
2.	Pain relief			
		acetaminophen		
		Adults	325–975 mg, q4h	$0.01–0.03/dose
		Children	15 mg/kg, q4h	$0.03/kg per dose
or		ibuprofen		
		Adults	200–400 mg, q4h	$0.02–0.03/dose
		Children	10 mg/kg, q6h	$0.02/kg per dose
or		aspirin		
		Adults only	325–975 mg, q4h	$0.01–0.03/dose

Second-line therapies[4]

Consider antibiotic therapy in the presence of the following: maxillary toothache, poor response to nasal decongestants, tenderness over the sinuses, mucopurulent discharge for more than a week, prolonged fever.[5]

1.	amoxicillin		
	Adults and children ≥12 years	500 mg, t.i.d. x 10 days	$6.03/10 days
	Children <12 years	15 mg/kg, t.i.d. x 10 days	$0.30/kg per 10 days
2.	If patient is allergic to penicillin		
	trimethoprim/sulfamethoxazole		
	Adults	160 mg/800 mg, b.i.d. x 10 days	$2.44/10 days
	Children	4 mg/20 mg per kg, b.i.d. x 10 days	$0.20/kg per 10 days
3.	If therapy with one of the above antibiotics has been unsuccessful		
	doxycycline		
	Adults and children >8 years	100 mg, b.i.d. x 10 days	$11.72/10 days
or	amoxicillin/clavulanate		
	Adults	500 mg/125 mg, t.i.d. x 10 days	$40.04/10 days
	Children	15 mg/kg of amoxicillin, t.i.d. x 10 days	$1.86/kg for 10 days (125 mg/5 mL) $1.56/kg for 10 days (250 mg/5 mL)

Additional instructions and notes

- No evidence of improved clinical cure rates is associated with a broader spectrum of antibiotic activity.[4]
- In one study, treatment of maxillary sinusitis in adults for 3 days appears to be as effective as treatment for 10 days.[6]
- Most otolaryngologists would generally agree that frontal sinusitis requires a more prolonged course of antibiotic treatment than maxillary sinusitis, primarily because of the thin posterior wall of the frontal sinus and its proximity to the anterior cranial fossa dura and frontal lobes.
- Decongestants do not help in children.[7] In adults, use topical decongestants for a maximum of 72 h, as longer use may lead to development of tolerance and rebound congestion. (Rebound congestion may take several weeks to reverse.) Oral decongestants are less effective than topical preparations, but do not cause rebound nasal congestion.
- Antihistamines are not effective for the treatment of sinusitis.

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EAR, NOSE AND THROAT

Ulcers, aphthous

Drugs of choice[1,2]

One of the following four treatments:

1.	Topical corticosteroids		
	hydrocortisone	mix 1% ointment 1:1 in oral protective emollient and apply thinly, t.i.d. after meals	$0.56/g ($0.02/g hydrocortisone + $0.54/g orabase)
or	betamethasone valerate	mix 0.05% ointment 1:1 in oral protective emollient and apply thinly, t.i.d. after meals	$0.56/g ($0.02/g betamethasone + $0.54/g orabase)
or	triamcinolone in oral protective emollient	apply thinly, t.i.d. after meals	$6.83/7.5 g
2.	Topical anti-infective agent		
	tetracycline	25 mg/mL oral suspension, 10 mL q.i.d. for 5 days; swish in mouth for 2 min	$3.02/5 days
3.	chlorhexidine 0.12% rinse[3]	10 mL, t.i.d. after meals; rinse for 1 min each time	$8.34/475-mL bottle
4.	sucralfate suspension[4]	dab on lesions, q.i.d.	$46.70/500-mL bottle

Second-line therapies[2]

For recurrent aphthae, aphthae not responsive to milder corticosteroids or aphthae associated with HIV infection[5,6]

	clobetasol 17-propionate	mix 0.05% ointment 1:1 in oral protective emollient and apply t.i.d.	$0.95/g ($0.41/g clobetasol + $0.54/g orabase
or	fluocinonide	mix 0.05% ointment 1:1 in oral protective emollient and apply 6 times/day	$1.02/g ($0.48 g fluocinonide + $0.54/g orabase)
or	betamethasone disodium phosphate	500 µg effervescent tablets, t.i.d.; dissolve in 5–10 mL water and swish in mouth for 2 min	$1.77/day

Additional instructions and notes

- Deficiencies of iron, folic acid or vitamin B_{12} have been demonstrated to be twice as prevalent in patients with recurrent aphthous ulcers as in a control group.

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EAR, NOSE AND THROAT

Vestibular disorders, acute

Drugs of choice[1]

1. For acute symptom relief in the emergency department

	dimenhydrinate	50–100 mg, I.M. or I.V.	$0.67–1.33/dose

2. For ongoing symptom relief on discharge

	dimenhydrinate	50–100 mg, q.i.d.	$0.04–0.08/day
	or	100 mg, per rectum, q.i.d.	$2.00/day
or	meclizine	25–50 mg, once daily to b.i.d.	$0.27–1.06/day

Second-line therapies[1]

For acute symptom relief in the emergency department

	prochlorperazine	5–10 mg, I.M. or I.V.	$0.50–0.99/dose
or	diphenhydramine	25–50 mg, I.M. or I.V.	$1.50–3.00/dose

For ongoing symptom relief on discharge

	diphenhydramine	25–50 mg, t.i.d. to q.i.d.	$0.33–0.88/day
or	prochlorperazine	5–10 mg, t.i.d. to q.i.d.	$0.33–1.32/day
or	methylprednisolone[2]	48-mg loading dose; then 32 mg, once daily x 4 days; then taper over next 4 days	$5.31/9 days
or	flunarizine[3]	10 mg, once daily	$1.52/day
or	scopolamine, transdermal[4]	1 patch every 72 h	$3.71/patch
or	promethazine	25 mg, q.i.d.	$2.48/day

Additional instructions and notes

- Pharmacotherapy combined with vestibular training is more effective than pharmacotherapy alone.[5]
- Stop medication after nausea has disappeared, as continued use may prolong the time course for central compensation of the peripheral tone imbalance.
- Prochlorperazine is associated with a high incidence of akathisia. Diphenhydramine can blunt this effect.[6]

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ELECTROLYTE DISTURBANCES

Hypercalcemia

Drugs of choice[1]

Symptomatic acute hypercalcemia (i.e., serum calcium >3.5 mmol/L or life-threatening symptoms)

	sodium chloride 0.9%	to correct dehydration over the first 1–3 h	
AND	calcitonin	4 IU/kg, S.C. or I.M., q12h	$0.31/kg
AND	pamidronate	60–90 mg, I.V., over 4 h	$315.00–472.00/dose

Second-line therapies[1]

Once the patient is rehydrated (i.e., urine volume 100 mL/h)

furosemide	40–80 mg I.V., q1h–q4h	$1.47–2.94/dose

Additional instructions and notes

- These recommendations are derived from the acute management of cancer-related hypercalcemia.
- Hydration alone rarely normalizes calcium concentration, but is important because it expands intracellular volume and increases renal calcium clearance.
- Many patients with hypercalcemia also have hypokalemia; thus, potassium levels must be monitored.

Reference

1. Chisholm MA, Mulloy AL, Taylor AT. Acute management of cancer-related hypercalcemia. *Ann Pharmacother* 1996;30:507-13.

ELECTROLYTE DISTURBANCES

Hyperkalemia

Drugs of choice[1]

1. To stabilize the cardiac cell membrane

	calcium chloride 10%		10–20 mL, I.V.; infuse 10 mL over 5–10 min	$1.25/10-mL amp
or	calcium gluconate 10%		30–60 mL, I.V.; infuse 10 mL over 5–10 min	$1.05/10-mL amp

2. To promote cellular uptake of potassium[2,3]

	dextrose 50% in water		50 mL, I.V. over 5 min	
AND	short-acting insulin		10 units, I.V.	$0.16/dose
AND	salbutamol		1200–1400 µg (6–12 puffs) by MDI	$0.02/puff
		or	10–20 mg (2–4 mL) by nebulizer	$1.18–2.36/dose
		or	0.5 mg, I.V. in 100 mL of 5% glucose over 10–15 min	$10.30/dose

3. To eliminate potassium from the body

sodium polystyrene sulfonate		30 g, oral	$11.35/dose
	or	60 g per rectum	$13.64/dose

Additional instructions and notes

- In euglycemic patients, administer glucose before giving insulin to avoid hypoglycemia.[4]
- Oral sodium polystyrene sulfonate may be administered with sorbitol to prevent constipation.
- To make a sodium polystyrene sulfonate enema, mix 60 g of polystyrene with 150–200 mL of aqueous vehicle (plain water, 10% dextrose in water, or an equal mixture of plain water and 2% methylcellulose suspension). The enema should be retained for at least 30 min, preferably longer.
- Sodium bicarbonate alone is ineffective in lowering potassium levels. Bicarbonate also does not appear to potentiate the actions of insulin or salbutamol in lowering potassium levels.[5]

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ELECTROLYTE DISTURBANCES

Hypernatremia

Drugs of choice[1]

1.	If patient is hypovolemic (hypotonic sodium loss)		
	sodium chloride 0.9%	to restore euvolemia, then	
	sodium chloride 0.2–0.45%	run at a rate to reduce sodium concentration by 10 mmol/L over 24 h	
2.	If hypernatremia is associated with potassium loss		
	sodium chloride 0.2–0.45%	run at a rate to reduce sodium concentration by 10 mmol/L over 24 h	
AND	potassium chloride	amount determined by degree of potassium loss	
3.	If patient is euvolemic (pure water loss)		
	dextrose 5% in water	run at a rate to reduce sodium concentration by 10 mmol/L over 24 h	
4.	If patient is hypervolemic (hypertonic sodium gain)		
	dextrose 5% in water	run at a rate to reduce sodium concentration by 10 mmol/L over 24 h	
AND	furosemide	20–40 mg, I.V., single dose	$0.74–1.47/dose

Additional instructions and notes

- First assess volume status. If patient is hypovolemic (most common), replace volume with 0.9% sodium chloride (sodium concentration, 154 mmol/L).
- Hypotonic fluids have the potential to cause cerebral edema; thus, patients must be carefully monitored.
- The following formula can be used to calculate the change in serum sodium from 1 L of infusate: change in serum Na = (infusate Na - serum Na)/(total body water + 1). If hypokalemia is also present use the following formula: change in serum Na = (infusate Na + infusate K - serum Na)/(total body water + 1).
- For patients in whom hypernatremia has developed over a period of hours, rapid correction will not increase the risk of cerebral edema. In these cases, reducing the serum sodium concentration at the rate of 1 mmol/L per h is appropriate.
- The goal of treatment is to reduce the serum sodium concentration to 145 mmol/L.
- Treatment must take average obligatory water losses into account.
- The preferred route for administering fluids is oral (using a feeding tube, if necessary). If this is not feasible, fluids should be given intravenously.

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ELECTROLYTE DISTURBANCES

Hyponatremia

Drugs of choice[1–3]

1. If patient has severe symptoms (coma, recurrent seizures), is euvolemic and urine is concentrated

	sodium chloride 3%	100 mL per h to correct sodium by 1–2 mEq/h over first few hours, then at a rate that does not deliver more than a total of 8 mEq in 24 h	
AND	furosemide	20–40 mg, I.V., single dose	$0.74–1.47/dose
AND	water restriction		

2. If patient has mild to moderate symptoms (progressive drowsiness, syncope), is hypovolemic and urine is concentrated

	sodium chloride 0.9%	1 L/h until volume corrected; then slow to maintenance rate; sodium correction rate should not deliver more than a total of 8 mEq in 24 h	
AND	water restriction		

3. If patient has mild symptoms

i. Patient euvolemic and urine dilute
water restriction

ii. Patient hypervolemic

	water restriction		
AND	furosemide	20–40 mg, I.V.	$0.74–1.47/dose

Second-line therapies

For seizures, see *Status epilepticus*

Additional instructions and notes

- The following formula can be used to calculate the change in serum sodium from 1 L of infusate: change in serum Na = (infusate Na - serum Na)/(total body water + 1). If hypokalemia is also present use the following formula: change in serum Na = (infusate Na + infusate K - serum Na)/(total body water + 1).
- Rapid correction of sodium can lead to central pontine myelinolysis. There is no consensus about the optimal treatment of symptomatic hyponatremia, but isolated cases of pontine myelinolysis have been reported with correction rates as low as 9–10 mEq in 24 h.
- Indications for stopping rapid correction of symptomatic hyponatremia are the cessation of

life-threatening manifestations, moderation of other symptoms or the achievement of a serum sodium concentration of 125–130 mEq (or even lower if the baseline serum sodium concentration is below 100 mEq).

- Corrective measures for nonhypotonic hyponatremia are directed at the underlying disorder rather than at the hyponatremia itself — insulin to treat hyperglycemia; furosemide to treat the absorption of irrigant solutions used in transurethral prostatectomy; hemodialysis to treat retention of hypotonic solutions in patients with renal failure.
- Because of the nature of brain adaptation, symptoms are much more likely to develop in cases of rapid onset (<48 h) of hyponatremia.
- Furosemide-induced diuresis is equivalent to a one-half isotonic saline solution and, therefore, aids in the correction of hyponatremia.

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GASTROENTEROLOGY

Abdominal pain, acute

Drugs of choice[1,2]

Opioid analgesics

	morphine	2.5–5 mg, I.V., every 10–15 min until pain is controlled; repeat q2h–q4h	$0.06–0.12/dose
or	meperidine	25–50 mg, I.V., every 10–15 min until pain is controlled; repeat q2h–q4h	$0.34–0.68/dose

Additional instructions and notes

- In the elderly, start with either 2.5 mg morphine or 25 mg meperidine.
- If patients who are hemodynamically unstable are treated with analgesics, the doses should be given more slowly and their blood pressure should be monitored closely.
- Because pain is usually the cause of nausea and vomiting, the use of antiemetics may not be necessary.
- Giving analgesia does not interfere with the ability to monitor disease progression in the patient.

References

1. Pace S, Burke TF. Intravenous morphine for early pain relief in patients with acute abdominal pain. *Acad Emerg Med* 1996;3:1086-92.
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GASTROENTEROLOGY

Colic, biliary

Drugs of choice

1.	Opioid analgesics		
	morphine	2.5–5 mg, I.V., every 10–15 min until pain is controlled; repeat q2h–q4h	$0.06–0.12/dose
or	meperidine	25–50 mg I.V., every 10–15 min until pain is controlled; repeat q2h–q4h	$0.34–0.68/dose
2.	Parenteral NSAIDs[1]		
	ketorolac	30 mg, I.V.; repeat in 30 min if necessary	$3.63/dose

Additional instructions and notes

- All opioids, including meperidine and morphine, may cause spasm of Oddi's sphincter and thus exacerbate pain.
- Currently, no trials demonstrate the usefulness of hyoscine (Buscopan®) for this problem.
- NSAIDs are a better choice than opioids when there is concern about respiratory depression association with opioids.

Reference

1. Dula DJ, Anderson R, Wood GC. A prospective study comparing I.M. ketorolac with I.M. meperidine in the treatment of acute biliary colic. *J Emerg Med* 2001;20:121-4.

GASTROENTEROLOGY

Constipation

Drugs of choice

1.	For those with difficulty initiating evacuation		
	glycerin[1]	1 suppository	$0.07/dose
2.	For stool primarily in the descending colon		
	sodium phosphates	1 enema	$0.84/enema
3.	For patients with fecal impaction, manual disimpaction followed by		
	oil retention enema[1]	followed by tap water enemas daily until no clinical or radiologic signs of obstruction	$4.34/enema
AND	polyethylene glycol/ electrolytes[2]	2 L/day x 2 days	$12.00/4-L bottle

Additional instructions and notes

- A flat plate x-ray film of the abdomen is useful in assessing the degree of constipation and guiding treatment.

References

1. Harari D, Gurwitz JH, Minaker KL. Constipation in the elderly. *J Am Geriatr Soc* 1993;41:1130-40.
2. Puxty JAH, Fox RA. Golytely: a new approach to faecal impaction in old age. *Age Ageing* 1986;15:182-4.

GASTROENTEROLOGY

Diarrhea, acute

Drugs of choice

Rehydration either intravenously or with commercially available oral preparations (e.g., Gastrolyte, Lytren, Pedialyte).[1,2]

Second-line therapies

1. Travelers' diarrhea, moderate to severe[3]

	trimethoprim/sulfamethoxazole[4]			
	Adults		160 mg/800 mg, b.i.d. x 3–5 days	$0.73/3 days
		or	320 mg/1600 mg, single dose	$0.24/dose
	Children		4 mg/20 mg per kg, b.i.d. x 3–5 days	$0.06/kg for 3 days
or	norfloxacin[4–6]		400 mg, b.i.d. x 3–5 days	$9.15/3 days
		or	800 mg, one dose	
or	ofloxacin		300 mg, b.i.d. x 3–5 days	$10.21/3 days
or	ciprofloxacin[7]		500 mg, b.i.d. x 3–5 days	$15.03/3 days
		or	500 mg, one dose	$2.51/dose

AND, with any of the above antibiotics,

loperamide[8–10]		
Adults	4-mg loading dose followed by 2 mg after each loose bowel movement to maximum of 16 mg/day	$0.25/2-mg caplet

2. Non-travelers' diarrhea in adult patients with four or more fluid stools per day for >3 days and at least one of the following: abdominal pain, fever, vomiting, myalgia or headache.

ciprofloxacin[11]	500 mg, b.i.d.x 5 days	$25.06/5 days

3. *Giardia lamblia*[12]

metronidazole		
Adults	250 mg, t.i.d. x 5 days	$0.42/5 days
Children	5 mg/kg, t.i.d. x 5 days	$0.003/kg for 5 days (250-mg tablet) $0.13/kg for 5 days (500 mg-capsule)
or paromomycin	8–12 mg/kg, t.i.d. x 7 days	$1.41–2.12/kg for 7 days

4. *Clostridium difficile* antibiotic-associated enterocolitis[13]

When diarrhea does not stop on termination of antibiotic, or recurs within 10 days of stopping antibiotic, or is severe

	metronidazole		
	Adults	250–500 mg, t.i.d. x 7–10 days (250-mg tablet)	$0.63–$1.26/7 days
	Children	7.5 mg/kg, t.i.d. x 7–10 days	$0.02/kg for 7 days (250-mg tablet) $0.27/kg for 7 days (500-mg capsule)
or	vancomycin		
	Adults	250 mg, q.i.d. x 7–10 days	$367.14/7 days
	Children	5 mg/kg, q.i.d. x 7–10 days	$7.34/kg for 7 days

Additional instructions and notes

- Dehydration and death can occur quickly in children under 1 year of age. Fluids are the mainstay of treatment in infants. If there is no vomiting, oral rehydration should be continued along with regular breast- or bottle-feeding.[14] Electrolyte replacement may be necessary if there is protracted or frequent vomiting or diarrhea.
- Diphenoxylate, loperamide and other antidiarrheal agents should not be used for the treatment of acute diarrhea in children. Their use is associated with hemolytic–uremic syndrome (HUS).[15,16]
- In adults, avoid antimotility agents if invasive enteritis (e.g., *Campylobacter*, *Salmonella*, *Shigella*, *Yersinia enterocolitica*) is suspected on the basis of fever and bloody diarrhea. These drugs may increase the duration of fever, diarrhea, excretion of organisms and the incidence of bacteremia, and they may also precipitate the development of a toxic megacolon. Antimotility agents may be used, judiciously, in adults who appear to have a toxigenic-induced diarrhea (e.g., *Staphylococcus*, *Clostridium perfringens*), where the diarrhea is seriously interfering with activities of daily living.

References

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travelers' diarrhea: ciprofloxacin plus loperamide compared with ciprofloxacin alone: a placebo-controlled, randomized trial. *Ann Intern Med* 1991;114:731-4.
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GASTROENTEROLOGY

Diverticulitis

Drugs of choice

1. For patients who are able to tolerate oral hydration, treatment may be initiated on an outpatient basis.[1,2]

	trimethoprim/ sulfamethoxazole	160 mg/800 mg, b.i.d. x 7–10 days	$1.71/7 days
AND	metronidazole	500 mg, q.i.d. x 7–10 days	$1.68/7 days (250-mg tablet) $23.80/7 days (500-mg capsule)

2. For patients with peritoneal signs or those who cannot tolerate oral hydration

	i. gentamicin[3]	4–6 mg/kg, I.V., once daily	$0.20–0.30/day
AND	clindamycin	600 mg, I.V., q8h	$27.45/day
or	ii. ticarcillin/clavulanate[1]	3 g, I.V., q6h	$39.60/day
or	iii. cefoxitin[3]	1–2 g, I.V., q6h	$46.52–92.36/day
or	iv. ampicillin[2]	2 g, I.V., q6h	$21.20/day
AND	metronidazole	500 mg, I.V., q8h	$45.00/day
AND	gentamicin	4–6 mg/kg, I.V., once daily	$0.20–0.30/day

Second-line therapies

For outpatient therapy as an alternative to the first-line agents one of the following combinations.[1]

	i. metronidazole	500 mg, t.i.d. x 7–10 days	$1.26/7 days (250-mg tablet) $17.85/7 days (500-mg capsule)
AND	cephalexin	500 mg, q.i.d. x 7–10 days	$8.36/7 days
or	ii. ciprofloxacin	500 mg, b.i.d. x 7–10 days	$35.14/7 days
AND	clindamycin	300 mg, t.i.d. x 7–10 days	$22.82/7 days

Additional instructions and notes

- Patients treated with oral antibiotics should be on a liquid diet until the acute attack has resolved. Once the acute attack has resolved, all patients should be maintained on a high-fibre diet.
- Monitor plasma concentration of gentamicin and reduce dose in patients with renal impairment.

References

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GASTROENTEROLOGY

Dyspepsia, acute

Drugs of choice

Acute pain relief

	aluminum hydroxide/ magnesium hydroxide double strength suspension	30 mL, single dose	$0.56/dose
AND	lidocaine 2% oral liquid[1]	5–15 mL, single dose	$0.26–0.77/dose

If response to the above is inadequate

	cimetidine	300 mg	$0.09/dose
or	ranitidine	150 mg, oral	$0.40/dose (oral)
	or	50 mg, I.M. or I.V.	$2.55/dose (I.M. or I.V.)
or	nizatidine	150 mg	$0.53/dose
or	famotidine	20 mg, oral or I.V.	$0.59/dose (oral) $3.73/dose (I.V.)

Additional instructions and notes

- Other antacids can be substituted for aluminum hydroxide/magnesium hydroxide.
- Patients taking NSAIDs should be advised to discontinue these agents.
- The above are temporary measures aimed at relieving the acute pain. Depending on the circumstances, further investigation may be appropriate.[2]

References

1. Welling LR, Watson WA. The emergency department treatment of dyspepsia with antacids and oral lidocaine. *Ann Emerg Med* 1990;19:785-8.
2. van Zanten SJOV, Flook N, Chiba N, Armstrong D, Barkun A, Bradette M, et al. An evidenced-based approach to the management of dyspepsia in the era of *Helicobacter pylori*. *CMAJ* 2000;162 (suppl 12):S1-23.

GASTROENTEROLOGY

Esophageal foreign bodies

Drugs of choice[1]

Endoscopy is the procedure of choice for treating this problem. When endoscopy is unavailable and the foreign body is in the lower esophagus

	glucagon[1,2]		
	Adults and children >20 kg	1–2 mg, I.V. or I.M.	$24.38–48.76/dose
	Children <20 kg	0.5–1 mg, I.V. or I.M.	$12.19–24.38/dose

Second-line therapies

	nitroglycerin[3]	0.4 mg spray every 5 min x 3	$0.06/spray
or	nifedipine[4]	10 mg, sublingual (pierce capsule)	$0.19/dose
or	diazepam[2]	5–10 mg, I.V.	$0.37–0.74/dose
or	carbonated beverages[5]	100 mL, consumed as quickly as possible	

Additional instructions and notes

- Despite anecdotal evidence of the effectiveness of glucagon and diazepam, a double-blind study showed that the combination of these agents was no more effective than placebo.[6]
- In a double-blind, placebo-controlled study, glucagon was no better than placebo in dislodging coins from the esophagus of children.[7]
- As glucagon affects smooth muscle only, it is effective only in the lower esophagus.
- The combination of glucagon and effervescent agents has been reported to be successful.[8]
- Eighty percent of foreign bodies occur in the pediatric age group; coins are the most common impacted object. In adults, pieces of meat and bones are usually involved.
- Controversy exists regarding the use of a Foley catheter for removing upper esophageal foreign bodies because there is no direct control of the object.
- The use of meat tenderizers to remove pieces of meat is not recommended.
- Patients with sharp-edged or pointed foreign bodies should be evaluated with endoscopy.
- Patients with alkaline button batteries lodged in the distal esophagus require urgent endoscopy.

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GASTROENTEROLOGY

Hemorrhoids

Drugs of choice[1]

1. Internal hemorrhoids, first or second degree

   Bulk laxative

	psyllium	3.4 g (1 rounded tsp) in 240 mL liquid, once daily	$0.16/day

   AND

   Stool softener

	docusate sodium	100 mg, once daily to t.i.d.	$0.04–0.12/day
or	docusate calcium	240 mg, once daily	$0.13/day

2. External hemorrhoids

   If hemorrhoids are not thrombosed, use all of the above plus over-the-counter creams or suppositories

zinc sulfate		0.5% ointment	$1.17/15 g
	or	suppository	$0.17/suppository

Additional instructions and notes

- Although bulk laxatives are widely used, there is no objective evidence for their effectiveness.[2]
- Avoid the use of hydrocortisone-containing compounds as studies support their use and some research indicates that they may be harmful.
- Patients should be encouraged to drink 6–8 cups of water daily and avoid straining at stool.
- Thrombosed hemorrhoids must be deroofed and the clot removed.

References

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GASTROENTEROLOGY

Nausea–vomiting

Drugs of choice

1. Nonmotion sickness, nonvestibular [1,2]

metoclopramide			
Adults		10–20 mg, I.M. or I.V., q6h prn	$2.10–4.20/dose
Children		0.15 mg/kg, I.M. or I.V., q6h prn	$0.03/kg per dose
or prochlorperazine			
Adults		10 mg, I.M. or I.V., q6h prn	$0.99/dose
	or	5–10 mg, rectal, t.i.d. to q.i.d. prn	$0.83/10-mg suppository
Children		0.13 mg/kg, I.M., q6h prn	$0.01/kg per dose
	or	2.5 mg, rectal, once daily to t.i.d.	$0.83/10-mg suppository

2. Breakthrough chemotherapy-induced nausea and vomiting[3]

Adults				
	lorazepam	1–2 mg sublingual, I.M. or I.V., q6h prn	$0.10–0.16/dose (sublingual) $0.53–$1.06/dose (I.M. or I.V.)
or	prochlorperazine	5–20 mg, I.M. or I.V.	$0.50–0.99/dose
	or	25 mg, rectal, q12h prn	$0.83/10-mg suppository
or	haloperidol	2.5–5 mg, I.M. or I.V., q6h prn	$1.24–2.49/dose
or	metoclopramide	10–20 mg, I.M. or I.V., q2h–q4h prn	$2.10–4.20/dose
or	droperidol	2.5–5 mg, I.M. or I.V., q6h prn	$2.63–5.25/dose
or	dexamethasone	10–20 mg, I.V., q4h–q6h, prn	$4.22–8.45/dose
Children			
	chlorpromazine	0.55 mg/kg, I.V., q6h–q8h prn	$0.01/kg per dose
	or	1.1 mg/kg, rectal, q6h–q8h prn dose (if age <5 years or weight <22 kg, then maximum dose 40 mg)	$0.02/kg per dose
or	lorazepam	0.05 mg/kg, sublingual, I.M. or I.V., q8h–q12h prn	$0.08/0.5-mg sublingual tablet $0.03/kg per dose I.M. or I.V.
or	methylprednisolone	0.5–1 mg/kg, I.V., q12h prn dose	$0.06–012/kg per

	or	dexamethasone	5–10 mg/m^2 body area, I.V., per q12h prn	$2.11–4.22/$m^2$ dose

Second-line therapies

Nonmotion sickness, nonvestibular

	dimenhydrinate			
	Adults		50 mg, I.M. or I.V., q4h prn	$0.67/dose
		or	50–100 mg, rectal, t.i.d. to to q.i.d. prn	$0.50/50-mg suppository
	Children 8–12 years		25–50 mg, I.M. or I.V., q6h prn	$0.33–0.67/dose
		or	25–50 mg, rectal, b.i.d. to t.i.d. prn	$0.50/50 mg suppository
	Children 6–7 years		25 mg, I.M. or I.V., q6h prn	$0.33/dose
		or	12.5–25 mg, rectal, b.i.d. to t.i.d.	$0.50/50-mg suppository
	Children 2–5 years		12.5–25 mg, I.M. or I.V., q6h prn	$0.17–0.33/dose
		or	12.5–25 mg, rectal, b.i.d. to t.i.d.	$0.50/50-mg suppository
or	haloperidol			
	Adults		2.5–5 mg, I.M. or I.V., q6h prn	$1.24–2.49/dose
	Children		20–50 µg/kg, I.M. or I.V., q6h prn	$0.01–0.02/kg per dose
or	droperidol			
	Adults		2.5–5 mg, I.M. or I.V., q6h prn	$2.63–5.25/dose
	Children		20–50 µg/kg, I.M. or I.V., q6h prn	$0.02–0.05/kg per dose

To blunt the akathisia associated with prochlorperazine[4]

	diphenhydramine		
	Adults	50 mg, I.V.	$3.00/dose

Additional instructions and notes

- Antihistamines, such as promethazine, are only effective for nausea and vomiting associated with motion sickness and, possibly, pregnancy.
- Administering prochlorperazine over 15 min does not prevent akathisia.[5]

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GASTROENTEROLOGY

Upper gastrointestinal hemorrhage

Drugs of choice

1. Variceal bleeding[1]

   Supportive therapy and sclerotherapy

2. Nonvariceal bleeding

   Supportive therapy and endoscopy

Second-line therapies

Variceal bleeding, if sclerotherapy is unavailable or will be delayed

octreotide[1–5]	50 μg, I.V. bolus; then 25 μg/h, I.V.	$4.71/dose $2.36/h

Additional instructions and notes

- Controlled trials have not shown any benefit from intravenous vasopressin[5] or oral antacids.[6]
- Proton pump inhibitors may improve outcome in acute peptic ulcer bleeding, but the available clinical evidence remains inconsistent.[7]
- Octreotide may have a role in peptic ulcer bleeding, but further research is necessary.[8]
- Intravenous H2 antagonists have no role in bleeding gastric ulcers.[9]

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GASTROENTEROLOGY

Worms, intestinal

Drugs of choice[1]

1. Pinworm (*Enterobius vermicularis*)[2]

	mebendazole		
	Adults and children >10 kg	100 mg, single dose; repeat in 2 weeks	$2.91/dose
	Children <10 kg	50 mg, single dose; repeat in 2 weeks	$1.46/dose
or	pyrantel pamoate	11 mg/kg, single dose (maximum 750 mg); repeat in 2 weeks	$0.05/kg per dose

2. Ascariasis (*Ascaris lumbricoides*)[3]

	pyrantel pamoate	11 mg/kg, single dose (maximum 750 mg)	$0.05/kg per dose
or	mebendazole[4]		
	Adults and children >10 kg	100 mg, b.i.d. x 3 days	$17.47/3 days
	or	500 mg, one dose	$14.56/dose
	Children <10 kg	50 mg, b.i.d. x 3 days	$8.73/3 days

3. Whipworm (*Trichuris trichiura*)[5]

	mebendazole[4]		
	Adults and children >10 kg	100 mg, b.i.d. x 3 days	$17.47/3 days
	or	500 mg, one dose	$14.56/dose
	Children <10 kg	50 mg, b.i.d. x 3 days	$8.73/3 days

Additional instructions and notes

- In cases of pinworm, the entire family should be treated.
- Pinworm eggs can survive for up to 2 weeks on clothing and bedding. Eggs often remain under the fingernails. Re-infection by auto-infection is common.
- Mebendazole should not be used in the first trimester of pregnancy or in children under 6 months of age.
- Pyrantel pamoate can be used in pregnancy and in children under 6 months of age.
- To verify clearance of whipworm and ascariasis, follow-up by checking stool for eggs and parasites.

References

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3. Tietze PE, Tietze PH. The roundworm, *Ascaris lumbricoides*. *Prim Care* 1991;18:25-41.

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GENITOURINARY SYSTEM

Colic, renal

Drugs of choice

1.	Opioid analgesics		
	morphine	2.5–5 mg, I.V., every 10–15 min until pain is controlled; repeat q2h–q4h	$0.06–0.12/dose
or	meperidine	25–50 mg, I.V., every 10–15 min until pain is controlled; repeat q2h–q4h	$0.34–0.68/dose
2.	Parenteral NSAIDs[1–3]		
	ketorolac	30 mg, I.V., repeat in 30 min if necessary	$3.63/dose

Additional instructions and notes

- Currently, no trials demonstrate the usefulness of hyoscine butylbromide (Buscopan®) for this problem.
- NSAIDs are a better choice than opioids when there is concern about respiratory depression association with opioids.

References

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GENITOURINARY SYSTEM

Epididymitis

Drugs of choice[1–3]

1.	Nonsexually transmitted		
	ofloxacin	300 mg, b.i.d. x 10 days	$34.05/10 days
2.	Sexually transmitted		
	cefixime	400 mg, single dose	$3.09/dose
or	ceftriaxone	250 mg, I.M., single dose	$10.75/dose
	AND to either cefixime or ceftriaxone, add		
	tetracycline	500 mg, q.i.d. x 10 days	$1.52/10 days
or	doxycycline	100 mg, b.i.d. x 10 days	$11.72/10 days
or	azithromycin	1 g, single dose	$19.73/dose
3.	Severe infection		
	ampicillin		
	Adults	2 g, I.V., q.i.d.	$21.20/day
	Children	50 mg/kg, I.V., q.i.d.	$0.76/kg per day
	AND		
	gentamicin		
	Adults	5–7 mg/kg, I.V., once daily	$0.25–0.35/kg per day
	Children	7.5 mg/kg, I.V., once daily	$0.37/kg per day

Second-line therapies[1–3]

1.	Nonsexually transmitted		
	trimethoprim/sulfamethoxazole		
	Adults	160 mg/800 mg, b.i.d. x 10 days	$2.44/10 days
	Children	4 mg/20 mg per kg per day, divided b.i.d. x 10 days	$0.10/kg for 10 days
2.	Sexually transmitted		
	ofloxacin[4]	400 mg, single dose	$1.70/dose
or	ciprofloxacin	500 mg, single dose	$2.51/dose
	AND to either ofloxacin or ciprofloxacin, add		
	tetracycline	500 mg, q.i.d. x 10 days	$1.52/10 days

or	doxycycline	100 mg, b.i.d. x 10 days	$11.72/10 days
or	azithromycin	1 g, single dose	$19.73/dose

Additional instructions and notes

- Nonsexually transmitted epididymitis is usually associated with either recent genitourinary tract manipulation or underlying urologic pathology.
- Boys with acute scrotal pain should be assessed for testicular torsion. Acute epididymitis is the cause of pain in only 15–20% of cases and most of these are idiopathic.
- Public health departments in some provinces provide cefixime, ceftriaxone, doxycycline and tetracycline free of charge.
- There is no clinical difference between tetracycline and doxycycline. Doxycycline may be taken twice daily, but at greater expense.

References

1. Laboratory Centre for Disease Control. *Canadian STD guidelines*. 1998 ed. Ottawa: Health Canada; 1998.
2. Drugs for sexually transmitted infections. *Med Lett Drugs Ther* 1999;41:85-90.
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GENITOURINARY SYSTEM

Priapism

Drugs of choice[1,2]

1. Low-flow priapism

   Related to sickle cell disease

	supplemental oxygen		
AND	sodium chloride 0.9%		
	Adults	250–300 mL/h	
	Children	3–4 mL/kg per h	
AND	sodium bicarbonate	50 mmol (in 50-mL ampoule) for each L of sodium chloride	$3.27/dose
AND	Analgesia — see *Sickle-cell crisis*		
AND	Erythrocyte exchange transfusion		

   Related to oral or injected medications or idiopathic (veno-occlusive)

phenylephrine (10 mg [1 mL] in 1 L of 0.9% sodium chloride)	5–10 mL, intracorporeal injection, every 5–10 min	$1.75/10-mg vial

2. High-flow (arterial) priapism (usually secondary to previous injury to groin or straddle trauma)

   Management on an elective basis

Additional instructions and notes

- If a diagnosis of low-flow versus high-flow priapism cannot be made based on history, aspirate blood from the penis and send it for blood gas analysis. The following blood gas values indicate low-flow priapism: pH <7.25, pO_2 <30 mmHg, pCO_2 >60 mmHg. Values characteristic of arterial blood indicate high-flow priapism.
- In low-flow priapism, if detumescence does not occur in 24 h, there is a high risk of permanent fibrosis and erectile dysfunction. Therefore, if the above measures are unsuccessful, surgical consultation should be sought. The risk of these complications in high-flow priapism is minimal.

References

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GENITOURINARY SYSTEM

Prostatitis

Drugs of choice[1–3]

1.	Acute bacterial		
	trimethoprim/ sulfamethoxazole	160 mg/800 mg, b.i.d. x 30 days	$7.33/30 days
or	ofloxacin[4,5]	300 mg, b.i.d. x 30 days	$102.15/30 days
or	ciprofloxacin[6]	500 mg, b.i.d. x 30 days	$150.35/30 days
2.	Severe infection (fever, chills, urinary retention)		
	ampicillin	2 g, I.V., q.i.d.	$5.30/dose
AND	gentamicin	5–7 mg/kg, I.V., once daily	$0.25–0.35/kg per day

Additional instructions and notes

- If the patient is experiencing painful urinary retention, urethral catheterization should be avoided. Suprapubic needle aspiration is much safer and more comfortable than a catheter for initial management.
- General support measures for outpatients should include bed rest, analgesics, antipyretics, hydration and stool softeners.

References

1. Laboratory Centre for Disease Control. *Canadian STD guidelines*. 1998 ed. Ottawa: Health Canada; 1998.
2. Nickel JC. Prostatitis: evolving management strategies. *Urol Clin North Am* 1999;26:737-51.
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GENITOURINARY SYSTEM

Urethritis

Drugs of choice[1,2]

Treat for gonorrhea and chlamydia

1.	Adults and children ≥9 years		
	cefixime	400 mg, single dose	$3.09/dose
	AND one of		
	tetracycline	500 mg, q.i.d. x 7 days	$1.06/7 days
or	doxycycline	100 mg, b.i.d. x 7 days	$8.20/7 days
or	azithromycin[3]	1 g, single dose	$19.73/dose
2.	Children <9 years		
	cefixime	8 mg/kg, single dose	$0.13/kg per dose
	AND one of		
	erythromycin base	20 mg/kg, b.i.d. x 7 days	$0.29/kg per 10 days (80 mg/mL) $0.42/kg per 10 days (40 mg/mL)
or	azithromycin	12–15 mg/kg, single dose	$0.45–0.57/kg per dose

Second-line therapies[1]

Adults

	ofloxacin	400 mg, single dose	$1.70/dose
or	ciprofloxacin	500 mg, single dose	$2.51/dose
or	ceftriaxone	250 mg, I.M., single dose	$10.75/dose
	AND to one of the above add either		
	erythromycin base	500 mg, q.i.d. x 7 days	$2.54/7 days
or	ofloxacin[4]	300 mg, b.i.d. x 7 days	$23.83/7 days

Additional instructions and notes

- Public health departments in some provinces provide cefixime, ceftriaxone, doxycycline, erythromycin and tetracycline free of charge.
- There is no clinical difference between tetracycline and doxycycline. Doxycycline may be taken twice daily, but at greater expense.

- Other erythromycins, including modified-release preparations, may be 2–7 times more expensive than erythromycin base.

References

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GENITOURINARY SYSTEM

Urinary tract infection in adults

Drugs of choice

1. For uncomplicated cystitis or pyelonephritis[1–4]

Cystitis

	trimethoprim/ sulfamethoxazole[1–6]		
	Women	160 mg/800 mg, b.i.d. x 3 days	$0.73/3 days
	Men	160 mg/800 mg, b.i.d. x 7 days	$1.71/7 days
or	trimethoprim[1,2]		
	Women	100 mg, b.i.d. x 3 days	$1.13/3 days
	Men	100 mg, b.i.d. x 7 days	$2.65/7 days
or	nitrofurantoin[1]		
	Women	100 mg, b.i.d. x 7 days	$1.39/3 days

Pyelonephritis

	trimethoprim/ sulfamethoxazole[1–6]		
	Women and men	160 mg/800 mg, b.i.d. x 10–14 days	$2.43/10 days

2. In pregnancy[2,7]

Cystitis

	trimethoprim/ sulfamethoxazole	160 mg/800 mg b.i.d. x 7 days	$1.71/7 days
or	nitrofurantoin	100 mg, b.i.d. x 7 days	$3.24/7 days
or	cephalexin	500 mg, b.i.d. x 7 days	$4.18/7 days
or	amoxicillin/clavulanate	250 mg/125 mg, t.i.d. x 7 days	$18.33/7 days

Pyelonephritis[8]

	cefazolin	1 g, I.V., q8h	$8.40/day
or	ampicillin	2 g, I.V., q6h	$21.20/day
or	ceftriaxone	1 g, I.V., once daily	$34.00/day
	AND, with one of the above		
	gentamicin	5–7 mg/kg, I.V. once daily	$0.25–0.35/kg per day

3. Pyelonephritis with signs of septicemia[2]

	i. ampicillin	2 g I.V., q6h	$21.20/day
	and		
	gentamicin	5–7 mg/kg, I.V., once daily	$0.25–0.35/kg per day
or	ii. cefotaxime	1 g, I.V., q8h	$27.54/day

or	iii. ceftriaxone	1 g, I.V., once daily	$34.00/day

Second-line therapies

1. Cystitis and mild to moderate pyelonephritis[1–4]

Cystitis

	amoxicillin/clavulanate[1,3]		
	Women	250 mg/125 mg, t.i.d. x 3 days	$7.86/3 days
	Men	250 mg/125 mg, t.i.d. x 7 days	$18.33/7 days
or	ofloxacin		
	Women	200 mg, b.i.d. x 3 days	$8.69/3 days
	Men	200 mg, b.i.d. x 7 days	$20.29/7 days
or	norfloxacin		
	Women	400 mg, b.i.d. x 3 days	$9.15/3 days
	Men	400 mg, b.i.d. x 7 days	$21.36/7 days
or	ciprofloxacin		
	Women[9]	250 mg, b.i.d. x 3 days	$13.33/3 days
	Men	500 mg, b.i.d. x 7 days	$35.08/7 days

Pyelonephritis

	amoxicillin/clavulanate[1,3]		
	Women and men	250 mg/125 mg, t.i.d. x 10–14 days	$26.19/10 days
or	ofloxacin		
	Women and men	200 mg, b.i.d. x 10–14 days	$28.98/10 days
or	norfloxacin		
	Women and men	400 mg, b.i.d. x 10–14 days	$30.51/10 days
or	ciprofloxacin		
	Women[10]	500 mg, b.i.d. x 7 days	$35.08/7 days
	Men	500 mg, b.i.d. x 10–14 days	$50.12/10 days

2. Pyelonephritis with signs of septicemia and penicillin allergy[1,2]

ciprofloxacin	200–300 mg, I.V., q12h	$33.00–49.50/day

Additional instructions and notes

- These regimens are for uncomplicated infection in which there is no evidence of obstruction, prostatic disease, underlying renal disease or recent intervention (e.g., cystoscopy or prostate surgery).
- In complicated cases of cystitis in women (pregnancy, diabetes, known urinary tract abnormality, recent intervention, recent antibiotic use, recent urinary tract infection, use of diaphragm) treat for 7 days.
- Fluoroquinolones are contraindicated during pregnancy.
- It is safe to use trimethoprim/sulfamethoxazole in pregnancy until near term.
- Fluoroquinolones are an acceptable first-line choice when resistance to trimethoprim and trimethoprim/sulfamethoxazole is above 10–20%.
- A positive culture and pyuria are common in the institutionalized elderly and do not

support a diagnosis of symptomatic urinary tract infection in the absence of genitourinary tract symptoms. Asymptomatic bacteriuria in the institutionalized elderly should not be treated.[11]

- Most patients with catheter-associated urinary tract infections are asymptomatic. Symptoms referable to the urinary tract, fever or peripheral leukocytosis have little predictive value for the diagnosis of catheter-associated urinary tract infection.[12] In addition, pyuria should not be used as the sole criterion for obtaining a urine culture in a patient with a catheter.[13] Catheter-associated urinary tract infection should only be treated in patients who are septic and have no other demonstrable site of infection.

References

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HEMATOLOGY

Sickle-cell crisis

Drugs of choice[1]

1. Supplemental oxygen

AND

2. Fluid replacement

	oral		
or	sodium chloride 0.45% + dextrose 5% in water		
	Adults	250–500 mL/h, I.V.	
	Children	6–8 mL/kg per h, I.V.	

AND

3. Analgesia

morphine		
Adults	5–10 mg, I.V., q1h or more frequently	$0.12–0.24/dose
Children[2]	0.1 mg/kg, I.V. over 30 min; then 5–40 µg/kg per h by infusion or more frequently	$0.002/kg per 30 min (15 mg/mL)
Alternative for children[3]		
morphine, controlled release	1.9 mg/kg, q12h	$0.04/kg per dose
AND for breakthrough pain		
morphine, immediate release	0.4 mg/kg, q2h–q3h	$0.01/kg per dose

Second-line therapies

sodium cromoglycate[4] inhalation	or	20 mg (1 spincap) 10.4 mg (4 puffs) each nostril	$0.46/spincap $13.76/bottle

For analgesia in those intolerant of morphine

meperidine		
Adults	50–100 mg, I.V., q1h or more frequently	$0.68–0.72/dose

For priapism associated with sickle-cell disease, see *Priapism*.

Additional instructions and notes

- Antihistamines may be necessary when morphine is used.
- Level of fluid replacement in children should be lower (3–4 mL/kg) in a chest crisis where overloading with fluid is detrimental.

References

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HEMATOLOGY

Venous thromboembolism — treatment

Drugs of choice[1]

Low-molecular-weight heparins (LMWHs)

	nadroparin	171 IU/kg, S.C., once daily x 5–10 days	$0.81/kg per 5 days
or	daltaparin	200 units/kg, S.C., once daily x 5–10 days	$1.50/kg per 5 days
or	enoxaparin	1.5 mg/kg, S.C., once daily x 5–10 days	$1.50/kg per 5 days
or	tinzaparin	175 units/kg S.C., once daily x 5–10 days	$2.80/kg per 5 days

AND, with any of the above

	warfarin	5–10 mg, once daily to start; then adust up or down until INR is within correct therapeutic range	$0.17–0.30/day

Additional instructions and notes

- Baseline measures for activated partial thromboplastin time (aPTT), international normalized ratio (INR) and complete blood count should be taken.
- Warfarin should be started on the same day as the LMWH.
- Discontinue LMWH when INR is >2.0 for 2 or more consecutive days. LMWHs must be used for a minimum of 5 days.
- There is no statistically significant different between LMWHs and unfractionated heparin in terms of effectiveness, incidence of major or minor bleeding or thrombocytopenia.
- While patients are using LMWH, they should avoid intramuscular injections, and taking NSAIDs or aspirin because of the risk of bleeding and hematomas.

Reference

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METABOLIC DISORDERS

Alcoholic ketoacidosis

Drugs of choice[1]

	sodium chloride 0.9%	500 mL/h x 4 h; then 250 mL/h until volume is replaced and ketoacidosis is corrected	
AND	dextrose 5% in water	150 mL/h until ketoacidosis corrected	

AND in patients with hypokalemia or acidemia and normokalemia

	potassium chloride	10 mEq/h, I.V.	$0.28/h

Second-line therapies

For patients suspected of chronic alcoholism

	thiamine	100 mg, I.V. or I.M.	$1.13/dose
	magnesium sulfate	2 g, I.V. over the first 2–3 h	$0.59/dose

Additional instructions and notes

- Even with pH as low as 6.95, sodium bicarbonate has not been needed.
- The total amount of potassium needed should be guided by successive potassium measurements and the level of acidosis.
- Saline alone does not correct the ketoacidosis as rapidly as dextrose and saline.[2]
- The routine use of phosphate is not recommended.
- Thiamine and magnesium should be given on an empiric basis to anyone suspected of being a chronic alcoholic. Thiamine should be given at the same time as glucose.

References

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METABOLIC DISORDERS

Diabetic ketoacidosis and hyperglycemic hyperosmolar nonketotic syndrome

Drugs of choice[1–4]

sodium chloride 0.9%

	Adults	2–3 L over first several hours; then switch to 0.45% normal saline at 250–500 mL/h to maintain a urine output of 50 mL/h	
	Children	10–20 mL/kg in first 1–2 h; then switch to 0.45% normal saline at a rate to maintain urine volume of 1–2 mL/kg per h	
AND	insulin, short acting		
	Adults	5–10 units/h, I.V., by constant infusion until blood glucose is 10–12 mmol/L	$0.08–0.16/h
	or	0.1 units/kg per h, I.V., by constant infusion until blood glucose is 10–12 mmol/L	$0.002/kg per h
	Children	0.1 units/kg per h, I.V., by constant infusion until blood glucose is 10–12 mmol/L	$0.002/kg per h

AND where normal renal function has been established

potassium chloride

Adults	20–40 mEq, I.V. in each L of fluid	$0.57–1.14/L
Children	0.6 mEq/kg, I.V. in each L of fluid	$0.02/kg per L

Second-line therapies

If pH < 7.0 consider

sodium bicarbonate (50 mmol in 50-mL ampoule)

Adults	50–100 mmol, I.V. in first L of fluid	$3.27–6.54/dose
Children	1–2 mmol/kg, I.V. over first 2 h	$0.07–0.13/kg per dose

Additional instructions and notes

- Administer potassium according to the following guidelines.[4]

	Initial potassium level	Treatment
Adults	>5.5 mEq/L	Do not give additional potassium, but recheck level in 2 h
	3.3–5.5 mEq/L	Give 20–30 mEq/h potassium and check level in 2 h

	<3.3 mEq/L	Give 40 mEq/h potassium and check level in 2 h
Children	>5.5 mEq/L	Do not give additional potassium, but recheck level in 1 h
	3.3–5.5 mEq/L	Give 30–40 mEq/h potassium and check level in 1 h
	<3.3 mEq/L	Give 40–60 mEq/h potassium and check level in 1 h

- Insulin adheres to the walls of glass and polyvinyl bottles and tubing, making administration of an exact amount difficult. To ensure delivery of the correct concentration, run approximately 10 units of the insulin infusion (or about the amount that would be infused in an adult in 1 h) through the tubing *before* beginning to infuse the patient.
- In children, after initial resuscitation, assume dehydration of 10% and administer 0.45% normal saline over the next 24 h to supply fluid replacement. Add to this amount, normal maintenance fluids.
- In children, cerebral edema complicating diabetic ketoacidosis is an unpredictable and often fatal, but potentially reversible, condition. Because there are no predictors for either its occurrence or its outcome, judicious fluid replacement and close monitoring of neurologic state and corrected sodium are required.
- When blood glucose level falls to about 10–15 mmol/L change intravenous fluid to 5% dextrose in water plus 0.45% sodium chloride.
- The insulin infusion should not be stopped until glucose level is below 10 mmol/L and the acidosis and ketosis are resolved.
- The value of an insulin bolus before beginning a regular insulin infusion is debatable.[5]
- It is usually not necessary to replenish phosphate.
- There is debate over whether it is necessary to give magnesium.
- The value of using bicarbonate in diabetic ketoacidosis is unclear.[6,7]
- The cause of the hyperglycemic crisis should be sought and treated.

References

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METABOLIC DISORDERS

Hypoglycemia

Drugs of choice[1,2]

Adults		
dextrose 50% in water	25–75 g (50–150 mL), I.V. bolus	
Children >3 years		
dextrose 50% in water	0.2–0.5 g/kg (2–5 mL/kg), I.V. over 3 min	
Children 1–3 years		
dextrose 25% in water	0.2–0.5 g/kg (2–5 mL/kg), I.V. over 3 min	
Children <1 year		
dextrose 10% in water	0.2–0.5 g/kg (2–5 mL/kg), I.V. over 3 min	

Second-line therapies[1,2]

Adults and children >20 kg		
glucagon	1 mg, S.C., I.M. or I.V., single dose	$24.38/dose
Children <20 kg		
glucagon	0.5 mg, S.C., I.M. or I.V., single dose	$12.19/dose

Additional instructions and notes

- Recovery of normal level of consciousness is slower after administration of glucagon than glucose. Some patients treated with glucagon may need additional treatment with glucose.
- Watch for recurrence of hypoglycemia, especially in patients taking oral hypoglycemic agents.

References

1. Collier A, Steedman DJ, Patrick AW, Nimmo GR, Matthews DM, MacIntyre CCA, et al. Comparison of intravenous glucagon and dextrose in treatment of severe hypoglycemia in an accident and emergency department. *Diabetes Care* 1987;10:712-5.
2. Patrick AW, Collier A, Hepburn DA, Steedman DJ, Clarke BF, Robertson C. Comparison of intramuscular glucagon and intravenous dextrose in the treatment of hypoglycaemia coma in an accident and emergency department. *Arch Emerg Med* 1990;7:73-7.

Rhabdomyolysis

Drugs of choice[1]

	sodium chloride 0.9%	500–1000 mL/h, I.V. to maintain a urine flow of 300 mL/h	
AND	sodium bicarbonate (50 mmol in 50-mL ampoule)	10 mmol/h, I.V.	$0.65/h

If urine volume drops below 300 mL/h add to each L of the above

	mannitol	10 g (50 mL of a 20% solution)	$4.44/dose

Additional instructions and notes

- Adjust the bicarbonate dose to maintain pH of urine >6.5.
- Avoid the use of calcium for asymptomatic hypocalcemia associated with rhabdomyolysis, because it may raise intracellular calcium levels, promoting further muscle injury.
- Patients must be assessed for hyperkalemia and treated appropriately. See *Hyperkalemia*.
- Therapy for the coagulopathy associated with this syndrome is directed at treatment of the underlying disease process.
- Aggressive fluid therapy should be started as early as possible.

Reference

1. Better OS, Stein JH. Early management of shock and prophylaxis of acute renal failure in traumatic rhabdomyolysis. *N Engl J Med* 1990;322:825-9.

METABOLIC DISORDERS

Thyroid storm

Drugs of choice[1]

1.	To block hormone synthesis		
	propylthiouracil	600–1000 mg initially; then 150 mg, q6h	$1.07–1.79/dose $1.16/day

AND

2.	To block the release of already-synthesized hormone		
	potassium iodide	130 mg, once daily	$0.64/day

AND

3.	To block the conversion of T_4 to T_3		
	dexamethasone	2 mg, I.V., q6h	$3.36/day

AND

4.	To block peripheral adrenergic hyperactivity		
	propranolol[2]	1–2 mg I.V., every 10–15 min until desired effect	$6.71–13.43/dose

AND

5.	For hyperpyrexia		
	acetaminophen	650 mg, q3h–q4h	$0.02/dose

Second-line therapies[1]

If nonselective beta-adrenergic blockers are contraindicated then use $beta_1$-selective beta-adrenergic blockers

esmolol	500 μg/kg, I.V. bolus; dose then 50–200 μg/kg per min	$0.95/kg per bolus $0.09–0.38/kg per min

Additional instructions and notes

- Aspirin should not be used for hyperpyrexia because it displaces thyroid hormone from thyroglobulin, thus theoretically increasing the pool of metabolically active hormone.
- Potassium iodine should not be used until at least 1 h has elapsed after the patient received propylthiouracil.
- Propylthiouracil is preferred over methimazole because it has the additional minor effect of inhibiting peripheral conversion of T_4 to T_3.

References

1. Burch HB, Wartofsky L. Life-threatening thyrotoxicosis: thyroid storm. *Endocrinol Metab Clin North Am* 1993;22:263-77.
2. Das G, Krieger M. Treatment of thyrotoxic storm with intravenous administration of propranolol. *Ann Intern Med* 1969;70:985-8.

MISCELLANEOUS INFECTIONS

Febrile neutropenia, chemotherapy induced

Drugs of choice

1.	piperacillin/tazobactam[1]		
	Adults	4.5 g, I.V., q8h	$63.60/day
	Children	50–75 mg/kg, I.V., q8h	$0.78–1.20/kg per day

AND, if neutrophil count below 100/mm^3 add

	gentamicin		
	Adults and children >10 years	4–6 mg/kg, I.V., once daily	$0.20–0.30/kg per day
	Children <10 years	7.5 mg/kg, I.V., once daily	$0.37/kg per day

2. For adults and children at low risk of developing a serious infection (see *Additional instructions and notes*)[2,3]

	ciprofloxacin	10 mg/kg, t.i.d. (maximum dose 750 mg)	$0.15/kg per day
AND	amoxicillin/clavulanate	15 mg/kg of amoxicillin, t.i.d. (maximum dose of amoxicillin 500 mg q8h)	$0.15/kg per day (125 mg amoxicillin in 5 mL) $0.18/kg per day (250 mg amoxicillin in 5 mL)

Second-line therapies

	meropenem		
	Adults	0.5–1 g, I.V., q8h	$70.92–141.84/day
	Children	10–20 mg/kg, I.V., q8h	$1.41–2.85/kg per day
or	imipenem/cilastatin[4]		
	Adults	500–1000 mg, I.V., q6h	$98.68–197.36/day
	Children	15–25 mg/kg, I.V., q6h	$2.96–4.92/kg per day

AND, if neutrophil count below 100/mm^3, add

	gentamicin		
	Adults and children >10 years	4–6 mg/kg, I.V., once daily	$0.20–0.30/kg per day
	Children <10 years	7.5 mg/kg, I.V., once daily	$0.37/kg per day

In patients who are allergic to penicillin and cephalosporins

	ciprofloxacin		
	Adults	400 mg, I.V., q8h	$99.00/dose

	Children	10 mg/kg, I.V., q8h	$2.49/kg per day
AND	vancomycin		
	Adults	1 g, I.V. over 1 h, q12h	$104.90/day
	Children	20 mg/kg, I.V. over 1 h, q12h	$2.10/kg per day

Additional instructions and notes

- Patients should be treated until their neutrophil count is greater than 500/mm^3 and they are afebrile.
- Children at low risk have been treated with ciprofloxacin.[3]
- Adults at low risk meet the following criteria: anticipated duration of neutropenia (absolute neutrophil count less than 0.5 (10^9/L) is less than 7 days; no comorbidity; adequate oral intake; malignancy responding to current therapy; medical assistance available or patient has access to medical assistance; patient able to care for most daily needs; able to adhere to instructions; good family support or caregiver.[5] These criteria were also applied to children in one study.[3]
- If patients are on prophylactic fluoroquinolones, then the appropriate cultures should be taken and the patient followed.

References

1. Rosen P, Barkin RM, Hockberger RS, Ling LJ, Markovchick VJ, Marx JA, editors. *Emergency medicine concepts and clinical practice*. 4th ed. St. Louis: Mosby; 1997.
2. Davis DD, Raebel MA. Ambulatory management of chemotherapy-induced fever and neutropenia in adult cancer patients. *Ann Pharmacother* 1998;32:1317-23.
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4. Deaney NB, Tate H. A meta-analysis of clinical studies of imipenem-cilastatin for empirically treating febrile neutropenic patients. *J Antimicrob Chemother* 1996;37:975-86.
5. Rotstein C, Bow EJ. Adult patient care plan: management of the febrile neutropenic cancer patient on an outpatient basis. *Can J Infect Dis* 2000;11(suppl D):27-33D.

MISCELLANEOUS INFECTIONS

Hepatitis B — postexposure prophylaxis

Drugs of choice[1]

1.	Unvaccinated patients		
	hepatitis B immune globulin	1 dose, I.M. (400 IU), as soon as possible after exposure (within 24 h, if possible and no later than 72 h)	$330.00/vial
AND	hepatitis B vaccine	1 mL, I.M., at 0, 1 and 6 months after exposure	$20.75/dose
2.	Previously vaccinated patients, but known inadequate response (anti-HB_s negative)		
	hepatitis B hyperimmune globulin	1 dose. I.M. (0.06 mL/kg), as soon as possible after exposure (within 24 h if possible and no later than 72 h)	$330.00/vial
AND	hepatitis B vaccine	1 mL, I.M., booster dose; consider giving second dose in 1 month if risk factors for lack of response are present (i.e., patient is a smoker, >50 years old, immunosuppressed, or obese)	$20.75/dose

Additional instructions and notes

- The risk of transmission from a percutaneous injury ranges from 2 to 40%.
- If results of testing for antibody to hepatitis B surface antigen are available within 24–72 h and are adequate (>10 mIU/mL), treatment can be avoided.
- Hepatitis B hyperimmune globulin and vaccine can be administered simultaneously, but they should be injected at different sites with separate needles and syringes.
- Vaccine should be administered into the deltoid muscle.
- If seroconversion has previously occurred after hepatitis B immunization, then protection against hepatitis B is assured.

Reference

1. Gerberding JL. Management of occupational exposures to blood-borne viruses. *N Engl J Med* 1995;332:444-51.

MISCELLANEOUS INFECTIONS

HIV — postexposure prophylaxis

Drugs of choice[1–3]

1. After massive percutaneous exposure to blood with a low HIV titre (e.g., deep injury with large-bore needle previously in source patient's vein or artery); exposure to a smaller amount of blood with a high HIV titre; mucous-membrane or high-risk skin exposure (high HIV titre in source patient; prolonged contact; extensive area involved; skin integrity compromised), recommend

	zidovudine	200 mg, t.i.d. x 4 weeks	$285.00/4 weeks
	AND		
	lamivudine	150 mg, b.i.d. x 4 weeks	$246.40/4 weeks
	AND, possibly		
	indinavir	800 mg, t.i.d. x 4 weeks	$452.47/4 weeks
or	nelfinavir	750 mg, t.i.d. x 4 weeks	$458.64/4 weeks

2. After massive percutaneous exposure to blood with high HIV titre, recommend

	zidovudine	200 mg, t.i.d. x 4 weeks	$285.60/4 weeks
	AND		
	lamivudine	150 mg, b.i.d. x 4 weeks	$246.40/4 weeks
	AND		
	indinavir	800 mg, t.i.d. x 4 weeks	$452.47/4 weeks
or	nelfinavir	750 mg, t.i.d. x 4 weeks	$458.64/4 weeks

3. After percutaneous exposure to smaller amount of blood with a low HIV titre, to fluid containing visible blood, or to other potentially infectious fluid (semen or vaginal, cerebrospinal, synovial, pleural, peritoneal, pericardial or amniotic fluid) or tissue, offer

zidovudine	200 mg, t.i.d. x 4 weeks	$285.60/4 weeks
AND		
lamivudine	150 mg, b.i.d. x 4 weeks	$246.40/4 weeks

4. After mucous-membrane or high-risk skin exposure to fluid containing visible blood or other potentially infectious fluid or tissue, offer

zidovudine	200 mg, t.i.d. x 4 weeks	$285.60/4 weeks

AND, possibly

lamivudine	150 mg, b.i.d. x 4 weeks	$246.40/4 weeks

5. After percutaneous, mucous-membrane or skin exposure to other body fluid (e.g., urine), do not offer prophylaxis

6. Sexual intercourse and sexual assault, see *Sexual assault — prophylaxis for potential infection*

Additional instructions and notes

- Choice of prophylaxis must be tailored to the individual, considering the nature of the injury and the virologic status of and drug therapy for the source. Expert advice should be sought.
- The average risk of acquiring HIV infection after percutaneous exposure to HIV-infected blood is only 0.3%. Postexposure prophylaxis with zidovudine can reduce this risk by as much as 79%.[2]
- Prophylaxis should be started within 1 to 2 h after exposure and no longer than 24 h after exposure.
- Zidovudine and lamivudine are now available as a combination product (Combivir®) which can be taken as one tablet twice daily.
- The actual risk of community exposure, e.g., through discarded needles, is unknown but is probably significantly less than risk in the health care setting, due to unknown source and time.[4]

References

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2. Public health service guidelines for the management of health-care worker exposures to HIV and recommendations for postexposure prophylaxis. *MMWR Morb Mortal Wkly Rep* 1998 May 15;47(RR-7):1-39.
3. Henderson DK. Postexposure chemoprophylaxis for occupational exposures to the human immunodeficiency virus. *JAMA* 1999;281:931-6.
4. Section 7: Management of accidental exposure to HIV. In: *Therapeutic guidelines for HIV/AIDS and related conditions*. Vancouver: BC Centre for Excellence in HIV/AIDS; Nov. 2000. [cfeweb.hivnet.ubc.ca/guide/open.html; accessed 15 Jul. 2001]

MISCELLANEOUS INFECTIONS

Influenza

Drugs of choice

In general supportive therapy, such as antipyretics and analgesics, is all that is necessary.

Second-line therapies

1. initial Treatment for influenza type A only.[1] (Treatment should continue until day 7 after the onset of signs and symptoms.)

amantadine		
Adults over 65	100 mg, once daily	$0.52/day
Adults and children >12 years	200 mg, once daily	$1.04/day
Children 9–11 years	100 mg, b.i.d.	$0.52/day
Children 1–8 years	4.4–8.8 mg/kg per day (maximum 150 mg/day)	$0.04–0.07/kg per day

2. Treatment for influenza types A and B

zanamivir[2,3]		
Adults and children ≥12 years	10 mg (2 inhalations), b.i.d. x 5 days	$35.00/5 days
or oseltamivir[4]		
Adults only	75 mg, b.i.d. x 5 days	$42.00/5 days

Additional instructions and notes

- Therapy with any of the above medications must be started within 36–48 h of the onset of symptoms.
- Zanamivir and oseltamivir have limited benefits and only reduce the time patients are symptomatic by about 0.7 to 1.5 days.[4–6]
- No drug has been shown to reduce mortality, rate of admission to hospital or other serious complications in high-risk patients.

References

1. Wintermeyer SM, Nahata MC. Rimantadine: a clinical perspective. *Ann Pharmacother* 1995;29:299-310.
2. Hayden FG, Osterhaus ADME, Treanor JJ, Fleming DM, Aoki FY, Nicholson KG, et al. Efficacy and safety of the neuraminidase inhibitor zanamivir in the treatment of influenza virus infections. *N Engl J Med* 1997;337:874-80.
3. Management of Influenza in the Southern Hemisphere Trialists (MIST) Study Group. Randomised trial of efficacy and safety of inhaled zanamivir in treatment of influenza A and B virus infections. *Lancet* 1998;352:1877-81.
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controlled trial. *JAMA* 2000;283:1016-24.
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6. Zanamivir: no noticeable progress against influenza. *Can Fam Physician* 2000;46:2003-8.

MISCELLANEOUS INFECTIONS

Meningitis — treatment

Drugs of choice[1–3]

Begin empirical therapy in the emergency department.

1. Bacterial meningitis

Children <6 weeks			
	ampicillin	50 mg/kg, I.V. (q12h during week 1 of life; q6h–q8h during weeks 2–4 of life; q6h during weeks 4–6)	$0.19/kg per dose
AND	cefotaxime	50–75 mg/kg, I.V. (q12h during week 1 of life; q6h–q8h during weeks 2–4 of life; q6h during weeks 4–6)	$0.60–0.90/kg per dose
Children 6 weeks–3 months			
	ampicillin	50 mg/kg, I.V. q6h	$0.76/kg per day
AND	vancomycin	15 mg/kg I.V., q6h	$3.16/kg per day
AND one of			
	cefotaxime	75 mg/kg, I.V. q6h	$3.60/kg per day
or	ceftriaxone	100 mg/kg, I.V. at diagnosis; repeat 100 mg/kg, I.V. at 12 h and 24 h; then 100 mg/kg, I.V. once daily	$3.40/kg per dose
Children >3 months–18 years			
	cefotaxime	75 mg/kg. I.V. q6h	$3.60/kg per day
or	ceftriaxone	100 mg/kg. I.V. at diagnosis; repeat 100 mg/kg, I.V. at 12 h and 24 h; then 100 mg/kg, I.V. once daily	$3.40/kg per dose
AND, with either of the above,			
	vancomycin	15 mg/kg, I.V., q6h	$3.16/kg per day
Adults 18–50 years			
	cefotaxime	2 g, I.V. q6h	$73.44/day
or	ceftriaxone	2 g, I.V. q12h	$134.00/day
Adults >50 years			
	cefotaxime	2 g I.V. q6h	$73.44/day
or	ceftriaxone	2 g I.V. q12h	$134.00/day
AND, with either of the above,			
	ampicillin	2 g, I.V. q4h	$31.80/day

2. Suspected *Herpes simplex*

acyclovir		
Adults and children >12 years	10 mg/kg, I.V., t.i.d.	$2.91/kg per day
Children <12 years	500 mg/m^2 body area, I.V., t.i.d.	$145.92/m^2 per day

Second-line therapies

1. For children with a contraindication to vancomycin or cephalosporin and adults with a contraindication to cephalosporin[1]

chloramphenicol		
Adults	25 mg/kg, I.V. (up to 4 g/day) q6h	$0.48/kg per day
Children	Consult infectious disease specialist	

2. When instituting initial empirical therapy in a hospital setting where >2% of *Streptococcus pneumoniae* are drug resistant[4]

vancomycin		
Adults	1 g, I.V., q12h	$104.90/day

Additional instructions and notes

- Children under 3 months of age must be treated for *Listeria monocytogenes* and *E. coli* infection with ampicillin until a microbiologic diagnosis is made.
- Because of the near eradication of *Hemophilus influenzae* in children and the uncertain benefits of dexamethasone in treating *S. pneumoniae*, no recommendations can be made for the use of dexamethasone. If a decision is made to administer dexamethasone, it should be given only to children older than 6 weeks and before or within 1 h of antibiotic administration.[1] It is unclear whether dexamethasone has any benefit in adults.[5]
- Treatment with antibiotics should be started as soon as possible. Do not wait for lumbar puncture and computed tomography scan.
- Avoid use of ceftriaxone in infants under 60 days of age, unless there is no clinical sign of jaundice as it can displace bilirubin from its serum binding sites.

References

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Meningococcal disease — prophylaxis

Drugs of choice[1,2]

	rifampin		
	Adults and children	10 mg/kg, b.i.d. x 2 days (maximum 600 mg/day)	$0.12/kg for 2 days (300-mg capsule) $0.16/kg for 2 days (150-mg capsule)
	Children <1 month	5 mg/kg,, b.i.d. x 2 days	$0.08/kg for 2 days (150-mg capsule) $0.08/kg for 2 days (300-mg capsule)
or	ceftriaxone[3]		
	Adults	5 mg/kg, I.M., single dose (maximum 250 mg)	$0.22/kg per dose
	Children <15 years	125 mg, I.M., single dose	$5.38/dose
or	ciprofloxacin		
	Adults	500 mg, single dose	$2.51/dose

Additional instructions and notes

- Prophylaxis is indicated for close contacts with the index case, i.e., those sharing the same residence; daycare, kindergarten and school contacts; sexual contacts; and others who may have been exposed to the patient's oral secretions. Prophylaxis is not routinely required for exposed health care workers.[4] The index case, unless treated with ceftriaxone or cefotaxime, should also receive prophylaxis. Throat cultures are not helpful in determining who warrants chemoprophylaxis.
- Because the safety of rifampin has not been established in pregnancy, ceftriaxone should be used for pregnant women.
- Avoid ceftriaxone in infants under 60 days of age unless there is no clinical sign of jaundice as it can displace bilirubin from its serum binding sites.

References

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2. Schwartz B, Al-Tobaiqi A, Al-Ruwais A, et al. Comparative efficacy of ceftriaxone and rifampin in eradicating pharyngeal carriage of group A *Neisseria meningitidis*. *Lancet* 1988;1:1239-42.
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MISCELLANEOUS INFECTIONS

Necrotizing fasciitis

Drugs of choice

Immediate surgical debridement is the first-line therapy, followed by

Aggressive fluid resuscitation with crystalloids

AND

Antibiotics[1]

penicillin G potassium		
Adults	5 million units, I.V., q4h	$158.52/day
Children	100,000 units/kg, I.V., q4h	$3.18/kg per day
AND		
gentamicin		
Adults and children >10 years	5–7 mg/kg, I.V. once daily	$0.25–0.35/kg per day
Children <10 years	7.5 mg/kg, I.V. once daily	$0.37/kg per day
AND		
metronidazole		
Adults	500 mg, I.V., q8h	$45.00/day
Children	15 mg/kg, I.V. loading dose; then 7.5 mg/kg, I.V., q8h	$0.45/kg per dose $0.69/kg per day

AND

Hyperbaric oxygen[2,3]

Second-line therapies

1. For patients who are allergic to penicillin[1]

clindamycin		
Adults	600 mg, I.V., q8h	$27.45/day
Children	10 mg/kg, I.V., q8h	$0.45/kg per day
AND		
gentamicin		
Adults and children >10 years	5–7 mg/kg, I.V., once daily	$0.25–0.35/kg per day
Children <10 years	7.5 mg/kg, I.V., once daily	$0.37/kg per day

2. immune globulin, human[4] 150 mg/kg, I.V., once daily

Additional instructions and notes

- Necrotizing fasciitis is a polymicrobial disease involving both aerobic and anaerobic bacteria.[5]

- Overall there is no apparent difference in mortality or length of stay between patients treated with isotonic crystalloid resuscitation and those treated with colloid resuscitation.[6]

References

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MISCELLANEOUS INFECTIONS

Rabies

Drugs of choice

1. Patient not previously vaccinated[1]

   Cleanse wound thoroughly with soap and water and irrigate with virucidal agent such as povidone-iodine.

   AND

immune globulin, rabies	20 IU/kg, I.M.; if possible, infiltrate full dose around the wound; give any remaining volume I.M. at site anatomically distant from site of vaccine administration	

   AND

rabies vaccine	1.0 mL, I.M. (deltoid area) on days 0, 3, 7, 14 and 28	$175.00/dose

2 Patients previously vaccinated

   Cleanse wound thoroughly with soap and water and irrigate with virucidal agent such as povidone-iodine.

   AND

rabies vaccine	1.0 mL, I.M. (deltoid area) on days 0 and 3	$175.00/dose

Additional instructions and notes

- For young children, inject rabies vaccine in outer aspect of thigh.
- Day 0 is the day the first dose of vaccine is administered.
- Rabies immune globulin may partially suppress active production of antibodies; therefore, no more than the recommended dose should be given.
- If rabies immune globulin was not given when vaccination was begun, it can be given up to the seventh day after administration of the first dose of vaccine. Beyond the seventh day, rabies immune globulin is not indicated, because an antibody response to cell culture vaccine is presumed to have occurred.

Reference

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MISCELLANEOUS INFECTIONS

Septic shock

Drugs of choice

1. Aggressive fluid resuscitation with crystalloids[1]

sodium chloride 0.9%	20–25 mL/kg initial bolus; further boluses as required	

Adjust resuscitation fluid to achieve a urine volume of 1 mL/kg per h, mean arterial pressure >70 mmHg or systolic pressure >90 mmHg, heart rate <120 beats/min and improved mental status and skin perfusion.

2. If blood pressure does not respond to crystalloids, use vasopressors[1]

	dopamine	10–25 μg/kg per min	$2.78/200-mg vial
or	norepinephrine	0.2–1.5 μg/kg per min	$4.29/4-mg vial

Adjust vasopressor doses to achieve same targets as for fluid therapy (above).

3. For patients with a low cardiac index after support and an adequate mean arterial pressure[1]

dobutamine	5–15 μg/kg per min	$31.33/250-mg vial

4. For all patients, antibiotics[2]

	Adults		
	ticarcillin/clavulanate	3.1 g, I.V. q4h	$59.40/day
or	piperacillin/tazobactam	3.375 g, I.V. q4h	$95.40/day
or	imipenem/cilastatin	0.5 g, I.V. q6h	$98.68/day
or	meropenem	1 g, I.V. q8h	$141.84/day
AND, if methicillin-resistant *Staphylococcus aureus* is a concern, add			
	vancomycin	1 g, I.V. q12h	$104.90/dose
	Children		
	cefotaxime	50 mg/kg, I.V. q8h	$1.80/kg per day
or	ceftriaxone	100 mg/kg, I.V. once daily	$4.30/kg per day
AND, if methicillin-resistant *Staphylococcus aureus* is a concern, add			
	vancomycin	20 mg/kg, I.V. q12h	$2.10/kg per day

Additional instructions and notes

- Overall there is no apparent difference in mortality or length of stay between patients treated with isotonic crystalloid resuscitation and those treated with colloid resuscitation.[3]
- There is no overall beneficial effect of corticosteroids.[4]
- Low doses of dopamine have no renal protective effect.[5]
- Infusion of inotropic doses of epinephrine causes lactic acidosis.[6]

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1. Task force of the American College of Critical Care Medicine. Practice parameters for hemodynamic support of sepsis in adult patients in sepsis. *Crit Care Med* 1999;27:639-60.
2. Gilbert DN, Moellering RC Jr, Sande MA. *The Sanford guide to antimicrobial therapy*. 29th ed. Hyde Park, VT: Antimicrobial Therapy Inc; 1999.
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4. Lefering R, Neugebauer EAM. Steroid controversy in sepsis and septic shock: a meta-analysis. *Crit Care Med* 1995;23:1294-303.
5. Australian and New Zealand Intensive Care Society (ANZICS) Clinical Trials Group. Low-dose dopamine in patients with early renal dysfunction: a placebo-controlled randomised trial. *Lancet* 2000;356:2139-43.
6. Day NPJ, Phu NH, Bethell DP, Mai NTH, Chau TTH, Hien TT, et al. The effects of dopamine and adrenaline infusions on acid-base balance and systemic haemodynamics in severe infection. *Lancet* 1996;348:219-23.

MISCELLANEOUS INFECTIONS

Spontaneous bacterial peritonitis

Drugs of choice[1]

	amoxicillin/clavulanate[2]	500 mg/125 mg, t.i.d. x 5 days	$20.02/5 days
or	cefotaxime	2 g, I.V., q12h	$37.12/day

If patient is not receiving quinolone prophylaxis or if hypersensitive to beta-lactam

	ofloxacin[3]	400 mg, b.i.d. x 5 days	$17.02/5 days

Additional instructions and notes

- The most common causative organisms in patients not receiving quinolone prophylaxis are Gram-negative aerobic bacteria from the family Enterobacteriaceae and non-enterococcal *Streptococcus* spp. In those receiving quinolone prophylaxis, causative organisms are Gram-positive cocci or quinolone-resistant Gram-negative bacilli.

References

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3. Navasa M, Follo A, Llovet JM, Clemente G, Vargas V, Rimola A, et al. Randomized, comparative study of oral oflocaxin versus intravenous cefotaxime in spontaneous bacterial peritonitis. *Gastroenterology* 1996;111:1011-7.

MISCELLANEOUS INFECTIONS

Toxic shock

Drugs of choice

1. Aggressive fluid resuscitation with crystalloids[1]

sodium chloride 0.9%	20–25 mL/kg initial bolus; further boluses as required	

Adjust resuscitation fluid to achieve urine volume of 1 mL/kg per h, mean arterial pressure >70 mm Hg or systolic pressure >90 mm Hg, heart rate <120 beats/min and improved mental status and skin perfusion.

2. If blood pressure does not respond to crystalloids, use vasopressors[1]

	dopamine	10–25 μg/kg per min	$2.78/200-mg vial
or	norepinephrine	0.2–1.5 μg/kg per min	$4.29/4-mg vial

Adjust vasopressor doses to achieve same targets as for fluid therapy (above).

3. For patients with a low cardiac index after support and an adequate mean arterial pressure[1]

dobutamine	5–15 μg/kg per min	$31.33/250-mg vial

4. If toxic shock is *Staphylococcus*-related[2]
Treat source of infection, e.g., drain abscess, remove tampon

AND

	cefazolin		
	Adults	1–2 g, I.V., q8h	$8.40–16.80/dose
	Children	10–15 mg/kg, I.V., q8h	$0.12–0.18/kg day
or	cloxacillin		
	Adults	2 g, I.V., q6h	$40.00/day
	Children	25–50 mg/kg, I.V., q6h	$0.48–1.00/kg per day

5. If toxic shock is *Streptococcus*-related[2]
Aggressive surgical drainage or debridement

AND

i. penicillin G potassium		
Adults and children >12 years	4 million units, I.V., q4h	$126.78/day
Children <12 years	100,000 units/kg, I.V., q4h	$3.18/kg per day

AND

clindamycin[3]

Adults	900 mg, I.V., q8h	$41.16/day
Children	15 mg/kg, I.V., q8h	$0.69/kg per day

or ii. In patients allergic to penicillin

erythromycin

Adults	1 g I.V., q6h	$93.32/day
Children	10 mg/kg, I.V., q6h	$0.92/kg per day

or azithromycin

Adults	500 mg, I.V., once daily	$20.00/day
Children	10 mg/kg, I.V., once daily	$0.40/kg per day

Second-line therapies

For *Streptococcus*-related toxic shock

immune globulin, human[4]	2 g, I.V., single dose

Additional instructions and notes

- Antibiotics have not been proven to be of benefit in *Staphylococcus*-related disease.
- Overall there is no apparent difference in mortality or length of stay between patients treated with isotonic crystalloid resuscitation and those treated with colloid resuscitation.[5]
- There is no overall beneficial effect of corticosteroids.[6]
- Low doses of dopamine have no renal protective effect.[7]
- Infusion of inotropic doses of epinephrine causes lactic acidosis.[8]

References

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MUSCULOSKELETAL SYSTEM

Bursitis and tendinitis

Drugs of choice[1]

Patients should be instructed to rest the injury by avoiding painful activities (not by immobilization), use passive range-of-motion exercises and apply local heat or ice packs.

Second-line therapies[2–6]

1. NSAIDs

	ibuprofen	400–600 mg, q.i.d. x 14 days	$2.08–2.60/14 days
or	naproxen	250–500 mg, b.i.d. x 14 days	$2.99–5.91/14 days
or	indomethacin	25–50 mg, t.i.d. x 14 days	$3.66–6.35/14 days

2. Steroid injection for tendinitis

	triamcinolone	2.5–40 mg (0.06–1 mL) at insertion of tendon	$0.43–6.82/dose
or	methylprednisolone	4–80 mg (0.1–2 mL) at insertion of tendon	$0.47–9.00/dose

Additional instructions and notes

- The dose of steroid depends on the site of injection.
- Steroid injections may not be superior to injections of lidocaine or saline for rotator cuff injury.[7,8]
- There is little evidence to support the use of any of the common interventions (NSAIDs, intra-articular and subacromial steroid injection, oral steroids, physiotherapy, manipulation under anesthesia, hydrodilatation and surgery) in managing shoulder pain. What evidence there is suggests that NSAIDs and subacromial steroid injections may be superior to placebo in improving range of abduction in rotator cuff tendinitis and the addition of steroid injection to NSAIDs does not seem to confer further benefits.[9]
- Triamcinolone may provide longer relief than methylprednisolone.
- In patients at high risk of gastrointestinal bleeding, consider using one of the cyclooxygenase-2 (COX-2) inhibitors instead of other NSAIDs.

References

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MUSCULOSKELETAL SYSTEM

Gout

Drugs of choice[1]

	NSAIDs		
	ibuprofen	400–600 mg, q.i.d.	$0.16–0.20/day
or	naproxen	250–500 mg, b.i.d.	$0.22–0.42/day
or	indomethacin	25–50 mg, t.i.d.	$0.27–0.45/day

Second-line therapies[1]

1. Systemic glucocorticoids have been used effectively in the management of polyarticular gout when colchicine or NSAIDs are contraindicated.

prednisone	25–50 mg, once daily x 3–5 days; then reduce by 5 mg/day	$0.10/50-mg tablet $0.01/5-mg tablet

2. Intra-articular glucocorticoids are useful in treating acute gout when only one joint or bursa is involved.

	triamcinolone	2.5–40 mg (0.06–1 mL), intra-articular	$0.43–6.82/dose
or	methylprednisolone	4–80 mg (0.1–2 mL), intra-articular	$0.47–9.00/dose

3. When NSAIDs are ineffective, contraindicated or not tolerated,

colchicine	500 µg, every h; continue until symptoms begin to settle, nausea, vomiting or vertigo develops, or maximum of 6 mg has been reached	$0.05/0.6-mg tablet $0.21/1-mg tablet

Additional instructions and notes

- There is no consensus on which of the available drugs is most effective in treating the acute event.
- The affected joint should be placed at rest during treatment.
- The earlier colchicine is administered, the better the response. If the attack is treated within the first few hours after onset, a favourable response may be expected in 90% of cases. If treatment is delayed beyond 12 h, a response will likely occur in about 75% of cases within 96 h.
- The dose of injected steroid depends on the size of the joint.
- All NSAIDs are equally efficacious if equipotent doses are used.
- Sudden lowering of serum uric acid level may precipitate or aggravate an acute episode; therefore, it is recommended that allopurinol not be introduced during an attack of gout,

and patients already using allopurinol should cease taking it.

- In patients at high risk of gastrointestinal bleeding, consider using one of the COX-2 inhibitors instead of other NSAIDs.

Reference

1. Emmerson BT. The management of gout. *N Engl J Med* 1996;334:445-51.

MUSCULOSKELETAL SYSTEM

Low back pain, acute

Drugs of choice[1–3]

	i. acetaminophen	650 mg, q.i.d.	$0.08/day
or	ii. NSAIDs		
	naproxen	250 mg, q.i.d.	$0.44/day
	or piroxicam	20–40 mg, once daily	$0.72–1.43/day
	or diflunisal	500 mg, b.i.d.	$1.04/day

Second-line therapies

	acetaminophen/caffeine/codeine		
or	ASA/caffeine/codeine		
	codeine dose	60 mg (2 30-mg tablets), q4h	$0.06/dose

If back pain is thought to be due to muscle spasm

benztropine[4]	2–4 mg, I.M., single dose	$4.73–9.46/dose

Additional instructions and notes

- NSAIDs do not appear to be effective in patients who have low back pain with sciatica or in patients with sciatica with nerve root symptoms.[2,3]
- Bed rest is no more effective than watchful waiting in patients with sciatica.[5]
- Most patients improve considerably during the first 4 weeks after seeking treatment, but 66–75% continue to experience at least mild pain at that time, and about 33% report continuing pain of at least moderate intensity.[6]
- Among patients with acute low back pain, continuing ordinary activities within the limits permitted by the pain leads to more rapid recovery than either bed rest or back-mobilizing exercises.[7]
- Adding codeine (60 mg) to acetaminophen (600 mg) produces a modest increase in pain relief. Smaller doses of codeine do not help.[8,9]
- In 6–10% of Caucasians and 2% of Southeast Asians codeine is ineffective.
- The only controlled trial comparing diazepam to placebo did not find any advantage to diazepam.[10]
- In patients at high risk of gastrointestinal bleeding, consider using one of the COX-2 inhibitors instead of other NSAIDs.

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MUSCULOSKELETAL SYSTEM

Neck pain, acute

Drugs of choice

There is some evidence to support the use of manual treatments (manipulation, massage and mobilization) in combination with drug treatment (analgesics and anti-inflammatories), education and physical methods (hydrotherapy, short-wave diathermy, traction and ultrasound) for short-term pain relief.[1]

Advising patients with acute whiplash neck injuries to continue engaging in their normal, pre-injury activities produces a better outcome during the first 14 days after injury than telling patients to take sick leave and immobilizing their necks.[2]

Second-line therapies

If neck pain is thought to be due to muscle spasm

benztropine[3]	2–4 mg, I.M. single dose	$4.73–9.46/dose

Additional instructions and notes

- In general, conservative treatments have not been studied in enough detail to assess efficacy or effectiveness adequately.

References

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MUSCULOSKELETAL SYSTEM

Strains and sprains

Drugs of choice[1–7]

NSAIDs

	ibuprofen	400–600 mg, q.i.d. x 7–14 days	$1.04–1.30/7 days
or	diflunisal	500 mg, b.i.d. x 7–14 days	$7.25/7 days
or	diclofenac	50 mg, t.i.d. x 7–14 days	$8.27/7 days

Second-line therapies

	acetaminophen/caffeine/codeine		
or	ASA/caffeine/codeine		
	codeine dose	60 mg (2 30-mg tablets), q4h	$0.06/dose

Additional instructions and notes

- Use ice, rest and elevation for first 1–2 days. After the first few days, restricted activity should replace rest.
- Ibuprofen was not found to be superior to placebo in one study.[4]
- Although only the above three NSAIDs have been studied, there is no reason to believe that any other NSAID would be any less effective.
- Adding codeine (60 mg) to acetaminophen (600 mg) produces a modest increase in pain relief. Smaller does of codeine do not help.[8,9]
- Ultrasound therapy is no better than placebo in the management of lateral ligament ankle injuries.[10]
- Early mobilization produces the best results in lateral ligament ankle injuries.[11]
- In patients at high risk of gastrointestinal bleeding, consider using one of the COX-2 inhibitors instead of other NSAIDs.

References

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NEUROLOGY

Alcohol-related seizures

Drugs of choice[1]

1. For the treatment of acute seizures

	diazepam	0.2 mg/kg, I.V. at 2 mg/min	$0.02/kg per dose
or	lorazepam	0.1 mg/kg, I.V. at 2 mg/min	$0.05/kg per dose

2. For the prevention of acute recurrent withdrawal seizures[2]

lorazepam	2 mg, I.V. over 1–2 min	$1.06/dose

Second-line therapies

Seizures in patients in whom intravenous access cannot be established

	diazepam	0.5 mg/kg, rectal (maximum dose 20 mg)	$0.04/kg per dose
or	midazolam	0.05–0.2 mg/kg, I.M.	$0.04–0.14/kg per dose

Additional instructions and notes

- Prevention of recurrent seizures was assessed only in the first 6 h following the initial seizure.
- Phenytoin is no better than placebo in preventing recurrent withdrawal seizures.[3]

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3. Chance JF. Emergency department treatment of alcohol withdrawal seizures with phenytoin. *Ann Emerg Med* 1991;20:520-2.

NEUROLOGY

Bell's palsy

Drugs of choice[1]

1. In patients at high risk of complete denervation (obvious asymmetry of the face and either no movement or only barely perceptible movement on the affected side)

acyclovir	400 mg, 5 times a day x 10 days	$86.44/10 days
AND		
prednisone	50 mg, once daily x 5 days; taper to 5 mg, once daily over next 5 days, then stop	$0.10/50-mg tablet $0.01/5-mg tablet

2 In patients who are unable to use aciclovir[2]

prednisone	50 mg, once daily x 5 days; taper to 5 mg, once daily over next 5 days, then stop	$0.10/50-mg tablet $0.01/5-mg tablet

Additional instructions and notes

- Prednisone, acyclovir or both should be used within 72 h. Other risk factors include age and diabetes.
- Evidence for the use of antivirals and corticosteroids is weak.[3,4]

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NEUROLOGY

Dystonic reaction

Drugs of choice[1]

benztropine		
Adults	1–2 mg, I.V.; then 1–2 mg b.i.d. x 3 days	$2.37–4.73/dose (I.V.) $0.05–0.10/3 days (oral)
Children	0.02–0.05 mg/kg, I.V.; then 0.02–0.05 mg/kg, b.i.d. x 3 days	$0.05–0.12/kg per dose (I.V.) $0.001/kg for 3 days (oral)

Second-line therapies[1]

diphenhydramine		
Adults	50–100 mg, I.V.; then 50–100 mg, t.i.d. to q.i.d. x 3 days	$3.00–6.00/dose (I.V.) $1.98–5.28/3 days (oral)
Children	1–2 mg/kg, I.V.; then 12.5–50 mg, t.i.d. to q.i.d. x 3 days	$0.06–0.12/kg per dose (I.V.) $0.50–2.64/3 days (oral)

Additional instructions and notes

- Some patients may require more than one dose of medication to control the reaction.
- Benztropine produces more rapid resolution of symptoms and has fewer side effects thandiphenhydramine.

Reference

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NEUROLOGY

Headache, cluster

Drugs of choice[1]

	oxygen[2]		6 L/min x 15 min via nonrebreathing face mask	
or	dihydroergotamine		0.25–1 mg, S.C., I.M. or I.V.; may be repeated after 1 h	$1.06–4.22/dose
or	sumatriptan[3]		20 mg (1 spray) in one nostril (may be repeated once in 24 h)	$12.95/spray
		or	6 mg, S.C., 1 dose (may be repeated once in 24 h)	$34.65/dose

Second-line therapies

If dihydroergotamine is used, then add

	metoclopramide	10 mg, I.V.	$2.10/dose

Additional instructions and notes

- Avoid dihydroergotamine and sumatriptan in patients with coronary artery disease.
- Avoid using dihydroergotamine in patients who have already used sumatriptan or one of the other triptans and vice versa.

References

1. Ekbom K. Treatment of cluster headache: clinical trials, design and results. *Cephalalgia* 1995(suppl 15):33-6.
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3. Wilkinson M, Pfaffenrath V, Schoenen J, Diener H-C, Steiner TJ. Migraine and cluster headache — their management with sumatriptan: a critical review of the current clinical experience. *Cephalalgia* 1995;15:337-57.

NEUROLOGY

Headache, migraine

Drugs of choice[1]

1.	Dopamine antagonists		
	prochlorperazine	10 mg, I.V.	$0.99/dose
or	chlorpromazine	0.1 mg/kg, I.V., repeat every 15 min x 3	$0.002/kg per dose
or	metoclopramide	10 mg, I.V.	$2.10/dose
2.	Serotonin receptor agonists		
	dihydroergotamine	1 mg, S.C., I.M. or I.V.	$4.22/dose
or	sumatriptan	6 mg, S.C.	$34.65/dose
	or	10–20 mg into one nostril	$12.95/spray
3.	Combination treatment		
	dihydroergotamine	1 mg, I.V.	$4.22/dose
	AND		
	metoclopramide	10 mg, I.V.	$2.10/dose

Second-line therapies

1.	Steroids		
	dexamethasone	10–20 mg, I.V.	$4.22–8.45/dose
2.	NSAIDs		
	ketorolac	30 mg, I.V. or I.M.	$3.63/dose
3.	haloperidol[2]	5 mg, I.V.	$2.49/dose
4.	For temporary relief while more definitive measures are undertaken		
	lidocaine 4% topical	0.5 mL in one nostril if headache unilateral and in both nostrils if bilateral	$0.06/nostril
5.	If all other agents have failed or are contraindicated		
	morphine	5.0–7.5 mg, I.V.	$0.12–0.18/dose
or	meperidine	50–75 mg, I.V.	$0.68–0.70/dose

Additional instructions and notes

- Because of variability in methodology, incomplete data and the lack of comparative trials, it is not possible to rank agents in terms of overall effectiveness.
- Recommendations for management are intended mainly for the patient with a severe or ultra-severe headache.

- As almost all studies have been conducted in adults, it is uncertain to what extent these recommendations can be applied to young migraine sufferers.
- Success rates for pain relief in the dopamine antagonist group appear to be highest with chlorpromazine, but no trials comparing variable doses exist to confirm its superiority.
- To prevent hypotension, patients should be given 1 L of normal saline before chlorpromazine is adminstered.
- Avoid dihydroergotamine and sumatriptan in patients with coronary artery disease. Avoid using dihydroergotamine in patients who have already used sumatriptan or one of the other triptans and vice versa.
- All dopamine antagonists are associated with a significant incidence of akathisia. Administering diphenhydramine or dimenhydrinate can blunt the akathisia.[3] The (peripheral) antiemetic effects of dimenhydrinate may be synergistic to the (central) antiemetic effects of the dopamine antagonists.

References

1. Ducharme J. Canadian Association of Emergency Physicians' guidelines for the acute management of migraine headache. *J Emerg Med* 1999;17:137-44.
2. Fisher H. A new approach to emergency department therapy of migraine headache with intravenous haloperidol: a case series. *J Emerg Med* 1995;13:119-22.
3. Vinson DR, Drotts DL. Diphenhydramine for the prevention of akathisia induced by prochlorperazine: a randomized, controlled trial. *Ann Emerg Med* 2001;37:125-31.

NEUROLOGY

Hepatic encephalopathy

Drugs of choice

	lactulose[1]	30–50 mL, q1h until diarrhea develops; then t.i.d. to q.i.d.	$0.44–0.72/dose

If inadequate response to lactulose[2]

	metronidazole	250 mg, t.i.d.	$0.09/day
or	tetracycline	500 mg, q.i.d.	$0.16/day

Second-line therapies

In cases of severe hepatic encephalopathy where there is a history of benzodiazepine use

flumazenil[3]	1 mg in 20 mL of 0.9% sodium chloride, I.V. over 3–5 min	$55.84/dose

Additional instructions and notes

- Relatively mild levels of hyponatremia, hypoglycemia, azotemia or dehydration will often have a disproportionate effect on cerebral function and require immediate correction.
- All drugs with a depressant effect on the central nervous system must be discontinued, and care should be taken not to prescribe even mild sedatives.
- Flumazenil should be started as soon as possible, ideally within 3 h of the onset of symptoms.
- If patients are unable to swallow, administer medications by nasogastric tube.

References

1. Blanc P, Daures J-P, Rouillon J-M, Peray P, Pierrugues R, Larrey D, et al. Lactitol or lactulose in the treatment of chronic hepatic encephalopathy: results of a meta-analysis. *Hepatology* 1992;15:222-8.
2. Podolsky DK, Chung RT. Cirrhosis and its complications. In: *Harrison'sonline*. McGraw-Hill. [www.harrisonsonline.com/server-java/Arknoid/amed/harrisons/co_chapters/ch299/ch299_p29.html; viewed Oct. 4, 2001]
3. Barbaro G, Di Lorenzo G, Soldini M, Giancaspro G, Bellomo G, Belloni G, et al. Flumazenil for hepatic encephalopathy grade III and IVa in patients with cirrhosis: an Italian multicenter double-blind, placebo-controlled, cross-over study. *Hepatology* 1998;28:374-8.

NEUROLOGY

Ischemic stroke and transient ischemic attacks

Drugs of choice

1. All patients

aspirin [1–3]	160–325 mg, once daily	$0.20–0.40/day

2. For patients with hypertension associated with acute stroke
   Hypertension associated with ischemic stroke should not be treated.[4,5]

3. For patients with hyperglycemia associated with acute stroke
   Treat with insulin to achieve euglycemia.[6]

Second-line therapies

For patients who cannot tolerate or are allergic to aspirin and for those with recurrent stroke or TIAs when taking aspirin

clopidrogel[7]	75 mg, once daily	$2.40/day

Additional instructions and notes

- Acute stroke, including a first-ever transient ischemic attack (TIA), should be managed as a medical emergency. Before initiating secondary preventive therapy, brain imaging (computed tomography or magnetic resonance imaging [MRI]) is necessary to rule out intracranial hemorrhage and other lesions that mimic stroke.
- Patients with a clearly defined time of onset of symptoms within 3 h of reaching the emergency department may be eligible for treatment with intravenous thrombolytics. Until it is clear that the benefits of using this therapy outweigh the risks, it should be restricted to use within formal research protocols or in monitored practice protocols that adhere to the National Institute of Neurological Disorders and Stroke eligibility criteria. Stroke thrombolysis should be limited to centres with appropriate neurological and neuroimaging resources.
- Hypotension should be evaluated and treated aggressively with intravenous fluids, inotropic agents or vasopressors as necessary to maintain organ perfusion and prevent extension of the infarct.
- Intravenous fluids should not include glucose, as hyperglycemia may worsen outcomes.[6]
- Early death, recurrent stroke or late death can be prevented in 1 patient with acute stroke by giving aspirin to 100 patients with acute stroke.[3]
- Trials do not support the routine use of either unfractionated heparin or low molecular weight heparins in ischemic stroke associated with atrial fibrillation.[1,8]
- Low doses of aspirin (80 mg/day) are also effective and used in some patients who are intolerant of higher doses of aspirin.[9]
- Further studies are necessary before the combination of aspirin and dipyridamole can be recommended.[10]

References

1. International Stroke Trial Collaborative Group. The international stroke trial (IST): a randomised trial of aspirin, subcutaneous heparin, both, or neither among 19435 patients with acute ischaemic stroke. *Lancet* 1997;349:1569-81.
2. Chinese Acute Stroke Trial (CAST) Collaborative Group. CAST: randomised placebo-controlled trial of early aspirin use in 20000 patients with acute ischaemic stroke. *Lancet* 1997;349:1641-9.
3. Pathansali R, Bath PM. IST and CAST: some answers but more questions. *J Hum Hypertens* 1998;12:73-4.
4. Powers WJ. Acute hypertension after stroke: the scientific basis for treatment decisions. *Neurology* 1993;43:461-7.
5. Lisk DR, Grotta JC, Lamki LM, Tran HD, Taylor JW, Molony DA, et al. Should hypertension be treated after acute stroke? A randomized controlled trial using single photon emission computed tomography. *Arch Neurol* 1993;50:855-62.
6. Wass CT, Lanier WL. Glucose modulation of ischemic brain injury: review and clinical recommendations. *Mayo Clin Proc* 1996;71:801-12.
7. CAPRIE Steering Committee. A randomised, blinded, trial of clopidrogel versus aspirin in patients at risk of ischaemic events (CAPRIE). *Lancet* 1996;348:1329-39.
8. Berge E, Abdelnoor M, Nakstad PH, Sandset PM. Low molecular-weight heparin versus aspirin in patients with acute ischaemic stroke and atrial fibrillation: a double-blind randomised study. *Lancet* 2000;355:1205-10.
9. Antiplatelet Trialists' Collaboration. Collaborative overview of randomised trials of antiplatelet therapy — I: Prevention of death, myocardial infarction, and stroke by prolonged antiplatelet therapy in various categories of patients. *BMJ* 1994;308:81-106.
10. Antiplatelet chemoprevention of occlusive vascular events and death. *Therapeutics Letter* 2000;37 Sep/Oct.

NEUROLOGY

Spinal cord injury

Drugs of choice

There is insufficient evidence to support the use of high-dose methylprednisolone within 8 h following an acute closed spinal cord injury as a treatment standard or as a guideline for treatment. Methylprednisolone is a treatment option for which there is weak clinical evidence.[1,2]

methylprednisolone[3]		
Initial dose	30 mg/kg, I.V., bolus over 15 min; then wait 45 min and begin maintenance dose	$3.52/kg per dose
Maintenance dose	5.4 mg/kg, I.V., per h x 23 h	$0.63/kg per dose

Additional instructions and notes

- There is no evidence to recommend this therapy in the pediatric population or in adults with multiple trauma, penetrating spinal cord injuries or medical comorbidities.
- Before beginning treatment with methylprednisolone, contact the receiving Spinal Unit to discuss therapy.

References

1. Hurlbert RJ. Methylprednisolone for acute spinal cord injury: an inappropriate standard of care. *J Neurosurg* 2000;93(1 suppl):1-7.
2. Coleman WP, Benzel E, Cahill DW, Ducker T, Geisler F, Green B, et al. A critical appraisal of the reporting of the national acute spinal cord injury studies (II and III) of methylprednisolone in acute spinal cord injury. *J Spinal Disord* 2000;13:185-90.
3. Bracken MD, Shepart MJ, Collins WF, Holford TR, Young W, Baskin DS, et al. A randomized, controlled trial of methylprednisolone or naloxone in the treatment of acute spinal-cord injury: results of the second national acute spinal cord injury study. *N Engl J Med* 1990;322:1405-11.

NEUROLOGY

Status epilepticus

Drugs of choice[1–4]

1. Benzodiazepine

diazepam		
Adults and children	0.2 mg/kg, I.V. at a rate of 2 mg/min (maximum dose 10 mg)	$0.02/kg per min
or lorazepam		
Adults	0.05–0.1 mg/kg, I.V., at a rate of 2 mg/min	$0.03–0.05/kg per dose
Children	0.05–0.1 mg/kg, I.V., over 1–2 min	$0.03–0.05/kg per dose

2. After either benzodiazepine

phenytoin		
Adults	20 mg/kg, I.V., at a rate of 50 mg/min	$0.65/kg per dose
Children <50 kg	20 mg/kg, I.V,. at a rate of 1 mg/kg per min	$0.65/kg per dose
or fosphenytoin		
Adults	20 mg/kg, I.V., at a rate of 150 mg/min (maximum dose 1 g)	$1.37/kg per dose
Children <50 kg	20 mg/kg, I.V., at a rate of 1–3 mg/kg per min	$1.37/kg per dose

3. If seizures continue

phenobarbital		
Adults	20 mg/kg, I.V., at a rate of 100 mg/min	$0.21/kg per dose
Children <50 kg	20 mg/kg, I.V., at a rate of 1 mg/kg per min	$0.21/kg per dose

Second-line therapies[2]

1. In patients where benzodiazepines and barbiturates are contraindicated because of underlying respiratory problems

phenytoin	doses as above

2. Patients in whom intravenous access cannot be established

diazepam		
Adults and children	0.5 mg/kg, rectal (maximum dose 20 mg)	$0.04/kg per dose

or	midazolam		
	Adults and children	0.05–0.2 mg/kg, I.M.	$0.04–0.14/kg per dose
	Children[5]	10 mg (2 mL), buccal	$0.74/dose
or	lorazepam		
	Adults and children	0.1 mg/kg, buccal	$0.08/0.5-mg sublingual tablet

Additional instructions and notes

- Buccal midazolam has only been tested on children ≥5 years.
- It may be necessary to repeat doses of benzodiazepines.
- Lorazepam has an antiseizure effect of longer duration (12 to 24 h) than diazepam (15–30 min) making it preferable to diazepam.

References

1. Lowenstein DH, Alldredge BK. Status epilepticus. *N Engl J Med* 1998;338:970-6.
2. Treiman DM, Meyers PD, Walton NY, Collins JF, Colling C, Rowan AJ, et al. A comparison of four treatments for generalized convulsive status epilepticus. *N Engl J Med* 1998;339:792-8.
3. Working Group on Status Epilepticus. Treatment of convulsive status epilepticus: recommendations of the Epilepsy Foundation of America's working group on status epilepticus. *JAMA* 1993;270:854-9.
4. Leppik IE, Derivan AT, Homan RW, Walker J, Ramsay RE, Patrick B. Double-blind study of lorazepam and diazepam in status epilepticus. *JAMA* 1983;249:1452-4.
5. Scott RC, Besag RMC, Neville BGR. Buccal midazolam and rectal diazepam for treatment of prolonged seizures in childhood and adolescence: a randomised trial. *Lancet* 1999;353:623-6.

Cervicitis

Drugs of choice[1]

1.	For gonorrhea		
	cefixime	400 mg, single dose	$3.09/dose
2.	For chlamydia		
	tetracycline	500 mg, q.i.d. x 7 days	$1.06/7 days
or	doxycycline	100 mg, b.i.d. x 7 days	$8.20/7 days
or	azithromycin[2]	1 g, single dose	$19.73/dose

Second-line therapies[1]

1.	For gonorrhea		
	ofloxacin	400 mg, single dose	$1.70/dose
or	ciprofloxacin	500 mg, single dose	$2.51/dose
or	ceftriaxone	125 mg, I.M., single dose	$5.38/dose
2.	For chlamydia		
	ofloxacin	300 mg, b.i.d. x 7 days	$23.87/7 days

If the patient is allergic to of intolerant of tetracycline-doxycycline or is pregnant,

	erythromycin base	500 mg, q.i.d. x 7 days	$2.54/7 days
or	amoxicillin[3]	500 mg, t.i.d. x 7 days	$4.22/7 days
or	azithromycin[4]	1 g, single dose	$19.73/dose

Additional instructions and notes

- Empiric therapy should be directed at both gonorrhea and chlamydia.
- Public health departments in some provinces provide cefixime, ceftriaxone, doxycycline, erythromycin and tetracycline free of charge.
- There is no clinical difference between tetracycline and doxycycline. Doxycycline may be taken twice daily, but at greater expense.
- Other erythromycins, including modified-release preparations, may be 2–7 times more expensive than erythromycin base.
- See also *Pelvic inflammatory disease*.

References

1. Laboratory Centre for Disease Control. *Canadian STD guidelines*. 1998 ed. Ottawa: Health Canada; 1998.
2. Martin DH, Mroczkowski TF, Dalu ZA, McCarty J, Jones RB, Hopkins SJ, et al. A controlled

trial of a single dose of azithromycin for the treatment of chlamydial urethritis and cervicitis. *N Engl J Med* 1992;327:921-5.
3. Alary M, Joly JR, Moutquin JM, Mondor M, Coucher M, Fortier A, et al. Randomised comparison of amoxicillin and erythromycin in treatment of genital chlamydial infection in pregnancy. *Lancet* 1994;344:1461-5.
4. Adair CD, Gunter M, Stovall TG, McElroy G, Veille J-C, Ernest JM. Chlamydia in pregnancy: a randomized trial of azithromycin and erythromycin. *Obstet Gynecol* 1998;91:165-8.

Contraception, postcoital

Drugs of choice[1]

levonorgestrel	750 µg as soon as possible after intercourse and 12 h later	$15.95/course of therapy

Second-line therapies[1]

norgestrel/ethinyl estradiol	1.0 mg/100 µg (2 tablets) as soon as possible after intercourse and 2 tablets 12 h later	$11.69/course of therapy

Additional instructions and notes

- These regimens may be offered up to 72 h after unprotected intercourse. The effectiveness of these drugs is unknown after this time frame.[2]
- Antiemetics should be used in conjunction with postcoital therapy.
- Patients should have a pregnancy test 1 week after postcoital therapy.
- Studies have shown that the proportion of pregnancies prevented (compared with the expected number without treatment) is 85% (95% CI 74–93) with the levonorgestrel regimen and 57% (95% CI 39–71) with the combination of ethinylestradiol and levonorgestrel and there is less nausea and vomiting with the former regimen.

References

1. WHO Task Force on Postovulatory Methods of Fertility Regulation. Randomised controlled trial of levonorgestrel versus the Yuzpe regimen of combined oral contraceptives for emergency contraception. *Lancet* 1998;352:428-33.
2. Cheng L, Gulmezoglu AM, Ezcurra E, Van Look PFA. Interventions for emergency contraception [Cochrane review]. In: The Cochrane Library; Issue 1, 2001. Oxford: Update Software.

Dysfunctional uterine bleeding

Drugs of choice[1]

	tranexamic acid	500 mg, t.i.d. x 3 days during menstruation	$9.64/3 days

Second-line therapies

1.	NSAIDs[1–3]		
	ibuprofen	400 mg, q.i.d. x 5 days during menstruation	$0.74/5 days
or	naproxen	250 mg, q.i.d. x 5 days during menstruation	$2.14/5 days
or	diclofenac	25 mg, t.i.d. x 5 days during menstruation	$2.85/5 days
or	mefenamic acid	500 mg, t.i.d. x 5 days during menstruation	$9.92/5 days
or			
2.	danazol[1,3]	200 mg, once daily for up to 3 months	$1.69/day

Additional instructions and notes

- Although medroxyprogesterone is widely used for this indication, no controlled trials of such use have been carried out.
- Danazol is superior to NSAID therapy in the reduction of symptoms; however, it is associated with an increased number of side effects.
- Only the four NSAIDs listed above have been studied for this condition.

References

1. Coulter A, Kelland J, Peto V, Rees MCP. Treating menorrhagia in primary care: an overview of drug trials and a survey of prescribing practice. *Int J Technol Assess Health Care* 1995;11:456-71.
2. Bonnar J, Sheppard BL. Treatment of menorrhagia during menstruation: randomised controlled trial of ethamsylate, mefenamic acid, and tranexamic acid. *BMJ* 1996;313:579-82.
3. Lethaby A, Augood C, Duckitt K. Nonsteroidal anti-inflammatory drugs for heavy menstrual bleeding [Cochrane review]. In: The Cochrane Library; Issue 1, 2001. Oxford: Update Software.

Dysmenorrhea

Drugs of choice

NSAIDs, ideally begun 24 h before expected onset of symptoms[1–3]

	aspirin	650 mg, q.i.d.	$0.08/day
or	ibuprofen	400 mg, q.i.d.	$0.16/day
or	naproxen		
	Initial dose	500 mg	$0.21/dose
	Maintenance	250 mg, q.i.d.	$0.44/day
or	mefenamic acid		
	Initial dose	500 mg	$0.66/dose
	Maintenance	250 mg, q.i.d.	$1.32/day

Additional instructions and notes

- The four NSAIDs listed above have been most extensively studied for this condition.
- In comparison studies, mefenamic acid appears to provide better pain relief than other NSAIDs.[1]
- Ibuprofen appears to have the most favourable risk-benefit ratio.[3]

References

1. Owen PR. Prostaglandin synthetase inhibitors in the treatment of primary dysmenorrhea: outcome trials reviewed. *Am J Obstet Gynecol* 1984;148:96-103.
2. Shapiro SS. Treatment of dysmenorrhea and premenstrual syndrome with non-steroidal anti-inflammatory drugs. *Drugs* 1988;36:475-90.
3. Zhang WY, Po ALW. Efficacy of minor analgesics in primary dysmenorrhoea: a systematic review. *Br J Obstet Gynaecol* 1998;105:780-9.

Eclampsia — seizure prophylaxis and prevention of recurrent seizures

Drugs of choice[1,2]

magnesium sulfate			
Initial dose		4 g, I.V., over 5–20 min	$1.18/kg per dose
	or	10 g, I.M.	
Maintenance dose		1 g/h, I.V., x 24 h	$0.30/h
	or	5 g, I.M., q4h x 24 h	$1.48/4 h

Additional instructions and notes

- Magnesium is superior to both diazepam and phenytoin in preventing the recurrence of seizures in eclampsia and in seizure prophylaxis in severe pre-eclampsia.
- Early signs of hypermagnesemia, including nausea, vomiting, weakness, and cutaneous flushing, usually appear at serum levels of approximately 3 mEq/L. As levels rise above 4 mEq/L, hyporeflexia is seen and deep tendon reflexes are eventually lost.

References

1. Chien PFW, Khan KS, Arnott N. Magnesium sulphate in the treatment of eclampsia and pre-eclampsia: an overview of the evidence from randomised trials. *Br J Obstet Gynaecol* 1996;103:1085-91.
2. Witlin AG, Sibai BM. Magnesium sulfate therapy in preeclampsia and eclampsia. *Obstet Gynecol* 1998;92:883-9

OBSTETRICS AND GYNECOLOGY

Ectopic pregnancy

Drugs of choice[1,2]

methotrexate	50 mg/m^2 body area, I.M., single dose	\$17.84/m^2 per dose

Additional instructions and notes

- Use of systemic methotrexate is less effective than surgical management, but may be offered to patients with a serum human chorionic gonadotropin (beta-hCG level) below 1500 IU who elect to have conservative therapy.[3,4]
- This treatment must only be offered to patients who are able to return for follow-up care to monitor serial beta-hCG levels.
- As many as 25% of patients will require more than one dose of methotrexate.
- Tubal rupture may occur unpredictably up to 30 days after methotrexate administration [3,4]

References

1. Slaughter JL, Grimes DA. Methotrexate therapy: nonsurgical management of ectopic pregnancy. *West J Med* 1995;162:225-8.
2. ACOG practice bulletin. Medical management of tubal pregnancy. Number 3, December 1998. Clinical management guidelines for obstetrician-gynecologists. American College of Obstetricians and Gynecologists. *Int J Gynecol Obstet* 1999;65:97-103.
3. Parker J, Bisits A, Proietto AM. A systematic review of single dose intramuscular methotrexate for the treatment of ectopic pregnancy. *Aus N Z J Obstet Gynecol* 1998;38(2):145-150.
4. Hajenius PJ, Mol BWJ, Bossuyt PMM, Ankum WM, Van der Veen F. Interventions for tubal ectopic pregnancy [Cochrane review]. In: The Cochrane Library; Issue 1, 2001. Oxford: Update Software.

OBSTETRICS AND GYNECOLOGY

Hemolytic disease of the fetus and newborn — prevention

Drug of choice[1]

Threatened or spontaneous abortion, ectopic pregnancy, trauma during pregnancy or any other condition with risk of feto-maternal hemorrhage in Rh negative mother.

Rh_o (D) immune globulin 300 µg, I.M., single dose

Additional instructions and notes:

- One 300-µg dose will protect against a 30-mL fetal hemorrhage and is the maximum dose required before 20 weeks gestation.
- After 20 weeks gestation, a large feto-maternal hemorrhage may require a larger dose to prevent isoimmunization. There are several laboratory screening tests that can be used to estimate the volume of fetal blood in the maternal circulation.

Reference

1. Hartwell EA, American Society of Clinical Pathologists. Use of Rh immune globulin: ASCP practice parameter. *Am J Clin Pathol* 1998;110:281-92.

Hyperemesis gravidarum

Drugs of choice[1]

	prednisone	20 mg, t.i.d. x 3 days; then reduce dose by half every 3 days	$0.30/course of therapy
or	methylprednisolone	20 mg, I.V. t.i.d. x 3 days; then reduce dose by half every 3 days	$36.99/course of therapy

Second-line therapies[1,2]

	promethazine	50 mg, I.M. or I.V., q8h	$3.69/day
or	ondansetron	4–8 mg, I.M. or I.V., q8h–q12h	$180.70–542.10/dose

After the patient leaves the emergency department

	pyridoxine[3]	25 mg, t.i.d.	$0.06/day
or	doxylamine/pyridoxine[4]	2 tablets, hs; if severe, add 1 tablet in morning and in mid-afternoon	$1.20/dose

Additional instructions and notes

- Ondansetron is not superior to promethazine.[2]
- Promethazine should be given over 3 min intravenously.
- Ondansetron should be given over 5 min intravenously.

References

1. Safari HR, Fassett MJ, Souter IC, Alsulyman OM, Goodwin TM. The efficacy of methylprednisone in the treatment of hyperemesis gravidarum: a randomized, double-blind controlled study. *Am J Obstet Gynecol* 1998;179:921-4.
2. Sullivan CA, Johnson CA, Roach H, Martin RW, Stewart DK, Morrison JC. A pilot study of intravenous ondansetron for hyperemesis gravidarum. *Am J Obstet Gynecol* 1996;174:1565-8.
3. Vutyavanich T, Wongtrangan S, Ruangsri R. Pyridoxine for nausea and vomiting of pregnancy: a randomized, double-blind, placebo-controlled trial. *Am J Obstet Gynecol* 1995;173:881-4.
4. de la Ronde S. *Guidelines for the management of nausea and vomiting in pregnancy*. Ottawa: Society of Obstetricians and Gynecologists of Canada; 1995.

Hypertension emergency in pregnancy

Drugs of choice[1,2]

	nifedipine	5–10 mg, every 30 min	$0.24–0.19/dose
or	labetalol	10–20 mg, I.V. over 2 min every 10 min	$1.62–3.24/dose

Additional instructions and notes

- Patients should be treated until their diastolic pressure is below 100 mmHg.
- An interaction between nifedipine and magnesium has been reported to produce profound maternal muscle weakness as well as maternal hypotension and fetal distress.

References

1. Magee LA, Ornstein MP, von Dadelszen P. Management of hypertension in pregnancy. *BMJ* 1999;318:1332-6.
2. Vermillion ST, Scardo JA, Newman RB, Chauhan SP. A randomized, double-blind trial of oral nifedipine and intravenous labetalol in hypertensive emergencies of pregnancy. *Am J Obstet Gynecol* 1999;181:858-61.

OBSTETRICS AND GYNECOLOGY

Mastitis

Drugs of choice[1–3]

1.	Mild to moderate		
	cloxacillin	500 mg, q.i.d. x 10 days	$7.78/10 days
or	cephalexin	500 mg, q.i.d. x 10 days	$11.94/10 days
2.	Severe		
	cefazolin	1–2 g, I.V., q6h	$11.20–22.40/day
or	cloxacillin	1–2 g, I.V., q6h	$20.00–40.00/day

Second-line therapies

If patient is allergic to penicillin

1.	Mild to moderate		
	clindamycin	300 mg, t.i.d. x 10 days	$32.60/10 days
2.	Severe		
	clindamycin	600 mg, I.V., q8h	$27.45/day
or	vancomycin	1 g, I.V., q12h	$104.90/day

Additional instructions and notes

- Continued nursing should be strongly encouraged, as breast engorgement may contribute to abscess formation. Studies have shown that infants suffer no ill effects if nursing is continued.[1,2,4]
- Manual expression of pus from infected breasts of lactating women appears to be effective in preventing breast abscesses.[1,3]
- Oral vancomycin should not be used as it is poorly absorbed.

References

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OBSTETRICS AND GYNECOLOGY

Pelvic inflammatory disease

Drugs of choice[1,2]

1.	Outpatient treatment		
	i. cefixime	400 mg, single dose	$3.09/dose
	AND		
	tetracycline	500 mg, q.i.d. x 2 weeks	$2.13/14 days
or	doxycycline	100 mg, b.i.d. x 2 weeks	$16.41/14 days
or	ii. cefoxitin[3,4]	2 g, I.M., single dose	$23.09/dose
	AND		
	probenecid	1 g, single dose	$0.38/dose
	AND		
	tetracycline	500 mg, q.i.d. x 2 weeks	$2.13/14 days
or	doxycycline	100 mg, b.i.d. x 2 weeks	$16.41/14 days
2.	Severe infection[5]		
	i. clindamycin	900 mg, I.V., q8h	$41.16/day
	AND		
	gentamicin		
	Initial dose	2 mg/kg, I.V.	$0.10/kg per dose
	Maintenance dose	1.5 mg/kg, I.V., q8h	$0.21/kg per day
or	ii. cefoxitin	2 g, I.V., q8h	$69.27/day
	AND		
	doxycycline	100 mg, b.i.d.	$1.18/day
or	iii. cefotetan	2 g, I.V., q12h	$63.28/day
	AND		
	doxycycline	100 mg, b.i.d.	$1.18/day
3.	In pregnancy		
	Outpatient treatment		
	cefixime	800 mg, single dose	$6.19/dose
	AND		
	erythromycin base	250 mg, q.i.d. x 2 weeks	$2.54/14 days
	Severe disease		
	clindamycin	900 mg, I.V., q8h	$41.16/day
	AND		
	gentamicin		
	Initial dose	2 mg/kg, I.V.	$0.10/kg per dose
	Maintenance dose	1.5 mg/kg, I.V., q8h	$0.21/kg per day

Second-line therapies[1,2]

1.	Outpatient therapy		
	i. ofloxacin	400 mg, b.i.d. x 2 weeks	$47.67/14 days
	AND either		
	metronidazole	500 mg, b.i.d. x 2 weeks	$1.68/14 days (250-mg tablet) $23.80/14 days (500-mg capsule)
or	clindamycin	300 mg, t.i.d. x 2 weeks	$45.64/14 days
or	ii. amoxicillin/clavulanate	500 mg/125 mg, t.i.d. x 2 weeks	$56.05/14 days
2.	In pregnancy		
	Outpatient therapy		
	amoxicillin/clavulanate	500 mg/125 mg, t.i.d. x 2 weeks	$56.05/14 days
	Severe disease		
	cefoxitin	2 g, I.V. q8h	$69.27/day
	AND		
	erythromycin	250 mg, I.V. q6h	$23.32/day

Additional instructions and notes

- In addition to severe infection, admission to hospital is preferred in any of the following circumstances: adolescence; appendicitis or ectopic pregnancy not excluded; suspected pelvic abscess; pregnancy; failed response to outpatient therapy; follow-up within 72 h not feasible.
- See also *Cervicitis*.

References

1. Drugs for sexually transmitted diseases. *Med Lett Drugs Ther* 1999;41:85-90.
2. Laboratory Centre for Disease Control. *Canadian STD guidelines*. 1998 ed. Ottawa: Health Canada; 1998.
3. Walker CK, Kahn JG, Washington AE, Peterson HB, Sweet RL. Pelvic inflammatory disease: metaanalysis of antimicrobial regimen efficacy. *J Infect Dis* 1993;168:969-78.
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OBSTETRICS AND GYNECOLOGY

Postpartum hemorrhage

Drugs of choice[1]

1. Primary postpartum hemorrhage (≥24 h after delivery)
   If bleeding persists after massage of the uterus and attempts to empty the uterus of retained products

ergonovine	250–500 µg (1–2 mL), I.M. or I.V. over 1 min	$1.35–2.70/dose

   If bleeding still continues

oxytocin	10–20 units in 500 mL of normal saline, I.V., at a rate of 0.1 units/min	$2.50–5.00/dose

2. Secondary postpartum hemorrhage (>24 h after delivery)

	metronidazole	500 mg, t.i.d. x 7–10 days	$1.26/7 days (250-mg tablet) $17.85/7 days (500-mg capsule)
or	amoxicillin/clavulanate	500 mg/125 mg, t.i.d. x 7–10 days	$18.33/7 days

Additional instructions and notes

- The antidiuretic effect of oxytocin can cause water overload if it is given in a large volume of electrolyte-free solution.
- If endometritis is excluded as a cause for secondary postpartum hemorrhage, then the patient should be investigated for retained products of conception.

Reference

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Sexual assault — prophylaxis for potential infection

Drugs of choice[1,2]

1. Empiric therapy for chlamydia, gonorrhea, trichomonas and bacterial vaginosis:

	cefixime	400 mg, single dose	$3.09/dose
and	azithromycin	1 gm, single dose	$19.73/dose
and	metronidazole	2 gm, single dose	$0.24/dose (250-mg tablet) $3.40/dose (500-mg capsule)

2. Treatment for hepatitis B
   See *Hepatitis B — postexposure prophylaxis*.

3. HIV postexposure prophylaxis

	zidovudine	200 mg, t.i.d. x 4 weeks	$285.60/4 weeks
and	lamivudine	150 mg, b.i.d. x 4 weeks	$246.40/4 weeks

Additional instructions and notes

- Victims of sexual assault should be offered postcoital contraception when there is a risk of pregnancy.
- The risk of contracting HIV through an isolated sexual exposure is very small (less than 0.3%), and there is currently no evidence to support or reject the use of postexposure prophylaxis in this setting.
- Patients who request HIV postexposure prophylaxis should be made aware of the uncertain effectiveness, cost and potential toxicity of this regimen.

References

1. 1998 guidelines for treatment of sexually transmitted diseases. Centers for Disease Control and Prevention. *MMWR Morb Mortal Wkly Rep* 1998;47(RR-1):1-111.
2. Management of possible sexual, injecting-drug-use, or other non-occupational exposure to HIV, including considerations related to antiretroviral therapy. Centers for Disease Control and Prevention. *MMWR Morb Mortal Wkly Rep* 1998;47(RR-17):1-14

OBSTETRICS AND GYNECOLOGY

Vaginitis

Drugs of choice[1–3]

1.	Candidiasis (antifungicide)		
	clotrimazole	200-mg tablet, intravaginal, hs x 3 days	$9.06/3 days
or	clotrimazole	500-mg tablet, intravaginal, single dose	$9.06/3 days
or	miconazole	400-mg ovule, intravaginal, hs x 3 days	$9.78/3 days
or	fluconazole	150 mg, single dose	$10.21/dose
or	tioconazole 6.5% ointment	5 g, intravaginal, single dose	$10.33/dose
or	terconazole 0.8% cream	5 g, intravaginal, hs x 3 days	$17.43/3 days
or	terconazole	80-mg vaginal suppository, hs x 3 days	$17.52/3 days
or	itraconazole	200 mg, once daily x 3 days	$21.00/3 days
2.	Bacterial vaginosis[4–6]		
	metronidazole	Two 250-mg tablets, b.i.d. x 7 days	$0.78/7 days
or	metronidazole gel 0.75%	5 g, intravaginal, b.i.d. x 5 days	$17.75/5 days
or	clindamycin 2% cream	5 g, intravaginal, once daily x 7 days	$26.19/7 days
3.	Trichomoniasis		
	metronidazole	2 g, single dose	$0.24/dose (250-mg tablet) $3.40/dose (500-mg capsule)
	or	500 mg, b.i.d. x 5 days	$0.60/5 days (250-mg tablet) $8.50/5 days (500-mg capsule)

Second-line therapies[1]

1.	Candidiasis		
	ketoconazole	200 mg, b.i.d. x 5 days	$11.84/5 days
2.	Bacterial vaginosis,[4,5] if patient is pregnant		
	metronidazole	2 g, single dose	$0.24/dose (250-mg

			tablet) $3.40/dose (500-mg capsule)
or	clindamycin	300 mg, t.i.d. x 7 days	$22.82/7 days

3. Trichomoniasis, if patient is in first trimester of pregnancy

	metronidazole	2 g, single dose	$0.24/dose (250-mg tablet) $3.40/dose (500-mg capsule)
or	clotrimazole vaginal tablet	100 mg, intravaginal once daily x 3 days	$4.53/3 days
or	clotrimazole 1% cream	5 g, intravaginal, once daily x 3 days	$7.00/3 days

4. Trichomoniasis, if patient is lactating

	metronidazole	2 g, single dose	$0.24/dose (250-mg tablet) $3.40/dose (500-mg capsule)

Additional instructions and notes

- If candidiasis is asymptomatic, treatment is unnecessary.
- Oral antifungal therapy is as effective as intravaginal therapy for the treatment of candidiasis, has a higher incidence of side-effects, but is the route of treatment preferred by study patients.
- In trichomoniasis, partners should be treated to prevent reinfection.
- Some experts suggest interrupting breastfeeding until 24 h after completing therapy for trichomoniasis.
- Fluconazole is contraindicated in pregnancy.
- Although single-dose metronidazole achieves the same immediate rate of clinical response as a 1-week course of metronidazole in the treatment of bacterial vaginitis, higher rates of recurrence have been reported.
- Metronidazole does not appear to be associated with increased teratogenic risk and, depending on the risk–benefit ratio, could be used in pregnancy and breastfeeding mothers.[6]

References

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OPHTHALMOLOGY

Angle closure glaucoma, acute

Drugs of choice[1,2]

	pilocarpine 2%	one drop every 15 min until pupils constrict	$2.90/15-mL bottle
AND	timolol 0.5%	one drop, b.i.d.	$9.30/5-mL bottle
AND	acetazolamide	500 mg, oral, then 250 mg q.i.d.	$0.06/initial dose
AND	mannitol 20%	1–2 g/kg (or 5–10 mL/kg), I.V. over 30–60 min, single dose	$4.44/50-mL vial
AND	prednisolone 1%	one drop every 15–30 min x 4, then q1h	$5.80/10-mL bottle

Additional instructions and notes

- One drop of pilocarpine every 6 h may be used as prophylactic treatment for the unaffected eye.
- Do not use pilocarpine in aphakic or pseudophakic papillary block or mechanical angle closure.
- Administer analgesia and sedation as required.

References

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OPHTHALMOLOGY

Blepharitis

Drugs of choice[1]

	tobramycin ophthalmic ointment	once daily to b.i.d. x 1–2 months	$3.67/3.5 g
or	polymyxin/bacitracin ophthalmic ointment	once daily to b.i.d. x 1–2 months	$3.77/3.5 g
or	erythromycin ophthalmic ointment	once daily to b.i.d. x 1–2 months	$4.03/3.5 g

Blepharitis associated with rosacea[2,3]

	tetracycline		
	Adults	250 mg, q.i.d. x 8 weeks	$4.26/8 weeks
	Children >8 years	20–50 mg/kg per day, divided q.i.d. x 8 weeks	$1.12–2.24/kg for 8 weeks
or	erythromycin		
	Adults	1 g, divided b.i.d. to q.i.d. x 3–6 weeks	$3.80/3 weeks
	Children	30–50 mg/kg per day divided b.i.d. to q.i.d. x 3–6 weeks	$0.63–1.05/kg for 3 weeks (80 mg/mL) $1.05–1.68/kg for 3 weeks (40 mg/mL)
or	doxycycline		
	Adults	50–100 mg, once daily to b.i.d. x 8 weeks	$16.80–66.08/8 weeks
	Children >8 years	2–5 mg/kg per day, once daily to b.i.d. x 8 weeks	$0.66–3.30/kg for 8 weeks

Additional instructions and notes

- Apply ointments to eyelid margins.
- Most *Staphylococcus* species are resistant to sulfacetamide sodium.
- Emphasize the importance of lid hygiene. Use lid scrubs (dilute baby shampoo or commercially available lid-cleansing products) before application of ointment. Cotton-tip swabs or commercially available cleaning pads moistened with warm water may be used.
- Artificial tears can provide symptomatic relief.
- There is no evidence to suggest that any of the above topical ophthalmic antibiotics is safer or more efficacious than the others.

References

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OPHTHALMOLOGY

Conjunctivitis, allergic

Drugs of choice

Topical ophthalmic agents

	lodoxamide 0.1% ophthalmic solution[1]	1–2 drops in each eye, q.i.d.	$10.25/10-mL bottle
or	sodium cromoglycate 2% ophthalmic solution[2]	1–2 drops in each eye, q.i.d.	$14.25/15-mL bottle
or	levocabastine 0.05% ophthalmic solution[3]	1–2 drops in each eye, b.i.d. to q.i.d.	$17.36/5-mL bottle
or	nedocromil sodium 2% ophthalmic solution[4,5]	1 drop in each eye, b.i.d.	$25.00/5-mL bottle
or	olopatadine 0.1% ophthalmic solution[5]	1–2 drops in each eye, b.i.d.	$25.50/5-mL bottle

Second-line therapies

1. Topical NSAIDs as adjuncts to drugs of choice[6,7]

	diclofenac 0.1% ophthalmic solution	1 drop in each eye, q.i.d.	$7.90/2.5-mL bottle
or	flurbiprofen 0.03% ophthalmic solution	1 drop in each eye, q.i.d.	$14.83/3-mL bottle
or	ketorolac 0.5% ophthalmic solution	1 drop in each eye, q.i.d.	$16.00/5-mL bottle

2. For rhinoconjunctivitis or as adjunctive therapy to drugs of choice

i. Oral antihistamines[8–10]

	chlorpheniramine		
	Adults	4–8 mg, hs to b.i.d.	$0.22–0.88/day
	Children 6–12 years	2 mg, hs to b.i.d.	$0.18–0.36/day
or	dexchlorpheniramine		
	Adults	4 mg, hs to b.i.d.	$1.69–3.38/day
	Children 6–12 years	1 mg, hs to b.i.d.	$0.42–0.84/day

ii. Oral antihistamines when sedation effects are unacceptable[8]

	cetirizine		
	Adults	10–20 mg, once daily	$0.62–1.24/day
	Children 6–12 years	5 mg, b.i.d.	$0.94/day
	Children 2–5 years	1–2.5 mg, b.i.d.	$0.12–0.32/day
or	fexofenadine		
	Adults	60 mg, b.i.d.	$0.90/day
	Children 7–12 years	30 mg, b.i.d.	$0.45/day
	Children 3–6 years	15 mg, b.i.d.	$0.22/day

or	loratadine		
	Adults	10 mg, once daily	$0.91/day
	Children <12 years	5 mg, once daily	$0.32/day

3. In severe cases that do not respond to other therapy, topical corticosteroids[11]

	fluorometholone 0.1% ophthalmic solution	1–2 drops in each eye, q.i.d. (maximum 2 weeks)	$8.70/5-mL bottle
or	rimexolone 1%	1–2 drops in each eye, q.i.d. (maximum 2 weeks)	$16.75/5-mL bottle

Additional instructions and notes

- When dealing with allergic rhinoconjunctivitis oral antihistamines may be first-line agents.
- There is no evidence that any of the above oral antihistamines (sedating or nonsedating) is more efficacious than the others for this indication.
- Symptoms may not improve for several days with lodoxamide.
- Soft contact lenses may discolour with sodium cromoglycate.
- Contact lens wearers may use levocabastine twice daily, 10 min before applying contact lenses in the morning and 10 min after their removal in the evening.
- Artificial tears and cool compresses several times per day may provide symptomatic relief.

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[www.emedicine.com/oph/topic85.htm; viewed July 4, 2001]

OPHTHALMOLOGY

Conjunctivitis, bacterial

Drugs of choice[1,2]

1. Broad-spectrum topical ophthalmic antibiotics

	sulfacetamide sodium 10% ophthalmic solution	2 drops, q2h–q3h x 7 days	$1.21/15-mL bottle
or	gentamicin 0.3% ophthalmic solution	2 drops, q2h–q3h x 7 days	$2.03/5-mL bottle
or	polymyxin/trimethoprim ophthalmic solution	2 drops, q2h–q3h x 7 days	$24.15/10-mL bottle

2. For children, treatment with ointment may be easier and more effective

	bacitracin 500 IU ophthalmic ointment	once daily to b.i.d. x 7 days	$2.35/3 g
or	sulfacetamide sodium 10% ophthalmic ointment	once daily to b.i.d. x 7 days	$3.34/3.5 g
or	polymyxin/bacitracin ophthalmic ointment	once daily to b.i.d. x 7 days	$3.77/3.5 g

Additional instructions and notes

- Although bacterial conjunctivitis is usually self-limiting, the use of antibiotics is associated with significantly improved rates of early clinical remission and early and late microbiological remission.[3]
- There is no evidence that any of the above topical antibiotics is more efficacious or safer than the others.[4]
- The use of flouroquinolones is not recommended for first-line therapy without cultures because of inherent and emerging acquired resistance among Gram-positive bacteria.[4]
- Emphasize hygiene: hands should be washed before and after touching eyes.
- Lid crusts may be removed by soaking in warm water.
- Contact lens wearers with conjunctivitis should be instructed to discontinue wearing the lenses until symptoms have completely resolved.
- *Neisseria* infection should be suspected when severe, bilateral, purulent conjunctivitis is present in a sexually active adult.

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OPHTHALMOLOGY

Corneal abrasion

Drugs of choice

1. For relief of pain during examination

	proparacaine 0.5%	1–2 drops every 5 min during examination to maximum of 10 drops	$4.03/15-mL bottle
or	tetracaine 0.5%	1–2 drops	$35.90/20-mL bottle

2. For relief of pain on discharge from the emergency department[1,2]

	diclofenac 0.1% ophthalmic solution	1 drop, q.i.d.	$7.90/2.5-mL bottle
or	fluriprofen 0.03% ophthalmic solution	1 drop, q.i.d.	$14.83/3-mL bottle
or	ketorolac 0.5% ophthalmic solution	1 drop, q.i.d.	$16.00/5-mL bottle

AND, in the case of significant pain, add

	acetaminophen/caffeine/codeine		
or	ASA/caffeine/codeine		
	codeine dose	60 mg (2 30-mg tablets), q4h	$0.06/dose

3. For ciliary spasm and photophobia

	tropicamide 0.5–1% ophthalmic solution	1 drop; repeat in 5 min if necessary	$7.58/15-mL bottle
or	cyclopentolate 0.5–1% ophthalmic solution	1 drop; repeat in 5 min if necessary	$11.51/15-mL bottle

Additional instructions and notes

- Proparacaine causes significantly less stinging than tetracaine, but has a shorter duration of action.
- There are no controlled trials showing the benefits of topical antibiotics, but they should be considered for deep or dirty wounds.
- It is not necessary to patch the affected eye.[3]
- Cyclopentolate produces cycloplegia for 6–24 h; tropicamide produces incomplete cycloplegia for 2–6 h.
- Never prescribe topical anesthetics for continued use, as they can cause corneal toxicity, block protective reflexes, cause secondary keratitis and compromise epithelial healing.
- Administer tetanus vaccine if necessary.

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OPHTHALMOLOGY

Corneal ulcer, bacterial

Drugs of choice[1,2]

	ofloxacin 0.3% ophthalmic solution	Day 1: 2 drops every 15 min for 6 h, then 2 drops every 30 min for remainder of day Day 2: 2 drops, q1h Days 3–14: 2 drops, q4h	$7.08/5-mL bottle
or	norfloxacin 0.3% ophthalmic solution	Day 1: 2 drops every 15 min for 6 h, then 2 drops every 30 min for remainder of day Day 2: 2 drops, q1h Days 3–14: 2 drops, q4h	$8.15/5-mL bottle
or	ciprofloxacin 0.3% ophthalmic solution	Day 1: 2 drops every 15 min for 6 h, then 2 drops every 30 min for remainder of day Day 2: 2 drops q1h Days 3–14: 2 drops, q4h	$9.70/5-mL bottle
or	ciprofloxacin 0.3% ophthalmic ointment	Days 1–2: 1.25 cm, q1h–q2h Days 3–14: 1.25 cm, q4h	$9.70/3.5 g

Additional instructions and notes

- Failure to treat this infection properly can result in permanent corneal damage.

References

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OPHTHALMOLOGY

Herpes simplex keratitis

Drugs of choice[1,2]

	trifluridine 1% ophthalmic solution	1 drop, q2h x 7 days; then q4h x 7 days	$27.80/7.5-mL bottle
or	acyclovir[3]	400 mg, 5 times a day x 10 days	$86.44/10 days

Second-line therapies[1–3]

idoxuridine 0.1% ophthalmic solution	1 drop, q1h while awake and q2h while asleep; continue treatment for 5–7 days after healing to a maximum of 21 days	$8.79/10-mL bottle

Additional instructions and notes

- Steroid drops are contraindicated. If there is evidence of uveitis, the patient should be referred to an ophthalmologist.
- Oral acyclovir is equivalent to topical antiviral therapy and does not confer added benefit when used in combination with a topical antiviral.[3]
- Consider a cycloplegic agent to reduce pain from ciliary spasm.

References

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OPHTHALMOLOGY

Periorbital (preseptal) and orbital cellulitis

Drugs of choice[1–3]

1. Periorbital (preseptal) cellulitis

i. Mild infection in adults and all children immunized against *Hemophilus influenzae* type B

cloxacillin		
Adults	500 mg, q.i.d. x 7 days	$5.45/7 days
Children	12.5–25 mg/kg, q.i.d. x 7 days	$0.28–0.56/kg for 7 days

ii. Children ≥5 years and not immunized against *Hemophilus influenzae* type B or any severely ill child regardless of immunization status

	cefotaxime	50 mg/kg, I.V., q8h	$1.80/kg per day
or	ceftriaxone	50 mg/kg, I.V., once daily	$2.15/kg per day

If staphylococcal or streptococcal infection is suspected, to the above regimen add

cloxacillin	25–50 mg/kg, I.V., q6h	$0.48–0.60/kg per day

2. Orbital cellulitis

cloxacillin		
Adults	2 g, I.V., q6h	$40.00/day
Children	25–50 mg/kg, I.V., q6h	$0.48–0.60/kg per day
AND one of		
cefotaxime		
Adults	2 g, I.V., q8h	$55.08/day
Children	50 mg/kg, I.V., q8h	$1.80/kg per day
or ceftriaxone		
Adults	2 g, I.V., once daily	$67.00/day
Children	50 mg/kg, I.V., once daily	$2.15/kg per day

If patient is not responding to the above, add

metronidazole		
Adults	500 mg, I.V., q8h	$45.00/day
Children	15 mg/kg, I.V., q8h	$1.35/kg per day

Second-line therapies

If patient is allergic to penicillin

clindamycin		
Adults	300 mg, oral or I.V.	$22.82/7 days (oral)

		t.i.d. x 7 days	$96.05/7 days (I.V.)
	Children	10 mg/kg, oral or I.V. t.i.d. x 7 days	$1.47/kg for 7 days (oral) $3.15/kg for 7 days (I.V.)
or	vancomycin		
	Adults	1 g, I.V., q12h	$104.90/day
	Children	20 mg/kg, I.V., q12h	$2.10/kg per day

Additional instructions and notes

- Failure to treat orbital cellulitis aggressively can result in loss of vision.
- The most common organisms are *Staphylococcus* sp. or *Streptococcus* sp. Some patients are infected with *Hemophilus influenzae*, anaerobes or other organisms.[4]

References

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OPHTHALMOLOGY

Uveitis, anterior

Drugs of choice[1]

1. Topical corticosteroids to suppress inflammation

	prednisolone sodium phosphate 1% ophthalmic solution	1–2 drops, 2–4 times a day; if severe inflammation, 1 drop/min x 5 min each hour	$5.80/10-mL bottle
or	fluorometholone acetate 0.1% ophthalmic suspension	1–2 drops, 2–4 times a day; if severe inflammation, 1 drop/min x 5 min each hour	$8.70/5-mL bottle

AND

2. Mydriatics and cycloplegics

	homatropine 2%	1 drop, 2–3 times a day	$8.70/15-mL bottle

Second-line therapies[1]

For patients with lower grades of inflammation

	tropicamide 1% ophthalmic solution	1 drop at night	$7.58/15-mL bottle
or	cyclopentolate 1% ophthalmic solution	1 drop at night	$11.51/15-mL bottle

Additional instructions and notes

- The two recommended topical corticosteroids both have potent anti-inflammatory effects as well as a low propensity to elevate intraocular pressure.
- Mydriatics prevent the formation of posterior synechiae.
- Homatropine is preferred because of its intermediate strength.

Reference

1. Dodds EM. Treatment strategies in patients with anterior uveitis. *Int Ophthalmol Clin* 2000;40:5-68.

PEDIATRICS

Bronchiolitis

Drugs of choice[1]

Supplemental oxygen, nasal toilet, fluid replacement and careful observation are the main therapies.

epinephrine[2]	3 mL (3 mg) of 1:1000 solution by nebulizer at 0 and 30 min	$0.99/dose

Second-line therapies

salbutamol[3,4] (5 mg/mL solution)	0.3 mL (1.5 mg) in 2.7 mL sodium chloride 0.9% at 0 and 30 min	$0.18/dose

Additional instructions and notes

- Short-term beta-adrenergic agonist therapy has no impact on respiratory rate or rate of admission to hospital, but does produce modest short-term improvement in the clinical features of mild or moderately severe bronchiolitis.[3,4]
- Ongoing use of bronchodilators (epinephrine and salbutamol) is not recommended unless there is objective improvement in clinical parameters, such as oxygen saturation, respiratory rate, work of breathing or wheezing.
- Ipratropium,[5] and routine use of antibiotics[6] do not produce any benefits in the treatment of bronchiolitis.
- The role of parenteral or nebulized/inhaled corticosteroids in bronchiolitis is unclear. A recent meta-analysis found that corticosteroids shorten the length of hospital stay by about half a day and shorten the duration of symptoms, but all of the trials included in this meta-analysis were carried out on children already admitted to hospital and, therefore, the benefits from using this group of drugs in the emergency department is unknown.[7] A recent large, randomized trial (also of children in hospital), not included in the meta-analysis revealed no benefit from oral corticosteroids.[8]

References

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2. Menon K, Sutcliffe T, Klassen TP. A randomized trial comparing the efficacy of epinephrine with salbutamol in the treatment of acute bronchiolitis. J Pediatr 195;126;1004-7.
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PEDIATRICS

Croup

Drugs of choice

1. For all children, corticosteroids[1]

	prednisone	1 mg/kg, single dose	$0.02/kg per dose
or	dexamethasone	0.6 mg/kg, oral or I.M., single dose	$0.24/kg per dose (oral) $0.25/kg per dose (I.V.)
or	budesonide	2 mg by nebulizer, single dose	$3.20/dose

2. For children with severe croup[2]

	racemic epinephrine (2.25% solution)	0.5 mL in 4.5 mL of sodium chloride 0.9%, via nebulizer	$0.36/dose
or	epinephrine	0.5 mg/kg (0.5 mL/kg) up to a maximum of 5 mL of 1:1000, via nebulizer	$0.17/kg per dose

Additional instructions and notes

- The use of glucocorticosteroids reduces the need for both epinephrine and admission to hospital.
- There is no proof of benefit from humidification.[3]
- Dexamethasone should preferentially be given by the oral route rather than by intramuscular injection.
- Oral dexamethasone is preferred to inhaled budesonide.[4]
- Epinephrine is at least as effective as racemic epinephrine.[5]

References

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epinephrine aerosols in the treatment of laryngotracheitis (croup). *Pediatrics* 1992;89:302-6.

PEDIATRICS

Diaper rash

Drugs of choice

1. Barrier creams, e.g., Penaten, Vaseline, Zincofax

2. If *Candida albicans* is present, add a topical anti-yeast agent[1,2]

	nystatin	100,000 units/g cream; paint on lesions t.i.d. to q.i.d. x 7–10 days	$2.10/30 g
or	Topical imidazoles		
	clotrimazole	1% cream, t.i.d. to q.i.d. x 7–10 days	$2.70/30 g
or	miconazole	2% cream, t.i.d. to q.i.d. x 7–10 days	$9.00/30 g
or	econazole	1% cream, t.i.d. to q.i.d. x 7–10 days	$12.51/30 g

AND to clear the intestinal fungal reservoir and prevent relapses[3]

nystatin oral suspension (100,000 units/mL)	1 mL, q.i.d. x 7–10 days, dropped into the mouth and swallowed	$1.66/7 days

3. If rash does not clear with barrier creams, use mild topical corticosteroids

hydrocortisone	0.5–1% ointment or cream, b.i.d. to q.i.d. for a maximum of 7–10 days	$0.60/30 g

Additional instructions and notes

- Hydrocortisone will cause the rash to become more erythematous initially.
- Change diapers frequently or leave diapers off. Avoid plastic pants.
- Use pharmacotherapy only when conditions are refractory.

References

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PEDIATRICS

Febrile children — suspected occult bacteremia

Drugs of choice[1–3]

1. Infants under 28 days with a temperature ≥38.0ºC should have a full septic work-up, and admission to hospital is strongly recommended. Any children who are sent home must be followed up in 12–24 h. Admitted children who do not appear to have a bacterial infection can be closely observed and antibiotics withheld. For children who appear toxic

	ampicillin	50 mg/kg, I.V.: q12h during week 1 of life; q6h–q8h during weeks 2–4 of life	$0.19/kg per dose
AND	cefotaxime	50–75 mg/kg, I.V.: q12h during week 1 of life; q6h–q8h during weeks 2–4 of life	$0.60–0.90/kg per dose

2. Infants 28–90 days old with a temperature ≥38.0ºC and <10 white blood cells per high-power field x(1000) on urinalysis

i. Low risk (see *Additional instructions and notes*)
Culture of blood, cerebrospinal fluid and urine (obtained by bladder catheterization or puncture)
AND follow up within 24 h

ii. Infants who do not fit the criteria for low risk should be admitted to hospital and receive a full septic work-up

AND

		ampicillin	50 mg/kg, I.V., q6h	$0.76/kg per day
AND		cefotaxime	75 mg/kg, I.V., q6h	$3.60/kg per day
	or	ceftriaxone	100 mg/kg, I.V. at diagnosis; repeat 100 mg/kg, I.V., at 12 h and 24 h; then 100 mg/kg, I.V., once daily	$4.30/kg per dose

3. Children 3–36 months old

i. With temperature <39ºC and not appearing toxic
Treat fever with acetaminophen or ibuprofen only if child is uncomfortable and follow up if fever persists for more than 48 h or clinical condition deteriorates.

ii. With temperature ≥39ºC and not appearing toxic and <15,000 white blood cells per mm^3
Treat fever with acetaminophen or ibuprofen only if child is uncomfortable and follow up within 24 h.

iii. With temperature >39 ºC and not appearing toxic and ≥15,000 white blood cells per mm^3
Blood culture, chest x-ray if symptoms present, stool culture if diarrhea, urine culture (boys <6 months, girls <2 years)

AND consider

	amoxicillin[4]	20 mg/kg, t.i.d. x 2 days	$0.07/kg for 2 days
or	ceftriaxone	50 mg/kg, I.V. or I.M., single dose	$2.15/kg per dose

AND follow up within 24 h

iv. Children appearing toxic should be admitted to hospital and receive a full septic work-up

AND

	cefotaxime	75 mg/kg, I.V. q6h	$3.60/kg per day
or	ceftriaxone	100 mg/kg, I.V. at diagnosis; repeat 100 mg/kg, I.V. at 12 h and 24 h; then 100 mg/kg, I.V. once daily	$4.30/kg per dose

Additional instructions and notes

- Criteria for low-risk infants between 28–90 days old are: previously healthy, nontoxic clinical appearance, no local bacterial infection on examination (except otitis media), white blood cell count 5000–15,000/mm^3, <1500 bands/mm^3, normal urinalysis, when diarrhea present <5 white blood cells per high power field in stool.
- Infants under 28 days of age should only be treated as outpatients when the parents are reliable and close follow-up can be assured.
- Avoid ceftriaxone in infants under 60 days of age unless there is no sign of jaundice, as this drug can displace bilirubin from its serum binding sites.
- If intravenous delivery cannot be readily established, antibiotics should not be delayed and the first dose should be intramuscular.
- For children 3–36 months old, oral antibiotics are equally as effective as parenteral antibiotics in the prevention of serious bacterial infections in those with *Strepococcus pneumoniae* occult bacteremia.[5] However, there is insufficient evidence to conclude that oral antibiotics prevent meningitis in this group of children.[6]

References

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Streptococcus pneumoniae occult bacteremia? A meta-analysis. *Pediatrics* 1997;99:438-44.

PEDIATRICS

Febrile seizures — fever management

Drugs of choice

There is no evidence that administration of antipyretics on either a regular or sporadic schedule prevents recurrent febrile seizures. Fever should only be treated if it is associated with discomfort or pain.

Additional instructions and notes

- A relatively low dose of ibuprofen (5 mg/kg) administered on a regular 6-h schedule did not result in a reduction of seizure recurrence compared with placebo.[1] Acetaminophen (15–20 mg/kg) administered on a regular 4-h schedule did not result in a reduction of seizure recurrence compared with sporadic administration of acetaminophen when temperature was greater than 37.9ºC.[2]
- For management of seizures, see *Status epilepticus*.

References

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PEDIATRICS

Pneumonia, community acquired — children

Drugs of choice[1]

1. Children <1 month of age (all patients should be treated in hospital)

	ampicillin	50 mg/kg, I.V.: q12h during week 1 of life; q6h–q8h during weeks 2–4 of life	$0.19/kg per dose
AND	cefotaxime	50 mg/kg, I.V.: q12h during week 1 of life; q6h–q8h during weeks 2–4 of life	$0.60/kg per dose

If pneumonitis syndrome is present (cough, tachypnea, progressive respiratory distress and radiologic evidence of bilateral diffuse pulmonary infiltrates)

	clarithromycin	7.5 mg/kg, q12h	$0.03/kg per day
or	erythromycin	10 mg/kg, oral or I.V., q6h	$0.04/kg per day (oral)
			$0.92/kg per day (I.V.)

2. Children 1–3 months of age

i. Pneumonitis syndrome present; outpatient or inpatient treatment will depend on clinical status, e.g., feeding difficulties, respiratory distress, sleeping difficulties

	clarithromycin	7.5 mg/kg, q12h	$0.03/kg per day
or	erythromycin	10 mg/kg, oral or I.V., q6h	$0.04/kg per day (oral)
			$0.92/kg per day (I.V.)

ii. Mild to moderate pneumonia; outpatient or inpatient treatment will depend on clinical status, e.g., feeding difficulties, respiratory distress, sleeping difficulties

Outpatient treatment (children >6 weeks)

	ceftriaxone	50–100 mg, I.V., once daily	$2.15–4.30/day

Inpatient treatment

	cefuroxime	50 mg/kg, I.V., q8h	$1.77/kg per day

ii. Severe pneumonia (in-hospital treatment)

	cloxacillin	25–50 mg/kg, I.V., q6h	$0.48–1.00/kg per day
AND	cefuroxime	50 mg/kg, I.V., q8h	$1.77/kg per day

3. Children 3 months to 5 years of age

i. Outpatient treatment

	amoxicillin	15 mg/kg, t.i.d. x 7–10 days; if any antibiotics used in previous 3 months or if child is in daycare,	$0.21–0.40/kg for 7 days

		then 30 mg/kg, t.i.d. x 7–10 days	
or	erythromycin base	10 mg/kg, q.i.d. x 7–10 days	$0.29/kg for 7 days (40 mg/mL) $0.43/kg for 7 days (80 mg/mL)
or	clarithromycin	7.5 mg/kg, b.i.d. x 7–10 days	$1.12/kg for 7 days
or	azithromycin (children >6 months)	10 mg/kg initial dose; then 5 mg/kg, once daily x 4 days	$0.32/kg for 5 days (20 mg/mL) $0.23/kg for 5 days (40 mg/mL)
ii. In hospital			
	ampicillin	45 mg/kg, I.V., q6h	$0.68/kg per day
or	cefuroxime	50 mg/kg, I.V., q8h	$1.77/kg per day
iii. In intensive care unit			
	cefuroxime	50 mg/kg, I.V., q8h	$1.77/kg per day
AND either			
	clarithromycin	7.5 mg/kg, b.i.d.	$0.03/kg per day
or	erythromycin (oral)	10 mg/kg, oral or I.V., q6h	$0.04/kg per day $0.92/kg per day (I.V.)

4. Children 5–18 years of age

i. Outpatient treatment			
	erythromycin (oral)	10 mg/kg, oral or I.V., q6h	$0.04/kg per day $0.92/kg per day (I.V.)
or	clarithromycin	7.5 mg/kg, b.i.d. x 7–10 days	$1.12/kg for 7 days
or	azithromycin (children >6 months)	10 mg/kg initial dose; then 5 mg/kg, once daily x 4 days	$0.32/kg for 5 days (20 mg/mL) $0.23/kg for 5 days (40 mg/mL)
ii. In hospital			
	clarithromycin	7.5 mg/kg, b.i.d.	$0.03/kg per day
or	erythromycin (oral)	10 mg/kg, oral or I.V., q6h	$0.04/kg per day $0.92/kg per day (I.V.)
AND to either of the above, consider adding			
	ampicillin	40 mg/kg, I.V., q6h	$0.60/kg per day
or	cefuroxime	50 mg/kg, I.V., q8h	$1.77/kg per day
iii. In intensive care unit			
	cefuroxime	50 mg/kg, I.V., q8h	$1.77/kg per day
AND either			
	clarithromycin	7.5 mg/kg, b.i.d.	$0.03/kg per day
or	erythromycin (oral)	10 mg/kg, oral or I.V., q6h	$0.04/kg per day

			$0.92/kg per day (I.V.)

5. Aspiration pneumonia (children aged 6 months to 18 years)[2]

	clindamycin	7.5 mg/kg. I.V., q8h	$0.33/kg per day
or	penicillin G potassium	62,500 units/kg. I.V., q6h	$1.28/kg per day

Additional instructions and notes

- Most cases of pneumonia in children under the age of 5 are due to viruses.
- The choice of antibiotics is empiric and based on assumptions deriving from the clinical presentation, the age of the patient and the most frequent pathogens for each age group.
- Avoid the use of ceftriaxone in infants under 60 days of age unless there is no clinical sign of jaundice as this drug can displace bilirubin from its serum binding sites.
- Few studies of pediatric pneumonia have been conducted in developed countries and many of these have been limited by poor power and inappropriate choice of antibiotic alternatives.

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PEDIATRICS

Urinary tract infection in children

Drugs of choice[1–3]

1. Simple cystitis

	trimethoprim/ sulfamethoxazole	6–10 mg/30–90 mg per kg, b.i.d. x 5–7 days	$0.15–0.25/kg for 5 days
or	amoxicillin/clavulanate	7.5 mg/kg, t.i.d. x 5–7 days	$0.39/kg for 5 days (250 mg/5 mL) $0.47/kg for 5 days (125 mg/5 mL)
or	cephalexin	12.5 mg/kg, q.i.d. x 5–7 days	$0.40/kg for 5 days
or	cefixime	4 mg/kg, b.i.d. x 5–7 days	$0.60/kg per 5 days

2. In children who are systemically ill with sepsis, dehydration and vomiting or in whom acute pyelonephritis is suspected; in any child who is known to have an anatomical abnormality; and in infants <3 months of age

	i. ampicillin	50 mg/kg, I.V., q6h	$0.76/kg per day
AND	gentamicin		
	Children >10 years	5 mg/kg per day, I.V., once daily	$0.25/kg per day
	Children <10 years	7.5 mg/kg per day, I.V., once daily	$0.37/kg per day
or	ii. cefotaxime	50 mg/kg, I.V., q8h	$0.18/kg per day
or	iii. ceftriaxone	50–75 mg/kg, I.V., once daily	$2.15–3.22/kg per day

Additional instructions and notes

- If the expected clinical response has not occurred with 2 days of antimicrobial therapy, another urine specimen should be cultured.
- No liquid preparation of trimethoprim is available, but, for young children, tablets can be crushed and mixed in syrup. Some pharmacies may prepare a suspension of trimethoprim.

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PSYCHIATRY

Agitated and disturbed patients — acute presentation

Drugs of choice[1–3]

	haloperidol	5 mg, I.V. or I.M.	$2.49/dose
or	droperidol	5 mg, I.V. or I.M.	$5.25/dose
AND to one of the above add			
	lorazepam	2 mg, I.V. or I.M.	$1.06/dose

Additional instructions and notes

- Patients receiving haloperidol or droperidol alone have a higher incidence of extrapyramidal reactions.
- Extrapyramidal reactions due to haloperidol or droperidol should be treated with benztropine (2 mg, I.V. or I.M.).
- Haloperidol or droperidol should be used alone when there is concern about respiratory depression associated with benzodiazepines. Lorazepam should be used alone when there is a concern about extrapyramidal reactions.
- Droperidol may be more effective in controlling agitated patients than haloperidol.[4]

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RESPIRATORY SYSTEM

Asthma — acute exacerbation

Drugs of choice[1,2]

Size and frequency of bronchodilator dose must be adjusted according to the patient's clinical symptoms and response.

1. Near death (i.e., peak expiratory flow rate [PEFR] and forced expiratory volume in the first second [FEV_1] not appropriate; patient exhausted, confused, diaphoretic; cyanosis; silent chest; decreasing respiratory effort; failing heart rate)

   100% oxygen
   AND
   continuous salbutamol inhalation
   AND
   intubation (see *Rapid-sequence intubation*)

2. Severe (unable to measure PEFR or PEFR ≥40%, in adults, or ≥50%, in children, of personal best or predicted level; O_2 saturation <90%, in adults, or <92%, in children; laboured respirations; difficulty speaking; no relief with beta-adrenergic agonists at usual doses or prehospital, tachycardia; altered mental state)

   supplemental oxygen to achieve 92–95% saturation

AND

salbutamol and ipratropium

Adults

	salbutamol	400–800 µg (4–8 puffs) by MDI with spacer every 15–20 min x 3; up to 100 µg (1 puff) every 30–60 s (4–20 puffs); then decrease frequency as symptoms improve	$0.02/puff
	ipratropium	80–160 µg (4–8 puffs) by MDI with spacer every 15–20 min x 3; up to 20 µg (1 puff) every 30–60 s (4–20 puffs); then decrease frequency as symptoms improve	$0.08/puff
or	salbutamol	5 mg (1 mL)	$0.59/dose
	ipratropium	0.25–0.5 mg (1–2 mL) diluted to 4 mL with normal saline, by nebulizer every 15–20 min x 3 to continuous; then decrease frequency as symptoms improve	$0.76–1.51/dose

Children[3]

salbutamol	30 µg/kg (0.3 puffs/kg) by MDI with spacer, every 15–20 min up to 30 µg/kg every 30 s (maximum	$0.02/puff

			300 µg); then decrease frequency as symptoms improve	
		ipratropium	60–120 µg (3–6 puffs) every 20–120 min; then decrease frequency as symptoms improve	$0.08/puff
	or	salbutamol	0.15 mg/kg (0.03 mL/kg) diluted up to 4 mL normal saline, by nebulizer, every 15–20 min to continuous; then decrease frequency as symptoms improve	$0.02/kg per dose
		ipratropium	0.25 mg (1 mL), diluted to 4 mL with normal saline, by nebulizer, every 20–120 min; then decrease frequency as symptoms improve	$0.76/dose
AND corticosteroids				
	prednisone			
	Adults		50 mg, single dose	$0.10/dose
	Children		1–2 mg/kg, single dose	$0.09–0.18/kg per dose
or	hydrocortisone			
	Adults		200 mg, I.V., bolus	$3.92/dose
	Children		5–7 mg/kg, I.V., bolus	$0.10–0.14/kg per dose
or	methylprednisolone			
	Adults		125 mg I.V. bolus	$12.87/dose
	Children		1–2 mg/kg, I.V. bolus	$0.12–0.23/kg per dose

3. Moderate (PEFR or FEV_1 40–60% of personal best or predicted (in adults) or 50–75% (in children); partial relief from beta-adrenergic agonists; dyspnea at rest; congested and chest symptoms; abbreviated speech)

   supplemental oxygen to achieve 92–95% saturation
   AND
   salbutamol and corticosteroids as for severe symptoms (above)
   AND
   consider ipratropium

4. Mild (PEFR or FEV_1 ≥60%, in adults, or ≥75%, in children, of personal best or predicted; exertional dyspnea or cough; increased use of beta-adrenergic agonists; nocturnal cough or symptoms; good response to beta-agonists)

   supplemental oxygen, prn

AND	salbutamol			
	Adults		400–800 µg (4–8 puffs), by MDI with spacer q1h	$0.02/puff

	or	5 mg (1 mL), diluted to 4 mL with normal saline, by nebulizer q1h	$0.59/dose
Children		30 µg/kg (0.3 puffs/kg), by MDI with spacer, q1h	$0.02/puff
	or	0.15 mg/kg (0.03 mL/kg), diluted with 3 mL normal saline, q1h	$0.02/kg per dose

5. For nearly all patients discharged from the emergency department, to prevent relapse

prednisone		
Adults	50 mg, once daily x 7–14 days	$0.70/7 days
Children	1–2 mg/kg, once daily x 3–5 days	$0.27–0.54/kg for 3 days

AND one of the following inhaled steroids

budesonide[4] (400 µg/puff)		
Adults and children	400–800 µg b.i.d.	$0.53/puff
or beclomethasone		
Adults (50 µg/puff)	500–1000 µg b.i.d.	$0.04/puff
Children (100 µg/puff)	250–500 µg b.i.d.	$0.28/puff
or fluticasone		
Adults (250 µg/puff)	250–500 µg b.i.d.	$0.30/puff
Children (125 µg/puff)	125–250 µg b.i.d.	$0.60/puff
or triamcinolone (200 µg/puff)		
Adults	800–1200 µg b.i.d.	$0.07/puff
Children	400–1200 µg b.i.d.	

Second-line therapies[1]

1. If severe exacerbation and poor or no response[5,6]

magnesium sulfate		
Adults	1–2 g, I.V., at 1 g/min	$0.29–0.59/dose
Children	25–40 µg/kg, I.V., at 1 g/min	$0.01/kg per dose

2. In patients who are coughing excessively, are too weak to inspire adequately or are moribund

salbutamol		
Adults	4 µg/kg I.V. over 2–5 min; then infusion of 0.1–0.2 µg/kg per min depending on response	$0.08/kg per dose
Children	7.5 µg/kg, I.V. over 2–5 min; then 1–10 µg/kg per min	$0.15/kg per dose

Additional instructions and notes

- Meta-analyses evaluating MDI and wet nebulization in children[7] and adults[8] indicate that the use of an MDI with a chamber or spacer is associated with more rapid onset of bronchodilation, shorter duration of emergency department treatment, fewer side-effects and greater patient preference.
- There is no benefit in giving corticosteroids intravenously, and this route should only be used if patients are unable to take an oral dose, e.g., too distressed or intubated or vomiting.
- If patients are already taking oral or inhaled corticosteroids, they should receive additional corticosteroids in the emergency department.
- It is not necessary to taper short courses of corticosteroids given on discharge from the emergency department.
- Methylxanthines are not recommended in the emergency department.[9]
- In adults, salbutamol is more effective and safer when inhaled than when given intravenously.[10–12]
- There is no difference in effectiveness between continuous and intermittent nebulization of salbutamol in severe asthma.[13]
- If there is a concern about fluid retention and if corticosteroids must be given intravenously, methylprednisolone is a better choice than hydrocortisone.

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RESPIRATORY SYSTEM

Bronchitis, acute

Drugs of choice[1–3]

Acute bronchitis is almost always viral in origin and a self-limiting condition. Meta-analyses of placebo-controlled trials confirm that there is no reduction in severity or duration of symptoms in patients receiving antibiotics. Treatment for most patients is largely focused on symptoms.

Second-line therapies[4]

For persistent, troublesome cough or bronchial hyperresponsiveness, inhaled short-acting beta-2 agonist

In the emergency department

	salbutamol	800 µg (8 puffs) by MDI with spacer; may repeat hourly x 2	$0.02/puff
	or	5 mg (1 mL of respirator solution), diluted to 4 mL with normal saline, by nebulizer; may repeat hourly x 2	$0.59/dose

On discharge home

	salbutamol MDI (100 µg per puff)	200 µg, q.i.d.	$0.02/puff
or	fenoterol MDI (100 µg per puff)	200 µg, q.i.d.	$0.05/puff
or	terbutaline Turbuhaler® (500 µg per puff)	500 µg, q.i.d.	$0.07/puff

Additional instructions and notes

- Remove and avoid irritants, such as cigarette smoke and toxic dusts.
- Cough suppressants may be of some mild value. See *Cough, acute*.

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RESPIRATORY SYSTEM

Chronic obstructive airways disease — acute exacerbation

Drugs of choice[1]

Supplemental oxygen to achieve an oxygen saturation level of 90–91%

AND

Bronchodilators — dose and dosing frequency must be adjusted based on symptoms

	ipratropium	80–160 µg (4–8 puffs) by MDI with spacer every 15–20 min x 3; increase to 20 µg (1 puff) every 30–60 s if necessary (4–20 puffs); decrease frequency if symptoms improve	$0.08/puff
	or	250–500 µg (1–2 mL in 3 mL normal saline), by nebulizer every 15–20 min x 3; increase to continuous inhalation if necessary; decrease frequency if symptoms improve	$0.76–1.51/dose

When no further response to ipratropium, add

	salbutamol	100–200 µg (1–2 puffs), by MDI with spacer, q1h	$0.02/puff
	or	5 mg (1 mL in 3 mL normal saline), by nebulizer, q1h	$0.59/dose

AND, in patients requiring hospital admission

	prednisone[2]	30–60 mg, once daily	$0.05–0.11/day
or	methylprednisolone[3]	125 mg, I.V., q.i.d.	$51.48/day

In patients with severe disease[4]

	Continuous positive airway pressure (CPAP)
or	Biphasic positive airway pressure (BIPAP)

Second-line therapies

1. Outpatient therapy[5]

tetracycline	250 mg, q.i.d. x 7 days	$0.53/7 days

or	amoxicillin	250–500 mg, t.i.d. x 7 days	$2.17–4.22/7 days
2.	Inpatient therapy		
	cefotaxime	1 g, I.V., q8h	$27.54/day
or	ticarcillin/clavulanate	3.1 g, I.V., q6h	$31.60/day
or	ceftriaxone	1 g, I.V., once daily	$34.00/day
or	piperacillin/tazobactam	4.5 g, I.V., q8h	$63.60/day

Additional instructions and notes

- The value of adding salbutamol to ipratpropium for acute exacerbations has not been established. The recommendation to start ipratropium first is based on its fewer and milder side effects.[1]
- Studies have shown that although PCO_2 rises in response to oxygen therapy, the amount of air moved by the patient per minute changes little. Patients with partial correction of hypoxia, who have mild respiratory acidosis, continue to have a high respiratory drive. It is the patient who is breathing too slowly who is at highest risk of apnea with oxygen therapy.
- Noninvasive ventilation (CPAP/BIPAP) reduces the need for intubation and inhospital mortality rate.[4]
- There is no role for theophylline or derivatives in acute exacerbations.
- The value of respiratory stimulants such as doxapram has yet to be established.
- Benefits from antibiotics are most evident for patients with the most symptoms (dyspnea, increased sputum volume, and sputum purulence). Many clinicians use antibiotics when two of the above three symptoms are present.[6]
- See also *Rapid-sequence intubation*.

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RESPIRATORY SYSTEM

Pneumocystis carinii pneumonia

Drugs of choice[1–4]

1. Mild to moderately severe disease

trimethoprim/sulfamethoxazole

Adults and children	5 mg of trimethoprim per kg, q.i.d. x 21 days (maximum 300 mg trimethoprim/day)	$0.32/kg per 21 days (160 mg trimethoprim/ tablet) $1.04/kg per 21 days (8 mg trimethoprim/mL)

2. Severe disease

trimethoprim/sulfamethoxazole

Adults and children	5 mg of trimethoprim per kg, I.V., q6h	$1.00/kg per day

3. If patient is intolerant of trimethoprim/sulfamethoxazole

pentamidine[5,6]

Adults and children	4 mg/kg per day, I.V., once daily	$0.67/kg per day

Second-line therapies[3,4]

1. Mild to moderately severe disease

i. clindamycin

Adults	300–450 mg, q.i.d. x 21 days	$91.28–136.91/21 days
Children	10 mg/kg, q.i.d. x 21 days	$6.18/kg for 21 days

AND

primaquine

Adults	15–30 mg, once daily x 21 days	$6.93–13.86/21 days
Children >1 year	300–600 µg/kg, once daily x 21 days	$1.39–2.78/kg for 21 days

or ii. dapsone

Adults	100 mg, once daily x 21 days	$4.20/21 days
Children	1–2 mg/kg, once daily x 21 days	$0.04–0.08/kg for 21 days

AND

trimethoprim/sulfamethoxazole

Adults and children	5 mg of trimethoprim per kg, q.i.d. x 21 days	$0.32/kg for 21 days (160 mg

		trimethoprim/ (maximum 300 mg trimethoprim/day)	tablet) $1.04/kg per 21 days (8 mg trimethoprim/mL)
or	iii. atovaquone[7]	750 mg, t.i.d. x 21 days	$717.26/21 days
2.	Severe disease		
	clindamycin		
	Adults	600 mg, I.V., q6h	$36.60/day
	Children	10 mg/kg, I.V., q6h	$0.60/kg per day
	AND		
	primaquine		
	Adults	15–30 mg, once daily	$0.33–0.66/day
	Children	300–600 µg/kg, once daily	$0.07–0.13/kg per day
3.	In any patient with PaO_2 <70 mmHg		
	prednisone[1]	40 mg, b.i.d. x 5 days; then 40 mg, once daily x 5 days; then 20 mg, once daily until antipneumocystis therapy is discontinued	$0.72/5 days $0.36/5 days $0.04/day

Additional instructions and notes

- Failure of treatment with an accepted regimen is uncommon. Thus, changing antimicrobial agents, other than for toxicity, is not generally indicated.
- Adjustment of the dose of trimethoprim/sulfamethoxazole to 4 mg of the trimethoprim component per kg per day may allow for continued therapy in patients who have problems tolerating the drug.
- In patients with minor intolerance to trimethoprim/sulfamethoxazole (minor rash, gastrointestinal intolerance) desensitization is preferred to switching agents for moderate to severe disease.
- Atovaquone and the combination of clindamycin and primaquine have not been studied in children.

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RESPIRATORY SYSTEM

Pneumonia, community-acquired — adults

Drugs of choice[1]

1. Outpatients without modifying factors

	erythromycin base	1–2 g, divided b.i.d. to q.i.d. x 10 days	$1.81–3.62/10 days
or	clarithromycin	250–500 mg, b.i.d. x 10 days	$29.58–59.16/10 days
or	azithromycin	500 mg initially; then 250 mg once daily x 4 days	$29.60/5 days

2. Outpatients with modifying factors

i. Chronic obstructive airways disease and no antibiotics or oral steroids in the past 3 months

	clarithromycin	250–500 mg, b.i.d. x 10 days	$29.58–59.16/10 days
or	azithromycin	500 mg initially; then 250 mg, once daily x 4 days	$29.60/5 days

ii. Chronic obstructive airways disease and antibiotics or oral steroids in the past 3 months

	levofloxacin	500 mg, once daily x 10 days	$50.10/10 days

3. Nursing-home patient or outpatient therapy

	i. amoxicillin/clavulanate	500 mg/125 mg, t.i.d. x 10 days	$40.04/10 days
	AND one of the following		
	erythromycin base	1–2 g, divided b.i.d. to q.i.d. x 10 days	$1.81–3.62/10 days
or	clarithromycin	250–500 mg, b.i.d. x 10 days	$29.58–59.16/10 days
or	azithromycin	500 mg initially; then 250 mg once daily x 4 days	$29.60/10 days
or	ii. levofloxacin	500 mg, once daily x 10 days	$50.10/10 days

4. Patients in hospital on medical ward

levofloxacin	500 mg, oral or I.V., once daily	$5.01/day (oral) $44.24/day (I.V.)

5. Patients in hospital in intensive care unit

i. *Pseudomonas aeruginosa* not suspected

	levofloxacin	500 mg, I.V., once daily	$44.24/day
	AND one of the following		
	cefotaxime	1 g, I.V., t.i.d.	$27.54/day
or	ticarcillin/clavulanate	3.1 g, I.V., q6h	$31.60/day
or	ceftriaxone	1 g, I.V., once daily	$34.00/day

or	piperacillin/tazobactam	4.5 g, I.V., q6h	$63.60/day

ii. *P. aeruginosa* suspected

	ciprofloxacin	500 mg, I.V., q12h	$82.50/day
	AND one of the following		
	gentamicin	5–7 mg/kg, I.V., once daily	$0.25–0.35/kg per day
or	tobramycin	300 mg, I.V., q12h	$36.14/day
or	meropenem	500–1000 mg, I.V., q8h	$79.92–141.84/day
or	imipenem/cilastatin	500–1000 mg, I.V., q6h	$98.68–197.36/day

6. Patients with aspiration pneumonia[2]

i. Community-acquired

	amoxicillin/clavulanate	500 mg/125 mg, t.i.d.	$3.99/day
	AND consider one of		
	erythromycin base	1–2 g, divided b.i.d. to q.i.d. x 10 days	$1.81–3.62/10 days
or	clarithromycin	250–500 mg, b.i.d. x 10 days	$29.58–59.16/10 days
or	azithromycin	500 mg initially; then 250 mg, once daily x 4 days	$29.60/5 days

ii. Resident in a long-term care facility

	levofloxacin	500 mg, oral or I.V., once daily	$5.01/day (oral) $44.24/day (I.V.)
or	ceftriaxone	1–2 g, I.V., once daily	$34.00–68.00/day

iii. Alcoholism related

	piperacillin/tazobactam	3.375 g, I.V., q6h	$63.60/day
or	imipenem/cilastatin	500 mg, I.V., q8h to 1 g, I.V., q6h depending on severity of disease	$74.01–197.36/day

Second-line therapies[2]

1. Outpatients without modifying factors

doxycycline	100 mg, b.i.d. x 10 days	$11.72/10 days

2. Outpatients with modifying factors

i. Chronic obstructive airways disease and no antibiotics or oral steroids in the past 3 months

doxycycline	100 mg, b.i.d. x 10 days	$11.72/10 days

ii. Chronic obstructive airways disease and antibiotics or oral steroids in the past 3 months

A. amoxicillin/clavulanate	500 mg/125 mg, t.i.d. x 10 days	$40.04/10 days
AND one of the following		
erythromycin base	1–2 g, divided b.i.d. to q.i.d.	$1.81–3.62/10 days

			x 10 days	
	or	clarithromycin	250–500 mg, b.i.d. x 10 days	$29.58–59.16/10 days
	or	azithromycin	500 mg initially; then 250 mg, once daily x 4 days	$29.60/5 days
or		B. cefuroxime axetil	500 mg, b.i.d. x 10 days	$57.35/10 days
		AND one of the following		
		erythromycin base	1–2 g, divided b.i.d. to q.i.d. x 10 days	$1.81–3.62/10 days
	or	clarithromycin	250–500 mg, b.i.d. x 10 days	$29.58–59.16/10 days
	or	azithromycin	500 mg initially; then 250 mg, once daily x 4 days	$29.60/5 days

3. Nursing-home patients or outpatient therapy

	cefuroxime axetil	500 mg, b.i.d. x 10 days	$57.35/10 days
	AND one of the following		
	erythromycin base	1–2 g, divided b.i.d. to q.i.d. x 10 days	$1.81–3.62/10 days
or	clarithromycin	250–500 mg, b.i.d. x 10 days	$29.58–59.16/10 days
or	azithromycin	500 mg initially; then 250 mg, once daily x 4 days	$29.60/5 days

4. Patients in hospital on medical ward

	cefuroxime	750 mg, I.V., q8h	$26.76/day
or	cefotaxime	1 g, I.V., q8h	$27.54/day
or	ceftriaxone	1 g, I.V., once daily	$34.00/day
	AND one of the following		
	erythromycin	1–2 g, oral or I.V., divided q6h to q12h	$0.18–0.36/day (oral) $23.33–46.00/day (I.V.)
or	clarithromycin	250–500 mg, q12h	$2.96–5.92/day
or	azithromycin	500 mg, oral or I.V., once daily	$9.86/day (oral) $20.00/day (I.V.)

5. Patients in hospital in intensive care unit

	i. *P. aeruginosa* not suspected		
	One of the following		
	azithromycin	500 mg, I.V., once daily	$20.00/day
or	erythromycin	2 g, I.V., divided b.i.d. to q.i.d.	$46.66/day
	AND one of the following		
	cefotaxime	1 g, I.V., t.i.d.	$27.54/day
or	ticarcillin/clavulanate	3.1 g, I.V., q6h	$31.60/day
or	ceftriaxone	1 g, I.V., once daily	$34.00/day
or	piperacillin/tazobactam	4.5 g, I.V., q6h	$63.60/day
	ii. *P. aeruginosa* suspected		
	One of the following		
	imipenem/cilastatin	500–1000 mg, I.V., q6h	$39.60/day

or	piperacillin/tazobactam	4.5 g, I.V., q6h	$63.60/day
or	meropenem	500–1000 mg, I.V., q8h	$70.92–141.84/day
or	ceftazidime	2 g, I.V., q8h	$111.30/day
AND one of the following			
	gentamicin	5–7 mg/kg, I.V., once daily	$0.25–0.35/kg per day
or	tobramycin	300 mg, I.V., q12h	$36.14/day
AND one of the following			
	azithromycin	500 mg, I.V., once daily	$20.00/day
or	erythromycin	2 g, I.V., divided b.i.d. to q.i.d.	$46.66/day

6. Patients with aspiration pneumonia

	levofloxacin	500 mg, oral or I.V., once daily	$5.01/day (oral) $44.24/day (I.V.)
or	ceftriaxone	1–2 g, I.V., once daily	$34.00–68.00/day

AND to one of the above add one of

	metronidazole	500 mg, oral or I.V., q8h	$0.06/day (250-mg tablet) $0.85/day (500-mg capsule) $15.00/day (I.V.)
or	clindamycin	600 mg, oral or I.V., q8h	$6.51/day (oral) $9.15/day (I.V.)

Additional instructions and notes

- One observational study did not find any improvement in medical outcome in patients with comorbid illness, over 65 years old or both who received one of the three first-line agents (recommended in the previous consensus guidelines) compared with those who did not. On average, the cost of therapy for those receiving of these first-line agents was 10 times greater than for those receiving alternative agents.[3]
- Ciprofloxacin is not indicated for the treatment of uncomplicated community-acquired pneumonia unless *Legionella* is suspected and the patient is unable to tolerate a macrolide (erythromycin, clarithromycin, azithromycin).

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RESPIRATORY SYSTEM

Pneumonitis, aspiration

Drugs of choice[1]

1. Pneumonitis

   i. The prophylactic use of antibiotics for aspiration pneumonitis is not recommended. Similarly, antibiotics should not be used if patients develop fever, leukocytosis or a pulmonary infiltrate shortly after aspiration.

   ii. Patients who aspirate gastric contents or who have small bowel obstruction or other conditions associated with colonization of the gastric contents or in whom symptoms persist for more than 48 h

	levofloxacin	500 mg, oral or I.V., once daily	$5.01/day (oral) $44.24/day (I.V.)
or	ceftriaxone	1–2 g, I.V., once daily	$34.00–68.00/day

Additional instructions and notes

- Corticosteroids are not recommended for aspiration pneumonitis.[2]
- Anaerobes are not the predominant organisms in aspiration pneumonia; therefore, penicillin and clindamycin may not be the antibiotics of choice in this situation in adults.[3,4]

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SKIN AND SOFT TISSUE

Allergic reactions (urticaria and pruritus), acute

Drugs of choice[1,2]

1. Antihistamines

diphenhydramine			
Adults		25–50 mg, oral or I.M. (oral)	$0.11–0.22/dose $1.50–3.00/dose (I.M.)
Children		1–2 mg/kg, oral or I.M.	$0.01–0.02/kg per dose (oral) $0.06–0.12/kg per dose (I.M.)

AND if urticaria persists after use of antihistamines

cimetidine			
Adults		300 mg	$0.09/dose
Children		5–7 mg/kg	$0.01–0.02/kg per dose
or ranitidine			
Adults		150 mg, oral	$0.40/dose
	or	50 mg, I.M.	$2.55/dose
Children		3 mg/kg, oral	$0.04/kg per dose
	or	1 mg/kg, I.M.	$0.05/kg per dose
or nizatidine			
Adults		150 mg	$0.53/dose
or famotidine			
Adults		20 mg, oral	$0.59/dose

2. On discharge from the emergency department, for ongoing treatment if required

i. Antihistamines[3–5]

chlorpheniramine		
Adults	4–8 mg, hs to b.i.d.	$0.22–0.88/day
Children 6–12 years	2 mg, hs to b.i.d.	$0.18–0.36/day
or dexchlorpheniramine		
Adults	4 mg, hs to b.i.d.	$1.69–3.38/day
Children 6–12 years	1 mg, hs to b.i.d.	$0.42–0.84/day

ii. For particularly disabling pruritus or in recurrent or recalcitrant cases prednisone[6]

Adults	25 mg, b.i.d. x 4 days	$0.40/4 days
Children	1 mg/kg, divided b.i.d. x 4 days	$0.36/kg for 4 days

Second-line therapies

When sedation effects are unacceptable

	cetirizine		
	Adults	10–20 mg, once daily	$0.62–1.24/day
	Children 6–12 years	5 mg, b.i.d.	$0.94/day
	Children 2–5 years	1–2.5 mg, b.i.d.	$0.12–0.32/day
or	fexofenadine		
	Adults	60 mg, b.i.d.	$0.90/day
	Children 7–12 years	30 mg, b.i.d.	$0.45/day
	Children 3–6 years	15 mg, b.i.d.	$0.22/day
or	loratadine		
	Adults	10 mg, once daily	$0.91/day
	Children <12 years	5 mg, once daily	$0.32/day

Additional instructions and notes

- See also, *Anaphylactic reactions*.
- Give H2 antagonists intravenously over at least 2 min to prevent hypotension and cardiac arrhythmias.
- All oral antihistamines (sedating or nonsedating) are equally efficacious.

References

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SKIN AND SOFT TISSUE

Bites, cat and dog

Drugs of choice[1,2]

1. Full-thickness bites that cannot be adequately debrided and irrigated — for prophylaxis, treat for 3 days; for established infection, treat for 7 days

	amoxicillin/clavulanate		
	Adults	500 mg/125 mg, t.i.d.	$3.99/day
	Children	30 mg of amoxicillin/kg, t.i.d.	$0.30/kg per day
or	cefuroxime axetil		
	Adults	500 mg, b.i.d.	$4.74/day
	Children	25 mg/kg, b.i.d.	$0.32/kg per day

2. Intravenous therapy should be instituted for patients with established infection and the following presentations: immunocompromised (including splenectomy) systemic manifestations of infection; cellulitis that is severe, has advanced past one joint, has spread rapidly and has not responded to oral antibiotics; or wounds or infections thought or known to involve a bone, joint, tendon or nerve.

	ticarcillin/clavulanate		
	Adults	3 g, I.V., q6h	$39.60/day
	Children	50 mg/kg, I.V., q6h	$0.64/kg per day
or	ceftriaxone		
	Adults	1 g, I.V., once daily	$34.00/day
	Children	50 mg/kg, I.V., once daily	$2.15/kg per day

Second-line therapies

1. Outpatient therapy for patients allergic to penicillin — for prophylaxis, treat for 3 days; for established infection, treat for 7 days

	i. trimethoprim/sulfamethoxazole		
	Adults	160 mg/800 mg, b.i.d.	$0.24/day
	Children	4 mg/20 mg per kg, b.i.d.	$0.02/kg per day
or	doxycycline		
	Adults and children >8 years	100 mg, b.i.d.	$1.18/day
or	clarithromycin		
	Adults	250–500 mg, b.i.d.	$2.96–5.92/day
	Children <12 years	15 mg/kg per day, divided b.i.d.	$0.16/kg per day
	AND to trimethoprim/sulfamethoxazole or doxycycline or clarithromycin, add metronidazole		
	Adults	500 mg, t.i.d.	$0.09/day (250-mg tablet) $2.55/day (500-mg capsule)

	Children	7.5 mg/kg, t.i.d.	$0.003/kg per day (250-mg tablet) $0.04/kg per day (500-mg capsule)
or	ii. ciprofloxacin		
	Adults only	500–750 mg, b.i.d.	$5.02–9.46/day
	AND		
	clindamycin	300 mg, t.i.d.	$3.27/day

2. Patients in hospital who are allergic to penicillin

	cefotaxime		
	Adults	1 g, I.V., q8h	$27.54/day
	Children	50 mg/kg, I.V., q8h	$1.80/kg per day
or	ceftriaxone		
	Adults	1 g, I.V., once daily	$34.00/day
	Children	50 mg/kg, I.V., once daily	$2.15/kg per day

Additional instructions and notes

- All wounds should be thoroughly cleaned, irrigated and debrided.
- Ensure that tetanus immunization is up to date.
- Cat bites tend to be puncture wounds that are difficult to irrigate adequately. Therefore, all full-thickness bites should be treated prophylactically with antibiotics.
- Only high-risk dog bites need prophylactic antibiotics (high-risk patients are those immunocompromised (including splenectomy); over 50 years; female; with full-thickness wounds; with puncture wounds; with wounds requiring debridement; presenting more than 24 h after the injury).[3,4]
- Antibiotic therapy should be started as quickly as possible, preferably while the patient is still in the emergency department.
- Antibiotic therapy should cover *Pasteurella multocida*, *Staphylococcus aureus*, streoptococci and anerobes. First-generation cephalosporins do not adquately treat *Pasteurella multocida* infection.

References

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SKIN AND SOFT TISSUE

Bites, human

Drugs of choice[1–3]

1. Patients seen within the first 3 h after injury

   i. "Clenched-fist" injury or if wound appears dirty

   amoxicillin/clavulanate

Adults	500 mg/125 mg, t.i.d. x 3–5 days	$12.01/3 days
Children	30 mg of amoxicillin/kg, t.i.d. x 3–5 days	$0.94/kg for 3 days

   ii. Bites to other areas of the body and clean wound
   Thorough irrigation and debridement

2. Patients seen 3–24 h after injury

   i. Uninfected clenched-fist injury or infected wound in any area of the body

   cefuroxime

Adults	750–1500 mg, I.V., q8h	$26.76–50.34/day
Children	50 mg/kg, I.V., q8h	$1.77/kg per day

   or piperacillin/tazobactam

Adults	2–4 g, I.V., q6h–q8h	$31.80–84.80/day
Children	100 mg/kg, I.V., q6h–q8h	$1.59–2.06/day

   or ticarcillin/clavulanate

Adults	3 g, I.V., q6h	$39.60/day
Children	50 mg/kg I.V., q6h	$0.48/kg per day

   or cefoxitin

Adults	2 g, I.V., q8h	$69.27/day
Children	40 mg/kg, I.V., q8h	$1.38/kg per day

   ii. Uninfected nonclenched-fist injury

   amoxicillin/clavulanate

Adults	500 mg/125 mg, t.i.d. x 3–5 days	$12.01/3 days
Children	30 mg amoxicillin/kg, t.i.d.x 3–5 days	$0.94/kg for 3 days

3. Patients seen more than 24 h after injury

   i. Clenched-fist injury or infected wound

   cefuroxime

Adults	750–1500 mg, I.V., q8h	$26.76–50.34/day
Children	50 mg/kg, I.V., q8h	$1.77/kg per day

   or piperacillin/tazobactam

Adults	2–4 g, I.V., q6h–q8h	$31.80–84.80/day
Children	100 mg/kg, I.V., q6h–q8h	$1.59–2.06/day

   or ticarcillin/clavulanate

	Adults	3 g, I.V., q6h	$39.60/day
	Children	50 mg/kg, I.V., q6h	$0.48/kg per day
or	cefoxitin		
	Adults	2 g, I.V., q8h	$69.27/day
	Children	40 mg/kg, I.V., q8h	$1.38/kg per day

ii. Uninfected bites to other areas of the body
No antibiotic therapy necessary

Second-line therapies[1,3]

1. Outpatient treatment when patient is allergic to penicillin

cefaclor		
Adults	250 mg, t.i.d. x 3–5 days	$5.79/3 days
Children	15 mg/kg, t.i.d. x 3–5 days	$0.36/kg for 3 days

2. Inpatient treatment when patient is allergic to penicillin

clindamycin		
Adults	600 mg, I.V., q8h	$27.45/day
Children	10 mg/kg, I.V., q8h	$0.45/kg per day
AND		
trimethoprim/sulfamethoxazole		
Adults	160 mg/800 mg, oral or I.V., q12h	$0.24/day (oral) $16.18/day (I.V.)
Children	8 mg/40 mg per kg, oral or (oral)	$0.04/kg per day
	I.V. q12h	$0.80/kg per day (I.V.)

Additional instructions and notes

- All wounds should be thoroughly cleaned, irrigated and debrided. Closed-fist injuries should be debrided through full range of motion.
- Ensure that tetanus immunization is up to date.
- Prophylactic antibiotic treatment of bites in areas other than hands is controversial.
- Antibiotic therapy should be started as rapidly as possible, preferably while the patient is still in the surgery or emergency department.
- Most infected wounds are polymicrobial, with an average of five organisms per wound. *Staphylococcus aureus*, streptococci, corynebacterium and *Eikenella corrodens* are the most common aerobic pathogens. *E. corrodens* is resistant to clindamycin and metronidazole, but is susceptible to trimethoprim/sulfamethoxazole.[3] Half of all anaerobes from the human mouth are resistant to penicillin.

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SKIN AND SOFT TISSUE

Burns, superficial and small partial-thickness

Drugs of choice[1,2]

1. Superficial burns, see *Sunburn*

2. Small partial-thickness burns
   Nonadherent, porous mesh gauze dressings without antibiotics, such as Jellnet®, covered with bulky, fluffed, coarse mesh gauze and an outer layer of semi-elastic coarse mesh. Change daily for first week.

Second-line therapies

	aspirin		
	Adults only	300–900 mg, q4h	$0.01–0.03/dose
or	acetaminophen		
	Adults	500–1000 mg, q4h	$0.01–0.03/dose
	Children	15 mg/kg, q4h	$0.03/kg per dose
or	ibuprofen		
	Adults	200–400 mg, q4h	$0.02–0.04/dose
	Children	10 mg/kg, q6h	$0.02/kg per dose

Additional instructions and notes

- Partial-thickness burns on the face, hands, feet, or genitals, in flexure creases, and in children may require additional treatment depending on the extent of the area involved.
- Ensure that tetanus immunization is up to date.
- Loose, necrotic skin and broken blisters should be thoroughly debrided.
- Treatment of intact blisters varies depending on their location and size. Large tense blisters in areas where they are likely to break should be evacuated by aspirating the blister with a sterile needle.[2]
- Topical antibiotics, such as silver sulfadiazine, delay healing and should be avoided.[3,4]
- For severe pain, use acetaminophen or aspirin in combination with codeine.

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SKIN AND SOFT TISSUE

Cellulitis

Drugs of choice[1,2]

1. Mild to moderate cases

cloxacillin		
Adults	500 mg, q.i.d. x 7 days	$5.45/7 days
Children <20 kg	12.5–25 mg/kg, q.i.d. x 7 days	$0.28–0.56/kg for 7 days
or cephalexin		
Adults	500 mg, q.i.d. x 7 days	$8.36/7 days
Children	6.25–12.5 mg/kg, q.i.d. x 7 days	$0.28–0.56/kg for 7 days

2. Severe cases

i. cloxacillin		
Adults	2 g, I.V., q6h	$40.00/day
Children	25–50 mg/kg, I.V., q6h	$0.48–1.00/kg per day
or ii. cefazolin		
Adults	1–2 g, I.V., q8h	$8.40–16.80/day
Children	10–15 mg/kg, I.V., q8h	$0.12–0.18/kg per day
or iii. cefazolin[3]	2 g, I.V., once daily	$5.60/day
AND		
probenecid	1 g, once daily	$0.38/day

Second-line therapies[1]

1. If patient is allergic to penicillin — mild to moderate cases

erythromycin base		
Adults	1 g, divided b.i.d. to q.i.d. x 7 days	$1.27/7 days
Children	30–50 mg/kg per day, divided b.i.d. to q.i.d. x 7 days	$0.21–0.35/kg for 7 days (80 mg/mL) $0.35–0.56/kg for 7 days (40 mg/mL)
or clindamycin		
Adults	300 mg, t.i.d. x 7 days	$22.82/7 days
Children	10 mg/kg, t.i.d. x 7 days	$0.76/kg for 7 days

2. If patient is allergic to penicillin — severe cases

clindamycin

	Adults	600 mg, I.V., q8h	$27.45/day
	Children	10 mg/kg, I.V., q6h	$0.45/kg per day
or	vancomycin		
	Adults	1 g, I.V., q12h	$104.90/day
	Children	20 mg/kg, I.V., q12h	$2.10/kg per day

Additional instructions and notes

- As it is difficult to distinguish clinically between cellulitis due to *Staphylococcus aureus* and *Streptococcus* group A, initial therapy should cover both organisms in most cases. Recurrent lower limb cellulitis is almost always due to *Streptococcus* and initial treatment can be started with oral or parenteral penicillin.
- Treating cellulitis due to *Streptococcus* group A organisms does not prevent poststreptococcal glomerulonephritis.
- Other erythromycins, including modified-release preparations, may be 2–7 times more expensive than erythromycin base.

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SKIN AND SOFT TISSUE

Dermatitis, contact

Drugs of choice[1]

1. Acute

i. For acute inflammation characterized by vesicular eruptions with exudation, oozing and crusting

	aluminum acetate/ benzethonium chloride	dilute 1:20 with tepid water; apply for 0.5–2 h, changing dressing every 5–15 min; repeat t.i.d. to q.i.d..	$0.70/sachet

ii. For localized areas, moderately potent topical corticosteroids

	betamethasone valerate[2]	0.1% cream, b.i.d. to q.i.d.	$0.68/30 g
or	triamcinolone	0.1% cream, b.i.d. to q.i.d.	$1.60/30 g
or	fluocinolone	0.025% cream, b.i.d. to q.i.d.	$1.60/30 g

iii. To relieve itching, oral antihistamines[3–5]

	chlorpheniramine		
	Adults	4–8 mg, hs to b.i.d.	$0.22–0.88/day
	Children 6–12 years	2 mg, hs to b.i.d.	$0.18–0.36/day
or	dexchlorpheniramine		
	Adults	4 mg, hs to b.i.d.	$1.69–3.38/day
	Children 6–12 years	1 mg, hs to b.i.d.	$0.42–0.84/day

2. Chronic

Mild, weakly potent to mild, moderately potent topical corticosteroids

	betamethasone valerate	0.05% cream, q.i.d.	$0.46/30 g
or	hydrocortisone	1% cream, b.i.d. to q.i.d.	$0.55/30 g

Second-line therapies

Acute

i. To relieve itching, oral antihistamines when sedation effects are unacceptable[3]

	cetirizine		
	Adults	10–20 mg, once daily	$0.62–1.24/day
	Children 6–12 years	5 mg, b.i.d.	$0.94/day
	Children 2–5 years	1–2.5 mg, b.i.d.	$0.12–0.32/day
or	fexofenadine		
	Adults	60 mg, b.i.d.	$0.90/day
	Children 7–12 years	30 mg, b.i.d.	$0.45/day
	Children 3–6 years	15 mg, b.i.d.	$0.22/day
or	loratadine		
	Adults	10 mg, once daily	$0.91/day
	Children <12 years	5 mg, once daily	$0.32/day

ii. Widespread dermatitis prednisone		
Adults	50 mg, once daily x 7 days; then reduce by 5 mg/day	$0.10/50-mg tablet $0.01/5-mg tablet
Children <12 years	1 mg/kg, once daily (maximum 50 mg/day) x 7 days; then reduce by 2.5 mg/day	$0.09/mg

Additional instructions and notes

- There is no evidence that calamine lotion or other such suspensions are of any benefit.
- All oral antihistamines (sedating and nonsedating) are equally efficacious.
- The recommendation to taper prednisone is based on expert opinion, not controlled clinical trials.

References

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SKIN AND SOFT TISSUE

Dermatophytosis

Drugs of choice

1. Tinea corporis, tinea cruris, tinea manus, tinea pedis interdigitalis

	i. Topical imidazoles[1–3]		
	clotrimazole	1% cream, b.i.d. x 3–4 weeks	$2.70/30 g
or	miconazole	2% cream, b.i.d. x 3–4 weeks	$9.00/30 g
or	econazole	1% cream, b.i.d. x 3–4 weeks	$12.51/30 g
or	ii. Topical allylamines[4,5]		
	naftifine	1% cream, b.i.d. x 1–2 weeks	$5.84/15 g
or	terbinafine	1% cream, once daily to b.i.d. x 1–2 weeks	$13.50/30 g

2. Tinea capitis[6–8]

	griseofulvin		
	Adults	333 mg, once daily x 8 weeks	$21.84/8 weeks
	Children	5.5 mg/kg per day x 8 weeks	$0.40/kg for 8 weeks
or	terbinafine		
	Adults	250 mg, once daily x 1 week	$23.56/week
	Children 20–40 kg	125 mg, once daily x 1 week	$11.78/week
	Children <20 kg	62.5 mg, once daily x 1 week	$5.89/week

AND, with either of the above, to limit the spread of infection to other children

	selenium sulfide	1% shampoo, twice weekly x 2 weeks	$5.15/200 mL

3. Plantar-type tinea pedis[9,10]

	terbinafine	1% cream, once daily to b.i.d. x 1–2 weeks	$13.50/30 g
or	terbinafine	250 mg, once daily x 2 weeks	$47.12/2 weeks
or	itraconazole	200 mg, once daily x 1 week	$49.00/week

4. Tinea versicolor[1,11–14]

	ketoconazole	400 mg, single dose	$2.37/dose
or	selenium sulfide	2.5% shampoo, once daily for 10–15 min x 7–14 days	$5.15/200 mL
or	ketoconazole	200 mg, once daily x 10 days	$11.83/10 days
or	terbinafine	1% cream, once daily to b.i.d. x 2 weeks	$13.50/30 g
or	ketoconazole	2% cream, once daily x 2 weeks	$13.59/30 g
or	itraconazole	200 mg, once daily x 1 week	$49.00/week

Additional instructions and notes

- Good personal hygiene is an important adjunct to antifungal treatment, e.g., drying between toes, using a separate towel for infected areas, wearing sandals in public showers and change rooms, avoiding sharing combs, hats and towels.

References

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SKIN AND SOFT TISSUE

Diabetic foot

Drugs of choice[1]

1.	Non-limb-threatening infection, see *Cellulitis*		
2.	Limb-threatening infections		
	i. ticarcillin/clavulanate	3.1 g, I.V., q6h	$39.60/day
or	ii. cefoxitin	2 g, I.V., q8h	$69.27/day
or	iii. ciprofloxacin	500 mg, I.V., q12h	$82.50/day
	AND clindamycin	600 mg, I.V., t.i.d.	$27.45/day
or	iv. imipenem/cilastin[2]	1 g, I.V., q6h	$197.36/day

Additional instructions and notes

- Limb-threatening infections — as evidenced by full-thickness ulceration, greater than 2-cm-diameter cellulitis with or without lymphangitis, bone or joint involvement, or systemic toxicity — are usually polymicrobial and caused by aerobic Gram-positive cocci, Gram-negative bacilli and anaerobes.

References

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SKIN AND SOFT TISSUE

Erysipelas

Drugs of choice

	penicillin V		
	Adults	250–500 mg, q.i.d. x 10 days	$1.50–3.00/10 days
	Children	5–12.5 mg/kg, q.i.d. x 10 days	$0.02–0.48/kg for 10 days

Second-line therapies

If the patient is allergic to penicillin

	erythromycin base		
	Adults	1 g, divided b.i.d. to q.i.d. x 10 days	$1.81/10 days
	Children	30–50 mg/kg per day, divided b.i.d. to q.i.d. x 10 days	$0.50–0.80/kg for 10 days (40 mg/mL) $0.30–0.50/kg for 10 days (80 mg/mL)
or	cephalexin		
	Adults	500 mg, q.i.d. x 10 days	$11.94/10 days
	Children	10 mg/kg, q.i.d. x 10 days	$0.40/kg for 10 days
or	clindamycin		
	Adults	300 mg, t.i.d. x 10 days	$32.60/10 days
	Children	10 mg/kg, t.i.d. x 10 days	$2.21/kg for 10 days

Additional instructions and notes

- In one controlled trial in patients with either general malaise or severe local findings, intravenous penicillin was no better than oral penicillin.[1]
- Other erythromycins, including modified-release preparations, may be 2–7 times more expensive than erythromycin base.

Reference

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SKIN AND SOFT TISSUE

Furunculosis

Drugs of choice

In most cases the use of moist heat to promote localization and drainage is sufficient.

If surrounding cellulitis is present[1]

	cloxacillin		
	Adults	500 mg, q.i.d. x 7 days	$5.45/7 days
	Children <20 kg	12.5–25 mg/kg,q.i.d. x 7 days	$0.28–0.56/kg for 7 days
or	cephalexin		
	Adults	500 mg, q.i.d. x 7 days	$8.36/7 days
	Children	6.25–12.5 mg/kg, q.i.d. x 7 days	$0.28–0.56/kg for 7 days

Second-line therapies

If the patient is allergic to penicillin

	erythromycin base		
	Adults	1 g, divided b.i.d. to q.i.d. x 7 days	$1.27/7 days
	Children	30–50 mg/kg per day, divided b.i.d. to q.i.d. x 7 days	$0.21–0.35/kg for 7 days (80 mg/mL) $0.35–0.56/kg for 7 days (40 mg/mL)
or	clindamycin		
	Adults	300 mg, t.i.d. x 7 days	$22.82/7 days
	Children	5–10 mg/kg t.i.d. x 7 days	$0.77–1.54/kg for 7 days

Additional instructions and notes

- Soap and water should be used to reduce the number of *Staphylococcus aureus* organisms on the body. Some physicians prefer hexachlorophene or chlorhexidine to soap.
- Other erythromycins, including modified-release preparations, may be 2–7 times more expensive than erythromycin base.

References

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SKIN AND SOFT TISSUE

Genital herpes

Drugs of choice[1]

1. Primary episode

	acyclovir[1]		200 mg, 5 times a day x 7–10 days	$30.74/7 days
		or	400 mg, t.i.d. x 7–10 days	$36.30/7 days
		or	5 mg/kg, I.V., q8h x 5–7 days	$7.30/kg for 5 days
or	famciclovir		250 mg, t.i.d. x 5–10 days	$51.00/5 days
or	valacyclovir		1 g, b.i.d. x 7–10 days	$84.56/7 days

2. Recurrent infections

	acyclovir[1,2]	400 mg, b.i.d. x 5 days	$17.29/5 days
or	famciclovir[3]	125–250 mg, b.i.d. x 5 days	$25.30–34.00/5 days
or	valacyclovir[4]	500 mg, b.i.d. x 5 days	$30.20/5 days

Additional instructions and notes

- Treatment should be started as early as possible.

References

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SKIN AND SOFT TISSUE

Herpes zoster, acute

Drugs of choice

Antiviral agents

	acyclovir[1,2]	800 mg, 5 times a day x 7 days	$99.95/7 days
or	valacyclovir[3]	1000 mg, t.i.d. x 7 days	$126.84/7 days
or	famciclovir[4]	500 mg, t.i.d. x 7 days	$126.84/7 days

Second-line therapies

In addition to the above therapies

amitriptyline[5]	25 mg, once daily x 90 days	$0.71/90 days

Additional instructions and notes

- Treatment must be started within 72 h of the appearance of symptoms; otherwise it should not be provided.
- The incidence of postherpetic neuralgia is strongly age-related and tends to be very rare in patients under 50 years of age; therefore, treatment in patients under 50 is not necessary. A significant proportion of patients over 60 years of age continue to have pain after healing of the rash.[6] However, immunocompromised patients and patients with ophthalmic zoster at any age should be treated.
- There is conflicting evidence about the value of adding corticosteroids to antiviral agents.[7,8]

References

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SKIN AND SOFT TISSUE

Impetigo

Drugs of choice[1,2]

Treatment should be directed against both *Streptococcus pyogenes* and *Staphylococcus aureus*

1.	Small areas[3]		
	mupirocin	2% topical ointment, t.i.d. x 10 days	$14.89/30 g
2.	Multiple lesions or large areas		
	cloxacillin		
	Adults	250–500 mg, q.i.d. x 10 days	$3.97–7.78/10 days
	Children	12.5–25 mg/kg, q.i.d. x 10 days	$0.40–0.80/kg for 10 days
or	cephalexin		
	Adults	250–500 mg, q.i.d. x 10 days	$5.97–11.94/10 days
	Children	6.25–12.5 mg/kg, q.i.d. x 10 days	$0.40–0.80/kg for 10 days

Second-line therapies

1.	If the patient is allergic to penicillin		
	erythromycin base[1]		
	Adults	1 g, divided b.i.d. to q.i.d. x 10 days	$1.81/10 days
	Children	30–50 mg/kg per day, divided b.i.d. to q.i.d. x 10 days	$0.50–0.80/kg for 10 days (40 mg/mL) $0.30–0.50/kg for 10 days (80 mg/mL)
or	clarithromycin[3]		
	Adults	250 mg, b.i.d. x 10 days	$29.58/10 days
	Children	15 mg/kg per day, divided b.i.d. x 10 days	$1.60/kg for 10 days
or	azithromycin		
	Adults	500 mg single dose on day one; then 250 mg once daily x 4 day	$29.60/5 days
	Children	12 mg/kg once daily x 5 days	$3.20/kg for 5 days (20 mg/mL) $2.25/kg for 5 days (40 mg/mL)
2.	If patient is allergic to penicillin and intolerant of macrolides		

clindamycin		
Adults	150 mg, t.i.d. x 10 days	$16.30/10 days
Children	5 mg/kg, t.i.d. x 10 days	$1.10/kg for 10 days

Additional instructions and notes

- Treating impetigo due to *Streptococcus* group A organisms does not prevent poststreptococcal glomerulonephritis.

References

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SKIN AND SOFT TISSUE

Lyme disease — early localized disease

Drugs of choice[1–3]

	tetracycline	250 mg, q.i.d. x 14 days	$1.06/14 days
or	doxycycline	100 mg, b.i.d. x 14 days	$16.41/14 days
or	amoxicillin		
	Adults	250–500 mg, t.i.d. x 14 days	$4.33–8.44/14 days
	Children	25–50 mg/kg per day, divided t.i.d. x 14 days	$0.63–1.26/kg for 14 days
or	cefuroxime axetil		
	Adults	500 mg, b.i.d. x 14 days	$80.28/14 days
	Children	250 mg, b.i.d. x 14 days	$44.80/14 days

Second-line therapies

Prophylaxis

Even in an area in which Lyme disease is endemic, the risk of infection with *Borrelia burgdorferi* after a recognized deer-tick bite is so low that prophylactic antimicrobial treatment is not routinely indicated unless the person is bitten by a nymphal deer tick that is at least partly engorged with blood.[4,5] In the latter case use

doxycycline	200 mg, single dose	$1.17/dose

Additional instructions and notes

- Treatment times are controversial. Some authorities recommend treatment for up to 30 days.[1,2]
- Despite antibiotic treatment of erythema migrans, other features of the disease (neurologic, cardiac, arthritic) may develop in 1–2% of patients.[3]

References

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Pediculosis

Drugs of choice[1–3]

permethrin 1% lotion	2 applications, 7–10 days apart	$4.49/application

Second-line therapies[1–3]

pyrethrins/piperonyl butoxide shampoo	2 applications, 7–10 days apart	$3.61/50 mL

Additional instructions and notes

- Remove nits daily with a fine-toothed comb.
- Treat all family members, and wash all clothes, bedding and towels.
- In general, inanimate objects do not have to be treated; however, all head apparel should be treated.

References

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SKIN AND SOFT TISSUE

Plantar puncture wounds

Drugs of choice[1]

For patients presenting within the first 24 h after the wound, surface cleansing and close follow-up seem to be adequate treatment. Complication rates after surface cleansing alone are about 12%[1] and may be as low as 6.4%.[2] No specific findings at initial presentation predict a subsequent complication.

Additional instructions and notes

- Consider *Pseudomonas* infection in wounds in the forefoot when the puncture wound has occurred through a sneaker.
- Wounds older than 24–48 h are more likely to be infected.[3]
- When wounds are infected, the most common organism is *Staphylococcus aureus*.[4]
- Wounds should be explored if there is the potential for presence of a foreign body or if there has been a stingray or marine animal envenomation.
- Ensure that tetanus immunization is up-to-date.

References

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SKIN AND SOFT TISSUE

Pressure ulcers

Drugs of choice

1. Patients with partial-thickness skin loss[1]

polyurethane dressings permeable to water vapour and oxygen, impermeable to water and bacteria	change 1–2 times per week	Opsite®: $34.68/ box of 10 x10 cm (14 cm) Tegaderm®: $69.48/ box of 50 x10 cm (10 cm)

2. Patients with full-thickness skin loss, but defect limited by deep fascia (stage 3)[1,2]

i. Locally infected ulcers (no surrounding cellulitis)[3] — clean with sterile physiologic saline, then

silver sulfadiazine	apply t.i.d. until wound is clear of microbes or for a maximum of 3 weeks	$3.96/30 g

ii. Ulcers with necrotic tissue — clean with sterile physiologic saline, then

collagenase	apply once daily	$69.64/30 g

iii. Clean ulcers[1,2]

hydrocolloid dressings impermeable to gas and moisture	change once daily to every 4 days	Comfeel Ulcus®: $41.10/box of 10 x10 cm (10 cm) Duoderm®: $24.75/box of 5 x10 cm (10 cm)

or

polyurethane dressings permeable to water vapour and oxygen, impermeable to water and bacteria	change 1–2 times per week	Opsite®: $34.68/ box of 10 x10 cm (14 cm) Tegaderm®: $69.48/box of 50 x10 cm (10 cm)

3. Patients with deep stage 3 or stage 4 (deep-fascia penetrated) ulcers

Refer patient to a dermatologist or plastic surgeon for treatment.

Additional instructions and notes

- Vitamin C does not help in the healing of pressure ulcers.[4]
- No reports in the literature support the use of topical agents (vitamins, minerals, elements, sugar, insulin, aloe vera gel, gelatin and yeast extract) in the treatment of pressure ulcers.[5]

- Antiseptics such as povidone-iodine, acetic acid, hydrogen peroxide and sodium hypochlorite are cytotoxic to cultured human fibroblasts and may impair healing.[2]
- Enzymatic debriding agents such as fibrinolysin/desoxyribonuclease and collagenase will damage healing tissue if used after a wound is clean.[2]
- Once an ulcer is clean, a moist wound environment should be maintained to facilitate healing.[2]

References

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Scabies

Drugs of choice[1–3]

permethrin 5% cream	single application at night; remove the next morning	$13.80/30 g

Second-line therapies[3,4]

crotamiton 10% lotion	1–2 applications at 24-h intervals; massage into skin until dry	$13.90/50 g

Additional instructions and notes

- Medication should be applied to the entire skin surface including the scalp and face. Pay particular attention to the groin, fingernails, toenails and behind the ears.
- Recommend isolation from contact until 24 h after treatment.
- Treat skin-to-skin contacts and all members of the household prophylactically at the same time as the patient is treated, even if they are asymptomatic.
- Some patients require a second application of permethrin, 7–10 days after the first, if live organisms persist or if new lesions appear.
- Itching may persist for 1–2 weeks after treatment.

References

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SKIN AND SOFT TISSUE

Sunburn

Drugs of choice

Any one of a number of over-the-counter medications, such as aloe vera lotion or calamine lotion, can be used for burning pain from superficial sunburns.

Second-line therapies[1,2]

	acetaminophen		
	Adults	325–650 mg, q4h	$0.01–0.02/dose
	Children	15 mg/kg,, q4h	$0.03/kg per dose
or	aspirin		
	Adults only	325–650 mg, q4h	$0.01–0.02/dose
or	ibuprofen		
	Adults	200–400 mg, q4h	$0.02–0.04/dose
	Children	10 mg/kg, q6h	$0.02/kg per dose

Additional instructions and notes

- Blistering associated with sunburn can be treated in the same way as superficial sunburn. Severe cases may require treatment for accompanying dehydration or secondary infection.
- Patients should avoid exposure to additional heat from hot showers and further exposure to sun.
- Topical anesthetics containing benzocaine are only effective in relieving itching and burning if the concentration of benzocaine is above 5% and if the benzocaine is present as the base not the salt.[3]
- Creams and sprays with a cooling or moistening effect afford transient, partial relief of subjective symptoms.
- For severe pain, use acetaminophen in combination with codeine.

References

1. Rosen P, Barkin RM, Hockberger RS, Ling LJ, Markovchick VJ, Marx JA, editors. *Emergency medicine concepts and clinical practice*. 4th ed. St. Louis: Mosby; 1997.
2. Hughes GS, Francom SF, Means LK, Bohan DF, Caruana C, Holland M. Synergistic effects of oral nonsteroidal drugs and topical corticosteroids in the therapy of sunburn in humans. *Dermatology* 1992;184:54-8.
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SKIN AND SOFT TISSUE

Varicella zoster

Drugs of choice[1,2]

1. Acute *Varicella* infection

   Immunocompetent children 1–12 years
   Therapy is not indicated.

   Immunocompromised children and adults

acyclovir	10 mg/kg, I.V., q8h x 7–10 days	$20.43/kg for 7 days

   Otherwise healthy, nonpregnant adults and adolescents, 13 years of age and older; and children 1–12 years with chronic cutaneous or pulmonary disorder

acyclovir	20 mg/kg, q.i.d. x 5 days (maximum 800 mg, q.i.d.)	$1.43/kg for 5 days (800-mg tablets) $0.24/kg for 5 days (200 mg/5 mL suspension)

2. Postexposure prophylaxis[3,4]

   Newborn infants of mothers who developed *Varicella infection* during the 5 days before or 48 h after delivery, immunocompromised children and adults, pregnant women, and all recipients of heterologous bone-marrow transplants

Varicella zoster immune globulin (VZIG)	125 units/10 kg, I.M. (maximum 625 units)

Second-line therapies[5]

Postexposure prophylaxis in immunocompetent children 1–12 years of age and adults

Varicella vaccine	0.5 mL, S.C.	$62.00/dose

Additional instructions and notes

- Oral acyclovir is recommended for adults and should be considered for adolescents in whom chickenpox is usually more severe than in children.
- Acyclovir must be started within 24 h of the appearance of the rash.
- Limited studies have reported a 90% protective efficacy for *Varicella* vaccine when children age 1–12 years are vaccinated within 3 days of exposure.
- Pregnant women are at higher risk for severe *Varicella* infection and its complications. Administration of VZIG to susceptible, pregnant women has not been found to prevent viremia, fetal infection, congenital *Varicella* syndrome, or neonatal *Varicella* infection. Thus, the primary indication for VZIG in pregnant women is prevention of complications due to *Varicella* in the mother, rather than protection of the fetus.

- VZIG has not been proven to be useful in treating clinical *Varicella* or *Herpes zoster* or in preventing the dissemination of these organisms and is not recommended for such use.
- Postexposure use of acyclovir may be a less-costly alternative to the use of VZIG in some susceptible people. However, before such a strategy can be considered, additional data are needed concerning the prophylactic use of acyclovir in healthy and immunocompromised people in all age groups.[4]

References

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2. Drwal-Klein LA, O'Donovan CA. Varicella in pediatric patients. *Ann Pharmacother* 1993;27:938-49.
3. National Advisory Committee on Immunization. *Canadian immunization guide*. 5th ed. Ottawa: Canadian Medical Association; 1998.
4. Prevention of varicella: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Morb Mortal Wkly Rep* 1996;45(RR11):1-25.
5. National Advisory Committee on Immunization. Statement on recommended use of varicella virus vaccine. *Can Commun Dis Rep* 1999;25(ACS 1):1-16.

TOXICOLOGY

Acetaminophen poisoning

Drugs of choice[1,2]

1. Activated charcoal

Adults	50 g, single dose	$10.73/dose
Children	1–2 g/kg, single dose	$0.21–0.43/dose

2. If acetaminophen level is in toxic range at 4 h after ingestion or if more than 8 h have passed since ingestion of >150 mg/kg or >10 g of acetaminophen

acetylcysteine	see chart (below)	$7.20/10-mL vial $17.65/30-mL vial

<<insert Table II from page 981 of the CPS, 36th ed. and put the following note at the bottom of it please>>

Additional instructions and notes

- Children who have ingested an acute dose of <150 mg/kg may require only close observation and no active treatment.[3]
- Acetylcysteine treatment provides hepatoprotection uniformly for the first 8 h after ingestion of a acetaminophen overdose, but efficacy decreases in a stepwise manner from 8 to 16 h after ingestion. However, therapy is still beneficial at any time if there is evidence of hepatotoxicity.[4]
- Patients taking drugs that induce hepatic enzymes, such as phenobarbital and phenytoin, and alcoholic patients may develop toxicity even when acetaminophen concentrations are below the treatment line. In these patients, protective therapy should be considered.
- Chronic ingestion of acetaminophen makes interpretation of levels difficult and the Rumack-Matthew nomogram cannot be relied on to predict toxicity.
- Gastric lavage is not recommended as it delays the use of charcoal and is unlikely to result in significant elimination.[5]
- Sorbitol does not enhance the efficacy of charcoal.[6]
- Although activated charcoal is the standard of care, no controlled trials have shown that it improves clinical outcomes.

References

1. Buckley NA, Whyte IM, O'Connell DL, Dawson AH. Oral or intravenous *N*-acetylcysteine: which is the treatment of choice for acetaminophen (acetaminophen) poisoning? *J Toxicol Clin Toxicol* 1999;37:759-67.
2. Perry HE, Shannon MW. Efficacy of oral versus intravenous *N*-acetylcysteine in acetaminophen overdose: results of an open-label clinical trial. *J Pediatr* 1998;132:149-52.

3. Mohler CR, Nordt SP, Williams SR, Manoguerra AS, Clark RF. Prospective evaluation of mild to moderate pediatric acetaminophen exposures. *Ann Emerg Med* 2000;35:239-44.
4. Keays R, Harrison PM, Wendon JA, Forbes A, Gove C, Alexander GJM, et al. Intravenous acetylcysteine in acetaminophen induced fulminant hepatic failure: a prospective controlled trial. *BMJ* 1991;303:1026-9.
5. Buckley NA, Whyte IM, O'Connell DL, Dawson AH. Activated charcoal reduces the need for *N*-acetylcysteine treatment after acetaminophen (acetaminophen) overdose. *J Toxicol Clin Toxicol* 1999;37:753-7.
6. McNamara RM, Aaron CK, Gemborys M, Davidheiser S. Sorbitol catharsis does not enhance efficacy of charcoal in a simulated acetaminophen overdose. *Ann Emerg Med* 1988;17:243-6.

TOXICOLOGY

Alcohol withdrawal

Drugs of choice[1–3]

diazepam	10 mg, oral or I.V., administered q1h until patient shows clinical improvement or becomes mildly sedated	$0.01/dose (oral) $0.74/dose (I.V.)

AND, to prevent Wernicke's encephalopathy

thiamine	100 mg, I.V., I.M. or oral	$1.13/dose

Additional instructions and notes

- Early control of symptoms is important as it is much more difficult to gain control after severe withdrawal symptoms have appeared or when the patient has progressed to delirium tremens.
- All benzodiazepines studied (alprazolam, chlordiazepoxide, clobazam, diazepam, lorazepam and oxazepam) appear equally efficacious in reducing signs and symptoms of withdrawal. The choice among them can be guided by the following clinical considerations: long-acting agents may be more effective in preventing withdrawal seizures; long-acting agents can contribute to a smoother withdrawal with fewer rebound symptoms; short-acting agents may be associated with lower risk of oversedation; certain benzodiazepines are more likely to be abused.[1,3]
- Many patients require a total dose of less than 60 mg of diazepam to control symptoms of alcohol withdrawal, but some may need higher doses, i.e., 120 mg or more, to treat their symptoms adequately, especially if alcohol withdrawal is well established and severe. The patients in the latter category should be referred to an intensive-care or high-dependency unit for the management of their alcohol withdrawal.
- Evidence does not support the routine use of vitamins other than thiamine, and some authors have questioned the value of routinely giving any intravenous vitamins.[4,5]
- Some authorities recommend giving magnesium on an empiric basis on the assumption that many chronic alcoholics will have a total body magnesium deficit because of poor diet. However, magnesium has not been shown to have any benefit in alcohol withdrawal.[6]
- Haloperidol or droperidol may be considered for use in conjunction with benzodiazepines for marked agitation or hallucinations. However, butyrophenones used alone are associated with a higher rate of complications, such as seizures and delirium tremens, and should not be used in the management of alcohol withdrawal. See *Agitated and disturbed patients*.
- Symptom-triggered therapy, which consists of monitoring patients and providing benzodiazepines only when symptoms of alcohol withdrawal appear, is an alternative to a predetermined, fixed benzodiazepine regimen.[7]

References

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Pharmacological Management of Alcohol Withdrawal. Pharmacological management of alcohol withdrawal: a meta-analysis and evidence-based practice guideline. *JAMA* 1997;278:144-51.
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3. Holbrook AM, Crowther R, Lotter A, Cheng C, King D. Meta-analysis of benzodiazepine use in the treatment of acute alcohol withdrawal. *CMAJ* 1999;160:649-55.
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TOXICOLOGY

Altered level of consciousness — toxin induced

Drugs of choice[1]

1. Dextrose
   The use of dextrose should be reserved for patients with proven hypoglycemia. Rapid-reagent blood glucose strips should be used to guide administration of hypertonic dextrose. Because these strips have a significant error rate, hypertonic dextrose should also be given to patients with borderline readings who have neurologic signs.

Adults	
dextrose 50% in water	25 g (50 mL), I.V. bolus
Children >3 years	
dextrose 50% in water	0.2–0.5 g/kg (2–5 mL/kg), I.V. over 3 min
Children 1–3 years	
dextrose 25% in water	0.2–0.5 g/kg (2–5 mL/kg), I.V. over 3 min
Children <1 year	
dextrose 10% in water	0.2–0.5 g/kg (2–5 mL/kg), I.V. over 3 min

AND, for all age groups

thiamine	100 mg, I.V. or I.M.	$1.13/dose

2. Naloxone
   The use of naloxone should be reserved for patients with signs and symptoms of opioid intoxication (miosis, respiratory depression). See *Opioid poisoning*.

3. Flumazenil
   Flumazenil is rarely indicated and should never be used where there is the likelihood of a significant proconvulsant or proarrhythmic coingestion (e.g., cyclic antidepressants, chloral hydrate, carbamazepine) or where benzodiazepine dependency is minimal.[2] Flumazenil can cause seizures and arrhythmias in these situations and is, therefore, contraindicated.

Second-line therapies

If intravenous delivery cannot be established and the patient has documented hypoglycemia

glucagon		
Adults and children >20 kg	1 mg, S.C. or I.M., single dose	$24.38/dose
Children <20 kg	0.5 mg, S.C. or I.M., single dose	$12.19/dose

Additional instructions and notes

- Few patients will regain consciousness following the use of thiamine, and rapid deterioration due to lack of thiamine is unexpected. However, it will prevent the possibility

of delayed deterioration secondary to nutritional deficiency.[1] Thiamine should be given at the same time as dextrose.

References

1. Hoffman RS, Goldfrank LR. The poisoned patient with altered consciousness: controversies in the use of a "coma cocktail." *JAMA* 1995;274:562-9.
2. Barnett R, Grace M, Boothe P, Latozek K, Neal C, Legatt D, et al. Flumazenil in drug overdose: randomized, placebo-controlled study to assess cost effectiveness. *Crit Care Med* 1998;27:78-81.

TOXICOLOGY

Amphetamine and ecstasy poisoning

Drugs of choice[1]

1. All patients (if ingestion was oral)

activated charcoal		
Adults	50 g, single dose	$10.73/dose
Children	1–2 g/kg, single dose	$0.21–0.43/kg per dose

2. Agitated patients[2]

diazepam		
Adults and children	0.2 mg/kg, I.V. at rate of 2 mg/min (maximum dose 10 mg)	$0.02/kg per min
or lorazepam		
Adults	0.1 mg/kg, I.V., at rate of 2 mg/min	$0.05/kg per dose
Children	0.5 mg, I.V., over 1–2 min	$0.26 per dose
or midazolam		
Adults and children	0.05–0.2 mg/kg, I.V. (over 1–2 min) or I.M.	$0.04–0.14/kg per dose

3. Patients with severe hypertension (hypertensive encephalopathy; malignant hypertension with acute MI, unstable angina, acute renal failure, intracranial bleeding, or acute left-ventricular failure)

nitroprusside		
Adults and children	0.25–1 μg/kg per min, I.V.; increase to 3 μg/kg per min	$14.87/50-mg vial
or phentolamine		
Adults and children	0.05 mg/kg, I.V. (initial adult dose of 1–2 mg, I.V.)	$0.16/kg per dose

4. Patients with hyperthermia (>40ºC). Aggressive temperature reduction with evaporative cooling and ice packs to the groin and axilla.

5. Patients with rhabdomyolysis. See *Rhabdomyolysis*.

6. Patients with cardiac dysrhythmias. See *Ventricular tachycardia, stable* and *Supraventricular tachycardia, narrow-complex and stable*.

7. Patients with seizures. See *Status epilepticus*.

Second-line therapies

1. For agitated patients[2] as an alternative to benzodiazepines. Can also be combined with

benzodiazepines as the two work synergistically.

	haloperidol	5–10 mg, I.V. or I.M.	$2.49–4.98/dose
or	droperidol	5–10 mg, I.V. or I.M.	$5.25–10.50/dose

2. Patients with seizures and for whom intravenous delivery cannot be established, see *Status epilepticus*.

Additional instructions and notes

- Most patients do not require any pharmacologic intervention.[3]
- Beta-adrenergic blockers are contraindicated in severe hypertension, as their administration may result in unopposed alpha effects causing coronary and peripheral arterial vasoconstriction.
- Dantrolene is not recommended for the treatment of hyperthermia caused by sympathomimetic drugs.
- Gastric lavage is not recommended as it delays the use of charcoal and is unlikely to result in significant elimination.
- There are no controlled trials to support the use of sorbitol or other cathartics in this situation.
- Although activated charcoal is the standard of care, no controlled trials have shown that it improves clinical outcomes.

References

1. Rosen P, Barkin RM, Hockberger RS, Ling LJ, Markovchick VJ, Marx JA, editors. *Emergency medicine concepts and clinical practice*. 4th ed. St. Louis: Mosby; 1997.
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TOXICOLOGY

Anticholinergic poisoning

Drugs of choice[1]

1. All patients

activated charcoal		
Adults	50 g, single dose	$10.73/dose
Children	1–2 g/kg, single dose	$0.21–0.43/kg per dose

2. Patients with hyperthermia (>40ºC). Aggressive temperature reduction with ice water or evaporative cooling.

3. Patients with seizures and agitation. See *Status epilepticus*.

4. To treat intractable seizures, coma, delirium, agitation, and symptomatic supraventricular tachycardia[2]

diazepam		
Adults and children	0.2 mg/kg, I.V. at rate of 2 mg/min (maximum dose 10 mg)	$0.02/kg per min
or lorazepam		
Adults	0.1 mg/kg, I.V., at 2 mg/min	$0.05/kg per dose
Children	0.5 mg, I.V., over 1–2 min	$0.26 per dose
or midazolam		
Adults and children	0.05–0.2 mg/kg, I.V. (over 1–2 min) or I.M.	$0.04–0.14/kg per dose

Second-line therapies

Patients with seizures and no access to intravenous treatment. See *Status epilepticus*.

Additional instructions and notes

- Antipyretics and simple cooling blankets are ineffective in temperature reduction.
- Physostigmine is not available in Canada.
- In mild cases of agitation and delirium, decreased environmental stimuli and reassurance may be sufficient treatment.
- Gastric lavage is not recommended as it delays the use of charcoal and is unlikely to result in significant elimination.
- There are no controlled trials to support the use of sorbitol or other cathartics in this situation.
- Orphenadrine has a much greater toxicity than other anticholinergic agents and ingestion of this substance should be treated like cyclic antidepressant poisoning. See *Cyclic antidepressant poisoning*.
- Although activated charcoal is the standard of care, no controlled trials have shown that it improves clinical outcomes.

References

1. Rosen P, Barkin RM, Hockberger RS, Ling LJ, Markovchick VJ, Marx JA, editors. *Emergency medicine concepts and clinical practice*. 4th ed. St. Louis: Mosby; 1997.
2. Burns MJ, Linden CH, Graudins A, Brown RM, Fletcher KE. A comparison of physostigmine and benzodiazepines for the treatment of anticholinergic poisoning. *Ann Emerg Med* 2000;35:374-81.

TOXICOLOGY

Antihistamine poisoning

Drugs of choice[1,2]

activated charcoal		
Adults	50 g, single dose	$10.73/dose
Children	1–2 g/kg, single dose	$0.21–0.43/kg per dose

Additional instructions and notes

- Gastric lavage is not recommended as it delays the use of charcoal and is unlikely to result in significant elimination.
- There are no controlled trials to support the use of sorbitol or other cathartics in this situation.
- Dimenhydrinate overdoses can have cardiac toxicity and should be treated like cyclic antidepressant poisoning. See *Cyclic antidepressant poisoning*.
- The phenothiazine group of antihistamines (methdilazine, promethazine, and trimeprazine) can cause anticholinergic side effects. See *Anticholinergic poisoning*.
- The alkylamine group of antihistamines (chlorpheniramine, dexchlorpheniramine, and pheniramine) are most likely to cause severe agitation. See *Agitated and disturbed patients*.
- There is limited information on the toxicity associated with nonsedating antihistamines (cetirizine, fexofenadine, and loratadine). A case of QT lengthening and life-threatening arrhythmia associated with fexofenadine has been reported. See *Torsades de pointe*.[3]
- Although activated charcoal is the standard of care, no controlled trials have shown that it improves clinical outcomes.

References

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2. Köppel C, Ibe K, Tenczer J. Clinical symptomatology of diphenhydramine overdose: an evaluation of 136 cases in 1982 to 1985. *Clin Toxicol* 1987;25:53-70.
3. Pinto YM, van Gelder IC, Heeringa M, Crijns HJ. QT lengthening and life-threatening arrhythmias associated with fexofenadine. *Lancet* 1999;353:980.

TOXICOLOGY

Barbiturate poisoning

Drugs of choice[1–3]

1. Multiple charcoal doses and urinary alkalinization are not effective against short and intermediate-acting barbiturates (amobarbital, butabarbital, pentobarbital, secobarbital).

activated charcoal

Adults	50 g initially; then 25 g, q4h over first 24 h	$10.73/initial dose $5.36/subsequent dose
Children	1–2 g/kg initially; then 1 g/kg, q4h over first 24 h	$0.21–0.43/kg for initial dose $0.21/kg per subsequent dose

2. If patient is vomiting and unable to tolerate charcoal or for severe poisoning[1]

sodium bicarbonate (50 mmol in 50-mL ampoule)

Adults	1 mmol/kg, I.V. bolus; then add 100 mmol (2 ampoules) to 1 L of 5% dextrose in water and deliver at a rate to maintain urine flow of 1–2 mL/kg per h and a urine pH of 7–8	$3.27/50-mL ampoule
Children	1 mmol/kg, I.V. bolus; then add 2 mmol/kg to 1 L of 5% dextrose in water and deliver at a rate to maintain urine flow of 1–2 mL/kg per h and a urine pH of 7–8	$3.27/50-mL ampoule

Additional instructions and notes

- The initial dose of activated charcoal prevents the absorption of the barbiturate and subsequent doses enhance elimination.
- No definitive studies document an improvement in morbidity and mortality levels with treatment.
- In urinary alkalinization, the arterial pH should not exceed 7.5 to 7.55. Urinary alkalinization requires the patient to have adequate potassium stores. Potassium levels should be monitored and supplemental potassium should be given if necessary.
- Multiple doses of charcoal are superior to urinary alkalinization.[1]
- Gastric lavage is not recommended as it delays the use of charcoal and is unlikely to result in significant elimination.
- There are no controlled trials to support the use of sorbitol or other cathartics in this situation.
- Although activated charcoal is the standard of care, no controlled trials have shown that it improves clinical outcomes.

References

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2. Pond SM, Olson KR, Osterloh JD, Tong TG. Randomized study of the treatment of phenobarbital overdose with repeated doses of activated charcoal. *JAMA* 1984;251:3104-8.
3. Bradberry SM, Vale JA. Multiple-dose activated charcoal: a review of relevant clinical studies. *J Toxicol Clin Toxicol* 1995;33:407-16.

TOXICOLOGY

Benzodiazepine poisoning

Drugs of choice

1. Patients with adequate ventilation. No treatment is necessary. Close observation only.

2 Patients with significant co-ingestions or where there is significant sedation, but still adequate airway protection

activated charcoal		
Adults	50 g, single dose	$10.73/dose
Children	1–2 g/kg, single dose	$0.21–0.43/kg dose

Second-line therapies[1,2]

In situations where there is respiratory depression with oxygen saturation below 91–92%, patients should be intubated rather than given flumazenil. If intubation cannot be accomplished then flumazenil can be used with extreme caution.

flumazenil		
i. Initial treatment		
Adults	0.2 mg, I.V., over 30 s; then 0.3–0.5 mg every min to a total of 3 mg	$27.92/0.5-mg vial
Children	0.01 mg/kg, I.V., every min to a maximum dose of 1 mg	

ii. Further treatment, if positive response but subsequent deterioration	
Adults	0.1–0.2 mg/h, I.V.
Children	2–10 μg/kg per h, I.V.

Additional instructions and notes

- Flumazenil should be restricted to situations where the patient is known *not* to have ingested proconvulsants or proarrhythmics (e.g., cyclic antidepressants, chloral hydrate, carbamazepine) and where the patient is not benzodiazepine-dependent. Flumazenil can cause seizures and arrhythmias in these situations and, therefore, is contraindicated.
- The effects of a single dose of flumazenil last about 1 h. Patients who respond to flumazenil should be closely monitored for signs of relapse into respiratory depression.
- Flumazenil infusions have not been shown to influence clinical outcome, and infusions should not be used as routine management.[3]
- Gastric lavage is not recommended as it delays the use of charcoal and is unlikely to result in significant elimination.
- There are no controlled trials to support the use of sorbitol or other cathartics in this situation.
- Although activated charcoal is the standard of care, no controlled trials have shown that it improves clinical outcomes.

References

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3. Chern CH, Chern TL, Wang LM, Hu SC, Deng JF, Lee CH. Continuous flumazenil infusion in preventing complications arising from severe benzodiazepine intoxication. *Am J Emerg Med* 1998;16:238-41.

TOXICOLOGY

Carbon monoxide poisoning

Drugs of choice

For patients with any of the following: loss of consciousness, coma, cardiovascular dysfunction, pulmonary edema, significant acidosis, carbon monoxide levels above 30–40%, symptoms that persist despite normobaric oxygen or neurologic impairment. Also for infants and pregnant women.

oxygen	100% at hyperbaric pressure

In other cases

oxygen	100%, delivered by a nonrebreather mask at normal atmospheric pressure

Additional instructions and notes

- Continue treatment at normobaric pressure until carbon monoxide level is below 10%.
- There is no evidence that unselective use of hyperbaric oxygen in the treatment of acute carbon monoxide poisoning results in a lower frequency of neurologic symptoms at 1 month. However, evidence from available randomized controlled trials is insufficient to provide clear guidelines for practice.[1]
- Pulse oximeter readings will show a misleading normal oxygen saturation.

Reference

1. Juurlink DN, Stanbrook MB, McGuigan MA. Hyperbaric oxygen for carbon monoxide poisoning (Cochrane review). In: The Cochrane Library, Issue 3, 2001. Oxford: Update Software.

TOXICOLOGY

Cocaine poisoning

Drugs of choice[1]

1. Patients with mild toxicity or a history of a brief seizure
   Observation in a quiet setting.

2. Patients who are agitated or anxious, or with psychosis, tachycardia, hypertension

	diazepam		
	Adults and children	0.2 mg/kg, I.V. at rate of 2 mg/min (maximum dose 10 mg)	$0.02/kg per min
or	lorazepam		
	Adults	0.1 mg/kg, I.V., at 2 mg/min	$0.05/kg per dose
	Children	0.5 mg, I.V., over 1–2 min	$0.26 per dose
or	midazolam		
	Adults and children	0.05–0.2 mg/kg, I.V. (over 1–2 min) or I.M.	$0.04–0.14/kg per dose

If patient is unresponsive to benzodiazepines alone, add

	haloperidol	5–10 mg, I.V. or I.M.	$2.49–4.98/dose
or	droperidol	5–10 mg, I.V. or I.M.	$5.25–10.50/dose

3. Patients with hyperthermia (>40ºC)
   Aggressive temperature reduction using evaporative cooling and ice packs to the groin and axilla.

4. Patients with rhabdomyolysis. See *Rhabdomyolysis*.

5. Patients with cardiac ischemia[2]

aspirin
AND
nitroglycerin (See *Angina, unstable*)
AND
benzodiazepines, see doses above

If pain persists after aspirin, nitroglycerin, and benzodiazepines

	phentolamine		
	Adults and children	0.05 mg/kg, I.V. (initial adult dose of 1–2 mg, I.V.)	$0.16/kg per dose
or	verapamil		
	Adults	5 mg, I.V.; repeat after 5–10 min as necessary	$15.41/dose
	Children	0.1–0.3 mg/kg, I.V.;	$0.31–0.92/kg per

	repeat after 30 min	dose

6. Patients with seizures. See *Status epilepticus*.

7. Patients with severe hypertension (hypertensive encephalopathy; malignant hypertension with acute MI, unstable angina, acute renal failure, intracranial bleeding, or acute left-ventricular failure)

	nitroprusside		
	Adults and children	0.25–1 μg/kg per min, I.V.; increase to 3 μg/kg per min	$19.87/50-mL vial
or	phentolamine		
	Adults and children	0.05 mg/kg, I.V. (initial adult dose of 1–2 mg, I.V.)	$0.16/kg per dose

Additional instructions and notes

- Phenytoin is unlikely to be of benefit in treating seizures caused by cocaine or benzodiazepines, and barbiturates should be used preferentially.
- Beta-adrenergic blockers are contraindicated for cocaine poisoning due to the risk of an unopposed alpha effect. Labetolol and the dihydropyridine class of calcium channel antagonists should also be avoided.

References

1. Renzi FP. Cocaine poisoning. In: Harwood-Nuss AL, Linden CH, Luten RC, Shepherd SM, Wolfson AB, editors. *The clinical practice of emergency medicine*. 2nd ed. Philadelphia: Lippincott-Raven; 1996:1291-4.
2. Hollander JE. The management of cocaine-associated myocardial ischemia. *N Engl J Med* 1995;335:1267-72.

TOXICOLOGY

Cyclic antidepressant poisoning

Drugs of choice[1,2]

1. All patients

activated charcoal		
Adults	50 g, single dose	$10.73/dose
Children	1–2 g/kg, single dose	$0.21–0.43/kg per dose

2. Patients with signs of cardiotoxicity (refractory hypotension, prolonged cardiac conduction, QRS interval ≥0.16 s, ventricular dysrhythmias)[3]

sodium bicarbonate (50 mmol in 50-mL ampoule)		
Adults and children	1–2 mmol/kg, I.V. bolus	$3.27/50-mL ampoule

3. If hypotension persists after treatment with sodium bicarbonate and volume replacement

	norepinephrine		
	Adults	8–12 μg/min, I.V.; increase in steps of 2–4 μg/min until hemodynamic effect is achieved	$4.29/4-mg vial
	Children	0.15–0.25 μg/kg per min, I.V.; increase in steps of 0.05–0.1 μg/kg per min until hemodynamic effect is achieved	
or	phenylephrine	40 μg/min, I.V. initially; titrate to maximum of 180 μg/min	$1.76/10-mg vial

4. Patients with seizures
   For treatment of seizures, see *Status epilepticus*. Seizures can result in significant acidosis and aggravate cardiac toxicity; therefore, after a seizure

sodium bicarbonate (50 mmol in 50-mL ampoule)		
Adults and children	1–2 mmol/kg, I.V. bolus	$3.27/50-mL ampoule

Additional instructions and notes

- Type Ia antidysrhythmics (quinidine, disopyramide, procainamide) and type Ic antidysrhythmics (flecainide) are contraindicated because they also inhibit fast sodium channels.
- Intravenous sodium bicarbonate is the treatment of choice for ventricular tachycardia.
- Gastric lavage is not recommended as it delays the use of charcoal and is unlikely to result in significant elimination. A trial comparing charcoal with lavage plus charcoal revealed no advantage from adding gastric lavage.[4]
- No controlled trials support the use of sorbitol or other cathartics in this situation.
- Although activated charcoal is the standard of care, no controlled trials have shown that it

improves clinical outcomes.

References

1. Pimentel L, Trommer L. Cyclic antidepressant overdoses: a review. *Emerg Med Clin North Am* 1994;12:533-47.
2. Rosen P, Barkin RM, Hockberger RS, Ling LJ, Markovchick VJ, Marx JA, editors. *Emergency medicine concepts and clinical practice*. 4th ed. St. Louis: Mosby; 1997.
3. Mackway-Jones K, Thomas M. Alkalinisation in the management of tricyclic antidepressant overdoses. *J Accid Emerg Med* 1999;16:139-40.
4. Bosse GM, Barefoot JA, Pfeifer MP, Rodgers GC. Comparison of three methods of gut decontamination in tricyclic antidepressant overdose. *J Emerg Med* 1995;13:203-9.

TOXICOLOGY

Ethylene glycol and methanol poisoning

Drugs of choice[1–3]

1. For both methanol and ethylene glycol poisoning

	ethanol 10% solution	loading dose of 0.6–0.7 g/kg, I.V. bolus (7.6 mL of solution/kg); then maintenance dose of 66–308 mg/kg (0.8–4.0 mL/kg) per h to maintain ethanol level of 22–33 mmol/L	
or	fomepizole	15 mg/kg, I.V.; then 10 mg/kg, I.V., q12h	$1000/1.5-mL vial (1 g/mL)

AND, in addition to either of the above, to treat metabolic acidosis

sodium bicarbonate (50 mmol in 50-mL ampoule)		
Adults	up to 400–600 mmol, I.V. in the first few hours	$3.27/50-mL ampoule
Children	8–12 mmol/kg, I.V. in first few hours	

2. For ethylene glycol poisoning, add

thiamine	100 mg, I.M. or I.V., q6h	$4.52/day
AND		
pyridoxine	50 mg, I.M. or I.V., q6h	$3.92/dose

3. For methanol poisoning, add

folic acid	50 mg, I.V., q4h x 6 doses	$86.16/course of therapy

Additional instructions and notes

- Treatment with either fomepizole or ethanol should be started as soon as possible to prevent the metabolism of ethylene glycol and methanol.
- Fomepizole does not replace hemodialysis in the management of methanol poisoning and most ethylene glycol poisonings because of the effect of alcohol dehydrogenase blockade on the elimination kinetics of both methanol and ethylene glycol.
- More frequent dosing with fomepizole is required in patients undergoing dialysis, as fomepizole is removed during that procedure.
- The routine administration of calcium to correct hypocalcemia in ethylene glycol poisoning is not recommended because of the potential to increase the formation of calcium oxalate crystals.[3]

References

1. Brent J, McMartin K, Phillips S, Burkhart KK, Donovan JW, Wells M, et al. Fomepizole for the treatment of ethylene glycol poisoning. *N Engl J Med* 1999;340:832-8.
2. Brent J, McMartin K, Phillips S, Aaron C, Kulig K. Fomepizole for the treatment of methanol poisoning. *N Engl J Med* 2000;344:424-9.
3. Barceloux DG, Krenzelok EP, Olson K, Watson W. American Academy of Clinical Toxicology practice guidelines on the treatment of ethylene glycol poisoning. *Clin Toxicol* 1999;37:537-60.

TOXICOLOGY

Gamma-hydroxybutyrate poisoning

Drugs of choice[1]

Supportive care, including maintaining blood pressure, protecting airway, intubation and mechanical ventilation.

Second-line therapies

For symptomatic bradycardia

atropine[1]	0.5 mg, I.V.; repeat once in 2–3 min if necessary	$0.43/dose

Additional instructions and notes

- Flumazenil and naloxone are not useful in this setting.

Reference

1. Li J, Stokes SA, Woeckener A. A tale of novel intoxication: a review of the effects of gamma-hydroxybutyric acid with recommendations for management. *Ann Emerg Med* 1998;31:729-36.

TOXICOLOGY

Iron poisoning

Drugs of choice

1. All patients, whole bowel irrigation[1,2]

polyethylene glycol/ electrolytes		
Adults and adolescents	2 L/h until effluent clear	$12.00/4-L bottle
Children	0.5 L/h until effluent clear	

2. In patients with symptoms of severe iron intoxication (75 μmol/L), chelation[3,4]

deferoxamine	15 mg/kg per h, I.V. (maximum daily dose of 6 g)	$52.50/2-g vial

Additional instructions and notes

- Charcoal does not adsorb iron.[5]
- A deferoxamine-containing solution for lavage is not recommended as systemic absorption of the iron–deferoxamine complex may enhance toxicity.[3,4]
- The addition of sodium bicarbonate or sodium phosphate to the lavage solution has not proved to be of benefit.[3,4]
- Whole-bowel irrigation has not been shown to be of benefit in clinical studies.

References

1. Tenenbein M. Whole bowel irrigation in iron poisoning. *J Pediatr* 1987;111:142-5.
2. Tenenbein M, Wiseman N, Yatscoff RW. Gastrotomy and whole bowel irrigation in iron poisoning. *Pediatr Emerg Care* 1991;7:286-8.
3. Mann KV, Picciotti MA, Spevack TA, Durbin DR. Management of acute iron overdose. *Clin Pharm* 1989;8:428-40.
4. Schauben JL, Augenstein L, Cox J, Sato R. Iron poisoning: report of three cases and a review of therapeutic intervention. *J Emerg Med* 1990;8:309-19.
5. Decker WJ, Combs HF, Corby DG. Adsorption of drugs and poisons by activated charcoal. *Toxicol Appl Pharmacol* 1968;13:454-60.

TOXICOLOGY

Long-acting anticoagulant (superwarfarin) poisoning

Drugs of choice[1,2]

1. Ingestion of doses <5 g
   In otherwise healthy people no treatment should be needed.

2. Ingestion of doses >5 g

activated charcoal		
Adults	50 g, single dose	$10.73/dose
Children	1–2 g/kg, single dose	$0.21–0.43/kg per dose

AND, depending on the results of coagulation tests,

phytonadione		
Adults	5–20 mg, I.V., q8h–q6h, administered over at least 20 min	$0.99–3.98/dose
Children	1–5 mg, I.V., q8h–q6h, administered over at least 20 min	$0.20–0.99/dose

Second-line therapies

In patients with active bleeding, administer fresh frozen plasma.

Additional instructions and notes

- In general, therapy should be guided by the level of anticoagulation. If there is no increase in prothrombin time (PT) by 48 h after ingestion, then toxicity is unlikely.
- There is no consensus as to how long phytonadione should be given by the intravenous route.
- In mild cases, phytonadione may be given by the oral or intramuscular route.
- At discharge, phytonadione doses should be in the range of 50 mg/day for adults. Patients may need to take medication for 3–4 months owing to the very long half-life of long-acting anticoagulants.
- Gastric lavage is not recommended as it delays the use of charcoal and is unlikely to result in significant elimination.
- There are no controlled trials to support the use of sorbitol or other cathartics in this situation.
- Although activated charcoal is the standard of care, no controlled trials have shown that it improves clinical outcomes.

References

1. Hollinger BR, Pastoor TP. Case management and plasma half-life in a case of brodifacoum

poisoning. *Arch Intern Med* 1993;153:1925-8.
2. Chua JD, Friedenberg WR. Superwarfarin poisoning. *Arch Intern Med* 1998;158:1929-32.

TOXICOLOGY

Neuroleptic malignant syndrome

Drugs of choice[1,2]

1. The key to good patient outcome is good supportive therapy: fluid replacement; and monitoring of cardiac, respiratory, and renal function.

2. Patients with temperature 38–40ºC, rigidity, and mental status and autonomic changes

	levodopa/carbidopa	250 mg/25 mg, t.i.d. to q.i.d.	$1.26–1.68/day
or	amantadine	100–200 mg, t.i.d.	$1.56–3.12/day
or	bromocriptine	2.5–10 mg, t.i.d.	$1.62–5.82/day

3. Patients with temperature >40ºC, rigidity, and mental status and autonomic changes

   Aggressive temperature reduction with evaporative cooling and ice packs to the groin and axilla

AND

dantrolene	1 mg/kg, I.V., every 1–2 min to 5 mg/kg	$13.50/kg per dose

4. Patients with rhabdomyolysis, see *Rhabdomyolysis*.

Additional instructions and notes

- Data on the effects of combining dantrolene and dopamine antagonists are lacking.

References

1. Sakkas P, Davis JM, Hua J, Wang Z. Pharmacotherapy of neuroleptic malignant syndrome. *Psychiatr Ann* 1991;21:157-64.
2. Velamoor VR. Neuroleptic malignant syndrome: recognition, prevention and management. *Drug Saf* 1998;19:73-82.

TOXICOLOGY

Opioid poisoning

Drugs of choice[1,2]

1. Patients with adequate ventilation
   No treatment is necessary. Close observation only.

2. Patients with inadequate ventilation

naloxone	0.2–0.4 mg, I.V. (may be given I.M. or S.C. if no I.V. access); repeat at 30–60 s intervals until spontaneous respiration (maximum dose 2–3 mg)	$6.29–12.59/dose

   In cases involving opioids with long half-lives, consider naloxone infusion

naloxone	calculate total initial dose required to reverse respiratory depression and administer two thirds of this dose q1h	

3. Acute oral opioid ingestion

activated charcoal		
Adults	50 g, single dose	$10.73/dose
Children	1–2 g/kg, single dose	$0.21–0.43/kg per dose

Additional instructions and notes

- Smaller starting doses of naloxone can be used for obvious heroin overdoses as long as ventilatory support is adequate.
- Large doses of naloxone may precipitate acute withdrawal reactions in chronic users.
- The effects of naloxone last about 20–40 min. Physicians can generally predict who can be safely discharged after an observation period of 2–3 h following administration of naloxone.[3] A clinical decision rule has been developed to predict who can be discharged early, but it requires validation.[4]
- Although naloxone has traditionally been administered by the intravenous route, it can be given either intramuscularly or subcutaneously (0.4 mg I.V. = 0.8 mg S.C.[5]). No prospective clinical trials have compared intramuscular and intravenous routes for naloxone or examined different doses of the drug.
- After the administration of naloxone, 0.4–3% of patients may experience serious complications, such as asystole, generalized convulsions, pulmonary edema, and violent behaviour. Administering naloxone slowly in small aliquots may reduce the risk of complications.[2]
- Large doses of naloxone (up to 10–15 mg) may be required in some circumstances, such as poisoning with pentazocine or other agonist–antagonist opioids, long-acting opioids such as

methadone, or potent opioids such as fentanyl.

- In cases of significant ingestion of sustained-release products, use whole bowel irrigation.
- Gastric lavage is not recommended as it delays the use of charcoal and is unlikely to result in significant elimination.
- There are no controlled trials to support the use of sorbitol or other cathartics in this situation.
- Although activated charcoal is the standard of care, no controlled trials have shown that it improves clinical outcomes.

References

1. Sporer KA. Acute heroin overdose. *Ann Intern Med* 1999;130:584-90.
2. Osterwalder JJ. Naloxone — for intoxications with intravenous heroin and heroin mixtures — harmless or hazardous? A prospective clinical study. *Clin Toxicol* 1996;34:409-16.
3. Etherington J, Christenson J, Innes G, Grafstein E, Pennington S, Spinelli JJ, et al. Is early discharge safe after naloxone reversal of presumed opioid overdose? *Can J Emerg Med* 2000;2:156-62.
4. Christenson J, Etherington J, Grafstein E, Innes G, Pennington S, Wanger K, et al. Early discharge of patients with presumed opioid overdose: development of a clinical prediction rule. *Acad Emerg Med* 2000;7:1110-8.
5. Wanger K, Brough L, Macmillan I, Goulding J, MacPhail I, Christenson JM. Intravenous vs subcutaneous naloxone for out-of-hospital management of presumed opioid overdose. *Acad Emerg Med* 1998;5:293-9.

TOXICOLOGY

Opioid withdrawal

Drugs of choice[1,2]

clonidine	100–200 µg, q4h x 7 days	$7.56–13.02/day

Second-line therapies

1. For diarrhea

loperamide	4-mg loading dose and 2 mg after each loose bowel movement to maximum of 16 mg/day	$0.25/2-mg caplet

2. For pain

	ibuprofen	400–600 mg, q.i.d. x 14 days	$2.08–2.60/14 days
or	naproxen	250–500 mg, b.i.d. x 14 days	$2.99–5.91/14 days

3. For nausea

	metoclopramide	10 mg, oral, I.M. or I.V., q4h	$0.36/day (oral) $12.60/day (I.M. or I.V.)
or	prochlorperazine	5 mg, oral, I.M. or I.V., q4h	$0.66/day (oral) $3.00/day (I.M. or I.V.)
or	octreotide[3]	100 µg, S.C., t.i.d.	$28.26/day

Additional instructions and notes

- Clonidine can cause hypotension; it should be used in hospital where blood pressure can be monitored for 6–8 h.
- Symptoms of mild opioid withdrawal include lacrimation, rhinorrhea, yawning, diaphoresis, anxiety, restlessness, and dysphoria. More severe opioid withdrawal is characterized by vomiting, diarrhea, abdominal pain and dehydration. Severe agitation, seizures, mental status changes, and hyperthermia are not seen.
- Symptoms usually start 3–8 h after the last heroin dose.
- Benzodiazepines may be used cautiously for sedation for a few days. Flunitrazepam has resulted in delirium and should be avoided.
- Prochlorperazine is associated with a high incidence of akathisia. Administering diphenhydramine can blunt this effect.[4]

References

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2. O'Connor PG, Carroll KM, Shi JM, Schottenfeld RS, Kosten TR, Rounsaville BJ. Three methods of opioid detoxification in a primary care setting: a randomized trial. *Ann Intern Med* 1997;127:526-30.
3. Bell JR, Young MR, Masterman SC, Morris A, Mattick RP, Bammer G. A pilot study of naltrexone-accelerated detoxification in opioid dependence. *Med J Aust* 1999;171:26-30.
4. Vinson DR, Drotts DL. Diphenhydramine for the prevention of akathisia induced by prochlorperazine: a randomized, controlled trial. *Ann Emerg Med* 2001;37:125-31.

TOXICOLOGY

Organophosphate poisoning

Drugs of choice[1]

activated charcoal		
Adults	50 g, single dose	$10.73/dose
Children	1–2 g/kg, single dose	$0.21–0.43/kg per dose

AND

atropine		
Initial dose		
Adults	2–5 mg, I.V., every 5 min until control of mucous membrane secretions is achieved	$1.73–4.33/dose
Children	0.02–0.05 mg/kg, I.V., every 5 min until control of mucous membrane secretions is achieved	$0.02–0.04/kg per dose
Maintenance dose, if symptoms are severe		
Adults	50–100 mg/h, I.V.	$43.33–86.66/h
Children	0.5 mg/kg per h, I.V.	$0.43/kg per h

Second-line therapies

pralidoxime		
Adults	1–2 g, I.V., over 15–30 min	$24.83/1-g vial
Children	25–50 mg/kg, I.V., over 15–30 min	

Additional doses of pralidoxime should be guided by the clinical response. Adults have required infusions of up to 500–1000 mg/h.

Additional instructions and notes

- Although animal studies support the use of pralidoxime, there have been conflicting results from controlled trials.[2–4]
- As much as 200–500 mg of atropine may be required in the first hour after oral ingestion.
- Atropine infusion doses should be titrated to maintain clear lungs and the decreased secretions or drying of secretions.
- Appropriate decontamination is vital. Organosphosphates are well absorbed across the skin; thus, for dermal exposures all clothes should be removed and the skin thoroughly flushed.
- Activated charcoal may be of limited benefit because of the rapid absorption of organophosphates.
- There are no controlled trials to support the use of sorbitol or other cathartics in this

situation.

- Although activated charcoal is the standard of care, no controlled trials have shown that it improves clinical outcomes.

References

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2. Johnson S, Peter JV, Thomas K, Jeyaseelan L, Cherian AM. Evaluation of two treatment regimens of pralidoxime (1 g single bolus dose vs 12 g infusion) in the management of organophosphorus poisoning. *J Assoc Physicians India* 1996;44:529-31.
3. Cherian AM, Peter JV, Samuel J, Jaydevan R, Peter S, Joel S, et al. Effectiveness of P2AM (PAM — pralidoxime) in the treatment of organophosphorus poisoning (opp) a randomized, double blind placebo controlled clinical trial. *J Assoc Physicians India* 1997;45:22-4.
4. Balali-Mood M, Shariat M. Treatment of organophosphate poisoning. Experience of nerve agents and acute pesticide poisoning on the effects of oximes. *J Physiol Paris* 1998;92:375-8.

TOXICOLOGY

Salicylate poisoning

Drugs of choice

1. All patients

activated charcoal[1]		
Adults	50 g initially	$10.73/dose
Children	1–2 g/kg initially	$0.21–0.43/kg per dose

2. To alkalinize urine

sodium bicarbonate (50 mmol in 50-mL ampoule)		
Adults and children	1–2 mmol/kg, I.V. over 1–2 h; repeat as required to maintain urine pH between 7.5 and 8	$3.27/50-mL ampoule

3. To correct dehydration and prevent hypoglycemia

dextrose 5% in water + sodium chloride 0.9%	I.V. infusion as indicated by clinical condition

Additional instructions and notes

- There is the potential for delayed toxicity with enteric-coated products.
- Patients who have ingested more than 150 mg/kg will probably develop symptoms and should be treated with activated charcoal. Patients who have ingested more than 300 mg/kg have a high potential for severe toxicity.
- Potassium deficiency must be corrected before an attempt is made to alkalinize the urine. Potassium levels should be monitored and, if necessary, supplemental potassium should be given.
- Urine output should be maintained at 2–3 mL/kg per h, but forced diuresis should be avoided.[2]
- Do not cause systemic alkalosis.
- Serum salicylate level is a poor indicator of the risk of complications, and the Done nomogram also has poor predictive value. Treatment should be based not only on serum level, but also on the clinical picture.[3]
- Peritoneal dialysis, hemodialysis, charcoal hemoperfusion, or exchange perfusion should be considered under the following circumstances: salicylate level >7.25 mmol/L after acute ingestion or >3.0–3.5 mmol/L after chronic ingestion; coma; renal, hepatic, or pulmonary failure; severe acid–base imbalance; rising serum salicylate levels; or failure to respond to more conservative therapy. Hemodialysis is the most effective of the 4 therapy options.
- Gastric lavage is not recommended as it delays the use of charcoal and is unlikely to result in significant elimination.
- There are no controlled trials to support the use of sorbitol or other cathartics in this situation.
- Although activated charcoal is the standard of care, no controlled trials have shown that it

improves clinical outcomes.

References

1. Barone JA, Raia JJ, Huang YC. Evaluation of the effects of multiple-dose activated charcoal on the absorption of orally administered salicylate in a simulated toxic ingestion model. *Ann Emerg Med* 1988;17:34-7.
2. Prescott LF, Balali-Mood M, Critchley JA, Johnstone AF, Proudfoot AT. Diuresis or urinary alkalinisation for salicylate poisoning? *BMJ* 1982;285:1383-6.
3. Dugandzic RM, Tierney MG, Dickinson GE, Dolan MC, McKnight DR. Evaluation of the validity of the Done nomogram in the management of acute salicylate intoxication. *Ann Emerg Med* 1989;18:1186-90.

TOXICOLOGY

Selective serotonin reuptake inhibitor poisoning and serotonin syndrome

Drugs of choice[1]

Supportive therapy and withdrawal of the precipitating drug is all that is needed in most cases.

In cases of substantial ingestion

activated charcoal		
Adults	50 g, single dose	$10.73/dose
Children	1–2 g/kg, single dose	$0.21–0.43/kg per dose

Second-line therapies

1. If patient develops serotonin syndrome (3 or more of the following signs: changes in mental status, agitation, myoclonus, hyperreflexia, diaphoresis, shivering, tremor, diarrhea, uncoordination, fever) without serious cardiovascular complications

cyproheptadine[2]	4–8 mg; may repeat once if necessary	$0.26–0.52/dose

If patient is unable to take medication orally[3]

	chlorpromazine	25–50 mg, I.M. or I.V.	$0.49–0.97/dose
or	propranolol	1–2 mg, I.V.	$7.71–13.43/dose

2. Ventricular tachycardia associated with serotonin syndrome
   See *Ventricular tachycardia*.

3. Severe hypertension associated with serotonin syndrome
   See *Hypertension emergency*.

4. Hypotension associated with serotonin syndrome
   Volume replenishment with isotonic crystalloids.

5. Seizures associated with serotonin syndrome
   See *Status epilepticus*.

6. Hyperthermia (>40ºC)
   Aggressive temperature reduction with evaporative cooling and ice packs to the groin and axilla.

7. Rhabdomyolysis
   See *Rhabdomyolysis*.

Second-line therapies

If patient develops serotonin syndrome (3 or more of the following signs: changes in mental status, agitation, myoclonus, hyperreflexia, diaphoresis, shivering, tremor, diarrhea, uncoordination, fever) without serious cardiovascular complications

methysergide[3]	2 mg; may repeat once if needed	$0.64/dose

Additional instructions and notes

- The most common symptoms are tachycardia, drowsiness, tremor, vomiting, and nausea. Although most patients never develop cardiovascular complications from isolated SSRI overdoses, nausea and mild tachycardia and hypertension, which require no treatment, have been reported.
- Patients should be given 1 L of normal saline before administration of chlorpromazine to prevent hypotension.
- Gastric lavage is not recommended as it delays the use of charcoal and is unlikely to result in significant elimination.
- There are no controlled trials to support the use of sorbitol or other cathartics in this situation.
- Although activated charcoal is the standard of care, no controlled trials have shown that it improves clinical outcomes.

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3. Mills KC. Serotonin syndrome: a clinical update. *Crit Care Clin* 1997;13:763-83.

Abbreviations

ASA	acetylsalicylic acid
b.i.d.	twice daily
BIPAP	biphasic positive airway pressure
COX-2	cyclooxygenase-2
CPAP	continuous positive airway pressure
g	gram(s)
h	hour(s)
HIV	human immunodeficiency virus
I.M.	intramuscular
INR	international normalized ratio
IU	international unit(s)
I.V.	intravenous
kg	kilogram(s)
L	litre(s)
LMWH	low molecular weight heparin
m	metre(s)
mEq	milliequivalent
min	minute(s)
mm	millimetre
mmol	millimol
MDI	metered-dose inhaler
µg	microgram(s)
mg	milligram(s)
MI	myocardial infarction
mL	millilitre(s)
NSAID	nonsteroidal anti-inflammatory drug
q1h (q2h, q8h, etc.)	every hour (every 2 hours, every 8 hours, etc.)
q.i.d.	four times daily
S.C.	subcutaneous
SSRI	selective serotonin reuptake inhibitor
TIA	transient ischemic attack
t.i.d.	three times daily
tsp	teaspoon

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