Methodist Healthcare – Memphis Hospitals

THERAPEUTICS MANUAL

Fifth Edition
June 2008

Dear Colleague:

The Methodist Healthcare-University Hospital Department of Pharmacy is pleased to provide you with a copy of the fifth edition of the Therapeutics Manual. Due to the overwhelming response to the manual, updates and new information have been included to enhance your practice.

The first section includes patient safety information. Unapproved abbreviations and high-risk medications are highlighted in this section. It also highlights which medications are restricted by physician specialty.

The next section includes Pharmacy & Therapeutics approved protocols. Additions to this version include protocols for antibiotic lock therapy, antihypertensives, RCN, and diltiazem.

The Methodist specific guidelines and consensus guidelines sections have been updated to include information on factor IX products, dofetilide, AOC/LOC, epoetin, lithium, warfarin, titrating parameters, and deep sedating agents.

The purpose of this manual is to provide concise drug information to aid you in your daily practice.

Sincerely,

Bob Lobo, Pharm.D, BCPS
Assistant Director, Clinical Pharmacy

Disclaimer: As there are new guidelines, policies, and procedures that are approved periodically for use at Methodist Healthcare-University Hospital, this book may contain information that is out of date. Consult the Molli website for the most up to date information. Also, with the ever changing medical literature, some of the information contained may be out of date. Consult the medical literature for the most recent information.

-COST INFORMATION-
Average Wholesale Price

$-	<$10
$$-	$10-30
$$$-	$30-50
$$$$-	$50-70
$$$$$-	>$70

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METHODIST HEALTHCARE - MEMPHIS HOSPITALS
DEPARTMENTS OF PHARMACY

University (516-8295)

Administrative Director of Pharmacy	Alison Apple, D.Ph., M.S.	418-3072
Asst. Director, Clinical Services	Bob Lobo, Pharm.D., BCPS	418-0040
Asst. Director, Pharmacy Operations	Wayne Segars, Pharm.D., M.S.	418-1151
Pharmacy Manager	Ben Smith, Pharm.D.	418-0112
Pharmacy Manager	Joyce Broyles, Pharm.D., BCNSP	418-0045

Clinical Pharmacy Specialists

Ambulatory Care	Anne Reaves, Pharm.D.	418-4111
Cardiology	Carrie Oliphant, Pharm.D., BCPS	418-0048
Critical Care	Chris Finch, Pharm.D., BCPS	418-0050
Emergency Department	Laurimay Laroco, Pharm.D.	516-2889
Neuro Critical Care	April Hurdle, Pharm.D., BCPS	418-4108
Internal Medicine	Justin Usery, Pharm.D., BCPS	418-4090
Nutrition/ID	Joyce Broyles, Pharm.D., BCNSP	418-0045
Solid Tumor Oncology	Carli Nesheiwat, Pharm.D., BCOP	418-0051
Oncology	Sundae Stelts, Pharm.D.	516-7385
Solid Organ Transplant	Amy Krauss, Pharm.D., BCPS	418-0043
Solid Organ Transplant	Jennifer Lehneman, Pharm.D.	418-4105

University of Tennessee Faculty

Sold Organ Transplant	Ben Duhart, M.S., Pharm.D.	532-3856
Internal Medicine	Larry Hak, Pharm.D., BCPS	524-7566
Internal Medicine	Tim Self, Pharm.D.	448-6465
Nephrology	Joanna Hudson, Pharm.D.	448-2655

Central Pharmacy/IV Room

Location (Phone):	Ground Tower/Link	(516-8812)
Hours of Operation:	7 Days a Week	24 Hours a day

Patient Care Area Pharmacist (PCAP)

Locations (Phone):	PCAP 6 - 6 Tower	(2664)/418-4034
	PCAP 7 - 7 Tower	(2750)/418-3322
	PCAP 8 - 8 Tower	(2884)/418-4091
	PCAP A – 8 Thomas	(8089)/418-4060
	PCAP B – 2 Sherard	(2485)/418-4059
Hours of Operation:	Sunday-Saturday	7AM-3PM

Critical Care Satellite

Location (Phone):	4 Tower	(8331)/418-4108

Hours of Operation:	7 Days a Week	7AM-11PM

Oncology Satellite

Location (Phone):	3 Crews	(7050)/418-4069
Hours of Operation:	Monday-Friday	7AM-6:30PM
	Saturday-Sunday	7AM-3PM

Surgery Satellite

Location (Phone):	3 Thomas	(8186)
Hours of Operation:	Monday-Friday	5AM-11PM

Outpatient Pharmacy

Location (Phone):	1 Tower	(8168)
Hours of Operation:	Monday-Friday	8:30AM-4PM

Transplant Satellite

Location:	7 East	(7065)/418-3320
Hours of Operation:	Monday-Friday	7AM-11PM
	Saturday-Sunday	7AM-3PM

NORTH (384-5206)

Director of Pharmacy	Linda Lipsky, D.Ph.	418-9101
Pharmacy Manager	Amanda LaBuda, Pharm.D.	418-4414
Nutrition	Kaleb Brown, Pharm.D.	269-2901
Hours of Operation:	7 Days a Week, 24 Hours a day	

SOUTH (516-3747)

Director of Pharmacy	Phyllis Weaver, M.S.	418-5325
Clinical Pharmacy Coordinator	Peggy Yam, Pharm.D., BCPS	418-4952
Hours of Operation:	7 Days a Week, 24 Hours a day	

GERMANTOWN (516-6977)

Clinical Pharmacy Coordinator	Jeff Cooper, Pharm.D.	418-5298
Nutrition	Elizabeth Betchick, Pharm.D., BCNSP	418-4860
Nutrition	Nicole Hamlett, Pharm.D.	418-4859
OR/SDS/Cath Lab	Martha Gardner	418-4856
Hours of Operation:	7 Days a Week, 24 Hours a day	

METHODIST EXTENDED CARE HOSPITAL (516-2111, fax: 516-2331)

Hours of Operation:	M-F 8AM to 5:30PM
	Weekends and Holidays 7AM to 3:30PM

Unapproved Abbreviations
Memphis City-Wide Standardized List

The following abbreviations may not be used in any clinical documentation, including all types of orders, progress notes, consultation reports, and operative reports.

Abbreviation to Avoid	Other Unacceptable Variations	Recommended Approach
U	u	Write out “units”
IU	I.U., iu, i.u.	Write out “international units”
QD	Q.D., qd, q.d.	Write out “daily”
QOD	Q.O.D., qod, q.o.d.	Write out “every other day”
MS		Write out “morphine sulfate”
MSO4		Write out “morphine sulfate”
MgSO4		Write out “magnesium sulfate”
Doses without “leading zero”		Use “leading zero”for doses<1 (e.g. 0.4)
Avoid use of trailing zeros		Write “2” instead of “2.0”
AU, AD, AS, AL, OS, OD, OU	au, ad, as, al, os, od, ou, a.u., a.d., a.s., a.l., o.s., o.d., o.u.	Indicate “each eye,” “left ear,” etc.
μg		Mcg

The abbreviations to avoid cannot be used in any form, upper or lower case, with or without periods.

These unapproved abbreviations have been identified by the JCAHO as having a high probability of being misinterpreted and resulting in a medication error.

High Risk Medications

- **Chemotherapeutic agents:**
  - Verbal orders not accepted
  - Standard Chemotherapy Order Form
  - Order requires an Attending physician's signature
  - Standard medication reference (Facts and Comparisons Chemotherapy Handbook®)
  - Pharmacy and Nursing double-check system

- **Concentrated electrolytes:**
  - No concentrated KCl (undiluted) in patient care areas
  - Diluted KCl infusions not floor-stocked
  - KCl infusions limited to 60 mEq per bag
  - Max infusion rates:
  - 10 mEq/hr not on a cardiac monitor
  - 20 mEq/hr if on cardiac monitor
  - MHT (Malignant Hematology and Transplant) may have a higher concentration of KCl:
    - Labeled with fluorescent green labels
    - Restricted to MHT unit
    - Must be infused in a central line
    - Two nurses must verify pump rate
  - NaCl 23.4% not floor stocked (exception: hemodialysis)
  - NaCl 23.4% separated from other NaCl in hemodialysis
  - NaCl 3% premix bags not floor stocked

- **Drotrecogin alfa (Xigris®):**
  - Restricted to "credentialed" ID physicians, pulmonologists, and critical care physicians
  - Standardized order form
  - Educational materials for Nursing and Pharmacy on MOLLI

- **Heparin (UFH) /Low Molecular Weight Heparins (LMWH)/Fondaparinux/Direct Thrombin Inhibitors (DTIs):**
  - Standardized heparin protocol
  - Heparin not started until 12 hours after the last LMWH dose
  - HIT protocol required when DTI used; page clinical specialist at 533-3381
  - LMWH Bridging Program

- **Hydromorphone and morphine:**
  - Higher concentrations of morphine not available as floorstock
  - "MSO_4" and "MS" not accepted for morphine

- Medication labels and MAR use TALL man letters: "HYDROmorphone"

- **<u>Insulin</u>:**
  - Standard sliding scale insulin protocol
  - "U" not accepted for units
  - Only "Regular" and "N" insulins floor-stocked
  - One formulary brand of insulin (Novolin® products)
  - Pharmacy enters all insulin doses
  - Standard concentration for insulin infusions (1 unit per ml)
  - Insulin infusions double checked by nursing
  - Insulin products in the pharmacy arranged by duration of action
  - Medication labels and MAR use TALL-man letters: NovoLOG and NovoLIN

- **<u>Neuromuscular blockers</u>:**
  - Not routinely floor-stocked
  - Segregated from other medications

- **<u>Epidural/spinal analgesia</u>:**
  - No orders for sedatives, narcotics, anticoagulants, or clopidogrel without discussion with anesthesia

- **<u>Patient Controlled Analgesia (PCA) pumps</u>:**
  - No meperidine PCA protocol
  - Nursing double checks the PCA
  - Standard PCA protocols for morphine and HYDROmorphone

Reporting Adverse Drug Events: Medication Errors and Adverse Drug Reactions

Why Report?
Adverse Drug Event reports are used to identify problems within the medication use system. From them, the Medication Safety Committee is able to identify improvement opportunities in medication care and delivery.

Adverse Drug Reactions (ADR):
Defined: any response to a drug that is noxious and unintended and that occurs at doses used in man for prophylaxis, diagnosis or therapy, excluding intentional and accidental overdose and drug abuse.

Medication Errors/Occurrences:
Briefly defined: any error in the medication use process (prescribing, transcribing, preparation/dispensing, administration, or monitoring), including omissions and errors that did not reach the patient. The error may or may not cause patient harm.

Complete an "Occurrence Report." The physician can request verbally that nursing or pharmacy complete a report. Orders for completion of reports should not be written in the medical record.

All adverse drug reactions, medication errors, and occurrences should be reported in Safeguard (available on the Molli website). If you are unable to report in Safeguard, inform the patient care coordinator or pharmacist so that they can report the adverse drug reaction, medication error, or occurrence.

Specific Medication Prescribing Guidelines

The following drugs are considered "on-formulary" at MH-MH hospitals, but carry certain restrictions on prescribing.

Generic name	Brand name	Restriction(s)	Alternative
Bosentan	Tracleer®	Must be prescribed by a pulmonologist or cardiologist	N/A
Budesonide	Entocort®	Must be prescribed by a gastroenterologist	Prednisone
Caspofungin	Cancidas®	Must be prescribed by an infectious disease physician, a pulmonologist, or a hematology/oncology/BMT physician	Ampho B, Abelcet®, Fluconazole
Cinacalcet	Sensipar®	Must be prescribed by a nephrologist for new orders or any physician may prescribe if it's a "continue home med" order	Calcium, Phosphate binders, Vitamin D sterols
Daptomycin	Cubicin®	Must be prescribed by an infectious disease physician or a pulmonologist	Vancomycin
Dofetilide	Tikosyn®	Physician must be authorized by manufacturer.	N/A
Ibutilide	Corvert®	Must be prescribed by a cardiologist; patient should be on a telemetry unit	N/A
Linezolid	Zyvox®	Must be prescribed by an infectious disease physician or a pulmonologist	Vancomyin
Nesiritide	Natrecor®	Must be prescribed by a cardiologist; may also be prescribed by an ER physician after consultation with a cardiologist *and* if BNP > 400 pg/ml. Patient must be on a telemetry unit. Patient must fail IV diuretic.	IV Nitroglycerin, IV diuretic
Quinupristin/ dalfopristin	Synercid®	Must be prescribed by an infectious disease physician	Vancomycin
Voriconazole	Vfend®	Must be prescribed by an infectious disease physician, a pulmonologist, or a hematology/oncology/BMT physician	Ampho B, Abelcet®, Fluconazole
Ziprasidone	Geodon®	Must be prescribed by a psychiatrist; Automatic stop of 72 hours; Max dose of 40 mg/24 hrs; documented failure of haloperidol	Haloperidol

Extended Interval Aminoglycoside Pharmacy Protocol

PHYSICIAN: Order "_____per pharmacy protocol". Specify drug.
NOTE: This is a pharmacy-run protocol

PHARMACIST: Follow Steps 1-10

Step 1: Determine if patient is candidate for protocol. If an exclusion exists, the pharmacist should contact the clinical specialist on call (533-3381) for assistance. The physician **must** be informed that the patient is not a good candidate for pulse-dose therapy and offer to dose the patient using standard dosing recommendations and pharmacokinetic monitoring.

Exclusions: unstable renal function, pediatric patient, ascites, burns>20% BSA, pregnancy, dialysis patient (any type)

Step 2: If patient does not have an exclusion, calculate Dosing Weight (DW):

1. DW = Actual Body Weight (ABW) unless ABW is > 1.2 X Ideal Body Weight (IBW)
2. If ABW is > 1.2 X IBW, use the following equation to determine dosing weight:
   DW = 0.4(ABW-IBW) + IBW
   IBW (male): 50 kg + 2.3 (inches > 5 feet)
   IBW (female): 45 kg + 2.3 (inches > 5 feet)

Step 3: Calculate and order one time dose (all doses should be diluted in 100 ml of fluid, and infused over 1 hour). Please round to the nearest 10 mg.

Initial Dose: ____ mg/kg X _____ kg (DW) = _____mg
(gentamicin/tobramycin – 5 mg/kg; amikacin – 20 mg/kg)
NOTE: up to 7 mg/kg gentamicin/tobramycin or 28 mg/kg amikacin may be requested by physician

Step 4: Order additional monitoring.

- Order twenty hour random level.
- Order serum creatinine if needed.

Step 5: Document actions in patient chart.

- Document initial actions in a note in the patient chart. This should include indication for use, serum creatinine, dose, and any other pertinent issues.

Step 6: Enter orders into computer system

- Enter aminoglycoside protocol code (Aminp) into patient profile on computer, as well as the order for the aminoglycoside dose.

- Fill out flow sheet and leave for the next pharmacist.
- Notify clinical specialist on call (533-3381).

Step 7: The next day, determine dosing interval based upon twenty hour random level using the following guidelines.

Gentamicin & Tobramycin 20-hour concentration	
<1.5 mcg/ml	Continue initial dose every 24 hours.
1.5-2.5 mcg/ml	Continue initial dose every 48 hours.
>2.5 mcg/ml	Obtain a second serum concentration 12-24 hours later; estimate the elimination half-life, and adjust the interval to approximately 4-5 times the half-life (keep on practical intervals – see below).
Amikacin 20-hour concentration	
<6 mcg/ml	Continue initial dose every 24 hours.
6-10 mcg/ml	Continue initial dose every 48 hours.
>10 mcg/ml	Obtain a second serum concentration 12-24 hours later; estimate the elimination half-life, and adjust the interval to approximately 4-5 times the half-life (keep on practical intervals – see below).

- Formula for calculation of half life from two random levels using these two formulas:

(1) $K = \frac{\text{LN (first level/second level)}}{\text{time elapsed between the two levels}}$ (2) Half – life = 0.693/K

Please note: LN is a natural log

First, calculate K using formula (1), then using the K you calculated in formula (1) calculate half-life utilizing formula (2). After a half life is obtained, multiply it by either 4 or 5 to get a practical dosing interval. For example**,** if a half life was estimated to be 11 hours, 4 times 11 would give 44 hours; 5 times 11 would give 55 hours – the "practical" interval would be 48 hours.

Step 8: Order dose/interval based on guideline interval. Specify when dose is to be given. Document results in patient chart.

Step 9: Monitor patient and update patient flow sheet daily. Order trough levels every 4-7 days (more often if needed). Document days of therapy, serum creatinine, and action planned or taken in patient chart daily.

Step 10: Adjust interval as needed, utilizing above guidelines.

Amphotericin B Bladder Irrigation Protocol

PHYSICIAN: Order as “Amphotericin B Bladder per Protocol”

PHARMACIST: Input into computer as “amph12.5irr”
Send label for admixture

NURSE: Conduct steps #2 through #5

1. Admix amphotericin B **12.5mg in 250ml sterile water**.
2. Insert triple-lumen urethral catheter.
3. Instill solution into bladder, cross-clamp X 1.5 hours.
4. Drain.
5. Repeat above procedure on day 2; no further treatment unless specifically ordered by physician.

Alcohol Withdrawal Syndrome Prophylaxis and Treatment Protocol

Instructions for use on reverse side. Use of this protocol requires MD authorization.

1. Implement Withdrawal Syndrome (DT) Precautions

2. Thiamine 100 mg po daily x 3 days
   Folic Acid 1 mg po daily x 3 days
   Therapeutic multivitamin 1 tablet po daily
   If patient unable to take PO:
   Thiamine 100 mg IV, Folic Acid 1 mg IV in NS 100 mL daily x 3 days

Select one or more from the following:

3. *Patient at **Low Risk** for alcohol withdrawal delirium [*1]:*
   (This regimen preferred for patients with COPD or respiratory illness)
   - ❑ Lorazepam 1 mg PO or IV q 1 hr prn early withdrawal symptoms. (Riker Goal=4)

4. *Patient at **High Risk** for alcohol withdrawal delirium [*2]:*
   - ❑ Lorazepam 1 mg PO or IV q 1 hr prn early withdrawal symptoms and scheduled lorazepam 2 mg PO or IV q 4 hr X 12 doses followed by 1 mg q 6 hr X 6 doses, then discontinue lorazepam.
     Nurse: Document Riker score on MAR prior to each scheduled dose. Hold dose if patient sedated or Riker score < 4.

5. *Alcohol withdrawal delirium (Delirium Tremens) Treatment Regimen[*3]:*
   Nurse: Document time and date of DT onset:_____
   Notify MD of DT's immediately and inquire regarding ICU transfer.

Begin Lorazepam 2 mg IV q 15 minutes prn and haloperidol 5 mg IV q 4 hr prn severe agitation (Riker Goal = 4). Only give haloperidol after patient has received at least 10 mg lorazepam.

6. Physician's Signature: _____

Riker Sedation/ Agitation Level	Description
(7) Dangerous Agitation	Pulls at IV; Tries to remove catheters; Climbs over bedrail; Strikes staff; Thrashes from side to side
(6) Very agitated	Does not calm despite frequent verbal reminding of limits; Requires physical constraints
(5) Agitated	Anxious or mildly agitated; Attempts to sit up; Calms down to verbal instructions
Sedation Goal ⇨ **(4) Calm & cooperative**	**Calm; Awakens easily; Follows commands**
(3) Sedated	Difficult to arouse; Awakens to verbal stimuli or gentle shaking but drifts off again; Follows simple commands
(2) Very sedated	Arouses to physical stimuli but does not communicate or follow commands; May move spontaneously
(1) Unarousable	Minimal or no response to noxious stimuli; Does not communicate or follow commands

General Information:

DTs occur when early alcohol withdrawal symptoms are not promptly recognized and treated. Treatment with benzodiazepines should reduce or eliminate withdrawal symptoms.

***Early alcohol withdrawal symptoms to monitor all patients for include*:**

GI Complaints: Nausea, vomiting, anorexia
Peripheral Nervous System Hyperactivity: Tremor, tachycardia, tachypnea, hypertension, fever, and diaphoresis

Drotrecogin alfa (Xigris®) Guidelines and Standard Orders

Prescribing is limited to ID and Pulmonary/Critical Care physicians and the patient MUST be in the ICU

1. Has life support been discussed? Is there reasonable expectation of survival?
2. Documented/suspected infection present & being appropriately treated? Infectious source: _____
3. Central venous access obtained?
4. Has the patient received adequate fluid resuscitation?

5. Are ≥2 SIRS criteria present?
(a. HR ≥ 90; **b**. RR ≥ 20 or $PaCO_2$ ≤ 32; **c.** Temp ≥ 38°C or ≤ 36°C; **d.** WBC ≥12, ≤4, or >10% bands)

6. Has ≥ 1 sepsis-induced organ failure below occurred in the last 48 hrs & persisted?
   a. Cardiac: SBP ≤90 or MAP ≤70 for ≥ 1 hr or need for vasopressor therapy
   b. Renal: UOP <0.5ml/kg/hr for ≥ 2 hr
   c. Hematologic: recent, unexplained decrease in PLT count to <80,000 or >50% decrease in previous 3 days
   d. Lactic acidosis: pH ≤7.3 or base deficit ≥ 5 with lactate >1.5 times normal
   e. Respiratory: PaO_2/FiO_2 ratio ≤250
   f. Other {i.e. CNS (altered consciousness, ↓ GCS), Hepatic (T.Bili >2 mg/dl x 2 days)}:_____

7. Are the following contraindications absent?
   a. Active (significant) bleeding from any source
   b. GI bleed requiring transfusion in the last 72 hrs
   c. <3 months post hemorrhagic CVA, or <2 months s/p intracranial/spinal surgery or head trauma
   d. History of intracerebral AV malformation, cerebral aneurysm, or mass lesion of the CNS
   e. Presence of an epidural catheter, or <12 hrs post surgery requiring general or spinal anesthesia
   f. Known hypersensitivity to drotrecogin alfa (activated)

8. The following conditions that may increase risk for adverse events with drotrecogin alfa have been carefully considered & the benefits of therapy outweigh the potential risks?
   a. INR>3
   b. Recent (in the last 7 days) use of glycoprotein IIb/IIIa inhibitors

c. Recent (in the last 3 days) use of thrombolytics
d. Anticoagulation with LMWH /heparin (in the last 12 hrs)
e. Warfarin, aspirin >650 mg/day, or other platelet inhibitors (in the last 7 days)
f. Cirrhosis with portal hypertension
g. Known bleeding disorder (i.e. hemophilia) or hypercoagulable state (i.e. protein C deficiency)
h. PLT count < 30,000 (even if PLT count is increased after transfusions)
i. <3 months post ischemic stroke
j. <6 weeks post GI bleed
k. Recent surgery (within the last 30 days)

9. Discontinue drotrecogin alfa for signs/symptoms of bleeding and 2 hours prior to any surgical or invasive procedure; resume infusion per M.D. instructions.

10. CBC daily x 4 (while receiving drotrecogin alfa).

11. **If the answer to questions 1-8 is YES, start drotrecogin alfa by continuous infusion at 24 mcg/kg/hr for a total duration of 96 hrs. Infuse drotrecogin alfa through a dedicated IV line.**

Patient weight (kg) _____

Weight must be documented to ensure accurate dosing

Glycoprotein IIb/IIIa Inhibitor Dosing Protocols/Orders

1. SCr: _____ mg/dl Is patient on dialysis Y N

2. Platelet count _____

If labs are > 48 hrs old obtain labs as STATs.
Initial dosing will be based on CrCl > 30ml/min until labs return.

2. Patient's Weight: _____ kg Height: _____ cm

4. Check one drug and corresponding dose:

____ Abciximab (ReoPro®)

If platelet count < 100,000, abciximab is contraindicated and will not be given.
0.25mg/kg IV bolus followed by 0.125mcg/kg/min IV infusion (max 10 mcg/min)
ReoPro will automatically be discontinued 12 hours after PCI unless indicated:

Discontinue ReoPro at: _____

____ Eptifibatide (Integrilin®)

If patient is on dialysis, eptifibatide is contraindicated and will not be given.
If calculated CrCl < 50 ml/min (based on actual body weight), the infusion rate will be automatically reduced to 1mcg/kg/min.

a. _____ ACS dose: 180mcg/kg IV bolus over 1 min followed by 2mcg/kg/min IV infusion

b. _____ Cath lab dose: 180mcg/kg bolus x 2, 10 minutes apart. Continuous 2mcg/kg/min IV infusion following first bolus.
(Note: this dose is only for initiating Integrilin in the cath lab at the onset of PTCA/stent.)

Integrilin will be automatically discontinued 24 hours after PCI unless indicated:

Discontinue Integrilin at: _____

_____ M.D.

(Place Patient Sticker Here)

Methodist Healthcare

PHYSICIAN'S ORDERS

HT: _____cm

WT: _____kg

DATE: _____

Allergies: _____ TIME: _____

P&T STANDARD HEPARIN PROTOCOL

(For use at Methodist Germantown, MECH, North, SNF, South, and University Hospitals.)

(This protocol is not intended for use in stroke patients nor pediatric patients).

1. Verify indication; DVT / PE? [ ] No [ ] Yes (Contact physician if indication not specified).
2. Is patient on any other form of heparin (enoxaparin / dalteparin / fondaparinux)?
   [ ] No [ ] Yes
   If No; Go to step 3
   If Yes;
   • Discontinue all other forms of heparin
   • If on full dose anticoagulation, delay Heparin bolus / infusion for 12 hours after last dose
   • If on prophylaxis doses, no delay is necessary
3. If patient has IM injection orders, Call MD for clarification (IM injections not recommended while on Heparin; may vaccinate if aPTT less than 110 seconds).
4. Labs: **(do not interrupt Heparin Infusion to collect labs nor collect from Heparin infusion IV line or distally).**
   • Start second IV line access (INT) for blood draws if necessary.
   • Obtain baseline aPTT and CBC without diff. (if not done in previous 48 hours)
   • Call MD if baseline or subsequent platelet count is less than 100,000 / mm3 or if platelet count decreases by 50% from baseline
   • CBC without differential every AM
   • aPTT six hours after starting infusion (order as "time priority")
   • aPTT every AM after Heparin Infusion begun and therapeutic range (aPTT 65 – 110 seconds) achieved.
5. **Give Heparin Initial Bolus prior to beginning infusion**

Indication is **NOT** DVT / PE	Indication is DVT / PE
Heparin Bolus IV push	Heparin Bolus IV push
[ ] No bolus per physician order	[ ] Weight less than 90 kg, give 5,000 units
[ ] Weight less than 50 kg, give 2,500 units	[ ] Weight 90–110 kg, give 7,500 units
[ ] Weight greater than 50 kg, give 5,000 units	[ ] Weight greater than 110 kg, give 10,000 units

6. **Initial rate** after bolus (use standard Heparin pre-mixed concentration of 20,000 units / 500 ml D5W).

Indication is **NOT DVT / PE**	Indication is DVT / PE
[ ] If weight equal to or greater than **58 kg,**	[ ] If weight equal to or greater than **87kg**
initial rate is: 25 ml/hr.	initial rate is: 38 ml/hr
[ ] If weight less than 58 kg, calculate initial rate. Initial rate =	[ ] If weight less than 87 kg, calculate initial rate. Initial rate=
Weight (in kg) divided by 2.3 = _____ml/hr	Weight (in kg) divided by 2.3=_____ml/hr

7. **Titration**

aPTT Value (in seconds)	Additional Action	Rate Change (in ml/hr)	Additional Labs (order as "time priority)
≤ 49.9 sec	Give bolus (same dose as initial bolus	Increase rate by 240 units / hr (6 ml / hr)	Repeat aPTT in 6 hours
50-64.9 sec	N/A	Increase rate by 120 units / hr (3 ml / hr)	Repeat aPTT in 6 hours
65-110 sec	N/A	Maintain same rate	N/A
110.1-124.9 sec	N/A	Decrease rate by 120 units / hr (3 ml / hr)	Repeat aPTT in 6 hours
≥ 125 sec	Hold infusion for 1 hour	Decrease rate by 240 units / hr (6 ml / hr)	Repeat aPTT 6 hours after infusion resumed

8. Update *Heparin Protocol Flow Record* (including all aPTT and platelet values, boluses, rates, and changes).
9. Discontinue daily CBC without Differential and daily aPTT when Heparin Protocol discontinued.

Physician Signature:	**Physician Number:**	**Date/Time**
RN Signature:		**Date/Time**

Methodist Healthcare

(Place Patient Sticker Here)

PHYSICIAN'S ORDERS

HT: _____cm

WT: _____kg

DATE: _____

Allergies: **Heparin**

TIME: _____

HEPARIN-INDUCED THROMBOCYTOPENIA (HIT) PROTOCOL ARGATROBAN

Orders completed by Nursing

1. Page Clinical Pharmacy Specialist / Coordinator for initiation and daily follow-up.
2. Order CBC without differential DAILY.
3. Draw baseline aPTT prior to infusion.
4. STAT aPTT 2 hours after the start of the continuous infusion and 2 hours after any rate change.
5. Stop all heparin or low-molecular weight heparin, including flushes or locks
6. Label all IV sites or catheters as "NO HEPARIN"
7. Adjust rate of infusion based upon *Argatroban Dose Adjustment Instructions.*

ARGATROBAN DOSE ADJUSTMENT INSTRUCTIONS (Use Standard Concentration 1 mg / mL)	
APTT (seconds)	Dose Adjustment /Monitoring ***(Maximum rate NOT TO EXCEED 10 mcg/kg /min or _____ml / hour)***
Greater than 90	Stop infusion for **1 hour** and then restart at **50%** slower rate. ***(Reminder - Draw aPTT 2 (two) hours after each rate change)***
45-90	Continue at current rate. ***Draw aPTT in AM***
Less than 45	Increase infusion rate by **20%. *(Reminder - Draw aPTT 2 (two) hours after each rate change)***

8. Document the initiation, the rate, rate changes, and discontinuation on the *HIT Protocol Flow Record.*
9. Document time of drawing and results of each aPTT value on the *HIT Protocol Flow Record.*
10. Discontinue daily CBC and aPTT when Argatroban is discontinued.
11. If any two sequential aPTTs exceed 90 seconds, page the Clinical Pharmacy Specialist / Coordinator at _____.

Orders for Pharmacist

1. Order bilateral lower extremity ultrasound for DVT if not done
2. Discontinue active orders for any heparin or LMWH and add to allergy list

Initial Maintenance Infusion:	
Total Bilirubin	**Dose**
Equal to or less than 1.5 mg / dL	2 mcg / kg / min
Exceeds 1.5 mg / dL	0.5 mcg / kg / min
Equal to or less than 1.5 mg / dL AND Patient critically ill	1 mcg / kg / min

3. Enter initial infusion rate _____mL/hr

Oral Anticoagulation (Physician Orders)

❑ Warfarin Dosing Service to follow & begin anticoagulation with warfarin after platelet count recovery & when physician specifies.

❑ Do not consult Warfarin Dosing Service. MD to manage warfarin.

Warfarin Management Recommendations (Not Orders)

1. Do not start warfarin until platelets greater than (> 100-150/mm^3).
2. Use doses no greater than 5 mg to initiate warfarin therapy
3. Minimum of 5 days overlap with argatroban and warfarin.
4. NOTE: Argatroban prolongs the INR, therefore it must overlap with warfarin until INR greater than 4
5. **If rate is less than 2 mcg/kg/min stop infusion**
   a. Obtain INR 4-6 hours after stopping argatroban infusion
   b. If INR 2-3 (therapeutic), continue with warfarin monotherapy
   c. If INR less than 2 (sub-therapeutic) resume argatroban at previous rate & repeat procedure the following day
6. **If rate is greater than 2 mcg/kg/min reduce to 2 mcg/kg/min**
   a. Obtain INR in 4-6 hours, if INR greater than 4, stop argatroban
   b. Obtain INR 4-6 hours after stopping argatroban infusion
   c. If INR 2-3 (therapeutic), continue with warfarin monotherapy
   d. If INR less than 2 (sub-therapeutic) resume argatroban at previous rate & repeat procedure the following day

Physician Signature: **Physician Number:** **Date/Time**

RN Signature: **Date/Time**

Methodist Healthcare

(Place Patient Sticker Here)

PHYSICIAN'S ORDERS

HT: _____cm

WT: _____kg

DATE: _____

Allergies: **Heparin**

TIME: _____

HEPARIN-INDUCED THROMBOCYTOPENIA (HIT) PROTOCOL FONDAPARINUX (ARIXTRA)

Orders completed by Nursing

1. Page Clinical Pharmacy Specialist / Coordinator for initiation and daily follow-up.
2. Order CBC without differential ***DAILY***
3. Discontinue lepirudin or argatroban, obtain aPTT every 4 hours until aPTT is less than 45 seconds prior to start of fondaparinux
4. Stop all heparin or low molecular weight heparin, including flushes or locks
5. Label all IV sites or catheters as "NO HEPARIN"
6. Document medication administration on MAR (Do not use HIT Flow Record).

Orders for Pharmacist

1. Order bilateral lower extremity ultrasound for DVT if not done
2. Discontinue active orders for any heparin or LMWH and add to allergy list
3. Discontinue lepirudin or argatroban if patient is currently receiving
4. Do not start fondaparinux until aPTT is less than 45 seconds if patient has previously received lepirudin, argatroban, or heparin
5. Dose based on criteria below:

If NOT acute HIT:	
Weight	Dose
Greater than 50 kg	2.5 mg subcutaneously every Day

If acute HIT or thrombosis is present:	
Weight	Dose
Less than 50 kg	5 mg subcutaneously every Day
50-100 kg	7.5 mg subcutaneously every Day
Greater than 100 kg	10 mg subcutaneously every Day

6. Give_____mg subcutaneously every Day.

Oral Anticoagulation (Physician Orders)

- ❑ Warfarin Dosing Service to follow & begin anticoagulation with warfarin after platelet count recovery & when physician specifies.
- ❑ Do not consult Warfarin Dosing Service. MD to manage warfarin.

Warfarin Management Recommendations (Not Orders)

1. Do not start warfarin until platelets greater than (> 100-150 / mm^3)
2. Use doses no greater than 5 mg to initiate warfarin therapy
3. Minimum of 5 days overlap with fondaparinux and warfarin
4. Must overlap warfarin with fondaparinux until therapeutic INR for 2 consecutive days

Physician Signature: **Physician Number:** **Date/Time**

RN Signature: **Date/Time**

Methodist Healthcare

(Place Patient Sticker Here)

PHYSICIAN'S ORDERS

HT: _____cm

WT: _____kg

DATE: _____

Allergies: **Heparin** TIME: _____

HEPARIN-INDUCED THROMBOCYTOPENIA (HIT) PROTOCOL for LEPIRUDIN (REFLUDAN)

Orders completed by Nursing

1. Page Clinical Pharmacy Specialist / Coordinator for initiation and daily follow-up.
2. Order CBC without differential daily.
3. Draw baseline aPTT prior to infusion, then aPTT 4 hours after the start of the continuous infusion and 4 hours after any rate change.
4. Stop all heparin or low-molecular weight heparin, including flushes or locks
5. Label all IV sites or catheters as "NO HEPARIN"
6. Discontinue daily CBC and aPTT when Lepirudin is discontinued.
7. Adjust rate of infusion based upon Lepirudin (Refludan) Dose Adjustment Instructions.

	LEPIRUDIN DOSE ADJUSTMENT INSTRUCTIONS
APTT (seconds)	Dose Adjustment /Monitoring
Greater than 75	Stop infusion **2 hours** and then restart at **50%** slower rate. ***Draw aPTT 4 hours after rate change***
45-75	Continue at current rate. ***Draw aPTT in AM***
Less than 45	Increase infusion rate by **20%. *Draw aPTT 4 hours after rate change***

8. If any two sequential aPTTs exceed 75 seconds, page the Clinical Pharmacy Specialist / Coordinator at _____.
9. Document the time of initiation, the rate, rate changes, and discontinuation on the (HIT) Protocol Flow Record.
10. Document time of drawing and results of each aPTT value on the Protocol Flow Record.

Orders for Pharmacist

1. Order bilateral lower extremity ultrasound for DVT if not done.
2. Discontinue active orders for any heparin and LMWH and add to allergy list
3. Calculate CrCL (Cockroft-Gault Equation) & document in medical record. Call MD to recommend argatroban if CrCL < 30 mL/min.

Optional Bolus: Appropriate if life-threatening thrombosis and low bleeding risk		
CrCL (mL/min)	**Dose**	**Dose limit**
less than 60	0.2 mg/kg	Not to exceed 22 mg
greater than 60	0.4 mg/kg	Not to exceed 44 mg
Administer bolus over 1 minute		

4. If bolus indicated, circle; Yes No; Enter bolus dose *(if applicable)* _____mg

Initial Maintenance Infusion: (Use standard concentration of 0.4 mg / mL)		
CrCL (mL/min)	**Dose**	**Dose limit**
15-29	0.01 mg/kg/hr	1.1 mg/hr **(max rate of 2.8 mL/hr)**
30-44	0.03 mg/kg/hr	3.3 mg/hr **(max rate of 8.3 mL/hr)**
45-60	0.05 mg/kg/hr	5.5 mg/hr **(max rate of 13.7 ml/hr)**
>60	0.1 mg/kg/hr	11 mg/hr **(max rate of 27.5 mL/hr)**

5. Enter initial infusion rate _____mL/hr

Oral Anticoagulation (Physician Orders)

- ❑ Warfarin Dosing Service to follow and begin anticoagulation with warfarin after platelet count recovery and when physician specifies.
- ❑ Do not consult Warfarin Dosing Service. MD to manage warfarin.

Warfarin Management Recommendations (Not Orders)

1. Do not start warfarin until platelets greater than (> 100-150/mm3).
2. Reduce infusion until aPTT 45–50 seconds prior to starting warfarin.
3. Use doses no greater than 5 mg to initiate warfarin therapy
4. Minimum of 5 days overlap with lepirudin and warfarin.
5. When INR greater than 2 for two days, stop lepirudin.

Physician Signature: **Physician Number:** **Date/Time**

RN Signature: **Date/Time**

Adult Patient Controlled Analgesia (PCA) Orders

This form should be used for all new PCA orders and dose modifications.

Physician: Check ONE of the boxes below and complete. Each blank must be complete in the appropriate section for order processing.

☐ **MorPHINE PCA Per Protocol**
For opioid naïve patients
(concentration: 1 mg/mL)

Basal rate: none unless box checked below
Bolus/demand dose: 1 mg/dose
Delay (lockout): 10 minutes
1 hour limit: 6 mg per hour
7 mg per hour if basal rate selected

☐ Add basal rate: 1 mg per hour

☐ **MorPHINE PCA (non-protocol)**
(concentration: 1 mg/mL)

Basal rate: _____per hour
Bolus/demand dose: ____mg/dose
Delay (lockout): _____minutes
1 hour limit: _____per hr

☐ **HYDROmorphone PCA per protocol**
(Dilaudid®) For opioid naïve patients
(concentration: 1 mg/mL)

Basal rate: none unless box checked below
Bolus/demand dose: 0.2 mg/dose
Delay (lockout): 10 minutes
1 hour limit: 1.2 mg per hour
1.4 mg per hour if basal rate selected

☐ Add basal rate: 0.2 mg per hour

☐ **HYDROmorphone PCA (non-protocol)**
(Dilaudid®) (concentration: 1 mg/mL)

Basal rate: _____per hour
Bolus/demand dose: ____mg/dose
Delay (lockout): _____minutes
1 hour limit: ____per hour

☐ **Non-protocol PCA Orders**

(medication):_____

Basal rate (if needed): _____per hour
Bolus/demand dose: _____mg/dose
Delay (lockout): _____**minutes**
1 hour limit: _____per hour

Physician Signature: Physician Number: Date/Time

_____

RN Signature: Date/Time

_____

(Place Patient Sticker Here)

Maximally Concentrated PCA Order for Adults

Only those experienced with the management of patients with very high opiate tolerance may prescribe a maximally concentrated PCA. This protocol is intended for patients with high opioid requirements, i.e. at least equivalent to morPHINE 50 mg IV per shift or HYDROmorphone 50 mg IV per shift. For patients with lower requirements, use the "Adult Patient Controlled Analgesia (PCA) Orders form.

Physician: Select ONE of the opioids below and complete the dosing information:

☐ MorPHINE PCA – maximally concentrated
(Maximum concentration: 5 mg/mL)

Basal rate dose: _____ **per hour**
Bolus/demand dose: _____ **mg/dose**
Delay (lockout): _____
1 hour limit: _____

☐ HYDROmorphone (Dilaudid®) PCA
(Maximum concentration: 10 mg/mL)

Basal rate dose: _____ **per hour**
Bolus/demand dose: _____ **mg/dose**
Delay (lockout): _____
1 hour limit: _____

Physician Signature: Physician Number: Date/Time

_____

RN Signature: Date/Time

CRITICAL CARE –
INTENSIVE INSULIN THERAPY
Page 1 of 2

HT: _____cm

WT: _____kg

DATE & TIME	PHYSICIAN'S ORDERS AND DIET	DATE &	PROGRESS RECORD
			Note Progress of Case, Complications, Consultations, Change in Diagnosis, Condition on Discharge, Instructions to Patient.

RESTRICTION: Patients must be in an intensive care unit

PHYSICIAN

1) Order "Intensive Insulin Protocol."
2) All patients must have a blood glucose (BG) ≥ 150 mg/dL x 2 measurements
3) This is **NOT** for the treatment of DKA.

PHARMACIST

1) D/C all previous insulin orders (including insulin in TPN) and antidiabetic medication orders.
2) Verify patient is receiving some source of exogenous glucose (e.g. tube feeds, D5, TPN) prior to initiating infusion.
3) Standard IV Insulin Infusion: 100 units Regular Human Insulin/100 ml NS (Final conc: 1 unit/ml)

NURSING

1) If patient has insulin in TPN, contact Nutrition Support Team to remove insulin from TPN with next bag change.
2) Stat serum potassium (K+)before starting insulin infusion, if no recent K+ available. If K+ is <3.3 call MD for K+ replacement orders before starting insulin infusion.
3) Change insulin drip every 24 hours.
4) Check bedside BG before starting infusion and Q1H.
   Change to Q2H Accuchecks when BG has remained in the goal range for 4 hours.
   If BG remains within goal range for 4 consecutive Q2H Accuchecks (8 hours), may decrease Accuchecks to Q4H.
5) Resume Q1H Accuchecks any time the infusion is stopped & restarted, for any infusion rate change or change in nutrition infusion rates.
6) Document infusion rate and BG values on flow sheet.
7) HOLD insulin infusion if TPN or continuous enteral feeds are stopped for any reason unless the patient is receiving another source of exogenous glucose. (e.g.D10W, D5W). Resume insulin infusion when TPN/enteral feedings are resumed. Resume insulin at the previous rate if TPN/enteral feedings are resumed at the previous rate.
   If TPN/enteral feedings are resumed at a different rate check BG 1 hr after feedings are resumed and start insulin protocol from the beginning.
   HOLD insulin infusion if patient is out of the ICU for a procedure. Restart upon return to ICU.
8) Discontinue intensive insulin protocol when patient is transferred from the ICU and initiate standard insulin sliding scale orders unless otherwise indicated by MD.

Goal: The goal is to maintain serum glucose from 80 to 150 mg/dL.

Initiating the Insulin Drip:					
Glucose:	151-190 mg/dL	191-240 mg/dL	241-300 mg/dL	301-400 mg/dL	>400 mg/dL
IVP Bolus:	2 units	4 units	6 units	10 units	14 units & call MD
Initial Rate:	1 unit/hr	2 units/hr	3 units/hr	4 units/hr	4 units/hr

1) ****If BG drops by more than 100 mg/dL from previous reading at any time, decrease rate by 50% and recheck BG in 1 hr.****
2) ****If BG drops by more than 50 mg/dL from the previous reading at any time, decrease rate by 25% and recheck BG in 1 hr.****

DATE & TIME	PHYSICIAN'S ORDERS AND DIET	DATE & TIME	PROGRESS RECORD
			Note Progress of Case, Complications, Consultations, Change in Diagnosis, Condition on Discharge, Instructions to Patient.

Adjust insulin rate as follows: (target blood glucose range 80-150 mg/dL)

Glucose	Drip Rate 1-3 units/hr	Drip Rate 4-6 units/hr	Drip Rate 7-10 units/hr	Drip Rate 11-14 units/hr	Drip Rate 15-18 units/hr	Drip Rate >18 units/hr
<60 mg/dL	D/C infusion and give 1 amp D50 IVP: Call MD and recheck glucose in 15 min. **1.** If glucose remains less than 60 mg/dL, repeat 25ml D50 IVP every 15 minutes until glucose >80 mg/dL. **2.** When glucose >100mg/dL, restart insulin infusion at 1/2 the previous rate (rounded to the nearest whole unit).					
61-79 mg/dL	D/C infusion and recheck glucose in 1 hr. **1.** If glucose remains less than 80 mg/dL, repeat 25ml D50 IVP every 15 minutes until glucose >80 mg/dL and call MD. **2.** When glucose >100mg/dL, restart insulin infusion at 1/2 the previous rate (rounded to the nearest whole unit).					
Glucose	**Drip Rate 1-3 units/hr**	**Drip Rate 4-6 units/hr**	**Drip Rate 7-10 units/hr**	**Drip Rate 11-14 units/hr**	**Drip Rate 15-18 units/hr**	**Drip Rate >18 units/hr**
80-150 mg/dL	No Changes Now – If glucose continues to decrease >20mg/dL over 2 consecutive Accuchecks; decrease rate by 1 unit/hr		No Changes Now – If glucose continues to decrease >20mg/dL over 2 consecutive Accuchecks; decrease rate by 2 units/hr		No Changes Now – If glucose continues to decrease >20mg/dL over 2 consecutive Accuchecks; decrease rate by 4 units/hr	
Glucose	**Drip Rate 1-3 units/hr**	**Drip Rate 4-6 units/hr**	**Drip Rate 7-10 units/hr**	**Drip Rate 11-14 units/hr**	**Drip Rate 15-18 units/hr**	**Drip Rate >18 units/hr**
151-190 mg/dL	Increase drip by 0.5 units/hr	Increase drip by 1 unit/hr	Increase drip by 1.5 units/hr	Increase drip by 2 units/hr	Increase drip by 2.5 units/hr	**CALL physician for a new order**
191-240 mg/dL	Increase drip by 1 unit/hr	Increase drip by 2 units/hr	Increase drip by 3 units/hr	Increase drip by 4 units/hr	Increase drip by 5 units/hr	
241-300 mg/dL	Increase drip by 1 unit/hr	Increase drip by 2 units/hr	Increase drip by 3 units/hr	Increase drip by 4 units/hr	Increase drip by 5 units/hr	
301-400 mg/dL	Increase drip by 2 units/hr	Increase drip by 3 units/hr	Increase drip by 4 units/hr	Increase drip by 5 units/hr	Increase drip by 6 units/hr	
>400 mg/dL***	Increase drip by 2 units/hr	Increase drip by 3 units/hr	Increase drip by 4 units/hr	Increase drip by 5 units/hr	Increase drip by 6 units/hr	
*****If still >400 mg/dL after 1 hr – Call MD**						

ADULT Pharmacological Protocol for Pediculosis (lice) & Scabies

PHYSICIAN: Write order for "Lice/scabies treatment per protocol."

PHARMACIST: Input orders into computer for permethrin.
For lice: input "PRN" orders for 7 days later with note: "Contact pharmacy for dose if live lice still present"
For scabies: input "PRN" orders for 14 days later with note: "Contact pharmacy for dose if live mites still present"
Dispense permethrin 1% (NIX) with "nit comb"

NURSE: Contact Infection Control.
See Protocol below.

Protocol - Head Lice:

- Wash hair, rinse with water, towel dry
- Apply 1% permethrin - Use sufficient volume to saturate hair and scalp
- Leave drug in contact with hair for 10 minutes
- Rinse with water
- Remove nits using "nit comb" while hair is still wet
  Individuals should remove the nits for aesthetic reasons or to decrease diagnostic confusion. A fine toothed "nit comb" can be used to make nit removal easier. The comb should be used on wet hair in order to remove the nits; combing dry hair does not seem to have the same effect.
- Repeat application if live lice present 7 days after initial treatment

Protocol - Scabies:

- Apply 30 gm of 5% permethrin for the average adult - no prior bathing required
- Apply to entire skin from jawline downwards, including all skin folds, groin, navel, external genitalia, and the skin under the nails
- Remove 8 to 14 hours after application by washing
- Repeat application if living mites present 14 days after initial treatment

Pregnancy:

Permethrin (or pyrethrins with piperonyl butoxide) is the treatment of choice for pubic lice in pregnant women as designated by the Centers for Disease Control and Prevention (CDC). Although not specifically mentioned, permethrin could also be used if other body areas of a pregnant woman are infested with lice (i.e., the head). It is classified as pregnancy category B.

Sliding Scale Regular/NovoLOG Insulin Protocol

Use regular insulin unless NovoLOG is specifically stated by physician

Regular Human Insulin (NovoLIN) OR Insulin Aspart (NovoLOG)

1. **Standardized Sliding Scale**

0-60	Initiate Hypoglycemic Protocol (see below)
61-150	No Insulin
151-200	3 units SQ
201-250	5 units SQ
251-300	8 units SQ
301-350	10 units SQ
351-400	12 units SQ
>400	15 units SQ and call MD

2. Accuchecks AC and HS, or Q6h if patient is NPO, on TPN or on continuous tube feedings.

HYPOGLYCEMIA PROTOCOL ORDERS

Patient symptomatic, but responsive:

1. Check blood glucose per meter.
2. If blood glucose <60 mg/dL:
   A. Give ½ cup fruit juice without sugar or 4 oz 2% milk AND if symptoms occur prior to mealtime, allow patient to eat without delay.
   B. Wait 15 minutes after juice or milk.
   C. If symptoms are absent, procedure complete
   D. If symptoms are present, recheck blood glucose.
   E. Repeat treatment until blood glucose > 80mg/dL, or symptoms relieved

Patient unresponsive:

1. Check blood glucose per meter.
2. If blood glucose < 60 mg/dL:
   A. If IV present, give 50 gm D50W. If no IV present, give 1 ml glucagon SQ with an insulin syringe.
   B. Wait 5 minutes after D50W. Wait 20 minutes after glucagon.
   C. Recheck blood glucose.
3. If patient responsive after 1 & 2:
   A. Give 8 oz 2% milk and 1 bread exchange.
   B. Wait 15 minutes.
   C. Recheck blood glucose.
   D. Repeat oral treatment until blood glucose > 80 mg/dL.
4. If patient unresponsive after 1 & 2
   A. Draw stat lab blood glucose.
   B. Give 50-100 grams D50W IV. Do not wait on lab results.
   C. Notify MD for further order

METHYLPREDNISOLONE (SOLU-MEDROL) PROTOCOL FOR SPINAL CORD INJURY

1. Methylprednisolone 30 mg/kg IV over 15 minutes STAT
2. Maintenance infusion (begun 45 min after end of bolus infusion):
- Begin 5.4mg/kg/hr IV in 500ml normal saline
3. Continue infusion for:
   - □ 23 hours if dose started 0 to 3 hours post injury
   - □ 47 hours if dose started 3 to 8 hours post injury
4. Start Methodist sliding scale insulin per protocol with accuchecks every 6 hours

Methylprednisolone Spinal Cord Injury Protocol: Instructions for Preparation and Administration

1. Bolus infusion
- 30 mg / kg IV in 50 ml of 0.9% normal saline over 15 minutes

2. Maintenance infusion:
- Started 45 min after end of bolus infusion
- 5.4mg/kg/hr IV in 500ml normal saline at 22ml/hr.
- Reconstitute dose with fluid from 500ml normal saline bag. Total volume should equal 500ml normal saline.
- See table for preparing the maintenance infusion
- Two bags needed to complete the 47 hour infusion

Patient weight (kilograms)	Dose (milligrams) to add to 500 ml 0.9% normal saline	Infusion rate (milliliters/hour)
45	5,600 mg	22
50	6,200 mg	22
55	6,800 mg	22
60	7,500 mg	22
65	8,100 mg	22
70	8,700 mg	22
75	9,300 mg	22
80	9,900 mg	22
85	10,600 mg	22
90	11,200 mg	22
95	11,800 mg	22
100	12,400 mg	22
105	13,000 mg	22
110	13,600 mg	22
115	14,300 mg	22
120	14,900 mg	22
125	15,500 mg	22

Thrombolytic Protocol for Declotting of Central Venous Access Devices

Methodist Healthcare – Memphis Hospitals

PHYSICIAN: Order as "Thrombolytic protocol for catheter clearance"

PHARMACIST: Input into computer.
Dispense Cathflo Activase vial and diluent (sterile water for injection, non-bacteriostatic)

NURSE: Place completed copy of protocol in orders section of the medical record.
Consult steps #1 through #6

1 1. Obtain Cathflo Activase (alteplase) from pharmacy after specifying the type of catheter (or lumen volume) and number of lumens requiring treatment.

2. Alteplase is not compatible with heparin or bacteriostatic solutions. *If possible*, remove any heparinized saline or bacteriostatic NS from the catheter lumen by aspiration or flushing, followed by flushing with non-bacteriostatic NS.

1 3. Prepare the solution:
1 a. Withdraw 2.2 ml of sterile water for injection (non-bacteriostatic)
2 b. Inject the 2.2 ml sterile water for injection (non-bacteriostatic) into alteplase vial, directing the stream
3 into the powder. If slight foaming occurs, let the vial stand undisturbed to allow large bubbles to dissipate.
4 c. Swirl vial gently until contents are completely dissolved. DO NOT SHAKE.

2 4. Instilling the solution:
a. Inspect solution for foreign matter and discoloration
1 b. Withdraw 2 ml (2 mg) of reconstituted solution from vial into a 5 cc luer lock syringe.
2 c. Instill alteplase dose (2 mg) slowly into catheter.
3 d. Allow the alteplase to dwell at least 30 minutes prior to aspirating.
4 e. If unable to aspirate, allow alteplase to dwell an additional 90 minutes (120 minutes total) before re-attempting aspiration.
5 f. Label catheter "Do not use" until alteplase is removed.
6 g. If catheter clears, aspirate 4 to 5 mls of blood then flush catheter per standard policy (see policy 006-002).

3 5. If patency is not restored, the alteplase dose may be repeated once.

6. If a repeat dose is necessary, allow at least a 1-2 hour dwell time (up to overnight, if circumstance permits) prior to attempting aspiration. If the catheter has not cleared, notify physician for additional orders.

Catheter	Inner Volume	Dose of Alteplase
Dialysis Catheter	1.9-2.3 ml	2 mg in 2 ml
PermaCath	1.9-2.3 ml	2 mg in 2 ml
Central Line (Single thru Quad)	0.35-0.5 ml	2 mg in 2 ml
PICC	0.4 ml	
Port-A-Cath (+ access device)	1.4 ml	
Hickman Catheter	1.3 ml	
Pherese-Flo Catheter Red line Blue line White line	 1.7 ml 1.5 ml 0.9 ml	2 mg in 2 ml
Arrow Pheresis Catheter Blue line (12 G) Red line (12 G) Blue line (16 G)	 1.3 ml 1.2 ml 0.35 ml	2 mg in 2 ml

Initiated per order of Dr._____ / _____RN

Antibiotic Lock Therapy Protocol for Intraluminal Catheter Infections

Methodist Healthcare - Memphis Hospitals

RESTRICTION: This protocol is restricted to infectious disease physicians and nephrologists.

PHYSICIAN:

1 Physicians may order the protocol by writing "_____ per lock therapy protocol"

2 Physicians must specify the antibiotic needed (list below), if heparin is needed (see list below), and the number of lines/lumens the lock is to placed in. Physicians should consult with nursing as to the administration of other medications through the line being treated.

3 Antibiotics available for protocol use are:

Antibiotic	Concentrations	Compatible with 100 units/ml heparin
Amikacin	2 mg/ml	No, immediate precipitation
Ampicillin	2 mg/ml	Yes
Cefazolin	5 mg/ml	Yes
Ciprofloxacin	2 mg/ml	No, immediate precipitation
Gentamicin	2 mg/ml	No, immediate precipitation
Levofloxacin	2 mg/ml	No, immediate precipitation
Vancomycin	2 mg/ml	No, immediate precipitation*

*Conflicting data available - may use if prescriber insists.

1 All antibiotics will be placed in normal saline; 5 mls of solution will be dispensed per treatment per lumen.

2 Lock therapy will run for 14 days, unless other orders are received by physician.

3 Other antibiotics may be used as literature and stability data permit, upon consult with clinical specialist on call.

PHARMACIST:

1 Consult with nurse to determine number of syringes needed for administration. For example, if line is to be used for bolus medications, one syringe will be needed to use after each administration of bolus medication (q8 = three syringes). If line is not to be used for medication administration, one syringe daily should be prepared.

2 Enter orders for appropriate antibiotic lock solution, utilizing concentrations above and normal saline as diluent. Place 14 days stop in computer (unless other orders have been specified by prescriber).

3 If heparin is requested, review compatibilities chart above. NOTE: heparin is incompatible with most of the antibiotics used. Call prescriber to resolve difficulties.

4 IV room will prepare solutions utilizing dilutions of standard antibiotic

concentrations. This syringe will be labeled with the following information:

Antibiotic Name/Antibiotic concentration Antibiotic Lock Protocol stock solution Expires: 14 days Date of preparation

***Example*:** a protocol written for vancomycin antibiotic lock, final volume to be 5 mL.
The standard vial concentration of vancomycin is 100 mg/mL. However, the concentration used
for the dose of vancomycin in this protocol is 10 mg/ml. To prepare this concentration, the
following steps should be completed:

Dilute 1000 mg vial (1 gram) with 10 ml SWFI to give 100 mg/ml (solution A)
Take 1ml of solution A and dilute with 9 ml of SWFI or normal saline to yield 10 mg/ml stock
(solution B)

NURSE:

1 Place completed copy of protocol in orders section of the medical record.
2 Instill medication in lumen of affected catheter, as ordered by physician.
□1 3. Medication administration in lines receiving antibiotic therapy - it is vital that lines undergoing antibiotic lock treatment receive the maximum dwell time with the therapy. If the physician requires that other medication be infused through the lumen being treated, the following procedure should be used.
1 Prior to administration of bolus medication, withdraw the antibiotic lock solution.
2 Flush lumen with normal saline.
3 Administer the ordered medication.
4 Flush lumen with normal saline.
5 Instill new antibiotic lock solution.

If continuous medications are infused through one or more lumens of a multi-lumen catheter undergoing antibiotic luck therapy, lumens will be alternated with antibiotic lock solution and continuous medications every 12 hours.

4. If no medications are needed to be infused through the lumen being treated, instill new antibiotic solution every 24 hours.

Intravenous Anti-Hypertensive Protocol

Not recommended for Acute Ischemic Stroke patients

For University Hospital Only <u>PHYSICIAN: Check one intravenous antihypertensive medication</u>

[ ] Diltiazem drip: 5 mg/hr. Titrate by 2.5 to 5 mg/hr as often as every 15 minutes to desired effect specified by MD or goal MAP range is achieved. Maximum dose is 15 mg/hr.

[ ] NitroGLYcerin drip: 5 mcg/min. Titrate by 5 mcg/min as often as every 3 – 5 minutes to desired effect specified by MD or goal MAP range is achieved. Maximum dose is 200 mcg/min.
Note: Nitroglycerin may be the preferred drug patients with acute coronary syndromes or CHF.

[ ] NitroPRUsside drip: 0.5 mcg/kg/min. Titrate by 0.5 mcg/kg/min as often as every 3 –5 minutes to desired effect specified by MD or goal MAP range is achieved. Maximum dose is 10 mcg/kg/min.
Note: Nitroprusside is typically the drug of choice except in patients with renal failure or neurosurgical patients.

[ ] NiCARdipine drip: 5 mg/hr. Titrate by 2.5 mg/hr as often as every 15 minutes to desired effect specified by MD or goal MAP range is achieved. Maximum dose is 15 mg/hr.
Note: Nicardipine may be the preferred agent in neurosurgical patients

<u>NURSE: Baseline characteristics</u>

Blood Pressure: _____
Mean Arterial Pressure: _____

Heart Rate: _____
Serum Creatinine: _____

<u>Goal within 2 hours</u> Reduce MAP by **NO MORE THAN 25%** within the first 2 hours of infusion initiation.

Calculation:
_____(Baseline MAP) x 0.75 = _____ (25% reduction)
**** reduce BP gradually without exceeding goal range****

<u>Goal between 2 and 6 hours</u> Continue infusion to achieve a **6 hour BP range of 150 –170 / 90 – 100**

<u>AFTER ADMISSION TO ICU</u> After 6 hour goal is achieved and transfer to ICU, begin the following scheduled and PRN medications in order to maintain BP: **140-160 / 90-100 mmHg**

<u>Oral medications to initiate after 6 hour goal is met</u>:
<u>Scheduled medications PRN medications for systolic BP > 160 mmHg</u>

[ ] _____

[] Labetalol 10 – 20 mg IV q 30 min PRN []
_____

[] Clonidine 0.1 mg PO q 1 hr PRN []
_____

[] Hydralazine 10 – 20 mg IV q 4 hrs PRN []
_____

[] Enalaprilat 0.625 – 1.25 mg IV q 6 hrs PRN

[] Other: _____

6 – 12 hours after oral medications started, begin to wean continuous infusion while utilizing PRN's.

<u>PHARMACIST</u>: Evaluate patient for oral therapy if intravenous regimen exceeds 48hrs.

Physician Signature:

_____

Radiocontrast Nephropathy Prophylaxis Protocol/Orders

Risk factors: Diabetes, Heart Failure, Age > 75, SCr > 1.5 or Estimated GFR < 60 ml/min

Patient weight: _____ kg

_____Standard Regimen

Sodium Bicarbonate—150 mEq/150 mL in 850 ml of D5W (Total volume: 1 liter)

Pre-contrast: Start infusion at 3 ml/kg/hr for 1 hour prior to procedure
Post-contrast: Continue infusion at 1 ml/kg/hr for 6 hours

AND

___Acetylcysteine (Mucomyst) 600 mg/ 3 ml solution po BID x 4 doses or _____ doses

___Acetylcysteine (Mucomyst) 1200 mg/ 3 ml solution po BID x 4 doses or _____ doses

Other regimen:_____

_____Emergent Procedure Regimen

Reserved for patients presenting with ST segment elevation MI or a condition requiring a procedure to performed in less than 1 hour.

Acetylcysteine (Acetadote) 1200 mg IV x 1given prior to the procedure, then Acetylcysteine (Mucomyst) 1200 mg PO BID x 4 doses

AND

Normal Saline 0.9% 1000 ml to infuse at a rate of 1 ml/kg/hr x 12 hours post procedure.

_____ M.D.

Post CV Surgery Diltiazem Atrial Fibrillation Protocol

**Do NOT use in heart failure patients*

RESTRICTION NOT for use in heart failure patients For use only with the CABG PostOp Caretrack

Guidelines:
Intended for patients who, within 72 hours of open-heart surgery, experience

1 – Sudden onset of atrial fibrillation (confirmed by 12-lead ECG) AND
2 – Accompanied by either ventricular response >120 beats per minute (bpm) lasting greater than 30 minutes **OR** symptoms such as lightheadedness, chest pain, dyspnea, dizziness or hypotension.

PHARMACIST 1. Input diltiazem bolus and drip with 72 hour automatic stop but do not send unless nurse requests.
2. Place in NOTE field: "call Rx for dose if patient develops afib (per protocol)."

NURSING 1. Monitor patient for atrial fibrillation signs and symptoms.
1 Initiate protocol per guidelines (above), and place completed copy of protocol in orders section of the medical record.
2 Call pharmacy for diltiazem drip when needed.

DO NOT USE IN HEART FAILURE PATIENTS

Give Diltiazem 0.25 mg/kg IV over 2 minutes (maximum dose = 20 mg).

After 15 minutes:

1 If HR < 120 bpm, start Diltiazem infusion at 10 mg/hour.
□1 2. If HR > 120 bpm and SBP > 100 mmHg, rebolus with Diltiazem 0.35 mg/kg IV (maximum dose = 25 mg). Then, after 15 minutes,
□2 a. Start Diltiazem infusion at 10 mg/hour.
□3 b. If HR > 120 bpm and SBP > 100 mmHg, may increase diltiazem infusion in 5 mg increments, up to 20 mg/hour
2 **If HR < 120 bpm for at least 2 hours, start Diltiazem 60 mg po q6h and discontinue infusion 2 hours after first oral dose.**
□1 4. If HR > 120 bpm after 4 hours, call the Cardiologist.
□2 Call cardiologist if still symptomatic and/or:
SBP < 100 mmHg,
ventricular response > 120 bpm at maximum dose,
diltiazem not tolerated,
chest pain

3 Discontinue Diltiazem infusion when patient converts to sinus rhythm OR if patient has adverse effects from Diltiazem (e.g., AV block, bradycardia, hypotension, decreased cardiac output).
4 Notify Cardiologist during rounds in AM after initiation of protocol.
5 Patient is to remain on Cardiac Surgery Pathway and participate in all activities, including cardiac rehabilitation, if not symptomatic.

Colchicine Guidelines

These guidelines apply for when colchicine is used for acute gout attacks.

PHARMACIST: Complete steps before dispensing doses≥0.6 mg TID

I. Contraindications (If present, call MD and do not dispense)

Diagnosis of ESRD and Liver Failure Combined
Neutropenia (WBC<3500/mm^3)

II. Precautions

Age > 65 years
Renal dysfunction (est. CrCl < 50 ml/min)

III. Cumulative Dose Limits- IV Colchicine:

When determining the patient's cumulative dose, you must add together all doses used to treat the acute attack, and not just what the patient had in the last 24 hours. When IV and PO doses of colchicine are given for an acute attack, you must add these doses together in order to determine the total cumulative dose.

If no precautions, the maximum cumulative dose is 4 mg.
If one or more precautions present, the maximum cumulative dose is 2 mg.

Once a cumulative dose limit is reached in a patient that has received IV colchicine, no further colchicine (even for prophylaxis) may be given for at least one week in those patients without precautions, or 3 weeks in patients with precautions.

Daily Dose Limits- PO Colchicine:

If no precautions, the maximum daily dose is 8 mg.
If one or more precautions present, the maximum daily dose is 4 mg.

*When an order for PRN colchicine is entered into Cerner do not send any doses until the drug is requested by nursing staff. When doses are requested you must check the history to ensure that the maximum cumulative dose has not been exceeded. Always check to see if patient has received any doses of IV colchicine.

MANAGEMENT OF HYPOMAGNESEMIA

CAUSES: Dietary deficiency/malnutrition, intestinal loss (diarrhea, laxative use), alcoholism, drug-induced renal losses (amphotericin B, cisplatin, diuretics, aminoglycosides)

SIGNS/SYMPTOMS:

Muscle weakness, vertigo, ataxia, seizures, anxiety, psychosis, confusion, paresthesias, cardiac arrhythmias

GUIDELINES FOR REPLACEMENT*

Serum Magnesium Concentration	IV Supplementation	Oral Supplementation
Severe Hypomagnesemia (Mg < 1mEq/L)		
Symptomatic	If life threatening cardiac arryhythmia, 2gm Mg sulfate may be pushed over 1 min in 10 ml of NS. If no emergency, give 4 gm IVPB over 2-4 hours. (Repeat x 1 if still symptomatic). Repeat serum Mg level in 8 hours, add 2-4 gm Mg sulfate to IVF daily, and monitor Mg level daily until stable.	Not Recommended
Asymptomatic	4 gm Mg sulfate IVPB over 2-4 hours. Repeat Mg level in 8 hours.	Not recommended

Mod. Hypomagnesemia (Mg 1-1.4 mEq/L) Symptomatic	Give 2-4 gm Mg sulfate IVPB over 2-4 hours and repeat if still symptomatic. Add 2-4 gm to IVF daily.	Not recommended
Asymptomatic	2-4 gm Mg sulfate IVPB over 2-4 hours	Mg Oxide 400 mg BID-TID
Mild Hypomagnesemia (Mg 1.5-1.8 mEq/L)	Give 2 g Mg sulfate IVPB over 2 hours	Mg Oxide 400 mg daily-BID

*In patients with normal renal function. If renal insufficiency is present, magnesium should be administered at ½ recommended dose to avoid magnesium toxicity.

TREATMENT:

IV replacement is recommended for the acute replacement of magnesium deficiency. Oral replacement is used primarily for maintenance therapy due to the poor PO absorption of magnesium and the likelihood of inducing diarrhea with excessive oral magnesium. Up to 50% or more of a dose of IV magnesium will be excreted in the urine, making repeat dosing and serum concentration monitoring necessary.

MONITOR:

Serum concentrations q8-12h during initial tx phase if severe, then q24h following stabilization (Mg>1.4 mEq/L). Full stabilization should occur within 7 days.

DISCONTINUE TX:

Discontinue therapy if patient develops hypotension (SBP < 80 mmHg), bradycardia (<60 bpm), hypermagnesemia, or absence of deep tendon reflexes.

MANAGEMENT OF HYPOPHOSPHATEMIA

CAUSES: Refeeding syndrome, intracellular shifts (glucose administration, insulin therapy, corticosteroid therapy), phosphorous deficiency (chronic alcoholism, vitamin D deficiency), decreased absorption (antacids, sucralfate), increased excretion (diuretics, hyperparathyroidism)

SIGNS/SYMPTOMS:

Cardiac dysrhythmias, respiratory failure, muscle weakness, numbness, tingling, confusion, lethargy, seizures, immune dysfunction, osteomalacia (chronic deficiency)

GUIDELINES FOR REPLACEMENT*

Serum Phosphorous Concentration	IV Supplementation (NaPhos or Kphos)	Oral Supplementation
PO_4 < 1.0 mg/dL	0.64 mmol/kg Phos over 6-8 hours	Not recommended
PO_4 1.0-2.4 mg/dL	0.32 mmol/kg Phos over 4-6 hours	2 packets Neutra Phos K or Neutra Phos BID (if no IV access)
PO_4 2.5-3.0 mg/dL	0.16 mmol/kg Phos over 2-4 hours	1 packet (Neutra Phos K or Neutra Phos) BID

* In patients with normal renal function. If renal insufficiency is present, ½ recommended replacement dose should be given.
** Round PO_4 doses to the nearest increment of 3. Typical doses are 15, 21, 30, or 45 mmol. **
** Each 15mmol PO_4 should be infused over 2 hours.**

PHOSPHOROUS PRODUCTS:

IV: Na Phosphate (3 mmol PO_4 and 4 mEq Na per ml)
K Phosphate (3 mmol PO_4 and 4.4 mEq K per ml)

Oral: Neutra Phos (8 mmol PO_4, 7 mEq Na, and 7 mEq K)
Neutra Phos K (8 mmol PO_4 and 14 mEq K)

MONITOR:

Serum phosphorous and calcium concentrations q12-24 hours during initial therapy, then every 1-3 days following stabilization. Concentrations may increase rapidly with IV replacement; thus, serum phosphorus levels should be measured prior to additional dosing.

DISCONTINUE TX:

Discontinue therapy if the patient develops hypocalcemia and/or hyperphosphatemia. Monitor Ca x Phos product. (If $[Ca^{++}]$ x [Phos] >70, the patient is at increased risk for metastatic calcification and organ damage.) Phosphorus should be replaced more cautiously if concomitant hypercalcemia is present.

MANAGEMENT OF HYPOKALEMIA

CAUSES: GI losses (nasogastric suction, vomiting, diarrhea, laxative use), renal losses (Mg depletion, diuretics, levodopa, steroids, amphotericin), intracellular shift (albuterol, insulin, metabolic alkalosis)

SIGNS/SYMPTOMS:

Cardiac dysrhythmias, muscle weakness/cramps, paralysis, respiratory distress, ileus, urinary retention, constipation

TREATMENT:

Infusion rates should not exceed 10 mEq/hr without concurrent ECG monitoring (A higher rate of 20 mEq/hr may be used with monitoring. In emergency situations only, a 40 mEq/hr rate can be used with continuous ECG monitoring).

Hypomagnesemia should also be corrected during potassium replacement.

GUIDELINES FOR REPLACEMENT*

Serum Potassium Concentration	IV Supplementation	**Oral Supplementation[1]**
K^+ < 3.0 mEq/L	40 mEq IV KCl X 2; repeat K^+ level 2-4 hours after the last infusion	N/A
K^+ 3.0-3.2 mEq/L	30 mEq IV KCl X 2	40 mEq x 2
K^+ 3.2-3.5 mEq/L	40 mEq IV KCl X 1	20-40 mEq x 2

*In patients with normal renal function. If renal insufficiency is present, more cautious replacement with ½ of the recommended doses should be given.

[1]Oral supplementation can replace IV supplementation if patient is asymptomatic and can take PO. If there is ongoing K+ losses (diuretic therapy, NG suction, etc), patients may require maintenance oral or IV supplementation after they are adequately replaced.

MONITOR: Serum K^+ concentrations q6-12h during early phases of tx if initial K+ <3.0 meq/L, and then q12-24h following stabilization (> 3.5 mEq/L). Stabilization should occur in 24-48 hours. In patients with serum K^+ <2.5 mEq/L, amount K^+ given should not be > 80 mEq without repeated measurements of serum K^+ concentrations.

Guidelines for Initiating Peripheral and Total Parenteral Nutrition

Parenteral nutrition (PN) is indicated for patients with nonfunctional GI tracts or those unable to ingest adequate calories orally or enterally. PN should be considered after 3-5 if adequate calories cannot be provided via the enteral route.

Initial orders for central parenteral nutrition (TPN) must be written on the approved preprinted order form. The Nutrition Support Team is automatically consulted on all new TPN patients. TPN orders must be written by 1600 daily, and all TPNs are hung at 2100 daily.

Recommended Monitoring:

- CMP, Mg, & PO_4 day #1; BMP, Mg, & PO_4 days #2-4; then CMP/BMP, Mg, & PO_4 at least twice weekly thereafter
- Blood glucose monitoring with sliding scale regular insulin Q6H. More frequent monitoring may be necessary for diabetics, critically ill patients, and patients on steroids.
- Baseline and weekly serum triglycerides (hold lipids for levels >300)
- Baseline nitrogen balance (24 hr UUN) except in acute and chronic renal failure (ARF/CRF)
- Initial and weekly prealbumin levels
- Daily weights
- Daily input and output (I/O)
- Relevant clinical information affecting nutrition support, such as medication changes (steroids, insulin, diuretics, propofol, oral electrolyte supplements, etc), fluid status (IV fluids, NG output, vomiting, diarrhea, etc), other nutrition sources (initiation of tube feeding or oral diet), decreased or increased acuity of illness, wound healing issues, clinical course (surgery, radiology findings, temperature curve)

Calorie Requirements:

- Most patients require 25-35 total kcal/kg/day depending on acuity of illness and baseline nutritional status.
- Calories should be based on the patient's ideal body weight (IBW) if actual weight is 100-130% of IBW. If actual weight is >130% then an adjusted weight should be used. If actual weight is <100% IBW, then actual weight should be used.

Males: IBW(kg) = 50 + (2.3 x inches >5 ft)
Females: IBW(kg) = 45.5 + (2.3 x inches >5 ft)
Adjusted wt (kg) = (ABW-IBW)0.4 + IBW

- Dextrose provision should not exceed 25 kcal/kg/day.
- Lipids should provide ~30% (max 50%) of a patient's non-protein calories (NPC). Total lipid/day should be limited to <1g/kg/day in most patients.
- Calculation of calories:
  Dextrose: 3.4 kcal/gram
  Protein: 4 kcal/gram
  Lipid: 20% = 2 kcal/mL (20% lipid emulsion 250ml=500 kcal)

Protein Requirements

Protein requirements for most patients are 1-1.5 gm/kg/day. Severely ill/stressed patients may require up to 2 gm/kg/day. Patients with acute renal failure or end-stage hepatic disease require protein restriction (0.6-1 gm/kg/day). Patients with chronic renal insufficiency may tolerate 1-1.2 gm/kg/day, and patients receiving hemodialysis may tolerate 1.2-1.4 gm/kg/day. Monitor BUN and serum creatinine to assess for protein tolerance.

Lipid Requirements

Intralipid should be given to most patients receiving PN if tolerated. Lipids may be administered twice weekly, every other day, or daily. Lipids may be given in the TPN (3-in-1) or as a separate piggyback. Lipids should be held for triglyceride levels >300. Patients receiving propofol infusions (formulated as 10% lipid emulsion) should not receive IV lipids, and patients who are tolerating some po intake may not require IV lipids to meet their nutrition support goals. In order to avoid essential fatty acid deficiency (EFA), the length of time without <u>any</u> nutritional source of lipids (PO or IV) should not exceed 3-4 weeks. 20% Intralipid 250 ml (50g) given twice weekly is sufficient to prevent EFA. If lipids are given as a separate piggyback (not added to the TPN bag), each bag should be infused over 12 hours.

General TPN Guidelines

The hospital preprinted TPN order form includes a standard adult TPN formula. This formula is <u>not</u> acceptable for all patients, especially patients with renal insufficiency; therefore, the formula should be modified as necessary.

<u>Standard Adult TPN Formula</u>

Dextrose	20%	Magnesium	8 mEq/L
Amino Acids	4.25%	CaGluc	4.7 mEq/L
NaCl	40 mEq/L	MVI	1 vial/day
NaAcetate	20 mEq/L	Trace elements	3 ml/day
KCl	20 mEq/L		
KPO_4	22 mEq/L		

- Central venous access should be confirmed and documented on the TPN order form. TPN solutions should be initiated at rates of 40-50 mL/hr and advanced

toward goal rate daily in increments of 20-30 ml/hr as tolerated. Alternatively, TPN may be initiated at goal rate, but with a decreased dextrose final concentration (10-12%). In this case, the dextrose final concentration should be advanced daily by 4-5% per day as tolerated. (Protein concentration can be started at goal.)

- Diabetic and glucose intolerant patients (pancreatitis, steroid therapy, postop hyperglycemia) should be started at a lower infusion rate (or lower dextrose concentration) to assess tolerance and avoid adverse events.
- An acceptable blood glucose (BG) while on TPN is 100-150 mg/dL. TPN rate or dextrose should not be increased in patients with blood glucose monitoring consistently above 200 mg/dL.
- Insulin may be added to the TPN solution to help manage hyperglycemia. Orders for insulin must be written in units/L. The typical starting dose of insulin is 10-20 units/L with adjustment as needed based on blood glucose levels.
- Patients at risk for volume overload (i.e. ARF/CRF, congestive heart failure) may require more concentrated TPN formulas to deliver their required calories in a smaller fluid volume. TPN infusion rate should be discussed with the responsible physician if questions regarding fluid restriction arise.
- Malnourished patients at risk for Refeeding Syndrome require greater than standard amounts of potassium, phosphorus, and magnesium in the initial TPN formulas. TPN should be initiated at a low rate or a low final concentration of dextrose (10%), and electrolytes must be monitored closely and replaced as indicated. TPN rate or formula should not be advanced until electrolytes are within normal limits.
- Patients with ARF/CRF generally need 0-50% of the standard potassium, phosphorus, and magnesium in TPN. The standard electrolyte orders are not appropriate in these patients. Electrolyte levels should be monitored closely.
- Patients with ARF/CRF, congestive heart failure (CHF), and hepatic disease with ascites are often volume overloaded and have increased total body Na (**even though serum Na may be low or normal**). Patients with these disease states should start with 0-50% of standard Na in their TPN, as Na may exacerbate their condition. Monitor serum Na and daily I/Os closely. *Note: 1/4NS ~40meq Na/L; 1/2NS ~80meq Na/L; NS ~160 meq Na/L.* **Total** Na (all salts) in TPN should not exceed 160 meq/L. Low Na levels should respond to changes in Na content or total volume of IV fluids and/or TPN and should not be "bolused" as they are usually a reflection of positive fluid balance and not a true Na deficiency. Fluid status should be evaluated carefully and discussed with physician if needed.
- Electrolytes should be ordered as mEq/L.

Standard electrolyte intakes assuming no organ dysfunction:

Electrolyte	Standard Intake (Daily)
Calcium	10-15 mEq/day
Magnesium	8-20 mEq/day
Phosphate	20-40 mmol/day
Sodium	1-2 mEq/kg/day + sodium losses
Potassium	1-2 mEq/kg/day
Acetate	As needed to maintain acid-base balance
Chloride	As needed to maintain acid-base balance

PPN Guidelines

The hospital supplies a premixed PPN formula (Clinimix) which can be utilized for short-term nutritional support (5-7 days). PPN is <u>not</u> recommended when central vein access is feasible because PPN may not provide adequate calories and is associated with thrombo-phlebitis and volume overload. (Large volumes of fluid are needed to provide calories at a low osmolarity.)

	<u>Clinimix Composition</u>*		
Dextrose	10%	Ca	4.5 mEq/L
Amino Acids	4.25%	Acetate	70 mEq/L
Na	35 mEq/L	Cl	39 mEq/L
K	30 mEq/L	PO_4	15 mMol/L
Mg	5 mEq/L		
(Total calories = 510 kcals/L)			

*Clinimix also availabe WITHOUT electrolytes

Alternative PPN formulas may be written if the standard Clinimix formula is inappropriate and TPN is not feasible. Total osmolarity of PPN should not exceed 1000mosm/L.

- All orders for PPN (except premixed formulas) must be initially written on a preprinted PPN/TPN order form. Maximum dextrose concentration for PPN is D10%.
- Due to lack of stability data and osmolarity issues, addition of ingredients to premixed solutions is strongly discouraged. If additional additives are desired, an individualized PPN/TPN formula should be written.
- Patients receiving PPN as sole source of nutrition should also receive lipids (i.e. 20% Intralipid –250 ml daily or 2-3 times per week) to provide additional calories and prevent essential fatty acid deficiency.

1. Standard for specialized nutrition support: adult hospitalized patients. *Nutrition in Clinical Practice* 17:384-391, 2002.

2. Guidelines for the use of parenteral and enteral nutrition in adult and pediatric patients. *JPEN* 26:1 supplement, 2001.

Automatic IV to PO Conversion Criteria

Antibiotics

Background:
Studies have shown that switching a patient from IV to oral therapy can decrease the length of stay in the hospital, and it may also improve patient outcomes. This conversion is conducted primarily by clinical or other well-trained pharmacists.

Criteria for Patient Eligibility[2]:

1) Patient is receiving intravenous therapy with one or more of the following antibiotics:
   - azithromycin
   - ciprofloxacin
   - clindamycin
   - fluconazole
   - gatifloxacin
   - levofloxacin
   - linezolid
   - metronidazole
   - ofloxacin
   - voriconazole
   - trimethoprim-sulfamethoxazole (exception: AIDS patient)

2) Patient shows improvement in signs and symptoms of infection, which were present when therapy was started, including improvement in cough and dyspnea.
3) Patient is afebrile (<100^{o} F) on two occasions 8 hours apart.
4) White blood cell count (WBC) is <15,000/mm^{3} and decreasing.
5) Patient has a functioning GI tract, as indicated by one of the following:
   - Receiving scheduled medications prescribed orally
   - In the absence of routine oral meds, tolerating an advancing diet X > 24h
6) If the overall clinical response is otherwise favorable, it may not be necessary to wait until the patient is afebrile before making the switch to oral therapy.

Exclusions:
Pharmacy will not independently initiate an IV-to-PO change on any patient with the following characteristics:

1) AIDS
2) Neutropenia (ANC < 1,500)
3) Organ transplant patient
4) Malabsorption syndrome.

Procedure:
If IV therapy has been continued for at least 2 days as defined above, a checklist will be completed. If all criteria are met, an order will be written in the chart for conversion to oral therapy; the conversions are listed below:

IV Antibiotic Dose		**Equivalent PO Dose**	
Azithromycin	500mg q24h	azithromycin	250mg q24h
Ciprofloxacin	200mg q12h	ciprofloxacin	250mg q12h
Clindamycin	900mg q8h	clindamycin	450mg q6h
	600mg q8h		300mg q6h
Fluconazole any dose		equivalent dose & interval	
Gatifloxacin any dose		equivalent dose & interval	
Levofloxacin any dose		equivalent dose & interval	
Linezolid any dose		equivalent dose & interval	
Metronidazole any dose		equivalent dose & interval	
Ofloxacin any dose		equivalent dose & interval	
TMP/SMX any dose		equivalent dose & interval	
Voriconazole 4 mg/kg q12h		voriconazole 200mg q12h (>40kg)	

Checklists will be retained for each patient; pharmacy will review the patient's status at least 48 hours **after** the conversion, and note the status as indicated on the checklist.

References:

1. Vfend package insert. New York, NY: Pfizer Inc.; 2002 May.
2. American Thoracic Society Guidelines for the Management of Adults with Community-acquired Pneumonia: Diagnosis, Assessment of Severity, Antimicrobial Therapy, and Prevention. Am J Respir Crit Care Med. 2001;163:1730-1754.

Histamine H2 Antagonists

Pharmacists may convert IV famotidine to oral famotidine if the following criteria are met:

1. Patient is receiving at least one routinely-administered oral medication.
2. Patient is receiving and tolerating any form of oral feedings.

Review of "Factors": Bebulin®, Benefix®, Mononine®, NovoSeven®

What you should know

Each of these products is different! They cannot be interchanged. Some situations to think about:

You receive an order for Factor IX 2000 units IV STAT. Which product should you use? First, check to see which products we have in stock then call the physician to determine which product he/she wants. Write an order clarification in the chart or have the physician write it.

You receive an order for Bebulin 500 units IV STAT. When you check the refrigerator you notice we are out of Bebulin. Should you substitute Benefix or Mononine? No! Call the physician and let him/her know that we are out of Bebulin and ask which product he/she would like to use.

Note below that really only 2 products have been studied for life-threatening bleeding due to warfarin: Bebulin VH® and NovoSeven®.

Bebulin VH® (Factor IX Complex, Vapor Heated)

Obtained from human plasma, this product is a concentrate of the vitamin Kdependent clotting factors, II, VII (low levels), IX, and X. It may also be referred to as Prothrombin Complex Concentrate (PCC). It is dosed in international units of factor IX. Note that vials may contain varying amounts of factor IX, and the number of units per vial will be indicated on the box and/or vial. This product is indicated for use of hemorrhage in hemophilia B patients but has become popular for off-label use of reversal of warfarin in life-threatening bleeding. It should be combined with FFP and vitamin K in the treatment of warfarin toxicity due to its short duration of action.

Benefix® (Coagulation Factor IX, Recombinant)

This product is a recombinant form of factor IX and is not obtained from human plasma. It is dosed in international units of factor IX, and each vial usually contains 250, 500, or 1000 international units. It is indicated for the treatment and prevention of hemorrhage in patients with hemophilia B. It has not been studied for the off-label use of warfarin reversal.

Mononine® (Coagulation Factor IX, Human)

This product is a concentrate of factor IX from human plasma and is indicated for the prevention and control of bleeding in hemophilia B. It contains nondetectable levels of factors II, VII, and X, and therefore, should not be used for the treatment of warfarin toxicity. It is dosed in international units of factor IX, and when reconstituted correctly, each mL contains 100 international units.

NovoSeven® (Coagulation Factor VIIa, Recombinant)

This product is the recombinant form of activated factor VII and is indicated for the treatment and prevention of bleeding in Hemophilia A or B patients with

inhibitors to factors VIII or IX and also in patients with congenital deficiencies of factor VII. It has been studied for hemorrhage due to warfarin toxicity, spontaneous intracerebral hemorrhage and trauma. At MUH, we stock the 4.8 mg vial although it is available as 1.2 mg and 2.4 mg vials. The 4.8 mg vial costs approximately $4000 and expires in 3 hours after reconstitution. When used for warfarin toxicity, it should also be combined with FFP and Vitamin K.

Dofetilide (Tikosyn®)

Overview

Dofetilide is a Class III antiarrhythmic agent that selectively inhibits the potassium current and prolongs the refractory period. It is indicated for conversion of atrial fibrillation/flutter to normal sinus rhythm. Dosing is based on QTc and calculated creatinine clearance. A 12-lead EKG will be performed to calculate QTc after each dose.

Contraindications/Cautions

Contraindicated with:

- Verapamil
- Cimetidine
- Ketoconazole
- Prochlorperazine
- Megestrol
- Trimethoprim (alone or in combination with sulfamethoxazole)

Contraindicated in patients with:

- Congenital or acquired long QT syndromes (baseline QTc>440 msec or 500 msec in
  patients with ventricular conduction abnormalities.
- Severe renal impairment (calculated creatinine clearance <20 ml/min)
- Known hypersensitivity to the drug

Caution in patients:

- Receiving other drugs that may deplete potassium or magnesium, prolong the QT interval, or interact with dofetilide's pharmacokinetics (see Micromedex for an extensive list, or see www.tikosyn.com.
- With severe hepatic failure. The use of dofetilide has not been evaluated in this patient population.

Dosing

Only MDs who have gone through the "certified prescriber" process with Pfizer may initially prescribe dofetilide. It may be continued as a home medication by non-credentialed physicians.

Electrolytes (potassium, magnesium) must be normal prior to initiation and during the administration of dofetilide.

Initial dose:

Calculated Creatinine Clearance	Dofetilide Starting dose
>60 ml/min	Dofetilide 500 mcg po q12h
40 to 60 ml/min	Dofetilide 250 mcg po q12h

20-39 ml/min	Dofetilide 125 mcg po q12h
<20 ml/min	**CONTRAINDICATED**

***Second dose**:* 2 to 3 hours after first dose, QTc is obtained. The physician must review the ECG before the second dose is given. If QTc has increased >15% from baseline or is >500 msec (550 msec in presence of ventricular conduction abnormality), notify physician so that s/he may reduce the dose according to the following table.

If starting dose based on Creatinine clearance is:	Then adjust dose (for QTc prolongation) to:
500 mcg po q12h	250 mcg po q12h
250 mcg po q12h	125 mcg po q12h
125 mcg po q12h	125 mcg po qd starting 24h after 1st dose

***Subsequent dosing**:* 2 to 3 hours after each dose (2nd to 5th doses) QTc is determined to avoid resultant ventricular arrhythmias. No further downward dose titration of dofetilide is recommended unless QTc>500 msec (550 msec in presence of ventricular conduction abnormalities) then DISCONTINUE dofetilide.

Side effects:
Torsade de pointes, Headache (11%), chest pain (10%), and dizziness (8%).

Pharmacy will provide patient education on dofetilide and contact the patient's outpatient Pharmacy to ensure it is stocked.

Antacid of Choice and Laxative of Choice

Antacid of choice and laxative of choice orders are standardized.

Antacid of choice includes:

- Maalox Max- 10 to 15 ml every 6 hour PRN

Laxatives of choice include:

- Milk of Magnesia (MOM)- 30 ml daily PRN

Or

- Bisacodyl tabs (Dulcolax®)- 5-10 mg daily, up to 30 mg daily

If the patient does not respond or does not want the indication medications, the physician should be contacted for specific orders:

- Antacid/laxative of choice orders will appear on the MAR as the indicated drugs
- Antacid/laxative of choice will be designated in the note field in the MAR.

Epoetin Guidelines and Procedures

Interchange

Darbepoetin	**Epoetin**
25 mcg weekly	2000 units TIW
40 mcg weekly	3000 units TIW
60 mcg weekly	5000 units TIW
100 mcg weekly	8000 units TIW
150 mcg weekly	10,000 units TIW
200 mcg weekly	20,000 units TIW

Dosing and Administration Guidelines:

Outpatient area	May use either epoetin or darbepoetin (do not interchange)
Weekly doses or biweekly doses	Should be changed to TIW dosing Examples: 10,000 units once weekly – divide by 3 – 3333 units – round to 3000 units TIW 40,000 units weekly to 10,000 units TIW
Dose cap	25,000 units TIW Any doses greater than that should be *interchanged* to 25,000 units TIW.
One time orders	Interpret as usual – one time orders may be given
Administration	SQ only on the nursing floor – not IV or in the dialysis unit
Doses other than 10,000, 20,000, or 40,000 units	Should be drawn up from the 20,000 unit MDV
Stability of syringe	7 days under refrigeration
Dose changes	None allowed after 72 hours of initial epoetin order
Scheduling	Doses written on Tuesday, Thursday, or Saturday should be put on the Tue, Thur, Sat schedule. Doses written on Sunday, Monday, Wednesday, or Friday should be put on the Mon, Wed, Fri schedule.

P and T Approved Indications:

- End stage renal disease (ESRD) on dialysis
- Chronic kidney disease NOT on dialysis
- Anemia in zidovudine-treated HIV patients
- Cancer patient actively on chemotherapy

- Reduction of allogenic blood transfusion in surgery patient
- Myelodysplastic Syndrome

Contraindications/Warnings against use:

- Indication not P & T approved or unclear
- Patient has uncontrolled hypertension (BP>185/110)
- Hemoglobin greater than 12 g/dL
- ESA used for active bleeding

Lithium Dispensing

All patients will have their plasma lithium concentration checked within 24 hours of admission if they have been taking lithium prior to admission. The pharmacy will not dispense lithium unless a level has been ordered. This policy should reduce the likelihood that patients with unrecognized lithium intoxication will continue to receive lithium after admission.

1. When an order is written to continue lithium from another treatment setting (including home), the pharmacist will review the laboratory orders and/or results to ensure that a lithium level has been ordered prior to dispensing lithium.

2. If a lithium level has not been ordered, the pharmacist will order a lithium level according to the following procedure:

    a. If the last lithium dose was taken greater than 10 hours ago, order the lithium level "stat", so that it is drawn before the next dose is given. (The optimum time for drawing lithium levels is approximately 12 hours from the last dose.)

    b. If the last lithium dose was taken less than 10 hours ago, order the lithium level for the next morning unless one of the following problems is present:

        i. Vomiting
        ii. Diarrhea
        iii. Ataxia
        iv. Slurred speech
        v. Confusion

3. If any one of the signs/symptoms of lithium toxicity above is present, do not dispense lithium and contact the prescriber immediately. The patient may not receive lithium until a stat serum concentration has eliminated the possibility of lithium intoxication.

4. Signs and symptoms of lithium toxicity will be printed on the MAR.

Guidelines for Initiating Warfarin Therapy

Coumadin Dosing Service is available by consult; write an order for Coumadin Dosing per Pharmacy to initiate the service.

1. Initiation and maintenance dosing of warfarin should commence with an average dose of 5 mg daily. This dose usually results in an INR of 2 within 4-5 days.
2. Starting doses of < 5 mg might be appropriate for elderly patients and patients with impaired nutrition, liver disease, or at high risk for bleeding.
3. Loading doses (i.e. > 10 mg) are not recommended.
4. Patients receiving concomitant drugs that effect warfarin metabolism will require closer monitoring. See table below for common drug interactions.
5. Heparin treatment can be discontinued when the INR has been therapeutic for 2 consecutive days (usually requires an overlap of 4-5 days.)
6. Low molecular weight heparin (LMWH) therapy as a bridge to therapeutic INR has been established for DVT/PE treatment.
7. Home LMWH therapy may be evaluated and initiated by paging the Clinical Pharmacy Specialist (533-3381).

Non-Inclusive List of Common Interactions with Warfarin

Drug	**Effect on INR**
Amiodarone	↑↑
Carbamazepine	↓
Ciprofloxacin	↑↑
Fibrates (Gemfibrozil, fenofibrate)	↑
Fluconazole	↑↑
Isoniazid (INH)	↑
Macrolides (Erythromycin, Clarithromycin)	↑
Metronidazole	↑↑
Nafcillin	↓↓
Primidone, Phenobarbital	↓
Propafenone	↑↑
Rifabutin, Rifampin	↓↓
Rosuvastatin	↑
Sulfamethoxazole/Trimethoprim	↑↑
Tetracyclines	↑
Voriconazole	↑

Hansten and Horn's Drug Interactions Analysis and Management, Facts and Comparisons, 2004.Adapted from The Seventh ACCP Conference On Antithrombotic and Thrombolytic Therapy: Evidence-Based Guidelines. 2004; 126(3).

Titrating Medications in the Critical Care Unit

Catalog Number	
Facility Manuals	Alliance, Fayette, Germantown, MECH, North, South, University
Service Categories	ALL
Team Members Performing	RN
Committee(s) / Council(s) Review Responsibility	P&T, Critical Care Committee, CPC
Service Area(s) Review Responsibility	Pharmacy, Critical Care
Population Served	Adult
Inpatient / Outpatient	Inpatient
Approval Date(s)	
Effective Date(s)	11/28/05
Replaces	N/A
Education Requirements	Instruction
Patient Medical Record Requirements	Critical Care Record
Associated Supplies	
Equipment Requirements	

POLICY:
A complete "titrate" order includes the drug name, route, starting dose, how to titrate the medication, and desired goal. If orders for these medications are not complete, then this policy should be utilized.
PURPOSE: To provide a standardized method for titrating or weaning medications in the intensive care unit and to prevent titrating or weaning too quickly.
TEAM MEMBERS PERFORMING
Registered nurses

PROCEDURE / PROCESS:

Medications	Initial Rate	Titration scale (for titrating and weaning purposes)[2]	Maximum rate
Vasopressor Agents			
Dopamine[1]	2.5 mcg/kg/min	2.5 mcg/kg/min as often as every 10 min to desired effect per MD orders	20 mcg/kg/min
Dobutamine[1]	2.5 mcg/kg/min	2.5 mcg/kg/min as often as every 10 min to desired effect per MD orders	20 mcg/kg/min
Norepinephrine	2 mcg/min	2 mcg/min every 5-10 min to desired effect per MD orders	90 mcg/min[3]
Epinephrine	1 mcg/min	1 mcg/min as often as every 5 min to desired effect per MD orders	100 mcg/min[3]

Vasopressin	0.02 units/min	Double dosage as needed every 30 min to desired effect per MD orders	0.1 units/min
Phenylephrine	50 mcg/min	10 mcg/min as often as every 5 min to desired effect per MD orders	360 mcg/min
Antihypertensive Agents			
Nicardipine	5 mg/hr	2.5 mg/hr as often as every 15 min to desired effect per MD orders	15 mg/hr
Nitroprusside	0.5 mcg/kg/min	0.5-1 mcg/kg/min as often as every 3-5 min to desired effect per MD orders	10 mcg/kg/min[3]
Nitroglycerin[1]	5 mcg/min	5 mcg/min every 3-5 min to desired effect per MD orders	200 mcg/min
Esmolol	50 mcg/kg/min	50 mcg/kg/min as often as every 5 min to desired effect per MD orders	300 mcg/kg/min
Labetalol	2 mg/min	1 mg/ min as often as every 10 min to desired effect per MD orders	Unknown (Watch for bradycardia)
Diltiazem[1]	5 mg/hr	2.5-5 mg/hr as often as every 15 min to desired effect per MD orders	15 mg/hr
Sedation Agents			
Lorazepam	0.5 mg/hr	0.5 mg/hr as often as every 15 min to Riker scale per MD	7 mg/hr
Midazolam	1 mg/hr	0.5 mg/hr as often as every 10 min to Riker scale per MD orders	7 mg/hr
Propofol	See Sedation Protocol for dosing guidelines		
Fentanyl	0.5 mcg/kg/hr	0.5 mcg/kg/hr as often as every 10 min to desired effect per MD orders	10 mcg/kg/hr

[1] Can be titrated on stepdown unit

[2] The physician must indicate a desired effect (desired blood pressure, Riker scale, etc.) and must be called for clarification if not.

3 Recommended maximum rate; no real max rate exists in literature.

MEMO
To: All Pharmacists

Re: Deep Sedating Agents for Moderate Sedation

Some time ago, there was debate about whether or not physician should be able to use "deep sedatives" for the purpose of moderate sedation (e.g. propofol for pacemaker insertion).

The medical staff defines deep sedating agents as:

- etomidiate
- ketamine
- methohexital
- propofol
- pentothal

Anesthesiologists, ED physicians, and critical care physicians may use these drugs for deep sedation but must be "credentialed."

Summary of "Consensus" Guidelines

In view of the growing complexity of medical care and the proliferation of trials related to management of patients, many organizations are choosing to invest significant efforts in an evidence-based approach to define guidelines for care. The following is a partial list of publications available which help to define "best approach" to the use of drugs for prevention and/or treatment of various disorders. Other guidelines are developed in greater detail in other sections of this handbook. The National Guideline Clearinghouse (www.guideline.gov) may also be referred to for Internet links to various organizations/publications.

Guideline/Disorder	Organization	Reference
Anemia: Cancer and Treatment Related	National Comprehensive Cancer Network	www.nccn.org
Antithrombotic therapy	American College of Chest Physicians	www.chestnet.org Chest 2004;126(3):s1-696.
Atrial Fibrillation	American College of Physicians	Ann Intern Med 2003;139:1009-17
Dementia	American Academy of Neurology	Neurology 2001;56:1143-66
Lipid Management	National Cholesterol Education Program	JAMA 2001;285(5/16):2486-97
Management of Menopause	Am. Assoc. of Clinical Endocrinology	Endocrine Practice 2006;12:315-77
Unstable Angina	ACC/AHA	www.acc.org
Hypertension	National Heart, Lung, and Blood Institute	www.nhlbi.nih.gov
COPD, Acute Exacerbations	ACP-ASIM/ACCP	Ann Intern Med 2001;134:600-20
Community-acquired Pneumonia	Infectious Diseases Society of America	Clin Infect Dis 2003;37:1405-33
Community-acquired Pneumonia	American Thoracic Society	Am J Respir Crit Care Med 2001;163:1730-54
HIV/AIDS, Antiretroviral Therapy	US Dept. Health & Human Services	www.aidsinfo.nih.gov
HIV/AIDS, Prevention Opp. Infections	CDC/USPHS	www.aidsinfo.nih.gov
Myocardial Infarction	ACC/AHA	www.acc.org
Neutropenic Fever, Cancer Patients	Infectious Diseases Society of America	www.nccn.org
Hematopoietic Colony-Stimulating Factors	American Society of Clinical Oncology	JCO Oct 20 2000;3558-3585
Infectious Diseases	Infectious Diseases Society of America	www.idsociety.org
Intravascular Catheter	Infectious Diseases Society of America	http://www.cdc.gov
Sepsis, Hemodynamic Support	Am College Critical Care Medicine	Crit Care Med 1999;27:639-60

Sinusitis	Sinus/Allergy Health Partnership	Otolaryngol Head Neck Surg 2000;123 (supplement 1)
Surgical Infection Prophylaxis	National Surgical Infection Prevention Project & Centers for Medicare Svcs	Clin Infect Dis 2004;38:1706-15
Tuberculosis	American Thoracic Society	Am J Resp Crit Care Med 2003;167:603-67.
Urinary Tract Infections-Women	Infectious Diseases Society of America	Clin Infect Dis 1999;29:745-58
Urinary Tract Infections - Long-term Care	Society for Healthcare Epidemiology Of America	Infect Cont Hosp Epidemiol 2001; 22(3):167-75l

Hyperlipidemia Therapy (NCEP Guidelines)

Risk Category[1]	LDL Goal	Lifestyle Changes	Drug Therapy
Very high risk**:* ***High risk: **CHD or CHD risk equivalents****	< **70** mg/dL **< 100** mg/dL	**≥ 100** mg/dL	**≥ 100** mg/dL (if <100 mg/dL, drug tx optional)
Moderately high risk: **2 + risk factors** **(10-year risk 10-20%)**	**< 130** mg/dL	**≥ 130** mg/dL	**≥ 130** mg/dL (100-129 mg/dL, consider drug tx)
Moderate risk: **2+ risk factors** **(10-year risk <10%)**	**< 130** mg/dL	**≥ 130** mg/dL	**≥ 160** mg/dL
Lower risk: **0-1 risk factor**	**< 160** mg/dL	**≥ 160** mg/dL	**> 190** mg/dL (160-189 mg/dL-drug tx optional)

*Very high risk factors include: CHD + (1) multiple major risk factor (especially diabetes), (2) severe and poorly controlled risk factors (especially cigarette smoking), (3) multiple risk factors of the metabolic syndrome, (4) patients with acute coronary syndrome (PROVE-IT).
**CHD equivalents include: peripheral artery disease, abdominal aortic aneurysm, symptomatic carotid artery disease, diabetes mellitus, multiple risk factors that confer a 10-year risk for CHD >20%.

Major Risk Factors That Modify LDL Goals[2]

- Current cigarette smoking
- Hypertension
- Low HDL cholesterol (< 40 mg/dL)
- Family history of premature Coronary Heart Disease (CHD)
  (CHD in male first-degree relative < 55 years; CHD in female first-degree relative <65 years)
- Age (Male ≥ 45 years; Female ≥ 55 years)

Negative risk factor (remove one risk factor if present)

- High HDL cholesterol (≥ 60 mg/dL)

[1]Grundy SM, Cleeman JI, et al. Implications of recent clinical trials for the National Cholesterol Education Program Adult Treatment Panel III Guidelines. Circulation 2004;110:227-239.
[2]Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). JAMA 2001;285:2486-2497.

LIPID LOWERING AGENTS

Drug Class	Lipid Effects	Available Agents	Dosing range	Cost
HMG-CoA reductase inhibitors (statins)	LDL ↓18-62% HDL ↑ 5-15% TG ↓ 7-30%	Atorvastatin (Lipitor®)***** Fluvastatin (Lescol®) Lovastatin (Mevacor®)+ Pravastatin (Pravachol®)+***** Rosuvastatin (Crestor®)***** Simvastatin (Zocor®)+*****	10-80mg/day 20-80mg/day 10-80mg/day 10-80mg/day 5-40mg/day 5-80mg/day	$-$$$$$
Aspirin + statin	See above	ASA + pravastatin (Pravigard PAC®)	81/20-325/80mg/day	$$$$$
Bile acid sequestrants	LDL ↓ 15-30% HDL ↑ 3-5% TG ↔ / ↑	Cholestyramine (Questran®)+***** Colestipol (Colestid®)+ Colesevelam (WelChol®)*	4-24 gm/day 5-30 gm/day 3.75-4.375 gm/day	$$$-$$$$$
Nicotinic acid	LDL ↓ 5-25% HDL ↑ 15-35% TG ↓ 20-50%	Immediate/sustained-release niacin+***** Niacin extended-released (Niaspan®)*****	1.5-6 gm/day 1-2 gm/day	$-$$ $$-$$$$
Nicotinic acid + statin	LDL ↓ 30-42% HDL ↑ 20-30% TG ↓ 32-44%	Niacin extended-release + lovastatin (Advicor®)	500/20-2000/40 mg/day	$$$$$
Absorption inhibitor	LDL ↓ 17-18% HDL ↑ 1% TG ↓ 7-9%	Ezetimibe (Zetia®)*	10 mg daily	$$$$$

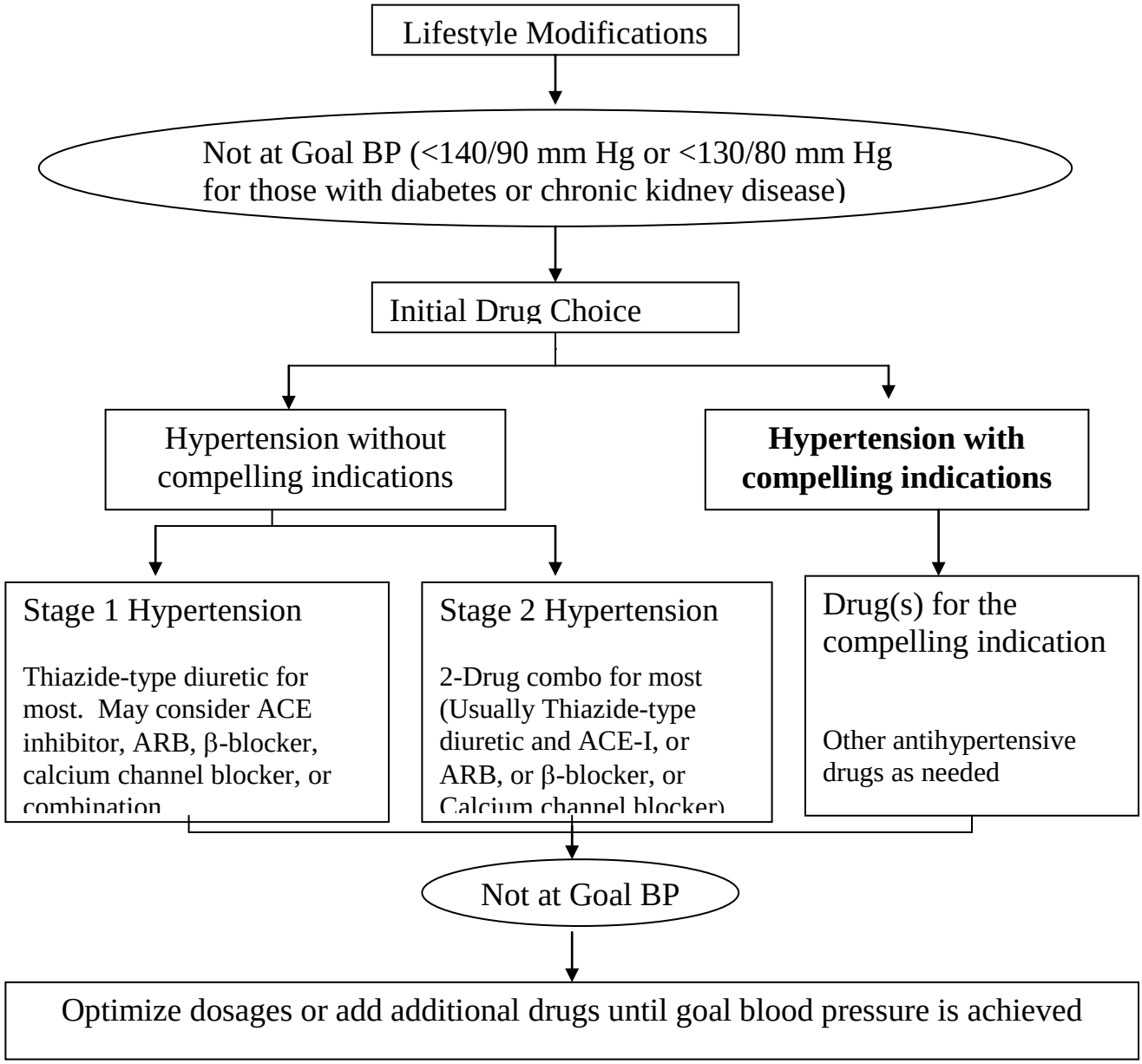
Absorption inhibitor + statin	LDL ↓ 45-60% HDL ↑ 6-10% TG ↓ 23-31%	Ezetimibe + simvastatin (Vytorin®)	10/10-10/80 mg/day	$$$$$
Fibric acids	LDL ↓ 5-20% HDL ↑ 10-20% TG ↓ 20-50%	Fenofibrate (Tricor®)* Fenofibrate micronized (Lofibra®) Gemfibrozil (Lopid®) +*	54-160 mg/day 67-200 mg/day 1200mg/day	$$-$$$$$

+ Generic available *****MH-MH formulary medications

Hypertension Therapy
JNC-VII Recommendations

CATEGORY	SYSTOLIC BP, mm Hg	DIASTOLIC BP, mm Hg
Normal	< 120	< 80
Prehypertension	120-139	80-89
Hypertension, Stage 1	140-159	90-99
Hypertension, Stage 2	≥ 160	≥ 100

Algorithm for Treatment of Hypertension



General Principles of Initiating Therapy:

1. Initiate therapy with the lowest dose possible, slowly titrating upward.

2. Optimal formulation should provide 24 hour efficacy with once daily dosing to enhance compliance, lower cost and allow for a more constant lowering of blood pressure.
3. Most patients with hypertension will require 2 or more antihypertensive medications to achieve their BP goals.
4. When BP is more than 20/10 mm Hg above goal, initiating therapy with 2 drugs should be considered.

Compelling Indications for Individual Drug Classes

Compelling Indication	Initial Therapy Options
Heart Failure	Thiazide diuretic, β blocker, ACE inhibitor, ARB, Aldosterone receptor blocker
Post-myocardial infarction	β blocker, ACE inhibitor, Aldosterone receptor blocker
High risk for coronary disease	Thiazide diuretic, β blocker, ACE inhibitor, Calcium channel blocker
Diabetes	Thiazide diuretic, β blocker, ACE inhibitor, ARB, Calcium channel blocker
Chronic kidney disease	ACE inhibitor, ARB
Recurrent stroke prevention	Thiazide diuretic, ACE inhibitor
Pregnancy	Methyldopa, β blocker, Vasodilator

β BLOCKERS

DRUG	INITIAL DOSE	TARGET DOSE	MAXIMUM DOSE
Atenolol (Tenormin®)†	25-50 mg daily	50-100 mg daily	100 mg daily
Bisoprolol (Zebeta®)†	2.5-5 mg daily	2.5-20 mg daily	40 mg daily
Metoprolol tartrate (Lopressor®)†	50-100 mg bid	100-450 mg in 2-3 divided doses	450 mg/day
Metoprolol succinate (Toprol XL®)	50-100 mg daily	100-400 mg daily	400 mg daily
Pindolol (Visken®)†	5 mg bid	10-30 mg in 2-3 divided doses	60 mg/day
Propranolol (Inderal®, Inderal LA®)†	40 mg bid, 60-80 mg daily	160-480 mg in divided doses,120-160 mg/day	640 mg/day

† Available in generic preparations. *Only formulary products are listed.

ACE INHIBITORS

DRUG	INITIAL DOSE	TARGET DOSE	MAXIMUM DOSE
Benazepril (Lotensin®)†	5-10 mg daily	20-40 mg daily or in divided doses	80 mg/day

Captopril (Capoten®)†	12.5-25 mg bid or tid	50 mg tid	150 mg tid
Enalapril (Vasotec®)†	5 mg daily	10-40 mg daily or in divided doses	40 mg/day
Fosinopril (Monopril®)†	10 mg daily	20-40 mg daily or in divided doses	80 mg/day
Lisinopril (Prinivil®, Zestril®)†	10 mg daily	20-40 mg daily	80 mg daily
Moexipril (Univasc®)	7.5 mg daily	7.5-30 mg daily or in divided doses	30 mg/day
Perindopril (Aceon®)	4 mg daily	4-8 mg daily	16 mg daily
Quinapril (Accupril®)†	10 mg daily	20-80 mg daily or in divided doses	80 mg/day
Ramipril (Altace®)	2.5-5 mg daily	2.5-20 mg daily or in divided doses	20 mg/day
Trandolapril (Mavik®)	1-2 mg daily	2-4 mg daily	8 mg daily

† Available in generic preparations
*All ACE inhibitors are on formulary.

ANGIOTENSIN II RECEPTOR BLOCKERS (ARB)

DRUG	INITIAL DOSE	TARGET DOSE	MAXIMUM DOSE
Losartan (Cozaar®)	25-50 mg daily	25-100 mg daily or in divided doses	100 mg/day
Valsartan (Diovan®)	80-160 mg daily	80-320 mg daily or in divided doses	320 mg/day

*Only formulary ARBs are listed.

DIURETICS

DRUG	INITIAL DOSE	TARGET DOSE	MAXIMUM DOSE
Thiazide Diuretics			
Chlorthalidone †	25 mg daily	25-100 mg daily	100 mg daily
Hydrochlorothiazide †	12.5 mg daily	25-100 mg daily	200 mg daily
Metolazone (Zaroxolyn®)†	1.25-2.5 mg daily	5-10 mg daily	10 mg daily
Loop Diuretics*			
Bumetanide (Bumex®)†	0.5-2 mg 1-2 times/day	Increase as needed	10 mg/day
Furosemide (Lasix®)†	10-40 mg daily	Increase by 20-40 mg as needed	240 mg bid

Torsemide (Demadex®)†	5-10 mg daily	Double the dose as needed	200 mg daily
Aldosterone Receptor Blockers			
Eplerenone (Inspra®)	50 mg daily	50-100 mg daily	100 mg daily
Spironolactone (Aldactone®)†	25 mg daily	25-200 mg daily or in divided doses	200 mg/day

*Furosemide 40 mg=10-20 mg of torsemide=1 mg of bumetanide
† Available in generic preparations
All listed agents are formulary.

CALCIUM CHANNEL BLOCKERS
(Not short acting, immediate release agents)

DRUG	INITIAL DOSE	TARGET DOSE	MAXIMUM DOSE
Nondihydropyridines			
Diltiazem (Cardizem®†, Tiazac®†)	30 mg tid, 180-240 mg daily	240-360 mg in 3-4 doses, 240-360 mg daily	360 mg/day
Verapamil (Calan®, Isoptin®, Verelan®)†	40 mg bid, 120 mg daily	80 mg tid, 120-240 mg daily	360 mg/day
Dihydropyridines			
Amlodipine (Norvasc®)†	2.5-5 mg daily	5-10 mg daily	10 mg daily
Nifedipine (Adalat CC®)†	30 mg daily	30-60 mg daily	120-180 mg daily
Nisoldipine (Sular®)	20 mg daily	20-40 mg daily	60 mg daily

† Available in generic preparations. *Only formulary calcium channel blockers are listed.

α-BLOCKERS
(Not Initial Monotherapy)

DRUG	INITIAL DOSE	TARGET DOSE	MAXIMUM DOSE
Doxazosin (Cardura®)†	1 mg daily	1-16 mg daily	16 mg daily
Terazosin (Hytrin®)†	1 mg qhs	1-5 mg qhs	20 mg qhs

† Available in generic preparations
Only formulary alpha blockers are listed.

CENTRAL α-AGONISTS and Other Centrally Acting Drugs
(Not Initial Monotherapy)

DRUG	INITIAL DOSE	TARGET DOSE	MAXIMUM DOSE
Clonidine (Catapres®†, Catapres TTS®)	0.05-1 mg bid, 0.1 mg patch every week	0.2-1.2 mg bid, 0.1-0.3 mg every week	2.4 mg/day 0.6 mg/week
Methyldopa (Aldomet®)†	250 mg bid-tid	500 mg-2 g in 2-4 divided doses	3 g/day
Guanafacine (Tenex®)†	1 mg qhs	1-3 mg qhs	3 mg qhs
Reserpine †	0.05-0.1 mg daily	0.1-0.25 mg daily	0.5 mg daily

† - Available in generic preparations
All listed agents are formulary.

DIRECT VASODILATORS
(Not initial Monotherapy)

DRUG	INITIAL DOSE	TARGET DOSE	MAXIMUM DOSE
Hydralazine (Apresoline®)†	10 mg qid	25-50 mg qid	300 mg daily
Minoxidil (Loniten®)†	2.5-5 mg daily	10-40 mg daily	100 mg daily

† - Available in generic preparations.
All listed agents are formulary.

Adapted from The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. JAMA 2003;289:2560-2572;May 21, 2003.

VTE Prophylaxis and Treatment:
Selected Recommendations from ACCP

Indication	Therapy
VTE Prophylaxis	
Do not use aspirin for VTE prophylaxis	
Use mechanical methods (GCS or IPC) if bleeding risk is high	
Laparoscopic procedures + VTE risk factors	LDUFH or LMWH, IPC or GCS
Minor surgery, age <40, no risk factors)	Early and aggressive mobilization
General surgery (moderate risk)*	LDUFH q12h or LMWH
General surgery (high risk)**	LDUFH q8h or LMWH
General surgery (very high risk)***	LMWH or LDUFH q8h + IPC/GCS
Gynecologic surgery (no risk)	Early and aggressive mobilization
Gynecologic surgery (major surgery)	LDUFH q12h or LMWH or IPC
Gynecologic surgery (major surgery with malignancy)	LDUFH q8h or LMWH, consider adding IPC/GCS
Urologic surgery (low or no risk)	None recommended
Urologic surgery (major, open)	LDUFH or LMWH or GCS or IPC
Urologic surgery (with multiple risk factors)	GCS +/- IPC with LDUFH or LMWH
Hip replacement/ hip fracture surgery	LMWH or fondaparinux or warfarin (INR 2-3) for at least 10 days. Consider using extended prophylaxis for up to 28-35 days post-operatively.
Elective knee replacement	LMWH or fondaparinux or warfarin (INR 2-3)
Neurosurgery	IPC with or without GCS
Trauma, Spinal cord injury	LMWH continued through rehabilitation
Ischemic stroke	LDUFH or LMWH
General medical patient (admitted for CHF or resp. illness or confined to bed and have additional risk factors)	LDUFH or LMWH
ICU patients	LDUFH or LMWH

Indication	Therapy
Treatment of Thromboembolism	Begin anticoagulation while awaiting test results when clinical suspicion is high.
	LMWH or UFH IV for at least 5 days. Overlap with warfarin until INR is in therapeutic range and stable.
	UFH is preferred in severe renal insufficiency. LMWH for the first 3-6 months should be considered for patients with VTE and cancer. Elastic compression stockings for 2 years after an episode of DVT reduces risk for post-thrombotic syndrome.

Indication	Therapy
Atrial Fibrillation	
Prior TIA or Stroke	Warfarin (target INR 2.5, range 2-3)
Any one of the following: History of hypertension or systemic embolism or diabetes or systolic heart failure or mitral stenosis or rheumatic mitral valve disease	Warfarin (target INR 2.5, range 2-3)
Age > 75	Warfarin (target INR 2.5, range 2-3)
Age 65-75 years and no other risk factors	Warfarin (target INR 2.5, range 2-3) or ASA 325 mg/day
Age <65 years and no other risk factors	Aspirin 325 mg/day

Indication	Therapy
Prosthetic Heart Valves	
Aortic bileaflet or tilting disk valves	Warfarin (target INR 2.5, range 2-3)
Aortic bileaflet valves + atrial fibrillation	Warfarin (target INR 3, range 2.5-3.5)
Mitral bileaflet or tilting disk valves	Warfarin (target INR 3, range 2.5-3.5)
Caged ball or caged disk valves	Warfarin (target INR 3, range 2.5-3.5) + ASA 80mg daily
Mechanical valves + atrial fibrillation or MI or left atrial enlargement or systolic heart failure or systemic embolism despite therapeutic INR	Warfarin (target INR 3, range 2.5-3.5) + ASA 80mg daily
Bioprosthetic valves (aortic or mitral)	Warfarin (goal INR 2-3) x 3 months then either no anticoagulation or ASA 80mg daily

Indication	Therapy
Ischemic Stroke/TIA	
Secondary Prevention Non-cardioembolic stroke	ASA 50-325 mg daily or the combination of ASA 25 mg and extended release dipyridamole 200 mg BID or clopidogrel 75 mg.

VTE = venous thromboembolism, LDUFH = low-dose-unfractionated heparin, LMWH = low-molecular-weight heparin, ASA = aspirin, GCS = graduated compression stockings, IPC = intermittent pneumatic compression

* Moderate Risk: Minor surgery in patients with additional risk factors; non-major surgery in patients aged 40-60 years, with no risk factors; major surgery and age <40 with no risk factors

** High Risk: Non-major surgery in patients > 60 or with additional risk factors; major surgery in patients > 40 years or with additional risk factors

***** Very High Risk: Major surgery in patients > 40 and history of VTE, cancer, hypercoagulable state; major trauma, spinal cord injury**

Adapted from The Seventh ACCP Conference On Antithrombotic and Thrombolytic Therapy: Evidence-Based Guidelines. 2004; 126(3): 163S-703S.

Perioperative Management of Patients Who Require Discontinuation of Warfarin

Risk of Thromboembolism	Example	Recommendation
Low annual risk (<4%)	Atrial fibrillation and no risk factors or stroke; VTE > 90 days ago	Withhold warfarin
Moderate annual risk (4-7%)	Mechanical aortic valve	Withhold warfarin; Optional bridging w/ LMWH or UFH
High annual risk (>70%)	Mechanical mitral valve; Atrial fib.+ hx of stroke; Recent VTE (<90 days)	Withhold warfarin and bridge w/ LMWH or UFH
If preoperative anticoagulation is critical	Mechanical mitral valve and recent TIA	Withhold warfarin and bridge with IV heparin until 5 hrs preop and obtain baseline aPTT

- In most cases, warfarin is stopped 4-5 days preoperatively, allowing the INR to return to normal by the time of the procedure. The period of time without warfarin may be reduced to two days by giving oral vitamin K 2.5 mg 48 hours prior to the procedure.
- LMWH may be used until 24 hours preoperatively and restarted 12-24 hours postoperatively ("bridging") in order to limit the amount of time the patient is without anticoagulation.

INR: International Normalized Ratio, LMWH: Low Molecular Weight Heparin, VTE: Venous thromboembolism

Dunn AS, Turpie AG. Perioperative management of patients receiving oral anticoagulants. A systematic review. Arch Intern Med. 2003;163:901-908.

Ansell J, Hirsh J, Poller L, et al. The pharmacology and management of the vitamin k antagonists. The 7th ACCP consensus conference on antithrombotic and thrombolytic therapy. Chest 2004;126:204S-233S.

CHRONIC HEART FAILURE THERAPY (ACC/AHA)

New York Heart Association Functional Classification:

Class I: Patients with cardiac disease but without limitations of physical activity. Ordinary physical activity does not cause undue fatigue, dyspnea, or palpitation.

Class II: Patients with cardiac disease that results in slight limitations of physical activity. Ordinary physical activity results in fatigue, palpitation, dyspnea, or angina.

Class III: Patients with cardiac disease that results in marked limitation of physical activity. Although patients are comfortable at rest, less than ordinary activity will lead to symptoms.

Class IV: Patients with cardiac disease that results in an inability to carry on physical activity without discomfort. Symptoms of congestive heart failure are present at rest. With any physical activity, increased discomfort is experienced.

Criteria Committee, New York Heart Association, Inc. Diseases of the Heart and Blood Vessels. Nomenclature and Criteria for Diagnosis, 7th ed. Boston, Little, Brown, 1973.

Classification Based on Disease Progression- 2005 Guidelines

Stage A: Patient at high risk for developing heart failure but has no structural heart disease (Examples: HTN; CAD; DM; History of cardiotoxic drug therapy or alcohol abuse, History of rheumatic heart fever; Family history of cardiomyopathy)

Stage B: Patient with structural heart disease who has never developed symptoms of heart failure (Examples: Previous MI; Left ventricular hypertrophy; Left ventricular dilatation; Asymptomatic valvular heart disease)

Stage C: Patient with past or current heart failure symptoms associated with underlying structural heart disease

Stage D: Patient with end-stage disease who requires specialized treatment strategies such as mechanical circulatory support, continuous inotropic therapy, cardiac transplantation or hospice care.

*This classification is intended to complement but not replace the New York Heart Association functional classification, which primarily gauges the severity of symptoms in patients who are in Stage C or D.

Therapy

Stage A:
1. Control blood pressure (angiotensin converting enzyme (ACE) inhibitors and beta blockers preferred).
2. Lifestyle modifications- smoking cessation, exercise, discourage alcohol and illicit drug use.
3. Treat lipid abnormalities in accordance with recommended guidelines.
4. Begin ACE inhibitors in patients with a history of atherosclerotic vascular disease, diabetes mellitus, or hypertension and associated cardiovascular risk factors.

Stage B:
1. Same recommendations as Stage A.
2. Initiate ACE inhibitor (ARB may be used if intolerant of ACE inhibitor) and beta blocker therapy post-myocardial infarction.

Stage C:
1. Same recommendations as Stage A and B.
2. Drugs for routine use: ACE inhibitors, beta blockers, diuretics.
3. Potential therapies: aldosterone antagonists, digoxin, angiotensin receptor blockers (ARBs), or hydralazine + isosorbide dinitrate.

Stage D:
1. Same recommendations as Stage A-C.
2. Possible IV inotropic therapy, heart transplantation, ventricular assist devices, and/or hospice care.

ACE Inhibitors should be used in all patients with an ejection fraction < 40% unless contraindicated. *Absolute contraindications include:* angioedema, pregnancy, and bilateral renal artery stenosis. *Relative contraindications include*: cough, SCr > 3.0, and significant hyperkalemia.

β blockers should be used in all stable patients who are taking maximally tolerated doses of ACE inhibitors plus/minus digoxin. Recommended beta blockers include bisoprolol, metoprolol XL, and carvedilol. *Absolute contraindications include*: HR <50, SBP < 90 mm Hg, and second or third degree heart block without a pacemaker. *Relative contraindications include*: bronchoconstrictive disease.

Diuretics should be prescribed for all patients with symptoms of heart failure. Diuretics should not be used alone even if the symptoms of heart failure are well controlled. **Loop diuretics** are the preferred diuretic agents for use in most patients with heart failure. If a patient experiences a 1-2 kg weight gain, double the loop diuretic dose. If this fails, **metolazone** can be added for several days. If hypotension or azotemia is observed, the rapidity of diuresis should be decreased. Overdosing of

diuretics can lead to volume depletion, which may increase the likelihood of hypotension with ACE inhibitors and risk of renal insufficiency. Nonsteroidal anti-inflammatory drugs may cause diuretic resistance and should be avoided in patients with heart failure.

Digoxin usage in heart failure was defined by the Digitalis Investigation Group. The results of the trial indicate that patients concurrently on ACE inhibitors and diuretics found benefit from digoxin by decreasing the number of hospitalizations, but mortality was not significantly affected. Digoxin can be added in patients with continued heart failure symptoms despite standard therapy. A subanalysis of the DIG trial showed an increase in mortality in patients with digoxin serum levels > 1. Goal digoxin level for heart failure is 0.5-0.8 ng/ml.

Aldosterone antagonists have been shown in clinical trials to reduce morbidity and mortality in heart failure patients. The RALES trial, was designed to evaluate the addition of spironolactone (Aldactone®) to standard heart failure therapy in Class III and IV heart failure patients. The EPHESUS trial, investigated eplerenone (Inspra®) in patients post-myocardial infarction with Class II-IV heart failure. The current guidelines recommend consideration in patients with moderately severe to severe symptoms of HF and reduced ejection fraction who can be carefully monitored. Obtain baseline labs prior to initiation ($K^+ < 5.5$ mmol/L and CrCl $\geq$30 ml/min).

Angiotensin Receptor Blockers (ARBs) that are approved for HF (candesartan, valsartan) are a reasonable alternative in patients who are ACE inhibitor intolerant. They should not be used in patients who have no prior use of an ACE inhibitor or in patients who are tolerating an ACE inhibitor. At this time, ARBs should be considered in patients who experience cough while receiving an ACE inhibitor. Use with caution in patients with a history of angioedema to ACE inhibitors.

The combination of **hydralazine** and **isosorbide dinitrate** should be considered when ACE inhibitors are not tolerated because of angioedema, renal insufficiency, hyperkalemia or cough. In addition, the A-HeFT trial (N Engl J Med 2004;351:2049-57.) found a mortality reduction from the combination of hydralazine and isosorbide dinitrate in African American patients who were receiving standard therapy (ACE inhibitor, diuretic, beta blocker).

Amlodipine and felodipine are the only **calcium channel blockers** that can be safely used in patients with heart failure.

Therapy for Diastolic Dysfunction:
Goals: control BP, HR, blood volume and ischemia.
Therapy: ACE inhibitors, beta blockers.

ACE INHIBITORS

DRUG	INITIAL DOSE	TARGET DOSE	MAXIMUM DOSE	COST/ Month
Captopril (Capoten®)	6.25 mg tid	50 mg tid	100 mg tid	$$
Enalapril (Vasotec®)	2.5 mg bid	10-20 mg bid	20 mg bid	$$
Fosinopril (Monopril®)	5-10 mg daily	20-40 mg daily	40 mg daily	$$$
Lisinopril (Zestril®, Prinivil®)	5 mg daily	20-40 mg daily	40 mg daily	$$
Quinapril (Accupril)	5 mg bid	20-40 mg bid	40 mg bid	$$$
Ramipril (Altace®)	1.25-2.5 mg daily	10 mg daily	10 mg daily	$$$$$

ANGIOTENSIN RECEPTOR BLOCKERS

DRUG	INITIAL DOSE	TARGET DOSE	MAXIMUM DOSE	COST/ Month
Candesartan (Atacand®)	4 mg daily	4-16 mg daily	32 mg daily	$$$$
Valsartan (Diovan®)	40 mg bid	40-160 mg bid	160 mg bid	$$$$

BETA BLOCKERS

DRUG	INITIAL DOSE	TARGET DOSE	MAXIMUM DOSE	COST/ Month
Bisoprolol (Zebeta®)	1.25 mg daily	2.5-10 mg daily	10 mg daily	$$$
Carvedilol (Coreg®)	3.125 mg bid	25 mg bid	50 mg bid	$$$$$
Metoprolol XL (Toprol®)	12.5-25 mg daily	200 mg daily	200 mg daily	$$$

ALDOSTERONE ANTAGONISTS

DRUG	INITIAL DOSE	TARGET DOSE	MAXIMUM DOSE	COST/ Month
Spironolactone (Aldactone®)	25 mg daily	25-50 mg daily	50 mg daily	$$
Eplerenone (Inspra®)	25 mg daily	50 mg daily	50 mg daily	$$$$$

HYDRALAZINE & ISOSORBIDE DINITRATE

DRUG	INITIAL DOSE	TARGET DOSE	MAXIMUM DOSE	COST/ Month
Hydralazine (Apresoline®)	10-25 mg bid	75 mg tid	100 mg tid	$
Isosorbide dinitrate	10 mg tid	40 mg tid	80 mg tid	$
Hydralazine/isosorbide (BiDil®)	37.5/20 mg tid	37.5/20 mg-75/40 mg tid	75/40 mg tid	$$$$

VARIOUS DIURETICS

DRUG	INITIAL DOSE	TARGET DOSE	MAXIMUM DOSE	COST (30 D supply)
Hydrochlorothiazide	12.5 mg daily	25-100 mg daily	200 mg daily	$
Loop Diuretics				
Furosemide (Lasix®)	10-40 mg daily	As needed, inc. by 20-40 mg	240 mg bid	$
Torsemide (Demadex®)	10-20 mg daily (Equal to 40 mg furosemide)	Double the dose as needed	200 mg daily	$$
Miscellaneous Diuretics				
Metolazone (Zaroxolyn®)	2.5 mg daily	5-10 mg daily	10 mg daily	$$-$$$

*All listed agents are formulary with the exception of Atacand® and BiDil®.

DAILY DOSES OF DIGOXIN

CrCl (ml/min)	Body weight (kg)					
	50	60	70	80	90	100
	dose (mg)					
10	0.125	0.125	0.125	0.125	0.25	0.25
20	0.125	0.125	0.125	0.25	0.25	0.25
30	0.125	0.125	0.25	0.25	0.25	0.25
40	0.125	0.25	0.25	0.25	0.25	0.25
50	0.125	0.25	0.25	0.25	0.25	0.25
60	0.25	0.25	0.25	0.25	0.25	0.375
70	0.25	0.25	0.25	0.25	0.25	0.375
80	0.25	0.25	0.25	0.25	0.375	0.375
90	0.25	0.25	0.25	0.25	0.375	0.5
100	0.25	0.25	0.25	0.375	0.375	0.5

The Digitalis Investigation Group. The effect of digoxin on mortality and morbidity in patients with heart failure. N Engl J Med 1997;336:525-33.

Adapted from 2005 Guideline update for the diagnosis and management of chronic heart failure in the adult: report of the American College of Cardiology/ American Heart Association task force on practice guidelines. www.acc.org; www.americanheart.org

Acute Myocardial Infarction (AMI) Therapy

AHA/ACC Guidelines 2004 Update[1]

Drug	Class of Recommendation
Aspirin	I. Initial dose of 162-325 mg orally and continued indefinitely at a daily dose of 75-162 mg to all patients without a true aspirin allergy.
Clopidogrel	I. 1. In patients who have had a PCI procedure, continue in combination with aspirin for at least 1 month after bare metal stent placement and up to 12 months in patients who are not at high risk for bleeding. After drug eluting stent placement (sirolimus, paclitaxel), patients should receive 12 months of therapy in combination with aspirin if they are not at high risk of bleeding[2]. 2. In patients in whom CABG is planned, withhold for at least 5 days, preferably for 7. 3. Alternative to aspirin in patients with hypersensitivity or major gastrointestinal intolerance.
Reperfusion therapy-Thrombolysis	I. 1. STEMI patients should undergo evaluation for reperfusion therapy. 2. Fibrinolysis is generally preferred if: invasive strategy is not an option, or delay to invasive strategy.
	III. 1. ST elevation, time to therapy >24 hours ischemic pain resolved 2. ST depression only
Heparin	I. 1. IV in patients undergoing percutaneous or surgical revascularization 2. IV in patients treated with selective thrombolytics (alteplase, reteplase, tenecteplase) 3. IV in patients treated with nonselective thrombolytic agents (streptokinase, anistreplase, urokinase) who are at high risk for systemic emboli. 4. Monitor platelet counts daily.
	IIa. IV or SQ UFH or SQ LMWH in patients not treated with thrombolytics without a contraindication for at least 48 hours.
	IIb. 1. It may be reasonable to administer in patients given streptokinase. 2. Prophylaxis for DVT with SQ UFH or SQ LMWH.
LMWH	IIb. Acceptable alternative to UFH for patients < 75 without significant renal dysfunction receiving thrombolytic therapy.
	III. 1. LMWH is not an alternative to UFH in patients > 75 receiving thrombolytic therapy. 2. LMWH is not an alternative to UFH in patients < 75 with significant renal dysfunction receiving thrombolytic therapy.

GP2b3a inhibitors	IIa. Reasonable to start treatment with abciximab as early as possible before primary PCI (w/ or w/out stenting) in patients with STEMI.
	IIb. Treatment with tirofiban or eptifibatide may be considered before primary PCI (w/ or w/out stenting) in patients with STEMI.
Beta Blockers	I. Oral beta blocker therapy to patients without a contraindication, Irrespective of thrombolytic or primary PCI therapy. Continue indefinitely.
	IIb. IV beta blockers to STEMI patients without contraindications, especially if tachyarrhythmia or hypertension is present.
ACE Inhibitors	I. Patients within the first 24 hours of anterior infarction, pulmonary congestion or LVEF < 40% in the absence of hypotension or known contraindications.
	IIa. All other patients within the first 24 hours
	IIb. The combination of ACE inhibitor and ARB may be considered in patients with persistent symptomatic heart failure and EF < 40%.
	III. An IV ACE inhibitor should not be given within the first 24 hours due to risk of hypotension.
Angiotensin receptor blocker (ARB)	I. Administer to patients who are intolerant of ACE inhibitors who have clinical or radiological signs of HF or EF < 40%.
Aldosterone blocker	I. Patients without significant renal dysfunction or hyperkalemia who are receiving therapeutic doses of ACE inhibitor, have LVEF < 40% and symptomatic heart failure or diabetes.
Nitroglycerin	I. 1. IV within the first 48 hours for persistent ischemia, CHF or hypertension. 2. Oral or topical nitrates are useful beyond the first 48 hours for treatment of recurrent angina if their use does not preclude therapy with beta blockers and ACE inhibitors.
	III. 1. SBP < 90 mm Hg or $\underline{\geq}$ 30 mm Hg below baseline, severe bradycardia, tachycardia, or suspected RV infarction. 2. Phosphodiesterase inhibitor use within the last 24 hours.
Calcium Channel Blockers	IIa. Verapamil or diltiazem in patients with contraindications to beta blockers or for relief of ongoing ischemia or control of RVR with Afib in the absence of CHF, LV dysfunction or AV block.
	III. 1. Nifedipine (short acting) is contraindicated 2. Diltiazem and verapamil are contraindicated in patients with acute MI and associated LV dysfunction or CHF.
Lipid Therapy	See lipid lowering guidelines Obtain lipid panel within 24 hours of admission.
Warfarin	I.

	1. Alternative to clopidogrel in aspirin allergic patients w/out stent placement. 2. Presence of Afib 3. LV thrombus (for at least 3 months)
	IIa. LV dysfunction and extensive wall motion abnormalities
	IIb. Severe LV dysfunction with or without CHF
Estrogen Replacement Therapy	III. 1. HRT with estrogen plus progestin for secondary prevention should not be given to postmenopausal women after STEMI. 2. Women already taking HRT at time of AMI should discontinue therapy. Weigh risks vs. benefits if patient wishes to continue HRT.

1. American College of Cardiology. ACC/AHA Guidelines for the Management of Patients with ST-elevation Myocardial Infarction http://www.acc.org/clinical/guidelines/stemi (accessed 2004 September).
2. Grines CL, Bonow RO, et al. AHA/ACC/SCAI/ACS/ADA Scientific Advisory. Prevention of premature discontinuation of dual antiplatelet therapy in patients with coronary artery stents. Circulation 2007;115:813-8.

The ACC/AHA classification system for procedures and treatments:

Class I: Evidence and/or general agreement that treatment is beneficial, useful, and effective.

Class II: Conflicting evidence and/or a divergence of opinion about the usefulness/efficacy.

Class IIa: Weight of evidence/opinion is in favor of usefulness/efficacy.

Class IIb: Usefulness/efficacy is less well established by evidence/opinion.

Class III: Evidence and/or general agreement that treatment is not useful/effective and in some cases may be harmful.

Asthma Guidelines

CLASSIFICATION OF ASTHMA SEVERITY:

Step 1: Intermittent

Symptoms ≤ 2 days/week; asymptomatic and normal PEF between exacerbations; exacerbations are brief (from a few hours to a few days); intensity may vary; nocturnal symptoms ≤ 2 nights/month.
FEV_1 or PEF ≥ 80%

Step 2: Mild Persistent

Symptoms > 2 days/week but < 1x/day; exacerbations may affect activity; nocturnal symptoms 3-4 nights/month.
FEV_1 or PEF ≥ 80%

Step 3: Moderate Persistent

Daily symptoms; daily use of short-acting $beta_2$ agonist; exacerbations affect activity; exacerbations > 2 times a week (may last days); nocturnal symptoms > 1 night/week.
FEV_1 or PEF > 60% -< 80%

Step 4: Severe Persistent

Continual symptoms; limited physical activity; frequent exacerbations; nocturnal
symptoms are frequent.
FEV_1 or PEF ≤ 60%

ASTHMA THERAPY BASED ON CLASSIFICATION

Step 1: Intermittent

Long Term Control: None needed.
Quick Relief:

Short acting inhaled $beta_2$-agonist (not ipratropium) as needed for symptoms. (Use of these agents more than twice a week may indicate the need to initiate long-term control therapy.)

Step 2: Mild Persistent

Long Term Control:

1. Preferred: Inhaled corticosteroid (low dose) with spacer device
2. Alternative: Cromolyn or nedocromil.
3. Alternative: Montelukast or zafirlukast.
4. Alternative: Theophylline SR

Quick Relief:
Short acting inhaled $beta_2$-agonist as needed for symptoms.

Step 3: Moderate Persistent

Long Term Control:

1. Preferred: Inhaled corticosteroid (low dose) and long-acting inhaled beta$_2$-agonist, especially for night-time symptoms OR inhaled corticosteroids (medium dose). Consider short course of oral corticosteroids (2 mg/kg/day, not to exceed 60mg/day).
2. Alternative: Low dose inhaled corticosteroids with either a leukotriene modifier (montelukast or zafirlukast) OR theophylline SR OR zileuton

Quick Relief:

Short-acting inhaled beta$_2$-agonist as needed for symptoms.

Step 4: Severe Persistent

Long Term Control:

Inhaled corticosteroids (medium-high dose) and long-acting inhaled beta$_2$-agonists and consider short course of oral corticosteroids (2 mg/kg/day, not to exceed 60mg/day).

Quick Relief:

Short acting inhaled beta$_2$-agonist as needed for symptoms.

Medications for Asthma and COPD

SHORT-ACTING BETA$_2$-AGONISTS

DRUG	HOW SUPPLIED	DOSE	COST (30 Day)
Albuterol (Proventil®,Ventolin®, ProAir® HFA)	90 mcg/puff; 200 puffs	2 puffs Q 4-6 hrs, max 12 puffs/day	$
Levalbuterol (Xopenex®) Levalbuterol (Xopenex® HFA)	0.63 mg/3 ml solution 1.25 mg/3 ml solution 45 mcg/puff; 200 puffs	0.63 mg Q 6-8 hrs via nebulizer 1-2 puffs Q 4-6 hours	$$$$ $$$$
Metaproterenol (Alupent®)	75 mg/puff; 100 puffs 150 mg/puff; 200 puffs	2-3 puffs Q 3-4 hrs, max 12 puffs/day	$$$$
Pirbuterol (Maxair®)	200 mcg/puff; 400 puffs	2 puffs Q 4-6 hrs, max 12 puffs/day	$$
Terbutaline (Brethaire®)	200 mcg/puff; 300 puffs	2 puffs Q 4-6 hrs	$$

INHALED CORTICOSTEROIDS

DRUG	HOW	DOSE	COMPARATIVE	COST

	SUPPLIED		DAILY DOSES	(30 Day)
Beclomethasone CFC (Beclovent®, Vanceril®)	42 mcg/puff; 80,200 puffs 84 mcg/puff (DS); 40,120 puffs	2 puffs tid-qid (42 mcg)	Low: 4-12 puffs Medium: 12-20 puffs High: > 20 puffs	$$$
Beclomethasone HFA (Q-var®)	40 mcg/puff; 80 mcg/puff	2 puffs bid	Low: 2-6 puffs Medium: 6-16 puffs High: >16 puffs	$$$
Budesonide Flexhaler (Pulmicort®) Budesonide Turbuhaler (Pulmicort®)	90 mcg/inhal (60 doses) 180 mcg/inhal (120 doses) 200 mcg/inhal (200 doses)	1-2 inhalations bid	Low: 1-2 inhal. Medium: 2-3 inhal. High: > 3 inhal.	$$$
Flunisolide (AeroBid®)	250 mcg/puff; 100 puffs	2 puffs bid	Low: 2-4 puffs Medium: 4-8 puffs High: > 8 puffs	$$$$$
Fluticasone HFA (Flovent®)	44 mcg/puff 110 mcg/puff 220 mcg/puff; 60, 120 puffs	2-4 puffs bid (44 mcg)	Low: 2-6 puffs Medium: 2-6 puffs (110 mcg) High: > 6 puffs (110 mcg)	$$$
Triamcinolone (Azmacort®)	100 mcg/puff; 240 puffs	2 puffs tid-qid; 4 puffs bid	Low: 4-10 puffs Medium: 10-20 puffs High: > 20 puffs	$$$

SYSTEMIC CORTICOSTEROIDS

DRUG	EQUIVALENT DOSE (mg)	GC POTENCY	MC POTENCY
Short-acting			
Cortisone	25	0.8	0.8
Hydrocortisone	20	1	1
Intermediate-acting			
Prednisone	5	4	0.8
Prednisolone	5	4	0.8
Methylprednisolone	4	5	0.5
Dexamethasone	0.75	20-30	0

Notes: GC: Glucocorticoid MC: Mineralocorticoid

LONG-ACTING INHALED/NEBULIZED BETA$_2$-AGONIST
NOT FOR ACUTE RELIEF

DRUG	HOW SUPPLIED	DOSE	COST (30 Day)
Salmeterol (Serevent Diskus®)	50 mcg/inhalation; 60 inhalations	1 inhalation Q 12 hrs	$$$$
Formoterol (Foradil®)	12 mcg/inhalation; 60 inhalations	1 puff Q 12 hrs	$$$$
Arformoterol* (Brovana®)	15 mcg/2 mL nebulized solution	15 mcg twice daily	$$$$

*Only used in COPD

LONG-ACTING INHALED BETA$_2$-AGONIST/INHALED CORTICOSTEROIDS
NOT FOR ACUTE RELIEF

DRUG	HOW SUPPLIED	DOSE	COST (30 Day)
Fluticasone/Salmeterol (Advair Diskus®) Fluticasone/Salmeterol (Advair® HFA)	100/50, 250/50, 500/50 mcg/inhalation 45/21, 115/21, 230/21 mcg/inhalation	1 inhalation Q 12 hours 2 inhalations Q 12 hours	$$$$
Budesonide/Formoterol (Symbicort® MDI)	80/4.5 mcg/inhalation 160/4.5 mcg/inhalation	2 inhalations Q 12 hours	$$$$

LEUKOTRIENE MODIFIERS*

DRUG	DOSAGE FORM	DOSE	COST (30 Day)
Montelukast (Singulair®)	10 mg tablet	10 mg daily	$$$$
Zafirlukast (Accolate®)	20 mg tablet	20 mg bid	$$$
Zileuton (Zyflo®, Zyflo CR®)	600 mg tablet, 1200 mg tablet	4 times/day, twice daily	$$$$

*Not indicated for COPD

MAST CELL STABALIZER

DRUG	HOW SUPPLIED	DOSE	COST (30 Day)
Cromolyn Sodium (Intal®)	1 mg/puff	2 puffs qid	$$$

THEOPHYLLINE
MAINTENANCE DOSE FOR ACUTE SYMPTOMS

POPULATION GROUP	ORAL THEOPHYLLINE (mg/kg/day)	I.V. AMINOPHYLLINE (mg/kg/hr)
Children 9-12y, and adolescent daily smokers of cigarettes or marijuana, and otherwise healthy adult smokers < 50 y	16	0.9
Adolescents 12-16y (nonsmokers)	13	0.7
Otherwise healthy nonsmoking adults (including elderly patients)	10 (not > 900 mg/day)	0.5
Cardiac decompensation, cor pulmonale and/or liver dysfunction	5 (not > 400 mg/day)	0.25

** **Aminophylline dose x 0.8 = Theophylline dose** **

ORAL THEOPHYLLINE PRODUCTS

DRUG	AVAILABLE STRENGTHS	DOSAGE FORMS	COST (30 Day)
Slo-Bid®	50 mg, 75 mg, 100 mg, 125 mg, 200 mg, 300 mg	Timed release capsules (8-12 hr dosing)	$$
Slo-Phyllin®	100 mg, 200 mg	Immediate release tablets	$$
Theo-Dur®	100 mg, 200 mg, 300 mg, 450 mg	Timed release tablets (8-24 hr dosing)	$$
Uniphyl®	400 mg, 600 mg	Timed release tablets (24 hr dosing)	$$

ORAL BETA$_2$-AGONISTS

DRUG	DOSAGE FORMS	DOSE	COST (30 Day)
Albuterol (Proventil®)	2 mg tablets 4 mg extended release	2-4 mg tid-qid, extended release 4-8 mg Q 12 hrs; max 32 mg/day	$ $$$
Terbutaline (Brethine®)	2.5 mg, 5 mg tablets	5 mg Q 6 hrs	$$$

ANTICHOLINERGIC MEDICATIONS

DRUG	DOSAGE FORMS	DOSE	COST (30 Day)
Ipratropium* (Atrovent®)	18 mcg/puff, 200 puffs 0.25mg/ml nebulized	2-3 puffs Q 6 hrs 0.25 mg Q 6 hrs	**$** **$**
Tiotropium# (Spiriva®)	18 mcg/inhalation	1 inhalation daily	$$$$

***Typically used in COPD or acute asthma. # Used only in COPD

Monitoring Pharmacotherapy:

1. Patient adherence to the regimen
2. Inhaler technique (use of spacer)
3. Level of usage of prn inhaled short-acting $beta_2$ agonist
4. Frequency of oral corticosteroid "burst" therapy
5. Changes in inhaled anti-inflammatory dose or other long-term-control medications
6. Peak Flow Meter monitoring

Patient Education:

1. Always use a spacer with inhalers to improve effectiveness of therapy.
2. Wait 1 minute after each inhalation before repeating
3. Use $beta_2$ agonist followed by inhaled steroids.
4. Rinse mouth after using an inhaled steroid.

Adapted from the recommendations of the National Heart, Lung, and Blood Institute's National Asthma Education and Prevention Program Expert Panel Report III: Guidelines for the diagnosis and management of asthma, August 2007.

Acute Asthma Management

The main therapies in the emergency department and hospital: supplemental oxygen, inhaled-beta2-agonists, systemic corticosteroids, and ipratropium (dose and frequency vary with severity).

Albuterol 1 unit dose = 2.5 mg albuterol
Ipratropium 1 unit dose = 0.5 mg ipratropium

Initial Assessment

- FEV_1 or PEF $\geq$40%
  -Oxygen to achieve O_2 saturation $\geq$90%
  -Inhaled beta2-agonist (Albuterol 10-15 mg continuous nebulization over 1 hr OR 2.5-5 mg nebulization Q 20 minutes)
  -Oral steroids if no immediate response or if patient recently on oral steroids (Prednisone 40-60 mg po now & daily; may give Solu-Medrol 40 mg IV if unable to take po)

- FEV_1 or PEF<40%
  -Oxygen to achieve O_2 saturation $\geq$ 90%
  -Inhaled beta2-agonist (Albuterol 10-15 mg continuous nebulization over 1 hr OR 2.5-5 mg nebulization Q 20 minutes) and anticholinergic (Ipratropium 0.5-1 mg continuous nebulization over 1 hr or 0.25-0.5 mg nebulization Q 20 minutes)
  -Oral steroid (Prednisone 40-60 mg po now & daily; may give Solu-Medrol 40 mg IV if unable to take po)

Repeat Assessment (after 1 hr of treatment)

- Moderate exacerbation (FEV_1 or PEF 40-69%)
  -Inhaled short-acting beta2-agonist (Albuterol 2.5-5 mg continuous nebulization over 1 hr)
  -If oral steroids not already given, administer Prednisone 40-60 mg po now & daily; may give Solu-Medrol 40 mg IV if unable to take po
  -Continue treatment 1-3 hours, provided there is improvement; make admit decision in <4 hours

- Severe exacerbation (FEV_1 or PEF <40%)
  -Oxygen to achieve O_2 saturation $\geq$90%
  -Inhaled short-acting beta2-agonist (Albuterol 2.5-5 mg continuous nebulization over 1 hr) + inhaled anticholinergic (Ipratropium 0.25-0.5 mg continuous nebulization over 1 hr)
  -Systemic steroid (Prednisone 40-60 mg po now & daily; may give Solu-Medrol 40 mg IV if unable to take po)

Repeat Assessment (after 1 hr of treatment)

- Good response (FEV_1 or PEF ≥ 70%)
  -Discharge home: continue treatment with inhaled beta2-agonist; consider inhaled corticosteroid; continue course of oral corticosteroid; patient education

- Incomplete response (FEV_1 or PEF 40-69%)
  -Admit to hospital: inhaled beta2-agonist; systemic corticosteroid; oxygen to maintain O_2 saturation ≥90%

- Poor response (FEV_1 or PEF <40%; PCO_2 ≥42 mmHg)
  -Admit to hospital Intensive Care
  -Inhaled beta2-agonist hourly or continuously
  -IV corticosteroid
  -Oxygen to achieve O_2 saturation ≥90%
  -Possible intubation and mechanical ventilation

Medications for Acute Asthma Exacerbations

INHALED SHORT-ACTING BETA$_2$-AGONISTS

MEDICATIONS	DOSAGES	COMMENTS
Albuterol		
Nebulizer solution (5 mg/mL)	2.5 - 5 mg q 20 min for 3 doses, then 2.5 - 10 mg q 1-4 hours prn, or 10-15 mg/hour continuously	Only selective beta2-agonists are recommended. For optimal delivery, dilute aerosols to minimum of 3 mL at gas flow of 6-8 L/min
HFA MDI (90 mcg/puff)	4-8 puffs q 20 min up to 4 hours, then q 1-4 hours prn	As effective as nebulized therapy if patient is able to coordinate inhalation maneuver. (Use spacer)
Levalbuterol		
Nebulizer solution (1.25mg/3ml)	1.25-2.5 mg q 20 min for 3 doses, then 1.25 – 5 mg q 1-4 hours prn, or 5-7.5 mg/hour continuously	Typically reserved for albuterol intolerance, failures, or tachycardia 0.63 mg of levalbuterol is equivalent to 1.25 mg of albuterol
HFA MDI (45 mcg/puff)	1-2 puffs q 4-6 hours	Typically reserved for albuterol intolerance, failures, or tachycardia
Pirbuterol		
MDI (200 mcg/puff)	See albuterol dose.	Has not been studied in severe asthma exacerbations.

SYSTEMIC (INHALED) BETA-AGONISTS

MEDICATIONS	DOSAGES	COMMENTS
Epinephrine 1:1000		
(1 mg/mL)	0.3-0.5 mg q 20 min for 3 doses sq	No proven advantage of systemic therapy over aerosol
Terbutaline		
(1 mg/mL)	0.25 mg q 20 min for 3 doses sq	No proven advantage of systemic therapy over aerosol

ANTICHOLINERGICS

MEDICATIONS	DOSAGES	COMMENTS
Ipratropium bromide		
Nebulizer solution (0.25 mg/mL)	0.5 mg q 30 min for 3 doses then q 2-4 hours prn	May mix in same nebulizer with albuterol. Should not be used as first-line therapy; should be added to beta2-agonist therapy for more severe cases
MDI (18 mcg/puff)	4-8 puffs prn	Dose delivered from MDI is low and has not been studied in asthma exacerbations.

CORTICOSTEROIDS

MEDICATIONS	DOSAGES	COMMENTS
Prednisone **Methylprednisolone** **Prednisolone**	120-180 mg/day in 3 or 4 divided doses for 48 hours, then 60-80 mg/day until PEF reaches 70% of predicted or personal best.	For outpatient "burst" use 40-60 mg/day in single or divided doses for adults (children –1-2 mg/kg/day, maximum 60 mg/day) for 3-10 days.

Adapted from the Expert Panel Report: Guidelines for the Diagnosis and Management of Asthma. NIH Publication No 02-5074. 8/07

Chronic Obstructive Pulmonary Disease (COPD) Recommendations

Stage	Characteristics
I: Mild	$FEV_1/FVC < 70\%$; FEV_1 80% predicted With or without symptoms (cough, sputum)
II: Moderate	$FEV_1/FVC < 70\%$; $50\% < FEV_1 < 80\%$ predicted with or without chronic symptoms (cough, sputum, dyspnea)
III: Severe	$FEV_1/FVC < 70\%$; $30\% < FEV_1 < 50\%$ predicted Repeated exacerbations and increased shortness of breath
IV: Very Severe	$FEV_1/FVC < 70\%$; $FEV_1 < 30\%$ predicted plus respiratory failure or clinical signs of right heart failure

COPD Therapy Based on Classification

Stage	Therapy
I: Mild	Short-acting bronchodilator as needed
II: Moderate	Maintenance treatment with one or more bronchodilators Rehabilitation Inhaled glucocorticosteroids if significant symptoms and lung function response
III: Severe	Regular treatment with one or more bronchodilators Rehabilitation Inhaled glucocorticosteroids if significant symptoms and lung function response or if repeated exacerbations
IV: Very Severe	Regular treatment with one or more bronchodilators Inhaled glucocorticosteroids if significant symptoms and lung function response or if repeated exacerbations Treatment of complications Rehabilitation Long-term oxygen therapy if respiratory failure Consider surgical options

NOTE: See asthma section for a list of medications and doses
Adapted from the recommendations of the NHLBI/WHO: Global Initiative for Chronic Obstructive Lung Disease. 2006 Update

Diabetes Mellitus Guidelines

Criteria for the Diagnosis of Diabetes Mellitus[1]

1. A fasting plasma glucose (FPG) of ≥ 126mg/dL (after no caloric intake for at least 8 hours).
2. A casual plasma glucose (taken at any time of day without regard to meals) ≥200mg/dL, accompanied by symptoms of increased thirst, urination and unexplained weight loss.
3. An oral glucose tolerance test (OGTT) value of ≥ 200mg/dL during the two-hour sample.

[1]These criteria should be confirmed by repeat testing on a different day.

Pre-diabetes- Hyperglycemia not sufficient to meet the diagnostic criteria for diabetes; formerly categorized as impaired glucose tolerance (IGT) or impaired fasting glucose (IFG).

- IFG = FPG 100 mg/dl to 125 mg/dl
- IGT = 2 hour plasma glucose 140 mg/dl to 199 mg/dl

Pre-diabetes is considered a risk factor for future diabetes and cardiovascular disease.

Testing for Gestational Diabetes Mellitus (GDM)[1]

Plasma Glucose	50g Screening Test[2] (fasting not required)	100g Diagnostic Test[3] (fasting required)
Fasting		95 mg/dL
1-h	140mg/dL (if present, indicates	180 mg/dL
2-h	need for 100g diagnostic test)	155 mg/dL
3-h		140 mg/dL

[1] Fasting plasma glucose of >126 or casual plasma glucose >200 meets the threshold for diagnosis and precludes the need for a glucose challenge.

[2] Screening should be performed (unless otherwise indicated) between 24-28 weeks of gestation.

[3] Diagnosis of GDM requires any two of the four plasma glucose values obtained during the test to meet or exceed the listed glucose values.

Screening for GDM may not be necessary in pregnant women who meet *all* of the following criteria: <25 years of age, normal body weight, no first-degree relative with diabetes, have no history of abnormal glucose metabolism or poor obstetric outcome, and not Hispanic, Native American, Asian-, African-American or Pacific Islander.

Recommendations for Adults with Diabetes Mellitus

Glycemic control

A_{1c}	<7.0%
Preprandial plasma glucose	90-130 mg/dl
Peak postprandial plasma glucose	<180 mg/dl
Blood pressure	<130/80 mmHg
Lipids (see hyperlipidemia guidelines)	
LDL	<100 mg/dl
Triglycerides	<150 mg/dl
HDL	>40 mg/dl

Concepts in setting glycemic goals:

- Goals should be individualized
- Certain populations (children, pregnant women, and elderly) require special considerations
- Less intensive goals may be indicated in patients with severe or frequent hypoglycemia
- More intensive goals may further reduce microvascular complication at the cost of increasing hypoglycemia.
- Postprandial glucose may be targeted if HbA_{1c} goals are not met despite reaching preprandial glucose goals.

Correlation between HbA_{1c} Level and Mean Plasma Glucose

A_{1c} (%)	mg/dl	mmol/l
6	**135**	**7.5**
7	**170**	**9.5**
8	**205**	**11.5**
9	**240**	**13.5**
10	**275**	**15.5**
11	**310**	**17.5**
12	**345**	**19.5**

American Diabetes Association Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care.* 2004;27 (supplement 1).

Pharmacologic Therapy of DM Type 2

Step 1: NONPHARMACOLOGIC THERAPY

-Diet

-Exercise
-If glycemic goals not achieved, progress to Step 2.
-If patient is very symptomatic, ketotic, pregnant, has severe hyperglycemia, or unrecognized DM Type 1, progress to Step 4.

Step 2: MONOTHERAPY
-Obese patient: metformin (preferred) or a thiazolidinedione
-Non-obese patient: sulfonylurea or insulin secretagogue (alternative: metformin)
-If glycemic goals not achieved, progress to Step 3.

Step 3: COMBINATION THERAPY
-Sulfonylurea + metformin
-Alternative: add thiazolidinedione to step 2 monotherapy
-If fasting plasma glucose is at goal, but patient has elevated post-prandial glucose, consider adding an alpha glucosidase inhibitor.
-If glycemic goals are not achieved, progress to Step 4.

Step 4: INSULIN
-Metformin + NPH or insulin glargine
-Sulfonylurea + metformin + NPH or insulin glargine

Other options:
-Thiazolidinedione + insulin (This combination is not recommended for patients with or at risk of heart failure.)
-NPH BID
-NPH + regular BID (70/30 insulin)
-Multiple (3 or more) injections)

Adapted from:

1. American Diabetes Association Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care.* 2004;27 (supplement 1).
2. UK Prospective Diabetes Study Group: Intensive blood-glucose control with sulfonylureas or insulin compared with conventional treatment and risk of complications in type 2 diabetes (UKPDS 33). *Lancet*. 1998; 352: 837-53.
3. UK Prospective Diabetes Study Group: Effect of intensive blood-glucose control with metformin on patients with type 2 diabetes (UKPDS 34). *Lancet*. 1998; 352: 854-65.

Lets try some text

Agents for Diabetes Mellitus Type 2

	Oral Sulfonylureas	Biguanides	Alpha-glucosidase Inhibitors	Thiazolidinediones	Meglitinides
Potentiate Hypoglycemia	Yes	No	No	No	Yes
Stimulate Insulin Secretion from Pancreas	Yes	No	No	No	Yes
Effect on Fasting Plasma Glucose	lowers 60-70mg/dL	lowers 60-70mg/dL	lowers 20-30mg/dL	lowers 35-40 mg/dL	lowers 60-70 mg/dL
Effect on HbA_1c	lowers 1.5-2%	lowers 1.5-2%	lowers 0.7-1%	lowers 1-1.2%	lowers 1.5-2%
Effect on Lipids	N/A	↓ LDL, TG ↑ HDL	N/A	↓ TG, ↑ HDL, LDL	N/A
Effect on Weight	↑	↓	N/A	↑	↑
Price	$-$$	$-$$	$$$	$$$$$+	$$$$

TG = triglycerides
LDL = low-density lipoprotein
HDL = high-density lipoprotein

Comparison Chart of Orally Administered Hypoglycemic Agents

	First Generation Oral Sulfonylureas		Second Generation Oral Sulfonylureas			Biguanides
	Acetohexamide (Dymelor®)	Chlorpropamide (Diabinese®)	Glipizide (Glucotrol®)	Glyburide (Diabeta®, Micronase®)	Glimepiride (Amaryl®)	Metformin (Glucophage®) (Glucophage XR®)
Starting Dose (mg/day)	500 mg	100-250 mg	5-10 mg	2.5-5.0 mg	1-2 mg	850-1000 mg 500 mg XR
Dosing Range	250-1500 mg	100-500 mg	2.5-40 mg	1.25-20 mg	1-8 mg	1000-2500 mg 2000 mg XR

# Daily Doses	1-2 (divide if dose >1000 mg)	1	1-2 (divide if dose > 15 mg)	1-2 (divide if dose > 10 mg)	1	2-3 (give 3 times daily if dose >2000 mg) XR: 1-2 times daily, usually with evening meal
Elimination	renal	renal	renal	renal, fecal	renal, fecal	renal
Half-life	6-8 hours	36 hours	2-4 hours	10 hours	5-9 hours	5.5 hours
Onset	1 hour	1 hour	1-3 hours	2-4 hours	2-3 hours	1-3 hours
Comments	Take at the same time each day	Take 30 min before meals	Take 30 min before meals	Take 30 min before meals	None	Give w/meals, contraindicated in patients with CHF requiring therapy and in males with SCr >1.5 (females >1.4)

All listed agents are formulary.

Comparison Chart of Orally Administered Hypoglycemic Agents, cont.

	Alpha-Glucosidase Inhibitors		**Thiazolidinediones**		**Meglitinides**	
	Acarbose (Precose®)*	Miglitol (Glyset®)	Pioglitazone (Actos®)*	Rosiglitazone (Avandia®)*	Repaglinide (Prandin®)*	Nateglinide (Starlix®)*
Starting Dose (mg/day)	75 mg	75 mg	15-30 mg	4 mg	1.5-6 mg	180-360 mg
Dosing Range	150-300 mg	150-300 mg	15-45 mg	4-8 mg	1.5-12 mg	180-360 mg
# Daily Doses	3	3	1	1-2 (divide if dose>4 mg)	preprandially, 2-4 times daily	preprandially, 2-4 times daily
Elimination	fecal	renal	renal	renal, fecal	fecal	renal, fecal

Half-life	2 hours	2 hours	3-7 hours	3-4 hours	1 hour	1-2 hours
Onset	1 hour	Data unavailable	1 hour	30-60 minutes	60-90 minutes	20 minutes
Comments	Give with first bite of meal	Give with first bite of meal	Obtain liver enzymes at initiation and every 2 months for the first year	Obtain liver enzymes at initiation and every 2 months for the first year	Patients who skip a meal should skip the dose; if a meal is added, add a dose	Patients who skip a meal should skip the dose; if a meal is added, add a dose

*Formulary agent

Insulin Products Comparison

	Brand	Generic	Onset (hr)	Duration (hr)	Comments
Rapid Acting					
	HumaLOG®	Lispro	<0.25	3-4	Administer 30 min. before meals; clear and colorless
	*NovoLOG®	Aspart	0.5	3-5	
Short Acting (Only insulin that can be given IV/IM)					
	HumuLIN® R	Regular	0.5-1	3-6	Administer 30-60 min. before meals; clear and colorless
	*NovoLIN® R				
Intermediate Acting					
	HumuLIN® N	NPH	2-4	10-16	Cloudy suspension
	*NovoLIN® N				
	*NovoLIN® L	Lente	3-4	16-20	Cloudy suspension; Do not mix with NPH or Regular insulin
	HumuLIN® L				
Long Acting					
	*HumuLIN® U	Ultralente	6-10	18-24	Cloudy suspension; Do not mix with NPH or Regular insulin

	*Lantus®	Glargine	4		Only long acting insulin that is clear; Do not mix with any other insulin

*Formulary Agent

Insulin Products Comparison

Mixtures					
	HumuLIN® 70/30 *NovoLIN® 70/30	70% NPH/30% regular insulin	0.5	16-18	Administer 30-45 min. before meal; cloudy suspension; do not mix with other insulin
	HumuLIN® Mixture 50/50	50% NPH/50% regular insulin			Administer 30-45 min. before meal; cloudy suspension; do not mix with other insulin
	*HumaLOG® Mixture 50/50	50% lispro protamine/50% lispro			Administer 15 min. before meals; cloudy suspension; do not mix with other insulin
	HumaLOG® Mixture 75/25	75% lispro protamine/25% lispro			Administer 15 min. before meals; cloudy suspension; do not mix with other insulin
	*NovoLOG® Mixture 70/30	70% aspart protamine/30%aspart			Administer 15 min. before meals; cloudy suspension; do not mix with other insulin

*Formulary Agent

Diabetic Ketoacidosis (DKA) Management

Patient Assessment and Initial Work Up:

1. History and physical exam with emphasis on the following:
    a. Precipitating factors (infection, omission or inadequate use of insulin, new onset diabetes, etc)
    b. Airway patency
    c. Level of consciousness
    d. Volume status

2. Initial work up includes the following:
    a. Blood chemistries
    b. Blood glucose (finger stick)
    c. Blood and urine ketones
    d. CBC with differential
    e. ABG
    f. Urinalysis
    g. If appropriate, obtain chest film, ECG, and blood cultures to evaluate the cause while patient is being hydrated.

3. Diagnosis
    a. Hyperglycemia (serum glucose > 250 mg/dL)
    b. Low bicarbonate (HCO_3 < 15 mEq/L)
    c. Low pH (pH < 7.3)
    d. Ketonemia 1:2 dilution
    e. Ketonuria: moderate

Fluid and Electrolytes:

4. After initial chemistries are drawn:
    a. Give 1 L 0.9% sodium chloride solution in the first hour.
    b. Follow with 0.45% sodium chloride solution at 200-1000 mL/hr depending on blood pressure, urine output and volume status.
    c. Do not exceed 5 L in 8 hours and follow I/Os strictly. Most patients require 4-8 L of fluid in the first 24 hours.
    d. Consider placing a pulmonary artery catheter if patient has a history of heart failure or renal failure or is elderly.

5. Begin potassium therapy if urine output adequate (no renal failure). If initial potassium is:
    a. < 3.3 mEq/L: potassium supplements may be given in IV fluids at 40 mEq/L (consider half as KCL and half as K phosphate if phosphate < 2.5 mEq/L).
    b. > 3.3 but < 5.5 mEq/L and urine output adequate: potassium supplements may be given in IV fluids at 20-30 mEq/L (consider half as KCL and half as K phosphate if phosphate < 2.5 mEq/L).

c. > 5.5 mEq/L: do not give potassium supplements.

Repeat serum K every 1-2 hours for the first few hours, then subsequent levels every 4-6 hours as needed.

6. Bicarbonate therapy is not given for a pH > 7.
   a. For a pH $\leq$ 7 but $\geq$ 6.9: give 1 ampule (44 mEq) sodium bicarbonate over 1 hour.
   b. For a pH $\leq$ 6.9: give 2 ampules (88 mEq) of sodium bicarbonate over 1 hour.

   Repeat ABG's every 2 hours until pH > 7. If initial pH > 7, there is no need to repeat ABG's. Follow HCO_3 on chemistries every 2 hours until HCO_3 normalizes, then subsequent levels every 4-6 hours as clinically indicated.

Insulin Therapy:

7. With the diagnosis of DKA confirmed and at least 1 L of saline infused, consider one of the following:
   a. *MILD DKA:*
      Loading dose: 0.4 units/kg of regular insulin (½ as IV push and ½ as SQ) followed by 0.1 units/kg/hr (IM/SQ) of regular insulin

      -OR-

   b. *MODERATE/SEVERE DKA:*
      Regular insulin bolus of 0.15 units/kg IV followed by a continuous infusion of Regular insulin at 0.1 units/kg/hr (regular insulin 100 units / 100mL NS)

8. Obtain plasma glucose hourly, chemistries (Chem 10) every 2 hours for the first few
   hours, then subsequent measurements every 4-6 hours as clinically needed.

9. If plasma glucose does not fall by at least 10% in the first hour, double the rate of the continuous insulin infusion or reload insulin with IM/SQ regimen. (see #7 above) Don't allow the blood sugar to fall at a rate > 100mg/dl/hr.

   After at least a 10% decrement of plasma glucose, continue insulin infusion at 7-10 units/hr or equivalent IM/SQ insulin regimen until plasma glucose reaches 200 mg/dL.

Resolving Diabetic Ketoacidosis:

10. Once plasma glucose reaches 250 mg/dL, change IV fluid to
    $D_5$1/2 NS at 100-300 mL/hr.

11. Monitor plasma glucose hourly and adjust insulin drip or equivalent IM/SQ insulin regimen (i.e. if the insulin drip is @ 5 units/hr, the equivalent SQ regimen is 5 units every hour) to keep glucose in the 100-200 mg/dL range. Continue intravenous insulin drip or equivalent insulin regimen until DKA is controlled (plasma glucose < 200mg/dL, HCO_3 > 15 mEq/L, and pH > 7.3). Measure serum ketones if uncertain why acidosis is persisting.

It is estimated that it takes twice as long for HCO_3 and pH to reach desired levels as it does for glucose to reach 200 mg/dL. The goals above can be achieved by using glucose infusions to prevent hypoglycemia while insulin therapy continues. Complications of therapy include but are not limited to: cerebral edema, ARDS, hyperchloremic acidosis, hypoglycemia and hypokalemia.

12. When patient is alert and able to take food by mouth, begin ADA diet. Also, begin NPH insulin regimen appropriate for patient 30 minutes prior to breakfast and evening meal with the following sliding scale regular human insulin (RHI) SQ before meals and at bedtime. Discontinue insulin drip 1 hour after first SQ dose of insulin.

Glucose	Insulin
<150	0 units RHI
150-200	5 units RHI
201-250	10 units RHI
251-300	15 units RHI
>300	20 units RHI

Kitabchi AE, Umpierrez GE, Murphy MB, et al. Hyperglycemic crises in diabetes. Diabetes Care 2004 Jan;27(Suppl 1):S94-102.

Prevention of Bacterial Endocarditis

Endocarditis prophylaxis recommended only for:

- high risk categories listed below **PLUS**
- dental procedures that involve manipulation of the gingival tissue or the periapical region of teeth or perforation of the oral mucosa

- **High risk categories**
  1. Prosthetic cardiac valve
  2. Previous bacterial endocarditis
  3. Congenital heart disease (CHD)
     - Unrepaired cyanotic CHD, including palliative shunts and conduits
     - Completely repaired congenital heart defect with prosthetic material or device, whether placed by surgery or by catheter intervention, during the first 6 months after the procedure
     - Repaired CHD with residual defects at the site or adjacent to the site of a prosthetic patch or prosthetic device (which inhibit endothelialization)
  4. Cardiac transplantation recipients who develop cardiac valvulopathy

- **Endocarditis prophylaxis not recommended for:**
  - Any other form of CHD not listed above
  - GI or GU procedures

Prophylactic regimens for dental procedures

Situation	Medication	Regimen
Oral	Amoxicillin	2 gm PO 1 hour before procedure
Unable to take oral medications	Ampicillin or Cefazolin or ceftriaxone	2 gm IM or IV 1 gm IM or IV 30 min before procedure
Penicillin allergy--oral	Cephalexin	2 gm PO 1 hour before procedure
	Clindamycin	600 mg PO 1 hour before procedure
	Azithromycin or Clarithromycin	500 mg PO 1 hour before procedure
Penicillin allergic and unable to take PO medications	Cefazolin or ceftriaxone	1 gm IM or IV 30 min before procedure
	Clindamycin	600 mg PO 1 hour before procedure

Adapted from Wilson W, Taubert KA, Gewitz M, Lockhart PB, Baddour LM, et al. Prevention of infective endocarditis. Circulation 2007;115:1-20.

Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS) Guidelines

The U.S. Department of Health and Human Services routinely issues guidance documents for the management of HIV infection. This table provides a summary of these recommendations for antiretroviral therapy (October 2006). For complete guidelines and updates, please refer to: **www.aidsinfo.nih.gov.**

Indications for Initiating Antiretroviral Therapy for the Chronically HIV-1 Infected Patient

Clinical Category	$CD4^+$ T Cell Count	Plasma HIV RNA	Recommendation
AIDS-defining illness or severe symptoms* **(AI)**	Any value	Any value	Treat
Asymptomatic **(AI)**	$< 200/mm^3$	Any value	Treat
Asymptomatic **(BII)**	$> 200/mm^3$ but $\leq 350/mm^3$	Any value	Treatment should be offered following full discussion of pros and cons with each patient
Asymptomatic **(CII)**	$> 350/mm^3$	$\geq 100,000$	Most clinicians recommend deferring therapy, but some clinicians will treat
Asymptomatic **(DII)**	$> 350/mm^3$	$< 100,000$	Defer therapy

Antiretroviral Regimens Recommended for Treatment of HIV-1 Infection in Antiretroviral Naïve Patients

Choose 1 from Column A + 1 from Column B		
	Column A (NNRTI or PI)	**Column B (Dual NRTI)**
Preferred	**NNRTI** Efavirenz **OR** **PI** Atazanavir + ritonavir OR Fosamprenavir + ritonavir OR Lopinavir/ritonavir (twice daily)	Emtricitabine/tenofovir OR Lamivudine/zidovudine
Alternative	**NNRTI** Nevirapine **OR** **PI** Atazanavir OR Fosamprenavir OR Fosamprenavir + ritonavir OR Lopinavir/ritonavir (once daily)	Abacavir/lamivudine OR Didanosine + (emtricitabine or lamivudine)

Medications Used for HIV/AIDS

	Name	**Strength**	Dosing	**Regard to food**
NRTI	Abacavir (ABC, Ziagen®)	300 mg tabs, 20 mg/ml oral solution	300 mg bid or 600 mg daily	Without regard to meals
	Didanosine (ddI, Videx EC®)	125, 200, 250, or 400 mg EC capsules	Wt > 60 kg: 400 mg daily (250 mg with tenofovir) Wt < 60 kg: 250 mg daily (200 mg with tenofovir)	Empty stomach
	Emtricitabine (FTC, Emtriva™)	200 mg capsules, 10 mg/ml solution	200 mg capsule once daily or 240 mg solution once daily	Without regard to meals

	Lamivudine (3TC, Epivir®)	150 and 300 mg tablets, 10 mg/ml oral solution	150 mg bid or 300 mg daily	Without regard to meals
	Stavudine (d4T, Zerit®)	15, 20, 30, 40 mg capsules, 1 mg/ml oral solution	Wt > 60 kg: 40 mg bid Wt < 60 kg: 30 mg bid	Without regard to meals
	Tenofovir (TDF, Viread®)	300 mg tabs	1 tab daily	Without regard to meals
	Zidovudine (AZT, ZDV, Retrovir®)	100 mg capsules, 300 mg tablets, 10 mg/ml IV solution, 10 mg/ml oral solution	300 mg bid or 200 mg tid	Without regard to meals
	Combinations			
	Abacavir + zidovudine + lamivudine (ABC+ZDV+3TC, Trizivir®)	ABC 300mg + ZDV 300mg + 3TC 150mg	1 tablet bid	Without regard to meals
	Abacavir + lamivudine (ABC + 3TC, Epzicom®)	ABC 600mg + 3TC 300mg	1 tablet daily	Without regard to meals
	Emtricitabine + tenofovir (FTC + TDF, Truvada™)	FTC 200mg + TDF 300mg	1 tablet daily	Without regard to meals
	Lamivudine + zidovudine (3TC + ZDV, Combivir®)	3TC 150mg + ZDV 300mg	1 tablet bid	Without regard to meals
	Efavirenz + emtricitabine + tenofovir (EFV + FTC + TDF, Atripla™)	EFV 600 mg + FTC 200 mg + TDF 300mg	1 tablet daily	Without regard to meals
NNRTI	Delavirdine (DLV, Rescriptor®)	100, 200 mg tabs	400 mg tid	Without regard to meals

	Nevirapine (NVP, Viramune®)	200 mg tabs or 50 mg/5ml oral suspension	200 mg daily x 14 days, then 200 mg bid	Without regard to meals
	Efavirenz (EFV, Sustiva®)	50, 100, 200 mg capsules or 600 mg tablets	600 mg HS	Empty stomach, avoid high fat meal

Medications Used for HIV/AIDS

	Name	**Strength**	Dosing	**Regard to food**
PI	Amprenavir (APV, Agenerase®)	50 mg caps, 15 mg/ml oral solution (not interchangeable on a mg/mg basis)	1400 mg bid (oral solution)	Avoid high fat meal
	Atazanavir (ATV, Reyataz™)	100, 150, 200 mg caps	400 mg daily (300 mg + 100 mg ritonavir if taken with efavirenz or tenofovir)	W/ food
	Darunavir (DRV, Prezista™)	300 mg tablet	600 mg + ritonavir 100 mg bid	W/food
	Fosamprenavir (fAPV, Lexiva™)	700 mg tabs	**ARV-naïve patients:** 1400 mg bid OR 1400 mg + ritonavir 200 mg daily OR 700 mg + ritonavir 100 mg bid **PI-experienced patients (Daily not recommended):** 700mg + ritonavir 100mg bid **Coadministration w/ efavirenz (fAPV boosted only):** 700 mg + ritonavir 100 mg bid OR 1,400mg + ritonavir 300mg daily	Without regard to meals

	Indinavir (Crixivan®)	200, 333, 400 mg caps	800 mg q8hrs OR 800 mg + ritonavir 100-200 mg q12hrs	1 hour before or 2 hours after meal
	Lopinavir/ritonavir (LPV/r, Kaletra®)	**Caps:** 133.3 mg/ 33.3 mg **Tabs:** 200mg/ 50 mg **Solution:** 400 mg/100 mg per 5 ml	400 mg/100 mg twice daily OR 800 mg/200 mg once daily	W/food
	Nelfinavir (NFV, Viracept®)	250, 625 mg tabs 50 mg/g oral powder	1250 mg bid OR 750 mg tid	W/food
	Ritonavir (RTV, Norvir®)	100 mg caps OR 600 mg/7.5 ml solution	600 mg q12hrs (as sole PI) OR 100-400 mg in 1-2 divided doses (as PI booster)	W/food
	Saquinavir (SQV, Invirase®)	200 mg hard gel caps, 500 mg tabs	1000 mg + ritonavir 100 mg bid	W/food
	Tipranavir (TPV, Aptivus®)	250 mg capsules	500 mg + ritonavir 100 mg twice daily	W/food
Fusion Inhibitors	Enfuvirtide (T20, Fuzeon™)	90 mg/1 mL inj	90 mg SC bid	

Drug Treatment for Fungal Infections

For the latest guidelines please refer to: http://www.idsociety.org

Empiric Treatment for suspected candidal infections may be considered in febrile patients with the following risk factors:

- Prolonged use of antibacterial antibiotics
- Immunosuppression
- Colonization by candida of multiple nonsterile sites
- Central venous catheters
- Hyperalimentation
- Surgery (especially surgery that transects the gut wall)
- Prolonged ICU stay
- Urinary tract instrumentation
- Advanced Age

Typical Antifungal Doses

Antifungal	Daily Dose (range)	Dose Adjustment with Renal Impairment
Fluconazole	IV or PO: 400 mg (200-800)	Yes
Itraconazole	200 mg (100-400)	Intravenous use not recommended with a CrCl < 30 ml/min
Voriconazole*	IV:6 mg/kg q12h x 2 doses, then 4 mg/kg q12h PO: 200 mg bid	Intravenous use not recommended with a CrCl < 30 ml/min
Posaconazole#	200 mg tid	No
Caspofungin*	70 mg x 1, then 50 mg	No
Amphotericin B	0.5 mg/kg (0.25-1.5)	No
Amphotericin B lipid complex	5 mg/kg	No

*Restricted to ID, Critical Care/Pulmonary, and Heme/Onc
#Restricted to ID and Heme/Onc

References:

1) Pappas PG, et al. *Guidelines for Treatment of Candidiasis*. CID 2004;38:161-189.
2) O'Grady, et al. Practice Guidelines for evaluating new fever in critically ill adult patients. CID 1998; 26:1042-59.
3) Slain DS, et al. Intravenous itraconazole. Ann Pharmacother 2001;35:720-729.
4) Prescribing Information. **Http://www.sporanox.com**

Acute Ischemic Stroke Guidelines

1. Fever is associated with increased morbidity/mortality. The source of any fever following stroke should be ascertained and treated with antipyretics.
2. Optimal management of hypertension remains controversial. Blood pressure may fall spontaneously if patient is allowed to rest in a quiet room, bladder is emptied, and headache or pain controlled. There is **no proven benefit for lowering blood pressure in patients with acute ischemic stroke**, and antihypertensive agents should be withheld unless DBP > 120 or SBP >220 mmHg. When treatment of blood pressure is necessary, a reasonable goal would be to lower blood pressure by ~15% during the first 24 hours. In particular, "prn" orders for oral antihypertensives should be avoided. Consider one of the following options:
   - Labetalol 10-20 mg IV prn SBP >220 OR DBP>120. May repeat or double dose every 10 min until max. of 300 mg **OR** Labetalol 10 mg IV followed by an infusion of 2-8 mg/min to achieve 15% reduction in BP
   - Nicardipine 5 mg/hour IV infusion. Titrate by 2.5 mg/hr every 5 min. to max. of 15 mg/hr until 15% reduction in BP (NOTE: cost ~ $300 per day!)
   - **If DBP>140**: Nitroprusside 0.25 mcg/kg/min IV infusion, titrate to achieve a 15% reduction in BP.
   - In patients who have preexisting hypertension and are neurologically stable, antihypertensive medications should be restarted at ~24 hours unless a specific contraindication exists.
3. Use of IV rtPA per protocol is recommended for patients who can be treated within 3 hours of symptom onset. Potential complications of IV rtPA include bleeding and angioedema.
4. Use of intra-arterial thrombolysis is an option for patients with major stroke of less than 6 hours duration due to large vessel occlusions of the MCA. Use in patients with basilar artery occlusion should be individualized.
5. Evidence indicates that persistent hyperglycemia (>140 mg/dL) during the first 24 hours after stroke is associated with poor outcomes, and thus hyperglycemia should be treated in patients with acute ischemia stroke.
6. Low dose subcutaneous heparin or LMWH or IPC is strongly recommended to prevent DVT in immobilized patients (grade A recommendation).
7. Published guidelines specifically state that anticoagulation with full doses of heparin or LMWH is **NOT** recommended for patients with acute ischemic stroke (grade A).
8. ASA 325 mg should be given within 24-48 hours after stroke onset.
9. The administration of clopidogrel alone or in combination with aspirin is not recommended for the treatment of acute ischemic stroke.
10. Early mobilization and comprehensive rehabilitation measures are strongly recommended.
11. Corticosteroids are not recommended for the management of cerebral edema and increased ICP following ischemic stroke.

Parenteral anticoagulation should not be prescribed until a brain imaging study has excluded the possibility of a primary intracranial hemorrhage. The level of anticoagulation should be closely monitored if a patient is receiving one of these medications.

Stroke. 2007;38:1655-1711

Pain Guidelines:

- **Non-opioid analgesics (e.g., acetaminophen, NSAIDs) are useful in both acute and chronic pain. They are recommended in most analgesic regimens for patients unless the patient has a contraindication to using them.[1]**
  - Acetaminophen
    - Little/no anti-inflammatory effect and does not damage the gastric mucosa[1]
    - Food and Drug Administration (FDA) maximum recommended dose is 4 grams/day[2]
    - Based on recent evidence, the American Liver Foundation recommends a maximum dose of 3 grams/day[3]
    - **Not recommended in neutropenic patients**
  - NSAIDs[1] (Examples include: ketorolac, ibuprofen, naproxen, and ketoprofen)
    - NSAIDs can produce gastrointestinal disturbances (nausea, vomiting, heartburn, dyspepsia, ulceration, GI bleed)
      - In patients where protection against ulcers is warranted, consider a proton pump inhibitor
      - Use the lowest possible dose for the shortest amount of time
        - Ketorolac (Toradol®) use should be limited to 5 days because of increased risk for GI hemorrhage
    - NSAIDs can induce renal insufficiency

- **Add an opioid analgesic to a non-opioid in a patient with acute pain or chronic cancer-related pain if the pain is not controlled.[1]**
  - Opioids are available in combination with non-opioids (e.g, oxycodone with acetaminophen)
    CAUTION: be cautious of the amount of acetaminophen in combination products, especially if being used in conjunction with other acetaminophen containing products
  - All opioids are metabolized by the liver and should be used with caution in patients with moderate-to-severe liver impairment, impaired ventilation, bronchial asthma, increased intracranial pressure, moderate-to-severe renal impairment and paralytic ileus.

Table 1: Selected Opioids that are morphine-like agonists[4]

Opioid	Oral equianalgesic dose (mg)	Parenteral equianalgesic dose (mg)	Precautions/Contraindications
Morphine	30	10	-May accumulate in renal impairment-has active metabolites

Hydromorphone	7.5	1.5	-May accumulate in renal impairment-NO active metabolites
Oxycodone	20	Not applicable	-May accumulate in renal impairment-has some active metabolites
Methadone*	Not applicable Contact pharmacy for dosing	Not applicable Contact pharmacy for dosing	-Dose titration should be done cautiously-takes about 4-5 days to reach steady state levels -Caution in older adults
Oxymorphone	10	Not applicable	-May accumulate in renal impairment-has some active metabolites

* Dosing is dependent on individual patient characteristics.

- Tramadol is a weak opioid agonist that also inhibits the reuptake of serotonin and norepinephrine. Tramadol lowers the seizure threshold; therefore, do not use in doses greater than 400 mg per day.[1]
- Fentanyl is available in a transdermal patch, lozenge, buccal tablet, iontophorectic transdermal system, and IV formulations. The patch is not intended for acute pain which includes post-operative pain.[1]

- **The route, dosage, and schedule of the analgesic needs to be individualized.[1]**
  - The oral route is preferable for analgesic administration.
  - The intramuscular route has the disadvantages of painful administration, and wide fluctuations in absorption.
  - The intravenous bolus route provides the most rapid onset for analgesia. Intravenous infusion route provides steady state blood concentrations of opioids and may be helpful in chronic pain conditions. Use extreme caution in opioid-naïve patients. Do not use opioids such as methadone and levorphanol in this way due to their long elimination half-lives.
  - Transdermal route
    - fentanyl patch (Duragesic®)
    - fentanyl iontophorectic transdermal system (Ionsys®)
  - Oral transmucosal route
    - Fentanyl citrate lozenge (Actiq®)
    - Fentanyl buccal tablet (Fentora™)
  - Rectal route is an alternative to those patients who cannot tolerate medications through the oral route.
  - PCA: See PCA protocol on pages 19 and 23 of the therapeutics manual.
  - Opioid titration should be individualized and adjusted to patient tolerance or emergence of adverse effects.

- **If the pain is present most of the day, then analgesics should be administered on a regular basis (not PRN).**[1]
    - a PRN order for a supplementary opioid should be used if necessary for breakthrough pain

- **Familiarize yourself with dose and time course of opioids**[1]
    - Sustained release regimens
        - To determine a sustained-release regimen, treat patient for 24-48 hours with an immediate-release opioid to determine the total daily dose of opioid required. Once the total daily dose of opioid is determined, prescribe 2/3 of the total daily opioid dose as sustained release preparation and provide the remainder of the dose as PRN immediate-release opioid.

- **To change to a new opioid or different route, use the equianalgesic table.**

- **Be able to recognize and treat the side effects of opioids.**[1]
    - The most common side effects of opioids include sedation, constipation, nausea, vomiting, itching, and respiratory depression. Patients generally gain tolerance to most opioid-induced adverse effects following several days of therapy.
    - Ways to manage side effects include
        - Change the dosing regimen or route of the drug in order to aim for more constant blood levels
        - Use a different opioid
        - Use multidrug and multimodal therapy
            - E.g., utilize an NSAID or an adjunct medication in order to reduce the dose of the opioid
        - Use another drug that counteracts the adverse effect of the opioid
            - Sedation
                - May be partially counteracted with a stimulant for patients receiving chronic opioid therapy (e.g., caffeine, dextroamphetamine, methylphenidate)
                  (The addition of a stimulant is not generally required for short-term opioid usage since patients gain tolerance to this adverse effect with continued use of the medication)
            - Constipation (Patients NEVER gain tolerance to this adverse effect).
                - Ensure that patient is on an appropriate bowel prophylaxis regimen
                - Patients who are taking opioids should take a stimulating laxative (e.g, senna, bisacodyl) in order to increase bowel motility with or without a stool softener according to stool consistency

        - A stool softener alone is not sufficient
    - Nausea and Vomiting
      Consider rotating to another opioid OR
        - For opioid induced nausea and vomiting consider adding a phenothiazine (prochlorperazine) or prokinetic agent (metoclopramide)
        - For motion-exacerbated nausea (due to vestibular disturbance) consider an antiemetic with antihistamine properties such as meclizine or scopolamine
        - For more severe or uncontrolled nausea consider a $5HT_3$ antagonist (e.g., ondansetron)
    - Itching
      Consider rotating to another opioid OR
        - Manage with antihistamines (e.g., diphenhydramine, promethazine, hydroxyzine, loratadine)
    - Respiratory depression
        - Monitor patient closely for respiratory depression
        - If needed, use an opioid antagonist (e.g, naloxone)

- **Do not use meperidine due to its hazards such as neurotoxicity risk. Be aware the potential hazards such as psychomimetic effects of mixed agonist-antagonists (e.g., pentazocine).[1]**

- **Adjunctive agents**
    - Glucocorticoids (e.g, dexamethasone)[1]
        - May decrease pain caused by edema—These may also be used for the management of bone pain
    - Bisphosphonates such as pamidronate and zoledronate and radionuclides such as strontium may be useful as adjuncts for metastatic bone pain[1]
    - Anticonvulsants[1]
        - Useful in neuropathic pain states (e.g., postherpetic neuralgia and trigeminal neuralgia)
        - Examples include gabapentin, pregabalin, phenytoin, carbamazepine, sodium valproate, clonazepam, topiramate, oxycarbazapine, lamotrigine, and zonisimade
            - Gabapentin is the most studied for pain and requires a dose reduction in renal insufficiency
    - Tricyclic antidepressants[1]
        - May be useful in diabetic neuropathy and postherpetic neuralgia
        - Relatively contraindicated in patients with coronary artery disease because they can worsen arrhythmias
        - Examples include nortriptyline, desipramine, amitriptyline, and imipramine
    - SNRI (Serotonin/norepinephrine reuptake inhibitor)[4]

        - Cymbalta® (duloxetine)
            - May be useful for the management of pain which is associated with diabetic neuropathy
    - Local anesthetics (e.g., EMLA cream, lidocaine patches)[1]
        - EMLA cream (lidocaine and prilocaine) may be useful for topical dermal anesthesia or post-herpetic neuralgia
        - Topical lidocaine patches may be useful for postherpetic neuralgia
    - Skeletal muscle relaxants/antispasmodic agents (e.g., carisoprodol, cyclobenzaprine)[1]
        - May be useful for acute muscle injury
    - Topical Agents (e.g., capsaicin)[1]
        - May be useful in peripheral neuropathic pain and arthritic pain

Terminology:[1]

- **Tolerance**:
    - A state of adaptation in which being exposed to a drug induces changes that cause a decrease in one or more of the drug's effects over the course of time
- **Physical dependence**:
    - A state of adaptation in which withdrawal symptoms may occur after abruptly stopping, quickly decreasing the dose, decreasing the blood level of a drug, and/or by administering an opioid antagonist. Withdrawal symptoms may be prevented by slowly tapering a patient off of the opioid.
        - Symptoms of withdrawal include anxiety, tachycardia, and sweating
    - Dependence is NOT addiction **and** this natural phenomena can occur with other classes of medications (e.g., antihypertensives)
- **Addiction: Continued use of a medication despite harm (to self or others)**
    - A chronic, neurobiologic disease with genetic, psychosocial, and environmental factors that influence its manifestations
    - Behaviors involved include: impaired control of drug use, compulsive use of the drug, craving of the drug, and drug-seeking behavior
    - ***Pseudoaddiction***
        - A term used to describe behaviors that a patient may exhibit when their pain is under treated.
        - These behaviors generally resolve when a patient's pain is effectively treated.

References:

1. Principles of analgesic use in the treatment of acute pain and cancer pain. American Pain Society. Fifth edition.
2. Letter from the Department of Health and Human Services. October 2005. www.fda.gov. Accessed August 24, 2007.

3. American Liver Foundation Issues Warning on Dangers of Excess Acetaminophen. http://www.liverfoundation.org/about/news/33/ Accessed August 22, 2007.
4. Adapted table from: principles of analgesic use in the treatment of acute pain and cancer pain. American Pain Society. Fifth edition.
5. Lexi-Comp Online: Duloxetine. Last updated on 8/10/2007.

SELECTED DRUGS THAT REQUIRE RENAL DOSING ADJUSTMENT

AMINOGLYCOSIDES		
DRUG	**NORMAL DOSE**	**RENAL ADJUSTMENT**
Amikacin (Amikin®)	Varies depending on indication	Cl_{cr} ≥60 mL/minute: Administer every 8 h Cl_{cr} 40-60 mL/minute: Administer every 12 h Cl_{cr} 20-40 mL/minute: Administer every 24 h Cl_{cr} <20 mL/minute: Loading dose, then monitor levels
Gentamicin (Garamycin®)	Varies depending on indication	Cl_{cr} ≥60 mL/minute: Administer every 8 h Cl_{cr} 40-60 mL/minute: Administer every 12 h Cl_{cr} 20-40 mL/minute: Administer every 24 h Cl_{cr} <20 mL/minute: Loading dose, then monitor levels
Tobramycin (Nebcin®)	Varies based on indication	Cl_{cr} ≥60 mL/minute: Administer every 8 h Cl_{cr} 40-60 mL/minute: Administer every 12 h Cl_{cr} 20-40 mL/minute: Administer every 24 h Cl_{cr} 10-20 mL/minute: Administer every 48 h Cl_{cr} <10 mL/minute: Administer every 72 h
CEPHALOSPORINS		
Cefazolin (Ancef®)	250 mg to 2 g every 6-12 h	Cl_{cr} 10-30 mL/minute: Administer every 12 h Cl_{cr} <10 mL/minute: Administer every 24 h
Cefadroxil (Duricef®)	1-2 g/day in 2 divided doses	Cl_{cr} 10-25 mL/minute: Administer every 24 h Cl_{cr} <10 mL/minute: Administer every 36 h
Cephalexin (Keflex®)	250-1000 mg every 6h	Cl_{cr} >10 mL/minute: 250-500 mg every 8-12 h Cl_{cr} <10 mL/minute: 250-500 mg every 12-24 h
Cefdinir (Omnicef®)	300 mg twice daily or 600 mg once daily	Cl_{cr} <30 mL/min: 300 mg once daily

Cefoxitin (Mefoxin®)	1-2 g every 6-8 h	Cl_{cr} 30-50 mL/minute: Administer 1-2 g every 8-12 h Cl_{cr} 10-29 mL/minute: Administer 1-2 g every 12-24 h Cl_{cr} 5-9 mL/minute: Administer 0.5-1 g every 12-24 h Cl_{cr} <5 mL/minute: Administer 0.5-1 g every 24-48 h
Cefaclor (Ceclor®)	250-500 mg tid	50-100% normal dose CrCl <10 administer 50% normal dose
Cefuroxime (Zinacef®)	Oral: 250-500 mg twice daily I.M., I.V.: 750 mg to 1.5 g every 6-8 h or 100-150 mg/kg/day in divided doses every 6-8 h	Cl_{cr} 10-20 mL/minute: Administer every 12 h Cl_{cr} <10 mL/minute: administer every 24 h
Cefixime (Suprax®)	400 mg/day divided every 12-24 h	Cl_{cr} 21-60 mL/minute or with renal hemodialysis: Administer 75% of the standard dose Cl_{cr} <20 mL/minute or with CAPD: Administer 50% of the standard dose
Ceftizoxime (Ceftizox®)	1-4 g every 8-12 h	Cl_{cr} 50-79 mL/minute: Administer 500-1500 mg every 8 h Cl_{cr} 5-49 mL/minute: Administer 250-1000 mg every 12 h Cl_{cr} 0-4 mL/minute: Administer 500-1000 mg every 48 h or 250-500 mg every 24 h
Cefepime (Maxipime®)	1-2 g q6-12h	See package insert for details
MACROLIDES		
Clarithromycin (Biaxin®)	250-500 mg every 12 h **or** 1000 mg (two 500 mg extended release tablets) once daily	Cl_{cr} <30 mL/minute: Half the normal dose or double the dosing interval
Erythromycin (various)	Varies- see package inserts	Cl_{cr} <10 mL/minute: see package inserts
PENICILLINS		

Amoxicillin (Amoxil®/Trimox®)	250-500 mg every 8 h or 500-875 mg twice daily	Cl_{cr} 10-30 mL/minute: 250-500 mg every 12 h Cl_{cr} <10 mL/minute: 250-500 mg every 24 h
Ampicillin (Polycillin®) IV	250-500 mg every 6 h	Cl_{cr} >50 mL/minute: Administer every 6 h Cl_{cr} 10-50 mL/minute: Administer every 6-12 h Cl_{cr} <10 mL/minute: Administer every 12-24 h
Penicillin G (various)	Varies depending on indication	Cl_{cr} >10 mL/minute: Administer full loading dose followed by 1/2 loading dose given every 4-5 h Cl_{cr} <10 mL/minute: Administer full loading dose followed by 1/2 loading dose given every 8-10 h
Piperacillin (Pipracil®)	2-4 g/dose every 4-6 h	Cl_{cr} 20-40 mL/minute: Administer 3-4 g every 8 h Cl_{cr} <20 mL/minute: Administer 3-4 g every 12 h
Piperacillin/ Tazobactam (Zosyn®)	3.375 g every 6 h **or** 4.5 g every 6-8 h	Cl_{cr} 20-40 mL/minute: Administer 2.25 g every 6 h (3.375 g every 6 h for nosocomial pneumonia) Cl_{cr} <20 mL/minute: Administer 2.25 g every 8 h (2.25 g every 6 h for nosocomial pneumonia)
Ampicillin/Sulfactam (Unasyn®)	1.5-3 g every 6 h	Cl_{cr} 15-29 mL/minute: Administer every 12 h Cl_{cr} 5-14 mL/minute: Administer every 24 h
Amoxicillin/ Clavulonate (Augmentin®)	250-500 mg every 8 h or 875 mg every 12 h	Cl_{cr} <30 mL/minute: Do not use 875 mg tablet or extended release tablets Cl_{cr} 10-30 mL/minute: 250-500 mg every 12 h Cl_{cr} <10 mL/minute: 250-500 every 24 h
QUINOLONES		
Ciprofloxacin (Cipro®)	Oral: 250-750 mg every 12 h I.V.: 200-400 mg every 12 h	Refer to package insert
Levofloxacin (Levaquin®)	250-500 mg every 24 hours; severe or complicated infections: 750 mg every 24 h	See package insert
OTHER ANTIBIOTICS		
Metronidazole (Flagyl®)	7.5 mg/kg every 6 h	100% normal dose Cl_{cr} <10 mL/minute: 50% normal dose

Aztreonam (Azactam®)	2 g every 8 h	50-75% normal dose Cl_{cr} <10 mL/minute: 25% normal dose
Tetracycline (various)	250-500 mg qid	250-500 mg every 12-24 h Cl_{cr} <10 mL/minute: 250-500 mg every 24 h
Vancomycin (Vancocin®)	1 g every 12 h	1 g every 24 h Cl_{cr} <10 mL/minute: 1g every 48-72 h
Ethambutol (Myambutol®)	See package insert	Cl_{cr} 10-50 mL/minute: Administer every 24-36 h Cl_{cr} <10 mL/minute: Administer every 48 h
Meropenem (Merrem®)	1.5-6 g/day divided every 8 h	Cl_{cr} 26-50 mL/minute: Administer recommended dose based on indication every 12 h Cl_{cr} 10-25 mL/minute: Administer one-half recommended dose every 12 h Cl_{cr} <10 mL/minute: Administer one-half recommended dose every 24 h
Pyrazinamide (Tebrazid™)	See package insert	Cl_{cr} <50 mL/minute: Avoid use or reduce dose to 12-20 mg/kg/day
Nitrofurantoin (Furadantin®, Macrobid®, Macrodantin®)	See package insert	Cl_{cr} <60 mL/minute: Contraindicated
Septra	See package insert	Cl_{cr} 15-30 mL/minute: Administer 50% of recommended dose Cl_{cr} <15 mL/minute: Use is not recommended
Trimethoprim	100 mg every 12 h or 200 mg every 24 h for 10 days; longer treatment periods may be necessary for prostatitis (i.e., 4-16 weeks); in the treatment of *Pneumocystis carinii* pneumonia; dose may be as high as 15-20 mg/kg/day in 3-4 divided doses	Cl_{cr} 15-30 mL/minute: Administer 100 mg every 18 h or 50 mg every 12 h Cl_{cr} <15 mL/minute: Administer 100 mg every 24 h or avoid use

Imipenem/Cilastatin (Primaxin®)	Dosage based on **imipenem** content I.V.: Weight ≥70 kg: 250-1000 mg every 6-8 h; maximum: 4 g/day. **Note:** For adults weighing <70 kg, refer to Dosing Adjustment in Renal Impairment	See package insert
OTHER DRUGS:		
Allopurinol (Zyloprim®)	See package insert	See package insert
Disopyramide (Norpace®)	100-300 mg every 6-12 h	Cl_{cr} 30-40 mL/minute: Administer every 8 h Cl_{cr} 15-30 mL/minute: Administer every 12 h or alter the dose as follows: Cl_{cr} 30-<40 mL/minute: Reduce dose 50% Cl_{cr} 15-30 mL/minute: Reduce dose 75% Cl_{cr} <15 mL/minute: Administer every 24 h
Enoxaparin (Lovenox®)	Treatment: 1.5mg/kg daily or 1 mg/kg every 12 h Prophylaxis: 30 mg BID or 40 mg daily	Cl_{cr} <30 mL/minute: Treatment: 1 mg/kg daily Prophylaxis: 30 mg daily
Famotidine (Pepcid®)	20-40 mg hs	Cl_{cr} <50 mL/minute: Manufacturer recommendation: Administer 50% of dose **or** increase the dosing interval to every 36-48 h (to limit potential CNS adverse effects).
Gabapentin (Neurontin®)	900-3600mg per day	Cl_{cr} ≥60 mL/minute: 300-1200 mg tid Cl_{cr} >30-59 mL/minute: 200-700 mg bid Cl_{cr} >15-29 mL/minute: 200-700 mg daily Cl_{cr} <15 mL/minute: 100-300 mg daily
Ketorolac (Toradol®)	I.M.: 60 mg as a single dose or 30 mg every 6 h (maximum daily dose: 120 mg) I.V.: 30 mg as a single dose or 30 mg every 6 h (maximum daily dose: 120 mg) Oral: 20 mg, followed by 10 mg every 4-6 h; do not exceed 40 mg/day; oral dosing is intended to be a continuation of I.M. or I.V. therapy only	Contraindicated in patients with advanced renal impairment. Patients with moderately-elevated serum creatinine should use half the recommended dose, not to exceed 60 mg/day I.M./I.V

Meperidine (Demerol®)	50-100 mg every 2-4 h	Cl_{cr} 10-50 mL/minute: 75% normal dose Cl_{cr} <10 mL/minute: 50% normal dose
Morphine (various)	Starting dose: 1 mg every 3-4 h, acute pain	75% normal dose Cl_{cr} <10 mL/minute: 50% normal dose
Metoclopramide (Reglan®)	See package insert	Cl_{cr} <40 mL/minute: Administer at 50% of normal dose
Primidone (Mysoline®)	125-250 mg/day at bedtime; increase by 125-250 mg/day every 3-7 days; usual dose: 750-1500 mg/day in divided doses 3-4 times/day with maximum dosage of 2 g/day	Cl_{cr} 50-80 mL/minute: Administer every 8 h Cl_{cr} 10-50 mL/minute: Administer every 8-12 h Cl_{cr} <10 mL/minute: Administer every 12-24 h
Procainamide (Procan SR®, Pronestyl®)	See package insert	Oral: Cl_{cr} 10-50 mL/minute: Administer every 6-12 h Cl_{cr} <10 mL/minute: Administer every 8-24 h I.V.: Loading dose: Reduce dose to 12 mg/kg in severe renal impairment. Maintenance infusion: Reduce dose by one-third in patients with mild renal impairment. Reduce dose by two-thirds in patients with severe renal impairment.
Sotalol (Betapace®)	See package insert	See package insert
ANTIVIRALS		
Didanosine	See package insert	See package insert
Famciclovir	See package insert	See package insert
Ganciclovir	Oral: 1000 mg 3 times/day with food **or** 500 mg 6 times/day with food 5 mg/kg/dose every 12 h or 5 mg/kg/day as a single daily dose	See package insert
Lamivudine	See package insert	See package insert

Stavudine	≥60 kg: 40 mg every 12 h <60 kg: 30 mg every 12 h	Cl_{cr} >50 mL/minute: ≥60 kg: 40 mg every 12 h <60 kg: 30 mg every 12 h Cl_{cr} 26-50 mL/minute: ≥60 kg: 20 mg every 12 h <60 kg: 15 mg every 12 h Cl_{cr} 10-25 mL/minute, hemodialysis (administer dose after hemodialysis on day of dialysis): ≥60 kg: 20 mg every 24 h <60 kg: 15 mg every 24 h
Valacyclovir	See package insert	See package insert
Zalcitabine	0.75 mg tid	Cl_{cr} 10-40 mL/minute: 0.75 mg every 12 h Cl_{cr} <10 mL/minute: 0.75 mg every 24 h
Zidovudine	See package insert	Cl_{cr} <15 mL/minute including hemo-/peritoneal dialysis: 100 mg (oral) or 1 mg/kg (I.V.) every 6-8 h
ANTIFUNGALS		
Fluconazole	200-800 mg/day; duration and dosage depends on severity of infection	No adjustment for vaginal candidiasis single-dose therapy For multiple dosing, administer usual load then adjust daily doses as follows: Cl_{cr} ≤50 mL/minute (no dialysis): Administer 50% of recommended dose or administer every 48 h
Flucytosine	Oral: 50-150 mg/kg/day in divided doses every 6 h	Cl_{cr} 20-40 mL/minute: Administer 37.5 mg/kg every 12 h Cl_{cr} 10-20 mL/minute: Administer 37.5 mg/kg every 24 h Cl_{cr} <10 mL/minute: Administer 37.5 mg/kg every 24-48 h, but monitor drug concentrations frequently

Itraconazole	100-400 mg/day; doses >200 mg/day are given in 2 divided doses; length of therapy varies from 1 day to >6 months depending on the condition and mycological response	Not necessary; itraconazole injection is not recommended in patients with Cl_{cr} <30 mL/minute; hydroxypropyl-β-cyclodextrin (the excipient) is eliminated primarily by the kidneys
Terbinafine	250-500 mg/day	Cl_{cr} <50 mL/minute: Oral administration is not recommended
Voriconazole	Oral: 100-300 mg every 12 h I.V.: 6 mg/kg every 12 h for 2 doses; followed by maintenance dose of 4 mg/kg every 12 h	Cl_{cr} <50 mL/minute, accumulation of the intravenous vehicle (SBECD) occurs. After initial loading dose, oral voriconazole should be administered to these patients, unless an assessment of the benefit: risk to the patient justifies the use of I.V. voriconazole.

Therapeutic Drug Monitoring

DRUG	SAMPLING TIME	THERAPEUTIC RANGE	MAJOR ROUTE OF ELIMINATION	SERUM HALF LIFE (nl)	COMMENTS
Amikacin	Trough: 30 minutes before the dose Peak: 30 minutes after the infusion has ended	Trough: 4-8 mcg/ml Peak: 15-30 mcg/ml	Renal: 100%	1.5-3 h	Persistent high levels may increase incidence of ototoxicity and nephrotoxicity.
Carbamazepine	Trough concentration	4-12 mcg/ml	Hepatic: 99%	8-20 h	Active metabolite is eliminated renally.
Digoxin	6 h after dose	CHF: 0.5-1 ng/ml Afib: 0.5-2.0 ng/ml	Renal: 75-85% Hepatic: 15%	36-44 h	
Gentamicin	Trough: 30 minutes before the dose Peak: 30 minutes after infusion has ended	Trough: 0.5-2 mcg/ml Peak: 3-10 mcg/ml	Renal: 100%	1.5-3 h	Persistent high levels may increase incidence of ototoxicity and nephrotoxicity.
Lidocaine	6-24 h after start of infusion	1.5-5 mcg/ml	Hepatic: > 90% Renal: < 10%	1.2-2.2 h	Protein binding changes in MI leads to elevated concentration; metabolite accumulates in renal failure.

Therapeutic Drug Monitoring

DRUG	SAMPLING TIME	THERAPEUTIC RANGE	MAJOR ROUTE OF ELIMINATION	SERUM HALF LIFE (nl)	COMMENTS
Lithium	12 h after evening dose	Acute mania: 0.6-1.2 mEq/L Bipolar: 0.8-1 mEq/L	Renal: 90%	14-28 h	Fluid and electrolyte manipulations may cause variations in steady-state concentrations.
Phenobarbital	Trough concentration	Adults: 20-40 mcg/ml Infants/children: 15-30 mcg/ml	Hepatic: 80% Renal: 20%	60-150 h	Half-life is decreased in children and is elevated in cirrhosis, elderly, and by valproic acid.
Phenytoin	Trough concentration	Adults/children: 10-20 mcg/ml Neonates: 8-15 mcg/ml Free level 1-2 mcg/ml	Hepatic: >95%	Dose & concentra - tion dependent	Therapeutic range for total phenytoin concentration decreases in ESRD and hypoalbuminemia.
Procainamide (PCA)	1 h after loading dose then every 24 h until stable	PCA: 4-10 mcg/ml NAPA: 15-25 mcg/ml	Renal: 50% Hepatic: 50%	2.5-5 h	Active metabolite, NAPA, is eliminated in urine 90% unchanged. NAPA accumulates in renal failure.
Quinidine	Trough concentration	2-5 mcg/ml	Hepatic: 60-80% Renal: 10-30%	5-7 h	Hepatic cirrhosis & CHF decrease clearance; phenobarbital and phenytoin increase clearance.

Therapeutic Drug Monitoring

DRUG	SAMPLING TIME	THERAPEUTIC RANGE	MAJOR ROUTE OF ELIMINATION	SERUM HALF LIFE (nl)	COMMENTS
Theophylline	IV: 30 min after load, then 12-18 h after maintenance PO: Trough conc.	COPD and asthma 5-15 mcg/ml Neonatal apnea: 6-13 mcg/ml Pregnancy: 3-12 mcg/ml	Hepatic: > 90% Renal: < 10%	6-8 h	Half-life is influenced by factors affecting hepatic enzymes.
Tobramycin	Trough: 30 minutes before the dose Peak: 30 minutes after the infusion has started	Trough: < 0.5-2 mcg/ml Peak: 3-10 mcg/ml	Renal: 100%	1.5-3 h	Persistent high levels may increase incidence of ototoxicity and nephrotoxicity.
Valproic acid	Trough concentration	Epilepsy: 50-100 mcg/ml Mania: 50-125 mcg/ml	Hepatic: 95%	10 h	Carbamazepine and phenytoin decrease half-life; protein binding is dependent on serum concentration.
Vancomycin	Trough: immediately before dose	Trough: 5-20 mcg/ml	Renal: 90%	2.5-6 h	Monitor trough for possible accumulation in renal failure. Avoid checking peak concentrations (frequent errors).

Equianalgesic Doses for Select Opioids Used in Severe Pain[1,2]

Opioid	*Common Proprietary Names*	*Starting Dose*	*Usual Dosing Interval*	*Oral Equianalgesic Dose*	*Parenteral Equianalgesic Dose*
Morphine	***Immediate release***: MSIR, Roxanol® ***Sustained release:*** MS Contin® Kadian® and Avinza®	15-30 mg po	3-4 hours 8-12 hours 12-24 hours	30 mg	10 mg
HYDROmorphone	Dilaudid®	4-8 mg po	Oral: 3-6 hours IV: 2-3 hours	7.5 mg	1.5 mg
*Meperidine	Demerol®	Not Recommended	3-4 hours	300 mg	75 mg
Oxycodone	***Immediate release***: OxyIR®, Roxicodone® Percocet® (combo product with acetaminophen) ***Sustained release***: Oxycontin®	10-20 mg po	4-6 hours 12 hours	20 mg	Not applicable

*Not recommended according to the American Pain Society.

Please Note:

- **The equianalgesic doses presented in the table are those for severe pain.**
- **When converting scheduled doses of opiates, decrease the amount of the new dose by 25-50% to account for incomplete opioid cross tolerance. This reduction is not necessary when converting PRN doses.**

Therefore, use the following formula to convert from one opioid to another:

$$\frac{\text{Total daily dose of the new opioid}}{\text{Equianalgesic dose of new opioid}} = \frac{\text{Total daily dose of the old opioid}}{\text{Equianalgesic dose of old opioid}}$$

Example Calculations:

Example 1:

An adult patient has a prescription for morphine 10 mg by mouth every four hours PRN pain. Calculate an equivalent dose of ORAL hydromorphone PRN pain.

Step 1: Calculate the total daily dose of the old opioid (morphine):
Answer: 10 mg x 6= 60 mg (total daily dose of morphine)
Step 2: Look on the chart to see the equianalgesic dose for ORAL morphine compared to ORAL hydromorphone.
Answer: 30 mg of oral morphine is equal to 7.5 mg of oral hydromorphone.
Step 3: Substitute the values determined from steps 1 and 2 into the equation to solve for the total daily dose of the new opioid or X.

Answer: $\frac{\text{Total daily dose of hydromorphone } \mathbf{(X)}}{\text{7.5 mg of oral hydromorphone}} = \frac{\text{60 mg of morphine per day}}{\text{30 mg of oral morphine}}$

X times 30 = 60 times 7.5
30X= 450 mg
X = 15 mg for the total daily dose of hydromorphone

Step 4: Divide this total daily dose by the number of hours in between doses to get the appropriate regimen.
Answer: Hydromorphone can be given every 3 to 6 hours. Therefore, if you give it every 4 hours, the dose would be 2.5 mg (15 mg divided by 6) every 4 hours PRN pain.
Hydromorphone 2.5 mg PO is equianalgesic to a dose of Morphine 10 mg PO.

Example 2: A patient is talking Oxycontin® 40 mg by mouth twice daily for chronic pain. She also takes oxycodone 10 mg by mouth every 4 hours as needed for pain, which she uses about two times per day. Her insurance has changed, and she must now use long-acting morphine (Morphine sulfate extended release) instead of long acting oxycodone (Oxycontin®).

Step 1: Calculate the total daily dose of the old opioid:
Answer: (40 mg x 2 of Oxycontin®) + (10 mg x 2 of oxycodone)= 100 mg (total daily dose)
Step 2: Look on the chart to see the equianalgesic dose for ORAL oxycodone compared to ORAL morphine.
Answer: 30 mg of morphine=20 mg of oxycodone
Step 3: Substitute the values determined from steps 1 and 2 into the equation to solve for the total daily dose of the new opioid X.

Answer: $\frac{\text{Total daily dose of morphine } \mathbf{(X)}}{\text{30 mg of morphine}} = \frac{\text{100 mg of oxycodone per day}}{\text{20 mg of oxycodone}}$

X times 20 = 30 times 100
20X=3000 mg
X= 150 mg for the total daily dose of morphine

Step 4: Decrease the amount of the new dose by 25-50% to account for incomplete opioid cross tolerance when converting from one opioid to another.
Answer: Reducing the dose of 150 mg by 25 to 50% would give a dose range of 75 to 112 mg of morphine per day.
Morphine sulfate extended release can be given every 12 hours.
Therefore, could use Morphine sulfate extended release 45 mg by mouth every 12 hours (90 mg per day).

References:

1. Principles of Analgesic Use in the Treatment of Acute Pain and Cancer Pain. American Pain Society. Fourth edition. 1999.
2. Lexi Drugs (Comp + Specialties). July 3. 2007.

Fentanyl Conversion

<table>
<tr>
<td>Transdermal Fentanyl Conversion
(Duragesic® 25, 50, 75, 100 mcg patch)
Not recommended for pediatrics</td>
<td>Oral transmucosal fentanyl citrate (OTFC)
(Actiq® 200, 400, 600, 800, 1200, 1600 mcg units)
Not recommended for pediatrics</td>
</tr>
<tr>
<td>
<table>
<tr><th>PO Morphine (mg/24 hr)</th><th>Duragesic® Equivalent (mcg/hr)</th></tr>
<tr><td>45-134</td><td>25</td></tr>
<tr><td>135-224</td><td>50</td></tr>
<tr><td>225-314</td><td>75</td></tr>
<tr><td>315-404</td><td>100</td></tr>
<tr><td>405-494</td><td>125</td></tr>
<tr><td>495-584</td><td>150</td></tr>
<tr><td>585-674</td><td>175</td></tr>
<tr><td>675-764</td><td>200</td></tr>
<tr><td>765-854</td><td>225</td></tr>
<tr><td>855-944</td><td>250</td></tr>
<tr><td>945-1034</td><td>275</td></tr>
<tr><td>1035-1124</td><td>300</td></tr>
</table>
Allow 12 to 16 hrs for patch to be effective. Change patch every 48 to 72 hrs.
</td>
<td>Actiq® delivers fentanyl through the lining of the mouth directly to the blood stream. Analgesia occurs in 5 to 15 minutes.

Instruct the patient to place Actiq® between the cheek and the gum and actively suck on the medicine. The patient can swab it around the check and swirl the handle for the best results. Biting or chewing decreases absorption. The entire unit should be used in 15 minutes unless pain relief is achieved before completion.

Start treatment with the 200-mcg dose. A second dose can be given approximately 30 minutes after the start of the first dose. If several episodes of breakthrough pain require more than one OTFC unit, consider an increase to the next higher dosage strength.

Keep all packaging and used product away from children and pets.</td>
</tr>
</table>

Pt. Name_____ MD_____
Date _____ RPh:_____
FIN#_____

Fentanyl Transdermal Patch (Duragesic®) Pharmacist Checklist

Form should be completed prior to processing medication. If order is a continuation of patients' home medication and dose, do not complete form and proceed with order entry. Verify that patient was still receiving fentanyl patch at home.

Instructions:

Complete one of the two sections below. For new fentanyl transdermal orders, complete the "Starting Dose" section. For transdermal fentanyl dose increases, complete the "Dose Increase" section. If the answer is "YES" to each question in the appropriate section, proceed with order processing. If any question is marked "NO", the physician must be contacted. If the order will not be processed by pharmacy, inform nursing not to apply patch.

Starting dose: If not a starting dose, move to "Dose increase" section.

YES **NO** Is fentanyl transdermal being prescribed for chronic pain? (Contraindicated for the management of acute, mild, post-operative, or intermittent pain) If transdermal fentanyl prescribed for acute pain, inform physician of the contraindication and that pharmacy may not process the order.

YES **NO** Is the patient opioid-tolerant? Opioid-tolerant is defined as patients who have been taking, for a week or longer, the equivalent of (see Table B):

- Oral morphine 60 mg per day
- Oral oxycodone 30 mg per day
- Oral hydromorphone (Dilaudid) 8 mg per day

If transdermal fentanyl prescribed for patient who is not opioid tolerant, inform physician of patient's opioid intake and package labeling for opioid non-tolerant patients. Recommend maximizing use of PRN medications and to consider prescribing patch in future if patient meets opioid-tolerant definition.

YES **NO** Is the prescribed transdermal fentanyl dose lower than or equal to the calculated equianalgesic patch dose? (See "Dose Conversion Guidelines" for instructions on how to calculate the transdermal fentanyl starting dose using long-acting and PRN opioids.)

If answer is "NO," contact physician and recommend lower dose of patch per calculated in Table A. If starting dose is >100 mcg patch, contact clinical pharmacy specialist on-call to verify calculations and dose.

Dose increase: For patients already receiving transdermal fentanyl.

YES **NO** For dose increases after the initial patch, has there been at least 3 days since the patch was initially placed? For other dose increases, has it been at least 6 days?

If the answer is "NO," contact physician and suggest maximizing PRN medications. Fentanyl transdermal has a 17 hour t½ and should not be titrated more frequently than listed above. Contact the clinical pharmacy specialist on-call if there are specific questions.

Was Physician contacted? No Yes

_____

If physician contacted, leave order clarification/telephone order in chart after discussion with physician (D/C fentanyl, lower patch dose, etc.).

Dose Conversion Guidelines*

To convert patients from oral or parenteral opioids to transdermal fentanyl, use the following steps:

1. Determine the opioid requirements from the previous 24 hours (including scheduled and PRN opioid medications). Use the MAR to add the amount of PRN opioid doses the patient has received.
2. If only one opioid (e.g. morphine) has been used over the last 24 hours, use **Table A** below to determine the transdermal fentanyl requirements. If patient has received more than one opioid (e.g. oxycodone plus hydromorphone, other combinations), use **Table B** to determine the total daily oral morphine equivalents and then oral morphine in **Table A** to determine the equianalgesic transdermal fentanyl dose.

TABLE A:*
Dose Conversion Guidelines

Current Analgesic	**Daily Dosage (mg/day)**				
Oral morphine	60-134	135-224	225-314	315-404	>404
IV morphine	10-22	23-37	38-52	53-67	>67
Oral oxycodone	30-67	67.5-112	112.5-157	157.5-202	>202
Oral codeine	150-447	448-747	748-1047	1048-1347	>1347
Oral hydromorphone	8-17	17.1-28	28.1-39	39.1-51	>51
IV hydromorphone	1.5-3.4	3.5-5.6	5.7-7.9	8-10	>10
IV meperidine	75-165	166-278	279-390	391-503	>503
	⇓	⇓	⇓	⇓	⇓
Recommended transdermal fentanyl dose	**25 mcg/hr patch**	**50 mcg/hr patch**	**75 mcg/hr patch**	**100 mcg/hr patch**	**Consult clinical specialist**

TABLE B:*
Equianalgesic Potency Conversion

	Equianalgesic Dose (mg)	
Name	**IV**	**PO**
Morphine	10	30
Hydromorphone	1.5	7.5
Oxycodone	-	20
Meperidine	75	--
Codeine	130	200

***The dose conversion tables listed above should not be used to convert transdermal fentanyl to oral or parenteral opioids.

Opioid Allergy

Scenario 1: Patient has an intolerance – not an allergy:

The following signs do NOT suggest an allergy:

- Flushing
- Itching
- Sneezing
- Sweating

This reaction is most likely a result of histamine release from mast cells, a common side effect of opioids and <u>not</u>an allergy.

Analgesic options include:

1. Switch to a nonopioid analgesic (NSAID, APAP)
2. Dose reduce the opioid
3. Dose reduce the opioid, and add/increase dose of nonopioid analgesic
4. Premedicate and concurrently medicate with an antihistamine (diphenhydramine 25-50mg) and possibly an H_2 blocker (famotidine 20 mg)
5. If the opioid is intravenously administered, reduce rate of infusion
6. Switch to an opioid that is less likely to cause a histamine release

Opioid	**Chemical Source**	**Histamine Releasing Ability**
Codeine	Natural	**High**
Morphine	Natural	**High**
Meperidine	Synthetic	**High**
Fentanyl	Synthetic	Low
Methadone	Synthetic	Low
Propoxyphene	Synthetic	Unknown
Hydrocodone	Semi-synthetic	Unknown
Hydromorphone	Semi-synthetic	Low
Oxycodone	Semi-synthetic	Low
Oxymorphone	Semi-synthetic	Low
Buprenorphine	Semi-synthetic	Unknown
Nalbuphine	Semi-synthetic	Unknown

Scenario 2: Patient has a TRUE allergy:

The following signs DO suggest an allergy:

- Hypotension (BP <90/60mmHg)
- Hives, maculopapular rash, erythema multiforme, pustular rash
- Difficulty breathing, speaking, or swallowing (i.e. bronchospasm)
- Swelling of face, lips, mouth, tongue, pharynx, or larynx (i.e angioedema)

This reaction is likely a **true allergy**.

Analgesic options include:

1. Switch to a nonopioid analgesic (NSAID, APAP)
2. The risk of cross-allergenicity between the chemical classes of opioids is low. If an opioid is necessary, choose an opioid in a different class from the one that caused the allergic reaction. For example, if meperidine, which is in class A, caused an allergic reaction, try an opioid listed under class B or C instead.
    a. Closely monitor the patient as it is possible to be allergic to more than one class of opioids.

b. Note that Ultram (tramadol) and Ultracet (tramadol/APAP) are contraindicated in patients allergic to ANY opioid.

Class A	Class B	Class C
meperidine fentanyl	methadone propoxyphene propoxyphene/APAP	morphine codeine hydrocodone oxycodone oxymorphone hydromorphone nalbuphine butorphanol

Example Situations:

1. You think the morphine drip is causing your patient to itch. It is possible the morphine is causing a histamine release. What can you do?

   Call the physician and ask him to order diphenhydramine 25-50mg PO q6-8 hours while the patient is on the morphine drip, or, call the physician and ask him to d/c the morphine and switch the patient to an equianalgesic dose of oxycodone which doesn't typically cause as much itching.

2. A patient presents in acute sickle cell crisis. He reports that "morphine gives me hives all over my body". What is your suggestion for pain control?

   To control his pain, do not prescribe any opioids listed in the same class as morphine. Try using an opioid from class A or B (see the above table for opioid classes). It is still important to watch him closely in case he develops signs and symptoms of an allergic reaction.

References:

1. Analgesic Options for Patients with Allergic-Type Opioid Reactions. Pharmacist's Letter/Prescriber's Letter 2006;22(2):220201
2. Salijoughian M. Opioids: Allergy vs. Pseudoallergy. US Pharmacist. 2006;7:HS-5-HS-9
3. Li, Fanny. Pharmacologically Induced Histamine Release: Sorting Out Hypersensitivity Reactions to Opioids. Drug Therapy Topics. 2006;35(4):13-15

Glucocorticoid Comparison

Agent	Equivalent dose (approximate mg)	Route of administration	Biologic half-life (hours)
Betamethasone	0.6-0.75	IM, IV, PO	36-54
Dexamethasone	0.75	IM, IV	36-54
Hydrocortisone	20	IM, IV, PO	8-12
Methylprednisolone	4	IM, IV, PO	18-36
Prednisolone	5	PO	18-36
Prednisone	5	PO	18-36

Methylprednisolone dose (example)	Equivalent dexamethasone dose	Equivalent hydrocortisone dose*
40 mg Q6H	8 mg Q6H	200 mg Q6H
60 mg Q6H	12 mg Q6H	300 mg Q6H
80 mg Q6H	16 mg Q6H	400 mg Q6H
125 mg Q6H	24 mg Q6H	625 mg Q6H

*Hydrocortisone has significant mineralocorticoid potency and may cause significant fluid retention

IV Push Rates for Adult Patients

MUST USE FILTER NEEDLE WHEN AMPULE IS USED

Drug	Rate of Administration	Diluent
Acetazolamide	100-500 mg/min	Dilute each 500 mg in 5 mL SWI
Atropine	0.4 mg/min	Undiluted
Bretylium	Over 1 min*	Undiluted in ventricular fibrillation
Bumetanide	Over 1-2 min*	Undiluted
Calcium chloride	**MAX** 1mL/min	Undiluted
Calcium gluconate	**MAX** 1mL/min	Undiluted
Dexamethasone (≤ 10 mg)	Over 1 min*	Undiluted
D50W	3 ml/min	Undiluted†
Diazepam	**MAX** 5 mg/min	Undiluted
Digoxin	≥ 5 min	Undiluted or with NS (4 fold)
Diphenhydramine	25 mg over 1 min	Undiluted
Droperidol	1.25 mg over 1-2 min	Undiluted
Enalapril	Over 5-10 min*	Undiluted
Epinephrine	0.1 mg/min	1:10,000 solution: Undiluted
Eptifibatide	Bolus over 1-2 min, then continuos infusion	Undiluted
Famotidine	Over 2 min*	20 mg diluted with 5-10 mL NS
Flumazenil	Over 15-30 seconds*	Undiluted
Furosemide	**MAX** 20 mg/min	Undiluted
Heparin	Test dose: 1,000 units/min After test dose: 5,000 units/min	Undiluted
Hydralazine	5 mg/1-5 min	Undiluted
Hydrocortisone	500 mg/min	Dilute to 50 mg/mL
Hydromorphone	Over 2-3 min*	Undiluted†
Iron Dextran	Test dose over 30 sec **MAX** 50 mg/min	Undiluted (test dose only)
Isoproterenol	2-10 mcg/min	Dilute with 10 mL NS
Labetalol	20 mg over 2 min	Undiluted
Lidocaine	25-50 mg/min	Undiluted
Lorazepam	**MAX** 2 mg/min	Dilute with equal volume of NS
Mannitol	200 mg/kg over 3-5 min	Undiluted†
Meperidine	Over 4-5 min*	Dilute to 10 mg/mL
Methylprednisolone succinate	500 mg over 2-3 min	Reconstitute as directed: 40-125 mg/mL

Metoclopramide	2 min	Undiluted (for doses 10 mg or less)
Metoprolol	5 mg over 1-2 min	Undiluted
Midazolam	Over 2 min*	Dilute 1 and 5 mg/mL with NS Max Concentration 0.5 mg/mL
Morphine	Over 4-5 min*	Undiluted
Naloxone	0.4 mg over 15 sec	Undiluted in an emergency
Nesiritide	2 mcg/kg (bolus) over 60 seconds, followed by continuos infusion	Draw loading dose (6 mcg/mL) from continuos infusion bag
Phenobarbital	**MAX** 60 mg/min	Use a minimum of 3 mL of SWI
Phentolamine	5 mg/min	Dissolve 5 mg with 1 mL of SWI
Phenytoin	**MAX** 50 mg/min	Undiluted
Procainamide	20-50 mg/min	Dilute each 100 mg with 5-10 mL of D5W
Prochlorperazine	**MAX** 5 mg/min	Undiluted
Promethazine	Each 25 mg over 1 min **MAX** 25 mg/min	Avoid IV route if possible (use IM or oral). Inject IV into freely flowing IV infusion set. If patient complains of pain, immediately stop injecting.
Propranolol	1 mg/min	Undiluted†
Sodium Bicarbonate	1 mEq/kg over 1-3 min	Undiluted†
Verapamil	5 mg over 2 min	Undiluted through Y-tube

*Assume all doses are safe over time period when not specified.
†Dilution not specified as required; assume undiluted.
D5W=dextrose 5% in water; SWI=sterile water for injection; NS=0.9% sodium chloride (normal saline)

Recommended Initial Vancomycin Dosing

Weight (kg)	CrCl (mL/min)								
	30	40	50	60	70	80	90	100	≥110
50	500q24h	500q24h	**500q12h**	**500q12h**	**500q12h**	**500q12h**	**500q12h**	500q8h	500q8h
55	500q24h	500q24h	**500q12h**	**500q12h**	**500q12h**	**500q12h**	**500q12h**	500q8h	500q8h
60	500q24h	500q24h	**500q12h**	**500q12h**	1000q12h	1000q12h	1000q12h	500q8h	500q8h
65	*1000q24h*	*1000q24h*	*1000q24h*	1000q12h	1000q12h	1000q12h	1000q12h	1000q12h	*1000q8h*
70	*1000q24h*	*1000q24h*	*1000q24h*	1000q12h	1000q12h	1000q12h	1000q12h	*1000q8h*	*1000q8h*
75	*1000q24h*	*1000q24h*	*1000q24h*	1000q12h	1000q12h	1000q12h	1000q12h	*1000q8h*	*1000q8h*
80	*1000q24h*	*1000q24h*	*1000q24h*	1000q12h	1000q12h	1000q12h	1000q12h	*1000q8h*	*1000q8h*
85	*1000q24h*	*1000q24h*	*1000q24h*	1000q12h	1000q12h	1000q12h	*1000q8h*	*1000q8h*	*1000q8h*
90	*1000q24h*	*1000q24h*	1000q12h	1000q12h	1000q12h	*1000q8h*	*1000q8h*	*1000q8h*	*1000q8h*
95	*1000q24h*	*1000q24h*	1000q12h	1000q12h	1000q12h	*1000q8h*	*1000q8h*	*1000q8h*	*1000q8h*
100	*1000q24h*	*1000q24h*	1000q12h	1000q12h	1000q12h	*1000q8h*	*1000q8h*	*1000q8h*	*1000q8h*
105	*1000q24h*	*1000q24h*	1000q12h	1000q12h	1000q12h	*1000q8h*	*1000q8h*	*1000q8h*	*1000q8h*
≥110	*1000q24h*	*1000q24h*	1000q12h	1000q12h	1000q12h	*1000q8h*	*1000q8h*	*1000q8h*	*1000q8h*

**Dose is in mg

**Vancomycin Troughs should be drawn with the 3rd dose

Pharmacotherapy 1999;19(3):257-266

Enoxaparin (Lovenox®) Indications and Dosages

INDICATION	DOSE (subcutaneous injection)	RENAL DYSFUNCTION DOSE (CrCl < 30 ml/min)
Prevention of DVT:		
(a) hip replacement	(a) 30 mg q 12 h, starting 12-24 h post-op *or* 40 mg q day, starting 12 h pre-op. Extended prophylaxis with 40 mg once daily is recommended for 3 weeks	(a) 30 mg once daily
(b) knee replacement	(b) 30 mg q 12 h, starting 12 -24 h post-op for up to 14 days	(b) 30 mg once daily
(c) abdominal surgery	(c) 40 mg q day, starting 2 h pre-op until ambulatory; for up to 12 days	(c) 30 mg once daily
(d) high risk medical patients	(d) 40 mg daily until ambulatory	(d) 30 mg once daily
Prevention of ischemic complications of unstable angina and non-Q-wave MI	1 mg/kg q 12 h (with aspirin) for at least 2 days and until clinically stable	1 mg/kg once daily
Acute ST elevation MI in patients receiving thrombolytics < 75 years old	30 mg IV bolus, 1 mg/kg q 12 h (with aspirin)	30 mg IV bolus, 1 mg/kg once daily
Acute ST elevation MI in patients receiving thrombolytics ≥ 75 years old	0.75 mg/kg q 12 h (with aspirin) No bolus	1 mg/kg once daily No bolus
Treatment of DVT:		
(a) inpatient +/- PE	(a) 1 mg/kg q 12 h, or 1.5 mg/kg once daily for a minimum of 5 days and until warfarin is in therapeutic range 2 days	1 mg/kg once daily
(b) outpatient no PE	(b) 1 mg/kg q 12 h as in (a) above	1 mg/kg once daily

Other (non-formulary) Low molecular weight heparins include: Dalteparin (Fragmin®) and Tinzaparin (Innohep®).

CATEGORY D AND X DRUGS IN PREGNANCY
Non-inclusive list**

Not all listed products are formulary items.

FDA CATEGORIES D AND X FOR DRUG USE IN PREGNANCY[1]

Category D: There is positive evidence of fetal risk but there may be certain situations where the benefit might outweigh the risk (life-threatening or serious diseases where other drugs are ineffective or carry a greater risk).

Category X: There is definite fetal risk based on studies in animals or humans or based on human experience and the risk clearly outweighs any benefit in pregnant women.

[1]From Federal Register 1980;44:37434-37467.

ACE Inhibitors
Benazepril (D)
Captopril (D)
Enalapril (D)
Fosinopril (D)
Lisinopril (D)
Moexipril (D)
Perindopril (D)
Quinapril (D)
Ramipril (D)
Trandolapril (D)

Angiotensin II Receptor Antagonists
Candesartan (D)
Eprosartan (D)
Irbesartan (D)
Losartan (D)
Olmesartan (D)
Telmisartan (D)
Valsartan (D)

Antiarrhythmics
Amiodarone (D)
See Beta Blockers

Antibiotics
Amikacin (D)*
Demeclocycline (D)
Chlortetracycline (D)
Doxycycline (D)
Methacycline (D)
Minocycline (D)
Kanamycin (D)
Streptomycin (D)
Sulfonamides (D)
Tetracycline (D)
Tobramycin (D)*

Anticonvulsants
Bromides (D)
Carbamazepine (D)
Ethotoin (D)
Phenytoin (D)
Phenobarbital (D)
Primidone (D)
Trimethadione (D)
Valproic Acid (D)

Antidepressants
Imipramine (D)
Nortriptyline (D)

Anti-Infectives
Trimetrexate (D)
Quinine (X)*
Ribavarin (X)
Povidone-Iodine (D)

Antifungals
Voriconazole (D)

Antilipemic Agents
Atorvastatin (X)
Fluvastatin (X)

Lovastatin (X)
Pravastatin (X)
Rosuvastatin (X)
Simvastatin (X)

Antineoplastics
See specialized reference

Barbiturates
Amobarbital (D)
Butalbital (D)
Mephobarbital (D)
Pentobarbital (D)
Phenobarbital (D)
Secobarbital (D)

Benzodiazepines
Alprazolam (D)
Chlordiazepoxide (D)
Clonazepam (D)
Clorazepate (D)
Diazepam (D)
Estazolam (X)
Flurazepam (X)
Lorazepam (D)
Midazolam (D)
Quazepam (X)

Beta Blockers
Acebutolol (D)
Atenolol (D)
Betaxolol (D)
Bisoprolol (D)
Carteolol (D)
Carvedilol (D)
Celiprolol (D)
Labetalol (D)
Mepindolol (D)
Metoprolol (D)
Nadolol (D)
Oxyprenolol (D)
Penbutolol (D)
Pindolol (D)
Propranolol (D)
Sotalol (D)
Timolol (D)

Central Nervous System Drugs
Oxazepam (D)
Temazepam (X)
Triazolam (X)
Colchicine (D)
Primidone (D)
Imipramine (D)
Phencyclidine (X)
Levorphanol (D)**
Lithium (D)
Pentazocine (D)**
Meprobamate (D)
Methaqualone (D)

Chelating Agents
Penicillamine (D)

Diuretics
(D if used in gestational hypertension)
Amiloride (B/D)
Bendroflumethiazide (C/D)
Bumetanide (C/D)
Chlorothiazide (C/D)
Chlorthalidone (B/D)
Ethacrynic Acid (B/D)
Furosemide (C/D)
Hydrochlorothiazide (B/D)
Indapamide (B/D)
Methyclothiazide (B/D)
Metolazone (B/D)
Polythiazide (C/D)
Spironolactone (C/D)
Triamterene (C/D)

Gastrointestinal Agents
Sulfasalazine (D)‡
Misoprostol (X)
Paregoric (D)**

Hematological Agents
Coumarin Derivatives (X)*
Dicumarol (D)
Warfarin (X)*

Hormones/Steroids
Betamethasone (D)
Cortisone (D)
Clomiphene (X)
Danazole (D)
Dexamethasone (D)
Estradiol (X)
Estrogens, Conjugated (X)
Estrone (X)
Ethinyl Estradiol (X)
Ethynodiol (D)
Fluoxymesterone (X)
Hormonal Pregnancy Test Tablets (X)
Hydrocortisone (D)
Hydroxyprogesterone (D)
Leuprolide (X)
Medroxyprogesterone (D)
Mestranol (X)
Methimazole (D)
Methyltestosterone (X)

Mifepristone (X)
Norethindrone (X)
Norgestrel (X)
Oral Contraceptives (X)
Prednisolone (D)
Prednisone (D)
Propylthiouracil (D)
Tamoxifen (D)
Testosterone (X)
Triamcinolone (D)

Immunosuppressants
Azathioprine (D)

Miscellaneous
Bosentan (X)
Chlorpropamide (D)
Cigarette Smoking (X)
Cyclazocine (D)
Diethylstilbestrol (X)
Dihydroergotamine (X)
Ergotamine (X)
Ethanol (D/X)†
Iodinated Glycerol (X)
Iodine (D)
Levallorphan (D)
Methylene Blue (D)
Nalorphine (D)
Norepinephrine (D)
Leflunomide (X)
Quinidine (X)
Reserpine (D)
Thalidomide (X)

NSAIDS/Pain Medications
Alfentanil (D)**
Aspirin (D)
Butorphanol (D)**
Celecoxib (D)
Codeine (D)**
Diclofenac (D)
Diflunisal (D)
Dihydrocodeine (D)**
Etodolac (D)
Fenoprofen (D)
Fentanyl (D)**
Flurbiprofen (D)
Hydrocodone (D)**
Hydromorphone (D)**
Ibuprofen (D)
Indomethacin (D)
Ketoprofen (D)
Ketorolac (D)
Meclofenamate (D)
Mefenamic Acid (D)
Meloxicam (D)
Meperidine (D)**
Methadone (D)**
Morphine (D)**
Nalbuphine (D)**
Nabumetone (D)
Naproxen (D)
Oxaprozin (D)
Oxycodone (D)**
Oxymorphone (D)**
Pentazocine (D)**
Phenylbutazone (D)
Piroxicam (D)
Propoxyphene (D)
Remifentanil (D)**
Sufentanil (D)
Sulindac (D)
Tolmetin (D)

Radiopharmaceuticals
Sodium Iodide I^{125} (X)
Sodium Iodide I^{131} (X)

Serums, Toxoids, & Vaccines
Measles (X)
Mumps (X)
Rubella (X)
Smallpox (X)
TC-83 Venezuelan Equine Encephalitis (X)
Yellow Fever (D)

Vitamins
Acitretin (X)
Calcifediol (C/D)***
Calcitriol (C/D)***
Cholecalciferol (C/D)***
Dihydrotachysterol (A/D)***
Ergocalciferol (A/D)***
Etretinate (X)
Isotretinoin (X)
Menadione (C/X)***
Tretinoin (systemic) (D)
Vitamin A (A/X)***
Vitamin D (A/D)

Most severe rating adapted from Briggs GG, Freeman RK, Yaffe SJ. *Drugs in Pregnancy and Lactation*. Baltimore, Williams & Wilkins, 2005. See Briggs for further information.

* Manufacturer's rating

** If used for prolonged periods or high doses at term.

*** If used in doses above the recommended daily allowance.

†If used in large amounts or prolonged periods.

‡If given near term.

ORAL DRUGS THAT SHOULD NOT BE CRUSHED OR CHEWED

Generally, drugs that should not be crushed include those that are enteric coated, extended release, or sublingual tablets.

Adalat-CC
Aggrenox
Allegra - D
Asacol
Augmentin XR
Avinza
Avodart
Azulfidine EN
Biaxin XL
Bisacodyl
Calan SR
Carbatrol
Cardene SR
Cardizem
Cardizem CD, SR, LA
Cartia XT
Ceftin
CellCept
Charcoal Plus
Chloral Hydrate
Chromagen
Cipro(taste)
Cipro XR
Claritin D
Colace
Colestid
Compazine Spansule
Covera HS
Creon 5,10,20
Crixivan
Cytovene
Cytoxan
Depakene
Depakote
Depakote ER
Deseryl (taste)
Detrol LA
Dexedrine Spansule
Diamox Sequels
Dilacor - XR
Ditropan XL
Docusate
Dolobid
Donnatal Extentab
Dulcolax
Dynabac
Dynacirc CR
E.E.S. 400 Filmtab
Ecotrin
Effexor XR
E-Mycin
Entex LA
Entocort EC
Ery-Tab
Eryc
Erythrocrin Stearate
Erythromycin Base
Eskalith CR
Evista
Feldene
Feosol
Feratab
Fergon
Flomax
Fosamax
Gleevec
Glucophage XR
Glucotrol XL
Guaifed
Humabid DM, LA
Imdur
Inderal-LA
Indocin SR
Isoptin SR
Isordil Sublingual
Isosorbide Dinitrate SL
KCL Extended Release
K-Dur
Klor-Con
K-Lyte CL
Levbid
Lexxel
Lithobid
Lodine XL
Macrobid
Mag-Tab SR
Mestinon Timespan
Micro-K
MS Contin
Mucinex
Myfortic
Naldecon
Nexium
Niaspan
Nicobid
Nicotinic Acid
Nitrostat
Norflex
Norpace CR
Oramorph SR
Ornade Spansule
Oxycontin
Pancrease
Pancrecarb MS
Paxil CR
Pentasa
Perdiem
Phazyme
Plendil
Prevacid
Prilosec

Procan SR
Procanbid
Procainamide
Procardia
Procardia XL
Pronestyl-SR
Proscar
Protonix
Proventil Repetabs
Prozac capsule
Quinidex Extentab
Rescon JR
Rhythmol SR
Ritalin-SR
Sinemet CR
Slo-Bid
Slo-FE
Slo-Niacin
Slow-K
Slow-Mag
Sudafed 12 hour
Sular
Tavist - D
Tegretol-XR
Temodar
Tessalon Perles
Theo-24
Theobid
Theo-Dur
Thorazine Spansule
Tiazac
Topamax
Toprol XL
Trental
Ultrase
Ultrase MT
Uniphyl
Verelan
Videx EC
Volmax
Voltaren XR
Wellbutrin SR, XL
Xanax XR

Common Calculations

Anion Gap

Anion gap = sodium - (chloride + HCO3)

Body Surface Area

$$BSA\ (m^2) = \sqrt{\frac{Ht\ (in) \times Wt\ (lb)}{3131}} \quad \text{or} \quad BSA\ (m^2) = \sqrt{\frac{Ht\ (cm) \times Wt\ (kg)}{3600}}$$

Corrected Calcium for Albumin Level

[(Normal albumin - patient's albumin) x 0.8] + measured serum calcium

Corrected Sodium

Corrected Na^+ = measured Na^+ + [1.5 x {(glucose - 150) ÷ 100}]

Do not correct for glucose < 150.

Correction of Serum Phenytoin Concentration for Albumin Level

- Adjusted concentration = measured concentration ÷ [(0.25 x albumin) + 0.1] (normal renal function)
- Adjusted concentration = measured concentration ÷ [(0.1 x albumin) + 0.1] (CrCl ≤10 ml/min)

Creatinine Clearance

$$CrCl\ (male) = \frac{(140\text{-age}) \times IBW\ (kg)}{72 \times \text{serum creatinine}}$$

CrCl (female) = CrCl (male) x 0.85

Dosing Weight (For use when ABW is > 1.2 x IBW)

Dosing Weight = 0.4 x (ABW - IBW) + IBW

Ideal Body Weight

IBW (male) = 50 + (2.3 x height in inches over 5 feet)

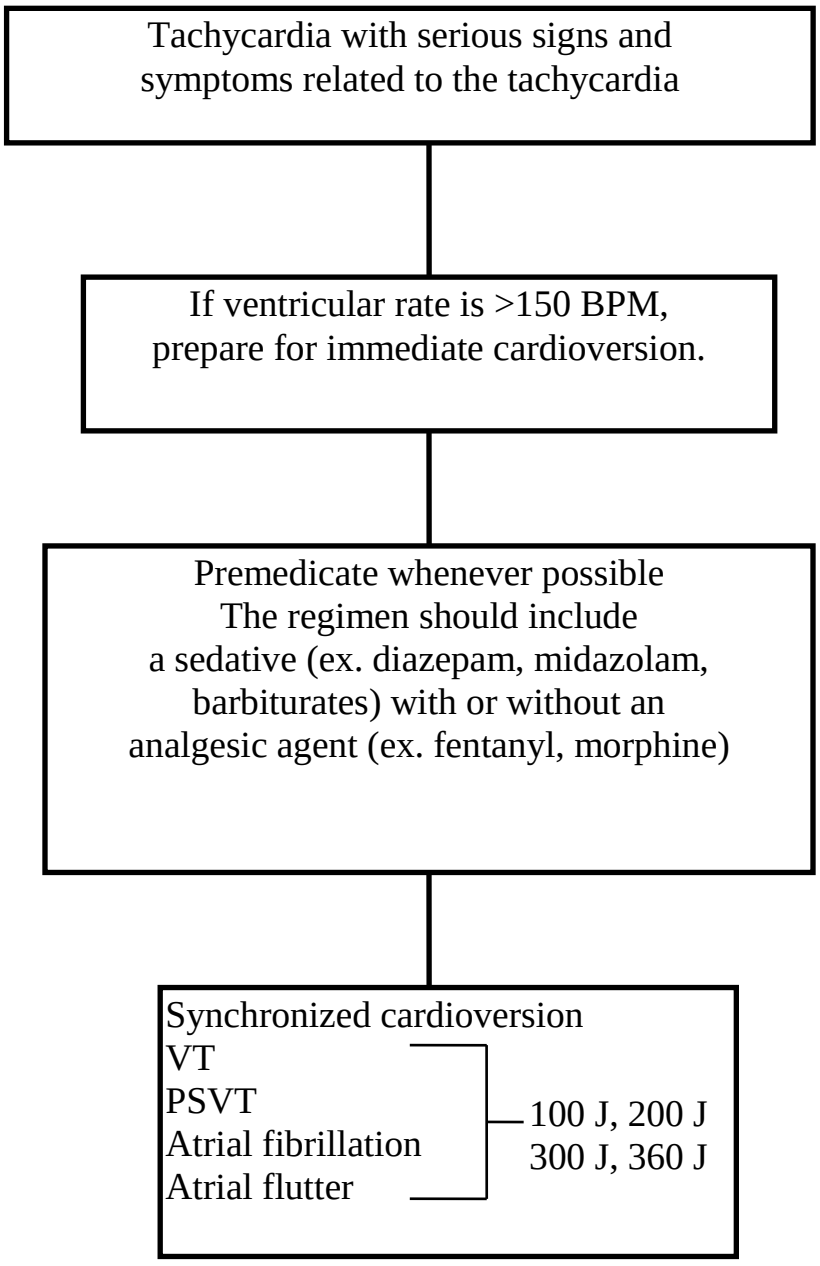
IBW (female) = 45 + (2.3 x height in inches over 5 feet)

Theophylline/Aminophylline Conversion

Aminophylline dose x 0.8 = Theophylline dose

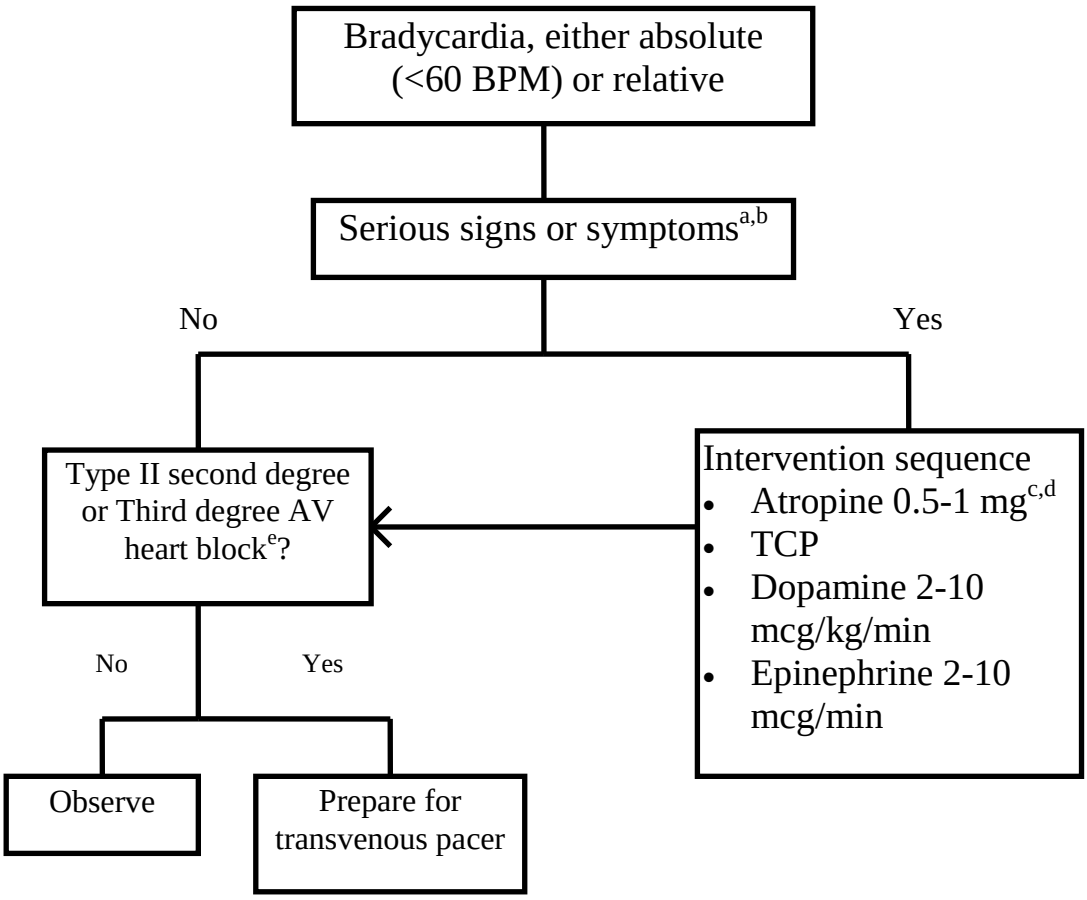
ACLS Guidelines

Synchronized Cardioversion



ACLS Guidelines

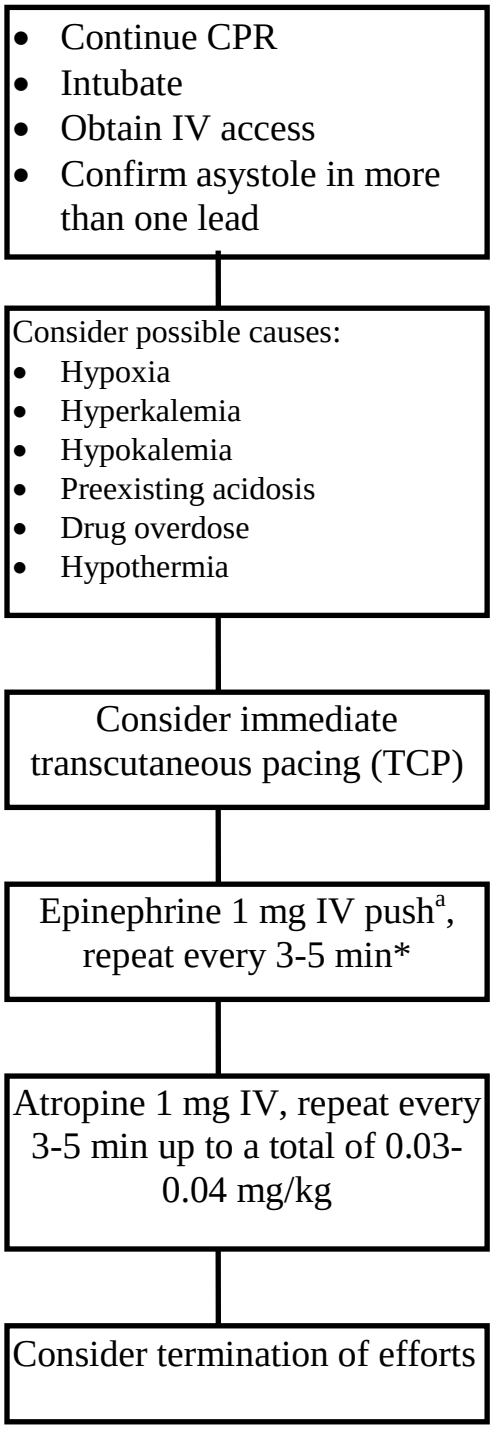
Bradycardia Algorithm



a. Serious signs or symptoms must be related to the slow rate.
b. Do not delay TCP while awaiting IV access or for atropine to take effect if patient is symptomatic.
c. Denervated transplanted hearts will not respond to atropine.
d. Atropine should be given in repeat doses every 3-5 min up to a total of 0.03-0.04 mg/kg. Use the shorter dosing interval (3 min) in severe clinical conditions.
e. Never treat third degree heart block plus ventricular escape beats with lidocaine.

ACLS Guidelines

Asystole Treatment Algorithm

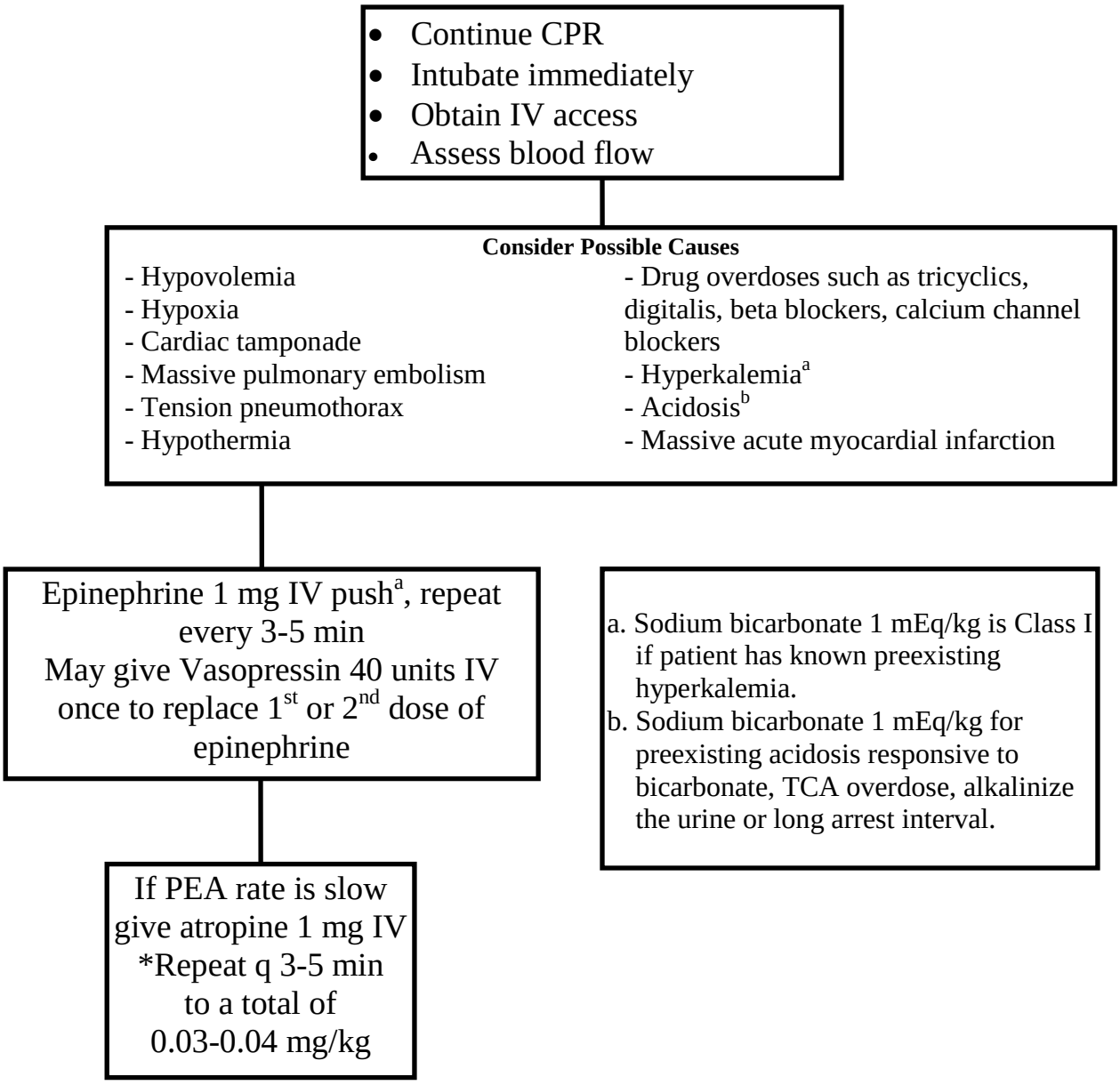


a. Vasopressin 40 units IV may be given to replace the first or second dose of epinephrine.

b. Sodium bicarbonate 1 mEq/kg if patient has known preexisting hyperkalemia.

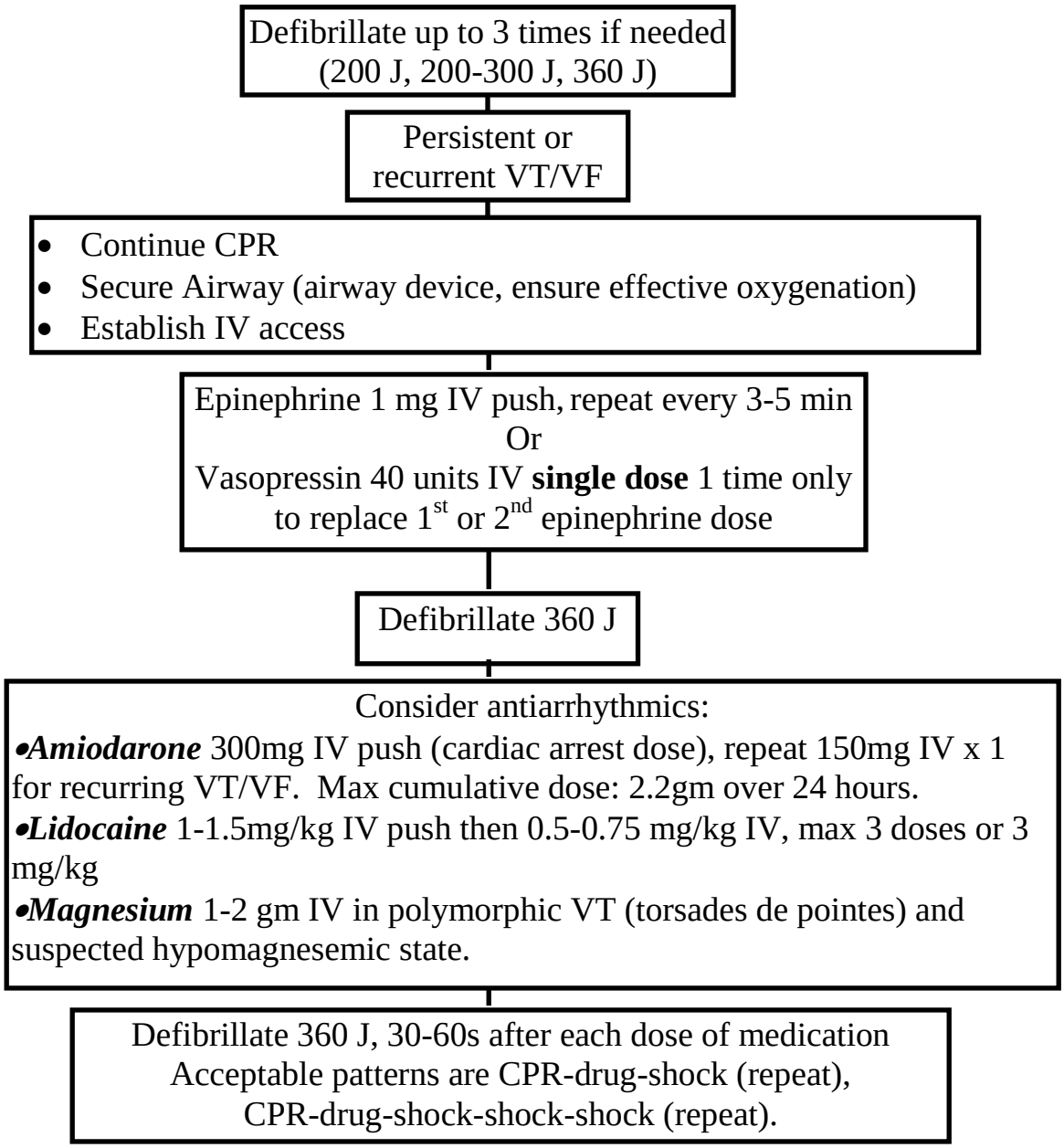
ACLS Guidelines

Pulseless Electrical Activity (PEA) Algorithm



ACLS Guidelines

Ventricular Fibrillation/Pulseless Ventricular Tachycardia (VF/VT) Algorithm



CMS Quality Indicators

Patients with acute myocardial infarction

- Recommended addition of aspirin at arrival to hospital
- Recommended aspirin at patient discharge
- Recommended ACE or ARB for patients with left ventricular systolic dysfunction
- Gave smoking cessation patient counseling
- Recommended beta blocker at discharge
- Recommended addition of beta blocker on arrival to hospital

CABG patients

- Recommended aspirin at patient discharge
- Got prophylactic antibiotics stopped within 24 hours of CABG

Heart failure patients

- Recommended ACE or ARB for patients with left ventricular systolic dysfunction
- Gave smoking cessation patient counseling

Pneumonia patients

- Recommended appropriate antibiotics consistent with current recommendations for type of pneumonia
- Got blood culture collected before start of antibiotic
- Recommended influenza and pneumococcus vaccination
- Ensured that antibiotics received within four hours of hospital admission
- Gave smoking cessation patient counseling

Hip or knee replacement

- Ensured that antibiotic prophylaxis received within one hour of surgical incision
- Suggested appropriate antibiotic prophylaxis for procedure
- Got prophylactic antibiotics stopped within 24 hours of procedure

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