ACLS

Name	Load / maintenance and titration / usual range	Contraindications, Adverse Effects & Precautions, Other
Atropine	**0.5 mg** (1 mg for PEA) rapidly IV/IO q 3-5 min, max. 3 doses	
Epinephrine	**1 mg** rapidly IV/IO q 3-5 min	
Vasopressin	Single dose **40 U** IV/IO	as a substitute to epinephrine 1st or 2nd dose
Amiodarone	**150 mg** IV over 10 min	for wide-complex rhythms (regular, irregular)
	taper (from IVI): 400 mg po tid x 5 d → 400 mg po bid x 5 d → 400 mg po daily x 5 d → 200 mg daily x 5 d	
Adenosine	**6 mg** rapid IV push (over 1 second into large vein + 20 mL flush + elevate extremity); if no conversion within 1-2 mins, give **12 mg** rapid IV push (may repeat **12 mg** once)	for regular SVT if vagal maneuver does not help
Naloxone	0.4-2 mg IV q2-3min (total up to 10 mg); if don't want analgesia reversal – use 0.1-0.2 mg dose	T1/2 ≥ 1 hour; continuously observe for minimum of 2 hours after the last dose (if recurs – start 0.04 mg/kg/hr IVI)

LOCAL ANESTHETICS

Name	Load / maintenance and titration / usual range	Contraindications, Adverse Effects & Precautions, Other
Lidocaine	**4.5 mg / kg / dose** (max 300 mg) **q 90 min** **7.0 mg / kg / dose** (max 500 mg) **q 90 min with epinephrine**	1% lidocaine – max **30** mL 1% lidocaine with epi – max **50** mL
Bupivacaine (Marcaine, Sensorcaine)	**Max 175 mg / dose q 3 hrs** **Max 225 mg / dose q 3 hrs with epinephrine**	0.25% bupivacaine – max **70** mL 0.25% bupivacaine with epi – max **90** mL May produce cardiac arrest Pregnancy Category: C

1% lidocaine with epinephrine = 10 mg/mL = 700 mg or 70 mL / 100 kg person but N.B. 50 mL is max
Formula: 70 mL x patient weight kg / 100 kg
0.25% bupivacaine with epinephrine = 2.5 mg/mL = max 90 mL (70 mL without epinephrine)

SEDATIVES / REVERSAL

Name	Load / maintenance and titration / usual range	Contraindications,

		Adverse Effects & Precautions, Other
Midazolam (Versed)	**1-4 mg** (rebolus 1-2 mg **q10-15min** to sedation) / **1-2 mg/h** (rebolus, titrate by 1-2 mg/h q10-15min) / **1-20 mg/h**	Duration of effect: 2-4 hours T1/2 =1.5-2.3 hours
Flumazenil (Romazicon)	**0.2 mg over 15 sec → repeat q1min up to total 1 mg (max 3 mg/hr)**	T1/2 40-80 min Duration of effect 45-90 min
Lorazepam (Ativan)	**1-4 mg** (rebolus 1-2 mg **q20-30min** to sedation) / **1-2 mg/h** (rebolus, titrate by 1-2 mg/h q10-15min) / **1-10 mg/h**	In status epilepticus: 4 mg repeat once in 10-15 min Agitation: up to 4 mg (0.02-0.06 mg/kg) q2-6h T1/2 = 10-20 hours
Diazepam (Valium)	**2-10 mg** orally bid-qid Moderate Anxiety: 2-5 mg IM or IV, repeated in 3-4 hrs PRN Severe Anxiety: 5-10 mg IM or IV, repeated in 3-4 hrs PRN	T1/2 = 2-4 days
Propofol (Diprivan)	**No** bolus (alt: 0.5 mg/kg test dose) / **5 µg/kg/min** (titrate 5-10 µg/kg/min q5-10min) / **5-80 µg/kg/min**	Short-acting (5-10 min). Excellent bronchodilation. Cardiac depression and vasogenic hypotension. If > 48 hours – **propofol-induced syndrome** – rhabdomyolysis. CI: liver injury
Etomidate (Amidate)	**0.2-0.6 mg/kg** (e.g. 20 mg) for intubation / **5-20 mcg/kg/min**	Reduces ICP, no effect on BP. May induce seizures, no analgesia (→ myoclonus), adrenal suppression, impairs renal function. CI: children & pregnancy (embryocidal), renal failure
Pentobarbital	**3-15 mg/kg** IV over 30 minutes / **0.5-5** mg/kg/h	Cardiac depression and vasogenic hypotension (H: volume + dopamine)
Lidocaine	**1.5 mg/kg** IVP before intubation or suctioning	
Dexmedetomidine (Precedex)	**No** bolus (or 1 µg/kg over 10 min) / **0.2-0.4 µg/kg/h** (titrate 0.1 µg/kg/h q30min*) / **0.2-1.4 µg/kg/h**	* to prevent BP↓ Does not affect respiratory drive
MgSO4	2-4 mg IV q1h	
Trazodone	**25-50 (max. 200) mg PO q8h** (max. 600 mg/d)	
Quetiapine (Seroquel)	**25-50 mg PO q12h** / titrate by 50 mg/dose/d (max. 400 mg/d)	
Haloperidol (Haldol)	to sedate acutely agitated patient: **2-10 mg IM q15min** until patient controlled (i.e. 2-5-5…)	CI: Parkinson. SI: neuroleptic malignant syndrome, urinary retention. Check elbows for rigidity – add benztropine if needed
Phenobarbital	**30-120 mg** PO/IV/IM q6h	oral : IV = 1 : 1

ANTIEPILEPTIC DRUGS (AED)

Name	Load / maintenance and titration / usual range	Therapeutic blood level	Contraindications, Adverse Effects & Precautions, Other
Cannabidiol (CBD) (Epidiolex)	**5 mg/kg/d** divided BID for 1 week → increase to **10 mg/kg/d** (if needed, may go up to 20).		check AST, ALT, total bilirubin – at start, at 1, 3, 6 months
Carbamazepine (CBZ) (Tegretol, Carbatrol)	100 mg × 2 on day 1; increase (by 200 mg/d with 100-mg increments q12h prn) to 200-400 mg × 2-4/day; not to exceed 2000 mg/d (children, 10-40 mg/kg/d)	4-12 µg/ml	induces its own hepatic metabolism (autoinduction) → T1/2 shortened by 50% during first few weeks (H: gradual dose titration); liver function tests monthly for 3-4 mos; CBC q week x 3 mos, then q month x 3 yrs
Clobazam	administered × 1-2/d; 10-20 mg/d		
Clonazepam (KLO) (Klonopin)	administered × 1-3/d. 0,25-12 mg/d (start at 1.5 mg/d divided TID, increase by 0.5-1 mg q 3 d; max 20 mg/d)	10–80 ng/mL	
Eslicarbazepine acetate (Aptiom)	400 mg once daily x 1 week → 800 mg once daily (recommended maintenance dose); max dose 1200 mg/d		
Ethosuximide (ETX) (Zarontin)	administered × 1-3/d; 500-1500 mg/d (10-75 mg/kg/d in children)		
Gabapentin (Neurontin, Horizant, Gralise)	start 300 mg/d divided TID, titrate up to 4800 mg/d		sedation
Lacosamide (Vimpat)	single-loading dose of **200 mg** (oral or injection) → 12 hours later start **100-mg twice-daily** dosing		
Lamotrigine (LTG) (Lamictal)	administered × 2/d; 75–300 mg/d → 150-800 mg/d (children 1-5 mg/kg/d)	1-15 µg/ml	one of preferred treatments during pregnancy

Levetiracetam (Keppra)	**20 mg/kg** IV (usually 1 g) / maintenance **500-1500 mg BID**		
Lorazepam (Ativan)	for status: 0.1 mg/kg: usually **2+2 mg** IV (2 mg if < 40 kg); wait 1 minute for response; if seizures continue → given additional doses up to max 9 mg (adult)		
Methsuximide (Celontin)	start with 300 mg qd → increase by 300 mg PRN at weekly intervals up to 1200 mg/d		
Midazolam	**10 mg** IM (5 mg if < 40 kg)		
Oxcarbazepine (OXC) (Trileptal)	start 300-600 mg/d with titration up to 2400 mg/d; recommended 1200 mg/d (children 10 → 30 mg/kg/d)	no need to check drug levels	retains CBZ benefits while avoiding autoinduction and drug interaction properties; no liver and hematologic toxicity
Phenobarbital (PHB) (Luminal)			
Phenytoin (PHT) (Dilantin) / Fosphenytoin (Cerebyx)	**adult dose**: load 15-20 mg PE/kg (usually 1 g, max 2 g; 100-150 mg PE/min) → 4-6 mg PE/kg/d (**300**-500 mg/d; 150 mg PE/min to minimize risk of hypotension and cardiac arrest). **pediatric dose**: load 15-20 mg PE/kg → initial dose: 5 mg PE/kg/d → maintenance 4-8 mg PE/kg **if > 6 years**, may require minimum adult dose (max 300 mg PE/d).		monitor [FREE phenytoin] (goal 1-2 mcg/ml) – first 2-24 hours after IV load, then again in 2-3 days. No other levels needed unless seizures occur. Reloading dose in mg = desired change in free conc x kg x 7
Rufinamide (Banzel)			
Valproate (Depakote)	**30 mg/kg** IV bolus → **3 mg/kg** IV (over 60 min) q6hrs		
Zonisamide (ZNS) **(**Zonegran**)**	administered × 1/d. 100 mg/d → up to 600 mg/d		

PARALYTICS

(used only with sedatives!)

Name	Load / maintenance and titration / usual range	Contraindications, Adverse Effects & Precautions, Other
Rocuronium	**0.6-1 mg/kg** then: a) 0.1-0.2 mg/kg IV q15-30min b) 10 µg/kg/min (titrate 2 µg/kg/min q5min) / 4-16 µg/kg/min	Titrate to 2-3 TOF (stop if TOF does not produce at least 1-2 twitches; if resumed, restart at 25% original dose) Rocuronium – short acting Vecuronium – intermediate acting
Vecuronium	**0.05-0.1 mg/kg** then: a) rebolus IV q45-60min b) 0.5-1.5 µg/kg/min (rebolus and titrate by 0.2 µg/kg/min) / no real max dose µg/kg/min	
Succinylcholine	**1-2 mg/kg** (usually **100 mg**); may repeat x1	Onset < 1 min; duration 3-10 min. Risk of hyperkalemia

MUSCLE RELAXANTS

Name	Load / maintenance and titration / usual range	Contraindications, Adverse Effects & Precautions, Other
Baclofen	PO: 10-80 mg q8hrs	IT : PO = 1 : 100
Carisoprodol (Soma)		
Chlorzoxazone (Lorzone, Parafon)		
Cyclobenzaprine (Flexeril, Amrix)	10 mg q6h PO	
dantrolene	25 → increase up to 100 mg qid	
Metaxalone (Skelaxin)		
Methocarbamol (Robaxin)	1500 mg q 6 h for 2-3 days then decrease to maintenance 1000 mg q 6 h	
Tizanidine (Zanaflex)	2-8 mg q6-8h PO (max. 36 mg/d)	If therapy needs to be discontinued, the dose should be decreased slowly (2-4 mg per day) to minimize the risk of rebound hypertension, tachycardia, and hypertonia

ANTIDEPRESSANTS

Name	Load / maintenance and titration / usual range	Contraindications, Adverse Effects & Precautions, Other
Duloxetine (Cymbalta)	**30 mg once a day** / **max 60 mg once a day**	A gradual dose reduction is recommended to avoid discontinuation symptoms

ANTIHYPERTENSIVES, negative INOTROPES

Name	Load / maintenance and titration / usual range	Contraindications, Adverse Effects & Precautions, Other
Na nitroprusside (Nipride)	**No** bolus / **0.25-0.5 µg/kg/min** (titrate 0.5 µg/kg/min q15min / **3 (0.1-10) µg/kg/min**	Cyanide ion toxicity Vasodilator – rises ICP
Nitroglycerine	**No** bolus / **5 µg/min** (titrate 5 µg/min q3-5min; if no response at 20 µg/min, increase by 10 µg/min q3-5min) / **5-200 µg/min**	Vasodilator – rises ICP
Labetalol (Trandate)	**20 mg** (0.25 mg/kg) over 2 min, then: a) rebolus q10min until **max 300 mg** b) **1-2 mg/min** (titrate 0.5-1 mg/min q5-10min) / **1-6 mg/min**	
Metoprolol	PO: 50 mg BID; max 450 mg/d MI – IV: 5 mg x3 q2min → after 15 minutes, start 50 mg PO q6h for 48 hours	oral : IV = 2.5-5 : 1 (IV q6h vs. oral q12h)
Hydralazine	IV: **10-40 mg q4-6h** PRN Oral: **10 mg q6h** / titrate by 10-25 mg/dose q2-5d / 25-100 mg/day in 2 divided doses (max 300 mg/d)	
Nicardipine	**No** bolus / **5 mg/h** (titrate 2.5 mg/h q15min) / **2.5-15 mg/h**	
Clevidipine		
Diltiazem	**10-20 mg** over 2 min, may rebolus after 20 min / **5-10 mg/h** (titrate 5 mg/h q5-10min) / **5-15 mg/h**	
Clonidine	**0.1 mg BID** / titrate by 0.1 mg weekly / 0.05-0.4 mg/d BID (max. 2.4 mg/d**)** Emergency: 0.1-0.2 mg; PRN additional 0.1 mg every hour (to max total 0.7 mg)	
Esmolol	SVT: **500 µg/kg** over 1 min / **50 µg/kg/min** (rebolus, then titrate by 50 µg/kg/min q5min) / **50-200 µg/kg/min**	

VASOPRESSORS, positive INOTROPES

Name	Load / maintenance and titration / usual range	Contraindications, Adverse Effects & Precautions, Other
Norepinephrine (Levophed)	**No** bolus / **0.1 µg/kg/min** (titrate 0.1 µg/kg/min q3-5min) / **0.05-1.5 µg/kg/min** (2-16 µg/min)	Decreases CSF production!
Dopamine	**No** bolus / **5 µg/kg/min** (titrate 2-5 µg/kg/min q10-30min) / **5-20 µg/kg/min**	
Dobutamine	**No** bolus / **5 µg/kg/min** (titrate 2.5-5 µg/kg/min q15min) / **2.5-20 µg/kg/min**	
Phenylephrine (Neo-Synephrine)	**No** bolus / **100-200 µg/min** (titrate 25-50 µg/min q10-20min) / **40-200 µg/min** (0.1-1.5 µg/kg/min)	
Atropine	**0.5 mg** / may repeat q 3-5min to **total 3 mg**	
Vasopressin	**No** bolus / **0.04 U/min** (no titration) / **0.04 U/min**	

ANALGETICS, OPIOIDS, OPIOID ANTAGONISTS, NSAIDS

Chemical Name (Brand Names)	Dosage	Contraindications	Adverse Effects & Precautions
Acetaminophen (Tylenol, Panadol)	**<12 yrs**: 10-15 mg/kg PO/PR q4-6h (max 75 mg/kg/d or 2.6 g/d). **Adults**: 375-1000 mg PO/PR q4-6h PRN (max 4 g/d; kids 12-18 yo max 2.6 g/d).	1. G-6-P deficiency 2. Hepatic dysfunction	Pregnancy B. Hepatotoxicity (esp. chronic alcoholism)
Naloxone (Narcan)	**0.1-0.2 mg → repeat q2-3min**	T1/2 30-60 min Duration of effect 20-45 min	
Fentanyl	**25-100 µg** (0.5-2 µg/kg) / **25 µg/h** (rebolus, titrate by 25-30%) / **25-150 µg/h** 2-12 yrs: 1-2 µg/kg/h;	Pregnancy C. Hypotension (morphine start with 2 mg), respiratory depression, constipation, urinary retention; chest wall	

	< 2 yrs: 2-3 µg/kg q30-60min; *transdermal*: q48-72h		rigidity (idiosyncratic reaction). Vagolytic action (↑ventricular response in supraventricular tachycardias)
Morphine sulfate	**2-4 mg** / **1-2 mg/h** (rebolus, titrate by 1-2 mg/h) / **1-10 mg/h** (higher if on vent)		
Hydromorphone (Dilaudid)	**0.3 mg** = 2 mg of morphine PO: 1-4 mg q4-6h		CI: 1. Obstetrical analgesia 2. ICP↑ 3. Ulcerative colitis, Crohn disease. Pregnancy C (D if used for prolonged periods / high doses). Seizures
Hydrocodone-APAP (Lortab, Vicodin, Norco)	**2.5-10 mg q4-6h** PO 2-13 yrs or < 50 kg: 0.1-0.2 mg/kg q4-6h		
Oxycodone-APAP (Percocet)	**5-20 mg q4-6h** PO long-acting form (OxyContin): 10-20 mg bid		Pregnancy C (D if used for prolonged periods or in high doses)
Tramadol (Ultram) 1) agonist of mu opioid receptor. 2) inhibitor of serotonin and norepinephrine reuptake (inhibits pain transmission in spinal cord)	**25-100 mg q6-8h** PO long acting form: 100-300 mg qd PO	CI: Opioid-dependence concurrent MAOI / SSRI / TCA / opioid, acute alcohol intoxication	Analgesic potency - 10% of that of morphine following IV administration. Pregnancy C. Side effects: 1. Seizures 2. Serotonin syndrome (with coadmin of antidepressants) 3. Suicide risk
Ketorolac (Toradol)	IV/IM: **0.25-0.5 mg/kg (15-30 mg) q6h** (max 2 mg/kg/d usually max 120 mg/d). PO: 20* mg once → 10 mg q4-6h (max 40 mg/d). *10 mg if age ≥ 65, renally impaired, weight < 50 kg		max 5 days; PO not approved for kids Bioavailability: PO = IM = IV
Fioricet	**1-2 tab q4h**; max 6 tab/d		Butalbital 50 mg + APAP 325 mg + caffeine 40 mg
Ibuprofen	**5-10 mg/kg q6h** (max 40 mg/kg/d)		

OSMOTIC THERAPY / DEHYDRATION / DI/ SIADH

Name	Load / maintenance and titration / usual range	Contraindications, Adverse Effects & Precautions, Other
Mannitol	1.0 (0.25-2.0) g/kg (usually **100 g**) IV bolus over 15 min / PRN ≥ 0.25 mg/kg q3-6 h Osmolality: 1098	Duration of ICP lowering: up to 6 hours CI: osmolality > 320 mOsm (keep ≈ 310), Na > 145 mmol/L, hypotension, dehydration (H: concomitant saline IVI), renal failure, severe pulmonary congestion or CHF, active intracranial bleeding
Hypertonic Saline	**3%** - 4-60 ml/kg Osmolality: 1026 **7.5%** - 2 ml/kg Osmolality: 2565 **23.4%** - 20–60 ml (1 mL/min) Osmolality: 8008	Duration of ICP lowering: up to 4 hours Increases cardiac output. Side effects: Hyperchloremic acidosis, hypokalemia, hypernatremia, central pontine myelinolysis
Furosemide	**10-80 mg** (1 mg/kg) IV q4-8h // max 600 mg/d	
Vasopressin	**0.5-1 unit/hr** / titrate by 1-2 units/hr every 10-60 mins	goal UOP 75-125 mL/hr
Acetazolamide (Diamox)	250 mg TID → 5 mg/kg PO/IV q6h; max 100 mg/kg/d	CI: Hyperchloremic acidosis Pregnancy C.

ANTIAGGREGANTS / REVERSAL

Name	Load / maintenance and titration / usual range	Contraindications, Adverse Effects & Precautions, Other
Aspirin	**No load / 81-325 mg/d**	Therapeutic if assay < 550; plasma half-life 15-20 mins
Aggrenox	**1 caps BID**	Aspirin 25 mg / Extended-release dipyridamole 200 mg
Clopidogrel (Plavix)	**300-600 mg** / **/75-150 mg daily**	3% of population are poor CYP2C19 metabolizers → antiplatelet response↓ (larger doses may help). Stop 5 days before surgery Therapeutic if assay < 194 (if > 194, may repeat loading boluses 600 mg up to 2 times)
Prasugrel (Effient)	60 mg loading (50% platelet inhibition within 1 h) → 10 mg daily	
Ticagrelor (Brilinta)	180 mg loading → maintenance 90 mg x2/d	If taken with aspirin, aspirin dose should not exceed 100 mg

Abciximab (ReoPro)		T½ - 10 minutes; effects on platelet function can be seen for up to 48 hours after infusion has been terminated, and low levels of glycoprotein IIb/IIIa receptor blockade are present for up to 15 days.
Desmopressin (DDAVP)	Uremic bleeding, ASA reversal: 10-20 mcg (0.3 mcg/kg) IV**; max dose 20 mcg**; may add platelet transfusion DI: 1-2 mcg BID (1 µg IV = 10 µg intranasal)	

Glycoprotein IIb/IIIa Inhibitors: eptifibatide, abciximab, tirofiban

Reversal:

1. Discontinue medication infusion.
2. Due to the short half-life of these agents, platelet transfusions are not indicated.

COX/ADP Inhibitors: aspirin, clopidogrel, prasugrel, ticagrelor, ticlopidine, cangrelor

Reversal:

1. Usefulness of platelet transfusions in intracranial hemorrhage (ICH) patients is uncertain.
2. Life-threatening bleeding and need for surgical procedure, may consider (weak evidence) PLATELET TRANSFUSION 2 doses (3 doses if on dual antiplatelet; 1 dose for aspirin only)
   - platelet function assay prior to platelet transfusion (platelet transfusions are not recommended if platelet function within normal limits or documented antiplatelet resistance).
3. 0.3-0.4 mcg/kg IV DDVAP (for aspirin only?)

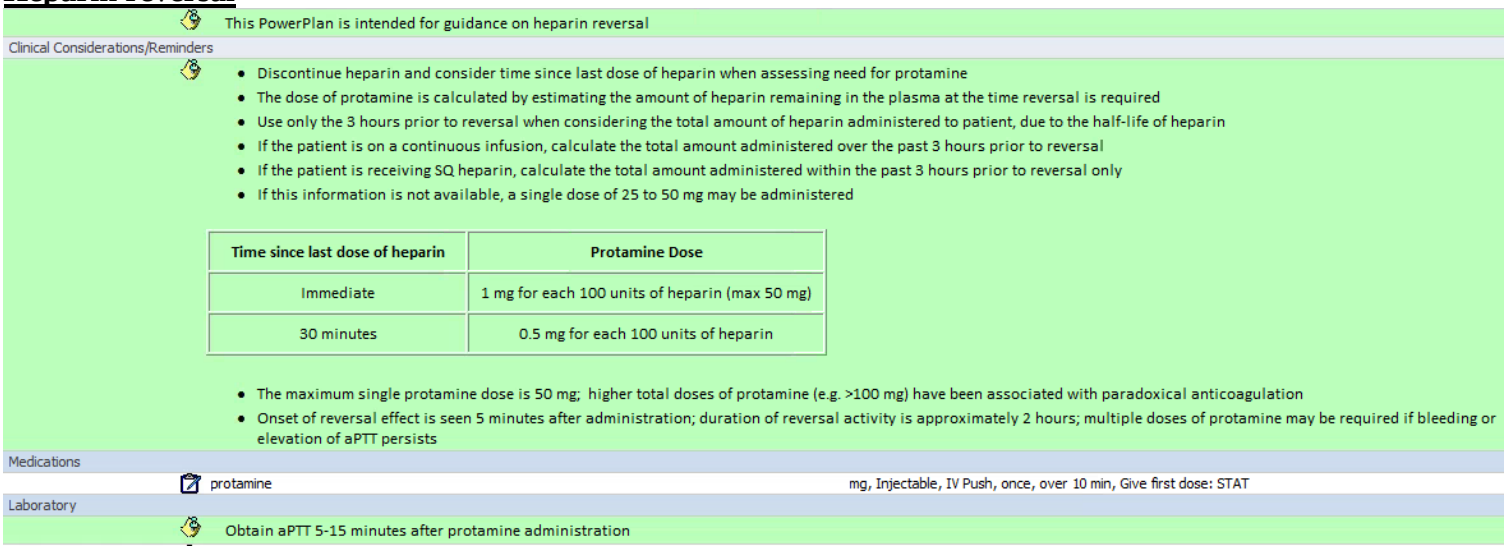
Aspirin: due to the increased risk of morbidity and mortality associated with *platelet transfusion* in patients with spontaneous ICH, it is only recommended for patients who will undergo a **neurosurgical procedure**. **Nonoperative patients** should be treated with *desmopressin*.

ANTICOAGULANTS / REVERSAL

Name	Load / maintenance and titration / usual range	Contraindications, Adverse Effects & Precautions, Other
Heparin	Prophylaxis: 5000 U ×3/d subQ (avoid IM) DVT/PE protocol: aPTT 70-110 CV protocol: aPTT 70-100	Pregnancy C. In neonates, use preservative (benzyl alcohol)-free heparin. CI: hx of heparin-induced thrombocytopenia
Enoxaparin	Prophylaxis: 30 mg q12 h /40 mg qd DVT: 1 mg/kg q12h	Start with warfarin; stop enoxaparin when INR 2-3
Bivalirudin (Angiomax)	starting dose 0.02 mg/kg/hr with aPTT goal of 45-75 (60) → aPTT every 2 hrs after each dose adjustment: if aPTT < 45 then increase dose by 20%; if 45-75 then no change in dose; if > 75 hold for 1 hr and decrease dose by 50%.	Check Hb every 6-8 hrs initially
Warfarin (Coumadin, Orfarin)	PO or IV: 2-5 mg ×1/d (first 3-5 d. with heparin) → 2-10 mg/d. Periodic INR: 1st after 4 days → daily (until stable) → q1-2 mo indefinitely (max INR = 4) Supplied: tab. 1, 2, 2½, 3, 4, 5, 6, 7½, 10 mg. 5 mg vial for IV.	1. Pregnancy (Pregnancy category X) 2. Recent surgery (CNS, eye), LP 3. Pericarditis, bacterial endocarditis 4. Recent bleeding (CNS, GI, GU, respiratory) 5. Liver disease, jaundice, GI ulcers 6. Cerebral aneurysms 7. Dissecting aorta, moderate÷severe hypertension 8. (Pre)eclampsia, threatened abortion 9. Protein C or S deficiency 1. Bleeding (esp. INR >4, >65 yrs) 2. Skin necrosis H: first 3-5 d. with heparin 3. Systemic cholesterol microemboli ("purple toe" syndrome)
NovoSeven® RT (coagulation Factor VIIa, recombinant)	Acute Bleeding Episode: **90 mcg/kg q2hr** for the duration of surgery, adjustable based on severity of bleeding. After hemostasis is achieved (to maintain the hemostatic plug): 90 mcg/kg q2-6hr to prevent postoperative bleeding (2 days for minor surgery, 5 days for major surgery)	Serious arterial and venous thrombotic events
4-Factor Prothrombin Complex Concentrate (4F-PCC) (Kcentra) -	25 units/kg (max: 2500 units) for INR 2-4 35 units/kg (max: 3500 units) for INR 4-6 50 units/kg (max: 5000 units) for INR > 6	**FDA approved for warfarin** PT/INR should be re-checked 30 minutes and 2 hours after administration and additional interventions should be ordered as appropriate (e.g. additional dose of PCC, supplement with FFP)

factors II, VII, IX, X, proteins C and S		
Protamine sulfate	1-1.5 mg/100 U heparin (0.5-0.75 if > 30 min from heparin discontinuation; 0.25-0.375 if > 60 min); max **50 mg** IV over 10 min 1 mg/1 mg of enoxaparin taken over past 8 h (0.5 mg of protamine for 1 mg of enoxaparin taken over past 8-12 h)	Pregnancy C. Anticoagulant effects (if maximum dose exceeded)
Vit. K (phytonadione)	2.5-10 mg once (2.5 mg is enough!) → q6-8h until PT normalized	Give IV (former fear of anaphylaxis is very rare; used to give IM therefore) Pregnancy C.
Idarucizumab (Praxbind)	5 g IV	**FDA approved for dabigatran**
Andexxa® (coagulation factor Xa [recombinant] inactivated-zhzo)	low dose (400 mg) or high dose (800 mg) IV	**FDA approved for apixaban, rivaroxaban**

Heparin reversal



This PowerPlan is intended for guidance on heparin reversal

Clinical Considerations/Reminders

- Discontinue heparin and consider time since last dose of heparin when assessing need for protamine
- The dose of protamine is calculated by estimating the amount of heparin remaining in the plasma at the time reversal is required
- Use only the 3 hours prior to reversal when considering the total amount of heparin administered to patient, due to the half-life of heparin
- If the patient is on a continuous infusion, calculate the total amount administered over the past 3 hours prior to reversal
- If the patient is receiving SQ heparin, calculate the total amount administered within the past 3 hours prior to reversal only
- If this information is not available, a single dose of 25 to 50 mg may be administered

Time since last dose of heparin	Protamine Dose
Immediate	1 mg for each 100 units of heparin (max 50 mg)
30 minutes	0.5 mg for each 100 units of heparin

- The maximum single protamine dose is 50 mg; higher total doses of protamine (e.g. >100 mg) have been associated with paradoxical anticoagulation
- Onset of reversal effect is seen 5 minutes after administration; duration of reversal activity is approximately 2 hours; multiple doses of protamine may be required if bleeding or elevation of aPTT persists

Medications

protamine — mg, Injectable, IV Push, once, over 10 min, Give first dose: STAT

Laboratory

Obtain aPTT 5-15 minutes after protamine administration

Heparin IV effect is over after 6 hours after the last dose.

PROTAMINE SULFATE IV - 1 mg per 100 units of heparin given in past 3 hours.

- onset is seen in 5 minutes and persists for 2 hours (check aPTT 5-15 mins after protamine).
- additional 0.5 mg of protamine sulfate per 100 unit of heparin if the aPTT does not improve.
- 50 mg maximum (higher doses cause paradoxical anticoagulation)

Low-molecular weight heparin reversal

This PowerPlan is intended for guidance on low molecular weight heparin reversal

Low Molecular Weight Heparin	Elimination Half-Life*
Enoxaparin	4-7 hours

*Elimination half-life is prolonged in renal impairment

Clinical Considerations/Reminders

- Discontinue enoxaparin
- Protamine partially reverses the anticoagulant effect of low-molecular weight heparins (LMWH)
- Consider time since last LMWH dose when assessing need for protamine

Time since last dose of LMWH	Protamine Dose
< 8 hours	1 mg for each 1mg of LMWH (max 50 mg)
8-12 hours	0.5 mg for each 1mg of LMWH (max 25 mg)
>12 hours*	Unlikely to be useful (max 25 mg)

*Consider reversal beyond 12 hours in patients with renal insufficiency

Medications

protamine — mg, Injectable, IV Push, once, over 10 min, Give first dose: STAT

Laboratory

Monitor anti-factor Xa activity 2-4 hours after protamine administration to confirm reversal

Heparin LMW Assay (Anti-Xa Low Molecular Weight Hepari... — Anticoagulant Therapy: Heparin, Routine Now, Lab Reporting Routine, X 1 Doses(Times)

PROTAMINE SULFATE IV

For enoxaparin - 1 mg of protamine for 1 mg of enoxaparin taken over past 8 h (0.5 mg of protamine for 1 mg of enoxaparin taken over past 8-12 h)

- additional 0.5 mg of protamine for 1 mg of enoxaparin in case of persistent bleeding or renal insufficiency.

For dalteparin - 1 mg of protamine for 100 anti-Xa units of dalteparin in past 3-5 half-lives of the drug.

- additional 0.5 mg of protamine for 100 anti-Xa units of dalteparin in case of persistent bleeding or renal insufficiency.
- rFVIIa 90 mcg/kg can be used when protamine is contraindicated.

Warfarin reversal

Clinical Considerations/Reminders

These guidelines represent an approximate guide for management of high INR's
- INR more than therapeutic range but less than 5.0 sec; no significant bleeding
- Lower or omit dose; monitor frequently and resume warfarin at lower dose when INR therapeutic
- If INR only minimally above therapeutic range, no dosage reduction may be required when dose is resumed
-- NO PHYTONADIONE INDICATED --

Medications

INR more than or equal to 5.0 sec, but less than 10.0 sec; no significant bleeding
- Omit next one to two doses, monitor more frequently, and resume at an appropriately adjusted dose when INR in therapeutic range
-- NO PHYTONADIONE INDICATED --
- Alternately, omit dose and give phytonadione 1.25-2.5 mg PO *(see footnote), particularly if patient at an increased risk of bleeding

phytonadione — Select an order sentence

INR greater than or equal to 10.0 sec, but no significant bleeding
- Hold warfarin and give phytonadione 2.5-5.0 mg PO *(see footnote)

phytonadione — Select an order sentence

Serious bleeding or life-threatening at any elevation of INR
- Hold warfarin and give phytonadione 10 mg IV
- May supplement with fresh frozen plasma (FFP) or prothrombin complex concentrate (PCC, Kcentra), depending on the urgency of the situation

phytonadione — 10 mg, Injectable, IV, once, Give first dose: STAT

Repeat, if necessary, depending on INR

Plasma SetUp - Fresh Frozen (FFP SetUp) — Stat Set Up, Medical Indication(s): Warfarin reversal

Prothrombin complex concentrate (Kcentra) (Dose based on factor IX (nine) component)
- INR 2 - 3.9 sec; use 25 units/kg (max dose 2,500 units)
- INR 4 - 6 sec; use 35 units/kg (max dose 3,500 units)
- INR greater than 6.0 sec; use 50 units/kg (max dose 5,000 units)

Note: prothrombin complex concentrate (Kcentra) contains heparin, do NOT use in patients with a history of heparin-induced thrombocytopenia (HIT)

prothrombin complex (prothrombin complex concentrate (Kcentra)) — Units, Injectable, IV, once, Give first dose: STAT
For warfarin reversal: 25 unit/kg doses should be limited to 2,500 units 35 unit/kg doses should be limited to 3,500 units 50 unit/kg doses should be limited to 5,000 units

Laboratory

PT (INR/PT) — Routine in AM, Requested Date/Time T+1;0300, Lab Reporting Routine, X 1 Doses(Times)

PT Stat (INR/PT Stat) — Stat, Lab Reporting Stat, X 1 Doses(Times)

PT Stat (INR/PT Stat) — Stat, Lab Reporting Stat, Draw 30 minutes after infusion of PCC is completed., X 1 Doses(Times)

Monitoring - INR

Reversal:

1) VITAMIN K 10 mg IV
2) only one of the following: PCC* / FFP 2-4 units (10-15 mL/kg) / rFVIIa 80 mcg/kg**

*20 units/kg for INR 1.6 – 3.9; 30 units/kg for INR 4-6; 50 units/kg for INR >6

- INR should be re-checked 30 minutes and 2 hours after administration and additional interventions should be ordered as appropriate (e.g. additional dose of PCC, supplement with FFP)
- PCC is faster and has less complications than FFP

**due to the *higher cost* and higher risk of *arterial thrombosis*, the neurocritical care society advises against the use of rFVIIa for warfarin reversal in patients with ICH, unless the patient will not accept blood products such as in the case of Jehovah's witnesses.

Oral Factor Xa inhibitor reversal

Apixaban (Eliquis), rivaroxaban (Xarelto), edoxaban (Savaysa), fondaparinux (Arixtra)

This PowerPlan is intended for guidance on oral Factor Xa inhibitors
- apixaban
- rivaroxaban
- edoxaban

EXCLUSION CRITERIA

DO NOT use reversal agents for Oral Direct Thrombin Inhibitors in the following situations:
- Elective surgery
- Bleeding managed with local hemostatic measures
- Bleeding has stopped
- Interventions can be delayed ≥ 8 h to permit clearance of effects in patient with normal renal function

Clinical Considerations/Reminders

- Discontinue medication
- Recommend reversal if last dose given within 3-5 elimination half-lives of the drug to ensure hemostasis
- Consider time of last dose and half-life of agent when deciding to reverse anticoagulant

Factor Xa Inhibitor	Elimination Half-Life*	
Apixaban	8-12 hours	- If ingested within 2 hours, consider administration of activated charcoal 50 grams - prothrombin complex concentrate (Kcentra) 25-50 units/kg may be considered
Rivaroxaban	5-9 hours	
Edoxaban	10-14 hours	

*Elimination half-life is prolonged in renal impairment

Medications

If ingested within 2 hours, consider administration of activated charcoal 50 grams

charcoal (charcoal oral suspension) — 50 g, Suspension, PO/NG, once, Give first dose: NOW

Prothrombin complex concentrate (Kcentra) 25-50 units/kg may be considered if emergent reversal of oral Factor Xa inhibitor is necessary
- 25 unit/kg doses should be limited to 2500 units
- 35 unit/kg doses should be limited to 3500 units
- 50 unit/kg doses should be limited to 5000 units

DO NOT use prothrombin complex concentrate in patients with a history of heparin-induced thrombocytopenia (HIT) as it contains heparin

prothrombin complex (prothrombin complex concentrate (K... — Units, 25-50 units/kg, Injectable, IV, once, Give first dose: NOW

Laboratory

May additionally consider administration of fresh frozen plasma (FFP) 15-20 mL/kg *(weak evidence)*

Plasma SetUp - Fresh Frozen — Medical Indication(s): Other (add to Comments) Factor Xa reversal

1. If drug was ingested within past 2-3 h → ACTIVATED CHARCOAL 50 g suspension PO/NG once
2. PCC (KCENTRA) 25-**50** U/kg IV ± FFP 15-20 mL/kg
3. ANDEXXA® (coagulation factor Xa [recombinant] inactivated-zhzo) – low dose (400 mg) or high dose (800 mg) IV

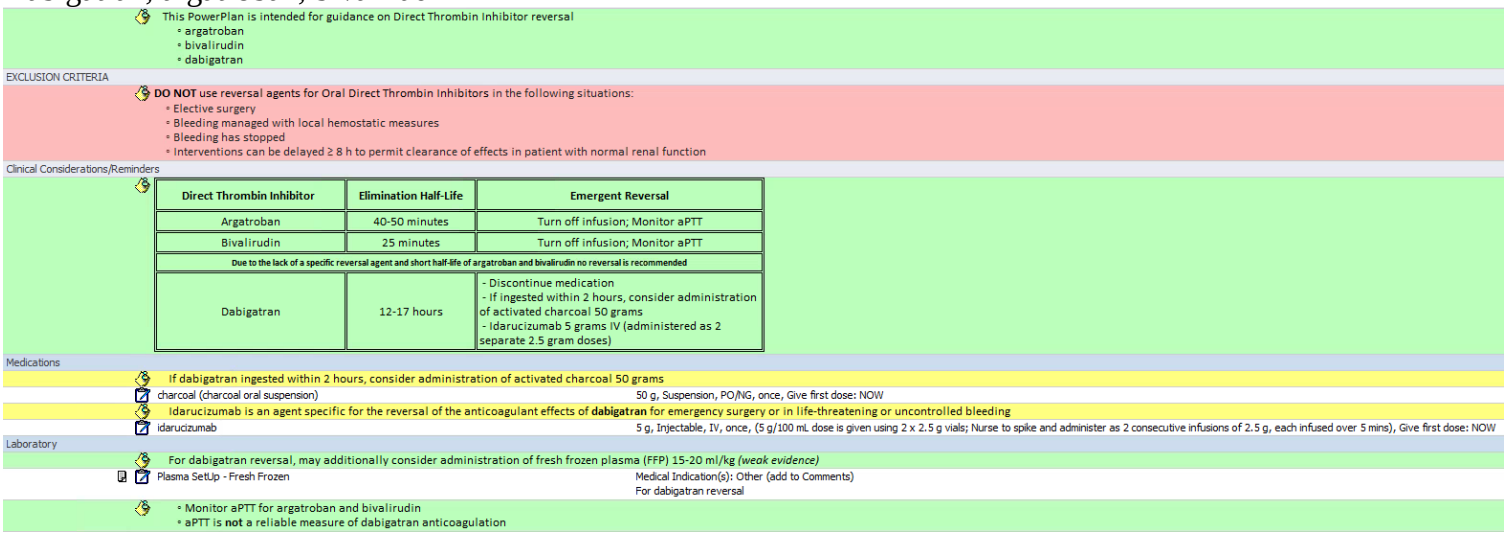
FXa Inhibitor	FXa Inhibitor Last Dose	< 8 Hours or Unknown	≥ 8 Hours
Rivaroxaban	≤ 10 mg	Low Dose	Low Dose
Rivaroxaban	> 10 mg / Unknown	High Dose	
Apixaban	≤ 5 mg	Low Dose	
Apixaban	> 5 mg / Unknown	High Dose	

- start the bolus at a target rate of 30 mg/min; within 2 minutes following the bolus dose, administer the continuous IV infusion (4 or 8 mg/min) for up to 120 minutes.

N.B. hemodialysis is ineffective because Factor Xa inhibitors are highly bound to proteins

Direct Thrombin (Factor IIa) inhibitor reversal

Dabigatran, argatroban, bivalirudin



This PowerPlan is intended for guidance on Direct Thrombin Inhibitor reversal
- argatroban
- bivalirudin
- dabigatran

EXCLUSION CRITERIA

DO NOT use reversal agents for Oral Direct Thrombin Inhibitors in the following situations:
- Elective surgery
- Bleeding managed with local hemostatic measures
- Bleeding has stopped
- Interventions can be delayed ≥ 8 h to permit clearance of effects in patient with normal renal function

Clinical Considerations/Reminders

Direct Thrombin Inhibitor	Elimination Half-Life	Emergent Reversal
Argatroban	40-50 minutes	Turn off infusion; Monitor aPTT
Bivalirudin	25 minutes	Turn off infusion; Monitor aPTT
Due to the lack of a specific reversal agent and short half-life of argatroban and bivalirudin no reversal is recommended		
Dabigatran	12-17 hours	- Discontinue medication - If ingested within 2 hours, consider administration of activated charcoal 50 grams - Idarucizumab 5 grams IV (administered as 2 separate 2.5 gram doses)

Medications

If dabigatran ingested within 2 hours, consider administration of activated charcoal 50 grams

charcoal (charcoal oral suspension) — 50 g, Suspension, PO/NG, once, Give first dose: NOW

Idarucizumab is an agent specific for the reversal of the anticoagulant effects of **dabigatran** for emergency surgery or in life-threatening or uncontrolled bleeding

idarucizumab — 5 g, Injectable, IV, once, (5 g/100 mL dose is given using 2 x 2.5 g vials; Nurse to spike and administer as 2 consecutive infusions of 2.5 g, each infused over 5 mins), Give first dose: NOW

Laboratory

For dabigatran reversal, may additionally consider administration of fresh frozen plasma (FFP) 15-20 ml/kg *(weak evidence)*

Plasma SetUp - Fresh Frozen — Medical Indication(s): Other (add to Comments)
For dabigatran reversal

- Monitor aPTT for argatroban and bivalirudin
- aPTT is **not** a reliable measure of dabigatran anticoagulation

1. If drug was ingested within past 2 h → ACTIVATED CHARCOAL 50 g suspension PO/NG once
2. For dabigatran → IDARUCIZUMAB (PRAXBIND) 5 g IV ± FFP 15-20 ml/kg (PCC ineffective)
3. Hemodialysis for patients with ESRD.

Monitoring: aPTT (not reliable for dabigatran)

- **ecarin clotting time (ECT)** - better marker of the DABIGATRAN anticoagulant activity than aPTT, INR, or thrombin time (TT); if ECT is not available, aPTT provides rough approximation

HORMONES, OSTEOPOROSIS

Name	Load / maintenance and titration / usual range	Contraindications, Adverse Effects & Precautions, Other
Dexamethasone	**10 mg q6h** IV/PO; taper – 6q6, 4q6, 4q12, 2q12h, 2QD, then off	Pregnancy C. Slow tapering with long-term use. Hyperglycemia, edema, peptic ulcers, hypokalemia, osteoporosis, euphoria, psychosis, growth suppression, myopathy, infections
Methylprednisolone	For spinal cord injury: **30 mg/kg** IV bolus over 15 min → **5.4 mg/kg/h** IVI over next 23 h	Pregnancy C. GI prophylaxis and insulin sliding scale are necessary CI: Systemic fungal infection
Hydrocortisone	100 mg IV/PO q8h x3, 40-50mg q8h x3, 20-25mg q8h x3, 20-25mg q8h x3; usual maintenance: 10 mg breakfast, 5mg lunch, 5mg dinner (or 20mg breakfast, 10mg dinner)	
Desmopressin (DDAVP)	DI: 1-2 µg q12h (1 µg IV = 10 µg intranasal)	
Teriparatide (Forteo)	20 µg SC qd	Contraindications: 1. Risk for osteosarcoma (prior radiotherapy to skeleton, Paget disease, unexplained alk. phosphatase↑) 2. Children 3. Bone metastases or metabolic diseases (other than osteoporosis) — Pregnancy C. Monitor for hypercalcemia, orthostatic hypotension
Alendronate (Fosamax)	10 mg PO qd ≥ 30 min before first food; do not lie down for 30 min	1. Inability to sit upright for at least 30 min 2. Hypocalcemia — Pregnancy C.
Calcitonin	1 puff 200 IU/d in alternating nostrils; 100 IU SC qd/qod	Pregnancy C. Hypocalcemia
Raloxifene HCl (Evista)	60 mg PO qd	1. Pregnancy (Pregnancy cat. D), breastfeeding 2. History of thromboembolia — Hot flashes and leg cramps

ANTIBIOTICS

Name Sensitive Resistant	Load / maintenance and titration / usual range	Contraindications, Adverse Effects & Precautions, Other
Vancomycin	0.5-2 g/d IV divided bid/qid; 10 mg/d IT children: 40 mg/kg/d divided tid/qid Preop prophylaxis – 15 mg/kg 2 doses Adjust dose in renal impairment	Pregnancy C. Too rapid IV infusion → red man syndrome Asses [vancomycin] after third dose drawn 0.5 h prior to next dosing. Goal trough concentration 15-20 mg/L
Penicillins	Hypersensitivity	Pregnancy B
Amoxicillin/clavulanate (Augmentin) Gr+ cocci (not MRSA!), Gr- rods (not Pseudomonas)	500/125 mg tid	See ***Penicillins*** 250-mg tabs have same dose of clavulanic acid as 500-mg tabs, administering 2 (250-mg) tabs is not recommended to achieve 500-mg dose
Cephalosporins		Pregnancy B. 1. Alcohol within 72 h → disulfiram-like reactions; 2. ↑Hypoprothrombinemic effects (of anticoagulants); 3. Nephrotoxicity (reduce dosage in renal failure).
Ceftriaxone (Rocephin) Gr+ and Gr- cocci, Gr- enteric rods Pseudomonas, Listeria	1-2* g/d IM/IV qd or bid (bid only for meningitis) *for obese > 100 kg	See ***Cephalosporins*** Do not administer within 48 hours of IV calcium-containing solutions Neonates with hyperbilirubinemia
Cefazolin (Ancef) Gr+ cocci, some Gr- rods (E. coli, Klebsiella, Proteus mirabilis, Moraxella) Enterococcus, some Gr- rods (Proteus vulgaris, Enterobacter sp, Morganella, Serratia sp, Pseudomonas, Listeria)	Preop prophylaxis – 2 g (30 mg/kg) IV 1 g for patients < 60 kg 3 g for patients > 120 kg	
Cefotetan (Cefotan)	1-2 g (20-40 mg/kg) IV/IM q12h	See ***Cephalosporins***
Cephalexin (Keftab, Keflex)	500 mg PO qid	See ***Cephalosporins***
Fluoroquinolones		Tendonitis, tendon rupture, CNS effects, peripheral neuropathy, myasthenia gravis exacerbation, QT prolongation and torsades de pointes, phototoxicity
Aminoglycosides	1. Renal insufficiency not dependent on dialysis 2. Myasthenia gravis, hypocalcemia	Pregnancy C. Nephrotoxicity, ototoxicity Enhance effects of neuromuscular blockers
Gentamicin (Garamycin) Gr- rods	3-5 mg/kg/d IV/IM divided q8h; < 5 yrs: 2.5 mg/kg q8h > 5 yrs: 2 mg/kg loading → maintenance 1.5 mg/kg q8h (max 300 mg/d)	see ***Aminoglycosides*** CrCl >90 mL/min and <60 years: q8hr CrCl 60-90 mL/min or ≥60 years: q12hr CrCl 25-60 mL/min: q24hr CrCl 10-25 mL/min: q48hr CrCl <10 mL/min: q72hr Following dialysis in ESRD
Clindamycin (Cleocin) Gr+ cocci, anaerobes Gr- rods, enterococci	150-450 mg PO q6h; children: 8-20 mg/kg/d PO divided q6-8h. Surgical Prophylaxis: 900 mg IV → redose q6hr	Pregnancy B. Clostridium difficile-associated diarrhea CI: 1. Antibiotic-associated colitis 2. Severe hepatic dysfunction (adjust dose)
Tetracyclines		Pregnancy
Doxycycline		

Gr- rods (unless sensitivity testing shows otherwise)		
Sulfonamides	1. Pregnancy 1st and 3rd trimesters 2. G-6-PD deficiency (→ hemolysis) 3. Megaloblastic (folate def.) anemia	Pregnancy C. Increases effects of warfarin, dapsone, phenytoin, methotrexate, sulfonylureas, zidovudine
Trimethoprim and sulfamethoxazole (Bactrim)	1 DS tab PO bid (tab. DS = 160/800; SS = 80/400 mg)	

ANTIEMETICS

Name	Load / maintenance and titration / usual range	Contraindications, Adverse Effects & Precautions, Other
Ondansetron (Zofran)	Max. single IV dose < 32 mg (risk of torsades de pointes)	
Promethazine (Phenergan)		Sedating
Prochlorperazine (Compazine)		

HYPERLIPIDEMIA

Chemical Name (Brand Names)	Dosage	Contraindications	Adverse Effects & Precautions
Ezetimibe (Zetia)	10 mg ×1/d (with or without food) with standard cholesterol-lowering diet	Pregnancy C.	
Gemfibrozil (Lopid)	600 mg ×2/d (30 min before morning and evening meals)	1. Combination with cerivastatin 2. Gallbladder, hepatic, severe renal disease	Pregnancy C.
Statins		Active liver disease Pregnancy, nursing Concomitant niacin, fibrates (gemfibrozil, fenofibrate)	Skeletal muscle effects Liver enzymes↑
Rosuvastatin (Crestor)	5-40 mg ×1/d		

NEAPDOROTI

Chemical Name (Brand Names)	Dosage	Contraindications	Adverse Effects & Precautions
Amoxicillin (Amoxil, Polymox)	1-day regimen: 3 g bid 3-day regimen: 500 mg qid 7-day regimen: 250 mg tid	See ***Penicillins***	See ***Penicillins***
Ampicillin (Omnipen)	500 mg PO qid 1-2 g (50 mg/kg) IV/IM q4-6h	See ***Penicillins***	See ***Penicillins*** ampicillin rash
Ampicillin /sulbactam (Unasyn)	3 g IV q6h	See ***Penicillins***	
Armodafinil (Nuvigil)	Single morning dose 150 or 250 mg		
Chloramphenicol		Pregnancy (3rd trimester → Gray syndrome)	
Cinnarizinum (Stugeron)	25-75 mg ×2-3/d PO		CNS sedation, extrapyramidal side effects, dry mouth, epigastric distress (H: use with food)
Diclofenac		Hepatotoxicity (even with topical gels) – measure ALT within 1-2 months of starting diclofenac	
Docusate sodium (Colace)	100 (50-500) mg/d PO qd or divided bid/qid	Pregnancy C. Decreases effects of warfarin; prolonged use → electrolyte imbalance	

Eltrombopag (Promacta)		Chronic liver disease	Thromboses
Erythromycin	250-500 mg PO qid pc	Hepatic impairment	Pregnancy B. GI side effects
Esomeprazole	20-40 mg/d PO/NG (suspend granules in 50 ml water, flush with 25 ml water)		
Famotidine (Pepcid)	20 mg ×2/d IV/PO	Adjust dosage in renal insufficiency	Pregnancy B.
Flunarizine	2 caps. × 1/d at bedtime	see ***Cinnarizine***	
Fosfomycin (Monurol)	3 g PO in 4 oz of water as single dose		Pregnancy B. GI side effects
Modafinil (Provigil)	Single morning dose 100-400 mg (dose increased gradually)	Not approved for children!	1. Life-threatening rash 2. Anxiety, mania, hallucinations, suicidal ideation
Mycophenolate mofetil (CellCept, Myfortic)		Pregnancy (Pregnancy category D)	
Nitrofurantoin (Macrobid)	1 tab PO bid with food	CrCl < 60 mL/min G-6-PD deficiency	Pregnancy B (in 3rd trimester – risk of newborn hemolytic anemia) 1. Irreversible peripheral neuropathy 2. Acute pneumonitis
NSAIDs		Pregnancy (oligohydramnios, premature closure of ductus arteriosus); narcotics are better analgesics!	
Paracetamol – see Acetaminophen			
Pentoxifylline (Agapurin, Trental, Pentilin)	400 mg × 2-3/d	Recent cerebral and/or retinal hemorrhage	Pregnancy C Risk of bleeding↑ (esp. if on warfarin – monitor INR frequently). Monitor for bleeding after surgery, with peptic ulcers.
Proton Pump Inhibitors			1. Risk of fractures of hip, wrist, spine (esp. postmenopausal women) 2. Clostridium difficile infections
Ranitidine (Zantac)	150 mg ×1-2/d (2-4 mg/kg ×1-2/d)	History of acute porphyria Caution in liver failure Adjust dosage in renal insufficiency	Pregnancy B.