OUR LADY OF THE LAKE
REGIONAL MEDICAL CENTER

Pharmacy Reference Booklet

For Use in Adults

January 2022

The following guidelines were prepared and reviewed by the Department of Pharmacy Education Committee and, specific sections, were approved by the Antimicrobial Stewardship Committee. These are only suggested guidelines based on the most current literature and P&T approved protocols. Questions regarding the information provided may be directed to:

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Anticoagulant Reversal Clinical Practice Guideline

Introduction

These clinical practice guideline recommendations are for patients on antithrombotic therapy requiring immediate, appropriate reversal.

ORAL ANTICOAGULANT REVERSAL	
MEDICATION Class: Factor Xa Inhibitors	**REVERSAL AGENT FOR LIFE THREATENING BLEEDING**
Rivaroxaban (Xarelto®) **Apixaban (Eliquis®)** **Edoxaban (Savaysa®)**	• **4F-PCC (Kcentra®) Fixed Dosing** ▪ Dose: 2000 units IV x 1 ▪ Administration: Must be used within 4 hours of reconstitution • Other options ▪ Activated charcoal 50 g orally for known recent ingestion within 2-4 hours
Dabigatran (Pradaxa®) Class: Direct Thrombin Inhibitor	• **First line** ▪ Idarucizumab (Praxbind®) – Dose: 5 g IV – Administration: Administered as 2 separate 2.5 g doses no more than 15 minutes apart – Onset: Less than 5 minutes • **Second line** ▪ 4F-PCC (Kcentra®) – Dose: 50 units/kg IV (max dose: 5,000 units) – Administration: Must be used within 4 hours of reconstitution – Onset: Within 10 minutes • **Other options** ▪ Activated charcoal 50 g orally for known recent ingestion within 2-4 hours ▪ Consider hemodialysis in patient not receiving Idarucizumab (Praxbind). It removes about 57% of the drug.

WARFARIN		
CLINICAL SCENARIO	**TREATMENT OF ELEVATED INR**	**TIME TO RECHECK INR**
No clinically significant bleeding, no urgent/emergent surgery, no dental extraction		
INR < 5	Hold warfarin dose and resume at lower dose when INR is therapeutic	24-48 hours
INR ≥ 5 but < 9	Patient at low risk for bleeding: Hold 1-2 doses of warfarin and resume at a lower dose when INR is therapeutic **OR** Patient at high risk for bleeding: Hold 1 dose of warfarin and give phytonadione (vitamin K) 2.5 – 5 mg PO	24-48 hours
INR > 9	Hold warfarin dose. Give Phytonadione (vitamin K) 2.5 – 5 mg PO. Repeat as needed	24-48 hours
Clinically significant bleeding		
Any INR	Hold warfarin therapy Give **Vitamin K (10 mg by slow IV infusion**)**, supplement prothrombin complex concentrate (PCC), depending upon urgency***; vitamin K injections may be needed q12h.	12-24 hours
Life-threatening bleed	Hold warfarin, Give 4 factor PCC + FFP plus vitamin K 5-10 mg by slow IV infusion • **4F-PCC (Kcentra®) Fixed dosing** Patients <100kg -- 1500 units Patients >100kg -- 2000 units	30 minutes after Kcentra infusion

*If continuing warfarin therapy is indicated after high doses of vitamin K, then heparin or low-molecular-weight heparin can be given until the effects of vitamin K have been reversed, and the patient becomes responsive to warfarin therapy.

**IV administration is associated with an increased risk of anaphylactoid reactions. Anaphylactoid reactions have occurred during the first infusion and in patients receiving IV phytonadione, which has been diluted and injected by slow IV infusion. Therefore, IV administration should be restricted to those situations where another route is not feasible and the increased risk involved is considered justified.

***Four-factor prothrombin complex concentrate preferred to plasma (Grade 2C—Chest 2012)

**NOTE*: If the IV route is used, phytonadione injection should be diluted prior to administration with preservative-free D5W, NS, or D5NS only and the infusion rate should not exceed 1 mg/minute.

PARENTERAL ANTICOAGULANT REVERSAL	
MEDICATION	**REVERSAL AGENT**
Argatroban Class: Direct Thrombin Inhibitor	• **4F-PCC (Kcentra®)** ▪ **Dose:** 50 units/kg IV (max dose: 5,000 units) ▪ **Administration:** Must be used within 4 hours of reconstitution ▪ **Onset:** Within 10 minutes • **Other options** ▪ Hemodialysis
Bivalirudin (Angiomax®) Class: Direct Thrombin Inhibitor	• **4F-PCC (Kcentra®)** ▪ **Dose:** 50 units/kg IV (max dose: 5,000 units) ▪ **Administration:** Must be used within 4 hours of reconstitution ▪ **Onset:** Within 10 minutes • **Other options** ▪ Hemodialysis
Heparin – Infusion	• **Protamine** ▪ **Dose:** 50 mg for urgent reversal following heparin drip ▪ (1 mg reverses 100 units of heparin with max single dose of 50 mg) Time since UFH administration — Dose of Protamine to Neutralize 100 units of Heparin <30 min — 1 mg to 1.5 mg 30-120 min — 0.5 mg to 0.75 mg >120 min — 0.25 mg to 0.375 ▪ **Administration:** Slow IV push over 10 minutes ▪ **Onset:** 5-15 minutes
Heparin – Subcutaneous	• **Protamine** ▪ **Dose:** 1 to 1.5 mg protamine per 100 units of heparin ▪ **Administration:** May be done by administering a portion of the dose (e.g. 25 to 50 mg) by IV slowly followed by a continuous infusion of the remaining portion over 8 to 16 hours ▪ **Onset:** 5-15 minutes

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PARENTERAL ANTICOAGULANT REVERSAL	
MEDICATION	**REVERSAL AGENT**
Enoxaparin (Lovenox®) Class: Low-Molecular Weight Heparin	• **Protamine** ▪ **Dose:** 1 mg for every 1 mg of enoxaparin administered within the last 8 hours (max single dose: 50 mg) If enoxaparin administered > 8 hours: 0.5 mg for every 1 mg of enoxaparin ▪ **Administration:** Slow IV push over 10 minutes ▪ **Onset:** 5-15 minutes ▪ Protamine reverses about 60% to 75% of enoxaparin
Fondaparinux (Arixtra®) Class: Factor Xa Inhibitor	• **4F-PCC (Kcentra®)** ▪ **Dose:** 50 units/kg IV (max dose: 5,000 units) ▪ **Administration:** Must be used within 4 hours of reconstitution ▪ **Onset:** Within 10 minutes

4F-PCC = 4-factor prothrombin complex concentrate

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$CHADS_2$ and CHA_2DS_2-VASc

DEFINITION AND SCORES FOR $CHADS_2$ AND CHA_2DS_2-VASc	
$CHADS_2$ ACRONYM	**SCORE**
Congestive Heart Failure	1
Hypertension	1
Age ≥75 years	1
Diabetes mellitus	1
Stroke/transient ischemic attack (TIA)/ thromboembolism (TE)	2
Maximum score	6
CHA_2DS_2-VASc ACRONYM	**SCORE**
Congestive HF	1
Hypertension	1
Age ≥75 years	2
Diabetes mellitus	1
Stroke/TIA/TE	2
Vascular disease (prior MI, PAD, or aortic plaque)	1
Age 65 to 74 years	1
Sex category (ie, female sex)	1
Maximum score	9

CHA_2DS_2-VASc score greater than 1 are at high risk

CHA_2DS_2-VASc score of 0, who are uncommon, are at low risk

Heart Failure: Pharmacotherapy with Mortality and Hospitalization Benefits

Definition: Heart failure (HF) is a clinical syndrome with current or prior symptoms and or signs caused by a structural and/or functional cardiac abnormality and corroborated by at least an elevated natriuretic peptide levels or objective evidence of cardiogenic pulmonary or systemic congestion[1]. The left ventricle ejection fraction (EF)[1] helps define groups where treatment differs and to determine if the heart failure is systolic versus diastolic. HF is further classified via NYHA classes and ACCF/AHA stages.

- EF ≥ 50% = HF with preserved ejection fraction (HFpEF) aka diastolic HF
- EF ≤ 40% = HF with reduced ejection fraction (HFrEF) aka systolic HF
- EF 41 – 49% = HF with mildly reduced EF (HFmrEF)
- HF with improved EF (HFimpEF): HF with a baseline LVEF of ≤ 40%, ≥ 10-point increase from baseline LVEF, and a second measurement of LVEF > 40%

CLASSIFICATION	
NEW YORK HEART ASSOCIATION (NYHA)	**ACCF/AHA**
• **Class I:** No physical limitations; ordinary physical activity does not cause HF symptoms • **Class II:** No symptoms at rest, but ordinary physical activities cause HF symptoms • **Class III:** No symptoms at rest, but less-than-ordinary physical activities cause HF symptoms • **Class IV:** HF symptoms at rest; inability to carry out ordinal physical activities	• **Stage A (At-Risk for HF):** At high risk for HF but without structural heart disease or HF symptoms • **Stage B (Pre-HF):** Structural heart disease but without HF symptoms • **Stage C (HF):** Structural heart disease with prior or current HF symptoms • **Stage D (Advanced HF):** Refractory HF requiring specialized interventions

American College of Cardiology/American Heart Association

GUIDELINE DIRECTED MEDICATION THERAPY (GDMT) WITH MORTALITY BENEFIT[2]			
Therapeutic Class	**Starting Dose**	**Target Dose**	**Formulary Meds**
Beta-Blockers			
Bisoprolol	1.25 mg PO daily	10 mg once	Bisoprolol
Carvedilol	3.125 mg PO twice daily	25 mg twice daily for weight < 85kg 50 mg twice daily for weight ≥ 85kg	Carvedilol
Metoprolol succinate XR	12.5-25mg PO twice daily	200 mg daily	Metoprolol succinate XR
Angiotensin-Converting Enzyme (ACE) Inhibitor* OR			
Captopril	6.25 mg PO 3 times daily	50 mg PO 3 times daily	
Enalapril	2.5 mg PO daily	10 to 20 mg PO twice daily	
Lisinopril	2.5 to 5 mg PO daily	20 to 40 mg PO daily	Lisinopril
Ramipril	1.25 mg daily	10 mg daily	
Angiotensin II Receptor Blocker (ARB) * OR			
Candesartan	4 to 8 mg PO daily	32 mg PO daily	
Losartan	25 to 50 mg PO daily	50 to 150 mg PO daily	Losartan
Valsartan	20 to 40 mg PO twice daily	160 mg PO twice daily	Valsartan

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GUIDELINE DIRECTED MEDICATION THERAPY (GDMT) WITH MORTALITY BENEFIT[2]

Therapeutic Class	Starting Dose	Target Dose	Formulary Meds
Angiotensin II Receptor Blocker; Neprilysin Inhibitor * (ARNI)			
Sacubitril/valsartan (Entresto)			
Patients previously on moderate to high ACE inhibitor	Sacubitril 49 mg/ valsartan 51 mg PO twice daily	Sacubitril 97 mg/ valsartan 103 mg PO twice daily	Sacubitril/ valsartan (Entresto) - all doses
Patients previously on low dose ACE inhibitor	Sacubitril 24 mg/ valsartan 26 mg PO twice daily	Same as above	
Patients not previously on an ACE inhibitor	Sacubitril 24 mg/ valsartan 26 mg PO twice daily	Same as above	
Isosorbide Dinitrate/Hydralazine (BIDIL)			
Fixed Dose (combination)	20 mg isosorbide dinitrate/ 37.5 mg hydralazine PO 3 times daily	40 mg isosorbide dinitrate/ 75 mg hydralazine PO 3 times daily	Isosorbide dinitrate/ hydralazine (BiDil)
Separate dosing	Isosorbide dinitrate: 20-30 mg PO 3-4 times daily Hydralazine: 25-50 mg PO 3-4 times daily	Isosorbide dinitrate: 120 mg PO daily in divided doses Hydralazine: 300 mg PO daily in divided doses	Isosorbide dinitrate Hydralazine
Mineralocorticoid (Aldosterone) Receptor Antagonists (MRA)			
Spironolactone	12.5 to 25 mg PO daily	25 mg – 50 mg PO daily	Spironolactone
Eplerenone	25 mg PO daily	50 mg PO daily	Eplerenone

* Patient can only be on one (ACEI or ARB or ARNI)

GUIDELINE-DIRECTED MEDICATION THERAPY (GDMT) – DECREASED HOSPITALIZATION – NO MORTALITY BENEFIT			
Med Class	**Starting Dose**	**Target Dose**	**Formulary Meds**
I_f Channel Inhibitor			
Ivabradine (Corlanor)	2.5 to 5 mg PO twice daily	7.5 mg PO twice daily	(None)
Cardiac glycoside			
Digoxin (Lanoxin)	0.125 to 0.25 mg PO daily Low doses (0.125 mg daily or every other day) should be used if patient >70 y/o, has impaired renal function, or low body mass	0.125 to 0.25 mg PO daily	Digoxin

GUIDELINE-DIRECTED MEDICATION THERAPY (GDMT) – SYMPTOMATIC TREATMENT		
Med Class	**Initial Starting Dose**	**Formulary Meds**
Diuretics		
Loop Diuretics		
Bumetanide	0.5 to 1.0 mg PO once or twice	Bumetanide
Furosemide	20 to 40 mg PO once or twice	Furosemide
Torsemide	10 to 20 mg PO once	
Thiazide Diuretics		
Chlorothiazide	250 to 500 mg PO once or twice	Chlorothiazide
Hydrochlorothiazide	25 mg PO once or twice	Hydrochlorothiazide
Indapamide	2.5 mg PO once	Indapamide
Metolazone	2.5 mg PO once	Metolazone
Potassium-sparing diuretics		
Amiloride	5 mg once	Amiloride
Spironolactone	12.5 to 25 mg PO once	Spironolactone
Triamterene	50 to 75 mg PO twice	Hydrochlorothiazide triamterene

GUIDELINE-DIRECTED MEDICATION THERAPY (GDMT)[2] – NOVEL THERAPY			
Med Class	**Starting Dose**	**Target Dose**	**Formulary Meds**
SGLT2 inhibitors			
Dapagliflozin (Farxiga)	10 mg PO daily (ensure eGFR ≥ 30 ml/min/1.73 m^2)	10 mg PO daily	Dapagliflozin
Empagliflozin (Jardiance)	10 mg PO daily (ensure eGFR ≥ 20 ml/min/1.73 m^2)	10 mg PO daily	

GUIDELINE-DIRECTED MEDICATION THERAPY (GDMT) – INOTROPIC SUPPORT	
Formulary Meds	**Initial infusion dose**
Dobutamine	2.5 to 5 mcg/kg/min IV
Dopamine	5 to 10 mcg/kg/min IV
Milrinone	0.125 to 0.75 mcg/kg/min IV

ACE inhibitors

- Block conversion of angiotensin I to angiotensin II → relaxation of vasculature → decreased peripheral resistance and reduced afterload
- Demonstrated significant reduction in morbidity/ mortality in HFrEF when taken concurrently with other HF meds
  - CONSENSUS trial and SOLVD trial both showed significant mortality reduction with enalapril
- Contraindications: hypersensitivity, previous angioedema with ACE inhibitor use, or concomitant aliskiren

Angiotensin Receptor Blockers (ARBs)

- Block binding of angiotensin II to its receptor → RAAS inhibition → prevents vasoconstriction/aldosterone release
- **Typically used when ACE inhibitors cannot be tolerated** (i.e., contraindications or development of dry cough)
  - Note: there is a risk of cross-reaction with ARBs in patients who had angioedema with an ACE inhibitor
- CHARM alternative study (candesartan) and HEAAL trial (losartan) demonstrated significant mortality reductions

Beta Blockers

- Block the beta-adrenergic receptor of the heart → prevents ventricular remodeling and treats tachycardia to provide rate control
- Beta blockers with HF mortality benefit are:
  - Bisoprolol, carvedilol, and metoprolol succinate (Toprol-XL)
- CORPERNICUS trial (carvedilol), CIBIS-II trial (bisoprolol), and MERIT-HF (metoprolol succinate) demonstrated significant reductions in mortality

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Aldosterone Inhibitors

- Spironolactone and eplerenone
- Inhibits aldosterone → decreases sodium retention and prevents Mg/K loss
- Shown to reduce morbidity/mortality when given in combination with an ACE inhibitor and BB in patients with NYHA class II-IV and EF ≤ 35%

Vasodilators

- Hydralazine/ isosorbide dinitrate (BiDil)
- Vasodilation and relaxation of blood vessels → improve blood flow → reduces workload on the heart
- Morbidity and mortality benefit in African Americans with NYHA class III-IV HFrEF
- For patients who cannot receive ACE inhibitors and ARBs (i.e., drug intolerance, hypotension, renal insufficiency)

ARNIs - Sacubitril/valsartan (Entresto)

- Sacubitril is a neprilysin inhibitor and decreases vasoconstriction, sodium retention, and remodeling
- Valsartan is an ARB that blocks binding of angiotensin II → RAAS inhibition → prevents vasoconstriction/ aldosterone release
- Recommended in those with chronic symptomatic HFrEF NYHA class II or III and previously tolerated ACE/ARB to further reduce morbidity/mortality
- Should not be administered concurrently with an ACE inhibitor or another ARB; 36-hour washout period required when converting from ACE inhibitor therapy to Entresto

Ivabradine

- Inhibits the I(f) channel aka the 'funny current' to reduce heart rate
- May be considered as add-on therapy in those that remain symptomatic despite max doses of ACEs/ARBs and BBs
- Was associated with decreased hospitalizations in the SHIFT clinical study

SGLT2 inhibitors

- Anti-diabetic agents that has some diuretic activity and has kidney-protective properties
- DAPA-HF trial (dapagliflozin) and EMPEROR-Reduced trial both demonstrated reduced morbidity/mortality in HF patients with or without DM

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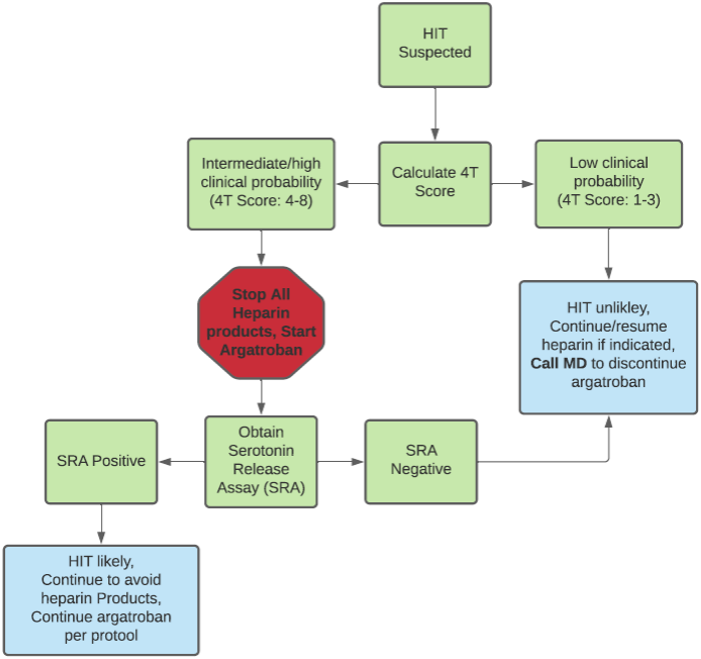
Heparin Induced Thrombocytopenia (HIT)

HIT should be considered whenever a patient experiences an unexplained drop in platelet counts.

Algorithm for Diagnosis and Initial Management of HIT[1,2]



4-T SCORE CALCULATION TABLE[3]			
4Ts	**2 Points**	**1 Point**	**0 Point**
Thrombocytopenia	Platelet count fall >50% from baseline and nadir ≥20 k/uL	Platelet count fall 30-50% or nadir 10 – 19 k/uL	Platelet count fall <30% from baseline or nadir <10 k/uL
Timing of platelet fall	Clear onset between 5-10 days OR ≤1 day WITH prior heparin exposure in the past 30 days	Onset after 10 days OR fall ≤1 day WITH heparin exposure 30 -100 days prior Or onset consistent with 5 -10 day fall BUT not clear (e.g. missing platelet count)	Platelet count fall <4 days WITHOUT recent exposure
Thrombosis or other sequelae	New thrombosis; skin necrosis; acute systemic reaction after IV heparin	Progressive or recurrent thrombosis. Non necrotizing skin lesions, suspected thrombosis	None
Other causes for thrombocytopenia	None apparent	Possible	Definite

Score 1 – 3: Low probability of HIT <5%

Score 4-5: Intermediate probability of HIT: ~14%

Score 6 – 8: High Probability of HIT: ~64%

Argatroban Initiation and Monitoring Protocol[4]

Consult Clinical Pharmacy to evaluate patient daily and to contact provider to discuss warfarin transition.

Refer to Argatroban protocol on OLOLRMC formweb for further details.

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Initial Labs:

- Baseline PT and aPTT and daily aPTT
- Baseline and daily CBC
- Baseline CMP including LFTs
- aPTT 2 hours after starting argatroban infusion and 2 hours after any rate change

Maximum infusion rate: **10 mcg/kg/min**

***Note**: Use ABW, Cap dose at 140kg*

Notify MD if:

- Unexpained drop in BP, tachycardia
- >1 g/dL drop in hemoglobin, gross hematuria, or overt signs of bleeding

Precautions

- Discontinue all sources of UFH/LMWH (IV, SC, flushes)
- Do not start Argatroban if PTT above 90 or INR above 2.5 – notify the physician
- Can cause false elevations of INR

NON-ICU AND ICU PATIENTS WITHOUT ORGAN DYSFUNCTION START: 1 MCG/KG/MIN		
aPTT (seconds)	**Rate of infusion**	**Check next aPTT**
<35	Increase by 0.5 mcg/kg/min	2 hours
35 – 54	Increase by 0.25 mcg/kg/min	2 hours
55 - 100	No change – Continue current rate	After 2 consecutive therapeutic readings, move to daily aPTT
101 – 110	Decrease by 0.25 mcg/kg/min	2 hours
111 – 120	Hold infusion for 1 hour and decrease by 0.5 mcg/kg/min	2 hours
>120	Stop infusion and call MD	STAT and every 2 hours

MULTIORGAN DYSFUNCTION WITHOUT CONCOMITTANT HEPATIC AND RENAL FAILURE / START: 0.5 MCG/KG/MIN		
aPTT (seconds)	**Rate of infusion**	**Check next aPTT**
<35	Increase by 0.25 mcg/kg/min	2 hours
35 – 54	Increase by 0.125 mcg/kg/min	2 hours
55 - 100	No change – Continue current rate	After 2 consecutive therapeutic readings, move to daily aPTT
101 – 110	Decrease by 0.125 mcg/kg/min	2 hours
111 – 120	Hold infusion for 1 hour and decrease by 0.25 mcg/kg/min	2 hours
>120	Stop infusion and call MD	STAT and every 2 hours

ICU PATIENTS WITH MODERATE TO SEVERE HEPATIC DYSFUNCTION OR COMBINED HEPATIC/RENAL DYSFNCTION START: 0.2 MCG/KG/MIN		
aPTT (seconds)	**Rate of infusion**	**Check next aPTT**
<35	Increase by 0.1 mcg/kg/min	2 hours
35 – 54	Increase by 0.05 mcg/kg/min	2 hours
55 - 100	No change – Continue with current rate	After 2 consecutive therapeutic readings, move to daily aPTT
101 – 110	Decrease by 0.05 mcg/kg/min	2 hours
111 – 120	Hold infusion for 1 hour and decrease by 0.25 mcg/kg/min	2 hours
>120	Stop infusion and Call MD	STAT and every 2 hours

Transitioning to Warfarin:

Consult Clinical Pharmacy to start transition to warfarin

Initiate warfarin after platelet count recovery:

- Platlets >150 k/uL OR
- Platlets close to patient's baseline

Start Warfarin at MAXIMUM 5 mg daily CONCURRENTLY with argatroban infusion

- DO NOT give warfarin Loading dose
- Obtain daily INR

When To Stop Argatroban:

Patients receving Argatroban ≤2 mcg/kg/min:

- Stop argatroban when combined INR >4
- Repeat INR in 4 - 6 hours
- If INR below therapeutic range, can restart argatroban
- Repeat procedure daily until INR on warfarin alone is within therapeutic range

Patients receviing Argatroban ≥2 mcg/kg/min:

- Reduce argatroban to <2 mcg/kg/min and repeat the INR 4 - 6 hours after dose reduction.
- Stop argatroban infusion when combined INR >4
- Repeat INR in 4 - 6 hours
- If INR is below therapeutic range, can restart argatroban
- Repeat procedure daily until INR on warfarin alone is within therapeutic range

References:

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3. Hogan M et al. Berger JS. Heparin-induced thrombocytopenia (HIT): Review of incidence, diagnosis, and management. Vasc Med. 2020 Apr;25(2):160-17
4. Argatroban: Lexicomp Online, Lexi-Drugs Online, Hudson, Ohio: UpToDate, Inc.; 2021; June 29, 2021.
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Summary of $P2Y_{12}$ Inhibitors

	CLOPIDOGREL	PRASUGREL
Mechanism of Action	Inhibits ADP-mediated platelet activation at $P2Y_{12}$ receptor	
Loading Dose	300-600 mg	60 mg
Maintenance Dose	75 mg daily	5-10 mg daily
Route	Oral	Oral
Prodrug	Yes	Yes
Reversible platelet binding	No	No
Onset	2-6 hr	30 min
% (ADP) inhibition	30-40	60-70
Recommended holding duration before CABG[c]	5 days	7 days
Other notable adverse effects or clinical pearls	Pharmacogenomic variability (CYP2C19) Caution with CYP2C19 inhibitors, which can affect conversion from prodrug to active isoform	Contraindication in patients with history of stroke or TIA because of increased bleeding risk Warning of use in patients older than 75 or weight less than 60 kg Patients less than 60kg may receive 5 mg MD

[a] Ticagrelor was held for 24-72 hr in the PLATO trial with no difference in major bleeding with clopidogrel.

[b] Not on Formulary

[c] Decisions to hold these agents before other invasive procedures must consider indications for use, risk of thrombosis, and risk of bleeding associated with intended procedure/surgery.

ADP = adenosine diphosphate; IV = intravenous(ly); LD = loading dose; MD = maintenance dose; TIA = transient ischemic attack.

	TICAGRELOR	CANGRELOR[b]
Mechanism of Action	Inhibits ADP-mediated platelet activation at $P2Y_{12}$ receptor	
Loading Dose	180 mg	30 mcg/kg
Maintenance Dose	90 mg twice daily	4 mcg/kg/min
Route	Oral	IV
Prodrug	No	No
Reversible platelet binding	Yes	Yes
Onset	30 min	2 min
% (ADP) inhibition	60-70	>95%
Recommended holding duration before CABG[c]	5 days[a]	1-6 hr
Other notable adverse effects or clinical pearls	Adenosine- induced dyspnea and bradyarrhythmia. Caution with strong CYP3A4 inhibitors/ inducer, which can affect ticagrelor clearance Avoid Aspirin > 100mg because lack of efficacy	An oral $P2Y_{12}$ antagonist must be given immediately after cangrelor discontinuation to maintain platelet inhibition

References

Brilakis ES, Patel VG, Banerjee S. Medical management after coronary stent implantation: a review. JAMA 2013;310:189-98; and Baron TH, Kamath PS, McBane RD. Current concepts: management of antithrombotic therapy in patients undergoing invasive procedures. N Engl J Med 2013;368:2113-24

Pharmacy Anticoagulation Stewardship

CLINICAL PRACTICE GUIDELINE:
Pre and Post- Procedural Management of Direct Oral Anticoagulant (DOAC)

DOAC	PROCEDURE BLEEDING RISK	CURRENT CRCL	PRE-PROCEDURE DOAC INTERRUPTION	DAY OF PROCEDURE	POST-PROCEDURE DOAC RESUMPTION
Apixaban	HIGH	>50 ml/min	**Stop 2 days** prior to procedure	NO DOAC	**Resume 48 - 72 hours**
		30 – 50 ml/min	**Stop 2 - 3 days** prior to procedure		
	LOW	>50 ml/min	**Stop 1 day** prior to procedure		**Resume 24 hours**
		30 – 50 ml/min	**Stop 1 - 2 days** prior to procedure		
Edoxaban	HIGH	≥50 mL/min	**Stop 2 days** prior to procedure	NO DOAC	**Resume 48 - 72 hours**
		30 – 49 ml/min	**Stop 2 - 3 days** prior to procedure		
	LOW	≥50 mL/min	**Stop 1 day** prior to procedure		**Resume 24 hours**
		30 – 49 ml/min	**Stop 1 - 2 days** prior to procedure		

CLINICAL PRACTICE GUIDELINE:

Pre and Post- Procedural Management of Direct Oral Anticoagulant (DOAC)

DOAC	PROCEDURE BLEEDING RISK	CURRENT CRCL	PRE-PROCEDURE DOAC INTERRUPTION	DAY OF PROCEDURE	POST-PROCEDURE DOAC RESUMPTION
Dabigatran	HIGH	≥50 mL/min	**Stop 2 - 3 days** prior to procedure	NO DOAC	**Resume 48 - 72 hours**
		30 – 49 ml/min	**Stop 4 - 5 days** prior to procedure		
	LOW	≥50 mL/min	**Stop 1 day** prior to procedure		**Resume 24 hours**
		30 – 49 ml/min	**Stop 2 - 3 days** prior to procedure		
Rivaroxaban	HIGH	>50 ml/min	**Stop 2 days** prior to procedure	NO DOAC	**Resume 48 - 72 hours**
		15 – 50 ml/min	**Stop 2 - 3 days** prior to procedure		
	LOW	>50 ml/min	**Stop 1 day** prior to procedure		**Resume 24 hours**
		15 – 50 ml/min	**Stop 1 - 2 days** prior to procedure		

Warfarin Management

Dose Management

1. Warfarin dosing should be individualized based on patient's bleeding risk, potential sensitivity to warfarin, indication, goal INR range, and if potential drug interactions exist (refer to tables II and V).

2. Anticoagulation effect is observed within 2 to 7 days after beginning oral warfarin, according to the dose administered. When a rapid effect is required, UFH or LMWH should be given concurrently with warfarin (i.e. "bridge" therapy) for > 4 days or until therapeutic INR is attained on warfarin for 24 hours.

   a. Refer to table II and V for patient assessment on initiating warfarin.

   b. For patients admitted on warfarin prior to admission, their home dose may be used and adjustment based on INR results

   c. For patient admitted on warfarin with different daily doses; **a fixed daily** dose (which is an average of the patient total weekly doses) may be used inpatient with adjustment based on daily INR results

   d. All adjustments to warfarin dosing will be done based on a current INR

Table II. Factors for Identifying Warfarin Sensitive Patients

Baseline INR > 1.5	**High**
Age > 65	**High**
Malnourished/ NPO > 3 days Malabsorption syndrome	**High**
Hypoalbuminemia < 2g/dL	**High**
Chronic diarrhea	**High**
Significant Hepatic disease: cirrhosis, T. bili. > 2.4 mg/dL, or alcohol abuse	**High**
Cancer	**High**
Decompensated Heart Failure/CHF	**High**
Hypo/Hyper-thyroid (thyrotoxicosis)	**High**
Genetic polymorphism of CYP450- 2C9	**High**
Current antiplatelet therapy **Thrombocytopenia (platelet <75K/uL)	**High**
End stage renal disease (ESRD)	**High**
GI bleed within the past 30 days	**High**
Surgery within past 2 weeks	**High**
Intracranial bleed within past 30 days	**High**
Baseline INR 1.2-1.5	**Moderate**
50-65 years of age	**Moderate**
Significant drug interactions	**Moderate**
Baseline INR < 1.5	**Low**
Age < 50 with no other risk factor	**Low**

Non-Pharmacological Interactions

1. Dietary interactions: inpatient **Ensure** nutritional supplement contains vitamin K
2. Feeding tube: consider holding tube feeding administration at least 2 hours prior to warfarin administration and post administration in patient with tube feeding to allow for adequate warfarin absorption.

Drug Interactions

1. Suggestions for managing drug interactions are listed in table V.
2. There are numerous drug, food, and dietary supplement interactions with warfarin. The following interactions are used commonly in the inpatient setting.

Table V. Common Drug Interactions

INTERACTIONS THAT INCREASE INR			
DRUG	**TIME TO EFFECT**	**SUGGESTED DOSE CHANGE**	**TIME TO RECHECK INR**
Fluoroquinolones **Macrolides** **Sulfamethoxazole and Trimethoprim** **Metronidazole**	Within 3-5 days	Decrease dose by 30%	After 5-7 days of starting or discontinuing therapy
Fluconazole **Itraconazole** **Ketoconazole** **Posaconazole** **Voriconazole**	Within 3-5 days	Decrease dose by 30%	After 5-7 days of starting or discontinuing therapy
Amiodarone	Within 7-14 days	Decrease dose by 50%	After 7 days for 1 month after starting or discontinuing therapy

INTERACTIONS THAT DECREASE INR			
DRUG	**TIME TO EFFECT**	**SUGGESTED DOSE CHANGE**	**TIME TO RECHECK INR**
Dicloxacillin **Nafcillin**	Within 4-7 days	Increase dose by 30%	After 5-7 days of starting or discontinuing therapy
Rifampin	Within 7-14 days	Increase dose by 50-60%	Every 7 days for 1 month after starting or discontinuing therapy
Carbamazepine	Within 14 days	Increase dose by 30%	Every 7 days for 1 month after starting or discontinuing therapy

INDICATIONS	THERAPEUTIC INR (RANGE)	DURATION/COMMENTS
ANTIPHOSPHOLIPID SYNDROME		
With previous arterial or venous thromboembolism	2.5 (2-3)	
Recurrent thrombosis while INR was 2 - 3	3.5 (3-4)	Chronic
ATRIAL FIBRILLATION (AF)/ ATRIAL FLUTTER		
CHADS-VASC score 0	None	No agent required
CHADS-VASC score 1	None or 2.5 (2-3)	ASA, warfarin, or no agent
CHADS-VASC score 2	2.5 (2-3)	Chronic
ISCHEMIC STROKE		
Non-cardioembolic stroke or TIA	None	Chronic / use antiplatelet therapy
Cardioembolic stroke or TIA	None or 2.5 (2-3)	Chronic
• With warfarin contraindication	None	Chronic / use aspirin 81-325 mg daily or ASA/Plavix combo
THROMBOEMBOLISM (DVT, PE) SYMPTOMATIC OR ASYMPTOMATIC (with concurrent UFH/LMWH for a minimum of 5 days and until INR >2 for 24 hours)		
Provoked event	2.5 (2-3)	3 months
Unprovoked 1st event		
• Proximal DVT or PE	2.5 (2-3)	At least 3 mo/chronic
• Distal DVT	2.5 (2-3)	3 months/ consider chronic therapy
Unprovoked 2nd event	2.5 (2-3)	Chronic
With malignancy	2.5 (2-3)	Chronic/preceded by LMWH x 3-6 mo
Chronic thromboembolic	2.5 (2-3)	Chronic
Pulmonary hypertension	2.5 (2-3)	Chronic

INDICATIONS	THERAPEUTIC INR (RANGE)	DURATION/COMMENTS
VALVULAR DISEASE		
Mitral valve prolapse		
• With TIAs or ischemic stroke	2.5 (2-3)	Chronic / use aspirin 81mg daily
• With recurrent TIA despite ASA therapy	2.5 (2-3)	Chronic
Rheumatic mitral valve disease		
• With AF, hx systemic emb, LA thrombus, LA> 55mm	2.5 (2-3)	Chronic
• S/p thromboembolic event despite anticoagulation	2.5 (2-3)	Chronic / add aspirin 81mg daily (INR 2.5-3.5)
VALVE REPLACEMENT BIOPROSTHETIC		
Aortic	2.5 (2-3)	3 months / aspirin 81mg daily
Mitral	2.5 (2-3)	3 months / followed by aspirin 81mg daily
With LA thrombus	2.5 (2-3)	Until resolution
With prior hx systemic embolism	2.5 (2-3)	At least 3 months
With additional risk factors for thromboembolism	2.5 (2-3)	Chronic / aspirin 81mg daily (low bleed risk)

continued on next page

INDICATIONS	THERAPEUTIC INR (RANGE)	DURATION/COMMENTS
VALVE REPLACEMENT MECHANICAL		
Aortic		
• Bileaflet in NSR w/ normal LA size	2.5 (2-3)	Chronic
• Medtronic Hall tilting disk in NSR w/normal LA size	2.5 (2-3)	Chronic
• Following prosthetic valve thrombosis	3 or 3.5 (3-4)	Chronic / plus aspirin 81mg daily
• With additional risk factors for VTE, Afib, LV dysfunction	3 (3-4)	Chronic
Mitral		
• Bileaflet or tilting disk	3 (2.5-3.5)	Chronic
• Following prosthetic valve thrombosis	3.5 (3-4)	Chronic / plus aspirin 81mg daily
Caged ball or caged disk (aortic or mitral)	3 (2.5-3.5)	Chronic
With additional risk factors for thromboembolism (AF, LA enlargement, hypercoaguable condition, low EF)	3 (2.5-3.5)	Chronic / add aspirin 81mg daily

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Alteplase

AHA / ASA 2018 Guidelines: Indications for Alteplase

Indications

- >18y of age
- Severe Stroke Symptoms (Given with any NIHSS score, if >25 outcome uncertain)
- Mild, but disabling stroke symptoms
- BP <185/110 mmHg
- Glucose levels >50 mg/dL
- LKW within 4.5 hours

Acceptable Conditions to Give Alteplase

- Early ischemic changes on NCCT of mild to moderate extent (other than frank hypodensity)
- Patients taking antiplatelet drug mono or dual therapy
- ESRD on HD and normal aPTT (elevated aPTT may have increased risk of hemorrhagic complications)
- History of diabetes or prior stroke
- Age > 80

AHA / ASA 2018 Guidelines: Contraindications for Alteplase

Contra-indications

- Unclear time and/ or unwitnessed symptom onset
- CT reveals acute intracranial hemorrhage
- History of intracranial hemorrhage
- Signs/Symptoms most consistent with a subarachnoid hemorrhage (SAH)
- Prior stroke within 3 months
- Recent severe head trauma (within 3 months)
- Intracranial/spinal surgery withing the prior 3 months
- GI malignancy or recent bleeding event within 21 days of their stroke event
- Platelets <100,000/mm3, INR >1.7, aPTT > 40s or PT >15s
- Taken DOACs within 48h (Betrixaban within 72 hours) or LMWH within 24h
- Use of Glycoprotein IIB/IIIa receptor inhibitors
- Symptoms consistent with infective endocarditis
- Aortic arch dissection
- Intra-axial intracranial neoplasm

DOSING CALCULATIONS FOR ALTEPLASE 100 MG VIAL (1MG/ML CONCENTRATION)			
TOTAL DOSE	**WASTE** (DISCHARGE IN SHARPS)	**BOLUS OVER 1 MINUTE**	**INFUSION OVER 60 MINUTES** (HANG REMAINDER IN VIAL)
0.9 mg/kg (max 90mg)	100 – Total Dose (at least 10mL)	10% of Total Dose (0.09 mg/kg)	90% of Total Dose (0.81 mg/kg – should be what is left in vial if waste and bolus already removed)

How to Reconstitute Alteplase

Step 1:

- Remove the protective cap from the top of the 100 mg alteplase vial and the vial of SWFI. Swab the top of each vial with an alcohol wipe to reduce risk of contamination

Step 2:

- Remove the transfer device from the wrapper and remove the protective cap from one end. Insert the piercing pin vertically into the center of the stopper of the vial of SWFI, keeping the vial upright

Step 3:

- Remove the protective cap from the other end of the transfer device. Holding the vial of alteplase upside down, position it so that the center of the stopper is directly over the exposed pin of the transfer device

Step 4:

- Push the vial of alteplase down onto the transfer device, making sure the piercing pin is inserted through the center of the alteplase vial stopper

continued on next page

Step 5:

- Invert the two vials, so that the vial of alteplase is on the bottom, right side up. Allow the entire contents of the vial of SWFI to follow down through the transfer device into the vial containing alteplase – a process that requires approximately 2 minutes

Step 6:

- Mix the solution with a gentle swirling motion or inversion. DO NOT SHAKE. Slight foaming of the solution is normal. The final concentration is 1 mg/mL

How to Administer Alteplase

Step 1:

- After reconstitution to 1 mg/mL, inspect solution for particulate matter and discoloration prior to administration

Step 2:

- Withdraw 10% of the 0.9 mg/kg dose (the bolus dose) from the alteplase vial using a 10 mL syringe and needle.
- Fill out a medication label with all required information (patient name, medication, dosage, time, date, RN signature) and affix label to the 10 mL syringe. – if time permits
- Administer IV bolus over 1 minute.

Step 3:

- Discard excess (should be AT LEAST 10mL) by removing from vial any quantity of drug in excess of that specified for patient treatment. When drawing off excess solution, be sure to insert the needle into the peripheral area of the vial top, away from the puncture site caused by the transfer device.
- Then administer the remainder of dose (0.81mg/kg) over 60 minutes by spiking the stopper of the reconstituted vial of alteplase with an infusion set using the same puncture site created by the transfer device. Be sure to vent the tubing.

- Peel the clear plastic hanger from the vial label. Hang the alteplase vial from the resulting loop and infuse the remainder of dose with the smart pump

Step 4:

- When pump alarms "no flow above", there is still some alteplase left in the tubing which must be infused. Remove the IV tubing connector from the alteplase bottle and attach it to a newly spiked 100 mL bag of 0.9% NS.
- Continue the infusion at the current setting to deliver the remainder of the original alteplase volume over the remaining time. Continue the infusion until the preset volume is completed.

Fluid Composition

	PLASMA	0.9% SODIUM CHLORIDE (NORMAL SALINE)		LACTATED RINGER'S	PLASMA-LYTE A	D5W	NORMOSOL-R
Sodium (mmol/L)	135-145	154		130	140	0	140
Potassium (mmol/L)	3.5-5.1	0		4	5	0	5
Chloride (mmol/L)	94-111	154		109	98	0	98
Calcium (mmol/L)	2.2-2.6	0		2.7	0	0	0
Magnesium (mmol/L)	0.8-1.2	0		0	1.5	0	3
Bicarbonate (mmol/L)	23-30	0		0	0	0	0
Lactate (mmol/L)	1-2	0		28	0	0	0
Acetate (mmol/L)	0	0		0	27	0	27
Gluconate (mmol/L)	0	0		0	23	0	23
Glucose (g/L)	1	0		0	0	50	0
Osmolarity (mOsm/L)	380	308		275	294	285	296

References:

1. Self WH, Semler MW, Wanderer JP, et al. Saline Versus Balanced Crystalloids for Intravenous Fluid Therapy in the Emergency Department: Study Protocol for a Cluster-Randomized, Multiple-Crossover Trial. Trials. 2017; 18:178.
2. Self WH, Semler MW, Wanderer JP, Wang L, Byrne DW, Collins SP, Slovis CM, Lindsell CJ, Ehrenfeld JM, Siew ED, Shaw AD, Bernard GR, Rice TW; SALT-ED Investigators. Balanced Crystalloids versus Saline in Noncritically Ill Adults. N Engl J Med. 2018 Mar 1;378(9):819-828. doi: 10.1056/NEJMoa1711586. Epub 2018 Feb 27. PMID: 29485926; PMCID: PMC5846618.

Sedation and Paralytics Reference

SEDATION						SEDATION	
AGENT	DOSE	ONSET OF ACTION	DURATION OF ACTION		METABOLISM	ACHIEVABLE SEDATION	ADVERSE EFFECTS/ NOTES
Propofol	Start at 10 mcg/kg/min; increase by 5 mcg/kg/min every 5 minutes for target RASS Max: 50 mcg/kg/min	30 secs	10 – 15 min		Hepatic, Glucuronidation	Light – deep sedation (RASS -1 to -5)	AE: Hypertriglyceridemia Pancreatitis PRIS (high doses > 4 mg/kg/hr for > 48h)
Fentanyl	Start at 25 mcg/hr; increase by 25 mcg/hr every 15 minutes for target RASS Max: 200 mcg/hr	30 – 60 seconds	30 – 60 minutes		Hepatic, CYP3A4	Light – deep sedation (RASS -1 to -5)	AE: Peripheral edema, respiratory depression, constipation
Hydromorphone	Start: 0.5 mg/hr; increase by 0.25 mg/hr every 60 minutes for target RASS Max: 4 mg/hr	~ 5 min	3 – 4 hr		Hepatic, Glucuronidation	Light – deep sedation (RASS -1 to -5)	AE: Respiratory depression, hypotension, bradycardia, AMS Notes: Very potent/close attention to dosing, accumulation in hepatic impairment
Midazolam	Start at 0.02 mg/kg/hr; increase by 0.02 mg/kg/hr every 10 minutes for target RASS Max: 0.25 mg/kg/hr	1 – 5 min	< 2 hr		Hepatic; CYP3A4	Light – deep sedation (RASS -1 to -5)	AE: Respiratory depression, hypotension, bradycardia, pruritis Notes: prolonged half-life with hepatic, renal failure
Ketamine	Start at 0.05 mg/kg/hr; increase by 0.1 mg/kg/hr every 15 minutes to target RASS Max: 2.5 mg/kg/hr	30 seconds	5 – 10 mins		Hepatic, N-dealkylation	Light – deep sedation (RASS -1 to -5)	AE: Emergence reactions, increased intracranial and intraocular pressures, laryngospasms Notes: Has less hemodynamic effects
Dexmedetomidine	Start at 0.2 mcg/kg/hr; then titrate by 0.2 mcg/kg/hr every 30 minutes for target RASS Max: 1.5 mcg/kg/hr	5 – 10 minutes	1 – 2 hr		Glucuronidation, methylation, CYP2A6	Light sedation only (RASS -1 to -3)	AE: Bradycardia, Hypotension Notes: Does not cause respiratory depression

PARALYTICS						
AGENT	DOSE	ONSET OF ACTION		DURATION OF ACTION	METABOLISM	ADVERSE EFFECTS/ NOTES
DEPOLARIZING NMDA						
Succinylcholine	RSI: 1 – 1.5 mg/kg	< 1 min		4 – 10 min	Esterases	AE: Can cause ↑ in intraocular and intracranial pressure Fasciculations Notes: Avoid in hyperkalemia, malignant hyperthermia
NON-DEPOLARIZING NMDAS						
Rocuronium	RSI: 0.6 – 1.2 mg/kg ICU paralysis: Start at 8 mcg/kg/minute; adjust by 0.8 mcg/kg/min every 60 minutes to maintain 1-2 twitched on train of 4 Max: 12 mcg/kg/min	1 – 2 min		20 – 30 min	Hepatic	AE: Hypertension, increased PVR, tachycardia Notes: Use with caution in hepatic failure
Vecuronium	RSI: 0.08 – 0.1 mg/kg ICU paralysis: start at 0.8 mcg/kg/min; adjust by 0.3 mcg/kg/min every 60 minutes to maintain 1-2 twitched on train of 4 Max: 1.7 mcg/kg/min	2.5 – 3 min		45 – 60 min	Hepatic, renal	AE: Bradycardia, edema, flushing Notes: Use with caution in patient with renal, hepatic dysfunction
Cisatracurium	RSI: 0.15 – 0.2 mg/kg ICU paralysis: Start at 3 mcg/kg/min; titrate by 0.5 mcg/kg/min every 30 min to maintain 1 -2 twitches on train of 4 Max: 10 mcg/kg/min	2 – 3 min		35 – 45 min	Hoffmann elimination	AE: Bradycardia, bronchospasm, hypotension, myopathy Notes: Use with caution in therapeutic hypothermia

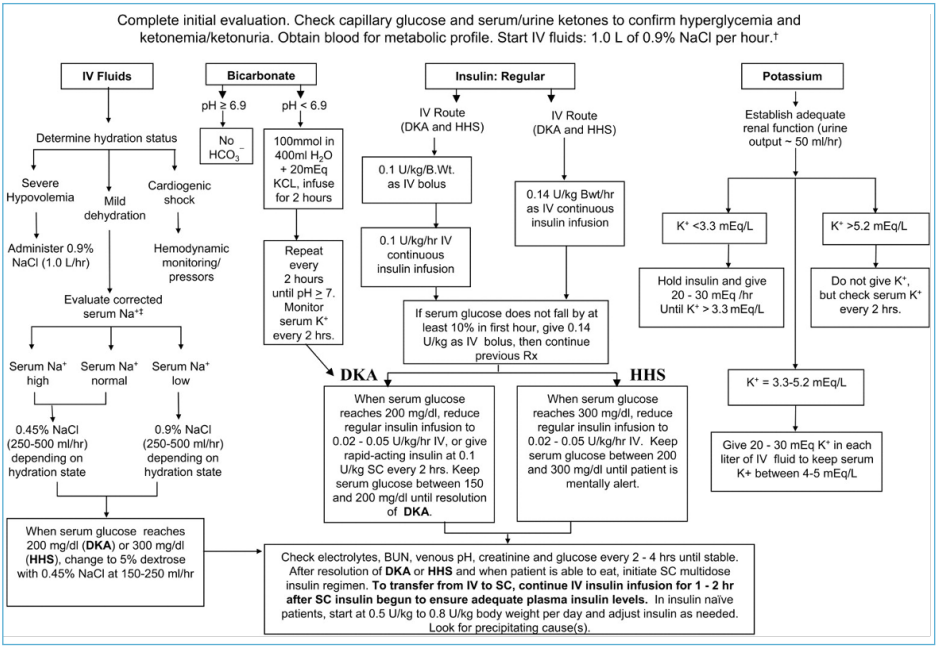
Vasopressor / Inotropes

DRUG		α1	β1	β2	DOPAMINE	VASOPRESSIN	NA+/ K+ ATPASE PUMPS	PDE III
Phenylephrine		+++	-	-	-	-	-	-
Norepinephrine		++++	++	-	-	-	-	-
Epinephrine	Low	+	+++	++	-	-	-	-
	High	+++	++	++	-	-	-	-
Dopamine	Low	-	+	-	++++	-	-	-
	Medium	+	++	-	+++	-	-	-
	High	+++	++	-	+	-	-	-
Dobutamine		+	++++	++	-	-	-	-
Vasopressin		-	-	-	-	+++	-	-
Midodrine		+++	-	-	-	-	-	-
Digoxin		-	-	-	-	-	+++	-
Milrinone		-	-	-	-	-	-	+++

Diabetic Ketoacidosis vs. Hyperosmolar Hyperglycemic State

	DIABETIC KETOACIDOSIS DKA			HYPEROSMOLAR HYPERGLYCEMIC STATE HHS
	MILD	MODERATE	SEVERE	
More Common Patient Population	Type I DM Younger			Type II DM Older
Onset	Rapid (<24h)			Slow (several days)
Blood Glucose (mg/dL)	>250			>600
Arterial pH	7.25 to 7.3	7 to <7.24	<7	Normal
Ketones	Present in plasma and urine			None or small amounts
Osmser (mOsm/L)	300-350			>350
Bicarbonate (mEq/L)	15-18	10 to <15	<10	Normal
Anion Gap	>10	>12	>12	Variable
Mental Status	Alert	Alert/drowsy	Stupor/ coma	Stupor/coma

Treatment Algorithm: OLOLRMC DKA and HHS ordersets are based on this algorithm:



Reference: Kitabchi AE, Umpierrez GE, Miles JM, Fisher JN. Hyperglycemic crises in adult patients with diabetes. Diabetes Care. 2009 Jul;32(7):1335-43. doi: 10.2337/dc09-9032. PMID: 19564476; PMCID: PMC2699725.

Hypertensive Urgency/Emergency

Hypertensive Urgency:

Blood Pressure >180/120 mmHg **WITHOUT** signs of **END ORGAN DAMAGE**

Hypertensive Emergency:

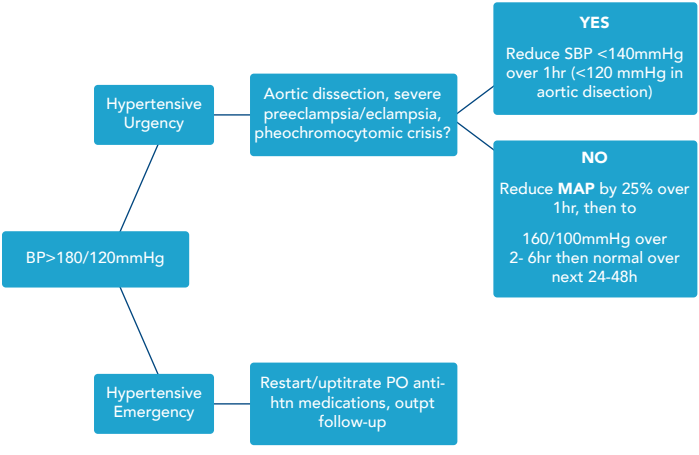
Blood Pressure >180/120mmHg **PLUS**

Signs of **END ORGAN DAMAGE:**

Cardiovascular: LVH, MI, aortic aneurysm, pulmonary edema

Cerebrovascular: encephalopathy, stroke, hemorrhage, retinopathy

Renal: albuminuria, proteinuria, AKI, renal failure



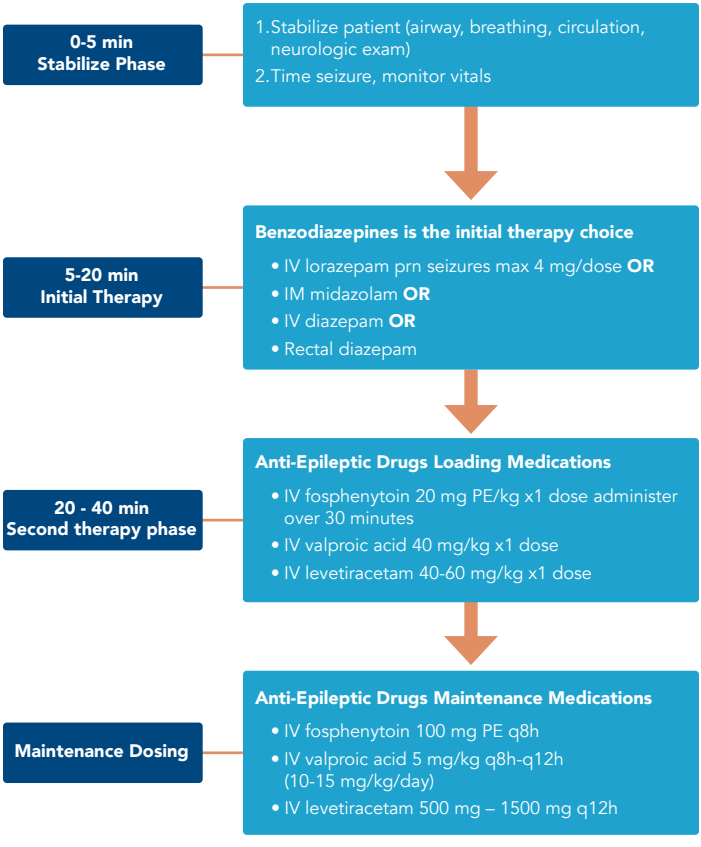
MEDICATIONS TO REDUCE BLOOD PRESSURE IN HYPERTENSIVE URGENCY/EMERGENCY

MEDICATION	DOSE	PHARMACOKINETIC PARAMETERS	MONITORING/ PRECAUTIONS	UNIT RESTRICTIONS
Labetalol	**IV Push:** 10 – 20 mg over 2 min then 20 – 80 mg Q10min	Onset: 5 min T1/2: 5.5 h	BP/HR, mental status	Telemetry required
	IV Infusion: START 2 mg/min; titrate by 1 mg/min Q10 min **MAX:** 6 mg/min			Critical care units only
Nicardipine	**IV Infusion:** START 5 mg/hr titrate by 2.5 mg/hr Q15 min **MAX:** 15 mg/hr	Onset: <1 min T1/2: 3 min	BP/HR, mental status	Critical care units only
Clevidipine	**IV Infusions:** START 1 mg/hr, titrate by doubling dose every 3 min **MAX:** 21 mg/hr	Onset: 2 – 4 min T1/2: 1 min	BP/HR, mental status, triglycerides	Critical care units only
Esmolol	**Loading Dose:** 500 – 1000 mcg/kg over 1 min **IV Infusion:** START 50 mcg/kg/min, increase by 50 mcg/kg/min Q5 min **MAX:** 300 mcg/kg/min	Onset: 2 min T1/2: 10 – 30 min	BP/HR, mental status	Critical care units only
Hydralazine	10 – 20 mg Q4 - 6h	Onset: 10 min T1/2: 3 - 7 h	BP/HR, mental status **Avoid in:** Patients w/ CAD, CHF	No restrictions

MEDICATIONS TO REDUCE BLOOD PRESSURE IN HYPERTENSIVE URGENCY/EMERGENCY

MEDICATION	DOSE	PHARMACOKINETIC PARAMETERS	MONITORING/ PRECAUTIONS	UNIT RESTRICTIONS
Enalaprilat	**IV Push:** 1.25 mg over 5 min Q6h	Onset: 15 min T1/2: 6 h	BP/HR, mental status, BUN, SCr, K+, angioedema Caution in renal impairment.	No restrictions
Nitroglycerin	**IV Infusion:** START: 5 mcg/ min; titrate by 5 mcg/min Q5 min; If no response at 20 mcg/min, increase by 10 mcg/min Q3 min **MAX:** 200 mcg/ minute	Onset: Immediate T1/2: 1 – 4 min	BP/HR, mental status **Avoid in:** Patients taking nitrates (e.g. sildenafil), pericarditis, cardiac tamponade	Critical care units only
Nitroprusside	**IV Infusion:** START: 0.5 mcg/ kg/min then titrate by 0.5 mcg/kg/min Q5 min **MAX:** 10 mcg/ kg/min **DO NOT EXCEED 10 mcg/ kg/min for more than 10 min at any given time**	Onset: <2 min T1/2: 35 h	BP (continuous monitoring required)/ HR, pH, mental status, SPO2/SvO2 **May Cause:** Cyanide toxicity, increased ICP, methemoglobinemia, thiocyanate toxicity (increased risk in renal impairment or prolonged infusions >72h).	Critical care units only
Clonidine	0.1 mg PO followed by 0.1 mg Q1hr prn **MAX:** 0.7 mg TOTAL	Onset: 30 – 60min T1/2: 12 - 16h	BP/HR, mental status	No restrictions

Status Epilepticus



Antibiotic Activity Chart

	Organism / Antibiotic	Penicillin	Oxacillin	Ampicillin	Amox/Clav	Amp/Sulb	Pip/tazo	Cefazolin	Ceftriaxone	Cefepime	Ceftazidime	Meropenem	Ertapenem	Imipenem	Levofloxacin	Ciprofloxacin	Doxycycline	Eravacycline	Gentamicin	Tobramycin	TMP/SMX	Clindamycin	Vancomycin	Daptomycin	Linezolid
Gram Negative Organisms	*Acinetobacter baumannii*					±	±			±	±	±		±	±	±		+	+	+	±				
	Citrobacter freundii						X		X	+	X	+	+	+	+	+		+	+	+	±				
	Citrobacter koseri						+		±	+	±	+	+	+	+	+		+	+	+	±				
	Enterobacter cloacae						X		X	++	X	+	+	+	+	+		+	+	+	+				
	Escherichia coli			±	±	±	+	+	+	+	+	+	+	+	±	±	±	+	+	+	±				
	Klebsiella (Enterobacter) aerogenes						X		X	+	X	+	+	+	+	+		+	+	+	+				
	Klebsiella oxytoca				±	±	+	+	+	+	+	+	+	+	+	+		+	+	+	+				
	Klebsiella pneumoniae				+	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+				
	Morganella morganii						+		+	++	+	+	+	±	±	±			+	+	±				
	Proteus mirabilis			+	+	+	+	+	+	+	+	+	+	±	±	±			+	+	±				
	Providencia stuartii						+		+	+	+	+	+	±	±	±			±	±	±				
	Pseudomonas aeruginosa						+			+	+	+		+	+	+			+	+					
	Serratia marcescens						X		X	++	X	+	+	+	+	+		+	+	+					
	Stenotrophomonas maltophilia										±				+						++				
Gram Positive Organisms	*Enterococcus faecalis*	+		++	+	+	+							+	±		±	+	±				+	+	+
	Enterococcus faecium																±	+	±				±	++	++
	Staphylococcus aureus (MSSA)		++	±	±	±	±	++	+	+		+	+	+			+	+	±		+	±	+	+	+
	Staphylococcus aureus (MRSA)																+	+	±		+	±	++	+	+
	Streptococcus agalactiae	++	+	+	+	+	+	+	+	+	±	+	+	+				+				±	+	+	+
	Streptococcus viridans group	±	±	±	±	±	±	+	++	+	±	+	+	+	+		±	+				±	+		+
	Streptococcus pyogenes	++	+	+	+	+	+	+	+	+	±	+	+	+				+					+	+	+	+
	Streptococcus pneumoniae	+	+	+	+	+	+	+	+	+	±	+	+	+	+			+				±	+	+	±	+

++ = recommended agent, clinically effective
+ = active (>80%)
± = variable activity
X = consider resistance due to inducible beta-lactamase
Blank boxes indicate intrinsic resistance or no data

Difficult treatment situations and recommendations for initial therapy:

- AmpC: *Citrobacter freundii*, *Enterobacter cloacae*, *Klebsiella aerogenes*, and *Serratia marcescens* can produce AmpC beta-lactamases after exposure to beta-lactams. Use of ceftriaxone or piperacillin-tazobactam could result in treatment failure.
- ESBL-positive: meropenem (Alternative: eravacycline) (Cefepime and piperacillin-tazobactam are not recommended)
- Acinetobacter: Ampicillin/sulbactam + gentamicin (Due to high resistance, initial combination therapy recommended)
- Piperacillin-tazobactam is not recommended for use in severe Staphylococcal infections
- Enterococcus is intrinsically resistant to cephalosporins. Do not attempt to use as monotherapy.
- Ceftazidime has very poor gram-positive coverage. Do not use as monotherapy if gram-positive coverage is needed.

IV TO PO CONVERSIONS FOR COMMON ANTIMICROBIALS					
IV AGENTS			PO AGENTS		APPROXIMATE ORAL BIOAVAILABILITY (%)
Azithromycin	250 – 500 mg	Q24h	Same dose	Same frequency	37
Clindamycin	600-900 mg	Q8h	450 mg	Q6h	90
Ciprofloxacin	400 mg 400 mg	Q12h Q8h	500 mg 750 mg	Q12h Q12h	70
Doxycycline	100 mg	Q12h	Same dose	Same frequency	90
Fluconazole	100 – 400 mg	Q24h	Same dose	Same frequency	90
Levofloxacin	250 – 750 mg	Q24h	Same dose	Same frequency	99
Linezolid	600 mg	Q12h	Same dose	Same frequency	100
Metronidazole	500 mg	Q8h	Same dose	Same frequency	100
Voriconazole	100 – 200 mg (4 mg/kg)	Q12h	Same dose	Same frequency	96

2020 OLOL Adult Inpatient Antibiogram: Non-Urine Sources
(Percent Susceptibilities of the Most Common Pathogens)

Legend: • Resistant
*Low isolate numbers
Breakpoint change
^Penicillin

Questions?
Microbiology Lab: 225-765-8761

Antimicrobial Stewardship Team:
225-374-8768, M-F 0830-1630

		# Isolates	ESBL (+)	PENICILLIN (NON-CSF)	PENICILLIN (CSF)	OXACILLIN	AMPICILLIN	AMP/SULB	PIP/TAZO	CEFUROXIME	CEFTRIAXONE	CEFTRIAXONE (CSF)	CEFTAZIDIME	CEFEPIME	MEROPENEM	LEVOFLOXACIN	GENTAMICIN	TOBRAMYCIN	ERYTHROMYCIN	CLINDAMYCIN	TMP/SMX	TETRACYCLINE	VANCOMYCIN
Gram Negative Organisms	*Acinetobacter baumanni*	57					75	40				51	47	49	47	91	96						
	Citrobacter freundii	22						•		•			100	100	95	95	95						
	Citrobacter koseri	18						89		100			100	100	100	100	100						
	Enterobacter cloacae	100						•		•			98	98	93	99	97			97			
	Escherichia coli	515	11%				45	54	86#				96	100	73	89	87			68			
	Klebsiella (Enterobacter) aerogenes	43						•		•			100	100	98	98	98			100			
	Klebsiella oxytoca	48	10%					71		88			96	96	96	98	96			94			
	Klebsiella pneumoniae	183	15%					72	80#	85			91	99	90	91	89			84			
	Morganella morganii	46							98	85			98	96	76	83	91			80			
	Proteus mirabilis	185					76	84	99	96			98	99	72	92	92			78			
	Providencia stuartii	13						23	100	85			92	100	15								
	Pseudomonas aeruginosa	292							92			89	88	92	78	93	99						
	Serratia marcescens	117							•	•			99	100	89	98	84						
	Stenotraphomonas maltophilia	66													88					100			
Gram Positive Organisms	*Enterococcus faecalis*	222		99			100									79							99
	Enterococcus faecium	46		20			26									83							39
	Staphylococcus aureus (Methicillin Resistant)	806																14	61	96	94		100
	Staphylococcus aureus (Methicillin Sensitive)	469				100												61	79	97	93		100
	Staphylococcus coagulase negative- All	378				43												37	52		83		100
	Staphylococcus epidermidis	217				33												29	47		82		100
	Staphylococcus lugdunensis	26				58												62	58		92		100
	Streptococcus agalactiae (Group B)	124		100						100								28	35				100
	Streptococcus viridans group	51		67						88									69				100
	Streptococcus Pyogenes (Group A)	31		100						100								61	61				100
	Streptococcus pneumoniae	64		98	52				69^	98	86				98			42	81	59	72		100

Disclaimer: This antibiogram represents percent susceptibilities of the most common pathogens isolated from adult inpatients at Our Lady of the Lake Regional Medical Center and Our Lady of the Lake Ascension in 2020

*Note: Interpret data with caution when there are less than 30 isolates tested

Isolates considered resistant if ESBL-positive

^ Represents 55 isolates tested at Our Lady of the Lake Main campus. Isolates from Ascension campus were not tested

• Because of the presence of inducible beta-lactamase, these organisms should be considered resistant to the antimicrobial indicated

Color legend: ≥90% 75-89 % ≤74%

2020 OLOL Adult Inpatient Antibiogram: Urine Sources
(Percent Susceptibilities of the Most Common Pathogens)

legend: • Resistant
*Low isolate numbers
^Penicillin
#2019 and 2020

Questions?
Microbiology Lab: 225-765-8761

Antimicrobial Stewardship Team:
225-374-8768, M-F 0830-1630

		# Isolates	ESBL (+)	NITROFURANTOIN	BENZYLPENICILLIN^	AMPICILLIN	AMP/SULB	PIP/TAZO	CEFTRIAXONE	CEFTAZIDIME	CEFEPIME	MEROPENEM	CIPROFLOXACIN	LEVOFLOXACIN	GENTAMICIN	TOBRAMYCIN	TMP/SMX	VANCOMYCIN
Gram Negative Organisms	*Acinetobacter baumannii*	22#*				73	55		68	64	64	64	64	91	91			
	Citrobacter freundii	66#		97			•	•		100	100		83	97	97			
	Citrobacter koseri	71#		85			100	100		100	100		97	100	100			
	Enterobacter cloacae	83#		42			•	•		95	98		88	95	96	95		
	Escherichia coli	1435	10%	95		43	54	89	90		98	100		65	91	92	64		
	Klebsiella (Enterobacter) aerogenes	49		10				•	•		96	100		84	98	100	98		
	Klebsiella oxytoca	65#	6%	69			58		89		95	99		92	94	92	94		
	Klebsiella pneumoniae	280	11%	24			79	88	89		95	99		85	95	93	87		
	Morganella morganii	51#						92	75		94	98		63	80	100	69		
	Proteus mirabilis	173	0.5%			74	80	98	97		98	100		65	88	87	75		
	Pseudomonas aeruginosa	120						89			85	89	75	66	90	97			
	Serratia marcescens	51						•	•		100	98		82	98	80			
	Stenotrophomonas maltophilia	12#*												75			75		
	Enterococcus faecalis	254		98	98	100									79			100	
	Enterococcus faecium	62#		11	6	8									85			26	

• Because of the presence of inducible beta-lactamase, these organisms should be considered resistant to the antimicrobial indicated
*Note: Interpret data with caution when there are less than 30 isolates tested
^Benzylpenicillin is penicillin G
#Isolates from 2019 and 2020 due to low isolate count (<30) in 2020

Disclaimer: This antibiogram represents percent susceptibilities of the most common pathogens isolated from adult inpatients at Our Lady of the Lake Regional Medical Center and Our Lady of the Lake Ascension in 2020

Color legend: ≥90% 75-89 % ≤74%

2020 CLSI Anaerobic Cumulative Antibiogram

(Isolates collected from selected US hospitals from 1 January 2013 to 31 December 2016)

Questions?
Microbiology Lab: 225-765-8761

Antimicrobial Stewardship Team:
225-374-8768, M-F 0830-1630

	PENICILLIN	AMP/SULBACTAM	PIP/TAZO	CEFOXITIN	IMIPENEM	ERTAPENEM	MEROPENEM	CLINDAMYCIN	MOXIFLOXACIN	METRONIDAZOLE
Bacteroides fragilis	-	84 (129)	96 (1030)	100 (830)	97 (189)	82 (133)	93 (1505)	26 (1013)	61 (256)	100 (1140)
Bacteroides thetaiotaomicron	-	82 (76)	87 (252)	13 (258)	100 (70)	-	99 (328)	28 (328)	54 (70)	100 (322)
Bacteroides ovatus	-	80 (30)	94 (206)	20 (177)	100 (49)	84 (133)	95 (236)	46 (207)	41 (59)	100 (236)
Bacteroides vulgatus	-	45 (20)*	92 (168)	73 (153)	97 (35)	-	96 (171)	53 (171)	31 (29)*	100 (186)
Bacteroides uniformis	-	84 (19)*	96 (78)	85 (72)	100 (19)*	-	100 (93)	45 (87)	48 (25)*	100 (89)
Parabacteroides distasonis	-	59 (27)*	95 (92)	29 (82)	100 (26)*	-	97 (100)	43 (108)	62 (37)	100 (118)
Prevotella spp.	100 (63)	97 (29)*	100 (63)	-	100 (29)*	-	98 (92)	69 (29)*	66 (92)	99 (92)
Fusobacterium spp.	-	100 (20)*	96 (55)	-	95 (75)	-	100 (20)*	77 (75)	68 (75)	95 (75)
Anaerobic gram-positive cocci**	100 (1647)	-	99 (1853)	-	99 (134)	-	100 (1647)	97 (1826)	72 (300)	100 (1692)
Cutibacterium (*Propionibacterium acnes*)	-	-	100 (18)*	-	94 (17)*	-	-	53 (17)*	95 (114)	0 (18)*
Clostridium perfringens	90 (402)	100 (15)*	100 (410)	-	100 (23)*	-	100 (417)	83 (425)	83 (23)*	100 (425)
Clostridioides difficile	6 (533)	99 (76)	93 (542)	-	69 (480)	-	99 (609)	32 (1013)	74 (480)	100 (1343)
Other *Clostridium spp.*	69 (390)	-	94 (439)	-	99 (71)	-	100 (390)	67 (461)	62 (71)	100 (461)

Disclaimer: This antibiogram was made from isolates around the US and is not specific to OLOL. Anaerobic susceptibility testing is not routinely performed.
*Note: Interpret data with caution when there are less than 30 isolates tested

**Anaerobic GPCx: *Peptococcus*, *Peptostreptococcus*, *Finegoldia*, *Peptoniphilus*, and *Anaerococcus*

Color legend: ≥90% | 75-89 % | ≤74%

Data legend:
100 % susceptible
(1647) (number of isolates)

Table 1 Recommended Adult Immunization Schedule by Age Group, United States, 2021

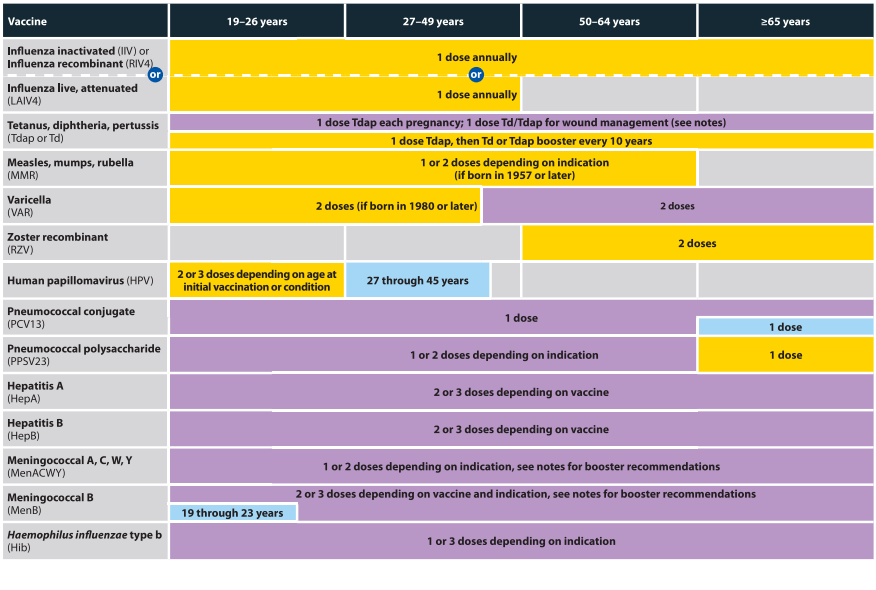
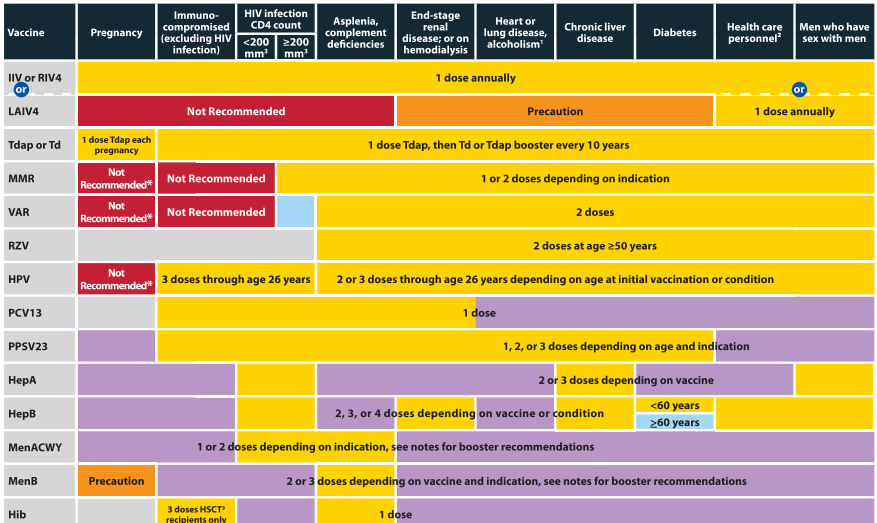


Table 2 Recommended Adult Immunization Schedule by Medical Condition and Other Indications, United States, 2021



1. Precaution for LAIV4 does not apply to alcoholism. **2.** See notes for influenza; hepatitis B; measles, mumps, and rubella; and varicella vaccinations. **3.** Hematopoietic stem cell transplant.

Beta-Lactam Allergy Cross Reactivity Table

Desired Beta-lactam			Allergy history: Penicillin	Oxacillin	Dicloxacillin	Amoxicillin (Amox/Clav)	Ampicillin (Amp/Sulb)	Piperacillin/Tazo	Cephalexin	Cefazolin	Cefoxitin	Cefuroxime	Cefdinir	Ceftazidime	Ceftriaxone	Cefotaxime	Cefepime	Ceftaroline	Ceftolozane/ Tazo	Meropenem	Ertapenem	Imipenem	Aztreonam
	Penicillins	Penicillin		△	△	X	X	△	X	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Oxacillin	△		△	△	△	△	△	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Dicloxacillin	△	△		△	△	△	△	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Amoxicillin (Amox/Clav)	X	△	△		X	△	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Ampicillin (Amp/Sulb)	X	△	△	X		△	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Piperacillin/Tazo	△	△	△	△	△		△	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	1st Gen	Cephalexin	X	△	△	X	X	△		✓	✓	✓	✓	△	△	✓	✓	✓	✓	✓	✓	✓	✓
		Cefazolin	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	2nd Gen	Cefoxitin	X	✓	✓	✓	✓	✓	✓	✓		X	✓	✓	△	△	✓	✓	✓	✓	✓	✓	✓
		Cefuroxime	✓	✓	✓	✓	✓	✓	✓	✓	X		✓	△	X	X	X	△	△	✓	✓	✓	△
	3rd Gen	Cefdinir	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		△	△	△	△	△	△	✓	✓	✓	✓
		Ceftazidime	✓	✓	✓	✓	✓	✓	△	✓	✓	△	△		X	X	△	△	X	✓	✓	✓	X
		Ceftriaxone	✓	✓	✓	✓	✓	✓	△	✓	△	X	△	X		X	X	△	△	✓	✓	✓	△
		Cefotaxime	✓	✓	✓	✓	✓	✓	✓	✓	△	X	△	X	X		X	△	△	✓	✓	✓	△
	4th Gen	Cefepime	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	△	△	X	X		△	△	✓	✓	✓	△
	Non- Gen	Ceftaroline	✓	✓	✓	✓	✓	✓	✓	✓	✓	△	△	△	△	△	△		△	✓	✓	✓	✓
		Ceftolozane	✓	✓	✓	✓	✓	✓	✓	✓	✓	△	△	X	△	△	△	△		✓	✓	✓	X
	Carba-penem	Meropenem	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		△	✓	✓
		Ertapenem	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	△		✓	✓
		Imipenem	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
	Mono	Aztreonam	✓	✓	✓	✓	✓	✓	✓	✓	✓	△	✓	X	△	△	△	✓	X	✓	✓	✓	

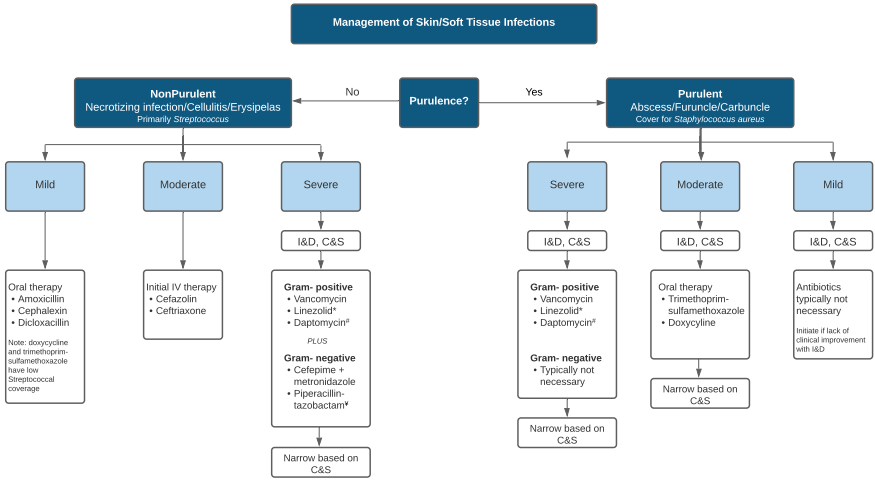
This resource was created from Beta-lactam side chain data and pre-existing cross reactivity tables. For any agents with mixed data, the more cautious designation was selected. If patient's allergy history states "penicillins" or "cephalosporins", obtain additional history from patient. If unable to determine, consider cross reactivity of all agents in the specified class. If test dose challenge is desired, contact clinical pharmacy for assistance. Can do 10% antibiotic dose x1 or can do graded challenge with 1%, 10%, then 100% antibiotic dose.

Symbol/Color legend:

✓ Side chains are different. Low risk of allergic reaction. If concerned, can order diphenhydramine PRN with first dose.

△ Side chains similar. Possible risk of allergic reaction. If anaphylaxis, use different agent. (Test-dose challenge with diphenhydramine + epinephrine PRN in select cases.) If not anaphylaxis, can order test-dose with diphenhydramine PRN with first dose

X Side chains nearly identical/identical. Higher risk for allergic reaction. If anaphylaxis, use different agent. If not anaphylaxis and limited alternative options exist, can consider test-dose challenge with diphenhydramine + epinephrine PRN.



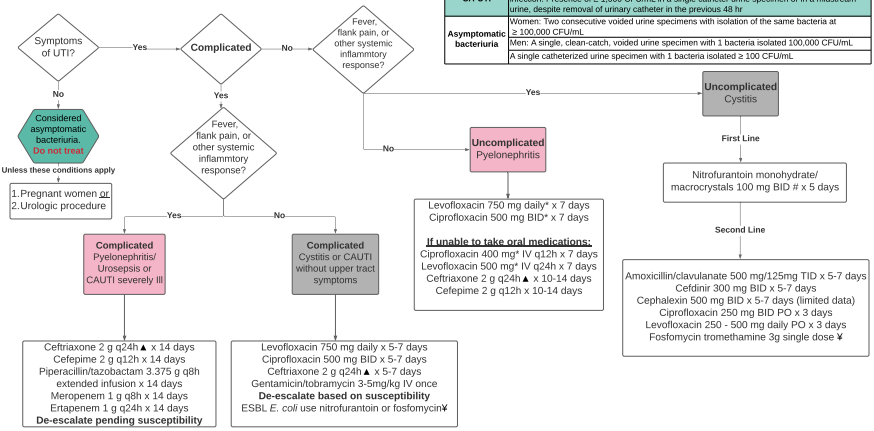
Note:
* Avoid initial use if bacteremia is suspected. Evaluate for drug interactions which could increase risk of serotonin syndrome. Risk of myelosuppression with use ≥14 days and neuropathy ≥28 days.
# Can be used if contraindication to vancomycin therapy. Avoid use if patient has concurrent bacterial pneumonia. Monitor CPK weekly while on therapy.
¥ Many studies have shown increased rates of nephrotoxicity when vancomycin and piperacillin-tazobactam are used together. Consider vancomycin + cefepime (+/- metronidazole) when possible.

Additional information to consider:
Clindamycin is NOT recommended as empiric coverage due to resistance >20% for most Staphylococcus and Streptococcus isolates. Can be used as an add-on for necrotizing infections.
Doxycycline and trimethoprim- sulfamethoxazole have low Streptococcal coverage and should not be used as monotherapy for nonpurulent cellulitis.
If methicillin-susceptible *Staphylococcus aureus*, nafcillin, cefazolin, or ceftriaxone can be used. Dicloxacillin or cephalexin can be used for step-down to oral therapy.

Urinary Tract Infection (UTI) Inpatient

Definition: Cystitis (infection of the bladder/lower urinary tract) and pyelonephritis (infection of the kidney/upper urinary tract).
Common Pathogens: *Escherichia coli, Klebsiella spp., Proteus spp.* and *Staphylococcus saprophyticus, Enterococcus faecalis.*

Category	Description
Uncomplicated UTI	Lower urinary symptoms (dysuria, frequency, and urgency) in otherwise healthy non-pregnant women
Complicated UTI	Pregnant women, men, obstruction, immunosuppression, renal failure, renal transplantation, urinary retention from neurologic disease, and individuals with risk factors that predispose to persistent or relapsing infection (e.g., calculi, indwelling catheters or other drainage devices).
CA-UTI	Presence of indwelling urinary catheters with signs and symptoms of UTI and no other source of infection. Presence of ≥ 1,000 CFU/mL in a single catheter urine specimen or in a midstream urine, despite removal of urinary catheter in the previous 48 hr
Asymptomatic bacteriuria	Women: Two consecutive voided urine specimens with isolation of the same bacteria at ≥ 100,000 CFU/mL
	Men: A single, clean-catch, voided urine specimen with 1 bacteria isolated 100,000 CFU/mL
	A single catheterized urine specimen with 1 bacteria isolated ≥ 100 CFU/mL



- Direct therapy based on culture results
- Flank pain = costovertebralangle (CVA) tenderness
- Pyuria or foul smelling urine are not indications for treatment
- E. coli susceptibility at OLOL to sulfamethoxazole-trimetoprim is low (68%) and should not be used empirically, if susceptible dosing is 800/160 mg BID x 3 days for cystitis and x 14 days for pyelonephritis

* Fluroquinolone resistance at OLOL is >10%, considering giving one dose of ceftriaxone 2g or a single dose of an aminoglycoside
# Avoid use in patients with CrCl <30 mL/min
▲Ceftriaxone 1 g can be found as adequate dosing, 2 g preferred at OLOL especially in critically Ill patients and/or high BMI
¥ fosfomycin (Monurol) is restricted to use in treating UTI's with VRE or ESBL-producing organisms
REVISED 8/2021

CAUTI:catheter-associated UTI
BID: twice daily
CFU: colony-forming unit
IV: intravenous
PCR: polyemerase chain reaction
PO: oral
WBC: white blood count

Hospital-Acquired Pneumonia / Ventilator-Associated Pneumonia (HAP/VAP)

Definition: Infection of lower respiratory tract that is contracted within a healthcare facility
Common Pathogens: *P. aeruginosa, Acinetobacter, Klebsiella, and* MRSA

HAP
Pneumonia develops ≥48h after hospitalization

VAP
Pneumonia develops ≥48h after endotracheal ventilation

Diagnosing Pneumonia
- Clinical evidence of pneumonia
- Respiratory culture and gram stain
- Blood cultures (severely ill)
- **MRSA/MSSA PCR nasal swab**

Any of the following?
- Ventilatory support
- Septic Shock
- Structural lung disease
- IV Antibiotics within 90 days

Additional MRSA Risk Factors
History of MRSA colonization or infection, intravenous drug use, necrotizing pneumonia, recent stay in a nursing home or skilled nursing facility, prolonged hospitalization with unknown MRSA colonization status

No → cefepime, piperacillin/tazobactam, meropenem, **or** levofloxacin ← No

Any of the following?
- ARDS prior to VAP
- Septic Shock at time of VAP
- IV antibiotics within 90 days
- Acute renal replacement prior to VAP
- ≥5 days in hospital prior to VAP

Additional MRSA Risk Factors
History of MRSA colonization or infection, intravenous drug use, necrotizing pneumonia, recent stay in a nursing home or skilled nursing facility, prolonged hospitalization with unknown MRSA colonization status

Yes → **Choose an antibiotic from each group**
Group 1: vancomycin or linezolid
Group 2: cefepime, meropenem, piperacillin/tazobactam, aztreonam[x]
Group 3: levofloxacin, ciprofloxacin, tobramycin, gentamicin ← Yes

Stop or consider not starting group 1 if
MRSA nasal swab negative or no MRSA risk factors

Group 1: Anti-MRSA Agents
Group 2: Antipseudomonal β-Lactam–Based Agents
Group 3: Antipseudomonal Non-β-Lactam–Based Agents

Duration of Treatment:
7 days based on clinical improvement and if no widespread infection or local complications (abscess, empyema)

- [x] If allergy documented to beta-lactams, aztreonam can be used as alternative for pseudomonal coverage
- Refrain from using double beta-lactams if feasible
- *Pseudomonas* fluoroquinolone susceptibility <80% according to 2019 antibiogram, be cautious if using for double coverage
- Tobramycin preferred over gentamicin for *Pseudomonas*
- Recommended to use clinical criteria alone, rather than using serum procalcitonin plus clinical criteria, to decide whether or not to initiate antibiotic therapy
- Negative nasal MRSA PCR has >95% negative predictive value, suggesting that pneumonia is unlikely to be due to MRSA pneumonia. If pneumonia suspected, pharmacy has protocol to order MRSA PCR. Pharmacy will need to contact providers to suggest discontinuation of anti MRSA agent taking into consideration other possible indications
- Direct therapy based on culture results
- Linezolid is an alternative to vancomycin in proven MRSA pneumonia without bacteremia

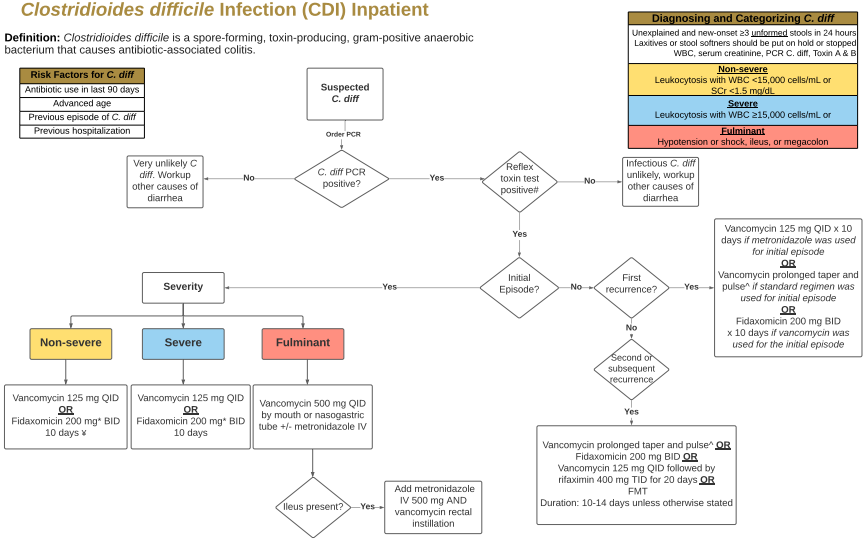
Reference: Kalil AC, Metersky ML, Klompas M, et al. Management of Adults With Hospital-acquired and Ventilator-associated Pneumonia: 2016 Clinical Practice Guidelines by the Infectious Diseases Society of America and the American Thoracic Society. Clin Infect Dis. 2016 Sep 1;63(5):e61-e111.

REVISED 8/2021

HAP: hospital-acquired pneumonia
VAP: ventilator-associated pneumonia
ET: endotracheal tube
MSSA: methicillin-sensitive *Staphylococcus aureus*
MRSA: methicillin-resistant *Staphylococcus aureus*
GNB: gram-negative bacilli
IV: intravenous
PCR: polymerase chain reaction
ARDS: acute respiratory distress syndrome

Clostridioides difficile Infection (CDI) Inpatient

Definition: *Clostridioides difficile* is a spore-forming, toxin-producing, gram-positive anaerobic bacterium that causes antibiotic-associated colitis.



^Vancomycin pulse dosing orderset is under "clostridium difficile general treatment" > recurrent episode > pulse dose
Toxins immunoassay has low sensitivity, false negatives are possible
¥ Can consider oral metronidazole 500 mg TID if preferred regimen not available
* Fidaxomicin is restricted to Infectious Diseases physicians for recurrent CDI or vancomycin allergy
- Do not perform repeat testing (within 7 days) during the same episode of diarrhea
- Although there is an epidemiologic association between proton pump inhibitor (PPI) use and CDI, and unnecessary PPIs should always be discontinued there is insufficient evidence for discontinuation of PPIs as a measure for preventing CDI
- Probiotics are recommended *against* using for the prevention of CDI
- Vancomycin is given orally, unless otherwise stated. Vancomycin IV does not have a role for C. diff treatment
- FMT is not covered by insurance

C. diff or CDI: *clostridioides difficile* infection
FMT: fecal microbiota transplantation
IV: intravenous
PCR: polymerase chain reaction
TID: three times daily
WBC: white blood count
QID: four times daily
Revised 11/2021

Community Acquired Pneumonia (CAP) Inpatient

Definition: Infection of lower respiratory tract that is contracted outside of a healthcare facility
Common Pathogens: *S. pneumoniae, H. influenzae, M. pneumoniae, S. aureus, Legionella spp., C. pneumoniae, M. catarrhalis*

Risk factors for MRSA	Risk factors for *Pseudomonas*
Known colonization or prior infection with MRSA	Known colonization or prior infection with *Pseudomonas*
Recent hospitalization	Recent hospitalization
IV antibiotics in previous 3 months	IV antibiotics in previous 3 months
Preceding influenza	Structural lung disease
Severe CAP requiring ICU admission, empyema, or necrotizing/cavitary infiltrates	Frequent COPD exacerbations with frequent steroids and antibiotics

Criteria for defining severe CAP validated definition includes either one major criterion or three or more minor criteria

Minor criteria
Respiratory rate>30 breaths/min
PaO2/FIO2 ratio <250
Multilobar infiltrates
Confusion/disorientation
Uremia (blood urea nitrogen level>20 mg/dL)
Leukopenia (WBC count <4,000 cells/mL)
Thrombocytopenia (platelet count <100,000/mL)
Hypothermia (core temperature <36 C)

Major criteria
Septic shock with need for vasopressors
Respiratory failure requiring mechanical ventilation

Suspected or confirmed CAP

Empiric abx treatment

Severe CAP based on criteria?

No → **Non-severe CAP**

Yes → **Severe CAP**

Combination antipneumoccal βL + macrolide¥ **OR** βL + Respiratory FQ

Risk factors?

Non-severe CAP

Combination antipneumoccal βL + macrolide¥ **OR** Respiratory FQ

Risk Factors?

MDRO considerations

- Prior respiratory isolation of **MRSA** → Yes → Add anti-MRSA agent and obtain cultures and nasal MRSA nasal PCR to allow for de-escalation
- Prior respiratory isolation of ***Pseudomonas*** → Yes → Add pseudomonal coverage and obtain cultures to allow for de-escalation
- Recent hospitalization and IV **MRSA** abx → Yes → Obtain cultures but WITHHOLD MRSA coverage unless MRSA nasal PCR is positive or culture results are positive
- Recent hospitalization and IV **pseudomonal** abx → Yes → Obtain cultures but WITHHOLD pseudomonal coverage unless culture results are positive

Severe CAP

MDRO considerations

- Prior respiratory isolation of **MRSA** → Yes → Add anti-MRSA agent and obtain cultures and MRSA nasal PCR to allow for de-escalation
- Prior respiratory isolation of ***Pseudomonas*** → Yes → Add pseudomonal coverage and obtain cultures to allow for de-escalation
- Recent hospitalization and IV **MRSA** abx → Yes → Add MRSA coverage and obtain MRSA nasal PCR and cultures to allow for de-escalation
- Recent hospitalization and IV **pseudomonal** abx → Yes → Add pseudomonal coverage and obtain cultures to allow for de-escalation

CAP Antibiotics Approved at OLOL

Anti-MRSA#	AMG	Respiratory FQs	Antipseudomonal FQs	Antipseudomonal/ Antipneumococcal βLs	Antipneumococcal βL	Macrolides
Vancomycin Linezolid	Gentamicin Tobramycin	Levofloxacin	Ciprofloxacin Levofloxacin	Cefepime, Piperacillin/tazobactam, Ceftazidime*, Meropenem	Ceftiaxone, Ampicillin/sulbactam	Azithromycin, Clarithromycin

- Continue antibiotics until patient achieves stability and for no less than a total of 5 days
- If allergy documented to beta-lactams, aztreonam can be used as alternative for pseudomonal coverage
- Macrolide resistance rates at OLOL are > 30% among *S. pneumoniae* isolates and monotherapy should not be used
- Refrain from using double beta-lactams if feasible
- Negative nasal MRSA PCR has >95% negative predictive value, suggesting that pneumonia is unlikely to be due to MRSA
- Pneumococcal and *Legionella* urinary antigens are not suggested to be routinely tested, unless; known outbreak, recent travel, or severe CAP
¥ If marcrolide use is contraidicated, doxycycline can be used as alternative
*Ceftazidime is restricted to infectious disease
#Anti-MRSA agents may also include ceftaroline, however restricted to infectious diseases

Abx: antibiotics
AMG: aminoglycoside
βL: beta-lactam
FQ: fluroquinolone
MDRO: multi-drug resistant organism
MRSA: methicillin-resistant *Staphylococcus aureus*
PCR: polyemerase chain reaction
WBC: white blood count

Pharmacokinetics of Commonly Used Insulin Preparations

PRANDIAL INSULIN			
Insulin Type	**Approximate Onset of Action**	**Effective Peak**	**Approximate Duration of Action**
Lispro, lispro-aabc, aspart, faster aspart, glulisine	15 to 30 minutes	1 to 3 hours	4 to 6 hours
Regular	30 minutes	1.5 to 3.5 hours	8 hours

BASAL INSULIN			
Insulin Type	**Half Life**	**Effective peak**	**Approximate Duration of Action**
NPH	4.4 hours	4 to 6 hours	12 hours
Insulin glargine			
- U-10	12 hours	No pronounced peak	20 to ≥ 24 hours
- U-300	19 hours	No pronounced peak	20 to ≥ 24 hours
Insulin detemir	5 to 7 hours	3 to 9 hours	6 to 24 hours
Insulin degludec	25 hours	No pronounced peak	≥ 24 hours

Opioid MME and Dosing Conversions

Morphine Milligram Equivalents (MME)

- Standard against which most opioids can be compared, in terms of potency
- Helps determine if a total daily dose of opioids is associated with ↑ overdose risk

OPIOID (doses in mg/day)	CONVERSION FACTOR
Codeine	0.15
Fentanyl (transderm in mcg/hr)	2.4
Hydrocodone	1
Methadone	
1-20mg/day	4
21-40mg/day	8
41-60mg/day	10
≥ 61-80mg/day	12
Morphine	1
Oxycodone	1.5
Oxymorphone	3

CAUTION: Do not use the calculated dose in MMEs to determine dosage for converting one opioid to another—the new opioid should be lower to avoid unintentional overdose caused by incomplete cross-tolerance and individual differences in opioid pharmacokinetics. Consult the medication label.

Steps to Calculate MME:

1. Calculate opioid dose in mg/day (except fentanyl—mcg/hr)

2. Multiply by conversion factor

DOSING CONVERSIONS		
OPIOID	**IV/IM (MG)**	**ORAL (MG)**
Morphine	10	30
Hydromorphone	1.5	7.5
Oxycodone	-	20
Hydrocodone	-	30
Codeine	130	200
Fentanyl	0.1	-
Meperidine	75	300
Oxymorphone	1	10

CAUTION: Fentanyl is dosed in mcg/hr and NOT mg/hr. Consult the fentanyl dosing table in the package inset for converting to a fentanyl patch.

Steps to Convert:

1. Calculate total 24hr dose requirements of current drug
2. Use ratio conversion to calculate the dose of the new drug
3. Calculate 24hr dose of new drug and reduce by at least 25%
4. Divide to attain appropriate interval and dose for new drug
5. Have agent available for breakthrough pain (~5-15% of total daily baseline opioid dose)

Centers for Disease Control and Prevention. 2018 Annual Surveillance Report of Drug-Related Risks and Outcomes — United States. Surveillance Special Report 2pdf icon. Centers for Disease Control and Prevention, U.S. Department of Health and Human Services. Published August 31, 2018.

Dyslipidemia

- Primary dyslipidemia is familial (genetic)
- Secondary dyslipidemia is acquired from diet, lifestyle, or drug/condition-induced

DRUG INDUCED DYSLIPIDEMIA			
↑ LDL and TG	↑ LDL	↑ TG	Conditions
Protease inhibitors	Fibric acids	Lipid emulsions	Obesity
Atypical antipsychotics	SGLT2 inhibitors	Propofol	Poor diet
Steroids	Thiazolidinediones	Beta blockers	Hypothyroidism
Diuretics			Nephrotic syndrome
Transplant drugs			Biliary obstruction

- ASCVD risk calculator: tools.acc.org/ascvd-risk-estimator-plus
  - Used to evaluate 10-year risk of having a primary CV event occur

STATIN BENEFIT GROUPS	PATIENT CRITERIA	STATIN
Secondary Prevention		
Clinical ASCVD Hx of MI, stable/unstable angina, stroke, TIA, PAD, coronary/arterial revascularization	< 75 years >75 years	High intensity Moderate intensity or high intensity
Primary Prevention		
LDL > 190 mg/dL		High intensity
Diabetes and age 40 – 75 years with LDL between 70 – 189 mg/dL		Moderate intensity
Age 40 – 75 years with LDL between 70 – 189 mg/dL	10-year ASCVD risk > 20%	High intensity
	10-year ASCVD risk > 7.5%	Moderate intensity
	10-year ASCVD risk < 7.5%	Consider risk-benefit

High Intensity ↓ LDL by > 50%	Moderate Intensity ↓ LDL by 30 – 49%	Low Intensity ↓ LDL by < 30%
Atorvastatin 40 – 80 mg	**Atorvastatin 10 – 20 mg**	Simvastatin 10 mg
Rosuvastatin 20 – 40 mg	**Rosuvastatin 5 – 10 mg**	**Pravastatin 10 – 20 mg**
	Simvastatin 20 – 40 mg	**Lovastatin 20 mg**
	Pravastatin 40 – 80 mg	Fluvastatin 20 – 40 mg
	Lovastatin 40 mg	Pitavastatin 1 mg
	Fluvastatin XL 80 mg	
	Fluvastatin 40 mg BID	
	Pitavastatin 2 – 4 mg	

*Fluvastatin, lovastatin, and simvastatin most efficacious when taken in the evening

- Statins—1st line for dyslipidemia and ASCVD risk reduction
  - ↓ LDL (see above) ↑HDL 5-15%, ↓ TG 10-30%
  - **Side effects:** myalgias, arthralgias, myopathy, liver function test abnormalities
  - **Contraindications:** liver disease, pregnancy/nursing, strong CYP3A4 inhibitors
- Ezetimibe—1st line for further LDL ↓ in patients already on max-tolerated statin
  - *Ideal for those that need high-intensity statin but cannot tolerate*
  - ↓LDL 13-20%, ↑HDL 1-3%, ↓ TG 5-10%
  - **Side effects:** myalgias, arthralgias, extremity pains

2019 ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease: Executive Summary. Journal of the American College of Cardiology. 2019. DOI: 10.1161/CIR.0000000000000677

Steroid Dose Conversion

In response to recent data regarding the use of dexamethasone in COVID patients[1], dexamethasone supply may be on allocation or shortage. This steroid conversion chart provides equivalent dosing of glucocorticoids when substitution is clinically appropriate.

STEROID DOSE CONVERSION CHART[2,3]			
Hydrocortisone 20mg	**Prednisone 5mg**	**Methylprednisolone 4mg**	**Dexamethasone 0.75mg**
25	7	5	1
40	10	8	1.5
50	12.5	10	2
60	15	12	2.25
65	17.5	13	2.5
80	20	16	3
100	25	20	4
200	50	40	8
250	65	50	10
300	75	60	12
400	100	80	15
500	125	100	20
600	150	125	25
1200	300	250	50
2500		500	100

STEROID DOSE CONVERSION CHART[2,3]			
Hydrocortisone 20mg	**Prednisone 5mg**	**Methylprednisolone 4mg**	**Dexamethasone 0.75mg**
Short-Acting (half-life 8-12 hours) Convert 1:1 to PO, may give in divided doses	Intermediate-Acting (half-life 18-36 hours) Prednisone= prednisolone	Intermediate-Acting (half-life 18-36 hours) May convert to PO prednisone	Long-Acting (half-life 36-54 hours) Convert 1:1 to PO
Glucocorticoid Potency: 1	Glucocorticoid Potency: 4-5	Glucocorticoid Potency: 5-6	Glucocorticoid Potency: 18
Mineralocorticoid Potency: 1	Mineralocorticoid Potency: 0.8	Mineralocorticoid Potency: 0.5	Mineralocorticoid Potency: <0.01

References:

1. Horby PW, Landrray MJ, et al. Effect of Dexamethasone in Hospitalized Patients With COVID-19 – Preliminary Report. medRxiv Preprint 2020.
2. Meikle AW, Tyler FH. Potency and duration of action of glucocorticoids. Effects of hydrocortisone, prednisone and dexamethasone on human pituitary-adrenal function. *Am J Med.* 1977;63(2):200-207. doi:10.1016/0002-9343(77)90233-9
3. Samuel S, Nguyen T, and Choi A. Pharmacologic Characteristic of Corticosteroids. *J Neurocrit Care.* 2017;10(2):53-59.

Chemo Chart

CHEMO CHART				CHEMO CHART		
DRUG	**ROUTE**	**DILUENT, CONCENTRATION, STABILITY**		**DOSING CONSIDERATIONS**	**INFUSION TIME**	**KEY POINTS**
Cisplatin (PLATINOL)	IV	NS, D51/2NS or D5NS (+/- mannitol): conc. 0.05 to 2mg/mL stable for 72hrs Stability dependent on Cl- concentration		Renal	30 min-4 hrs; 1 mg/minute CIV	Clarify cisplatin dose >100mg/m2 per 3-4 wk cycle
Cyclophosphamide (CYTOXAN)	IV	NS: conc. 0.24 to 20mg/mL D5W, 1/2NS, or D5NS: min conc. 2mg/mL NS, 1/2NS: 24 hrs(RT), 6 days(RF) D5W, D5NS: 24 hrs(RT), 36hrs(RF)		Renal Hepatic	1-3 hrs (high dose 2g-3g/m2); CIV (100mg-200mg/m2/day)	Hydration fluids and mesna.
Cytarabine [conventional] (CYTOSAR)	IV IT	IV: NS or D5W in 250 to 1000 mL; 8 days(RT) IT: PF NS up to 12 mL; use ASAP		Renal Hepatic	1-3 hrs (high dose 2g-3g/m2); CIV (100mg-200mg/m2/day)	IT and high dose-PF solutions only.
Doxorubicin [conventional] (ADRIAMYCIN)	IV	D5W or NS in 50 to 1000 mL; min conc. 2mg/mL; 7 days (RT), 15 days (RF)		Hepatic	3-10 min (IVP) 15-60 min CIV	VESICANT. Lifetime dose limit: 450-500mg/m2 due to risk of cardiomyopathy.
Etoposide (TOPOSAR)	IV	D5W or NS: conc. 0.2 to 0.4mg/mL 0.2 mg/mL: 96 hrs(RT) 0.4 mg/mL: 24hrs(RT)		Renal Hepatic	at least 30 min CIV	Concentrations >0.4mg/mL may precipitate.

CIV= (continuous IV infusion)

continued on next page

CHEMO CHART				CHEMO CHART		
DRUG	**ROUTE**	**DILUENT, CONCENTRATION, STABILITY**		**DOSING CONSIDERATIONS**	**INFUSION TIME**	**KEY POINTS**
Idarubicin (IDAMYCIN PFS)	IV	NS or D5W: 72 hrs (RT&RF)		Renal Hepatic (Contraindicated bilirubin >5mg/dL)	10-15 min into a free-running IV infusion of NS or D5W	VESICANT. Lifetime dose limit: 150mg/m2 due to risk of cardiomyopathy.
Ifosfamide (IFEX)	IV	D5W, NS, LR: conc. 0.6-20mg/mL; 24hrs(RF)		Renal Hepatic	at least 30 min.	Hydration fluids and mesna.
Methotrexate	IV IT	IV: NS or D5W; max conc. 25mg/mL; 24hrs(RT) IT: PF NS, LR up to 12 mL; use ASAP		Renal Hepatic	10 mg/min CIV	May require leucovorin (LCV) rescue with 100-500mg/m2. >500mg/m2 requires LCV rescue. IT and high dose-PF solutions only. High dose: urine pH, MTX levels, and sodium bicarb admin.
Rituximab (TRUXIMA)	IV	NS, D5W: conc. 1-4mg/mL; 24hrs(RF), 48hrs(RT)		N/A	See protocol in admin instructions; standard max rate 400 mg/hr	APAP and Benadryl premeds. Can reactivate Hep B.
Vincristine (ONCOVIN)	IV	NS: conc. 0.0015 mg/mL to 0.08 mg/mL; when protected from light NS or D5W: conc 20mcg/mL; up to 21 days (RF&RT)		Hepatic	10-15 min CIV	VESICANT. Dose cap of 2 mg/dose. Stability is dependent on protection from light. CYP3A4 substrate.

Disclaimer: This chart is intended to be a concise chemotherapy reference for the ten most commonly ordered chemotherapy drugs at LALK. This chart also focuses on common route of these medications at our institution. Please consult other resources and literature for further detail.

CIV= (continuous IV infusion)

Additional Institution Specific Information:

Per hospital protocol, no continuous infusion can utilize the same dose/bag for more than 24hrs at a time. Continuous infusions ordered to run over >24 hrs will have to be divided.

Oncology unit nurses typically prefer that IV Push chemo drugs be converted to IVPB if applicable for ease of administration.

Argatroban Infusion Protocol for Heparin Induced Thrombocytopenia (HIT) for Adult Patients

Indication:

Treatment of heparin-induced thrombocytopenia with thrombosis syndrome (HITS) or thrombosis prophylaxis in patients with history of HIT and contraindications for first line therapies

Precautions:

1. Discontinue all sources of heparin (IV, SC, heparin flushes) and Low Molecular Weight Heparins
2. List 'Heparin Allergy' on patient's profile
3. Can cause false elevations of INR
4. Discontinue all IM injections
5. No concurrent epidural analgesia, spinal or lumbar puncture
6. No anticoagulant within 24 hours of tPA for ischemic stroke
7. Do not start Argatroban if aPTT above 90 or INR above 2.5 – notify the physician

Initial labs:

- Baseline PT and aPTT and daily aPTT
- Baseline and daily CBC
- Baseline CMP including LFTs
- aPTT 2 hours after starting Argatroban infusion and 2 hours after any rate change

Patient Care Orders:

- Check aPTT 2 hours after the start of infusion and 2 hours after any rate change

- Once 2 consecutive aPTT readings are within therapeutic range, check daily aPTT
- Notify the physician for any unexplained drop in blood pressure, unexplained tachycardia, greater than 1 g/dl drop in hemoglobin, gross hematuria, or any overt signs of bleeding

Standard Argatroaban Infusion concentration: 1 mg/ml (250 mg / 250 ml

***** Maximum rate not to exceed 10 mcg/kg/min *****

- Use actual body weight up to 140 kg
- Maximum infusion rate 10 mcg/kg/min

Initial Infusion:

- **Non-ICU and ICU patients with no organ dysfunction: 1 mcg/kg/min**

DOSE ADJUSTMENT		
aPTT (seconds)	Rate of Infusion	Check aPTT in hours
Below 35	Increase by 0.5 mcg/kg/min	2 hours
35 to 54	Increase by 0.25 mcg/kg/min	2 hours
55 to 100	NO change – continue current rate	When 2 consecutive readings within therapeutic range, start daily aPTT
101 to 110	Decrease by 0.25 mcg/kg/min	2 hours
111 to 120	Hold infusion for 1 hour and decrease by 0.5 mcg/kg/min	2 hours
Above 120	Stop infusion and call the physician	STAT aPTT and check aPTT q 2 hours

- **Patients with multi-organ dysfunction without concomitant hepatic and renal failure: 0.5 mcg/kg/min**

DOSE ADJUSTMENT		
aPTT (seconds)	Rate of Infusion	Check aPTT in hours
Below 35	Increase by 0.25 mcg/kg/min	2 hours
35 to 54	Increase by 0.125 mcg/kg/min	2 hours
55 to 100	NO change – continue current rate	When 2 consecutive readings within therapeutic range, start daily aPTT
101 to 110	Decrease by 0.125 mcg/kg/min	2 hours
111 to 120	Hold infusion for 1 hour and decrease by 0.25 mcg/kg/min	2 hours
Above 120	Stop infusion and call the physician	STAT aPTT and check aPTT q 2 hours

- **ICU patient with moderate to severe hepatic dysfunction or combined hepatic/renal dysfunction: 0.2 mcg/kg/min**

DOSE ADJUSTMENT		
aPTT (seconds)	Rate of Infusion	Check aPTT in hours
Below 35	Increase by 0.1 mcg/kg/min	2 hours
35 to 54	Increase by 0.05 mcg/kg/min	2 hours
55 to 100	NO change – continue current rate	When 2 consecutive readings within therapeutic range, start daily aPTT
101 to 110	Decrease by 0.05 mcg/kg/min	2 hours
111 to 120	Hold infusion for 1 hour and decrease by 0.1 mcg/kg/min	2 hours
Above 120	Stop infusion and call the physician	STAT aPTT and check aPTT q 2 hours

Transition to Warfarin:

Consult clinical pharmacy

a. Initiate warfarin after platelet recovery

- Platelet count is ≥ 150000/µl

  OR

- Platelet count is close to baseline for patient with previous chronic low platelet count.

b. Due to combined effect on INR when Argatroban is used concurrently with Warfarin. Loading doses of warfarin should NOT be used.

- Start Warfarin at a maximum dose of 5 mg daily, concurrently with argatroban infusion
- Obtain INR and follow the instructions below to determine when to stop argatroban infusion based on INR levels.

Patients receiving Argatroban at less than or equal to 2 mcg/kg/min:

Argatroban therapy can be stopped when combined INR on warfarin and Argatroban is above 4. Repeat INR in 4 to 6 hours. If INR below the desired therapeutic range, Argatroban infusion can be restarted. Repeat the procedure daily until INR on warfarin alone is within desired therapeutic range.

Patients receiving Argatroban at greater than 2 mcg/kg/min:

In order to predict the INR on Warfarin alone, reduce argatroabn dose to less than 2 mcg/kg/min and repeat the INR 4 to 6 hours after dose reduction. Argatroban infusion can be stopped when combined INR on Warfarin and Argatroabn is above 4. Repeat INR in 4 to 6 hours. If INR is below the desired therapeutic range, Argatroban infusion can be restarted. Repeat the procedure daily until INR on warfarin alone is within desired therapeutic range.

References:

1. Cuker, Adam, et al. American Society of Hematology 2018 Guidelines for Management of Venous Thromboembolism: Heparin-Induced Thrombocytopenia. American Society of Hematology. 2018; 2(22): 2260-3392.
2. Baroletti, S., Goldhaber, S.. Heparin-Induced Thrombocytopenia. American Heart Association. 2006; 114: e355-e356.
3. **Argatroban:** drug information **Lexicomp 22nd edition**
4. Argatroban Dosage requirements and Outcomes in Intensive Care versus Non-intensive Care patients **Pharmacotherapy, 2009; 29(9): 1073-1081**
5. A direct thrombin inhibitor argatroban: a review of its use in patients with and without HIT **Biologics; 2007, June 1(2): 105-112**
6. Argatroban Anticoagulation in Critically Ill Patients **Ann. Pharmacotherapy; 2007, 41(5):749-54**

Abbreviated Aminoglycoside Dosing Guidelines (Adults)

Section V: Gentamicin/Tobramycin dosing and monitoring

Use extended interval dosing unless exclusion criteria is met

Gentamicin and Tobramycin — ODD

STEP 1: Choose initial dose

INDICATION	HIGH DOSE
Cystic Fibrosis¥	10mg/kg
Pulmonary Infections▲	5mg/kg
Septic Shock▲	5mg/kg
MDRO Infection▲	5mg/kg
Open Fracture / Trauma Prophylaxis	5mg/kg
UTI/Pyelonephritis	3mg/kg
Synergy Streptococci Endocarditis*	3mg/kg

▲ May consider up to 7mg/kg if patient is severely ill. Maximum dose of 500mg. Contact prescribing physician if pharmacy wants dose > maximum.

¥ Tobramycin only

* Gentamicin only

STEP 2: Determine ke and t1/2

Kkel= 0.00293 * CrCl + 0.014
t1/2= 0.693 ÷ ke
Can also consider using PK calculator in excel sheet

STEP 3: Choose preliminary dosing interval

Half-life in hours			
<4h	>4-6h	>6-8h	>8h
Q24h	Q36h	Q48h	Use traditional dosing

Please be cautious in patients ≥60 years old as they may have overestimated renal function

Gentamicin and Tobramycin Monitoring — ODD

1. Obtain random level 6 hours and 10 hours after start of infusion

a. Calculate patient specific ke and t1/2

b. See step 3 above to choose dosing interval based on t1/2

$$ke = \frac{1n\left(\frac{C_1}{C_2}\right)}{time\ between\ C_1\ and\ C_2}$$

c. High dose extended interval theoretically reaches peak concentrations seeing that the dose is >3x traditional dose, however if actual peak is needed use calculation:

$$C_{max} = \frac{C_1}{e^{-k\ (Time\ between\ C_{max}\ and\ C_1)}}$$

d. If only 1 level can be obtained, see appendix D and use Urban & Craig nomogram

2. Obtain trough level 4 hours prior to the third dose

If trough	Plan	Repeat Trough
<1mcg/mL	Keep dosing interval	2-3 times weekly
>1-3mcg/mL	Extend interval by 12 hrs unless interval already 72h	4 hours before new interval
>3mcg/mL	Consider traditional dosing	--

3. Patient with AKI (SCr increase by ≥0.3 in 48 hours, CrCl decrease by ≥50 %, or urine output decrease to <0.5mL/kg/hr).

a. Hold next dose, check random level 24-48 hrs after last dose

b. Do not re-dose until trough <1mcg/mL

c. Switch to pulse dosing and order gentamicin or tobramycin pulse dosing placeholder

Gentamicin and Tobramycin — Traditional Dosing and Monitoring

STEP 1: Determine Initial Traditional Dosing

INDICATION	Dose-Creatinine Clearance (mL/min)				
	>90	50-90	20-49	<20	HD/ CRRT
Gram Negative Infection	1.5mg/kg q8h	Q12h	Q24h	See full protocol	See full protocol
UTI	1mg/kg q8h	Q12h	Q24h		
Gram Positive Synergy*	1mg/kg q8h	Q12h	Q24h		
If patient is ≥60 years old, consider q12h vs q8h dosing					

STEP 2: Determine peak goal and dose adjustment

INDICATION	Goal Peak mcg/mL
Cystic Fibrosis¥	8-12
Pulmonary Infections	8-10
Intra-abdominal	6-8
Sepsis	6-8
Soft-tissue infection	6-8
Endometriosis	4-6
UTI/Pyelonephritis	4-6
Synergy Streptococci Endocarditis*	3-5

Monitoring

1. Obtain peak with 3rd dose
2. Draw peak 90 minutes from start of infusion
3. If not at goal, adjust with proportion calculation
4. Repeat peak with 3rd new dose
5. If peak at goal, use troughs for monitoring only

Adjust Peak

Aminoglycosides exhibit linear pharmacokinetics, increases or decreases in dose have a corresponding proportional increase or decrease in peak and trough values (assuming renal function is STABLE). Set up a proportional relationship to estimate the actual peak based on new dose.

$$\frac{\text{CPeak Actual}}{\text{CPeak Goal}} = \frac{\text{Current Dose}}{\text{New Dose}}$$

$$\frac{6\text{mcg/mL}}{10\text{mcg/mL}} = \frac{100\text{ mg Dose}}{(167\text{ mg dose})}$$

Once peak is determined, use troughs only for monitoring. If patient has acute change in status, peak may be repeated.

STEP 3: Determine trough and interval

Trough goal: <1mcg/mL

Obtain trough level 1 hour prior to 3rd dose

Obtain RFP baseline, then q24-72h, more frequently if rapidly changing renal function

If trough	Plan	Repeat Trough
<1mcg/mL	Keep dosing interval	2-3 times weekly
1-2mcg/mL	Extend interval by 12 hours	1 hour prior to 2nd dose
>2mcg/mL	Hold dose	In ~12 hours (morning labs if possible). Do not re-dose until random level is <1mcg/mL

PATIENT WITH AKI

SCr increase by ≥0.3 in 48 hours or

CrCl decrease by ≥50 % or

Urine output decrease to <0.5mL/kg/hr.

Also, if serum potassium >5.5mEq/L obtain trough sooner

1. Hold next dose, check random level 18-24 hrs after last dose
2. Do not re-dose until trough <1mcg/mL
3. Pulse dose based on random levels until renal function improves/stabilizes (Section VI)

¥ Tobramycin only

* Gentamicin only

Section VII: Amikacin Dosing and Monitoring:

Use extended interval dosing *unless* exclusion criteria is met

Amikacin — ODD

STEP 1: Choose initial dose	
INDICATION	**HIGH DOSE**
Cystic Fibrosis	30mg/kg
Pulmonary Infections▲	15mg/kg
Septic Shock▲	15mg/kg
MDRO Infection▲	15mg/kg
Open Fracture/ Trauma Prophylaxis	15mg/kg
Mycobacterial infections	See traditional dosing
Other Indications	15mg/kg

▲ May consider up to 20mg/kg if patient is severely ill. Maximum dose of 1400mg. Contact prescribing physician if pharmacy wants dose > maximum.

STEP 2: Determine ke and t1/2
ke= 0.00293 * CrCl + 0.014
t1/2= 0.693 ÷ ke
Can also consider using PK calculator in excel sheet

STEP 3: Choose preliminary dosing interval			
Half-life in hours			
<4h	>4-6h	>6-8h	>8h
Q24h	Q36h	Q48h	Use traditional dosing
Please be cautious in patients ≥60 years old as they may have overestimated renal function			

Amikacin Monitoring — ODD

1. Obtain random level 6 hours and 10 hours after start of infusion

a. Calculate patient specific ke and t1/2

b. See step 3 to choose dosing interval based on t1/2

$$ke = \frac{1n\left(\frac{C_1}{C_2}\right)}{time\ between\ C_1\ and\ C_2}$$

c. High dose extended interval theoretically reaches peak concentrations seeing that the dose is >3x traditional dose, however if actual peak is needed use calculation:

$$C_{max} = \frac{C_1}{e^{-k\ (Time\ between\ C_{max}\ and\ C_1)}}$$

d. If only 1 level can be obtained, see appendix D and use Urban & Craig nomogram

2. Obtain trough level 4 hours prior to the third dose

If trough	Plan	Repeat Trough
<2mcg/mL	Keep dosing interval	2-3 times weekly
2-4mcg/mL	Extend interval by 12 hrs unless interval already 72h	4 hours before new interval
>4mcg/mL	Consider traditional dosing	--

3. Patient with AKI (SCr increase by ≥0.3 in 48 hours, CrCl decrease by ≥50 %, or urine output decrease to <0.5mL/kg/hr)

a. Hold next dose, check random level 24-48 hrs after last dose

b. Do not re-dose until trough <2mcg/mL

c. Switch to pulse dosing and order amikacin pulse dosing placeholder (Section VIII)

Amikacin Traditional Dosing

STEP 1: Determine Initial Traditional Dosing

INDICATION	Dose-Creatinine Clearance (mL/min)				
	>90	50-90	20-49	<20	HD/ CRRT
Gram Negative Infection	7.5mg/kg q8h	Q12h	Q24h	See full protocol	See full protocol
UTI	5mg/kg q8h	Q12h	Q24h		
If patient is ≥60 years old, consider q12h vs q8h dosing					

Nontuberculous Mycobacterial Infections

INDICATION	AGE ≤50	AGE >50	
Mycobacterium *avium*	8-25mg/kg TIW	Max dose 500mg	Contact provider to ensure goal peak. Peaks to be obtained after first dose then weekly once at goal
Mycobacterium *fortuitum, chelonae, abscessus*	10mg/kg TIW		

STEP 2: Determine peak goal and dose adjustment

INDICATION	Goal Peak mcg/mL
Cystic Fibrosis	25-40
Pulmonary Infections	25-40
Sepsis	20-25
Soft Tissue Infection	20-25
Endometriosis	15-20
Mycobacterium avium	20-30
Mycobacterium *fortuitum, chelonae, abscessus*	20-30

Monitoring

1. Obtain peak with 3rd dose
2. Draw peak 90 minutes from start of infusion
3. If not at goal, adjust with proportion calculation
4. Repeat peak with 3rd new dose
5. If peak at goal, use troughs for monitoring only

Adjust Peak

Aminoglycosides exhibit linear pharmacokinetics, increases or decreases in dose have a corresponding proportional increase or decrease in peak and trough values (assuming renal function is STABLE). Set up a proportional relationship to estimate the actual peak based on new dose.

$$\frac{\text{CPeak Actual}}{\text{CPeak Goal}} = \frac{\text{Current Dose}}{\text{New Dose}}$$

$$\frac{17\text{mcg/mL}}{20\text{mcg/mL}} = \frac{500\text{ mg Dose}}{(588\text{ mg dose})}$$

Once peak is determined, use troughs only for monitoring. If patient has acute change in status, peak may be repeated.

STEP 3: Determine trough and interval

Trough goal: <4mcg/mL

Obtain trough level 1 hour prior to 3rd dose

Obtain RFP baseline, then q24-72h, more frequently if rapidly changing renal function

If trough	Plan	Repeat Trough
<4mcg/mL	Keep dosing interval	2-3 times weekly
4-8mcg/mL	Extend interval by 12 hours	1 hour prior to 2nd dose
>8mcg/mL	Hold dose	In ~12 hours (morning labs if possible). Do not re-dose until random level is <4mcg/mL

PATIENT WITH AKI

SCr increase by ≥0.3 in 48 hours or

CrCl decrease by ≥50 % or

Urine output decrease to <0.5mL/kg/hr

Also, if serum potassium >5.5mEq/L obtain trough sooner

1. Hold next dose, check random level 18-24 hrs after last dose
2. Do not re-dose until trough <4mcg/mL
3. Pulse dose based on random levels until renal function improves/stabilizes (Section VIII)

Anti-Factor Xa Monitoring Guideline for Enoxaparin (Adult)

Anti-factor Xa monitoring should be considered for the following patient populations:

- Obesity (>150 kg or BMI >35kg/m^2):
  - ***See and use the Automatic Anti-Xa monitoring protocol for morbidly obese patients***
- Underweight patients (BMI <18.5kg/m^2 or <50kg)
- Age <18 years
- Pregnancy
- Renal insufficiency (CrCl <30 mL/min). Preference is to use unfractionated heparin instead of LMWH.

Initial Xa level should be ordered **4 hours post-dose on day 2 of therapy**.

Therapeutic Anticoagulation

ENOXAPARIN DOSE	TARGET PEAK ANTI-XA LEVEL (UNITS/ML)
1 mg/kg Q 12 hours	0.6 - 1
1.5 mg/kg Q 24 hours	1 - 2
1 mg/kg Q 24 hours for CrCl < 30 ml/min	1 - 2

Initial doses will be capped at 150mg unless discussed with physician

Anti-Xa Monitoring and Dose Adjustment

LMWH DOSING NOMOGRAM FOR TREATMENT DOSE 1MG/KG BID ENOXAPARIN			
Anti-Xa level	**Hold next dose?**	**Dosage change (round to syringe size)**	**When to order next Xa level**
< 0.35	No	↑25%	4 h after next dose
0.35-0.59	No	↑10%	4 h after next dose
0.6-1	No	0	Next day, then in 1 week, and then monthly
1.1-1.5	No	↓20%	4 hours post next dose
1.6-2	Yes, for 3 hours	↓30%	4 hours post next dose
>2	Until anti-Xa level 0.5	↓40%	All further doses should be held and the anti-Xa level should be measured Q 12 hours until <0.5 units/mL. Enoxaparin can then be restarted at a dose of 40% less than what was originally ordered.
*If Xa monitoring is desired for a patient with normal renal function receiving enoxaparin 1.5mg/kg Q 24 hours, it is recommended to convert patient to Q 12 hour dosing and then take an anti-xa level 4 hours after the 3rd Q 12 hour dose.			

Linear Kinetics equation[5]

$$\text{New dose} = \frac{\text{Current dose x goal Anti- Xa}}{\text{Current Anti - Xa}}$$

Prophylactic Anticoagulation

- Goal Xa: 0.2-0.4 units/mL
- Clear guidance for appropriate dose adjustments is not available at this time. It has been proposed to adjust prophylaxis doses by 10mg increments.

Lab monitoring:

- Baseline platelet count and serum creatinine
- Repeat weekly

References:

1. Freeman AL, Pendleton RC, et al. Prevention of venous thromboembolism in obesity. Expert Rev Cardiovasc Ther. 2010. 8(12):1711-1721.
2. Garcia DA, Baglin TP, et al. Parenteral anticoagulants: Anithrombotic therapy and prevention of thrombosis, 9th ed: American College of Chest Physicians evidence-based clinical practice guidelines: Chest. 2012; 141(2)(Suppl): e24-e43S.
3. Levine L, Pallme N, et al. Analysis of Anti-Xa Concentrations in Patients on Treatment Dose Enoxaparin: A Retrospective Chart Review. Advances in Pharmacology and Pharmacy. 2013. 1(2): 37-41.
4. Lovenox [package insert]. Bridgewater, NJ: Sanofi-Aventis; 2011.
5. Kruse MW, Lee JJ. Retrospective evaluation of a pharmacokinetic program for adjusting enoxaparin in renal impairment. Am Heart J. 2004;148:582-9. [PMID: 15459586]
6. Nutescu, Edith A, et al. "Anticoagulation: Low-Molecular-Weight Heparins in Renal Impairment and Obesity: Available Evidence and Clinical Practice Recommendations Across Medical and Surgical Settings." *Annals of Pharmacotherapy*, vol. 43, no. 6, 2009, pp. 1064–1083., doi:10.1345/aph.1l194.

Anti-Xa Monitoring in Morbidly Obese Patients Guideline for Enoxaparin

Clinical pharmacists will automatically monitor and manage enoxaparin treatment dosing in morbidly obese patients using an Anti-Xa assay.

- Morbidly obese define as ≥ 150 kg or BMI ≥ 35kg/m2

Initial Enoxaparin Dosing

THERAPEUTIC ANTICOAGULATION:	
Enoxaparin Dose	**Target Peak Anti-Xa Level (units/ml)**
1 mg/kg Q 12 hours	0.6 - 1
1.5 mg /kg Q 24 hours	1 - 2
1 mg/kg Q 24 hours for CrCl < 30 ml/min	1 - 2

(Initial doses will be capped at 150mg)

Anti-Xa Monitoring and Dose Adjustment

Initial Xa level should be ordered **4 hours after the 3rd dose of enoxaparin**

LMWH DOSING NOMOGRAM FOR TREATMENT DOSE 1MG/KG Q12H[8]			
Anti-Xa level	**Hold next dose**	**Dosage change**	**When to order next Anti-Xa level**
< 0.35	No	↑25%	4 h after next dose
0.35-0.59	No	↑10%	4 h after next dose
0.6-1	No	0	Next day, then in 1 week, and then monthly
1.1-1.5	No	↓20%	4 h after next dose
1.6-2	Yes, for 3 hours	↓30%	4 h after next dose
>2	Until anti-Xa level 0.5	↓40%	All further doses should be held and the anti-Xa level should be measured Q 12 hours until <0.5 units/mL. Enoxaparin can then be restarted at a dose of 40% less than what was originally ordered.

Linear Kinetics equation[7]

$$\text{New dose} = \frac{\text{Current dose x goal Anti- Xa}}{\text{Current Anti - Xa}}$$

Lab monitoring:

- Baseline platelet count, serum creatinine, hemoglobin and hematocrit
- Repeat weekly

References

1. Lalama, Jeffrey T, et al. "Assessing an Enoxaparin Dosing Protocol in Morbidly Obese Patients." Journal of Thrombosis and Thrombolysis, vol. 39, no. 4, May 2015, pp. 516-521.
2. Nathaniel R. Thompson-Moore, et al. "Evaluation and Pharmacokinetics of Treatment Dose Enoxaparin in Hospitalized Patients with Morbid Obesity." Clinical and Applied Thrombosis/Hemostasis, January 19, 2015.
3. Lim, Wendy, et al. "Meta-Analysis: Low-Molecular-Weight Heparin and Bleeding in Patients with Severe Renal Insufficiency." *Annals of Internal Medicine*, vol. 144, no. 9, Feb. 2006, p. 673., doi:10.7326/0003-4819-144-9-200605020-00011.
4. Deal, Eli N, et al. "Evaluation of Therapeutic Anticoagulation with Enoxaparin and Associated Anti-Xa Monitoring in Patients with Morbid Obesity: A Case Series." Journal of Thrombosis and Thrombolysis, vol. 32, no. 2, Aug. 2011, pp. 188-194.
5. Bazinet A, Almanric K, Brunet C et al (2005) Dosage of enoxaparin among obese and renal impairment patients. Thromb Res 116:41-50.
6. Lee, Young R, et al. "Monitoring Enoxaparin with Antifactor Xa Levels in Obese Patients." Pharmacotherapy, vol. 35, no. 11, Nov. 2015, pp. 1007-1015.
7. Kruse MW, Lee JJ. Retrospective evaluation of a pharmacokinetic program for adjusting enoxaparin in renal impairment. Am Heart J. 2004;148:582-9. [PMID: 15459586]
8. Nutescu, Edith A, et al. "Anticoagulation: Low-Molecular-Weight Heparins in Renal Impairment and Obesity: Available Evidence and Clinical Practice Recommendations Across Medical and Surgical Settings." *Annals of Pharmacotherapy*, vol. 43, no. 6, 2009, pp. 1064–1083., doi:10.1345/aph.1l194.
9. Lovenox® (enoxaparin sodium injection), for subcutaneous and intravenous use http://products.sanofi.us/Lovenox/Lovenox.pdf

IV to PO Pharmacy Conversion Protocol

Inclusion Criteria for IV to PO Conversion		
Must tolerate oral diet or enteral nutrition and/or receiving other oral medications		
Additional Inclusion Criteria for Antimicrobial Therapy IV to PO Conversion		
Must satisfy above criteria AND: • Infection does not require IV antibiotics • Afebrile (< 100.4˚F in the last 24 hours) • Received ≥ 24 hours of IV antibiotics • Documentation of clinical improvement • Non-neutropenic (ANC > 500) • WBC <11 cells/μL or improving ▪ Defined as WBC <15 and decrease by ≥2 in 48 hours	Infections that Require IV Antibiotics • CNS infections (e.g., meningitis brain/ spinal abscess) • Orbital cellulitis • Endocarditis • Mediastinitis • Osteomyelitis • Gangrene • Empyema	• Neutropenic fever • Pancreatic necrosis or abscess • Bloodstream infection due to *Staphylococcus*, *Pseudomonas*, *Enterococcus*, or *Candida* • Endophthalmitis • Cystic fibrosis exacerbation
Exclusion Criteria		
• NPO status (excluding NPO, except medications) • Post-pyloric enteral tube ▪ Dobhoff, J tube • Inability or difficulty swallowing AND no enteral access	• NG tube residuals > 500 ml for ≥ 2x in 24 hours • Nausea/vomiting with use of an antiemetic in the previous 24 hours • Active GI bleed • Mucositis	• Continuous tube feedings that cannot be interrupted (applies only to drugs that bind to enteral formula) • Continuous nasogastric (NG) tube suctioning • Short bowel syndrome, ileus, partial/total gastrectomy • Shock with vasopressor use in the previous 24 hours

AUTOMATIC PHARMACY CONVERSIONS				
NON-ANTIMICROBIAL				
IV Agents			Oral Agents	
Famotidine	20 mg	Q12 - 24h	Same dose	Same frequency
Lacosamide**	50-200 mg	Q12h	Same dose	Same frequency
Levetiracetam**	500-1500 mg	Q12h	Same dose	Same frequency
Levothyroxine†**	Dose varies	Daily	Double IV dose	Daily
Methocarbamol‡**	1000 mg	Q8h	750 mg	Q8h
Metoclopramide	5 - 10 mg	Q6 - 12h	Same dose	Same frequency
Pantoprazole	40 mg	Q24h	Same dose	Same frequency
Folic Acid	1 mg	Q24h	Same dose	Same frequency
Thiamine€**	100 mg	Q24h	Same dose	Same frequency

AUTOMATIC PHARMACY CONVERSIONS				
ANTIMICROBIALS				
	IV Agents		Oral Agents	
Azithromycin	250 - 500 mg	Q24h	Same dose	Same frequency
Clindamycin	600 - 900 mg	Q8h	450 mg	Q6h
Ciprofloxacin	400 mg 400 mg	Q12h Q8h	500 mg 750 mg	Q12h Q12h
Doxycycline	100 mg	Q12h	Same dose	Same frequency
Fluconazole	100 - 400 mg	Q24h	Same dose	Same frequency
Levofloxacin	250 - 750 mg	Q24h	Same dose	Same frequency
Linezolid	600 mg	Q12h	Same dose	Same frequency
Metronidazole	500 mg	Q8h	Same dose	Same frequency
Voriconazole	100-200mg or 4mg/kg	Q12h	Same dose	Same frequency

OPPORTUNITIES FOR STEP-DOWN THERAPY **MUST CONTACT PROVIDER TO OBTAIN ORDER FOR IV TO PO CONVERSION **					
IV Agents			**Oral Agents**		
Fosphenytoin**	100 mg	Q8 - 12h	**Phenytoin**	Same dose	Same frequency
Phenytoin**	100 mg	Q8 - 12h	**Phenytoin**	Same dose	Same frequency

IV Agents			**Oral Agents**		
Ampicillin	500 mg - 1g	Q6 - 8h Q12h Q24h	**Amoxicillin**	500 mg	Q8h Q12h Q24h
Ampicillin/ Sulbactam	1.5 - 3g	Q6h	**Amox/Clav**	875mg/ 125mg	Q12h
Cefazolin	1 - 2 g	Q8h Q12-24h	**Cephalexin**	500 mg	Q6h Q8 - 12h
Ceftriaxone	1 - 2 g	Q24h	**Cefdinir**	300mg	Q12h
TMP-SMX#	5-20mg/kg	Divided q6-24h	**TMP-SMX#**	Same dose	Same frequency

** Patient must be seizure free for 24 hours

† Round to nearest tablet size; if oral dose is different from home dose, must contact prescriber to confirm appropriate dosing; exclusion for automatic conversion is myxedema coma

‡ Methocarbamol injection can be used for up to 24 hours before it is eligible for conversion to oral therapy

If being used for PCP pneumonia, ensure significant clinical improvement has occurred before recommending switch to PO

€ IV formulation preferred for treatment of Wernicke syndrome. OK to change if indication is for prevention of Wernicke syndrome

Medications Requiring Special Monitoring

(June 2020)

Intensive Care Units (Critical Care)

The definition of an intensive care unit at Our Lady of the Lake is one that has been designated as having the capability to care for patients that require the highest level of care and who may require mechanical ventilation. The difference between a progressive care unit and intensive care unit is the capability of administering titratable vasoactive medications along with continuous analgesia and sedation. These units have the capability of telemetry monitoring of all patients and maintain a sufficient nurse to patient ratio that allows for proper monitoring of these medications during and post-administration.

- HVCU
- MICA & MICB
- SICA & NCCU
- TNCC
- EMERGENCY DEPARTMENT (OLOL and Ascension)
- HVPU/PACU
- SE ICU

Cardiac Telemetry Units (Monitored)

The definition of a monitored unit at Our Lady of the Lake is one that has been designated as having the capability of telemetry monitoring of all patients, maintains a nursing staff competent to administer medications designated in this document, and has a sufficient nurse to patient ratio that allows for the proper monitoring of these medications post administration.

- MED2
- HV7A & HV7B
- EAU
- CCDU
- HV8A & HV8B
- HVAU

Medical Telemetry Units

The definition of a medical telemetry unit at Our Lady of the Lake is one that has telemetry monitoring capability (not necessarily all beds), maintains a nursing staff competent to administer some blood pressure medications as designated in the document below, and has a sufficient nurse to patient ratio that allows for the proper monitoring of these medications post administration.

- CAR 1
- 4MNT
- STU (6-S)
- MED1 (4-E)
- MED5 (4-W)
- MED6
- NEPHROLOGY (5-E)
- NEUROLOGY (5-S)
- SUR1 &SUR2
- ORTHO
- ONCOLOGY (5-W)
- SE TELE
- SE MED 1
- SE MED 2

Progressive Care Unit

The definition of a Progressive Care Unit at Our Lady of the Lake is one that has been designated as having the capability of telemetry monitoring of all patients, maintains a nursing staff competent to administer medications designated in this document, and has a sufficient nurse to patient ratio that allows for the proper monitoring of these medications post administration. The main difference between a monitored unit and progressive care unit is the capability of mechanical ventilation.

- PCU

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* Medications indicated in the ACLS algorithm may be given on any unit during a Code Blue

** Pediatric Meds Requiring Special Monitoring can be found at :

https://fparchives.com/ololrmc/documents/Children's%20Hospital%20Medications%20Requiring%20Special%20Monitoring%2002092017.pdf

DEPARTMENTS OF NURSING AND PHARMACY MEDICATIONS REQUIRING SPECIAL MONITORING (JUNE 2020)				DEPARTMENTS OF NURSING AND PHARMACY MEDICATIONS REQUIRING SPECIAL MONITORING (JUNE 2020)	
GENERIC DRUG NAME (TRADE NAME)	**ROUTE OF ADMINISTRATION**	**MAJOR INDICATION**		**REASON FOR RESTRICTIONS**	**AREAS WHERE ADMINISTRATION IS PERMITTED**
Abciximab *Reopro®*	IV bolus, followed by infusion	Adjunct to PTCA for the prevention of abrupt closure of treated coronary artery		Constant monitoring of cardiac & blood pressure important because of side effects including excessive bleeding, hypotension and bradycardia.	Critical Care Units Cardiac Telemetry Units (Monitored) Progressive Care Units
Adenosine *Adenocard®*	Rapid IV Push	Paroxysmal supraventricular tachycardia (PSVT)		Slows conduction time through AV node. May produce first, seco nd, third degree heart block.	Critical Care Units Progressive Care Units Cardiac Telemetry Units (Monitored) – MD must be present for administration
Albuterol *Ventolin®*	Continuous nebulization	Status asthmaticus		Increased patient monitoring	Critical Care Units Progressive Care Units
Alteplase (TPA) *Activase®*	IV infusion	Management of AMI, CVA, and PE in adults for the lysis of thrombi.		Needs to be given where diagnostic & monitoring equip are avail due to risk of serious hemorrhage, incl. potentially fatal intracranial bleeding & internal bleeding	Critical Care Units except for doses used for catheter clearance
Amiodarone *Cordarone®*	IV Bolus, followed by IV Infusion IVPB (PO maintenance dose may be converted to IV if patient NPO and has been receiving for > 1 month. Dose must be reduced by 50%) NOTE: Loading infusion/IV bolus = 150mg IVPB over 10 minutes Maintenance IV infusion = 1 mg/min IV x 6 hours followed by 0.5 mg/min IV x 18 hours, or dose specified by prescriber with no titrations	Treatment of VF and VT (NOT to be used in Torsades de pointes)		Constant monitoring of cardiac & blood pressure important because of side effects including hypotension & cardiac arrhythmias.	Loading Infusion and maintenance in Critical Care Units (exceptions: PCU, HVAU, CCDU, MED2, HV7, & HV8) Maintenance Infusions may be continued in Cardiac Telemetry Units (Monitored) ONLY if the patient has been loaded in above units or has been on PO amiodarone for more than a month.

DEPARTMENTS OF NURSING AND PHARMACY MEDICATIONS REQUIRING SPECIAL MONITORING (JUNE 2020)				DEPARTMENTS OF NURSING AND PHARMACY MEDICATIONS REQUIRING SPECIAL MONITORING (JUNE 2020)	
GENERIC DRUG NAME (TRADE NAME)	ROUTE OF ADMINISTRATION	MAJOR INDICATION		REASON FOR RESTRICTIONS	AREAS WHERE ADMINISTRATION IS PERMITTED
Atracurim Tracrium®	IV Push IV infusion	Adjunct to general anesthesia to facilitate endotracheal intubation and to relax skeletal muscle during surgery or mechanical ventilation.		A neuromuscular blocker which can severely compromise respiratory function and cause respiratory paralysis. Reactions may need to be managed by manual or mechanical ventilation. Dosage must be individualized by response. Monitoring is necessary.	Critical Care Units
Atropine	IV Push (IM and SC routes do not require special monitoring)	Treatment of cardiac arrhythmias		Cardiovascular adverse reactions such as changes in heart rate may increase the frequency and severity of anginal attacks in patients with coronary artery disease.	Critical Care Units Cardiac Telemetry Units (Monitored) Progressive Care Units 5-W-Oncology Oncology Infusion Centers
Bumetanide *Bumex*	IV Push IV infusion	Treatment of volume overload		Close monitoring of urinary output is necessary to determine the effectiveness of the continuous infusion. Continuous infusions of bumetanide may significantly augment diuresis which can lead to overdiuresis, hypokalemia, and hypomagnesemia. Close monitoring of volume status and electrolytes is necessary.	Critical Care Units Cardiac Telemetry Units (Monitored) Progressive Care Units **IV Push may be given on all units, infusion limited to listed units**
Calcium Chloride	IV Push IVPB Central Line Preferred	1.Cardiac resuscitation 2.Hypocalcemic disorders 3.Hyperkalemic ECG disturbances		Dosage may need to be adjusted during cardiac resuscitation by constant ECG monitoring. Drug may precipitate arrhythmias in the digitalized patient. May cause a decrease in blood pressure. Injection is irritating to the vein and must not be injected into tissues due to necrosis and extravasation.	Critical Care Units *Exception: During ACLS/Code Blue*

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GENERIC DRUG NAME (TRADE NAME)	**ROUTE OF ADMINISTRATION**	**MAJOR INDICATION**		**REASON FOR RESTRICTIONS**	**AREAS WHERE ADMINISTRATION IS PERMITTED**
Calcium Gluconate	IV Push IVPB	1. Hypocalcemic disorders 2. Hyperkalemic ECG disturbances		Drug may precipitate arrhythmias.	Critical Care Units Cardiac Telemetry Units (Monitored) Progressive Care Units **IVPB may be given on all units. IV Push may be given on all units for hyperkalemia ONLY. For any other indication, IV Push is restricted to listed units.**
Cisatracurium *Nimbex®*	IV Push IV infusion	Adjunct to general anesthesia to facilitate endotracheal intubation and to relax skeletal muscle during surgery or mechanical ventilation.		A neuromuscular blocker which can severely compromise respiratory function and cause respiratory paralysis. Reactions may need to be managed by manual or mechanical ventilation. Dosage must be individualized by response. Monitoring is necessary.	Critical Care Units
Clevidipine *Cleviprex®*	IV Infusion (Large peripheral vein)	Short-term treatment of hypertension		Caution & monitoring because of hypotension, tachycardia, and changes in afterload	Critical Care Units
Dexmedetomidine *Precedex®*	IV infusion	Sedation of initially intubated patients during treatment in intensive care units.		Hypotension and bradycardia have been associated with patients with high vagal tone or rapid infusions of dexmedetomidine	Critical Care Units Procedural Units including SMA, SMAT & HVAU: Anesthesia MUST administer & remain with patient until is able to breath spontaneously without support and patient responds to verbal stimuli
Digoxin *Lanoxin®*	IV Push	Control of rapid ventricular response in adults with atrial fibrillation		Monitoring of heart rate and rhythm important because of side effects including cardiac arrhythmias and heart block	Critical Care Units Cardiac Telemetry Units (Monitored) Progressive Care Units

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GENERIC DRUG NAME (TRADE NAME)	**ROUTE OF ADMINISTRATION**	**MAJOR INDICATION**		**REASON FOR RESTRICTIONS**	**AREAS WHERE ADMINISTRATION IS PERMITTED**
Diltiazem *Cardizem®*	IV Bolus IV Infusion	1. Atrial fibrillation, atrial flutter 2. Paroxysmal supraventricular tachycardia 3. Reduce blood pressure, increase coronary artery blood flow		Constant monitoring of cardiac & blood pressure important because of side effects including hypotension & cardiac arrhythmias	Critical Care Units Cardiac Telemetry Units (Monitored) Progressive Care Units **Progressive Care and Cardiac Telemetry Units must use fixed rate, no titrations**
Dobutamine *Dobutrex®*	IV infusion **(Central Line recommended)** May be given through peripheral if using large bore IV at AC site (Ex: CCDU stress test)	Increase cardiac contractility for treatment of cardiac decompensation		Continuous monitoring in ECG and blood pressure important. Monitor pulmonary wedge pressure and cardiac output. A marked increase in heart rate or blood pressure & precipitation of ventricular ectopic activity may occur.	Critical Care Units Progressive Care Units Cardiac Telemetry Units (Monitored) **Progressive Care and Cardiac Telemetry Units must use fixed rate, no titrations**
Dofetilide *Tikosyn®*	PO	Maintenance of normal sinus rhythm(NSR) in patients with atrial fibrillation; conversion of atrial fibrillation to NSR		T.I.P.S. REMS program QTc, SCr, and electrolyte monitoring required	Critical Care Units Progressive Care Units Cardiac Telemetry Units (Monitored) Continuation of home medication may occur on any unit. **New initiations on listed units ONLY.**
Dopamine *Intropin®*	IV infusion **(Central Line)** May be given through large bore peripheral line for Progressive Care and Cardiac Telemetry Units only if at fixed rate, up to max of 5 mcg/kg/min	1. Increase cardiac contractility 2. Increase organ perfusion 3. Increase urine output in the treatment of shock syndrome & chronic cardiac decompensation		Must monitor urine flow, cardiac output & blood pressure during infusion to its alpha, beta and dopaminergic effects. Infuse into large vein to prevent extravasation	Critical Care Units Progressive Care Cardiac Telemetry Units (Monitored) **Progressive Care and Cardiac Telemetry Units must use fixed rate, no titrations (should not exceed 5 mcg/kg/min)**

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GENERIC DRUG NAME (TRADE NAME)	**ROUTE OF ADMINISTRATION**	**MAJOR INDICATION**		**REASON FOR RESTRICTIONS**	**AREAS WHERE ADMINISTRATION IS PERMITTED**
Doxapram HCL *Dopram®*	IV Push IV Infusion	Post anesthesia, to stimulate respiration; Drug induced CNS depression; chronic pulmonary disease associated with acute hypercapnia.		Not a muscle relaxant or narcotic antagonist. Maintain adequate airway and oxygenation. Narcosis may recur. Close observation until patient fully alert for 30 minutes to one hour.	Critical Care Units
Droperidol *Inapsine®*	IM IV Push	To produce tranquilization and to reduce the incidence of nausea and vomiting in surgical and diagnostic procedures; For premedication, induction, and as an adjunct in the maintenance of general and regional anesthesia; In neuroleptanalgesia in which droperidol is given concurrently with an opioid analgesic, to aid in producing tranquility and decreasing anxiety and pain; Antiemetic.		QT prolongation and/or torsades de pointes reported at doses at or below recommended doses, even in patients with no known risk factors for QT prolongation. Potentially fatal. Baseline 12-lead ECG prior to administration of droperidol to determine if a prolonged QT interval (i.e., QTc greater than 440 msec for males or 450 msec for females) is present. If there is a prolonged QT interval, droperidol should NOT be administered. ECG monitoring should be performed prior to treatment and continued for 2-3 hours after completing treatment to monitor for arrhythmias.	Critical Care Units Progressive Care Units Cardiac Telemetry Units (Monitored) **Patient must remain on above units during administration and for 3 hours post administration**
Edrophonium *Enlon®*	IV Push	Diagnosis of myasthenia gravis Differentiation of cholinergic crises from myasthenia crises Reversal of nondepolarizing neuromuscular blockers		Potential for cholinergic crisis and arrhythmias	Critical Care Units Cardiac Telemetry Units (Monitored) Progressive Care Units ***Must be given in the presence of a physician on all units***

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GENERIC DRUG NAME (TRADE NAME)	**ROUTE OF ADMINISTRATION**	**MAJOR INDICATION**		**REASON FOR RESTRICTIONS**	**AREAS WHERE ADMINISTRATION IS PERMITTED**
Epinephrine *Adrenaline®*	IV infusion **(Central Line)** IV Push Intra cardiac into the left ventricular chamber (IM & SC do not require monitoring)	1. Treatment of ventricular stand still 2. Treatment of cardiac arrest and AV block 3. Hypotension/Shock		Monitoring important because of cardiovascular effects including increase in high blood pressure, aortic rupture, serious cardiac arrhythmias, cerebrovascular hemorrhage, & pulmonary edema necessitate extreme caution.	Critical Care Units *Exception: During ACLS/Code Blue*
Eptifibatide *Integrilin®*	IV push, followed by infusion	Acute coronary syndrome, including the medically managed and the patient scheduled for PTCA		Constant monitoring of cardiac & blood pressure important because of side effects including excessive bleeding, hypotension and bradycardia.	Critical Care Units Cardiac Telemetry Units (Monitored) Progressive Care Units
Epoprostenol *Flolan®, Veletri®*	Continuous Nebulization IV infusion (Central Line)	Pulmonary hypertension Acute respiratory distress syndrome		Constant hemodynamic monitoring due to risk of side effects including hypotension as well as risk of reflex hypertension if infusion abruptly interrupted which can result in sudden cardiac death	Critical Care Units
Esmolol *Brevibloc®*	IV Infusion (Central Line Preferred)	For rapid control of supraventricular tachycardia		Monitoring heart rate necessary during titration	Critical Care Units
Etomidate *Amidate®*	IV Push	Induction and maintenance of general anesthesia		Monitoring of cardiac function and blood pressure necessary	Critical Care Units *Exception: During ACLS/Code Blue for RSI*
Fenoldopam *Corlopam®*	IV Infusion (Central Line Preferred) May be given through peripheral if using large bore IV at AC site	Hypertensive emergency		Monitor blood pressure (hypotension) and heart rate (tachycardia). May cause hypokalemia. Monitor serum potassium.	Critical Care Units Progressive Care Cardiac Telemetry Units (Monitored) **Progressive Care and Cardiac Telemetry Units may administer fixed doses of 0.1 mcg/kg/min or less (no titration).**

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GENERIC DRUG NAME (TRADE NAME)	**ROUTE OF ADMINISTRATION**	**MAJOR INDICATION**		**REASON FOR RESTRICTIONS**	**AREAS WHERE ADMINISTRATION IS PERMITTED**
Fentanyl *Sublimaze®*	IM Slow IV Push IV Infusion (Epidurals can be used on non-Cardiac Telemetry Units (Monitored)) Intranasal	For analgesic action of short duration during anesthesia as needed; for use as a narcotic analgesic supplement in general or regional anesthesia; for administration as a neuroleptic as an induction of anesthesia; for use as an anesthetic agent with oxygen in selected high risk patients.		Vital signs must be routinely monitored.	Critical Care Units Procedural Units (including SMA, SMAT & HVAU): Anesthesia must be present if nursing administers for moderate sedation, May be given on Progressive Care and Cardiac Telemetry Units (Monitored) by a physician only for conscious sedation Comfort Care Patients (any location; no monitoring required)
Fosphenytoin *Cerebyx®*	IV Push IV Infusion	For control of generalized convulsive status epilepticus and prevention and treatment of seizures occurring during neurosurgery; indicated for short term parenteral administration when other means of phenytoin administration are unavailable		Vital signs must be routinely monitored. Do not exceed 150 mg PE/minute.	No restrictions.
Furosemide *Lasix*	IV Push IV Infusion	Treatment of volume overload		Close monitoring of urinary output is necessary to determine the effectiveness of the continuous infusion. Continuous infusions of furosemide may significantly augment diuresis which can lead to overdiuresis, hypokalemia, and hypomagnesemia. Close monitoring of volume status and electrolytes is necessary.	Critical Care Units Cardiac Telemetry Units (Monitored) Progressive Care Units **IVP may be given on all units, infusion limited to listed units**

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Haloperidol *Haldol*	IV Push IM	Emergency sedation of severely- agitated or delirious patients (unlabeled use)		Higher doses and intravenous administration of haloperidol appear to be associated with a higher risk of QT prolongation and TdP EKG monitoring is required when given IV and it is not acceptable to be administered for the indication of nausea.	Critical Care Units Progressive Care Units Cardiac Telemetry Units (Monitored) Comfort Care Patients (any location; no monitoring required) **IM may be given on all units; IVP limited to listed units**
Hydralazine *Apresoline®*	IV Push	Hypertensive emergency/urgency and management of moderate to severe hypertension		Blood pressure response may be unpredictable in some patients Blood pressure monitoring required after administration	No restrictions
Ibutilide *Corvert®*	IV infusion over 10 minutes	Convert atrial fibrillation / flutter of recent onset.		Can cause either sustained or unsustained polymorphic VT (i.e. Torsades de pointes).	Critical Care Units
Insulin Drip	IV Infusion	Treatment of Hyperglycemia		Requires hourly monitoring of blood glucose	Critical Care Units Progressive Care Units
Isoproterenol *Isuprel®*	IV Infusion IM SC Intra cardiac in an emergency	1. Management of shock & cardiac arrest 2. Increase cardiac contractility & rate to increase cardiac output.		Produces cardiac effects (tachycardia, seizures, pulmonary edema) which may aggravate existing cardiac problems. ECG monitoring is necessary.	Critical Care Units

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GENERIC DRUG NAME (TRADE NAME)	**ROUTE OF ADMINISTRATION**	**MAJOR INDICATION**		**REASON FOR RESTRICTIONS**	**AREAS WHERE ADMINISTRATION IS PERMITTED**
Ketamine *Ketalar®*	IV Push IV Infusion IM PO	Sole anesthetic for short surgical procedures; Bronchodilation. Dissociative anesthetic; induction and maintenance of anesthesia, especially in hypovolemic or high- risk patients.		Cardiovascular hypertension, tachycardia, arrhythmias, bradycardia. Pulmonary: depression, apnea, laryngospasm. CNS: tonic, clonic movement, emergence delirium. GI: nausea, vomiting, hypersalivation. Eye: Diplopia, nystagmus, slight elevation in intraocular tension	**All orders require the provider to have sedation privileges and if ordered outside of the Critical Care Unit or on Non-intubated Patients, must be administered by a provider with sedation privileges ONLY** IV Push, IV infusion, IM, PO Allowed on Critical Care Units RN may administer ONLY in intubated patients Oral Use (PO): • 5-W, PCU • Ordering provider must be palliative care • For intractable pain ONLY Procedural Units including SMA, SMAT & HVAU: Anesthesia MUST administer & remain with patient until is able to breath spontaneously without support and patient responds to verbal stimuli
Labetolol *Trandate®*	Slow continuous infusion IV Push	For control of blood pressure in severe hypertension.		Slow continuous infusion necessitates a controlled administration device & continuous hemodynamic monitoring. IV push requires frequent hemodynamic monitoring.	Critical Care Units Cardiac Telemetry Units (Monitored) Progressive Care Units Medical Telemetry (Monitored) **IV Push on listed units; IV infusion on Critical Care Units only.**

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GENERIC DRUG NAME (TRADE NAME)	**ROUTE OF ADMINISTRATION**	**MAJOR INDICATION**		**REASON FOR RESTRICTIONS**	**AREAS WHERE ADMINISTRATION IS PERMITTED**
Labetolol *Trandate®*	Slow continuous infusion IV Push	For control of blood pressure in severe hypertension.		Slow continuous infusion necessitates a controlled administration device & continuous hemodynamic monitoring. IV push requires frequent hemodynamic monitoring.	Critical Care Units Cardiac Telemetry Units (Monitored) Progressive Care Units Medical Telemetry (Monitored) **IV Push on listed units; IV infusion on Critical Care Units only.**
Lidocaine *Xylocaine®*	Slow continuous infusion IV Push	Treatment cardiac arrhythmias (Exception: Monitor not required for 100mg in 250ml used to decrease the pain of infusion of KCl & other drugs – will be mixed only in the pharmacy)		Slow continuous infusion with controlled admin device. ECG and vital signs routinely monitored.	Critical Care Units Progressive Care Units ***Exceptions: CCDU, MED2, HV7, & HV8***
Lorazepam *Ativan®*	IV Infusion IV Push IM	Continuous sedation to intubated, mechanically ventilated adult patients to provide continuous sedation and control of stress responses or for acute agitation/anxiety		Requires monitoring of cardiovascular status, blood pressure, and heart rate. Patient must also be mechanically ventilated if on continuous infusion.	IV infusion on Critical Care Units only IM & IV push on all units *Space benzodiazepine administration at least 30 minutes from administration of opiates to avoid respiratory depression*
Mannitol *Osmitrol®*	IV Piggyback	Treatment of increased intracranial pressure and cerebral edema Hemodynamic support for intradialytic hypotension		Requiring monitoring of cardiovascular status, intracranial pressure, serum osmolality.	Critical Care Units May be given during hemodialysis procedure on dialysis units for blood pressure support

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GENERIC DRUG NAME (TRADE NAME)	ROUTE OF ADMINISTRATION	MAJOR INDICATION		REASON FOR RESTRICTIONS	AREAS WHERE ADMINISTRATION IS PERMITTED
Metoprolol *Lopressor®*	IV Push	1.Atrial tachyarrhythmias 2.Myocardial infarction		IV push requires frequent hemodynamic monitoring.	Critical Care Units Progressive Care Units Cardiac Telemetry Units Medical Telemetry (Beta Blocker naïve patients may be initiated on telemetry monitor All Units **without** a Monitor (Metoprolol IV may administered on patients who have been receiving PO beta blockers and is currently NPO) Note: Patients should not be transferred for the sole purpose of receiving IV metoprolol
Midazolam *Versed®*	IV Push IV Infusion IM Intranasal	For conscious sedation prior to general anesthesia, before administration of other anesthetic agents; to supplement nitrous oxide and oxygen for short surgical procedures; continuous infusion for sedation in mechanically ventilated-patients		Midazolam IV has been associated with respiratory arrest especially when used for conscious sedation. Requires continuous monitoring of respiratory and cardiac function.	IV infusion: Critical Care Units only IV Push: Critical Care Units Progressive Care Units on mechanical ventilation Preop Units (IV Push): May administer 1 mg doses up to a maximum of 2 mg for anxiety Preop Units (Moderate Sedation): Doses up to 10mg may be given by nursing provided appropriate monitoring available in the presence of Anesthesia IM may be given on all units

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Milrinone *Primacor®*	IV bolus, followed by IV infusion	1. Increase heart contractility 2. Treatment of CHF when digitalis is not effective. 3. Congestive heart failure		Monitors heart rate, blood pressure, fluids and electrolytes. Do not admix with furosemide	Critical Care Units Progressive Care Units Cardiac Telemetry Units (Monitored) – must be fixed rate, no titrations
Nesiritide *Natrecor®*	IV bolus, followed by infusion	Treatment of patients with acutely decompensated congestive heart failure who have dyspnea at rest or with minimal activity.		Caution & monitoring because of hypotension, tachycardia, and bradycardia.	Critical Care Units Cardiac Telemetry Units (Monitored) Progressive Care Units
Nicardipine *Cardene IV®*	IV Infusion (Large peripheral vein)	Short-term treatment of hypertension		Caution & monitoring because of hypotension, tachycardia, and changes in afterload	Critical Care Units
Nitroglycerin *Tridil®*	IV Infusion	1. CHF 2. Angina 3. Hypertension crisis		Caution & monitoring because of hypotension, tachycardia, palpitations, syncope & collapse. Dosage dependent on patient response; monitoring is necessary.	Critical Care Units
Nitroprusside *Nipride®*	IV Infusion	Hypertension crisis		A potent hypotensive drug which can cause profound hypotension, loss of consciousness. Causes cyanide toxicity. Monitor blood pressure & renal function & output; cyanide levels to regulate dosage & effects.	Critical Care Units
Norepinephrine *Levophed®*	IV Infusion **(Central Line)**	Restoration of blood pressure in controlling certain acute hypotensive states & adjunct in treatment of cardiac arrest and profound hypotension.		A powerful peripheral vasoconstrictor and potent inotropic stimulation of the heart. Central venous pressure monitoring may be necessary during dosing titration.	Critical Care Units

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GENERIC DRUG NAME (TRADE NAME)	**ROUTE OF ADMINISTRATION**	**MAJOR INDICATION**		**REASON FOR RESTRICTIONS**	**AREAS WHERE ADMINISTRATION IS PERMITTED**
Pancuronium *Pavulon®*	IV Push	Adjunct to anesthesia to induce skeletal muscle relaxation.		Neuromuscular blocker which may cause respiratory insufficiency or apnea. Reactions may need to be managed by manual or mechanical ventilation. Dosage must be individualized by response. MONITOR necessary.	Critical Care Units
Pentobarbital	IV Push IV Infusion	Refractory status epilepticus; barbiturate coma in patients with severe brain injury and increased ICP		May cause hypotension and respiratory depression when administered IV	Critical Care Units
Phenylephrine *Neosynephrine®*	IV infusion **(Central Line)**	Hypotension/Shock		Potent, direct-acting alpha-adrenergic stimulator with beta-adrenergic activity that produces systemic arterial vasoconstriction that requires close monitoring of blood pressure and pulse	Critical Care Units
Phenobarbital	IV Push IV Infusion	Management of generalized tonic- clonic, status epilepticus and partial seizures		May cause hypotension and respiratory depression when administered IV	Critical Care Units Progressive Care Units Cardiac Telemetry Units Medical Telemetry **(monitored patient only)**
Phenytoin *Dilantin®*	IV Push Do Not Add to IV Fluids	Seizures		Adults – IV push slowly less than 50mg/ min. No monitor needed on adults.	Adult units not restricted

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Procainamide	IV Infusion	Ventricular arrhythmias		Potentially fatal blood dyscrasias (agranulocytosis) and proarrhythmic effects Continued administration leads to development of positive ANA test in 50% of patients, which may result in drug-induced lupus erythematosus-like syndrome ECG and continuous vital signs routinely monitored	Critical Care Units
Propofol *Diprivan®*	IV Push IV Infusion	Continuous sedation to intubated, mechanically ventilated adult patients to provide continuous sedation and control of stress responses. Also, used for cardioversion and other special procedures.		Significant hypotension and bradycardia.	Critical Care Units Cardiac Telemetry Units (Monitored) and Progressive Care Units (IV Push only and only if administered by physician) Procedural Units (including SMA, SMAT & HVAU: Anesthesia MUST administer & remain with patient until is able to breath spontaneously without support and patient responds to verbal stimuli)
Propranolol *Inderal®*	Slow IV Push	Life threatening arrhythmias or those occurring under anesthesia		Central venous pressure and ECG monitoring required. Injection should not exceed 1mg/min to avoid lowering blood pressure and causing cardiac standstill.	Critical Care Units Progressive Care Units
Quinidine	IV	Antimalarial schizonticide Antiarrhythmic with a Class 1A activity		Cardiac effects Risk of torsades	Critical Care Units

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Rocuronium *Zemuron®*	IV Push IV Infusion	Adjunct to general anesthesia; to facilitate endotracheal intubation; skeletal muscle relaxation during surgery or mechanical ventilation.		Respiratory depression or apnea may occur. Manual or mechanical ventilation may be necessary to manage the patient.	Critical Care Units *Exception: During ACLS/Code Blue for RSI*
Sodium Chloride *Hypertonic Saline*	IV Push IV infusion (**Central Line** – for infusions greater than or equal to 3%) **Exception:** Peripheral line for 3% at discretion of physician in TNCC and NCCU	Hyponatremia Elevated intracranial pressure due to various etiologies (e.g. traumatic brain injury, intracranial hemorrhage, transtentorial herniation)		Risk of central pontine myelinolysis (due to rapid correction of hyponatremia), frequent monitoring of serum sodium and osmolality, hemolysis, transient hypotension (especially with 23.4%).	3% NaCl: Critical Care Units, Progressive Care Units, Cardiac Telemetry Units (monitored), and 5-W oncology >3% NaCl: Critical Care Units only
Succinylcholine *Anectine® Quelicin®*	IM IV Push IV infusion	1. Adjunct to general anesthesia 2. Induce skeletal muscle relaxation or paralysis during surgery		A neuromuscular blocker which produces muscular paralysis resulting in respiratory depression or apnea. Malignant hyperthermic crisis and cardiac effects may also occur.	Critical Care Units *Exception: During ACLS/Code Blue for RSI*
Tenecteplase *TNKase®*	IV bolus	Management of AMI.		Needs to be given where diagnostic & monitoring equip are avail due to risk of serious hemorrhage, incl. potentially fatal intracranial bleeding & internal bleeding.	Critical Care Units
Tirofiban *Aggrastat®*	IV bolus loading dose, followed by infusion	Acute coronary syndrome, including the medically managed and the patient scheduled for PTCA		Constant monitoring of cardiac & blood pressure important because of side effects including excessive bleeding (including thrombocytopenia), coronary artery dissection, and bradycardia.	Critical Care Units Cardiac Telemetry Units (Monitored) Progressive Care Units

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Vasopressin	IV infusion **(Central Line)** IM SC	Vasodilatory Shock/septic shock		Circumoral pallor (with high doses), hypertension, bradycardia, arrhythmias, venous thrombosis, vasoconstriction, distal limb ischemia, requires an increased level of monitoring	Critical Care Units **(IM & SC administration does not require special monitoring)**
Vecuronium *Norcuron®*	IV Push IV Infusion	Adjunct to general anesthesia; to facilitate endotracheal intubation; skeletal muscle relaxation during surgery or mechanical ventilation.		Respiratory depression or apnea may occur. Manual or mechanical ventilation may be necessary to manage the patient.	Critical Care Units
Verapamil *Calan®, Isoptin®*	Slow IV Push	1. Temporary control of rapid ventricular rate in atrial flutter or atrial fibrillation. 2. Supraventricular arrhythmias.		Due to some patients experiencing life- threatening adverse reactions (hypotension, asystole), the use of IV Verapamil needs to be monitored.	Critical Care Units Cardiac Telemetry Units (Monitored) Progressive Care Units

** Central line administration restrictions are based on pH (less than 5 or greater than 9), osmolarity (greater than 500 mOsm/L), and extravasation potential*

Rev. June 24, 2020

Automatic Renal Dosing Protocol

Our Lady of the Lake Regional Medical Center (Revised July 2020)

Creatinine Clearance (CrCl) will be calculated based on the Cockcroft-Gault equation for all renal dose adjustments

- If patient weighs less than Ideal Body Weight (IBW) use Actual Body Weight (ABW) for calculating CrCl
- If patient weights >120% of IBW then use Adjusted Body Weight (AdjBW) for calculating CrCl

$$\text{CrCl (male)} = \frac{(140\text{-Age}) \times \text{IBW}}{72 \times \text{SCr}} \qquad \text{CrCl (female)} = \frac{(140\text{-Age}) \times \text{IBW}}{72 \times \text{SCr}} \ (\times 0.85)$$

Modify the order in the EMR, place the comment "Renally adjusted per P&T approved dosing protocol for CrCl < * mL/min"** or use dot phrase .RAPP

HD: Hemodialysis, CAPD: Continuous ambulatory peritoneal dialysis, CRRT: Continuous renal replacement therapy, SLED: sustained low-efficiency dialysis, PIRRT: prolonged intermittent renal replacement therapy, IBW: Ideal body weight, SCr: Serum creatinine, IV: intravenous, PO: oral, CVVH: Continuous venovenous hemofiltration, CVVHD: Continuous venovenous hemodialysis, CVVHDF: Continuous venovenous hemodiafiltration, LD: Loading dose, CF: Cystic fibrosis, FN: Febrile neutropenia, PNA: Pneumonia, NF: Non-formulary or restricted, 2g-2g-3g: give dose only post HD (M-W-F or T-R-S in fashion 2g-2g-3g), TIW: Three times weekly, 4-4-6: 4mg/kg-4mg/kg-6mg/kg TIW post HD, 8-8-10: 8mg/kg-8mg/kg-10mg/kg TIW post HD, 10-10-12: 10mg/kg-10mg/kg-12mg/kg TIW post HD, SSTI: skin and soft tissue infection, PCP: Pneumocystis pneumonia, Steno: *Stenotrophomonas* OM: Osteomyelitis, DFI: Diabetic foot infection, NR: Not recommended, CI: Contraindicated

Antimicrobials								
Medication	**Usual dose**	**CrCl <50mL/min**	**CrCl <30mL/min**	**CrCl <10mL/min**	**HD**	**CAPD**	**SLED**	**CRRT**
Acyclovir (IV) [IBW] HSV	5 mg/kg q8h	5 mg/kg q12h	5 mg/kg q24h (CrCl<25)	2.5 mg/kg q24h	2.5 mg/kg q24h	2.5 mg/kg q24h	5 mg/kg q12-24h	CVVH: 5 mg/kg q24h CVVHD/HDF: 5 mg/kg q12-24h
HSV Encephalitis, Zoster	10 mg/kg q8h	10 mg/kg q12h	10 mg/kg q24h (CrCl<25)	5 mg/kg q24h	5 mg/kg q24h	5 mg/kg q24h	10 mg/kg q12-24h	CVVH: 10 mg/kg q24h CVVHD/HDF: 10 mg/kg q12-24h
Acyclovir (PO) Varicella zoster	800 mg 5x/day	800 mg 5x/day	800 mg q8h (CrCl<25)	800 mg q12h	800 mg q12h	800 mg q12h	No data	No data
Amikacin	See aminoglycoside dosing protocol							
Amoxicillin/ clavulanate	500 mg q8h or 875 mg q12h	500 mg q8h or 875 mg q12h	500 mg q12h	500 mg q24h	500 mg q24h	250 mg q12h	No data	500 mg q12h
Ampicillin (IV)	2 g q6h	2 g q8h	2 g q8h	2 g q24h	1 g q12h	1 g q24h	2 g q8h	CVVH: 2 g q12h CVVHD/HDF: 2 g q8h
Endocarditis, Meningitis	2 g q4h	2 g q6h	2 g q6h	2 g q12h	2 g q12h	2 g q24h	2 g q6h	CVVH/CVVHD: 2 g q8h CVVHDF: 2 g q6h
Ampicillin/ sulbactam	1.5-3 g q6h	1.5-3 g q6h	1.5-3 g q12h	1.5-3 g q24h (CrCl<14)	1.5-3 g q24h	3 g q24h	3 g q12h	CVVH: 3 g q12h CVVHD/HDF: 3 g q8h
Aztreonam	1-2 g q8h	1-2 g q8h	0.5-1 g q8h	0.5 g q8h	0.5 g q12h	0.5 g q12h	2 g q12h	CVVH: 1 g q12h CVVHD/HDF: 2 g q12h

Antimicrobials								
Medication	**Usual dose**	**CrCl <50mL/min**	**CrCl <30mL/min**	**CrCl <10mL/min**	**HD**	**CAPD**	**SLED**	**CRRT**
Cefazolin	2 g q8h	2 g q8h	1 g q12h (CrCl<34)	1 g q24h	1 g q24h or 2g-2g-3g TIW post HD	0.5 g q12h	2 g q12h	CVVH: 1 g q12h CVVHD/HDF: 2 g q12h
Cefepime	2 g q12h	1 g q12h (CrCl<60)	1 g q24h	0.5 g q24h (CrCl<11)	0.5 g q24h or 2 g TIW post HD	1 g q24h or 2 g q48h	2 g q12h	2 g q12h
FN, Critically Ill, Meningitis, Pseudomonas, CF, Endocarditis, PNA	2 g q8h	2 g q12h (CrCl<60)	1 g q12h	1 g q24h (CrCl<11)	1 g q24h or 2 g TIW post HD	2 g q48h	2 g q12h	2 g q12h
Ceftazidime/ Avibactam (NF)	2.5 g q8h	1.25 g q8h	0.94 g q12h	0.94 g q24h (CrCl<15)	0.94 g q24h	No data	1.25 g q8h	1.25 g q8h
Ceftolozane/ Tazobactam (NF)	1.5 g q8h	750 mg q8h	375 mg q8h	No data	LD: 750 mg; 150 mg q8h	No data	750 mg q12h	750 mg q8h
Pneumonia	3 g q8h	1.5 g q8h	750 mg q8h	No data	LD: 2.25 g; 450 mg q8h	No data	750 mg 8h	1.5 g q8h
Ceftaroline (NF)	600 mg q12h	400 mg q12h	300 mg q12h	200 mg q12h (CrCl<15)	200 mg q12h	200 mg q12h	400 mg q12h	400 mg q12h
MRSA bacteremia	600 mg q8h	600 mg q12h	400 mg q12h	300 mg q12h (CrCl<15)	300 mg q12h	300 mg q12h	600 mg q12h	600 mg q12h
Cefdinir (PO)	300 mg q12h	300 mg q12h	300 mg q24h	300 mg q24h	300 mg q24h	300 mg q24h	No data	No data
Cefuroxime (PO)	500 mg q12h	500 mg q12h	500 mg q24h	500 mg q48h	500 mg q48h and post HD	500 mg q24h	No data	No data
Cephalexin	500 mg q6h	500 mg q12h	250 mg q12h	250 mg q24h (CrCl<14)	500 mg q24h	250 mg q24h	No data	No data
Ciprofloxacin (IV)	400 mg q12h	400 mg q12h	200 mg q24h	200 mg q24h	200 mg q24h	200 mg q24h	400 mg q12h	400 mg q12h
Meningitis, Pseudomonas	400 mg q8h	400 mg q8h	400 mg q24h	400 mg q24h	400 mg q24h	400 mg q24h	400 mg q12h	400 mg q12h
Ciprofloxacin (PO)	500 mg q12h	500 mg q12h	250 mg q24h	250 mg q24h	250 mg q24h	250 mg q24h	250 mg q12h	250 mg q12h
Meningitis, Pseudomonas	750 mg q12h	500 mg q12h	500 mg q24h	500 mg q24h	500 mg q24h	500 mg q24h	500 mg q12h	500 mg q12h

Automatic Renal Dosing Protocol

Antimicrobials								
Medication	**Usual dose**	**CrCl <50mL/min**	**CrCl <30mL/min**	**CrCl <10mL/min**	**HD**	**CAPD**	**SLED**	**CRRT**
Daptomycin Non-severe infections: SSTI	4-6 mg/kg q24h	4-6 mg/kg q24h	4-6 mg/kg q48h	4-6 mg/kg q48h	4-6 mg/kg q48h or 4-4-6 TIW post HD	4-6 mg/kg q48h	6 mg/kg q24h	6 mg/kg q48h
Serious infections: OM, Bacteremia, Fournier's gangrene, DFI, Endocarditis	8-10 mg/kg q24h	8-10 mg/kg q24h	8-10 mg/kg q48h	8-10 mg/kg q48h	8-10 mg/kg q48h or 8-8-10 TIW post HD	8-10 mg/kg q48h	8 mg/kg q24h	8 mg/kg q48h
Enterococcal Bacteremia or Endocarditis	10-12 mg/kg q24h	10-12 mg/kg q24h	10-12 mg/kg q48h	10-12 mg/kg q48h	10-12 mg/kg q48h or 10-10-12 TIW post HD	10-12 mg/kg q48h	10 mg/kg q24h	10 mg/kg q48h
Ertapenem	1 g q24h	1 g q24h	500 mg q24h	500 mg q24h	500 mg q24h or 1 g TIW post HD	500 mg q24h	1 g q24h	1 g q24h
Fluconazole (IV/PO)	LD: 400-800 mg; 100-400 mg q24h	50% dose q24h	50% dose q24h	50% dose q24h	100-400 mg post HD	50% dose q24h	LD: 800 mg; 400 mg q24h	LD: 800 mg; 200-800 mg q24h
Flucytosine	25 mg/kg q6h	25 mg/kg q12h	25 mg/kg q12h	25 mg/kg q24h	25 mg/kg q24h or 50 mg/kg post HD	1000 mg q24h	No data	25 mg/kg q12h
Gentamicin	See aminoglycoside dosing protocol							
Levofloxacin (IV/PO)	500 mg q24h	LD: 500 mg; 250 mg q24h	LD: 500 mg; 250 mg q48h (CrCl<20)	LD: 500 mg; 250 mg q48h	LD: 500 mg; 250 mg q48h	LD: 500 mg; 250 mg q48h	500 mg q48h	500 mg q48h
Pneumonia, Complicated SSTI, Osteomyelitis, Intra-abdominal infection	750 mg q24h	750 mg q48h	LD: 750 mg; 500 mg q48h (CrCl<20)	LD: 750 mg; 500 mg q48h	LD: 750 mg; 500 mg q48h	LD: 750 mg; 500 mg q48h	750 mg q48h	750 mg q48h

Antimicrobials								
Medication	**Usual dose**	**CrCl <50mL/min**	**CrCl <30mL/min**	**CrCl <10mL/min**	**HD**	**CAPD**	**SLED**	**CRRT**
Meropenem	500 mg q6h	500 mg q8h	500 mg q12h (CrCl<25)	500 mg q24h	500 mg q24h	500 mg q24h	1 g q12h	1 g q12h
CNS, eye, GNR MIC≥4	2 g q8h	2 g q12h	1 g q12h (CrCl<25)	1 g q24h	1 g q24h	1 g q24h	1 g q12h	1 g q12h
Oseltamivir Treatment	75 mg q12h	30 mg q12h (CrCl<60)	30 mg q24h	No data	LD: 30 mg; 30 mg post HD	30 mg once	30 mg q24h	30 mg q24h
Piperacillin/ Tazobactam LD: 4.5 g 30 mins; **4-h infusion***	3.375 g q8h	3.375 g q8h	3.375 g q12h (CrCl<20)	3.375 g q12h	3.375 g q12h	3.375 g q12h	3.375 g q8h	3.375 g q8h
*Piperacillin/tazobactam 4-hour infusion is preferred over standard dosing. Please see piperacillin/tazobactam extended infusion protocol								
Piperacillin/ Tazobactam 30-min infusion	3.375 g q6h	2.25 g q6h (CrCl<40)	2.25 g q8h (CrCl<20)	2.25 g q8h	2.25 g q12h	2.25 g q12h	3.375 g q8h	2.25 g q6h
HAP/VAP, *Pseudomonas*	4.5 g q6h	3.375 g q6h (CrCl<40)	2.25 g q6h (CrCl<20)	2.25 g q6h	2.25 g q8h	2.25 g q8h	3.375 g q8h	3.375 g q6h
Sulfamethoxazole/ Trimethoprim IV/PO Dose based on trimethoprim PCP, Steno	5 mg/kg q8h	5 mg/kg q8h	5 mg/kg q12h	5 mg/kg q24h	5 mg/kg q24h	5 mg/kg q24h	5 mg/kg q8h	5 mg/kg q8h
Tobramycin	See aminoglycoside dosing protocol							
Vancomycin	See vancomycin dosing protocol							

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Automatic Renal Dosing Protocol

Anticoagulants							
Medication	**Indication**	**Usual dose**	**Renal Adjustment**	**HD**	**CAPD**	**SLED**	**CRRT**
Apixaban (Eliquis)	DVT/ PE Treatment	10 mg q12h x 7 days; then 5mg q12h	No dosage adjustment is recommended Note that patients with SCr >2.5 mg/dL or CrCl <25 were excluded from trials	Not studied, use not recommended. Note that patients with ESRD on dialysis were excluded from trials. May consider reduced dose of 5 mg q12h for 7 days; then 2.5 mg q12h			
	Nonvalvular Atrial fibrillation (A Fib)	5 mg q12h	Any 2 of the following: Age ≥80, weight ≤60 kg, SCr ≥1.5 mg/dL: 2.5 mg q12h	Not studied, use not recommended. Note that patients with ESRD on dialysis were excluded from trials. May consider reduced dose of 2.5 mg q12h			
	Post-op VTE prophylaxis (hip/knee replacement surgery)	2.5 mg q12h	No dosage adjustment is recommended by the manufacturer. Note that patients with CrCl <30 were excluded from trials	Not studied, use not recommended. Note that patients with ESRD on dialysis were excluded from trials.			
Dabigatran (Pradaxa)	Nonvalvular Atrial fibrillation (A Fib)	150 mg q12h	CrCl 15-30: 75 mg q12h CrCl <15: not recommended	Not recommended. Patients on dialysis were excluded from clinical trials.			
	Treatment and reduction in the risk of recurrence of DVT and PE	150 mg q12h after 5-10 days of parenteral anticoagulation	CrCl <30: not recommended	Not recommended. Patients on dialysis were excluded from clinical trials.			
	Post-op VTE prophylaxis (hip/knee replacement)	110 mg given 1 to 4 hours post–op; 220 mg q24h maintenance dose x 10 -14 days at least	CrCl <30: not recommended Note that patients with CrCl <30 were excluded from trials	Not studied, use not recommended.			

Anticoagulants							
Medication	**Indication**	**Usual dose**	**Renal Adjustment**	**HD**	**CAPD**	**SLED**	**CRRT**
Rivaroxaban (Xarelto)	DVT/PE Treatment, reduction of risk of recurrent DVT/PE	15 mg q12h with food x 21 days; then 20 mg q24h with food	CrCl <15: not recommended	Use not recommended			
	Nonvalvular Atrial fibrillation (A Fib)	20 mg q24h with dinner	CrCl 15-50: 15 mg q24h with food CrCl <15: not recommended				
	PCI with Atrial fibrillation (A Fib)	15 mg q24h with meal plus clopidogrel or aspirin	CrCl 30-50: 10 mg q24h plus clopidogrel or aspirin CrCl <15: Avoid use				
	Post-op VTE prophylaxis (hip/knee)	10 mg q24h	<15: not recommended				
	VTE prophylaxis in acutely ill medical patients	10 mg q24h	<15: not recommended				
	CAD or PAD	2.5 mg q12h	<15: Avoid use	Avoid use ESRD patients on dialysis were not enrolled in clinical studies.			
Enoxaparin (Lovenox)	DVT prophylaxis (general)	40 mg q24h	CrCl <30: 30 mg q24h	Not recommended--unfractionated heparin preferred. If enoxaparin is used, consider monitoring anti-Xa levels.			
	DVT prophylaxis (abdominal surgery)	40 mg q24h	CrCl <30: 30 mg q24h				
	DVT prophylaxis (bariatric surgery) unlabeled	40 mg q12h	CrCl <30: 30 mg q24h				
	DVT prophylaxis (trauma, hip/knee replacement)	30 mg q12h or (40 mg q24h)	CrCl <30: 30 mg q24h				
	DVT/PE treatment, NSTEMI/STEMI treatment	1 mg/kg q12h	CrCl <30: 1 mg/kg q24h				
	DVT/PE treatment option	1 mg/kg q12h or 1.5 mg/kg q24h	CrCl <30: 1 mg/kg q24h				
	Atrial fibrillation (A Fib) (unlabeled)	1 mg/kg q12h or 1.5 mg/kg q24h	CrCl <30: 1 mg/kg q24h				

Automatic Renal Dosing Protocol

Miscellaneous Medications								
Medication	**Usual dose**	**CrCl <50mL/min**	**CrCl <30mL/min**	**CrCl <10mL/min**	**HD**	**CAPD**	**SLED**	**CRRT**
Famotidine Stress ulcer prophylaxis	20 mg BID	20 mg daily (CrCl<60)	20 mg every other day	20 mg every other day	20 mg every other day	20 mg every other day	20 mg every other day	20 mg every other day
Rosuvastatin	5-40 mg daily	5-40 mg daily	5 mg daily (10 mg/day maximum)	5 mg daily (10 mg/day maximum)	May consider 5-10 mg daily	Not studied		
Simvastatin*	5-80 mg daily	5-80 mg daily	Initiate 5 mg daily	Initiate 5 mg daily	Not studied			
*80 mg simvastatin reserved for patients taking for >12 consecutive months								
Zoledronic acid (Zometa) Bone metastases from solid tumors, multiple myeloma, prostate cancer (androgen deprivation), breast cancer (adjuvant or aromatase inhibitor)	4 mg once *See zoledronic acid protocol*	3.5 mg once (CrCl<60) 3.3 mg once (CrCl<50) 3.0 mg once (CrCl<40)	NR	NR	NR			
Hypercalcemia	4 mg once	Mild to moderate impairment: no dosage adjustment. Severe impairment (SCr >4.5): risk versus benefit.						
Zoledronic Acid (Reclast) [ABW CrCl] Nononcology	5 mg once	5 mg once	CI (CrCl<35)	CI	CI			

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Vancomycin Initial Dosing Recommendations

- **The guidelines in this document to not apply to peri-op vancomycin or LOPA (organ donation) patients**
- Review the MAR and antimicrobial summary to identify any previous doses (i.e. ER, one-time dose, outside facility etc)
  - Can also use search function (use quotations, i.e. "vancomycin" to find exact matches in chart)
- Initial dose/schedule is based upon the patient's **actual body weight (ABW) and creatinine clearance (CrCl)**
- Initial dose maximums without MD approval/evidence of need from prior dosing history
  - **Maximum single dose = 2000 mg, round to the nearest 250 mg**
  - **Maximum total daily dose = 4 grams**
    - Ex: for q8hr interval, max empiric dose is 1250mg to stay under 4gm/day
    - > 4 grams/day of vancomycin is associated with a higher risk of developing nephrotoxicity
- Initial frequency limits without MD approval/evidence of need from prior dosing history
  - **Age 41-65:** Minimum dosing frequency q12hr
  - **Age >65:** Minimum dosing frequency q18hr
- Time the maintenance dose to start at the selected interval following the initial dose
  - Ex: For q12h interval: if initial dose ordered @0600, order the next dose to start at 1800
- Pharmacist must enter a "Pharmacy to Dose Vancomycin Consult" if one has not already been entered (except for peri-op doses and one-time ED orders)
- **If unsure about complex cases, please reach out to available clinical pharmacists for advice/assistance**

Pharmacy Consult In-basket

- All pharmacists must check the In-basket for "Consult Messages" for their units every 30 minutes to identify new vanc consults
  - Ensure that initial loading and maintenance doses have been ordered as appropriate
- **Do not** delete the message. Leave as "Read" in the in-basket for clinical pharmacist follow up within 24 hrs

Vancomycin Loading Doses

- Loading doses of vancomycin (20-25 mg/kg) are recommended in patients with serious MRSA infections
- **A loading dose of 20mg/kg should be ordered for ALL PATIENTS** (unless receiving PD)
  - **Maximum dose is 2000mg**
- Patients on peritoneal dialysis will receive 15mg/kg x1 instead of an initial loading dose (shown in table below)

Vancomycin Initial Maintenance Regimens

- Time the maintenance dose to start at appropriate interval following the initial loading dose

CRCL (ML/MIN)	SUGGESTED REGIMEN		
> 90	**Age ≤ 40:** 20mg/kg x1 LD, then 15 mg/kg q8h *(*Max empiric dose 1250mg q8h)*	**Age 41-65:** 20mg/kg x1 LD, then 15 mg/kg q12h	**Age >65:** 20mg/kg x1 LD, then 15mg/kg q18h *(*q12h if used previously or if approved by MD)*
60-90	**Age ≤ 65:** 20mg/kg x1 LD, then 15 mg/kg q12h	**Age > 65:** 20mg/kg x1 LD, then 15 mg/kg q18h *(*q12h if used previously or if approved by MD)*	
30-59	20mg/kg x1 LD, then 15 mg/kg q24h		
< 30	20mg/kg x1 LD, then pulse dosing order (vancomycin pulse dosing by pharmacy, start time in 1 month) *This order produces read-only tasks for RN and is tied to a fake vancomycin NDC to prevent accidental administration*		
CVVHDF	20mg/kg x1 LD, then 15-20 mg/kg q24h		
IHD, SLED	20mg/kg x1 LD, then 500-1250mg (~10mg/kg) after each IHD/SLED		
PD	15 mg/kg x 1 (NO loading dose)		

Last revision date: March 10, 2020

Notes

Notes

Notes

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