Chapter 16

Drug Formulary

A. Intensive Care Sedation and Analgesia

VECURONIUM:

Indications: Skeletal muscle paralysis to facilitate endotracheal intubation and maintenance of mechanical ventilation

Adverse reactions: Cardiac arrhythmias, hypotension, respiratory insufficiency, bronchospasm

Onset of action: 1 to 3 minutes

Duration of action: 30 to 40 minutes

Neonates: Intravenous bolus: 0.1 mg/kg

Maintenance infusion: 0.03 to 0.15 mg/kg/hour

(Usual dos: 0.1 mg/kg/hour)

Infants (< 1 year): Intravenous bolus: 0.1 mg/kg

Maintenance infusion: 0.06 to.0.09 mg/kg/hour

(Usual dose: 0.1 mg/kg/hour)

Infants and children: Intravenous bolus: 0.1 mg/kg

(> 1 year) Maintenance infusion: 0.09 to 0.15 mg/kg/hour

(Usual dose: 0.1 mg/kg/hour)

Adults: Intravenous bolus: 0.1 mg/kg

Maintenance infusion: 0.09 to 0.15 mg/kg/hour

(Usual dose: 0.1 mg/kg/hour)

FENTANYL:

Indications: Sedation and analgesia

Neonates: Intravenous bolus: 1 to 4 mcg/kg, may repeat every 2 to 4 hours

Maintenance infusion: 1 to 2 mcg/kg as an initial dose followed by (continuous sedation and analgesia) 0.5 to 1 mcg/kg/hour

(Usual dose: 1 mcg/kg/hr)

Infants and children > 1 year:

Intravenous bolus: 1 to 2 mcg/kg, may repeat every 1/2 to 1 hour

Maintenance infusion: 1 to 2 mcg/kg initial dose followed by (continuous sedation and analgesia) 1 to 3 mcg/kg/hour

(Usual dose: 1 mcg/kg/hr)

Adults:

Intravenous bolus: 0.5 to 1 mcg/kg, may repeat every 1/2 hour; repeat every 5 minutes if higher doses are needed

PROPOFOL:

Indications: ICU sedation in mechanically ventilated patients

Adverse Reactions: Hypotension, bradycardia, myocardial depression, respiratory depression, hyperlipidemia, metabolic acidosis

Infants and children: Start with a low dose continuous infusion

Adults: Initial rate of 5 mcg/kg/minute (0.3 mg/kg/hour) as a continuous infusion, increase every 10 minutes by 5 mcg to 10 mcg/kg/minute (0.3 mg to 0.6 mg/kg/hour) until desired sedation is achieved

Usual dose: 5 mcg to 50 mcg/kg/minute (0.3 to 3 mg/kg/hour)

MIDAZOLAM

Indications: Sedation (anxiolysis) and a continuous sedation of mechanically ventilated patients

Adverse Reactions: Cardiac arrest, hypotension, respiratory depression, apnea, bronchospasm, myoclonic jerking, nystagmus, muscle tremors

Onset of action: 1 to 5 minutes (IV)

Duration of action: 20 to 30 minutes

Neonates: Intravenous bolus: 0.05 to 0.1 mg/kg

Maintenance infusion: 0.03 mg to 0.06 mg/kg/hour (0.5 mcg/kg to 1 mcg/kg/minute)

Infants and children: Intravenous bolus: 0.05 mg to 0.1 mg/kg

> 2 months: Maintenance infusion: 0.06 mg/kg/hour (1 mcg/kg/minute)

> 6 months: Intravenous bolus: 0.05 mg to 0.1 mg/kg

Maintenance infusion: 0.06 mg to 0.12 mg/kg/hour

(1 mcg to 2 mcg/kg/minute)

Adults:

Maintenance infusion: 0.02 mg to 0.1 mg/kg/hour (1 to 7 mg/hour)

LORAZEPAM:

Indications: Sedation (anxiolysis) and sedation

Adverse Reactions: Bradycardia, hypotension, respiratory depression, myoclonic jerking, nystagmus

Onset of action: 15 to 30 minutes (IV)

Duration of action: 8 to 12 hours

Infants and Children:

Intravenous dose: 0.05 mg/kg/dose (maximum 2 mg dose); repeat every 4 to 8 hours

Adults: Intravenous dose: 1 to 10 mg/day in divided doses

MORPHINE:

Indications: Sedation, analgesia, and left ventricular failure

Adverse Reactions: Bradycardia, hypotension, CNS depression, respiratory depression, ADH and histamine release, ocular miosis

Neonates:

Parenteral doses: 0.05 mg/kg every 4 to 8 hrs (IM, IV, Sub); maximum 0.1 mg/kg/dose

Continuous infusion: Initial at 0.01 mg/kg/hour (10 mcg/kg/hour); not to exceed 0.015-0.02 mg/kg/hour

Infants and children:

Parenteral doses: 0.1 mg/kg every 3 hrs (IM, IV, Sub); maximum dose < 15 mg

Continuous infusion: 0.01 mg to 0.04 mg/kg/hour

Adults:

Parenteral doses:.5 mg to 20 mg every 4 hrs (IM, IV, Sub)

Usual dose: 10 mg every 4 hours

Continuous infusion: 10 mg/hour, may increase up to 80 mg/hour as tolerated/needed

NALOXONE (ANTIDOTE)

< 20 kg or < 5 yrs-0.1 mg/kg

> 20 kg or > 5 yrs-2 mg

For total reversal of narcotics effect, use small repeated doses (0.01 to 0.03 mg/kg)

CHLORAL HYDRATE:

Indications: Sedation and hypnotic

Adverse Reactions: Parodoxical excitement, respiratory depression

Neonates: Anxiety: 25 mg/kg/dose, may repeat every 6 hours

Infants and children: Sedation and anxiety: 25 to 50 mg/kg/day divided every 6 hours (maximum 500 mg/dose)

Hypnotic: 50 mg/kg (maximum 2 g/dose/day)

Adults: Sedation and anxiety: 250 mg thrice a day

Hypnotic: 500 to 1000 mg (maximum 2 g/dose/day)

DEXMEDETOMIDINE:

Indications: Sedation of mechanically ventilated patients

♣ Duration of infusion should not exceed 24 hours.

Adverse Reactions: Hypotension, bradycardia, hyperglycemia, acidosis, hypekalemia, leukocytosis, oliguria, elevated liver enzymes, bronchospasm

Actions: Alpha- 2 adreno-receptor agonist; produces 'arousable sedation' like NREM sleep by activity on the Locus Ceruleus of brain stem; analgesia by alpha-2 receptor stimulation in dorsal horn of spinal cord; stimulates alpha-1 adreno receptors only in large doses

Infants and Children:

Loading (IV) dose: 0.5 to 1 mcg/kg, this should be followed by maintenance infusion of 0.2 to 0.7 mcg/kg/hour

(Titrate the dose to a desired clinical response)

Usual infusion rate: Children < 1 year = 0.4 mcg/kg/hour

Children > 1 year = 0.29 mcg/kg/hour

Adults:

Loading (IV) dose: 1 mcg/kg, is followed by a maintenance infusion of 0.2 to 0.7 mcg/kg/hour

PHENOBARBITAL:

Indications: Grandmal (generalized-tonic-clonic) seizures, partal seizures, prevention and treatment of neonatal hyperbilirubinemia, chronic cholestasis, neonatal and febrile seizures, and sedation

Adverse Reactions: Hypotension, circulatory collapse, parodoxical excitement, hyperkinetic activity, megaloblastic anemia, hepatitis, respiratory depression

Preoperative / procedure sedation:

Children: Oral, IM, IV doses: 1 to 3 mg/kg 1 hour before procedure

Adults: IM dose 100-200 mg 1 hour before procedure

Sedation:

Children: Oral Dose: 2 mg/kg 3 times a day

Adults: Oral, IM doses: 30 to 120 mg/day in 3 divided doses

Hypnotic:

Children: IM, IV doses: 3-5 mg/kg at bedtime

Adults: Oral, IM, IV doses: 100-320 mg at bedtime

Hyperbilirubinemia:

Children < 12 years: Oral dose: 3 to 8 mg/kg/day in 2 or 3 divided doses; maximum of 12 mg/kg/day

Adults: Oral dose: 90-180 mg/day in 2-3 divided doses

Anticonvulsant: Status epilepticus:

Loading dose: intravenous:

Neonates: 15-20 mg/kg as a single dose or may be divided

Infants, children, and adults: 15 to 18 mg/kg in a single or divided dose; maximum loading 20 mg/kg

♣ In some patients may give additional doses of 5 mg/kg/dose every 15 to 30 minutes until seizure is controlled or a total dose of 30 mg/kg is given.

Maintenance Dose: ♣ Start the maintenance 12 hours after loading dose.

Neonates: 3-4 mg/kg/day once daily; check serum levels and increase to 5 mg/kg/day as needed

Infants: 5 to 6 mg/kg/day in 1-2 divided doses

Children:

1-5 years: 6-8 mg/kg/day in 1-2 divided doses

5-12 years: 4-6 mg/kg/day in 1-2 divided doses

Children > 12 years and adults: 1-3 mg/kg/day in 1-2 divided doses

B. Diuretics of Common Usage

MANNITOL:

Indications: Reduction of elevated intracranial presssure, prevention and therapy of oliguria / anuria of acute renal failure, and promotes excretion of toxic solutes

Adverse Reactions: Circulatory overload, hypo/hypernatremia, hypo/hyperkalemia, pulmonary edema, water intoxication/dehydration

Infants and children: Initial dose: 0.5 to 1 g/kg

Maintenance: 0.25 to 0.5 g/kg every 4 to 6 hours

Adults: Initial dose: 0.5 to 1 g/kg

Maintenance: 0.25 to 0.5 g/kg every 4 to 6 hours

♣ Test Dose: 200 mg/kg may be given over 3 minutes in both children and adults to assess renal function and produce urine flow of 1 mL/kg/hour (in children), 30 mL/hour (in adults), for the next 3 hours before starting the infusion.

FUROSEMIDE:

Indications: Edema of hepatic, renal, and cardiac diseases

Adverse Reactions: Hypotension, hyponatremia, hypochloremia, hypokalemia, alkalosis, prerenal azotemia, dehydraion, hyperuricemia, ototoxicity

Onset of action: 5 minutes (IV), 30 minutes (IM), 30-60 minutes (oral)

Duration of action: 2 hours (IV), 6 hours (oral)

Neonates: Oral dose: 1 to 4 mg/kg twice a day

Intravenous dose: 1 to 2 mg/kg twice a day (may use IM route)

Infants and Children:

Oral dose: 1 to 6 mg/kg/day in two / three divided doses

Intravenous dose: 1 to 2 mg/kg every 6 to 12 hours (or IM)

Continuous infusion: 0.05 mg to 0.2 mg/kg/hour

Adults:

Oral dose: 20 to 80 mg/dose, may increase by increments of 20-40 mg per dose every 6 hours (total dose 600 mg/day)

Intravenous dose: 20 to 40 mg every 4 to 6 hours, may increase by 20 mg/dose, until a desired effect.

Continuous infusion: 0.1 mg to 0.4 mg/kg/hour

Continuous infusion of furosemide and mannitol:

Mannitol 10 to 20 mg/kg hour and furosemide 0.05 mg to 0.5 mg/kg hour, tailor the dose for a desired effect (urine flow)

HYDROCHLORTHIAZIDE:

Indications: Edema of renal and cardiac diseases

Adverse Reactions: Hypotension, hypokalemia, hyperglycemia, hyperuricemia, hypochloremic metabolic alkalosis, prerenal azotemia

Neonates and infants (< 6 months):

Oral dose: 2 to 4 mg/kg/day in 2 divided doses

Infants (> 6 months) and children:

Oral dose: 2 mg/kg/day in 2 divided doses, (maximum 200 mg)

Adults:

Oral dose: 12.5 to 100 mg/day in 2 divided doses

♥ Mixture of hydrochlorthiazide and furosemide for continuous infusion:

Furosemide 0.1 mg/kg/hour + hydrochlorthiazide 1 mg/kg/hour

May increase or decrease the rate of infusion for a desired effect

Maintain the ratio of furosemide / hydrochlorthiazide 1:10

ETHACRYNIC ACID:

Indications: Edema of CHF, renal and hepatic disease, and management of hypertension

Adverse Reactions: Hypocalcemia, hypokalemia, hyperglycemia, hypomagnesemia, thrombocytopenia, ototoxicity, renal and hepatic injury

Children: Oral dose: 1 mg/kg/dose / daily, may increase the dose every 3 days to a maximum of 3 mg/kg/day

Intravenous: 1 mg/kg/dose, repeat doses are not usually recommended; may be given if needed every 12 hours

Adults: Oral dose: 25 to 400 mg/day in 2 divided doses

Intravenous: 0.5 to 1 mg/kg/dose, maximum 100 mg/dose; repeat doses are not usually recommended; may give if needed every 12 hours

BUMETANIDE:

Indications: Edema of CHF, renal disease, hepatic disease, and management of hypertension

Adverse Reactions: Hypotension, hyperglycemia, hypokalemia, hypochloremia, hyponatermia, ototoxicity, elevated serum creatinine

Neonates: Parenteral dose: 0.01 to 0.05 mg/kg/dose every 24 to 48 hours

Infants and children:

Parenteral dose: 0.015 to 0.1 mg/kg/dose every 6 to 24 hours, maximum dose 10 mg/24 hours

Adults: Parenteral dose: 0.5 mg to 1 mg/dose, repeat every 2 to 3 hours if needed; maximum dose 10 mg/24 hours

Continuous infusion: 0.9 to 1 mg/hour; dilute in D5W to achieve concentration of 0.024 mg/mL

METOLAZONE (ZAROXOLYN):

Indications: Edema of renal and cardiac disease

Adverse Reactions: Hypotension, hypokalemia, hyponatremia, hypochloremic metabolic alkalosis, hyperglycemia, prerenal azotemia, hyperuricemia, hypomagnesemia, epistaxis, blurred vision

Infants and children: Oral dose: 0.2 to 0.4 mg/kg/day in 2 divided doses

Adults: Oral dose: 5 to 20 mg/day

SPIRONOLACTONE (aldactone):

Indications: Edema/ascites of renal, cardiac, and hepatic disease, essential hypertension, hypokalemia, and primary hyperaldosteronism

Adverse Reactions: Arrhythmia, hyperkalemia, hyponatremia, hyperchloremic metabolic acidosis, amenorrhea, gynaecomastia, renal failure, dyspnea

Neonates: Oral dose: 1 to 3 mg/kg/day in divided doses

Infants and children: Oral dose: 1.5 to 3.3 mg/kg/day in divided doses

Adults: Oral dose: 25 to 200 mg/day in divided doses

ACETAZOLAMIDE (diamox):

Indications: Edema, metabolic alkalosis, glaucoma, and hydrocephalus.

Adverse Reactions: Seizures, hyperchloremic metabolic acidosis, hypokalemia, hyperepnea (due to increased renal excretion of sodium bicarbonate and water due to competitive inhibition of carbonic anhydrase).

Neonates: 5 mg/kg/daily (Rx of edema)

Infants and children: 5 mg/kg/daily (Rx of edema)

Adults: 250 to 375 mg/day (Rx of edema)

C. Electrolytes and Minerals

AMMONIUM CHLORIDE:

Indications: Correction of metabolic alkalosis and urine acidifying agent

♣ NH4CL is an alternative treatment. It is used only after supplementation of NaCl and KCl.

Adverse Reactions: Bradycardia, hyperventilation, confusion, coma

Correction of metabolic alkalosis by serum HCO_3^- method:

$$\text{mEq of } NH_4Cl = 0.5 \times \text{weight in kg} \times (\text{serum } HCO_3^- - 24)$$

Give only 1/2 to 2/3 of the calculated dose

Correction of metabolic alkalosis by base excess method:

$$\text{mEq of } NH_4Cl = 0.3 \times \text{weight in kg} \times \text{Base excess}$$

Give only 1/2 to 2/3 of the calculated dose

Correction of metabolic alkalosis by chloride method:

$$\text{mEq of } NH_4Cl = 0.2 \times \text{weight in kg} \times (103 - \text{serum } Cl^-)$$

Give only 1/2 to 2/3 of the calculated dose

Infants and children: Intravenous or oral dose:

75 mg/kg/day in 4 divided doses, maximum dose 6 g/day

Adults: 1.5 g/dose every 6 hours

♣ Parenteral administration: Dilute to 0.2 mEq/mL to 0.4 mEq/mL (10.6 to 21.2 mg/mL) and infuse over 3 hours; maximum rate of infusion 1 mEq/kg/hour.

(ammonium chloride 53 mg = 1 mEq of ammonium and 1 mEq of chloride)

SODIUM BICARBONATE:

Indications: Metabolic acidosis, hyperkalemia, and cardiac arrest

Adverse Reactions: Cerebral hemorrhage (due to rapid injection), intracranial acidosis, tetany, hypocalcaemia, hypokalemia, pulmonary edema, tissue necrosis (due to extravasation of drug)

Neonates, infants, and children:

Cardiac arrest: 1 mEq/kg, initial dose (give slowly intravenous); repeat 0.5 mEq/kg after 10 minutes

$$\text{Metabolic acidosis: mEq of } HCO_3 = 0.3 \times \text{weight in kg} \times \text{base deficit}$$

or/

$$\text{mEq of } HCO_3 = 0.5 \times \text{weight in kg} \times (24 - \text{serum } HCO_3^-)$$

Adults:

$$\text{Metabolic acidosis: mEq of } HCO_3 = 0.2 \times \text{weight in kg} \times \text{base deficit}$$

or/

$$\text{mEq of } HCO_3 = 0.5 \times \text{weight in kg} \times (24 - \text{serum } HCO_3^-)$$

♣ If acid- base status is unavailable: 2-5 mEq / kg slow infusion is given over 3 to 4 hours.

(Do not give this dose for neonates)

SODIUM CHLORIDE:

Indications: Restoration of Na^+ in hyponatremia, heat prostration, muscle cramps, and ECF expansion

Adverse Reactions: Hypervolemia, thrombosis, pulmonary edema

Maintenance requirements:

Neonates: 2-4 mEq/kg/day

Infants and children: 3-4 mEq/kg/day (maximum 100 to 150 mEq/day)

Adults: 150 mEq/day

Serious Hyponatremia:

$$\text{Required mEq of } Na^{+} = \text{Desired } Na^{+} \text{ (mEq)} - \text{Actual } Na^{+} \text{ (mEq)} \times 0.6 \times \text{Weight in kg}$$

Give only 1 mEq/Kg/hour (Maximum rate of infusion)

Hypertonic saline solution (> 0.9%) is used only at initial stages.

Acutely correct serum sodium in 5 mEq/L/dose increments to gain serum Na^{+} of 125 mEq/L. In asymptomatic patients, do gradual correction in increments of 10 mEq/L/day

CALCIUM GLUCONATE:

Indications: Treatment and prevention of hypocalcaemia, and hypocalcemic tetany, hyperkalemia, and cardiac resuscitation if epinephrine fails to improve cardiac contraction

Adverse Reactions: Bradycardia, cardiac arrhythmias, coma, muscle weakness

Rx of Hypocalcaemia:

Neonates: 50 to 200 mg/kg/dose × 4 doses / or as a continuous infusion (100-800 mg)

Infants and children: 50 to 125 mg/kg/dose × 4 doses / or as a continuous infusion (200-500 mg)

Rx of Hypocalcaemic tetany:

Neonates: 100 to 200 mg/kg infusion followed by 125 mg/kg × 4 doses / or as a continuous infusion (500 mg)

Infants and children: 100 to 200 mg/kg/infusion followed by100 mg/kg × 4 doses / or as a continuous infusion (500 mg)

Rx of Hyperkalemia / cardiac arrest:

Neonates, infants and children: 60 to 100 mg/kg, may repeat the dose

(Maximum 3 grams/dose)

Adults: 1 to 3 grams

(1 gm of Calcium gluconate = 4.5 mEq of elemental Ca^{2+})

CALCIUM CHLORIDE:

Rx of Hypocalcaemia:

Infants and children: 10 to 20 mg/kg / dose, repeat every 4 to 6 hours prn

Adults: 500 mg to 1 gm/dose, repeat ever 4 to 6 hours prn

Rx of Hypocalcaemic tetany:

Infants and children: 10 mg/kg / over 5 to 10 minutes may repeat after 4 hours/or as a continuous infusion (maximum of 200 mg/kg/day)

Adults: 1 gm over 10 to 30 minutes, repeat after 4-6 hours

Rx of Hyperkalemia / cardiac arrest:

Infants and children: 20 mg/kg, may repeat in 10 minutes

Adults: 2-4 mg/kg, repeat every 10 minutes if necessary

POTASSIUM CHLORIDE:

Indications: Restoration of K^+ in hypokalemia

Adverse Reactions: Vomiting, bradycardia, muscle weakness, dyspnea

Maintenance requirements:

Infants: 1-2 mEq/kg/day

Children: 2-3 mEq/kg/day

Adults: 40-80 mEq/day

♣ IV doses should be mixed in patient's maintenance fluids.

♥ Intermittent IV doses are given for severe hypokalemia on ECG monitoring (as in postop cardiac surgery).

Prevention of hypokalemia (in diuretic treatment):

Infants and children: 1-2 mEq / kg / 24 hours in 2 divided doses

Adults: 20-40 mEq / 24 hours in 2 divided doses

Rx of Hypokalemia:

Children: Intravenous: 1 mEq/kg/over 2 hours, may repeat as needed

♥ If intravenous intermittent dosing should exceed 0.5 mEq/kg/hour, need EKG monitoring; maximum dose = 3 mEq/kg/day.

Usual dose in post cardiac surgery patients = 0.25 mEq/kg/hour

Adults: Intravenous: 5-10 mEq/hour, may repeat as needed

♣ Intravenous and intermittent dosing should not exceed 20 mEq / hour.

♥ Need EKG monitoring if dose exceeds 5 mEq/hour, maximum dose = 400 mEq/day.

POTASSIUM ACETATE:

Indications: Replacement in potassium deficiency (when chloride is normal or high); the acetate is a source of bicarbonate

Adverse Reactions: Bradycardia, skeletal muscle weakness, abdominal pain, alkalosis

Children: 2 to 5 mEq/kg/day

Intravenous dose: 0.5 to 1 mEq/kg/dose

Maximum dose: 30 mEq/dose

Infusion rate: 0.3 to 0.5 mEq/kg/hour

Maximum rate of infusion: 1 mEq/kg/hour

Adults: 40 to 100 mEq/day

Intravenous dose: 5 to 10 mEq/dose

Maximum dose: 40 mEq/dose

Infusion rate: to 10 mEq/dose to be infused over 2 to 3 hours

Maximum rate of infusion: 20 mEq /hour

Serum potassium levels/Potassium dosage/Rate of infusion guidelines (in adults):

i) Serum potassium > 2.5 mEq/L

Maximum infusion rate 10 mEq/hour

Maximum concentration of the solution 40 mEq/L

Maximum 24 hour dose: 200 mEq

ii) Serum potassium < 2.5 mEq/L

Maximum infusion rate 20 mEq/hour

Maximum concentration of the solution 80 mEq/L

Maximum 24 hour dose: 400 mEq

Recommended concentration of the solution:

Maximum concentration of peripheral line: 100 mEq/Liter

Maximum concentration of central line: 400 mEq/Liter

♥ Potassium should be usually given in maintenance IV fluids.

♣ Intermittent infusions are given only for severe potassium depleted states.

POTASSIUM PHOSPHATE:

Indications: Treatment of hypophosphatemia and hypokalemia

Adverse Reactions: Bradycardia, hyperkalemia, acute renal failure, hypocalcaemic tetany, paralysis

Maintenance requirements of elemental phosphorous (oral form):

0 to 6 months = 240 mg

6 to 12 months = 360 mg

1 to 10 years = 800 mg

> 12 years = 1200 mg

(30 mg of phosphorous approximately equals to 1 mmol)

Maintenance requirements:

Children: Intravenous: 0.5 to 1.5 mmol/kg/24 hours

Oral route: 2 to 3 mmol/kg/24 hours in 3 divided doses

Adults: Intravenous: 5 to 30 mmol/24 hours

Oral route: 50 to 150 mmol /24 hours in 3 divided doses

Children (< 4 years): Oral dosage: 250 mg phosphorous (8 mmol) 4 times a day

Children (> 4 years) and Adults:

Oral dosage: 250 to 500 mg phosphorous (8 to 16 mmol) 4 times a day

Phosphate repletion: ♣ (given through intravenous route only) for hypophosphatemia.

Children: Intravenous: 0.25 to 0.5 mmol/kg administer over 4 to 6 hours

If symptoms persist, obtain serum phosphorous levels after first dose, and assess clinically for further therapy.

Adults: Intravenous: 0.16 mmol/kg over 4 to 6 hours; dose may be increased by 25 to 50% if symptoms are severe with hypophosphatemia.

Maximum dose: 0.24 mmol/kg/day

MAGNESIUM SULPHATE:

Indications: Hypomagnesemia, seizures, cardiac arrhythmias (VT, VF) due to low magnesium, and torsade de-pointes

Adverse Reactions: Hypotension and asystole (rapid administration), CNS depression, complete heart block, somnolence (if serum magnesium levels are high in the range of 3 mg to 10 mg/dL)

Rx of hypomagnesemia:

Neonates: Intravenous:

25 to 50 mg/kg (0.2 to 0.4 mEq/kg) every 8 to 12 hours

Infants and children: Intravenous:

25 to 50 mg/kg every 6 hours

High doses up to 100 mg/kg/dose may be used if hypomagnesemia persists

Give maintenance IV infusion of 30 to 60 mg/kg/day

Adults (intravenous): 1 gram of $MgSO_4$ IV every 6 hours

Rx of severe hypomagnesemia: 8 to 12 gm/day in divided doses

Rx of severe arrhythmias:

1 to 2 gm (8 to 16 mEq) IV in 100 mL D5W in 5 to 60 minutes, followed by infusion of 0.5 to 1 gm/hour

Intramuscular administration: Use 25% solution in children

Use 25% or 50% solution in adults

Maintenance: 0.2 to 0.5 mEq/kg/24 hours

Maximum dose: 8 to 16 mEq/24 hours

(125 mg of $MgSO_4$ equals to 1 mEq of Mg^{2+})

D. Antiarrhythmic Drugs

Cassification of Antiarrhythmic Drugs:

Class I: Sodium channel blockade:

I A. Prolonged repolarization: Quinidine, procainamide, and disopyramide.

(high potency Na^+ blokade (wide QRS), prolonged QT due to K^+ blockade).

I B. Shorten repolarization: Lidocaine, mexiletine, tocainide, and phenytoin.

(low potency Na^+ blockade (no effect on QRS), short QT).

I C. Little effect on repolarization: Encainide, flecainide, propafenone, and moricizine.

(potent Na^+ blockade (prolong QRS), no QT change).

Class II: Beta-adrenergic blockade: Propranolol, esmolol, acebutolol, and 1-sotalol.

(slow sinus rhythm, prolonged PR, no effect on QRS or QT).

Class III: Potassium channel blockade (prolongs repolarization).

Amiodarone, bretylium, d, l-sotalol, and ibutilide.

(prolonged QT with increased refractory period, no effect on QRS).

Class IV: Calcium channel blockade: Verapamil, diltiazem, and bepridil.

(selective AV nodal L calcium blockers, slow sinus rhythm, prolonged PR, no effect on QRS or QT).

Miscellaneous actions: Adenosine, digitalis, and magnesium.

(due to unspecified actions other than the above classes).

QUINIDINE:

Indications: Prevention of paroxysmal supraventricular tachycardia, AV nodal tachycardia, ventricular tachycardia, atrial fibrillation, and after cardioversion of atrial fibrillation and atrial flutter

Adverse Reactions: Hypotension and vascular collapse with rapid IV injection, ventricular fibrillation, thrombotic thrombocytopenic purpura, hepatitis, chinconism (nasuea, tinnitus, syncopy, etc.)

Children: Oral dose: (quinidine sulphate) usual dose: 6 mg/kg/dose every 4 to 6 hours; range: 15 to 60 mg/kg/day in 4 to 5 divided doses /or,

900 mg/m^2/day in 5 divided doses

Intravenous dose: (quinidine gluconate) 2 to 10 mg/kg/dose every 3 to 6 hours (♣ usually not recommended for children)

Adults: Oral dose (quinidine sulphate): 100 to 600 mg/dose every4 to 6 hours

Oral dose (quinidine gluconate): 324 to 972 mg every 8 to 12 hours

Intramuscular (quinidine gluconate): 400 mg/dose every 4 to 6 hours

Intravenous (quinidine gluconate): 200 to 400 mg/dose every 4 to 6 hours; infusion rate < 10 mg/minute

Qunidine gluconate salt 267 mg = Qunidine sulphate 200 mg

♣ Several hours before administering the actual dose, give a test dose of 2 mg/kg in children; give a test dose of 200 mg in adults for observation of any idiosyncratic reaction.

PROCAINAMIDE:

Indications: Treatment and prevention of ventricular tachycardia, premature ventricular contractions, paroxysmal atrial tachycardia, atrial flutter, and atrial fibrillation

Adverse Reactions: Hypotension, bradycardia, AV Block, prolonged QT, wide QRS, thrombocytopenia, hepatomegaly with elevated liver enzymes, lupus like syndrome (arthralagia, myalgia, positive Coomb's test, and pleural and pericardial effusions)

Children: Intravenous loading dose: 3 to 6 mg/kg/dose over 5 minutes, not to exceed 100 mg/dose; may repeat every 5 to 10 minutes to a maximum loading dose of 15 mg/kg

Maintenance infusion: 20 to 80 mcg/kg/minute, maximum dose 2 g/day

Maintenance oral dose: 15 to 50 mg/kg/day in divided doses every 4 to 6 hours, maximum dose 4 g/day

PALS dose: (for perfusing tachycardias; should not use with amiodarone)

Intravenous: 15 mg/kg infused over 30 minutes

Stop the infusion for bradycardia or if the QRS widens > 50%

Adults: Intravenous loading dose: 50 to 100 mg/dose infused over 5 minutes, repeat every 5 to 10 minutes for adequate control or a maximum of 15 mg/kg (maximum loading 1 to 1.5 g)

Maintenance infusion: 3 to 4 mg/minute, range 1 to 6 mg/minute

Maintenance oral dose: 50 mg/kg/day or 2 to 4 g/day in two divided doses

ACLS dosing: 20 mg/minute until arrhythmia is controlled or until hypotension occurs, or QRS widens > 50%, or 17 mg/kg is infused.

Refractory ventricular fibrillation:

Loading: 30 mg/minute infusion, up to a total of 17 mg/kg is given if necessary.

Maintenance: 1 to 4 mg/minute

LIDOCAINE:

Indications: Ventricular ectopy, ventricular tachycardia, ventricular fibrillation, pulse-less VT or VF after defibrillation and epinephrine dose, premature ventricular contractions (hemodynamicaly unstable), and monomorphic or polymorphic VT (with normal or prolonged QT)

Adverse Reactions: Brdaycardia, hypotension, cardiovascular collapse, lethargy, seizures, paresthesias, muscle twitching, respiratory depression

Children: Intravenous loading dose:

Initial: 1 mg/kg, may give a second bolus of 0.5 mg to 1 mg/kg in 15 minutes if there is a delay in starting a continuous infusion.

♣ Give half the loading dose in severe CHF.

Continuous infusion: 25 to 50 mcg/kg/minute

The dose is 20 mcg/kg/minute in hepatic disease, CHF, cardac arrest, and shock.

Endotracheal route: 2-10 times the intravenous loading dose

Adults: Initial bolus: 1 to 1.5 mg/kg, repeat 0.5 mg to 0.75 mg/kg every 5 to 10 minutes prn to a total of 3 mg/kg

Continuous infusion: 1 to 4 mg/minute

Endotracheal route: 2 to 2.5 times the intravenous loading dose

MEXILETENE:

Indications: Serious ventricular arrhythmias and premature ventricular contractions

Adverse Reactions: Syncope, hypotension, atrail / ventricular arrhythmias, tinnitus, diplopia, positive ANA (anti-nuclear antibody)

Children: Oral dose: 1.4 to 5 mg/kg/dose, range (3.3 mg/kg/dose) every 8 hours

Adults: Oral dose: 200 to 300 mg every 8 hours

PHENYTOIN:

Indications: Ventricular arrhythmias (due to digitalis intoxication, prolonged QT syndrome and post-cardiac surgery in children) and seizures (simple, complex, and grand-mal)

Adverse Reactions: Dyskinesia, nystagmus, cardiovascular collapse, Stevens-Johnson syndrome, hyperglycemia, SLE syndrome

Infants and children:

Intravenous loading dose: 1.25 mg/kg every 5 minutes, up to 15 mg/kg

Maintenance dose: 5 to 10 mg/kg/day in 3 divided doses (oral / intravenous)

Adults:

Intravenous loading dose: 1.25 mg/kg every 5 minutes, up to 15 mg/kg

Oral loading dose: 250 mg 4 times/a day -- day 1,

250 mg 2 times/a day -- for 2 days

Oral maintenance dose: 300 - 400 mg/day in 4 divided doses

♣ Intravenous infusion rate precautions:

Neonates: Do not exceed the rate of 0.5 mg/kg/minute

Infants, children, and adults: Do not exceed the rate of 1 to 3 mg/kg/minute

Maximum rate of infusion: 50 mg/minute

FLECAINIDE:

Indications: Prevention and supression of life threatening ventricular arrhythmias (e.g., sustained ventricular tachycardia) and Rx of symptomatic and disabling supraventricular arrhythmias (do not use if 2^{nd} or 3^{rd} degree AV block, bifasicular or trifasicular block, myocardial depression, and cardiogenic shock are present.)

Adverse Reactions: Worsening ventricular arrhythmias, bradycardia, CHF, hepatic dysfunction, tremors, paresthesias, blood dyscrasias

Children: Initial dose: 1 to 3 mg/kg/day in 3 divided doses or 50 to 100 mg/m^2/day in 3 divided doses

Usual therapeutic dose: 3 to 6 mg/kg/day or 100 to 150 mg/m^2/day in 3 divided doses

For uncontrolled arrhythmias: Dosing may go up to 8 mg/kg/day or 200 mg/m^2/day

Adults: 100 mg every 12 hours; may increase the dose every 3 days to a maximum of 400 mg/day

Usual dose in supraventricular arrhythmias: 50 mg every 12 hours; maximum 300 mg/day

PROPRANOLOL:

Indications: Tetralogy of Fallot (cyanotic spells), hypertension, arrhythmias (AV nodal re-entry and catecholamine induced, etc.), IHSS, thyrotoxicosis, migraine, and essential tremor

Adverse Reactions: Hypotension, AV Conduction disturbances, depressed myocardial contractility, CHF, bronchospasm, hypoglycemia, hyperglycemia, cold extremities

Neonates, infants, and children:

Arrhythmias:

Intravenous dose: 0.01 to 0.1 mg/kg slowly over 10 minutes; repeat every 6 hours as needed

Start with a lower dose and increase to the 0.15 mg/kg every 6 hours

Maximum dose: 1 mg (infants) 3 mg (children) IV every 6 hours

Oral dose: 2 to 4 mg/kg/day in divided doses (every 6 hours)

Start with 0.5 to 1 mg/kg/day and increase every 3 days up to a higher dose

Maximum dose: 16 mg/kg/day

Tetralogy cyanotic spells:

Intravenous dose: 0.15 to 0.25 mg/kg/dose slowly, repeat in 15 minutes

Oral dose: 1 to 2 mg/kg/dose every 6 hours, initiate with half the dose and increase every 24 hours to a maximum of 5 mg/kg/day

ESMOLOL:

Indications: Supraventricular tachycardia (for control of ventricular rate) and perioperative hypertension

Adverse Reactions: Hypotension (dose > 200 mcg/kg/minute), Raynaud's phenomenon, broncho-constriction

Actions: Class II anti-arrhythmic, beta-1 adrenergic blocker with no effect on beta-2 receptors unless larger doses are used

Children:

Supraventricular tachycardia:

Intravenous: Give 100 to 500 mcg/kg over 1 minute followed by a continuous infusion of 200 mcg/kg/minute

Or

600 mcg/kg over 2 minutes followed by a continuous infusion of 200 mcg/kg/minute

Titrate the infusion rate upward by 50 to 100 mcg/kg/minute every 10 minutes, until 10% reduction of ventricular rate or blood pressure

Usual mean dose: 550 mcg/kg/minute; range: 300 to 1000 mcg/kg/minute

Perioperative hypertension:

Intravenous loading dose: 500 mcg/kg over 1 minute followed by a continuous infusion: 50 to 250 mcg/kg/minute

♣ It is used often with nitroprusside, e.g., in repair of coarctation of aorta.

Adults:

Intravenous loading dose: 500 mcg/kg over 1 minute followed by an infusion of 50 mcg/kg/minute for 5 minutes

♣ If there is no adequate response, follow with another loading dose of 500 mcg/kg over 1 minute and a continuous infusion of 100 mcg/kg/minute.

This process may be repeated to achieve maximum therapeutic effect.

Maximum maintenance dose: 200 mcg/kg/minute

Usual dose range: 50 to 200 mcg/kg/minute

AMIODARONE:

Indications: Life threatining venticular arrhythmias, recurrent VF and unstable VT unresponsive to other therapy, and supraventricular arrhythmias unresponsive to other therapy

Adverse Reactions: Atropine resistant bradycardia, heart block, proarrhythmia and torsade de pontes, myocardial depression, hypothyroidism, hepatic toxicity, pulmonary fibrosis, interstitial pneumonitis, optic neuritis, permanent blindness

Infants and Children:

Ventricular arrhythmias:

Oral loading dose: 10 to 15 mg/kg/day in 2 divided doses for 5 to 15 days or until adequate control of arrhythmias, or onset of prominent adverse effects; then switch to a reduced dose of 5 mg/kg/day for several weeks; then if arrhythmias do not re-occur, adjust to the lowest effective dosing

Maintenance: 2.5 mg/kg/day given for 5 of 7 days week

PALS recommendations:

Pulse less VF, VT: 5 mg/kg rapid IV bolus

Perfusing tachycardias: 5 mg/kg IV over 20 to 60 minutes and may repeat up to a maximum of 15 mg/kg/day

♣ Do not use with other drugs that prolong QT.

Adults:

Ventricular arrhythmias:

Oral loading dose: 800 to 1600 mg/day in 2 divided doses for 1 to 3 weeks, then 600 to 800 mg/day in 2 divided doses for 1 month; then oral maintenance: 400 mg/day

Intravenous loading dose: 1000 mg given in first 24 hours as given below:

150 mg over 10 minutes (rate 15 mg/minute);

360 mg over 6 hours (rate 1 mg/minute);

540 mg over 18 hours (rate 0.5 mg/minute) and after 24 hours, follow with a maintenance infusion of 540 mg over 18 hours (rate 0.5 mg/minute)

Supplemental doses: Boluses of 150 mg/10 minutes are given for breakthrough VF or VT, maximum daily dose of 2 g

ACLS recommendations:

Pulseless VF, VT: 300 mg rapid IV bolus, supplemental boluses of 150 mg for recurrent or pulse-less VF or VT (maximum dose 2.2 g/24 hours)

Atria Fibrillation:

Oral loading dose: 600 to 800 mg/day in 2 divided doses for 2-4 weeks, then 400 mg/day for 3 to 6 months; then 100 to 300 mg/day

Usual maintenance dose 200 mg/day

SOTALOL:

Indications:

Life threatening ventricular arrhythmias (sustained VT)

Adverse Reactions: CHF, pro-arrhythmias, prolonged QT, torsade de pointes, hypotension, hyperglycemia in diabetics, paresthesias, cough

Neonates, infants and children < 2 years:

Reduce the dose by an age factor obtained from the curve.

(see the text for details)

E.g., age factor for an infant of 1 month age = 0.68

Initial dose = 0.68 × 30 mg/m^2/dose given 3 times daily

Children > 2 years:

Initial dose: 30 mg/m^2/dose three times a day

Increase the dose every 36 hours as needed; monitor HR, QTc, and clinical response

If QTc is > 500 msec use extreme caution

If QTc is > 550 msec discontinue or reduce the dose

Maximum dose: 60 mg/ m^2/dose 3 times daily

Alternative dosing:

Initial dose: 2 mg/kg/day in 3 divided doses, increase the dose every 36 hours as needed by 1 to 2 mg/kg/day and monitor HR, QTc, and clinical response

Maximum dose: 8 mg/kg/day in 3 divided doses (do not exceed adult dose)

Adults:

Initial dose: 80 mg twice daily, increase the dose every 36 hours as needed; monitor HR, QTc, and clinical response

Maximum usual dose: 240 to 320 mg/day in 2 divided doses

Usual effective dose: 160 to 320 mg/day in 2 divided doses

Higher dose: 480 to 640 mg/day in 2 to 3 divided doses (for refractory ventricular arrhythmias)

VERAPAMIL:

Indications: Angina, hypertension, supraventricular tachyarrhythmias such as atrial flutter, atrial fibrillation, and PSVT

Adverse Reactions: Hypotension, AV blocks, CHF, elevated liver enzymes, tinnitus

Infants (< 1 year):

♣ Intravenous dosing is usually not recommended.

IV: 0.1 to 0.2 mg/kg (dose), usual dose 0.75 to 2 mg/dose

Repeat the dose in 30 minutes if necessary

♣ Have IV calcium available at bed side.

Children:

Intravenous dose: 0.1 to 0.3 mg/kg/dose, maximum usual dose 5 mg/dose

Repeat the dose in 30 minutes if necessary

Maximum 2nd dose 10 mg/dose

Oral dose: (not well established)

4 to 8 mg/kg/day in 3 divided doses / or

Age of 1 to 5 years: 40 to 80 mg every 8 hour

Ag > 5 years: 80 mg every 8 hours

Adults: Oral dose: 240 to 480 mg/day in 3 or 4 divided doses

Intravenous: 5 mg/dose, repeat 5 to 10 mg in 15 to 30 minutes if needed / and if the patient tolerates the initial dose, until a maximum total dose of 20 mg

♣ Intravenous continuous infusion:

Give after a loading dose of 5 to 10 mg, repeat the dose in 30 minutes if needed then a continuous infusion rate of 5 to 10 mg/hour; the usual range is 4 mg to 20 mg/hour; higher doses of 20 mg/hour may produce adverse effects

DILTIAZEM:

Indications: Hypertension, angina (use oral sustained release), and supraventricular tachycardias such as atrial fibrillation and flutter (use intravenous form)

Adverse Reactions: Hypotension, bradycardia, AV block, erythema multiforme, elevation of liver enzymes

Hypertension:

Children:

Oral dose: 1.5 mg to 2 mg/kg/day in 3 divided doses; maximum dose 3.5 mg/kg/day

Adults:

Oral dose: 30 to 120 mg three times a day; maintenance dose of 180 to 360 mg/day

Arrhythmias:

Adults:

Intravenous dose: Initial bolus of 0.25 mg/kg over 2 minutes, if there is no adequate response; a second bolus of 0.35 mg/kg over 15 minutes, followed by a maintenance infusion: 5 to 15 mg/hour for 24 hours

Maintenance oral dose: Give 3 hours after bolus doses or after a maintenance infusion is stopped

♣ Dose calculator for oral dose = (an infusion rate in mg/hour × 3) + 3 × 10

E.g., (infusion rate 5 mg/hour × 3) +3 × 10 = 180 mg/day

DIGOXIN:

Indications: CHF, To slow the ventricular rate in atrial fibrillation, atrial flutter, and supraventriucular arrhythmias

Adverse Reactions: A-V block, sino-atrial block, ventricular ectopy and arrhythmias, atrial tachycardia with AV block, yellow or green vision, neuralgia, nasuea and vomiting

Onset of action: 5 minutes to 30 minutes (IV), 0.5 to 2 hours (oral)

Duration of action: 1-4 hours (IV), 2 to 8 hours (oral)

Table 16.1 *Total digitalizing and maintenance doses in children and adults.*

	Total digitalizing dose (TDD)		**Maintenance Dose**	
	Oral	**IV**	**Oral**	**IV**
Neonates:	35 mcg/kg	25 mcg/kg	10 mcg/kg	5 mcg/kg
Infants:				
< 2 years	55 mcg/kg	45 mcg/kg	10 mcg/kg	8 mcg/kg
< 5 years	40 mcg/kg	30 mcg/kg	10 mcg/kg	7 mcg/kg
<10 years	35 mcg/kg	20 mcg/kg	10 mcg/kg	5 mcg/kg
>10 years	15 mcg/kg	10 mcg/kg	5 mcg/kg	3 mcg/kg
Adults:	1 to 1.5 mg	0.5 to 1 mg	0.25 to 0.5 mg	0.1 to 0.4 mg

♣ Give one half of TDD initially, then one quarter of the dose every 6 to 8 hours. ♣ Maintenance dose is given in 2 divided doses in children < 10 years.

E. Cardiac Inotropic Drugs

DOPAMINE:

Indications: Increase of cardiac output, blood pressure, and urine volume after adequate volume replacement

Adverse Reactions: Tachycardia, hypertension, ventricular arrhythmias, vasoconstriction, dilated pupils, azotemia

Actions: Low dose: (1 to 5 mcg/kg/minute) stimulates dopaminergic receptors (results in renal and mesentric vasodilation, increased urine flow)

Intermediate dose: (5 to 15 mcg/kg/minute) stimulates beta-1 adrenergic receptors and dopaminergic receptors (increased heart rate, cardiac output, and increased renal blood flow and urine flow)

High dose: (> 15 mcg/kg/minute) stimulates alpha adrenergic receptors (vasoconstriction and increased blood pressure)

Neonates: Intravenous continuous infusion: 1 to 20 mcg/kg/minute

Infants and children: Continuous infusion: 1 to 20 mcg/kg/minute

Maximum 50 mcg/kg/minute

Adults: Continuous infusion: 2 to 50 mcg/kg/minute

If > 20 to 30 mcg/kg/minute are needed, consider using pressors such as epinephrine or nor-epinephrine

MILRINONE:

Indications: Acute ventricular dysfunction or decompensation

Adverse Reactions: Supra ventricular and ventricular arrhythmias, hypokalemia, thrombocytopenia

Actions: Inhibition of phospho-diesterase III increases cyclic AMP levels in myocardium and vascular smooth muscle (inotropic and vasodilating effect)

Neonates, infants and children:

Intravenous loading dose: 50 mcg/kg is given over 15 minutes

Continuous infusion: 0.5 mcg/kg/minute (range 0.25 to 0.75 mcg/kg/minute)

Adults:

Intravenous loading dose: 50 mcg/kg is given over 10 minutes

Continuous infusion: 0.5 mcg/kg/minute (range 0.375 to 0.75 mcg/kg/minute)

DOBUTAMINE:

Indications: Ventricular dysfunction or decompensation

Adverse Reactions: Sinus tachycardia, ventricular arrhythmias, hypertension

Actions: beta-1 adrenergic receptor stimulator with no beta-2 and alpha adrenergic receptor activity

Neonates: Continuous infusion: 2 to 15 mcg/kg/minute

Children and adults: Continuous infusion: 2.5 to 15 mcg/kg/minute

Maximum infusion rate: 40 mcg/kg/minute

EPINEPHRINE:

Indications: Treatment of shock that persists after fluid replacement, and cardiac arrest

Adverse Reactions: Organ ischemia (renal and mesenteric vasoconstriction), cardiac arrhythmias, sudden death

Actions: Stimulates beta-1, beta-2, and alpha adrenergic receptors (causes relaxation of smooth muscles of bronchial tree, cardiac inotropic, and chronotropic effects); small doses causes dilatation of skeletal muscle vasculature (due to stimulation of beta-2 vascular receptors); large doses cause constriction of skeletal, renal, and splanchinic vasculature smooth muscle

Neonates, infants and children:

Intravenous infusion: 0.05 to 1 mcg/kg/minute

Adults: Intravenous infusion: 1 to 10 mcg/minute

NOR-EPINEPHRINE:

Indications: Treatment of shock that persists after fluid replacement

Adverse Reactions: Organ ischemia (renal and mesenteric vasoconstriction), sloughing of superficial tissues after extravasation of drug

Actions: Beta-1 and alpha adrenergic receptor stimulation (inotropic, chronotropic effects, vasoconstriction, and increases coronary blood flow)

Children: Intravenous infusion: Initial dose: 0.05 to 0.1 mcg/kg/minute

Maximum: 1 to 2 mcg/kg/minute

Adults: Intravenous infusion: Initial doses: 4 mcg/minute

Maximum: 8 to 12 mcg/minute

PHENYLEPHRINE:

Indications: Treatment of hypotension and vascular collapse in shock, supraventricular tachycardia, and tetralogy of Fallot in cyanotic spells

Adverse Reactions: Angina, reflex bradycardia, tremors

Rx. Hypotension:

Children:

Intravenous dose: Bolus: 5 to 20 mcg/kg/dose every 10 to 15 minutes as necessary; infuse the dose over 30 seconds

Continuous infusion: 0.1 to 0.5 mcg/kg/minute; titrate to the desired effect

Adults:

Intravenous dose: Bolus: 0.1 to 0.5 mg/dose every 10 to 15 minutes as necessary; infuse the dose over 30 seconds

Continuous infusion: 100 to 180 mcg/minute; titrate to the desired effect

Usual maintenance infusion rate 40 to 60 mcg/minute

Rx. Paroxysmal supraventricular tachycardia:

Children: Intravenous dose: 5 to 10 mcg/kg over 20 seconds

Adults: Intravenous dose: 0.25 to 0.5 mg over 20 seconds

ISOPROTERENOL:

Indications: Ventricular arrhythmias secondary to AV nodal block, bradyarrhythmias with hemodynamic compromise, atropine resistant bradyarrhythmias, third degree AV block, low cardiac output, asthma, or reversible airway obstruction

Adverse Reactions: Ventricular arrhythmias, hypotension, parotitis

Action: Stimulates beta-1 and beta-2 receptors (chronotropic and inotropic effects, relaxes bronchial, gastrointestinal, uterine, vascular smooth muscle, and causes peripheral vasodilation)

Neonates, infants, and children:

Intravenous infusion: 0.05 to 2 mcg/kg/minute

Adults: Intravenous infusion: 2 to 20 mcg/min

F. Afterload (Vascular Resistance) Modulators and Hypotensive Agents

HYDRALAZINE:

Indications: Moderate to severe hypertension, CHF, and primary pulmonary hypertension

Adverse Reactions: Orthostatic hypotension, pyridoxine-deficiency induced peripheral neuropathy, SLE like syndrome

Action: Direct vasodilation of arterioles (little effect on veins)

Infants and children:

Oral dose: Initial dose of 0.75 to 1 mg/kg/day in 3 to 4 divided doses; not to exceed 25 mg/dose over initial 3 to 4 week period

May increase later to a maximum of 5 mg/kg/day in infants, may increase to a maximum of 7.5 mg/kg/day in children in 4 divided doses

Maximum daily dose 200 mg/day

Parenteral (IM, IV): Initial: 0.1 to 0.2 mg/kg / dose (not to exceed 20 mg/dose) every 4 to 6 hours; may increase up to 1.7 to 3.5 mg/kg/day in 4 divided doses

Adults:

Oral dose: Initial: 10 mg 4 times a day, increase by 10 - 25 mg/dose every 2 to 5 days to a maximum daily dose of 300 mg/day

Parenteral (IM, IV): Initial: 10 to 20 mg/dose every 4 to 6 hours

May increase to 40 mg/dose every 4 to 6 hours

NITROGLYCERIN:

Indications: Angina pectoris, CHF (associated with acute MI), pulmonry hypertension, hypertensive emrgencies (in perioperative period in cardiac surgery), and treatment of extravasation of drugs

Adverse Reactions: Acute coronary insuffiency with abrupt withdrawl, hypotension, restlessness

Actions: Decreases oxygen demand by reducing the LVEDP and by reducing systemic vascular resistance; it is a coronary vasodilator and improves collateral flow to ischemic myocardium; it is more of a veno-dilator and less of an arteriolar dilator

Children:

Intravenous continuous infusion:

Initial: 0.25 to 0.5 mcg/kg/minute, titrate by 0.5 to 1 mcg/kg/minute every 5 minutes as necessary, usual dose: 1 to 3 mcg/kg/minute

Maximum dose: 5 mcg/kg/minute

(doses up to 20 mcg/kg/minute may be used)

Adults:

Intravenous continuous infusion:

Initial: 5 mcg/minute, increase by 5 mcg/minute every 5 minutes to 20 mcg/minute; increase further as needed by 10 mcg/minute every 5 minutes to 200 mcg/minute

Rx. Extravasation injuries:

Children and adults:

Ointment: 4 mm/kg, maximum dose 25.4 mm (1 inch), apply every 6 to 8 hours as needed

♣ Apply the measured dose of ointment to the extravasations site evenly.

1 mL of ointment = 25.4 mm (a full packet)

NITROPRUSSIDE:

Indications: Hypertensive crises, CHF, and afterload reducing agent

Adverse Reactions: Restlessness, elevated intracranial pressure, cyanide toxicity, thiocyanate toxicity

Actions: Peripheral vasodilator (arteriolar and venous smooth muscle relaxant) and reduces aortic and left ventricular impedance

Metabolism of nitroprusside takes place in erythrocytes and tissues → cyanide → liver (rhodnase) → incorporation of sulphdryl radicals →formation of thiocyanate → excretion in kidney.

♣ Monitor acid base status, acidosis is the earliest sign of cyanide toxicity.

Monitor serum thiocyanate levels:

i) If requiring infusion > 3 days

ii) If dose is > 4 mcg/kg/minute

iii) In all patients with renal dysfunction

♣ Monitor cyanide levels in hepatic dysfunction:

Serum thiocyanate levels: Toxic 35-100 mcg/mL

Fatal > 200 mcg/mL

Serum cyanide levels: Normal < 0.2 mcg/mL

Normal smokers < 0.4 mcg/mL

Toxic > 2 mcg/mL

Lethal > 3 mcg/mL

Signs of thiocyanate toxicity:

Metabolic acidosis, pink skin, almond smell of breath, methemoglobinemia, psychoses, blurred vision, weakness, tinnitus, seizures, dilated pupils, altered consciousness, and coma (see Chapter 16, Section H for management of thiocynate toxicity).

Infants, children, and adults:

Intravenous infusion: 0.3 to 0.5 mcg/kg/minute

Usual dose: 3 mcg/kg/minute

Maximum dose: 8 to 10 mcg/kg/minute

ENALAPRIL:

Indications: Hypertension, CHF, asymptomatic LV dysfunction, and protienuria of nephrotic syndrome (steroid resistant)

Adverse Reactions: Hypotension, syncope, vertigo, hypoglycemia, hyperkalemia, neutropenia, cholestatic jaundice, fulminant hepatic necrosis, cough, eosinophilic pneumonitis, deterioration of renal function

Neonates: Oral dose: Initial dose: 0.1 mg/kg/day; increase the dose and frequency every few days as necessary

Intravenous dose: 5 to 10 mcg/kg/dose every 8 to 24 hours

For management of hypertension:

Infants and children: Oral dose: Initial dose: 0.1 mg/kg/day in 2 divided doses, increase the dose every few days to a maximum of 0.5 mg/kg/day

Intravenous dose: 5 to 10 mcg/kg/dose every 8 to 24 hours

For management of hypertension:

Adults: Oral dose: Initial dose: 2.5 mg to 5 mg/day increase as required

Usual dose: 10 to 40 mg/day in 2 divided doses (hypertension)

5 to 20 mg/day in 2 divided doses (CHF)

20 mg/day in 2 divided doses (asymptomatic LV dysfunction)

Intravenous dose: 0.625 to 1.25 mg every 6 hours, may increase to 5 mg every 6 hours for management of hypertension

CAPTOPRIL:

Indications: Hypertension, CHF, and post-myocardial infarction LV dysfunction

Adverse Reactions: Hypotension, tachycardia, hyperkalemia, neutropenia, hepatic necrosis (fulminant), elevated serum creatinine

Neonates: 0.05 mg to 0.1 mg/kg/dose every 8 to 24 hours

Titrate the dose up to 0.5 mg/kg/dose every 6 to 24 hours

Infants: 0.15 mg to 0.3 mg/kg/dose, titrate the dose up to maximum of 6 mg/kg/day in 4 divided doses

Children: 0.3 to 0.5 mg/kg/dose, titrate the dose up to maximum of 6 mg/kg/day in 2 to 4 divided doses

Older children: 6.25 mg to 12.5 mg/dose every 12 to 24 hours, titrate to a maximum of 6 mg/kg/day in 2 to 4 divided doses

Adults: 12.5 to 25 mg/dose every 8 to 12 hours, titrate the dose by 25 mg / dose increments to a maximum of 450 mg

PHENOXYBENZAMINE:

Indications: Management of hypertension and sweating in pheochromocytoma

Adverse Reactions: Syncope, shock, ocular miosis, nasal congestion, muscle weakness

Action: Noncompetitive alpha-adrenergic blockade of postganglionic synapses of exocrine glands and smooth muscle

Infants and children:

Oral dose: Initial: 0.2 mg/kg once daily, maximum dose 10 mg/dose

May increase every 4 days by 0.2 mg/kg/day increments

Usual maintenance dose: 0.4 to 1.2 mg/kg/day in divided doses

Maximum dose: 2 to 4 mg/kg/day

Adults:

Oral dose: Initial: 10 mg/dose twice daily, may increase the dose every other day to the usual dose of 10 to 40 mg every 8 to 12 hours

PHENTOLAMINE:

Indications: Antidote to extravasations of vasoactive drugs, hypertension, and a vasodilator

Asdverse Reactons: Angina, arrhythmias, exacerbation of peptic ulcer

Action: Competetive blockade of alpha-adrenergic receptors; positive inotropic and chronotropic effects; reverses vasoconstriction of drugs extravasated in the subcutaneous tissue

Alpha- adrenergic drug extravasations:

Neonates:

Infiltrate the area with a small (1 mL) amount of solution (made with 2.5 to 5 mg in 10 mL of normal saline) within 12 hours of extravasation

Do not exceed 0.1 mg/kg or 2. 5 mg of total dose

Infants, children and adults:

Infiltrate the area with 1 mL of solution (made with 5 mg to 10 mg in 10 mL of normal saline) within 12 hours of extravasation

Do not exceed 0.1 mg/kg or 5 mg of total dose

Hypertension (prior to surgery for pheochromocytoma):

Children: (IM, IV): 0.05 to 0.1 mg/kg/dose 1 to 2 hours before surgery, repeat as necessary; maximum single dose 5 mg

Adults: (IM or IV): 5 mg/dose 1 to 2 hours before surgery, repeat as necessary

Hypertensive crises (as in sypathomimetic amines infusion interactions):

Adults: IM or IV: 5-20 mg

CLONIDINE:

Indications: Hypertension and adjunct in Rx of neuropathic pain

Adverse Reactions: Raynaud's phenomenon, hypotension, sedation, sodium and water retention, xerostomia

Actions: Alpha-2 adrenoreceptor agonist in brain stem; activates inhibitory neurons and decreases sympathetic outflow with reduction of vasomotor tone and heart rate

Hypertension:

Children:

Oral doses: Initial: 5-10 mcg/kg/day in divided doses every 8-12 hours

Increase gradually to 5 to 25 mcg/kg/day in 4 divided doses

Maximum dose: 0.9 mg/day

Transdermal patch: Switch to transdermal patch after the oral dose is titrated and stabilized dose is equivalent to total oral daily dose

Adults:

Hypertension: Oral doses:

Initial dose: 0.1 mg twice daily, maintenance dose: 0.2-1.2 mg/day in 2-4 divided doses

Maximum dose: 2.4 mg/day

Transdermal patch: Apply once a week

Initial treatment: 0.1 mg/24 hours applied once every week, adjust the dose based on response

DIAZOXIDE: (Hyperstat)

Indications: Hypotensive agent

Contraindications: Hypertension associated with aortic coarctation, arteriovenous shunts, and dissecting aortic aneurysm

Adverse Reactions: Hypotension, CHF, edema, hyperglycemia, ketoacidosis, sodium and water retention, extrapyramidal symptoms, thrombocytopenia

Action: Direct smooth muscle relaxation of peripheral arterioles; inhibition of insulin release from pancreas

Children and adults: Intravenous: 1-3 mg/kg; may repeat the dose 5-15 minutes for an adequate control

Maximum dose: 150 mg as a single injection

♣ Administer by a rapid IV injection, do not give by intramuscular or subcutaneous route.

LABETALOL:

Indications: Moderate to severe hypertension and hypertensive emergencies

Adverse Reactions: CHF, AV conduction distrubances (less than propranolol), xerostomia, bronchospasm

Actions: Alpha, beta-1, and beta-2 receptor blocker; reduces serum renin levels

Children: Oral dose: Start at 4 mg/kg/day in 2 divided doses (some have started 3 mg/kg/day to 20 mg/kg/day and increased up to 40 mg/kg/day)

Intravenous: Intermittent boluses: 0.2 to 0.5 mg/kg/dose, maximum dose 20 mg/dose

Hypertensive emergency:

Continuous infusion: of 0.4 to 1 mg/kg/hour with a maximum of 3 mg/kg/hour

Alternate dosing

Initial bolus of 0.2 to 1 mg/kg (maximum 20 mg) followed by a continuous infusion of 0.25 to 1.5 mg/kg/hour (mean 0.78 mg/kg/hour)

Adults: Oral doses: Initial dose: 100 mg twice a day, increase by 100 mg every 3 days until a desired response

Usual oral dose: 200-400 mg twice a day (maximum 2.4 g/day)

Intravenous dose: Initial dose: 20 mg a dose, may give 40 to 80 mg at 10 minute intervals up to 300 mg of a total dose

Intravenous infusion: 2 mg/minute, titrate to response

TOLAZOLINE:

Mechanism of action and effects:

Vasodilation occurs by means of a direct effect on peripheral vascular smooth muscle, and indirect effects are produced, in part, by release of endogenous histamine, moderate alpha-adrenergic blocking activity, and histamine agonist activity; reduces pulmonary arterial pressure and vascular resistance

It has sympathomimetic (cardiac stimulation, both inotropic and chronotropic), parasympathomimetic (stimulation of gastrointestinal tract that is blocked by atropine), and histamine-like (stimulation of gastric secretion) actions

Indications: (withdrawn in US)

Treatment of persistent pulmonary hypertension and treatment of persistent pulmonary hypertension in the newborn (persistent fetal circulation) if $Sa\,O_2$ cannot be maintained by supplemental oxygen and/or mechanical ventilation

Adverse Reactions:

Gastrointestinal hemorrhage may be fatal, hypochloremic alkalosis, systemic hypotension, hypotension may be very common in neonates and may occur suddenly, acute renal failure, especially oliguria, thrombocytopenia, diarrhea, nausea and vomiting, increased pilomotor activity (goose flesh), peripheral vasodilation (flushing), tachycardia, mydriasis

Technique of administration:

The drug should be given by trained personnel only in pediatric or neonatal intensive care. Respiratory support should be immediately available. Administer intravenously by means of an infusion pump for precise adjustment of the flow rate. Pretreatment with antacids may prevent gastrointestinal bleeding in infants.

Treatment of adverse effects and/or overdose and Hypotension:

* Keep the patient's head low and administer intravenous fluids.

* Use of epinephrine or nor epinephrine is not recommended due to risk of a further decrease in BP.

* If fluid expansion fails to maintain BP, need high doses of intravenous dopamine infusion. Dopamine may be used simultaneously with the tolazoline infusion.

Usual pediatric dose: Pulmonary hypertension:

Intravenous:

Initial dose: 1 to 2 mg / kg via scalp vein over a five-to ten-minute period /or infused into any vein that drains into the superior vena cava to maximize delivery to the pulmonary artery.

Maintenance:

Intravenous infusion: 0.2 mg (200 mcg) / kg per hour for each 1 mg/kg body weight. Drug gradually be withdrawn when arterial blood gases remain stable. If necessary, the initial bolus dose may be repeated during the maintenance infusion.

Decrease the infusion rate in patients with renal tubular dysfunction and oliguria < 0.9 mL/kg/hour

G. Gastrointestinal and Antisecretory Drugs

SUCRALFATE:

Indications: Prevention of stress ulcers, duodeal ulcer disease, and NSAID induced mucosal damage

Adverse Reactions: Facial edema, flatulence, respiratory difficulty

Action: Forms a paste like complex with gastric acid, and adheres to the damaged mucosal surface forming a protective cover against pepsin, peptic acid, and bile salts

Children: Stress ulcers and gatric ulcers:

40-80 mg/kg/day divided every 6 hours

Stomatitis:

5 to 10 mL (1 g/10 mL) swish and swallow 4 times a day

Adults: Prophylaxis of stress ulcers:

1 g 4 times a day

Therapy of stress ulcers:

1 g every 4 hours

Stomatitis:

10 mL (1 g/10 mL) swish and swallow 4 times a day

Duodenal ulcers:

Treatment: 1 g 4 times a day for 6 to 8 weeks

or

2 g twice daily for 6 to 8 weeks

Maintenance / prophylaxis: 1 g twice daily

FAMOTIDINE:

Indications: Gastric hypersecretory conditions and control of gastric pH in critically ill

Adverse Reactions: Brdadycardia, seizures, nausea, vomiting, thrombocytopenia, elevated BUN and creatinine, cholestatic jaundice

Action: H_2 receptor antagonist

Neonates and infants (< 3 months): Oral dose: 0.5 mg/kg/daily

Infants > 3 months to 1 year: Oral dose: 0.5 mg/kg / dose twice daily / or once at a bedtime

Children: Peptic Ulcer: Oral / Intravenous dose:

0.5 mg/kg/day in two divided doses or a single dose at a bedtime, maximum (40 mg/day)

GERD: Oral / Intravenous dose:

1 mg/kg/day in two divided doses or a single dose at a bedtime, maximum (80 mg/day)

Adults: Oral dose:

Peptic ulcer: 10 mg twice daily for 4-8 weeks

Maximum daily dose 40 mg

Gastric hypersecretory states: 20 mg every 6 hours

Maximum 160 mg every 6 hours

GERD: 20 mg twice daily for 6 weeks

Intravenous dose: 20 mg every 12 hours

♣ Need dosing adjustment in renal impairment.

(Reduce the daily dose / or decrease the frequency)

♣ Parenteral IV bolus at 10 mg / over 2 minutes or a continuous infusion over 15 to 30 minutes.

OMEPRAZOLE:

Indications: Gastric hypersecretory states, peptic ulcer disease, GERD, and Rx of duodenal ulcers associated with helicobacter pylori

Adverse Reactions: Tachycardia, vertigo, hemifacial dysesthesia, agranulocytosis, hypoglycemia, thrombocytopenia, hepatitis, proteinuria

Gastroesophageal reflux disease (GERD):

Infants and children:

1 mg/kg/dose once a day or twice a day

Usual effective dose range: 0.2 to 3.5 mg/kg/day / or

Children > 2 years: < 20 kg: 10 mg once a day

> 20 kg: 20 mg once a day

Treatment protocols in Adults:

(GERD):

20 mg/day for 6 to 8 weeks

Active duodenal / gastric ulcers:

20 to 40 mg/day for 6 to 8 weeks

Gastric hypersecretory states:

60 mg/day to 120 mg three times a day

Helicobacter pylori associated with duodenal ulcer:

♣ Use these agents adjunct to antibiotic therapy.

Children: 15 to 30 kg: 10 mg twice a day

> 30 kg: 20 mg twice a day

Adults: 20 mg twice a day or 40 mg daily

PANTOPRAZOLE:

Action: Inhibits the gastric parietal cell membrane enzyme (H^+/K^+) ATPase or proton pump and suppresses the gastric acid secretion; it has significant antimicrobial activity against Helicobacter pylori

Indications: Gastric hypersecretory states, GERD, and Rx of duodenal ulcers associated with Helicobacter pylori

Adverse Reactions: Tachycardia, angina, palpitations, vertigo, headache, insomnia, migraine, urticaria, rare toxic epidermal necrolysis, hyperglycemia, hyperlipemia, thrombocytopenia, leukopenia, hepatitis, proteinuria

Gastroesophageal reflux disease (GERD):

Children:

20 mg (0.5 to 1 mg/kg/dose) once a day for 28 days

Adults:

(GERD):

40 mg/day (oral) for 8 weeks

40 mg/day (IV) for 7-10 days

Gastric hypersecretory states:

Oral: 40 mg two times a day

IV: 80 mg twice daily (adjust the dose to maintain acid output < 10 mEq/hour)

Doses up to 240 mg/day are used

Helicobacter pylori associated with duodenal ulcer:

♣ Use these agents adjunct to antibiotic therapy.

40 mg once or twice a day

ONDANSETRON (Zofran):

Indications: Postoperative nausea and vomiting and prevention of vomiting due to emetogenic drugs

Adverse Reactions: Syncope, brady-tachycardias, dizziness, seizures, tremor, blurred vision, xerostomia, elevated liver enzymes

Action: 5-HT_3 receptor antagonist and blocks serotonin peripherally on vagal nerve terminals and centrally on chemoreceptor trigger zone

Postoperative nausea and vomiting:

Children > 2 years / < 40 kg: Intravenous: 0.1 mg/kg

Children > 40 kg and Adults: Intravenous: 4 mg

Repeat the second dose if there is no relief, infuse IV over 15 minutes, and for IM administration use undiluted injection

Drug induced vomiting:

Oral dose:

Children: 4-11 years: 4 mg 3 times a day

Children > 11 years and Adults: 8 mg 3 times a day / or 24 mg once a day

Intravenous dose:

Children > 3 years: 0.15 mg/kg infused over 30 minutes before drug administration (as in chemotherapy)

Repeat subsequent doses after 4 to 8 hours

METOCLOPRAMIDE:

Indications: Symptomatic treatment of gastric stasis, esophegeal reflux, and nausea and vomiting (of postoperative period)

Adverse Reactions: Hypotension, AV block, tardy-dyskinesia, seizures, galactorrhea, methemoglobinemia, porphyria hepatica

Action: It is dopamine receptor antagonist in the chemoreceptor trigger zone of CNS

Neonates, infants, and children:

Gatroesophageal reflux: 0.4 to 0.8 mg/kg/day in 4 divided doses

Nausea and vomiting: 0.1 to 0.2 mg/kg/dose repeat every 6 to 8 hours

Adults: Gatroesophageal reflux: 10 to 15 mg 4 times/day

Nausea and vomiting: 10 mg, repeat every 6 to 8 hours

♣ Need dosing adjustment in renal impairment.

(Reduce the dose by 75% to 50% of the recommended dose)

RANITIDINE:

Indications: Treatment of gastric and duodenal ulcers, GERD, gastric hypersecretory states, treatment and prophylaxis of erosive esophagitis, and prevention of stress ulcers

Adverse Reactions: Gynecomastia, thrombocytopenia, hepatitis, elevated serum creatinine, bradycardia, arthralgias

Actions: It is a H_2 receptor antagonist of gastric parietal cells

Term infants: Oral dose: 2 mg/kg/day divided every 12 hours

Intravenous: 1.5 mg/kg/dose (a loading), followed after 12 hours by a maintenance of 1.5 to 2 mg/kg/day divided every 12 hours

Continuous infusion: After a loading dose, follow by 0.04 to 0.08 mg/kg/hour

Children (> 1 month to 16 years):

Peptic ulcer disease:

Oral dose: 2 to 4 mg/kg/day in two divided doses, maximum 300 mg/day

Maintenance: 2 to 4 mg/kg/day divided in two doses; maximum 150 mg/day

Intravenous: 2 to 4 mg/kg/day divided every 6 to 8 hours, maximum 200 mg/day

GERD or erosive esophagitis:

Oral dose: 4 to 10 mg/kg/day in two divided doses

Maximum: 300 mg/day (GERD), maximum: 600 mg/day (erosive esophagitis)

Intravenous: 2 to 4 mg/kg/day divided every 6 to 8 hours, maximum 200 mg/day

Or

Continuous infusion: 1 mg/kg/loading, followed by 0.08 to 0.17 mg/kg/hour (2 to 4 mg/kg/day)

Adults:

GERD, peptic ulcers, and stable erosive esophagitis:

Oral dose: 150 mg twice daily

Gastric hypersecretory states:

Oral: 150 mg twice daily. maximum 600 mg/day

Parenteral dose: 50 mg/dose every 6 to 8 hours (not to exceed 400 mg/day)

Continuous infusion: 50 mg bolus, followed by 6.25 mg/hour

Keep the pH > 4.0 for prevention, Keep the pH.7.0 for treatment

Erosive esophagitis:

Oral dose: 150 mg four times daily

♣ Require the dose adjustment in renal impairment (reduce the dose by 50 to 75%).

H. Miscellaneous Drugs

VASOPRESSIN:

Indications: Diabetes insipidus, prevention and Rx of postoperative abdominal distension, GI hemorrhage, refractory ventricular fibrillation, and refractory vasodilator shock

Adverse Reactions: Limb ischemia (Infusion > 10 units/hr), angina, heart block, cardiac arrest, water intoxication, hyponatremia, tremor, bronchoconstriction

Vasodilatory shock: (unresponsive to fluids and cathecholamines) as in post-cardiac surgery

Infants and children: 0.0003 to 0.002 units/kg/minute, titrate to effect / or

0.018 to 0.12 units/kg/hour, titrate to a desirable effect

Adults: 0.04 to 0.1 unit/minute, titrate to a desirable effect

♣ Doses of > 0.05 units/minute are associated with increased risk of a cardiac arrest in some patients.

♥ Abrupt discontinuation of drug results in hypotension, so gradually taper the drug.

Diabetes insipidus:

(intramuscular or subcutaneous):

♥ Doses are variable, titrate the dose based upon serum and urine sodium, osmolality, urine output, and fluid balance.

Infants and children (2.5 to 10 units 2 to 4 times a day

Adults: 5 to 10 units 2 to 4 times a day (range: 5-60 units/day)

Continuous infusion:

Children and adults: Initial: 0.5 milliunit/kg/hour (0.0005 unit/kg/hour)

Increase the dose twice (double dosage) every 30 minutes as needed to a maximum of 10 milliunit/kg/hour (0.01 units/kg/hour)

(1 milli unit = 1/1,000 units or 0.001 units)

Abdominal distension:

Adults: Intramuscular: 5 units initially, repeat every 3 to 4 hours

OCTEROTIDE ACETATE:

Indiactions: Metastatic carcinoid, VIPOMA's, secretary diarrhea, and postoperative chylothorax

Adverse Reations: Flushing, hypertension, hypotension, seizures, galactorrhea, hypoglycemia, steatorrhea, hepatitis

Actions: Mimics natural somatostatin by inhibiting release of serotonin, gastrin, VIP, insulin, glucagon, secretin, motilin, and pancreatic polypeptide; inhibits growth hormone, intestinal motility, and intestinal secretion of water and electrolytes

Treatment of diarrhea:

Infants and children:

Intravenous and S. C doses: 1-10 mcg/kg every 12 hours

IV continuous infusion: Initial dose of 1 mcg/kg bolus followed by 1 mcg/kg/hour

Adults:

Subcutaneous: Initial dose of 50 mcg 1-2 times a day

Intravenous: Initial dose: 50 to 100 mcg every 8 hours

Increase by 100 mcg/dose every 48 hours

Maximum dose: 500 mcg every 8 hours

Chylothorax:

Infants and children: Intravenous: An initial bolus of 1 mcg/kg, followed by a continuous infusion of 0.2 mcg/kg/hour

DEXAMETHASONE:

Indications: Airway edema and to facilitate ventilator weaning in brochopulmonary dysplasia

Adverse Reactions: Similar to other corticosteroids

Neonates:

Airway edema or extubation:

Intravenous: 0.25 mg/kg/dose 4 hours prior to scheduled extubation, then every 8 hours for 3 doses in total

Range: 0.25 to 1 mg/kg/dose for 1 to 3 doses

Maximum: 1 mg/kg/day

Bronchopulmonary dysplasia (to facilitate weaning from ventilator):

Oral / Intravenous: 0.5 to 0.6 mg/kg/day given divided doses every 12 hours for 3-7 days, then taper over 1 to 6 weeks

Children:

Airway Edema or Extubation:

Oral, IM, IV: 0.5 to 2 mg/kg/day in divided doses every 6 hours

Begin 24 hours prior to extubation and continue 4 doses after extubation

Physiologic replacement:

Oral, IM, IV: 0.03 mg to 0.15 mg/kg/day or 0.6 to 0.75 mg/m^2/day

Give in divided doses every 6-12 hours

Cerebral edema:

Oral, IM, IV: Loading dose: 1-2 mg/kg/dose

Maintenance dose: 1 to 1.5 mg/kg/day in divided doses every 4-6 hours

Maximum dose: 16 mg/day

HYDROCORTISONE:

Indications: Anti-inflammatory agent, adrenocortical insufficiency, septic shock, dermatoses, and miscellaneous uses

Adverse Reactions: Hypertension, edema, CHF, maceration of skin, redness, sodium and water retention, cataracts, glaucoma, immunosupression, osteoporosis

Neonatal hypoglycemia:

(Refractory to continuous glucose infusion of > 12-15 mg/kg/minute)

Intravenous/oral doses: 5 mg/kg/day in three divided doses or 1-2 mg/kg every 6 hours

Physiologic replacement:

Children: Intramuscular: 0.25 to 0.35 mg/kg/day or 12-15 mg/m^2/day once daily

Oral dose: 0.5 to 0.75 mg/kg/day or 20-25 mg/m^2/day divided every 8 hours

Shock:

Children: Intravenous: Initial dose: 50 mg/kg as a bolus followed by 50 mg/kg as a 24 hour continuous infusion

Or

Initial dose: 50 mg/kg as a bolus and repeat 50 mg/kg after 4 hours or every 24 hours

Adolescents and adults: Intravenous: 500 mg to 2 g every 2-6 hours

Acute adrenal insufficiency:

Infants: IM or IV: 1 to 2 mg/kg / IV bolus followed by 25 to150 mg/day in divided doses every 6 to 8 hours

Children: Intravenous: 1 to 2 mg/kg / IV bolus followed by 150 to 250 mg /day in divided doses every 6 to 8 hours

Adults: Intravenous: 100 mg IV bolus followed by 300 mg/day in divided doses every 8 hours or as a continuous infusion for 48 hours, after achieving stability, change to an oral dose

Oral dose: 50 mg every 8 hours for 6 doses, then taper to 30-50 mg/day in divided doses

Anti-Inflammatory / Immunosupressive:

Infants and children:

Oral dose: 2.5 to 10 mg/kg/day or 75 to 300 mg/m^2/day divided every 6 to 8 hours

IM, IV: 1 to 5 mg/kg/day or 30-150 mg/m^2/day divided every 12 to 24 hours

Adults: Oral, Sub, IM, IV: 15 to 240 mg every 12 hours

LEVOTHYROXINE:

Indications: Replacement therapy in congenital or acquired hypothyroidism, adjunct Rx for surgery and radioiodine in thyroid cancer, and treatment and prevention of goiters

Adverse Reactions: Cardiac arrhythmias, CHF, angina, pseudotumor cerebri

Neonates, infants, and children:

Oral doses:

0-3 months: 10-15 mcg/kg, use a lower dose (25 mcg/day) if risk of CHF exists

Use a higher dose (50 mcg/day) if serum T4 is low (< 5 mcg %)

3-6 months: 8-10 mcg/kg or 25 to 50 mcg/day

6-12 months: 6-8 mcg/kg or 50 to 75 mcg/day

1-5 years: 5-6 mcg/kg or 75 to 100 mcg/day

6-12 years: 4-5 mcg/kg or 100-125 mcg/day

> 12 years: 2-3 mcg/kg or 150 mcg/day

After full growth and puberty: 1.7 mcg/kg

IM or IV doses: 50% to 75% of an oral dose

Adults:

Hypothyroidism:

Oral dose: 1.7 mcg/kg/day or 100-200 mcg/day

For severe hypothyroidism start with 12.5 to 50 mcg/day and increase by 25 to 50 mcg/day at 2-4 week intervals

IV, IM: 50% of an oral dose

Myxodema stupor:

Intravenous: 200-500 mcg/dose then 75-300 mcg/daily

ALPROSTADIL (prostaglandin E_1):

Indications: Temporary maintenance of patency of ductus arteriosus and relaxation of vascular and ductus smooth muscle, used in the following congenital heart defets (see Table 16.2).

Table 16.2 *Congenital heart diseases requiring use of alprostadil for survival.*

Cyanotic Heart disease	***Acyanotic Heart disease**
i) Pulmonary atresia (pulmonary stenosis)	i) Interrupted aortic arch
ii) Tricuspid atresia	ii) Coarctation of aorta
iii) Tetralogy of Fallot	iii) Hypoplastic left heart syndrome

*Patent ductus dependent physiology for an immediate survival

Adverse Reactions: Hypotension, bradycardia, apnea, seizures, hypocalcaemia, hypoglycemia, hypokalemia, gastric outlet obstruction (due to antral hypeplasia), cortical hyperostosis of long bones (resembles osteomyelitis clinically), platelet aggregation defects

Pharmacodynamics:

Maximum effect:

Acyanotic group: in 1.5 to 3 hours (range 15 minutes to 11 hours), cyanotic group: in 30 minutes

Duaration of the effect: Ductus closes 1 to 2 hours after the infusion is ceased.

Neonates and infants: Usual dose: 0.1 mcg/kg/minute, reduce the dose with adequate therapeutic response

(reduce to 1/2 to 1/10 of the dose to obtain a lowest effective dose)

Range: 0.05 mcg to 0.1 mcg/kg/minute. If therapeutic response is not adequate, the dose is increased gradually. Maintenance: 0.01 to 0.4 mcg/kg/minute

HUMAN ALBUMIN:

Indications: Plasma volume expansion and maintenance of cardiac output, hypoproteinemia associated with generalized edema, and decreased intravascular volume (nephrotic syndrome and premaure neonates)

Adverse Reactions: Pulmonary edema, hypervolemia, allergic reactions

Neonates: Rx of hypovolemia:

0.5 g/kg/dose. Range 0.25 g to 0.5 g/kg/dose

Rx of hypoproteinema:

0.5 g to 1 g/kg/dose, repeat every 1 to 2 days

Infants and children: Rx of hypovolemia:

0.5 to 1 g/kg/dose, repeat as needed; maximum 6 g/kg/day

Rx of hypoproteinema:

0.5 g to 1 g/kg/dose, repeat every 1 to 2 days

Adults: Rx of hypovolemia:

25 g, repeat as necessary; maximum 250 g/48 hours

Note:

5% albumin is used for volume expansion.

25% albumin is used for hypoproteinemia with fluid and sodium restrictions (e.g., generalized edema).

Infuse albumin dose over 30 to 60 minutes

Maximum rates of infusion after initial volume replacement is as below:

5% Albumin → 2 to 4 mL/minute

25% Albumin → 1 mL/minute

DEXTROSE:

Indications: Rx of hypoglycemia in neonates (10% solution)

Rx of hypoglycemia in infants and children (25% solution)

Rx of hypoglycemia (25% solution with addition of insulin)

Rx of insulin induced hypoglycemia and hyperkalemia in adults (50% solution)

Averse Reactions: Hypervolemia, hypophosphatemia, hypokalemia, metabolic acidosis, pulmonary edema

Hypoglycemia: Use repeated infusions as needed

Neonates: 0.1-0.2 g/kg/dose (1-2 mL/kg/dose of 10% solution)

May follow with infusion of 4 to 6 mg/kg/minute

Infants: < 6 months: 0.25-0.5 g/kg/dose (1-2 mL.kg/dose of 25% solution)

maximum 25 g/dose

Infants (> 6 months) and children: 0.5 to 1 g/kg/dose (2-4 mL/kg/dose of 25% solution)

Maximum 25 g/dose

Adolescents and adults: 10-25 g (40-100 mL of 25% solution or 20-50 mL of 50% solution)

Hyperkalemia: Use repeated infusions as needed

Infants and children: 0.5 to 1 g/kg (25% solution) plus 1 unit of regular insulin for every 4-5 g of dextrose; infuse over 1-2 hours

Adolescents and adults: 0.1 mL/kg of 50% solution plus 1 unit of regular insulin for every 4-5 g of dextrose

METHYLENE BLUE: (ANTIDOTE)

Indications: Antidote for drug induced methemoglobinemia and cyanide poisoning

Adverse Reactions: Hypotension, cyanosis, mental confusion, blue-green facies, blue-green urine, methemoglobin formation

Actions: At low concentration, it converts methemoglobin to hemoglobin; at high concentrations, it converts ferrous iron of reduced hemoglobin to ferric iron and forms methemoglobin; it binds cyanide to form cyanomethemoglobin, and prevents cyanide to interfere with cytochrome systems

Children and adults:

Acute methemoglobinemia:

Children and Adults:

Intravenous: 1-2 mg/kg or 25-50 mg/m^2, repeat after 1 hour prn

Chronic methemoglobinemia:

Adults: Oral dose: 100-300 mg/day

SODIUM THIOSULPHATE: (ANTIDOTE)

Indications: Antidote used alone or in combination with amyl nitrite and sodium nitrite for cyanide and nitroprusside toxcity, and prevention of cisplatinum nephrotoxicity

Adverse Reactions: Hypotension, coma, depression (thiocynate intoxication), tinnitus

Action: Provides extra SH (sulphydryl) radical to the liver enzyme rhodnase which metabolizes cyanide to thiocynate; thiocynate is excreted in urine; amyl nitirite and sodium nitrite promote the formation of methemoglobin which binds with cyanide to form cyanomethemoglobin, a non-toxic product

Cyanide and Nitroprusside toxcity:

Administer the following drugs in a sequential order

1) AMYL NITRITE: Infants, children and adults:

Inhale vapors from 1 ampoule continuously over 15-30 seconds

Interrupt for 15 seconds (to prevent hypoxia)

Reinhale until sodium nitrite is ready for use

2) SODIUM NITRITE:

Infants and children (< 25 kg)

IV: Give according to hemoglobin concentration (see Table 16.3)

It is followed immediately by sodium thiosulphate

Children > 25 kg and Adults:

IV: Give 300 mg followed immediately by sodium thiosulphate

SODIUM THIOSULPHATE:

Infants and children < 25 kg:

IV: Give according to hemoglobin concentration (see Table 16.3)

Children > 25 kg and Adults:

IV: 12.5 g infusion over 10 minutes (50 mL of 25% solution)

♣ If signs of toxicity re appear, repeat the injections of both sodium nitrite and sodium thiosulphate at half the original doses.

♥ Prophylactically may give both drugs in asymptomatics at (1/2) the original dose 2 hours after 1st injection.

Table 16.3 *Dose of sodium nitrite and thiosulphate in children < 25 Kg (based on Hb in Gm%).*

Hemoglobin Gm%	Sodium Nitrite (mg/kg)	Sodium Nitrite (3%) mL/kg	Sodium Thiosulphate 25% (mL/kg)
7	5.8	0.19	0.95
8	6.6	0.22	1.10
9	7.5	0.25	1.25
10	8.3	0.27	1.35
11	9.1	0.30	1.50
12	10.0	0.33	1.65
13	10.8	0.36	1.80
14	11.6	0.39	1.95

1 mL 3% sodium nitrite = 30.5 mg, 1 mL 25% sodium thiosulphate = 250 mg

NALOXONE (ANTIDOTE)

< 20 kg or < 5 yrs: 0.1 mg/kg

> 20 kg or > 5 yrs: 2 mg

For total reversal of narcotics effect, use small repeated doses of 0.01 to 0.03 mg/kg

IBUPROFEN:

Indications: Non-steroidal anti-inflammatory drug (NSAID) for mild to moderate pain

Adverse Reactions: Heartburn, peptic ulcer, inhibition of platelet aggergation, acute renal failure

Action: Inhibits prostaglandin synthesis

Analgesic:

Infants and children:

Oral dose: 4-10 mg/kg/dose every 6-8 hours

Antipyretic:

6 months to 12 years: Temp < 102.5 ℉: 5 mg/kg/dose every 6 to 8 hours

Temp > 102.5 ℉: 10 mg/kg/dose every 6 to 8 hours

(maximum dose 40 mg/kg/day)

Inflammatory conditions:

Adults:

Oral dose: 400-800 mg/dose 3-4 times a day, maximum 3.2 g/day

Analgesia:

Oral dose: 200-400 mg/dose every 4-6 hours, maximum 1.2 g/day

ACETAMINOPHEN:

Indications: Mild to moderate postoperative pain and fever, it does not have systemic anti-inflammatory effect

Adverse Reactions: Hepatic necrosis with overdose, renal injury with chronic use

Neonates: Oral and rectal doses: 15 mg/kg/dose every 6 hours

Infants and children: Oral dose: 15 mg/kg/dose every 4 to 6 hours; not to exceed 5 doses/24 hours

Rectal dose: 20 mg/kg/dose every 4 to 6 hours

Children > 12 years:

Oral and rectal doses: 325 to 600 mg every 4 to 6 hours

Adults: Not to exceed 4 g/24 hours

Bronchodilators and Mucolytics:

ACETYLCYSTEINE (mucomyst):

Indications: Adjunctive inhalation Rx for viscid pulmonary secretions complicating surgery, bronchopulmonary disease, intravenous / oral therapy for acetaminophen toxicity, and treatment of obstructive meconium ileus

Adverse Reactions: Hypotension, vasodilation, angioedema, bronchospasm, stomatitis

Action: Free sulphydryl group breaks disulphide bonds of mucoproteins; restoration of glutathione levels and/or acts as a substrate for conjugation of acetaminophen toxic metabolite

Nebulized inhalation:

Infants: 2-4 mL of 10% solution (or 1-2 mL of 20%) 3-4 times/day

Children: 6-10 mL of 10% solution (or 3-5 mL of 20%) 3-4 times/day

Adults: 5-10 mL of 10-20% solution 3-4 times/day

Intratracheal:

Adults and children: 1-2 mL of 10-20% solution every 1-4 hours

♥ Aerosolized bronchodilator should be given 10 minutes prior to mucomyst.

Acetaminophen toxicity:

Intravenous/oral dosing: (refer text for details):

ALBUTEROL:

Indications: Prevention of bronchospasm in reversible airway obstruction as in asthma, COPD, and bronchospasm during exercise

Adverse reactions: Hypertension, angina, hypokalemia, xerostomia, muscle cramps

Action: Beta-2 adrenergic agonist, bronchodilator, and it has little effect on beta-1 receptors

Nebulized inhalation:

Children < 12 years:

0.15-0.25 mg/kg (minimum 1.25 mg, maximum 5 mg) every 4-6 hours

Or

0.01 mL-0.05 mL/kg (minimum 0.25 mL, maximum 1 mL) of 0.5% solution every 4-6 hours

Children > 12 years and adults:

1.25 mg-5 mg every 4-6 hours

Or

0.25 mL to 1 mL of 0.5% solution ever 4-6 hours

♥ For nebulization, dilute the dosage in 1-2 mL of normal saline

Inhalation aerosol (MDI) 90 mcg/spray:

Children > 4 years and adults:

1-2 inhalations every 4-6 hours

2 inhalations 30 minutes before exercise (prevention of bronchospasm)

Oral form:

Children 2-6 years: 0.1 mg-0.2 mg/kg/dose 3 times a day

Maximum 4 mg/dose 3 times a day

Children 6-12 years: 2 mg/dose 3-4 times a day

Children> 12 years and adults: 2-4 mg/dose 3-4 times a day.

IPRATROPIUM: (atrovent)

Indications: Anticholinergic bronchodilator in bronchospasm of reversible airway obstruction (asthma, COPD, etc.), and rhinorrhea

Advese Reactions: Usually are rare (hypertension, insomnia, urticaria, xerostomia, and mydriasis)

Action: Acetylcholine receptor blocker in bronchial smooth muscle resulting in bronchodilation; inhibits seromucinous secretions of glands of nasal mucosa

Nebulized inhalation:

Neonates: 25 mcg/kg/dose 3 times a day

Infants: 12-250 mcg/dose 3 times a day

Children: 250-500 mcg/dose 4 times a day

Children > 12 years and adults: 250 mcg/dose 4 times a day

Metered dose inhalation (MDI):

Children: 1-2 inhalations every 6 hours, not to exceed 12/day

Children > 12 years and adults: 2-3 inhalations every 6 hours, not to exceed 12/day

Nasal spray:

Children > 12 years and adults: 0.03% solution, 2 sprays in each nostril 2-3 times a day

♥ Nebulization may be administered with or without dilution with normal saline.

LEVALBUTEROL:

Indications: Treatment and prevention of bronchospasm in reversible airway obstruction (e.g., asthma, COPD)

Adverse reactions: Hypertension, angina, hypokalemia, hyperglycemia, xerostomia, muscle cramps

Action: R-isomer of albuterol is beta-2 adrenergic agonist, bronchodilator, anti-histaminic; and it has little effect on beta-1 receptors

Nebulized inhalation:

Children 2-11 years:

0.31 mg 3 times a day, not to exceed 0.63 mg / 3 times a day

Children > 11 years and adults:

0.63 mg 3 times a day, maximum 1.25 mg 3 times a day

♣ 0.63 mg of levalbuterol is equivalent to 1.25 mg of albuterol.

I. Antimicrobials and Antifungal Agents

1. PENICILLINS

Action: Bactericidal, inhibit cell wall synthesis by binding to penicillin-binding proteins, and inhibit transpeptidation step of peptidoglycan synthesis

Adverse reactions: Seizures, fever, urticaria, exfoliative dermatitis, erythema multiforme, Steven-Jhonson syndrome, vomiting, pseudomembranous colitis, thrombocytopenia, anemia, neutropenia, prolonged bleeding time, vasculitis, hypersensitivity

Drug interactions: Probencid decreases the elimination of penicillins; allupurinol increases the frequency of penicillin skin rash; oral contraceptives (estrogen containing) effectiveness is reduced; cross-react with cephalosporin hypersensitivity; antibiotic activity with aminoglycosides is synergistic; chloramphenicol, tetracyclines, and erythromycin may antagonize the activity of penicillin; exercise caution in seizure disorders and modify dosage in renal and hepatic impairment

PENICILLIN G (aqueous / parenteral):

Indications:

Sepsis, meningitis, pericarditis, endocarditis, and pneumonia due to gram-positive organisms (except Staphylococcus aureus); infections due to some gram-negative organisms such as N. gonorrhea; infections of some anaerobes and spirochetes

Adverse Reactions: Common to penicillins and Jarisch-Herxheimer reaction, interstitial nephritis, thrombophelbitis, anaphylaxis

Neonates: (IM, IV):

Postnatal age < 7 days:

< 2 kg weight: 50,000 units/kg/day divided q. 12 hours

100,000 units/kg/day divided q. 12 hours (meningitis)

> 2 kg weight: 75,000 units/kg/day divided q. 8 hours

150,000 units/kg/day divided q. 8 hours

Congenital syphilis: 100,000 units/kg/day divided q. 12 hours

streptococcal meningitis: 250,000-400,000 units/kg/day divided q. 8 hours

Postnatal age > 7 days:

< 2 kg weight: 75,000 units/kg/day divided q. 8 hours

150,000 units/kg/day divided q. 8 hours (meningitis)

> 2 kg weight: 100,000 units/kg/day divided q. 6 hours

2000,000 units/kg/day divided q. 6 hours

Congenital syphilis: 150,000 units/kg/day divided q. 8 hours

Streptococcal meningitis: 450,000 units/kg/day divided q. 6 hours

Infants and children: (IM, IV):

Mild to moderate infection:

100,000-250,000 units/kg/day in divided doses q. 4-6 hours

Severe infections:

250,000-400,000 units/kg/day in divided doses q. 4-6 hours

Maximum dose: 24 million units / day

Adults: (IM, IV):

2-24 million / units/day divided q 4-6 hours

PENICILLIN G Benzathine:

It is a long acting penicillin and serum levels are detectable 1-4 weeks after a single dose.

Indications: Active against gram-positive organisms and spirochetes; treatment of mild to moderately severe infections caused by organisms (i.e., Streptococcal pharyngitis) susceptible to low concentration of penicillins; prophylaxis against organisms causing rheumatic fever

Adverse Reactions:

Same like aqueous penicillins

♣ Penicillin G Benzathine should be administered by deep intramuscular injection. Intravenous administration is contraindicated and is associated with cardiopulmonary arrest.

Infants: (deep IM):

Group A streptococcal upper respiratory tract infection:

25,000-50,000 units/kg as a single dose, maximum 1.2 million units/dose

Children: (deep IM):

Group A streptococcal upper respiratory tract infection:

< 30 kg: 300,000-600,000 units as a single dose

> 30 kg: 900,000 units as a single dose

Prophylaxis of rheumatic fever:

25,000-50,000 units / dose every 3-4 weeks, maximum dose 1.2 million units/dose

Syphillis (> 1 year duration):

50,000 units/kg every week for 3 consecutive weeks, maximum 2.4 million units/dose

Adults: (deep IM):

Group A streptococcal upper respiratory tract infection:

1.2 million units as a single dose

Prophylaxis of rheumatic fever:

1.2 million units every 3-4 weeks or 600,000 units twice a month

Syphillis (> 1 year duration):

2.4 million units (use 1.2 million at 2 injection sites) every week for 3 consecutive weeks.

Syphillis (early):

2.4 million units as a single dose (use two injection sites)

PENICILLIN V Potassium:

Indications: Treatment of mild to moderately severe susceptible infections (penicillin sensitive organisms) of upper respiratory tract, skin, and urinary tract; prophylaxis against pneumococcal infection and rheumatic fever

Adverse reactions: Common to penicillins, pseudomembranous colitis, black hairy tongue

Systemic infections: (oral dose):

Children < 12 years: 25-50 mg/kg/day in divided doses q. 6-8 hours

Maximum dose 3 gm/day

Children > 12 years and adults: 125-500 mg every 6-8 hours

Prophylaxis of rheumatic fever:

Children: 250 mg 2-3 times a day for 10 days

Adults: 500 mg 2-3 times a day for 10 days

Prophylaxis of pneumococcal infections:

(in functional or anatomic asplenia, sickle cell disease, etc.)

Children < 3 years: 125 mg twice daily

Children > 3-5 years: 250 mg twice daily

♣ Discontinue penicillin after 5 years of age if a child receives peumococcal immunization and/or has not developed pneumococcal infection.

Recurrent rheumatic fever prophylaxis:

Children and adults: 250 mg twice daily for 10 days

2. AMOXICILLIN

Indications: Infections of sinuses, middle ear, respiratory tract, urinary tract, and skin due to susceptible bacteria, i.e., streptococci, nonpenicillinase-producing staphylococci, H. influenza, E. coli, N. gonorrhea, Proteus mirabilis, and E. fecalis; treatment of Lyme disease; prophylaxis of infective endocarditis and H. pylori eradication

Adverse reactions: Common to penicillins, cholestatic jaundice, elevated liver enzymes, tooth discoloration (yellow, grey, brown)

Neonates and infants:

< 3 months: 20-30 mg/kg/day in divided doses q. 12 hours

Infants > 3 months and children:

25-50 mg/kg/day in divided doses q. 8 hours

Adults: 250-500 mg every 8 hours, maximum dose 2-3 gm/day

Endocarditis prophylaxis:

Children: 50 mg/kg 1 hour before procedure (should not exceed adult dose)

Adults: 2 gm 1 hour before procedure

H. pylori eradication: (in adults)

1 gm twice daily for 2 weeks plus a proton pump inhibitor plus another antibiotic (i.e., clarithromycin)

Acute gonorrheal infection:

Children > 2 years: 50 mg/kg with probencid 25 mg/kg as a single dose

Adults: 3 gm with probencid 1 gm as a single dose

Clavulanic Acid with Amoxicillin:

Clavulanic acid binds and inhibits beta-lactamases which inactivate amoxicillin (penicillins), and the combination increases the spectrum of amoxicillin.

Dosing is based on amoxicillin component.

Neonates and infants:

< 3 months: 30 mg/kg/day in divided doses q. 12 hours

Infants (> 3 months): 20-40 mg/kg/day in divided doses q. 8 hours

Children (< 40 kg): 80-90 mg/kg/day in divided doses q. 12 hours

For drug resistant middle ear infection and sinusitis:

Children (> 16 years): 2 gm (extended release) every 12 hours for 10 days

Adults: 2 gm (extended release) every 12 hours for 7-10 days

For community-acquired pneumonia:

Adults: 500 mg every 12 hours (less severe infections and non-respiratory tract)

500 mg every 8 hours or 875 mg every 12 hours for severe infections and respiratory tract infections

3. AMPICILLIN

Indications: Infections due to streptococci, non-penicillinase producing staphylococci, pneumococci, enterococci, H. influenza, E. coli, Proteus mirabilis, Salmonaella, Shigella, Listeria, meningococci, E. Fecalis, and Klebsiella; initial empiric treatment in combination with aminoglycoside or cefotaxime for bacterial sepsis in neonates; prophylaxis of infective endocarditis

Adverse reactions: Common to penicillins, oral candidiasis, interstitial nephritis

Children:

Oral dose: 50-100 mg/kg/day divided every 6 hours, maximum dose 2-3 gm/day

Adults:

Oral dose: 250-500 mg every 6 hours

Neonates: Parenteral dosing (IM, IV):

Postnatal age < 7 days:

< 2 kg weight: 50 mg/kg/day divided every 12 hours

100 mg/kg/day divided every 12 hours (meningitis or sepsis)

> 2 kg weight: 75 mg/kg/day divided every 8 hours

150 mg/kg/day divided every 8 hours (meningitis or sepsis)

200 mg/kg/day divided every 8 hours (streptococcal meningitis)

Postnatal age > 7 days:

< 2 kg weight: 75 mg/kg/day divided every 8 hours

150 mg/kg/day divided every 8 hours (meningitis or sepsis)

300 mg/kg/day divided every 6 hours (streptococcal meningitis)

> 2 kg weight: 100 mg/kg/day divided every 6 hours

200 mg/kg/day divided every 6 hours (meningitis or sepsis)

300 mg/kg/day divided every 6 hours (streptococcal meningitis)

Infants and children:

Parenteral dosing (IM, IV):

100-200 mg/kg/day divided every 6 hours

200 mgkg/day divided every 6 hours (meningitis or sepsis); maximum 12 gm/day

Adults:

Parenteral dosing (IM, IV):

500 mg-3 gm every 6 hours, maximum dose 14 gm/day

Prophylaxis of endocarditis:

Infants and children:

Regular risk procedure: (respiratory tract, esophageal, oral, or dental)

50 mg/kg within 30 minutes before procedure, maximum dose 2 gm

High risk procedure (on GI tract or genitourinary tract):

50 mg/kg (maximum dose 2 gm) plus gentamicin 1.5 mg/kg (maximum dose 120 mg) within 30 minutes of procedure, 25 mg/kg after 6 hours

Adults:

Regular risk procedure (respiratory tract, esophageal, oral, or dental):

2 gm within 30 minutes before the procedure

High risk procedure (on GI tract or genitourinary tract):

2 gm plus gentamicin 1.5 mg/kg (maximum dose 120 mg) within 30 minutes of the procedure, 1 gm after 6 hours

AMPICILLIN with SULBACTAM:

Action: Sulbactam inhibits beta-lactamases which inactivate penicillins; sulbactam has no antibacterial action by itself; it increases the spectrum of ampicillin (includes beta-lactamase producing organisms)

Dosing is based on ampicillin component only.

Parenteral dosing (IM, IV):

Infants > 1 month: 100-150 mg (ampicillin)/kg/day divided q 6 hours

200-300 mg (ampicillin)/kg/day divided q 6 hours (meningitis)

Children: 100-200 mg (ampicillin)/kg/day divided q 6 hours

200-400 mg (ampicillin)/kg/day divided q 6 hours (meningitis), maximum dose 8 gm/day

Adults: 1-2 gm q 6 hours

Maximum dose 12 gm/day

Unasyn (3 gm vial = 2 gm ampicillin and 1 gm sulbactam)

4. ANTI- PSEUDOMONAL PENICILLINS

Carbenicillin, Ticarcillin, Piperacillin

A. Carbenicillin:

Indications: Urinary tract infections or asymptomatic bacteriuria or prostatitis due to susceptible strains of Pseudomonas aeurginosa, E. coli, indole positive Proteus, and Enterobacter species

Action: Similar to penicillins; inhibits bacterial cell wall synthesis during active multiplication, and is bactericidal

Adverse Reactions: Many similar to penicillins, urticaria, thrombocytopenia, anemia, GI symptoms, furry tongue, hepatotoxicity, vaginitis

♣ Oral carbenicillin should be used only for urinary tract infections.

Children:

35-50 mg/kg/day divided q. 6 hours, maximum dose 2-3 gm/day

Adults:

1-2 tablets (1 tablet-382 mg base) every 6 hours

B. TICARCILLIN:

Indications: Septicemia, severe acute and chronic respiratory tract, skin, soft tissues, and urinary tract infections due to strains of Pseudomonas, Proteus, E. Coli, and Enterobacter

Actions: Similar to penicillins and bactericidal

Adverse reactions: Similar to penicillins, cholestatic hepatitis, cystitis, hematuria, metabolic alkalosis

Parenteral dosing: (IM, IV):

♣ For uncomplicated urinary tract infection, usually, IM ticarcillin is given.

Neonates: (IV administration):

Postnatal age < 7 days:

< 2 kg: 150 mg/kg/day in divided doses q. 12 hours

> 2 kg: 225 mg/kg/day in divided doses q. 8 hours

Postnatal age > 7 days:

< 2 kg: 225 mg/kg/day in divided doses q. 8 hours

> 2 kg: 300 mg/kg/day in divided doses q. 6-8 hours

Infants and children:

IM: 50-100 mg/kg/day in divided doses q. 6-8 hours

IV: 200-300 mg/kg/day in divided doses q. 4-6 hours

♣ Higher doses are used in acute pulmonary infections associated with cystic fibrosis, i.e., 400 mg/kg/day divided q 4-6 hours; maximum dose 24 gm/day.

Adults:

IM: 1 gm every 6 hours

IV: 1-4 gm every 4-6 hours

Maximum dose 24 gm/day

C. TICARCILLIN and CLAVULANATE potassium

Clavulanate binds and inhibits beta-lactamases and prevents degradation of ticarcillin; clavulanate expands ticarcillin spectrum to include beta-lactamase producing S. aureus, H. Influenza, Moraxella catarrhalis, Proteus species, Klebsiella, and B. fragilis

Indications: Septicemia, lower respiratory tract, urinary tract, skin and soft tissue, and bone and joint infections due to susceptible (beta-lactamase producing) organisms

Adverse Reactions: Common to penicillins, cholestatic jaundice, toxic epidermal necrolysis, superinfections, stomatitis

Parenteral dosing (IV): Dosing is based on ticarcillin component

Neonates and infants < 3 months:

200-300 mg/kg/day (ticarcillin component) in divided doses q. 6-8 hours

Infants > 3 months and children:

Mild to moderate infections: 200 mg/kg/day in divided doses q. 6 hours

Severe infections: 300 mg/kg/day in divided doses q. 4-6 hours, maximum dose 400 mg/kg/day; not to exceed 18-24 gm/day

Adults:

3 gm ticarcillin component every 4-6 hours

Maximum dose 18-24 gm/day

TIMENTIN 3.1 gm vial (3 gm of ticarcillin plus 0.1 gm of clavulanic acid)

D. PIPERACILLIN:

Indications: Serious infections due to susceptible gram-positive, gram-negative, anaerobic, mixed aerobic-anaerobic organisms; empirical antibiotic therapy for serious infections in granulocytopenic patients; carbenicillin or ticarcillin resistant serious infections due to Pseudomonas aeruginosa

Actions: Similar to penicillins and bactericidal

Adverse reactions: Similar to penicillins, cholestatic hepatitis, interstitial nephritis

Parenteral dose (IM, IV):

Neonates:

< 7 days: 150 mg/kg/day divided q. 8 hours

> 7 days: 200 mg/kg/day divided q. 6 hours

Infants and children:

200-300 mg/kg/day divided q. 4-6 hours, maximum dose 24 gm/day

♣Use higher doses in infections associated with cystic fibrosis.

350-500 mg/kg/day divided q. 4 hours

Adults:

2-4 gm / dose q. 4-8 hours, maximum dose 24 gm/day

E. PIPERACILLIN and TAZOBACTAM:

Tazobactam binds and inhibits beta-lactamases and prevents degradation of piperacillin; tazobactam expands piperacillin spectrum to include beta-lactamase producing S. aureus, H. Influenza, E. Coli, Klebsiella, B. fragilis, and Acinetobacter

Indications: Bacterial sepsis, intra-abdominal, skin and soft tissue, gynecological, and urinary tract infections due to piperacillin resistant, and beta-lactamase producing organisms

Adverse Reactions: Common to penicillins, cholestatic jaundice, interstitial nephritis

Parenteral dosing (IV): Dosing is based on piperacillin component

Infants < 6 months: 150-300 mg (piperacillin component)/ kg/day divided q. 6-8 hours

Infants > 6 months and children:

240 mg/kg/day divided every 8 hours

300-400 mg/kg/day divided every 6 hours (serious pseudomonal infection), maximum dose 18 gm/day (piperacillin component)

Adults: 3 gm (piperacillin component) every 6 hours, maximum 18 gm/day

ZOSYN 3.375 gm vial (3 gm piperacillin and 0.375 gm of tazobactam)

5. ANTI-STAPHYLOCOCCAL PENICILLINS

Nafcillin, Oxacillin, Dicloxacillin

A. Nafcillin:

Indications: Osteomyelitis, endocarditis, CNS infections, and septicemia due to penicillinase producing strains of staphylococcus

Actions: Bactericidal and similar to penicillins

Adverse Reactions: Common to penicillins and interstitial nephritis

Neonates: (IM, IV):

Postnatal age < 7 days:

< 2 kg: 50 mg/kg/day in divided doses q. 12 hours

> 2 kg: 75 mg/kg/day in divided doses q. 8 hours

Postnatal age > 7 days:

< 2 kg: 75 mg/kg/day in divided doses q. 8 hours

> 2 kg: 100 mg/kg/day in divided doses q. 6 hours

Infants and children:

(IM, IV):

Mild to moderate infections: 50 mg-100 mg/kg/day in divided doses q. 6 hours

Severe infections: 100-200 mg/kg/day in divided doses q. 4-6 hours, maximum dose 12 gm/day

Oral dose: 50 mg-100 mg/kg/day in divided doses q. 6 hours

Adults:

Oral dose:

Mild to moderate infections: 250 mg-500 mg q. 4-6 hours

Severe infections: 1 gm q. 4-6 hours

IM: 500 mg every 4-6 hours

IV: 500-2000 mg every 4-6 hours

B. OXACILLIN:

Indications: Osteomyelitis, endocarditis, CNS infections, and septicemia due to pencillinase producing strains of staphylococcus

Actions: Bactericidal and similar to penicillins

Adverse Reactions: Common to penicillins, interstitial nephritis, pseudomembarnous colitis

Neonates: (IM, IV):

Postnatal age < 7 days:

< 2 kg: 50-100 mg/kg/day in divided doses q. 12 hours

> 2 kg: 75-150 mg/kg/day in divided doses q. 8 hours

Postnatal age > 7 days:

< 2 kg: 75-150 mg/kg/day in divided doses q. 8 hours

> 2 kg: 100-200 mg/kg/day in divided doses q. 6 hours

Infants and children:

(IM, IV):

Mild to moderate infections:

100 mg-150 mg/kg/day in divided doses q. 6 hours, maximum dose 4 gm/day

Severe infections: 150-200 mg/kg/day in divided doses q. 4-6 hours, maximum dose 12 gm/day

Adults: (IM, IV)

Mild to moderate infections: 500 mg-1 gm q. 6 hours

Severe infections: 1-2 gm q. 4-6 hours

C. DICLOXACILLIN:

Indications: Skin and soft tissue infections, pneumonia, and follow-up Rx of osteomyelitis due to penicillinase producing strains of staphylococci

Actions: Bactericidal and similar to penicillins

Adverse Reactions: Common to penicillins, C. difficile colitis

Oral dosing:

Children (< 40 kg):

25-50 mg/kg/day divided every 6 hours

50-100 mg/kg/day divided every 6 hours (osteomyelitis)

Children (> 40 kg) and Adults:

125-500 mg every 6 hours

Maximum dose: 2 gm/day

6. CEPHALOSPORINS

(First Generation)

Cefazolin, Cephalexin, Cephradine, Cefadroxil

Action: Bactericidal, inhibit cell wall synthesis by binding to penicillin-binding proteins, and inhibiting transpeptidation step of peptidoglycan synthesis

Drug interactions: Probencid decreases the elimination of cephalosporins; cross-react with penicillin hypersensitivity

♣ Exercise caution in seizure disorder and patients on anticoagulants.

Modify dosage in renal and hepatic impairment and in patients on anticoagulants.

A. Cefazolin:

Indications: Septicemia, bone and joint, skin and soft tissue, biliary, respiratory, and urinary tract infections due to susceptible gram-positive streptococci and staphyloccocci (except enterococcus); gram-negative bacilli like E. coli, Proteus mirabilis, and Klebsiella; prophylaxis of infective endocarditis; preoperative prophylaxis

Adverse Reactions: As common to penicillins, seizures, fever urticaria, exfoliative dermatitis, erythema multiforme, Steven-Jhonson syndrome, vomiting, diarrhea, pseudomembranous colitis, oral candidiasis, thrombocytopenia, anemia, neutropenia, prolonged bleeding time, renal failure, elevated liver enzymes, hypersensitivity

Parenteral dosing (IM, IV)

Neonates:

Postnatal age < 7 days: 40 mgkg/day divided every 12 hours

Postnatal age > 7 days:

< 2 kg weight: 40 mgkg/day divided every 12 hours

> 2 kg weight: 60 mgkg/day divided every 8 hours

Infants and children:

50-100 mg/kg/day divided every 8 hours, maximum 6 gm/day

Prophylaxis of endocarditis:

25 mg/kg within 30 minutes before a planned procedure (respiratory tract, esophageal, oral, and dental), maximum dose 1 gm

Adults: 0.5-2 gm every 6-8 hours, maximum dose 12 gm/day

Prophylaxis of endocarditis:

1 gm within 30 minutes before procedure (respiratory tract, esophageal, oral, and dental)

Perioperative prophylaxis:

1 gm 30-60 minutes before surgery, 0.5-1 gm every 8 hours for 24 hours postoperatively

B. Cephalexin

Indications: Skin, soft tissue, bone and joint, middle ear, respiratory, and genito-urinary tract infections due to gram-positive group A beta-hemolytic Streptococcus and Staph aureus (except Enterococcus and MRSA); gram-negative bacilli like E. coli, Proteus mirabilis, and Klebsiella

♣ It is an alternative drug for prophylaxis against infective endocarditis.

Adverse Reactions: Similar to cephalosporin and penicillins, arthralgia

Oral dosage:

Children: 25-50 mg/kg/day divided every 6-8 hours

50-100 mg/kg/day divided every 6-8 hours (severe infections)

Streptococcal pharyngitis / skin and soft tissue infections:

25-50 mg/kg/day divided every 12 hours

Prophylaxis of endocarditis:

50 mg/kg 60 minutes before a planned procedure (respiratory tract, esophageal, oral, and dental), maximum dose 2 gm

Adults:

250-500 mg every 6 hours, maximum dose 4 gm/day

Streptococcal pharyngitis / skin and soft tissue infections:

500 mg every 12 hours

Prophylaxis of Endocarditis:

2 gm 60 minutes before a planned procedure (respiratory tract, esophageal, oral, and dental)

C. Cephradine:

Indications: Skin, soft tissue infections due to gram-positive group A beta-hemolytic streptococci and Staphylococcus aureus; respiratory tract infections due to group A beta-hemolytic streptococci and Streptococcus pneumonia; middle ear infections due to group A beta-hemolytic streptococci, Streptococcus pneumonia, and H. influenza; urinary tract infections due to gram-negative bacilli like E. coli, Proteus mirabilis, and Klebsiella

Oral Dosage:

Infants > 9 months and children: 25-50 mg/kg/day divided every 6-12 hours

75-100 mg/kg/day divided every 6-12 hours (middle ear infection)

Maximum dose: 4 gm/day

Adults: 250-500 mg every 6-12 hours

D. Cefadroxil:

Indications: Skin, soft tissue, upper respiratory tract infections due to susceptible gram- positive group A beta-hemolytic streptococci and Staphylococcus aureus; urinary tract infections due to gram-negative bacilli like E. coli, Proteus mirabilis and Klebsiella

Adverse Reactions: Similar to cephalosporins and penicillins, vaginitis

Infants and children: 30 mg/kg/day divided every 12 hours, maximum dose 2 gm/day

Adults: 1-2 gm/day divided every 12 hours, maximum dose 4 gm/day

CEPHALOSPORINS (second generation):

Cefuroxime, Cefotetan, Cefoxitin, Cefaclor, Cefprozil

Action: Bactericidal, inhibit cell wall synthesis by binding to penicillin-binding proteins, and inhibits transpeptidation step of peptidoglycan synthesis

Drug interactions: Probencid decreases the elimination of cephalosporins; cross-react with penicillin hypersensitivity; modify dosage in renal and hepatic impairment

A. Cefuroxime:

Indications: Septicemia, bone and joint, skin and soft tissue, middle ear, maxillary sinus, lower and upper respiratory, and urinary tract infections due to susceptible organisms such as group B streptococci, pneumococci, staphylococci, H. influenzae (A & B), E. coli, Proteus mirabilis, Klebsiella, and Enterobacter sp; for preoperative prophylaxis; treatment of Lyme disease

Adverse Reactions: As common to penicillins, seizures, fever, urticaria, exfoliative dermatitis, erythema multiforme, vomiting, diarrhea, pseudomembranous colitis, stomatittis, vaginitis, thrombocytopenia, anemia, neutropenia, prolonged bleeding time, renal failure, elevated liver enzymes, hypersensitivity

Parenteral dosing (IM, IV):

Neonates: 50 mgkg/day divided every 12 hours

Infants and children: 75-150 mg/kg/day divided every 8 hours, maximum 6 gm/day

Adults: 750 mg-1.5 gm every 8 hours, maximum dose 6 gm/day

Perioperative prophylaxis:

1 to 1.5 gm 30-60 minutes before surgery

1 gm every 12 hours for 24 hours postoperatively

Oral dosage:

Infants > 3 months and children < 12 years:

Pharyngitiis, URT:

Suspension: 20 mg/kg/day divided every 12 hours, maximum dose 500 mg/day

Middle ear, sinuses, and skin infections:

Suspension: 30 mg/kg/day divided every 12 hours, maximum dose 1 gm/day

Tablet: 250 mg every12 hours

Adults: 250 mg-500 mg every 12 hours

Uncomplicated urinary tract infection: 125-250 mg every 12 hours

Uncomplicated gonorrhea: A single dose 1 gm

Early Lyme disease: 500 mg every 12 hours × 20 days

B. Cefotetan:

Indications: Septicemia, bone and joint, skin and soft tissue, lower respiratory tract, urinary tract, gynecological, and intra-abdominal infections due to susceptible gram-negative anaerobes like Bacteroides, enteric gram-negative bacilli like E. coli, Proteus mirabilis, and Klebsiella; many strains of N. gonorrhea; preoperative prophylaxis

♣ Not active against Enterobacter sp, and is less active against gram-positive streptococci and staphylococci than first generation cephalosporins.

Adverse Reactions: As common to penicillins, seizures, fever, urticaria, exfoliative dermatitis, vomiting, diarrhea, pseudomembranous colitis, thrombocytopenia, anemia, neutropenia, hemolytic anemia, prolonged bleeding time, elevated liver enzymes, elevated BUN and creatinine, hypersensitivity

♣ cefotetan induced hemolytic anemia is three times more common than other cephalosporins.

Parenteral dosing: (IM, IV)

Children: 40-80 mg/kg/day divided every 12 hours, maximum dose 6 gm/day

Preoperative prophylaxis:

IV:40 mg/kg 30-60 minutes prior to procedure

Gentamicin 2 mg/kg may be added for a ruptured hollow viscus

Adolescents and adults:

2-4 gm/day divided every 12 hours. Maximum dose 6 gm/day

Pelvic infections:

IV: 2 gm every 12 hours for 48 hours and doxycycline 100 mg IV / oral every 12 hours for 14 days

Preoperative prophylaxis:

1-2 gm 30-60 minutes before surgery

C. Cefoxitin (Mefoxin):

Indications: Septicemia, bone and joint, skin and soft tissue, lower respiratory tract, urinary tract, gynecological, and intra-abdominal infections due to susceptible gram- negative anaerobes like Bacteroides, enteric gram-negative bacilli like E. coli, Proteus mirabilis, and Klebsiella; many strains of N. gonorrhea; preoperative prophylaxis; not active against Enterobacter species

Adverse Reactions: As common to penicillins, fever urticaria, exfoliative dermatitis, vomiting, diarrhea, pseudomembranous colitis, thrombocytopenia, anemia, neutropenia, prolonged bleeding time, transient elevated liver enzymes, elevated BUN and creatinine, hypersensitivity

Parenteral dosing (IM, IV):

Neonates:

90-100 mg/kg/day divided every 8 hours

Infants > 3 months and children:

Mild to moderate infections: 80-100 mg/kg/day divided every 6-8 hours

Severe infections: 100-160 mg/kg/day divided every 4-6 hours, maximum dose 12 gm/day

Perioperative prophylaxis:

30-40 mg/kg 30-60 minutes before surgery, followed by same dose every 6 hours for 24 hours postoperatively

Adolescents and adults:

1-2 gm every 6-8 hours. Maximum dose 12 gm/day

Pelvic infections: IV 2 gm every 6 hours for 48 hours, and doxycycline 100 mg IV /oral every 12 hours for 14 days

Perioperative prophylaxis:

1-2 gm 30-60 minutes before surgery, followed by 1-2 gm every 6-8 hours for 24 hours postoperatively

D. Cefaclor:

Indications: Bone and joint, skin and soft tissue, middle ear, maxillary sinus, respiratory, and urinary tract infections due to susceptible gram-positive streptococci, pneumococci, staphylococci, and H. influenza (excluding beta-lactamse and ampilicillin resistant starins) and gram-negative bacilli like E. coli, Proteus mirabilis, and Klebsiella

Adverse Reactions: Common to penicillins, seizures, fever, confusion, urticaria, exfoliative dermatitis, erythema multiforme, Steven-Johnson syndrome, toxic epidermal necrolysis, vomiting, diarrhea, pseudomembranous colitis, stomatittis, thrombocytopenia, anemia, neutropenia, prolonged bleeding time, interstitial nephritis, elevated liver enzymes, hypersensitivity

Oral dosage:

Children > 1 month: 20-40 mg/kg/day divided every 8-12 hours

Maximum dose 2 gm/day

Middle ear infection: 40 mg/kg/day divided every 12 hours

Streptococcal Pharyngitis: 20 mg/kg/day divided every 12 hours

Adults: 250-500 mg every 8 hours or 2 gm/day divided every 12 hours

Streptococcal pharyngitis: 375 mg (extended release) every 12 hours

Skin and soft tissue infections:

375 mg (extended release) every 12 hours × 10 days

Uppper respiratory tract:

375 mg (extended release) every 12 hours × 10 days

E. Cefprozil:

Indications: Skin, soft tissue, middle ear, respiratory tract infections due to gram-positive group A beta-hemolytic streptococci, S. pneumonia, Staphylococcus aureus (except enterococcus and MRSA), and H. influenza, and M. catarrhalis

Adverse Reactions: Similar to cephalosporins and penicillins, serum sickness

Oral Dosage:

Infants > 6 months and children:

Middle ear infection: 30 mg/kg/day divided every 12 hours

Maximum dose: 1 gm/day

Streptococcal pharyngitis: 15 mg/kg/day divided every 12 hours

Maximum dose: 1 gm/day

Skin and soft tissue infections: 20 mg/kg/once daily

Children > 12 years and adults:

250-500 mg every 12 hours. or 500 mg every 24 hours

CEPHALOSPORINS (Third generation)

Cefotaxime, Ceftriaxone, Ceftizoxime, Ceftazidime, Cefpodoxime, Cefixime, Cefdinir

Action: Bactericidal, inhibit cell wall synthesis by binding to penicillin-binding proteins and inhibit transpeptidation step of peptidoglycan synthesis

Drug interactions: Probencid decreases the elimination of cephalosporins; cross-react with penicillin hypersensitivity and other cephalosporins; modify dosage in renal and hepatic impairment; use caution in patients with colitis

A. Cefotaxime:

Indications: Bone and joint, skin and soft tissue, lower respiratory, genito-urinary tract, and intra-abdominal infections due to gram-positive streptococci, pneumococci, staphylococci, and

meningeal infections (H. influenza); nonpseudomonal gram-negative bacilli infections not covered by 2nd generation and gram-negative bacilli infections in presence of aminoglycoside toxicity; N. gonorrheal urethritis and pelvic inflammatory disease

Adverse Reactions: Cardiac arrhythmias, fever, urticaria, vomiting, diarrhea, pseudomembranous colitis, thrombocytopenia, anemia, neutropenia, transient elevation of BUN, creatinine, and liver enzymes, hypersensitivity

Parenteral dosing (IM, IV):

Neonates:

Postnatal age < 7 days:

< 2 kg weight: 100 mg/kg/day divided every 12 hours

> 2 kg weight: 100-150 mg/kg/day divided every 8-12 hours

Postnatal age > 7 days:

< 2 kg weight: 150 mg/kg/day divided every 8 hours

> 2 kg weight: 150-200 mg/kg/day divided every 6-8 hours

Infants and children < 12 years:

< 50 kg: 100-200 mg/kg/day divided every 6-8 hours

Meningitis: 200 mg/kg/day divided every 6 hours

> 50 kg:

Moderate to severe infections: 1-2 gm every 6-8 hours

Life threatening infections: 2 gm/dose every 4 hours, maximum dose 12 gm/day

Children > 12 years and adults:

1-2 gm every 6-8 hours, maximum dose 12 gm/day

B. Ceftriaxone:

Indications: Septicemia, meningitis, bone and joint, skin and soft tissue, lower respiratory, genito-urinary tract, and intra- abdominal infections due to gram-negative aerobic bacilli and cocci infections (H. influenzae, Enterobacteriaceae, Neisseria, etc.); chancroid; resistant middle ear infections; variable activity against gram-positive cocci; emergecy management of infections with high risk for bacteremia; salmonellosis, shigellosis, and pneumonias of unestablished etiology; not active against Pseudomonas aeruginosa

Adverse Reactions: Fever, urticaria, rash, headache, vomiting, diarrhea pseudomembranous colitis, cholelithiasis, vaginitis, thrombocytopenia, anemia, neutropenia, transient elevation of BUN, creatinine, and liver enzymes

Parenteral dosing (IM, IV):

Neonates:

Postnatal age < 7 days: 50 mg/kg/day every 24 hours

Postnatal age > 7 days: < 2 kg weight: 50 mg/kg/day every 24 hours

> 2 kg weight: 50-75 mg/kg/day every 24 hours

Gonoccocal infection:

25-50 mg/kg/day every 24 hours for 7 days (14 days for suspected meningitis)

Infants and children:

50-75 mg/kg/day divided every 12-24 hours

Meningitis: 80-100 mg/kg/day divided every 12-24 hours, maximum dose 4 gm/day

Uncomplicated gonoccocal infection: 125 mg as a single dose

Complicated gonoccocal infections:

< 45 kg child:

Peritonitis, arthritis, bacteremia: 50 mg/kg/day every 24 hours for 7 days, maximum dose 1 gm/day

Meningitis: 50 mg/kg/day divided every 12 hours for 10-14 days, maximum dose 2 gm/day

Endocarditis: 50 mg/kg/day divided every 12 hours for 28 days, maximum dose 2 gm/day

> 45 kg child:

Peritonitis, arthritis, bacteremia: 1 gm/day every 24 hours for 7 days

Meningitis: 1-2 gm / dose every 12 hours for 10-14 days

Endocarditis: 1-2 gm / dose every 12 hours for 28 days

Relapsing middle ear infections: 50 mg/kg/day every 24 hours for 3 days

Acute epididymitis: 250 mg IM single dose

Chancroid: 50 mg/kg IM as a single dose (maximum 250 mg)

Adults:

1-2 gm every 12-24 hours (frequency depends on severity of infection)

Maximum dose 4 gm/day

C. Ceftizoxime:

Indications: Septicemia, meningitis, bone and joint, skin and soft tissue, lower respiratory, and urinary tract infections due to gram-negative aerobic enteric bacilli (E. coli, Klebsiella, Enterobacteriaceae) and gram-negatve cocci (H. influenzae, Neisseria); variable activity against gram-negative anaerobes, Bacteroid species than cefoxitime; variable activity against gram-positive cocci, but is not active against Pseudomonas aeruginosa

Adverse Reactions: Fever, urticaria, rash, headache, vomiting, diarrhea, vaginitis, thrombocytopenia, anemia, neutropenia, transient elevation of BUN, creatinine, and liver enzymes

Parenteral dosing (IM, IV):

Infants > 6 months and children:

150-200 mg/kg/day divided every 6-8 hours, maximum dose 12 gm/day

Adults:

1-2 gm every 8-12 hours

Uncomplicated gonoccocal infection: 1 gm IM as a single dose

Life threatining infections: 2 gm every 4 hours or 4 gm every 8 hours

D. Ceftazidime:

Indications: Septicemia, meningitis, bone and joint, skin and soft tissue, lower respiratory, genito-urinary tract, and intra-abdominal infections due to gram-negative cocci (H. influenzae, Neisseria) and gram-negative aerobic bacilli (including Enterobacteriaceae and Pseudomonas); pseudomonal infections in the presence of aminoglycoside toxicity and empiric therapy of infections in granulocytopenia

Adverse Reactions: Fever, urticaria, rash, headache, myoclonia, vomiting, diarrhea, pseudomembranous colitis, candidiasis, vaginitis, thrombocytopenia, anemia, neutropenia, hemolytic anemia, transient elevation of BUN and creatinine, transient elevation of liver enzymes, jaundice, anaphylaxis

Parenteral dosing (IM, IV):

Neonates:

Postnatal age < 7 days: > 2 kg weight:

100-150 mg/kg/day divided every 8-12 hours

Postnatal age > 7 days:

> 1.2 kg weight: 150 mg/kg/day divided every 8 hours

Infants and children (12 years):

100-150 mg/kg/day divided every 8 hours, maximum dose 6 gm/day

Meningitis: 150 mg/kg/day divided every 8 hours, maximum dose 6 gm/day

Adults: 1-2 gm every 8-12 hours

Urinary tarct infections: 250-500 mg every 12 hours

E. Cefpodoxime (Proxetil):

Indications: Uncomplicated N. gonorrheal infection, uncomplicated skin and soft tissue, lower respiratory tract (community-acquired pneumonias) infections due to streptococci, staphylococci, and H. influenza (non-beta-lactamse producing); upper respiratory and middle ear infections by H. Influenza and M. catarrhalis; urinary tract infections due to gram-negative bacilli like E. coli, Klebsiella, and Proteus; not active against Pseudomonas aeruginosa and Enterobacter

Adverse Reactions: Fever, rash, headache, vomiting, diarrhea pseudomembranous colitis, vaginal candidiasis, thrombocytopenia, anemia, neutropenia, prolonged PT and PTT, transient elevation of BUN, creatinine, and liver enzymes, jaundice

Oral dosage:

Infants (> 6 months) and children (< 12 years):

10 mg/kg/day divided every 12 hours, maximum dose 800 mg/day

Adolescents and Adults:

100-400 mg/dose every 12 hours

Uncomplicated gonococcal infection:

200 mg as a single dose

F. Cefixime (Suprax):

Indications: Urinary tract, skin and soft tissue, respiratory tract, and middle ear infections due to streptococci, staphylococci, H. influenza (non-beta-lactamse producing), and M. catarrhalis; gram-negative bacilli like E. coli, Klebsiella, Proteus, and Enterobacteriaceae; uncomplicated N. gonorrheal infection (urethritis, cervicitis) and shigellosis (TMP-SMX resistant)

Adverse Reactions:

common to other cephalosporins

Oral dosage:

Infants and Children:

8 mg/kg/day divided every 12-24 hours, maximum dose 400 mg/day

Acute UTI infection:

16 mg/kg/day divided every 12 hours × day 1, then 8 mg/kg/day every 24 hours for 13 days

Prophylaxis for sexual victimization:

8 mg/kg as a single dose (maximum 400 mg dose) plus azithromycin 20 mg/kg as a single dose (maximum dose 1 gm)

Begin hepatitis B immunization and prophylaxis for trichominasis and vaginal bacterial infection.

Adolescents and adults:

400 mg/day divided every 12-24 hours

Uncomplicated gonococcal infection:

400 mg as a single dose (maximum 400 mg dose) plus azithromycin 1 gm as a single dose / or doxycycline100 mg twice daily for 7 days

Prophylaxix for sexual victimization:

400 mg as a single dose plus azithromycin 1 gm as a single dose or

Doxycycline 100 mg twice daily for 7 days plus metronidazole 2 gm as a single dose plus begin hepatitis B immunization (if not fully immunized) and prophylaxis for HIV

G. Cefdinir (Omnicef):

Indications: Skin and soft tissue, respiratory tract, and middle ear infections due to susceptible gram-positive Streptococcus pyogenes and staphylococci; inadequate activity against beta-lactamse producing H. influenza and M. catarrhalis

Adverse Reactions: Common to other cephalosporins, Steven Johnson syndrome, hemolytic anemia, prologed PT, cholestatic jaundice

Oral dosage:

Infants (> 6 months) and children (< 12 years):

Middle ear and URT infections:

14 mg/kg/day divided every 12 hours for 5-10 days, Maximum 600 mg/day

Skin and Soft tissue infections:

14 mg/kg/day divided every 12 hours for 10 days, maximum 600 mg/day

Sinus infections:

14 mg/kg/day divided every 12 hours for 10 days, maximum 600 mg/day

Children > 12 years and Adults:

URT infections and exacerbation of chronic bronchitis:

600 mg once daily for 10 days or 300 mg every 12 hours for 5-10 days

Skin and soft tissue infections and community-acquired pneumonias:

300 mg every 12 hours for 10 days

Sinus infections:

600 mg once daily for 10 days or 300 mg every 12 hours for 10 days

CEPHALOSPORINS (Fourth generation)

Cefepime:

Action: Bactericidal, inhibits cell wall synthesis by binding to penicillin-binding proteins and inhibits transpeptidation step of peptidoglycan synthesis

Drug interactions: Probencid decreases the elimination of cephalosporins; potentiate aminoglycoside toxicity; cross-react with penicillin hypersensitivity and other cephalosporins; modify dosage in renal impairment; use caution in patients with colitis

Indications: Skin and soft tissue, lower respiratory, and urinary tract infections; more active than 3rd generation against gram-positive bacteria such as staphylococci, aerobic gram-negative bacilli infections resistant to 3rd generation; active against Pseudomonas aeruginosa and monotherapy in febrile neutropenia

Adverse Reactions: Headaches, encephalopathy, fever, rash, urticaria, vomiting, diarrhea, pseudomembranous colitis, thrombocytopenia, anemia, neutropenia, agranulocytosis, transient elevation of BUN, creatinine, and liver enzymes, hypersensitivity

Parenteral dosing:

Infants > 2 months and children < 16 years:

< 40 kg: 50 mg/kg / dose every 12 hours

Monotherapy for febrile neutropenia:

50 mg/kg / dose every 8 hours

Bronchopulmoanry infection in cystic fibrosis:

50 mg/kg/dose every 8 hours (maximum 2 gm/dose every 8 hours)

Meningitis:

50 mg/kg every 8 hours

Adults:

1-2 gm every 12 hours

Pseudomonal infections:

Use higher or more frequent dosing

Monotherapy for febrile neutropenia:

2 gm every 8 hours

Urinary tract infections:

500 mg every 12 hours

7. QUINOLONES

Ciprofloxacin, Levofloxacin, Ofloxacin, Nalidixic acid

Actions: Inhibits DNA-gyrase and topoisomerase IV in susceptible organisms; promotes breakage of double-stranded DNA; DNA gyrase is essential for maintenance of DNA helical structure, replication, repair, transcription, and recombination

Drug interactions and precautions: Probenecid and cimetidine increase serum ciporoflaxacin (quinolone) concentrations; magnesium, aluminum, and calcium containing antacids decrease ciprofloxacin absorbtion; quinolones decrease warfarin clearance and along with NSAIDs prolongs INR (prothrombin time); decrease theophylline clearance and concomitant use may result in seizures, cardiac arrest, and respiratory failure; use with caution in seizure disorders and renal impairment

♣ Not a first drug of choice in pediatric patients; usuage may result in tendon, cartilage, and joint abnormalities, especially along with use of a steroid.

Indications: Documented or suspected pseudomonal infections of bone and joint, skin, soft tissue, respiratory tract, and urinary tract; complicated pyelonephritis and urinary tract infections in children due to E. coli; infections due to multidrug- resistant gram-positive staphylococci, Mycobacterium tuberculosis, and aerobic gram-negative bacilli; management of exacerbation of respiratory infections in cystic fibrosis; infectious diarrheas due to Salmonella, Shigella, and Campylobacter jejuni (use oral dosage)

Adverse Reactions: Pruritis, urticaria, erythema multiforme, Steven-Johnson syndrome, anaphylaxis, fever, headaches, seizures, hallucinations, agitation, somnolence, hypertension, hypotension, torsade de pointes, angina, bronchospasm, pulmonary edema, anemia, neutropenia, esinophilia, hyperglycemia, hyperlipidemia, electrolyte abnormalities, nausea, vomiting, diarrhea, GI bleeding, pseudomembranous colitis, pancreatitis, elevated liver enzymes, cholestatic jaundice, arthropathies, tendinitis, tendon rupture, myalgia and peripheral neuropathy, elevated BUN and creatinine, interstitial nephritis, renal failure

A. Ciprofloxacin:

Neonates:

Intravenous:

7-40 mg/kg/day divided every 12 hours

Children:

Oral dose:

20-30 mg/kg/day in 2 divided doses, maximum dose 1.5 gm/day

Intravenous:

20-30 mg/kg/day divided every 12 hours, maximum dose: 800 mg/day

Anthrax (initial or postexposure treatemt):

Intravenous:

20 mg/kg/day divided every 12 hours for 60 days, maximum dose: 800 mg/day

Oral dose:

30 mg/kg/day in 2 divided doses for 60 days, maximum dose 1 gm/day

Complicated UTI or pyelonephritis:

Intravenous:

18-30 mg/kg/day divided every 8 hours for 10-21 days

Maximum dose: 1200 mg/day

Oral dose:

20-40 mg/kg/day in 2 divided doses for 10-21 days

Maximum dose: 1.5 gm/day

Cystic fibrosis:

Oral dose:

40 mg/kg/day in 2 divided doses, maximum dose 2 gm/day

Intravenous:

30 mg/kg/day divided every 8-12 hours, maximum dose 1.2 gm/day

Adults:

Oral dose:

250-750 mg every 12 hours depending on severity of infection

Uncomplicated UTI or pyelonephritis:

100-250 mg every 12 hours for 3 days or

500 mg (extended release) every 24 hours for 3 days

Complicated UTI or pyelonephritis:

500 mg every 12 hours for 7-14 days or

1000 mg (extended release) every 24 hours for 7-14 days

Anthrax (initial or postexposure treatemt):

Oral dose:

500 mg every 12 hours for 60 days

Intravenous:

200-400 mg every 12 hours depending on severity of infection

400 mg every 12 hours for 60 days (treatment of infection)

Infectious diarrhea:

500 mg every 12 hours for 5-7 days

Uncomplicated gonococcal infection:

500 mg as a single dose

Chancroid:

500 mg twice daily for 3 days

B. Levofloxacin:

Actions:

L-isomer of ofloxacin inhibits DNA-gyrase (bacterial topoisomerase IV) in susceptible organisms, promoting breakage of double-stranded DNA; DNA gyrase is essential for maintenance of DNA helical structure, replication, repair, transcription, and recombination

Indications: Maxilllary sinus, skin, soft tissue, lower respiratory tract, complicated urinary tract infections, pyelonephritis, community-acquired pneumonias due to multidrug-resistant organisms such as Streptococcus pneumonia (penicillin resistant strains), Staphylococcus aureus, Mycobacterium tuberculosis, Hemophilus influenzae, H. parainfluenzae, Moraxella catarrhalis, Klebsiella pneumonia, Legionella pneumophila, Chlamydia pneumoniae, Mycoplasma pneumoniae, E. coli, Enterobacter cloacae, Enterococcus fecalis, S. pyogenes, and Proteus mirabilis; infectious diarrheas due to Salmonella, Shigella, E, coli, Campylobacter jejuni, and Vibrio-parahemolyticus; postexposure prophylaxis of anthrax

♣ Less active against pseudomonas aeruginosa than ciprofloxacin; combination with a betalactam or anti- pseudomonal drug is recommended.

Adverse Reactions: Similar to quinolones, congestive heart failure, prolongation of QT, toxic epidermal necrolysis, thrombocytopenia, hemolytic anemia

Oral / Intravenous dosage:

Children: (little information available for use)

6 months - 5 years:

10 mg/kg / dose every 12 hours

> 5 years:

10 mg/kg/dose every 24 hours, maximum dose 500 mg/day

Adults:

Community-acquired pneumonia:

500 mg every 24 hours for 7-14 days or

750 mg every 24 hours for 5 days

Nosocomial pneumonia:

750 mg every 24 hours for 7-14 days

Chronic bronchitis:

500 mg every 24 hours for 7 days

Acute maxillary sinus infection:

500 mg every 24 hours for 10-14 days

Complicated UTI or pyelonephritis:

250 mg every 24 hours for 10 days

Uncomplicated UTI:

250 mg every 24 hours for 3 days

Complicated skin and soft structure infection:

750 mg every 24 hours for 7-14 days

Drug-resistant tuberculosis:

500-1000 mg every 24 hours (maximum dose 1 gm)

Infectious (traveler’s) diarrhea:

500 mg every 24 hours for 3 days

Anthrax (postexposure treatment):

500 mg every 24 hours for 60 days

C. Ofloxacin:

Actions: Inhibits DNA-gyrase (bacterial topoisomerase II) in susceptible organisms, promoting breakage of double-stranded DNA; DNA gyrase is essential for maintenance of DNA helical structure, replication, repair, transcription, and recombination

Indications: Acute exacerbations of bronchitis, uncomplicated skin, soft tissue, and urinary tract infections, community-acquired pneumonias, uncomplicated urethral and cervical gonorrhea, pelvic inflammatory disease, complicated urinary tract and prostate infections due to susceptible organisms such as Staphylococcus aureus, Streptococcus pyogenes, Streptococcus pnemoniae, C. koseri, H. influenzae, Klebsiella pneumonia, E. coli, Enterobacter aerogenes, Proteus mirabilis, Pseudomonas aeruginosa, N. gonorrhea, and C. trachomatis

Adverse Reactions: Similar to other quinolones, congestive heart failure, prolongation of QT, toxic epidermal necrolysis, thrombocytopenia, hemolytic anemia

Oral dosage:

Children: (limited information available for use)

15 mg/kg/day divided every 12 hours

Adults:

Community-acquired pneumonia, chronic bronchitis, and uncomplicated skin and soft structure infection:

400 mg every 12 hours for 10 days

Uncomplicated cervical and urethral gonorrhea:

400 mg as a single dose

Nongonococcal cervicitis and urthritis (c. trachomatis):

300 mg every 12 hours for 7 days

Pelvic inflamatory disease:

400 mg every 12 hours for 10-14 days

Uncomplicated UTI (cystitis):

200 mg every 12 hours for 3 days

Complicated UTI or pyelonephritis:

200 mg every 12 hours for 10 days

Prostate infection:

300 mg every 12 hours for 6 weeks

D. Nalidixic Acid (NegGram):

Actions: DNA gyrase is essential in organisms for maintenance of DNA helical structure, replication, repair, transcription, and recombination; inhibits DNA–gyrase (bacterial topoisomerase) promoting breakage of double-stranded DNA

Indications: Lower urinary tract infections due to susceptible gram-negative organisms such as Klebsiella pneumonia, E. coli, Enterobacter, and Proteus mirabilis; inactive against Pseudomonas

Adverse Reactions: Similar to other quinolones, mteabolic acidosis, elevated ICP (intracranial pressure), insomnia, but uncommon cardiovascular complications

Oral dosgae:

Children > 3 months:

55 mg/kg/day divided every 6 hours

Prophylaxixs of UTI:

30 mg/kg/day divided every 12 hours

Adults:

Initial dose:

1 gm 4 times a day for 1-2 weeks

Suppressive therapy:

500 mg 4 times a day

8. AMINOGLYCOSIDES

Gentamicin, Tobramycin, Amikacin, Streptomycin, Neomycin

Actions: Inhibits bacterial protein synthesis by binding to 30S and 50S riibosomal subunits and results in defective bacterial cell membrane

Drug interactions and precautions: Increased toxicity with concurrent use of amphotericin B, magnesium, penicillins, cephalosporins, vancomycin, and loop diuretics; potentate the effect of neuromuscular blocking agents; once daily administration may result in pyrogenic endotoxin-like

reaction (fever, chills, tachycardia, and hypotension); modify dosage and exercise caution in neonates (renal immaturity), neonates on ECMO, renal impairment, depressed neuromuscular transmission, hypocalcaemia, and auditory or vestibular impairment

Indications: Treatment of endocarditis, septicemia, bone, CNS, skin and soft tissue, respiratory tract, abdominal, and urinary tract infections due to susceptible gram-negative organisms such as E. coli, Enterobacter, Proteus, Pseudomonas, Serratia, and gram positive Staphylococcus aureus; prophylaxis against bacterial endocarditis in high risk patients; in combination with ampicillin used as empiric therapy for sepsis in newborns

Adverse Reactions: Vertigo, dizziness, unstable gait, ataxia, neuromuscular blockade, muscle cramps, optic neuritis, hypomagnesemia, nausea and vomiting, elevated liver enzymes, granulocytopenia, thrombocytopenia, ototoxicity (correlates with high serum levels and duration of Rx) with tinnitus, vertigo(vestibular damage), and hearing loss; nephrotoxicity (due to high trough levels), urine casts, proteinuria, decreased GFR, elevated BUN and creatinine

A. Gentamicin (Garamycin):

Parenteral dosage (IM, IV):

♣ The usual dosage should be based on ideal body weight than actual weight, except in neonates. Neonatal dosage is based on actual weight.

Neonates:

Postnatal age < 7 days:

2.5 mg/kg/dose every 12 hours

Postnatal age > 7 days:

< 2 kg: 2.5 mg/kg/dose every 8-12 hours

> 2 kg: 2.5 mg/kg/dose every 8 hours

Neonates on ECMO:

Initial dose: 2.5 mg/kg/dose every 18 hours

Subsequent dosing: Determined by monitoring serum levels

Once daily dose:

Premature neonate:

3.5 to 4 mg/kg/dose every 24 hours

Full term neonate:

3.5 to 5 mg/kg/dose every 24 hours

Infants and children:

2.5 mg/kg/dose every 8 hours or

5 to 7.5 mg/kg/dose every 24 hours

Endocarditis prophylaxis (high risk patients):

1.5 mg/kg/dose (maximum 120 mg) 30 minutes prior to procedure, plus ampicillin or vancomycin

Pulmonary infections in cystic fibrosis:

2.5 to 3.3 mg/kg/dose every 6 to 8 hours

Hemodialysis:

1.25 to 1.75 mg/kg/dose postdialysis

Some children and infants may require more frequent dosing (every 6 hours) based on serum levels, renal function, and clinical condition.

Adults:

3 to 6 mg/kg/day in divided doses every 8 hours or once daily dosing of 4 to 6.6 mg/kg / day every 24 hours

Endocarditis prophylaxis: (high risk patients):

1.5 mg/kg/dose (maximum 120 mg) 30 minutes prior to procedure, plus ampicillin or vancomycin

Hemodialysis:

0.5 to 0.7 mg/kg/dose postdialysis

Table 16.4 *Modification of gentamicin dose in renal impairment.*

Creatine clearance mL/minute/1.73 m^2	Dose	Frequency
40-60 mL/minute	2.5 mg/kg	every 12 hours
20-40 mL/minute	2.5 mg/kg	every 24 hours
< 20 mL/minute	2.5 mg/kg	Monitor serum levels, half life and Vd to determine frequency

Vd = volume of distribution of drug, Vd = Ab/Cp (Ab = amount of drug in the body or dose administered, Cp = plasma drug concentration).

B. Tobramycin:

Indications: Treatment of endocarditis, septicemia, bone, CNS, skin and soft tissue, respiratory tract, abdominal, and urinary tract infections due to Pseudomonas aeruginosa and susceptible nonpseudomonal gram-neagative enteric organisms (E. coli, Enterobacter, Proteus, Serratia) that are more sesitive to tobramycin than gentamicin; empiric therapy in cystic fibrosis and immunocompromised

Parenteral dosage (IM, IV):

♣ The usual dosage should be based on ideal body weight than actual weight, except in neonates. Neonatal dosage is based on actual weight.

Neonates:

Postnatal age < 7 days:

2.5 mg/kg/dose every 12 hours

Postnatal age > 7 days:

< 2 kg: 2.5 mg/kg/dose every 8-12 hours

> 2 kg: 2.5 mg/kg/dose every 8 hours

Infants and children:

2.5 mg/kg/dose every 8 hours

Pulmonary infections in cystic fibrosis:

2.5 to 3.3 mg/kg/dose every 6 to 8 hours

Hemodialysis:

1.25 to 1.75 mg/kg/dose post Dialysis

Adults:

3 to 6 mg/kg/day in divided doses every 8 hours or

Once daily dosing:

4 to 6.6 mg/kg/day every 24 hours

Hemodialysis:

0.5 to 0.7 mg/kg/dose post dialysis

C. Amikacin:

Indications: Treatment of gram-neagative enteric infections (e.g., E. coli, Enterobacter, Proteus, Pseudomonas, Serratia, Klebsiella) resistant to gentamicin and tobramycin; active against mycobacterial organisms

Parenteral dosage (IM, IV):

♣ The usual dosage should be based on ideal body weight than actual weight, except in neonates. Neonatal dosage is based on actual weight.

Neonates:

Postnatal age < 7 days:

7.5-10 mg/kg/dose every 12 hours

Postnatal age > 7 days:

< 2 kg: 7.5-10 mg/kg/dose every 8-12 hours

> 2 kg: 10 mg/kg/dose every 8 hours

Infants and children:

15-22.5 mg/kg/day divided every 8 hours

Nontuberculous mycobacterial infection:

15-30 mg/kg/day divided every 12-24 hours as a part of multiple drug regimen, maximum 1.5 gm/day

Adults:

15 mg/kg/day in divided doses every 8-12 hours, maximum 1.5 gm/day

Mycobacterial infection (M. avium complex):

7.5-15 mg/kg/day divided every 12-24 hours as a part of multiple drug regimen

D. Streptomycin:

Indications: Used in combination with other drugs for streptococcal and enterococcal endocarditis, mycobacterial infections, brucellosis, tularemia, and as a combination treatment for active tuberculosis

Adverse Reactions: Common to other aminoglycosides, myocarditis, cardiovascular collapse, toxic epidermal necrolysis

Parenteral dosing (IM, IV): Use IV if IM is not feasible

Neonates:

10-20 mg/kg/day once daily

Infants:

20-30 mg/kg/day in divided doses every 12 hours

Children:

Nonmycobacterial infections:

20-40 mg/kg/day divided every 6-12 hours in combination with other antibiotics

Plague:

30 mg/kg/day divided every 8-12 hours

Tuberculosis:

20-40 mg/kg/day once daily, not to exceed 1 gm/day or

20-40 mg/kg dose twice weekly, not to exceed 1.5 gm/dose

Discontinue the drug after 3 months of treatment, and susceptibility of other agents (rifampin, isoniazid) are to be established.

Adults:

Streptococcal endocarditis:

1 gm every 12 hours for 1 week, then 500 mg every 12 hours for 1 week

Enterococcal endocarditis:

1 gm every 12 hours for 2 weeks, then 500 mg every 12 hours for 4 weeks in combination with penicillin

Plague:

2 gm/day in divided doses until patient is afebrile for 3 days

Tularemia:

1-2 gm/day in divided doses for 7-10 days or afebrile for 5-7 days

Tuberculosis:

15 mg/kg/day once daily, not to exceed 1 gm/day, / or

25-30 mg/kg dose twice weekly, not to exceed 1.5 gm/dose

Discontinue the drug after 3 months of treatment and susceptibility of other agents (rifampin, isoniazid) are to be established.

E. Neomycin:

Indications: Treatment of hepatic encephalopathy, diarrhea due to E. Coli, preoperative preparation of gastrointestinal tract for surgery, and minor skin infections

Adverse Reactions: Common to aminoglycosides, malabsorbtion, candidiasis; potentiates oral anticoagulant action; neomycin given parenterally is more toxic than other aminoglycosides

♣ Parenteral administration is not recommended.

Oral doasge:

Neonates:

Diarrhea:

50 mg/kg/day divided every 6 hours

Children:

50 mg/kg/day divided every 6-8 hours

Preoperative

90 mg/kg/day divided every 4 hours for 2 days or 25 mg/kg/dose at 1 PM, 2 PM, and 11 PM day preceding surgery in combination with mechanical bowel preparation and erythromycin base

Hepatic encephalopathy:

2.5 to 7 gm/m^2/day divided every 4-6 hours for 5 days, maximum dose 12 gm/day

Diarrhea due to enteropathogenic E. Coli:

50 mg/kg/day divided every 6 hours for 2-3 days

Adults:

500-2000 mg/day divided every 6-8 hours

Preop bowel preparation:

1 gm each hour for 4 doses, then 1 gm every 4 hours ×5 doses or 1 gm dose at 1 PM, 2 PM, and 11 PM day preceeding surgery in combination with mechanical bowel preparation and erythromycin base or 6 gm/day divided every 4 hours for 3 days

Hepatic encephalopathy:

4-12 gm/day divided every 4-6 hours for 5 days

Diarrehea due to enteropathogenic E. Coli:

3 gm/day divided every 6 hours for 2-3 days.

9. CARBAPENEMS

Ertapenem, Imipenem, Meropenem

Actions:

Inhibit bacterial cell wall synthesis by binding to penicillin-binding proteins.

Indications: Infections due to multidrug-resistant gram-positive and gram-negative aerobic and anaerobic organisms such as S. aureus, S. pyogenes, S. pnemoniae, H. inflenza, M. catarrhalis, E. coli, Klebsiella, Enterobacter, B. fragilis, and Pseudomonas aueroginosa

Drug interactions and precautions:

Probenecid increases serum carbapenems concentrations; cross-react with penicillins, cephalosporins, other beta-lactams hypersensitivity; use with caution in seizure disorders, renal impairment, and adjust dose in renal impairment

Adverse Reactions:

Rash, pruritis, urticaria, anaphylaxis, fever, headaches, seizures, hallucinations, agitation, altered mental status, hypotension, tachycardias, angina, respiratory distress, elevated platelet count and eosinophil counts, nausea, vomiting, diarrhea, oral candidiasis, pseudomembranous colitis, pancreatitis, elevated liver enzymes, cholelithiasis, renal dysfunction, hematuria

A. Ertapenem (Invanz):

Indications: Skin and soft tissue, complicated intra-abdominal, pelvic and urinary tract infections, and community-acquired pneumonias due to susceptible anaerobes, E. coli, Klebsiella, H. influenza (beta-lactamase negative), Staphylococcus aureus (methicillin sensitive strains), Streptococcus pneumonia, S. pyogenes, and S. agalactiae

Parenteral dosage: (IM, IV):

Children > 3 months to 12 years:

15 mg/kg/dose every 12 hours, maximum 1 gm/day

Adolescents and adults:

1 gm once daily

Duration of treatment: Intra-abdominal infections: 5-14 days

Acute pelvic infections: 3-10 days

Skin and soft tissue infections: 7-14 days

Urinary tract infections: 10-14 days

Community-acquired pneumonias: 10-14 days

B. Imipenem and Cilastin (Primaxin):

Actions: Similar to other carbapenems, strong affinity for PBPs (penicillin binding proteins) 1 and 2; cilastin inhibits renal metabolism of imipenem by competitive inhibition of peptidases in proximal tubules

Indications: Multidrug-resistant gram-negative infections of bone and joint, skin and soft tissue, lower respiratory tract, intra-abdominal, pelvic, urinary tract, endocarditis, and septicemia; treatment of multiple organisms infections, in which other agents have limited spectrum or increased toxic potential; treatment of gram-negative sepsis in immunocompromised

Adverse Reactions: Similar to carbapenems, neutropenia, eosinophilia, and discoloration of urine; emegence of resistant strains of Pseudomonas aeruginosa

Parenteral dosage (IV, IM):

♣ IM dosing is given in mild to moderate infections only and dosing is based on imipenem component of primaxin.

Neonates:

Postnatal age < 7 days:

50 mg/kg/day divided every 12 hours

Postnatal age > 7 days:

< 1.5 kg: 50 mg/kg/day divided every 12 hours

> 1.5 kg: 75 mg/kg/day divided every 8 hours

Infants (4 weeks to < 3 months):

100 mg/kg/day divided every 6 hours

Infants (> 3 months) and Children:

60-100 mg/kg/day divided every 6 hours

Maximum dose 4 gm/day

Adults:

Serious infections:

2-4 gm/day divided every 6 hours

Mild to moderate infections:

1-2 gm/day divided every 6-8 hours

Table 16.5 *Primaxin dosage in renal impairment.*

Creatinine clearance mL/min/1.73 m ^{2}	% decrease in daily dosage	Frequency
41-70	50	6 hours
21-40	65	8 hours
6-20	75	12 hours
< 6 ---- give only if on hemodialysis		

C. Meropenem:

Actions: Similar to other carbapenems, strong affinity for PBPs (pencillin binding proteins) 2, 3, 4 of E. coli and Pseudomonas aeruginosa, and strong affinity for PBPs 1, 2, 4 of Staphylococcus aureus exerts it bactericidal effect

Indications: Infections of skin and soft tissue, lower respiratory tract, pelvic and urinary tract due to multidrug-resistant gram-positive and gram-negative aerobic and anaerobic organisms such as S. aureus, S. pyogenes, S. Pneumoniae, H. inflenza, M. catarrhalis, E. coli, Klebsiella, Enterobacter, Serratia, Pseudomonas, Bacteroides fragilis, and Bacteroides cepacia

Adverse Reactions: Similar to carbapnemes and neutropenia

Pareteral dosage (IV only):

Neonates:

Postnatal age < 7 days:

20 mg/kg/dose every 12 hours

Postnatal age > 7 days:

< 2 kg: 20 mg/kg/dose every 12 hours

> 2 kg: 20 mg/kg/dose every 8 hours

Children > 3 months:

60 mg/kg/day divided every 8 hours, maximum dose 6 gm/day

Adults:

1.5-3 gm/day divided every 8 hours, maximum dose 6 gm/day

10. CARBACEPHEMS

Loracarbef:

Actions: Inhibits bacterial cell wall synthesis by binding to one or more of penicillin-binding proteins; inhibits final transpepidation step of peptidoglycan synthesis in bacterial cell wall

Drug interactions and precautions: Probenecid ↑ serum carbacephem concentrations; hypersentivity reactions cross-react with penicillins, cephalosporins, and other beta-lactams; use with caution in renal impairment, colitis, and adjust dose in renal impairment

Indications: Mild to moderate community-acquired skin and soft tissue, respiratory tract, and urinary tract infections due to susceptible Staphylococcus aureus, S. pyogenes, S. Pneumoniae, H. inflenza, M. catarrhalis, and E. coli

Adverse Reactions: Rash, pruritis, urticaria, Steven-Johnson syndrome, anaphylaxis, headaches, insomnia, agitation, fever, somnolence, hypotension (due to vasodilatation), thrombocytopenia, neutropenia, eosinophilia, nausea, vomiting, diarrhea, oral candidiasis, pseudomembranous colitis, elevated liver enzymes, cholestatic jaundice, renal dysfunction, elevated BUN and creatinine

Oral doage:

Children (6 months-12 years):

Acute sinus and middle ear infections:

30 mg/kg/day divided every 12 hours for 10 days

URT and Skin and soft structure:

15 mg/kg/day divided every 12 hours

Adults:

URT, pneumonias, bronchitis:

400 mg every 12 hours

Uncomplicated UTI:

200 mg once daily for 7 days

Skin and soft tissue infections:

200 mg every 12 hours

Pyelonephritis (uncomplicated):

400 mg every 12 hours for 14 days

11. MACROLIDES

Erythromycin, Azithromycin, Clarithromycin

A. Erythromycin:

Action: Inhibits bacterial RNA dependent protien synthesis by binding to 50S ribosomal subunit and blocks transpeptidation step

Indications: Mild to moderately severe upper and lower respiratory tract, skin and soft tissue infections due to susceptible gram-positive staphylococci, streptococci, Mycoplasma pneumonia, Legionella pneumonia, Lyme disease, Chlamydia, chancroid, diptheria, pertussis, Campylobacter gastroenteritis, and preoperative bowel preparation

Drug interactions and precautions: Decreases clearnace of cisapride, terfenadine, pimozide, and increases the risk of cardiac arrhythmias; decreases clearance of lovastatins and simvastatins, and concomitant use results in rhabdomyolysis

Potentiate anticoagulant effect of warfarin; hepatic impairment in older children and adults; benzyl alcohol (> 99 mg/kg/day) component of erythromycin lactobionate injection produces fatal ‘gasping syndrome’ in neonates

Adverse Reactions: Rash, pruritis, anaphylaxis, dizziness, fever, ototoxicity (IV use), ventricular arrhythmias, prolongation of QT, bradycardia, hypotension (IV administration), eosinophilia, cholestatic jaundice, hepatic toxicity (0.1% in children, 0.25% in adults), nausea, vomiting, diarrhea, stomatitis, pseudomembranous colitis, infantile hypertrophic pyloric stenosis

Neonates:

Oral doasage (ethyl succinate salt):

Postnatal age < 7 days:

20 mg/kg/day in divided doses every 12 hours

Postnatal age > 7 days:

< 2 kg: 20-30 mg/kg/day divided every 12 hours

> 2 kg: 30-40 mg/kg/day divided every 6-8 hours

Chlamydial pneumonia:

50 mg/kg/day divided every 6 hours for 14 days

Infants and children:

Oral doasage:

(200 mg of ethyl succinate salt is equivalent to 125 mg of erythromycin base or 125 mg of estolate)

Base: 30-50 mg/kg/day divided every 6-8 hours, not to exceed 2 gm/day

Ethyl succinate: 30-50 mg/kg/day divided every 6-8 hours, not to exceed 3.2 gm/day

Estolate: 30-50 mg/kg/day divided every 6-12 hours, not to exceed 2 gm/day

Stearate: 30-50 mg/kg/day divided every 6 hours, not to exceed 2 gm/day

Chlamydial pneumonia:

50 mg/kg/day divided every 6 hours for 10-14 days

Preoperative bowel preparation:

20 mg/kg of erythromycin base at 1, 2, and 11 PM a day prior to surgery along with neomycin and mechanical bowel prep

Intravenous (lactobionate salt):

15-50 mg/kg/day divided every 6 hours, not to exceed 4 gm/day

Prokinetic agent (improves gastric and intestinal motility):

Initial dose: 1-3 mg/kg IV infused over 60 minutes, followed by a dose of 20 mg/kg/day orally in 2-4 divided doses before meals

Adults:

Oral doasage:

Estolate, stearate, base: 250-500 mg every 6-12 hours

Ethyl succinate: 400-800 mg every 6-12 hours

Base delayed release: 333 mg every 8 hours

Chlamydial infections:

Base: 500 mg every 6 hours for 7 days or

Ethyl succinate: 800 mg every 6 hours for 7 days

Preoperative bowel preparation:

1 gm of erythromycin base at 1, 2, and 11 PM a day prior to surgery, given along with neomycin and mechanical bowel prep

Intravenous (lactobionate salt):

5-20 mg/kg/day divided every 6 hours, not to exceed 4 gm/day

(may be given as a continuous infusion over 24 hr)

Prokinetic agent (improves gastric and intestinal motility):

Initial dose: 200 mg IV infused over 60 minutes, following dose: 250 mg orally 3 times a day before meals

B. Azithromycin:

Action:

Simialr to other macrolides

Indications:

Mild to moderately severe infections of upper and lower respiratory tract, community-acquired pneumonias, skin and soft tissue, middle ear, urethral, and cervical infections due to susceptible Staphylococcus aureus, S. pneumoniae, M. catarrhalis, N. Ngonorrhea, H. inflenzae. N. gonorrhea, H. inflenzae, Mycoplasma pneumoniae, Mycobacterium avium complex, Chlamydia pneumoniae, C. psittaci, and C. trachomatis; pulmonary infection in cystic fibrosis; treatment of babesiosis and endocarditis prophylaxis

Drug interactions and precautions:

Interact with same drugs like other macrolide agent erythromycin; use caution in patients with hepatic or renal impairment

Adverse Reactions: Rash, pruritis, Steven Johnson syndrome, toxic epidermal necrolysis, photosensitivity, ventricular arrhythmias, palpitation, angina, hypotension, headache, insomnia, agitation, fatigue, seizures, thrombocytopenia, anemia, leukopenia, cholestatic jaundice, nausea,

vomiting, diarrhea, oral candidiasis, pseudomembranous colitis, pancreatittis, abdominal pain, nephritis, acute renal failure, ototoxicity, anaphylaxis

Oral dose:

Children > 6 months:

Respiratory tract infections:

10 mg/kg / on a day 1 (maximum dose 500 mg/day), followed by 5 mg/kg/day once daily on days 2 to 5 (maximum dose 250 mg/day)

Middle ear infection:

Single dose regimen:

30 mg/kg dose (maximum 1500 mg)

Three day regimen:

10 mg/kg once daily for 3 days (maximum 500 mg/day)

Five day regimen:

10 mg/kg dose on a day 1 (maximum dose 500 mg), followed by 5 mg/kg/day once daily on days 2 to 5 (maximum dose 250 mg/day)

Children > 2 years:

Upper respiratory tract infections:

12 mg/kg once daily for 5 days (maximum 500 mg/day)

Uncomplicated Chlamydial urethritis, cervicitis:

Single 10 mg/kg dose (maximum 1 gm)

Primary prevention of disseminated MAC (mycobacterium avium complex):

5 mg/kg/day once daily (maximum dose 250 mg/day) or 20 mg/kg / (maximum dose 1200 mg) once weekly given alone or in combination with rifabutin

Treatment and secondary prevention of disseminated MAC:

5 mg/kg/day once daily (maximum dose 250 mg/day) in combination with ethambutol with or without rifabutin

Babesiosis:

12 mg/kg/day once daily for 7-10 days along withoral atovaquone 40 mg/kg/day divided twice daily

Endocarditis prophylaxis:

15 mg/kg/dose 1 hour before procedure

Children > 6 years and adolescents:

Cystic fibrosis (chronic Pseudomonas aeruginosa infection):

> 25 kg - < 40 kg:

250 mg three times weekly (Mon, Wed, Fri), if not tolerated decrease to twice or once weekly

> 40 kg:

500 mg three times weekly, if not tolerated decrease to twice or once weekly

Adolescents > 16 years and adults:

Oral dose:

Respiratory tract, skin, and soft tissue infections:

500 mg on a day 1, followed by 250 mg once daily on days 2-5

Exacerbation of infection in COPD:

500 mg once daily for 3 days

Nongonococcal (chlamydial) urethritis, cervicitis, and chancroid:

Single 1 gm dose

Primary prevention of disseminated MAC:

1200 mg once weekly given alone or combination with rifabutin

Treatment and secondary prevention of disseminated MAC:

500 mg once daily in combination with ethambutol with or without rifabutin

Intravenous:

500 mg once daily for 2 days, followed by oral dose therapy

C. Clarithromycin:

Actions: Simialr to other macrolides, 14-hydroxy compound is twice more potent

Indications: Skin and soft tissue, middle ear, mild to moderately severe infections of upper and lower respiratory tract, and community-acquired pneumonias due to Staphylococcus aureus, Streptococcus pneumoniae, M. catarrhalis, N. gonorrhea, H. inflenzae, Mycoplasma pneumoniae,

Chlamydia trachomatis, Legionella species; prevention and treatment of mycobacterium avium complex (MAC) infection in HIV patients; eradication of Helicobacter pylori infection and endocarditis prophylaxis (in penicillin allergy)

Drug interactions and precautions: Interact with same drugs like other macrolide agents; use caution in patients with hepatic or renal impairment; fluconazole and ritonavir increase calrithromycin levels; safety of drug is not established in chidren < 6 months of age

Adverse Reactions: Similar to other macrolides, rash, pruritis, Steven Johnson syndrome, headache, hallucinations, eevated PT, leukopenia, hyperbilirubinemia, nausea, vomiting, diarrhea, dysguesia, stomatitis, pseudomembranous colitis, pancreatittis, abdominal pain, nephritis, acute renal failure, ototoxicity, anaphylaxis

Infants and children

Oral dosage:

Respiratory tract, skin, and soft tissue infections:

15 mg/kg/day divided evry 12 hours for 7-10 days

Middle ear infection:

15 mg/kg/day divided evry 12 hours for 10 days

Endocarditis prohylaxis:

15 mg/kg / dose 1 hour before procedure

Primary prevention of disseminated MAC as determined by CD4 counts:

15 mg/kg/day divided every 12 hours, maximum dose 1 gm/day given alone or in combination with rifabutin; follow schedule given below:

Children < 12 months: < 750 cells / microliter (uL)

1-2 years: < 500 cells/uL

2-6 years: < 75 cells/uL

> 6 years: < 50 cells/uL

Treatment and secondary prevention of disseminated MAC:

15 mg/kg/day divided every 12 hours, maximum dose 1 gm/day given in combination with ethambutol with or without rifabutin

Adolescents and adults:

Oral dose (immediate release tablets):

Lower respiratory tract, skin, soft tissue, and other infections:

250 mg every 12 hours for 7-14 days

Sinusitis and bronchitis:

500 mg every 12 hours for 7-14 days

Endocarditis prohylaxis:

500 mg 1 hour before procedure

Primary prophylaxis of disseminated MAC for CD4 counts < 50 cells/uL:

500 mg twice daily given alone or combination with rifabutin

Treatment and secondary prevention of disseminated MAC:

500 mg twice daily given in combination with ethambutol with or without rifabutin

Helicobacter pylori infection:

250 mg twice daily, up to 500 mg three times a day given in combination with omeprazole (proton pump inhibitor), bismuth subsalicylate, tetracycline, and H_2 receptor blocker

Oral dose: Extended release tablets:

Sinusitis:

Two 500 mg tablets every 24 hours for 14 days

Community-acquired pneumonia and bronchitis:

Two 500 mg tablets every 24 hours for 7 days

12. OXAZOLIDINONE

Linezolid:

Action: Inhibits bacterial RNA dependent protien synthesis by binding to 23S, 50S ribosomal subunits, preventing formation of 70S complex

Indications: Treatment of complicated and uncomplicated skin and soft tissue infection (i.e., diabetic foot), community-acquired pneumonias, nosocomial peneumonias, and bacteremias due to susceptible vancomycin-resistant enterococcus (E. faecium, VRE), Sterptococcus pneumoniae,

Sterptococcus pyogenes, Streptococcus agalactiae, multidrug-resistant Staphylococcus aureus, and MRSA

Drug interactions and precautions:

Interacts with other MAO inhibitors and avoid use with serotonergic agents such as tricyclic antidepressants, meperdine; pancytopenia occurs after > 2 weeks, peripheral and optic neuropathy after > 4 weeks of treatment; oral suspension containing benzoate (benzyl alchol > 99 mg/kg/day) may result in gasping syndrome in neonates; use caution in uncontrolled hypertension, carcinoid, pheochromcytoma, hepatic, and renal impairment

Adverse Reactions: Rash, pruritis, headache, insomnia, fever, dizziness, lactic acidosis, leukopenia, anemia, thrombocytopenia, nausea, vomiting, tongue discoloration, pseudomembranous colitis (C. difficile), peripheral and optic neuropathy, elevated liver enzymes

Parenteral (IV) and oral dosage:

♣ No doasage adjustment is needed when switching from IV to an oral dose.

♣ No dosage adjustment is necessary in renal or mild to moderate hepatic impairment.

Neonates < 7 days:

Oral, IV: 10 mg/kg/dose every 12 hours, may increase to every 8 hours

Neonates > 7 days, Infants and children:

Complicated skin and soft tissue infections, nosocomial or community-acquired pneumonias, and bacteremias:

Oral, IV: 10 mg/kg/dose every 8 hours for 10-14 days

Vancomycin-resistant enterococcus (VRE):

Oral, IV: 10 mg/kg/dose every 8 hours for 14-28 days

Uncomplicated skin and soft tissue infection:

Children < 5 years:

Oral: 10 mg/kg/dose every 8 hours for 10-14 days

Children 5-11 years:

Oral: 10 mg/kg/dose every 12 hours for 10-14 days

Children > 12 years, adolescents, and adults:

Complicated skin and soft tissue infections, nosocomial or community-acquired pneumonias, and bacteremias:

Oral, IV: 600 mg every 12 hours for 10-14 days

Vancomycin-resistant enterococcus (VRE):

Oral, IV: 600 mg every 12 hours for 14-28 days

Uncomplicated skin and soft tissue infections:

Oral: 600 mg every 12 hours for 10-14 days

13. TETRACYCLINES

Tetracycline, Doxycycline, Demeclocycline

A. Tetracycline:

Action: Inhibits bacterial protein synthesis binding to 30S and 50S ribosomal subunits and may also result in alterations in bacterial cytoplasmic membrane

Indications: Treatment of Rocky Mountain spotted fever due to Rickettsia, brucellosis, moderate to severe inflammatory acne skin infections (acne vulgaris), Lyme disease, Mycoplasma, and Legionella infections

Drug interactions and precautions: Antacids (containing calcium, magnesium, aluminum), iron, zinc, kaolin, and bismuth decrease tetracycline absorption; increases anticoagulant effect of warfarin; use caution in hepatic or renal impairment and modify dosage in renal impairment; risk of retardation of skeletal development, enamel hypoplasia, permanent discoloration of teeth in children < 8 years and further increased risk in children < 4 years.

Adverse Reactions: Photosensitivity, rash, exfoliative dermatitis, discoloration of nails, pseudotumor cerebri (risk increases along with use of methoxyflurane), fever, retardation of skeletal growth and teeth, nausea, vomiting, diarrhea, glossitis, stomatitis, oral candidiasis, pseudomembranous colitis, hemolytic anemia, hepatotoxicity, renal damage with Fanconi like syndrome

Children > 8 years:

Oral dosage:

25-50 mg/kg/day in divided doses every 6 hours, maximum 3 gm/day

Adolescents and adults:

Oral dosage: 250-500 mg / dose every 6-12 hours

B. Doxycycline:

(Tetracycline derivative)

Action: Similar to tetracyclines

Indications: Treatment of Rocky Mountain spotted fever due to Rickettsia, Ehrichiosis, Lyme disease, Mycoplasma, Legionella, and anthrax infections; treatment of nongonococcal pelvic inflammatory disease, chlamydia urethritis, and pleurodesis for persistent or malignant effusions

Drug interactions and precautions: Simialr to tetracycline; not to use in patients with hepatic impairment and modify dosage in renal impairment

Adverse Reactions: Most are similar to tetracycline; photosensitivity, rash, exfoliative dermatitis, discoloration of nails, headache, elevated intracranial pressure, retardation of skeletal growth and teeth in infants and children, nausea, vomiting, diarrhea, esophageal ulceration, oral candidiasis, pseudomembranous colitis, neutropenia, eosinophilia, hepatotoxicity

Children > 8 years:

Oral and intravenous:

2-4 mg/kg/day divided every 12-24 hours, maximum 200 mg/day

Lyme disease:

Oral dose: 100 mg/dose twice daily for 14-21 days

Chlamydial infections:

Oral dose: 100 mg/dose twice daily for 7-10 days

Anthrax infection:

♣ In presence of systemic involvement / head and neck ulceration give intravenous therapy, initially in combination with other agents mentioned below either with 1 or 2 drugs for 60 days.

Other agents: Rifampin, vancomycin, ampicillin, penicillin, imipenem, clindamycin, clarithromycin, and chloramphenicol.

Treatment:

Intravenous dose: 5 mg/kg/day divided every 12 hours for 60 days

Oral dose: Switch to oral therapy when clinically appropriate, maximum dose 200 mg/day

Prophylaxis of anthrax (inhalation exposure):

Oral dose: 5 mg/kg/day divided every 12 hours for 60 days

Maximum dose 200 mg/day

Adolescents and adults:

Oral and intravenous:

100-200 mg/day divided every 12-24 hours

Lyme disease:

Oral dose: 100 mg/dose twice daily for 14-21 days

Chlamydial infections:

Oral dose: 100 mg/dose twice daily for 7-10 days

Anthrax infection:

♣ In presence of systemic involvement / head and neck ulceration give intravenous therapy, initially in combination with other agents either one or two drugs for 60 days.

Other agents: Rifampin, vancomycin, ampicillin, penicillin, imipenem, clindamycin, clarithromycin, and chloramphenicol**.**

Intravenous dose: 100 mg every 12 hours for 60 days

Oral dose: Switch to oral therapy when clinically appropriate, 100 mg every 12 hours for 60 days

Prophylaxis anthrax (inhalation exposure):

Oral dose: 100 mg every 12 hours for 60 days

Pelvic inflammatory disease:

Oral or intravenous dose: 100 mg every 12 hours for 14 days in combination with cefoxitin or cefotetan (hospitalized patient)

Oral dose: 100 mg every 12 hours for 14 days in combination with ceftriaxone, a single dose (out-patient)

Sclerosing agent in pleural effusions:

Instill 500 mg in 25-30 mL of normal saline into pleural space after drainage of pleural fluid. Clamp the thoracostomy tube and remove the fluid later.

Sclerosing agent in malignant and recurrent pleural effusions:

Administer via chest tube 500 mg in 250 mL of normal saline into pleural space and lavage. Clamp the thoracostomy tube for 24 hours and then drain the fluid.

C. Demeclocycline:

(Tetracycline derivative)

Actions: similar to other teracyclines

Indications: Acne, gonorrhea, pertusis, chronic bronchitis, and urinart tract infections caused by susceptible gram-positive and gram-negative organisms; treatment of chronic SIADH (inappropriate ADH) secretion

Drug interactions and precautions: Similar to other tetracyclines; may cause reversible diabetes inspidus syndrome

Adverse Reactions: Most are simialr to other tetracyclines; photosensitivity, rash, exfoliative dermatitis, discoloration of nails, eryhthema multiforme, Steven-Johnson syndrome, headache, elevated intracranial pressure, vertigo, diabetes inspidus, hypophasphatemia, retardation of skeletal growth and teeth in infants and children, nausea, vomiting, diarrhea, esophageal ulceration, oral candidiasis, pseudomembranous colitis, neutropenia, eosinophilia, hemolytic anemia, hepatotoxicity, renal failure, nephrogenic diabetes inspidus, anaphylaxis

Children > 8 years:

Oral dosage:

8-12 mg/kg/day in divided doses every 6-12 hours

Adolescents and adults:

Oral dosage:

150 mg 4 times a day or 300 mg every 12 hours

SIADH Syndrome:

Initial dose: 600-1200 mg/day or 13-15 mg/kg/day divided every 6-8 hours, then decrease to 600-900 mg/day

Uncomplicated gonorrhea:

Initial dose: 600 mg, then 300 mg every 12 hours × 4 days (3 gm/total dose)

14. SULPHONAMIDES

Sulphadiazine, sulphamethoxazole sulphisoxazole,

A. Sulphadiazine:

Action: Inhibits bacterial folic acid synthesis and bacterial growth by preventing convesrion of para-aminobenzoic acid (PABA) to dihydrofolic acid by competitive inhibition to dihydrofolic acid.

Indications: Treatment of urinary tract infection and nocardiosis; adjunctive treatment in toxoplasmosis; rheumatic fever prophylaxis in penicillin allergic patients

Drug interactions and precautions: PABA, procaine, tetracaine antagonize antibacterial action of sulpha drugs; increases anticoagulant effect of coumarin; sulphonylureas (antidiabetic agents) increase hypoglycemia; use caution in patients with hepatic or renal impairment.; use caution in urinary obstruction, blood dyscrasias, and G-6PD deficiency

Adverse Reactions: Photosensitivity, rash, exfoliative dermatitis, Steven-Johnson syndrome, urticaia, headache, dizziness, fever, vasculitis, serum sickness-like reaction, nausea, vomiting, diarrhea, abdominal pain, hepatotoxicity, granulocytopenia, thrombocytopenia, hemolytic anemia, aplastic anemia, acute nephropathy, crystalluria

Oral Dosage:

Congenital toxoplasmosis:

Neonates:

100 mg/kg/day divided every 12 hours for 12 months in combination with pyrimethamine 1 mg/kg/day once daily and supplemental folinic acid 5 mg every 2 days for first 6 months, then pyrimethamine 1 mg/kg/day 3 times a week and supplemental folinic acid 10 mg 3 times a week for next 6 months

Toxoplasmosis:

Children:

Oral dosage:

120-200 mg/kg/day in divided doses every 6 hours in combination with pyrimethamine 2 mg/kg/day divided every 12 hours for 3 days, followed by pyrimethamine 1 mg/kg/day once daily (maximum dose 25 mg/day) with supplemental folinic acid 5-10 mg every 3 days

Adolescents and adults:

Oral dosage:

2-8 gm/day divided every 6 hours combination with pyrimethamine 25 mg/day with supplemental folinic acid 5-10 mg every 3 days

Rheumatic fever prophylaxis:

< 30 kg: 500 mg once daily

> 30 kg: 1 gm once daily

B. Sulphamethoxazole and Trimethoprim (Bactrim):

Action: Sulphas inhibit bacterial folic acid synthesis and bacterial growth by preventing conversion of para-aminobenzoic acid (PABA) to dihydrofolic acid by competitive inhibition; trimethoprim inhibits conversion of dihydrofolate to teterhydrofolate, and results in sequential inhibition of enzymes of folic acid pathway

Indications: Urinary tract infections due to E. coli, Klebsiella, Enterobacter, Proteus (including indole positive); middle ear infection due to amoxicillin resistant H. influenzae, S. pneumoniae, M. catarrhalis; acute exacerbation of chronic bronchitis; typhoid, shigellosis, Nocardia asteroids, and Xanthomonas maltophilia infections; prophylaxis and treatment of Pneumocystis carini pneumonia

Drug interactions and precautions: Fatal toxicities (toxic epidermal necrolysis, hepatic necrosis, aplastic anemia) may occur; contraindicated in porphyria, megaloblastic anemia due to folate deficiency; use caution in patients with hepatic or renal impairment, blood dyscrasia, G-6PD deficiency

Preparations (syrup, tablets) containing sodium benzoate (benzyl alcohol > 99 mg/kg/day) produce fatal gasping syndrome (metabolic acidosis, seizures, and hypotension) in neonates; modify dosage in renal impairment

Adverse Reactions: Rash, exfoliative dermatitis, toxic epidermal necrolysis, Steven-Johnson syndrome, urticaria, headache, insomnia, hallucinations, seizures, fever, ataxia, myocarditis, hypotension, vasculitis, serum sickness-like reaction, nausea, vomiting, anorexia, diarrhea, glossitis, pseudomembranous colitis, splenomegaly, pancreatitis, hepatitis, cholestatic jaundice, granulocytopenia, thrombocytopenia, hemolytic anemia (with G-6-P-D deficiency), megaloblastic and aplastic anemias, interstitial nephritis, acute nephropathy, crystalluria

Oral or intravenous dosage:

Dosage is based on trimethoprim (TMP) component

Children > 2 months and adults:

Mild to moderate infections:

6-12 mg TMP/kg/day in divided doses every 12 hours

Severe infections / Pneumocystis:

15-20 mg TMP/kg/day in divided doses every 6-8 hours

Prohylaxis of Pneumocystis (in Children only)

150 mg TMP/m^2/day in divided doses every 12 hours administerd 3 times / week on alternate days / or

150 mg TMP/m^2/day in divided doses every 12 hours administerd 3 days / week on consecutive days / or

150 mg TMP/m^2/day in divided doses every 12 hours administerd 7 days / a week

Maximum dose/day: TMP 320 mg, Sulphamethoxazole 1600 mg

Prohylaxis of urinary tract infection:

2 mg TMP/kg/dose daily or 5 mg TMP/kg/dose twice weekly

Adults:

Prophylaxis of Pneumocystis:

One double strength tablet daily/or

One single strength tablet daily (acceptable alternative)

Urinary tract infection/chronic bronchitis:

One double strength tablet every 12 hours for 10-14 days

C. SULPHISOXAZOLE (Gantrisin):

Action: Inhibits bacterial folic acid synthesis and bacterial growth by competitive inhibition of para-aminobenzoic acid and conversion to dihydrofolic acid

Indications: Treatment of urinary tract, middle ear infections, nocardiosis, and chlamydia; treatment of pelvic inflammatory disease in prepubertal children

Drug interactions and precautions: PABA, procaine, tetracaine antagonizes antibacterial action of sulpha drugs; increases anticoagulant effect of coumarin, sulphonylureas (antidiabetic agents) induce hypoglycemia; use caution in hepatic or renal impairment, obstructive uropathy, blood dyscrasia, and G-6PD deficiency; in infants < 2 months, compete with protein binding sites for bilirubin and results in kernicterus

Adverse Reactions: Photosensitivity, rash, exfoliative dermatitis, Steven-Johnson syndrome, urticaria, headache, dizziness, fever, vasculitis, serum sickness-like reaction, nausea, vomiting, diarrhea, abdominal pain, granulocytopenia, thrombocytopenia, hemolytic anemia, aplastic anemia, hepatotoxicity, acute nephropathy, crystalluria

Infants > 2 months and children:

Oral dose:

75 mg/kg / a single dose, followed by 120-150 mg/kg/day in divided doses every 4-6 hours, maximum 6 gm/day

Pelvic inflammatory disease:

100 mg/kg/day in divided doses every 6 hours, in combination with ceftriaxone

Chlamydial infections:

100 mg/kg/day divided every 6 hours, maximum dose: 2 gm/day

Prophylaxis of UTI:

10-20 mg/kg/day divided every 12 hours

Adults:

2-4 gm stat, followed by 4-8 gm/day in divided doses every 4-6 hours

15. Miscellaneous Antibiotics

A. Aztreonam:

Action: Binds to penicillin binding protein 3, which results in bacterial filamentation and inhibits bacterial cell wall synthesis

Indications: Multidrug-resistant gram-negative infections, in which beta-lactams are contraindicated; septicemia, skin and soft tissue, lower respiratory tract, intra-abdominal, gynecological, and urinary tract infections due to E. coli, Klebsiella, Enterobacter, Proteus mirabilis, Serratia marcescens, Citrobacter, H. influenza, and Pseudomonas aeruginosa

Drug interactions and precautions: Cross-react with other beta-lactams (penicillins, cephalosporins) hypersensitivity; probenecid and furosemide increase serum aztreonam levels; use caution in patients with renal impairment and modify the dosage; avoid concomitant use with agents that induce betalactamase production (cefoxitin, imipenem)

Adverse Reactions: Rash, pruritis, urticaria, toxic epidermal necrolysis, seizures, confusion, fever, hypotension, transient EKG changes, nausea, vomiting, diarrhea, pseudomembranous colitis, neutropenia, thrombocytopenia, eosinophilia, anemia, aplastic anemia, hepatitis, jaundice, elevated BUN and creatinine

Parenteral dosage:

Neonates:

Postnatal age < 7 days:

90 mg/kg/day divided every 8 hours

Postnatal age > 7 days:

< 2 kg: 90 mg/kg/day divided every 8 hours

> 2 kg: 120 mg/kg/day divided every 6 hours

Infants > 1 month and children:

90-120 mg/kg/day divided every 6-8 hours

Cystic fibrosis:

50 mg/kg/dose every 6-8 hours, maximum dose 8 gm/day

Adults:

Urinary tract infections:

500 mg to 1 gm every 8-12 hours

Moderately severe and systemic infections:

1 gm IM or 2 gm IV every 8-12 hours

Severe systemic and life threatening infections:

2 gm IV every 6-8 hours, maximum dose 8 gm/day

Dose adjustment in renal impairment:

Creatinine clearance (Cl cr) 10-30 mL/min: reduce dose by 50% and give at usual interval

Cl cr < 10 mL/min: Reduce dose by 75% and give at ususal interval

B. Vancomycin:

Action: Binds to D-alanyl-D-alanine and blocks glycopeptide polymerization of phospho-disaccharide-pentapeptide complex in second stage of cell wall synthesis; inhibits bacterial cell wall synthesis and alters bacterial cell-membrane permeability

Indications: Infections due to methicillin-resistant S. aureus (MRSA) or beta-lactam resistant coagulase negative staphylococci; serious or life-threatening infections of CNS, endocarditis, and bone due to streptococci and staphylococci in patients allergic to penicllins and cephalosporins; empiric therapy of IV line infections, hemodialysis shunts, prosthetic heart valves and vascular grafts; oral treatment of staphylococcal enterocolitis and pseudomembranous colitis due to C. difficile.

Drug interactions and precautions: Anesthetic agents interact producing flushing, erythema, hypotension, hypothermia; potentiate the effects of other nephrotoxic and ototoxic drugs (aminoglycosides); modify dosage in renal impairment

Adverse Reactions: Red neck syndrome, macular skin rash, urticaria, hypersensitivity, low back pain. fever, chills, hypotension, cardiac arrest, nausea, vomiting, neutropenia, eosinophilia, hepatitis, jaundice, ototoxicity (due to prolonged serum levels of > 40 mcg/mL), nephrotoxicity (due to trough concentration of > 10 mcg/mL), elevated BUN and creatinine

Neonates:

Intravenous:

Postnatal age < 7 days:

10-15 mg/kg/dose every 8-12 hours

Postnatal age > 7 days:

< 2 kg: 10-15 mg/kg/dose every 8-12 hours

> 2 kg: 15-20 mg/kg/dose every 8 hours

Infants > 1 month and children:

40 mg/kg/day divided every 6-8 hours

Staphylococcal CNS infections and endocarditis:

60 mg/kg/day divided every 6 hours, maximum dose 1 gm/dose

Adults:

Intravenous:

0.5 gm every 6 hours / or 1 gm every 12 hours, maximum dose 4 gm/day

Table 16.6 *Vancomycin dose adjustment in renal impairment.*

Creatinine clearance (mL/minute)	Dose	Frequency
> 90 mL/min	normal dose	every 6 hours
70-89 mL/min	normal dose	every 8 hours
46-69 mL/min	normal dose	every 12 hours
30-45 mL/min	normal dose	every 18 hours
15-29 mL/min	normal dose	every 24 hours

Renal dysfunction, endstage renal disease:

10-20 mg/kg, subsequent doses depend on serum drug levels

Prophylaxis of endocarditis (penicillin allergic patients):

Children: 20 mg/kg / 1 hour before procedure plus gentamycin 1.5 mg/kg 30 minutes before procedure

Adults: 1 gm 1 hour before procedure plus gentamycin 1.5 mg/kg (maximum dose 120 mg) 30 minutes before procedure

Antibiotic associated Staphylococcal enterocolitis, Pseudomembranous colitis:

Mteronidazole is the usual drug of choice, alternately use oral vancomycin

Oral vancomycin

Children: 40 mg/kg/day in divided doses every 6 hours for 7-10 days, not to exceed 2 gm/day

Adults: 0.5-2 gm/day in divided doses every 6-8 hours for 7-10 days

C. Clindamycin:

Action: Binds to 50S ribosomal subunits, preventing peptide bond formation and inhibits bacterial cell wall synthesis, bacteriostatic, and bactericidal

Indications: Treatment of respiratory tract, skin and soft tissue, intra-abdominal, pelvic (female) infections; septicemia due to Fusobacterium, Bacteroides, Actinomyces; active against most aerobic gram-positive sterptococci, staphylococci (except enterococcus); prophylaxis for bacterial endocarditis in penicillin allergic patients; preoperative prophylaxis for head and neck, oral, and intra-abdominal surgery; treatment of babesiosis

Drug interactions and precautions: Increase in neuromuscular blocking effects of pancuronium; contraindicated in patients with prior pseudomembranous colitis, regional enteritis, ulcerative colitis, hepatic impairment or hypersensitivity to clindamycin or lincomycin; topical or systemic drug may cause fatal colitis (i.e., persistent diarrhea, severe abdominal cramps, and passage of bloody mucus)

Injections containing benzyl alcohol (> 99 mg/kg/day) produce gasping syndrome in neonates; capsule contains tetrazine which causes reactions; use caution in severe hepatic or renal impairment and modify dosage in renal impairment

Adverse Reactions: Rash, urticaria, exfoliative dermatitis, erythema multiforme, Steven-Johnson syndrome, headache, dizziness, fever, hypotension, cardiac arrhythmia (due to prolonged QT), cardiac arrest, nausea, vomiting, diarrhea, esophagitis, pseudomembranous colitis, granulocytopenia, thrombocytopenia, neutropenia, eosinophilia, elevated liver enzymes, renal dysfunction, vaginal candidiasis

Neonates:

Parenteral dosage (IM, IV):

Postnatal age < 7 days:

15 mg/kg/day divided every 8 hours

Postnatal age > 7 days:

< 2 kg: 15 mg/kg/day divided every 8 hours

> 2 kg: 20-30 mg/kg/day divided every 6-8 hours

Infants and children:

Oral dose: 10-30 mg/kg/day divided every 6-8 hours, maximum dose1.8 gm/day

Parenteral dosage (IM, IV):

25-40 mg/kg/day divided every 6-8 hours, maximum dose 4.8 gm/day

Prophylaxis of bacterial endocarditis (in penicillin allergic patients for dental and upper respiratory tract procedures):

Oral: 20 mg/kg 1 hour before procedure

Intravenous: 20 mg/kg 30 minutes before procedure

Maximum dose: 600 mg

Preoperative prophylaxis:

Intravenous: 10 mg/kg (maximum 600 mg) plus gentamycin 2 mg/kg (maximum 120 mg) 30 minutes before procedure

Babesiosis:

Oral: 20-40 mg/kg/day divided every 8 hours for 7 days plus quinine alkaloid

Adolescents and adults:

Oral dose: 150-450 mg / dose every 6-8 hours, maximum dose 1.8 gm/day

Parenteral dosage (IM, IV):

1.2-1.8 gm/day in 2-4 divided doses, maximum dose 4.8 gm/day

Prophylaxis of bacterial endocarditis (in penicillin allergic patients for dental and upper respiratory tract procedures):

Oral: 600 mg 1 hour before procedure

Intravenous: 600 mg 30 minutes before procedure

Preoperative prophylaxis:

Intravenous: 600 mg plus gentamycin 1.5 mg/kg (maximum 120 mg) 30 minutes before procedure

Babesiosis:

Intravenous: 1.2 gm twice daily plus quinine

Oral: 600 mg 3 times a day for 7 days plus quinine

Pelvic inflammatory disease:

Intravenous: 900 mg every 8 hours for 24-48 hours, followed by oral dose of 600 mg 3 times a day for 14 days

D. Chloramphenicol:

Action: Reversibly binds to 50S ribosomal subunits, preventing peptide bond formation and inhibits bacterial cell wall synthesis

Indications: Treatment of serious infections due to organisms in which other less toxic agents are either resistant or having less penetration in tssues; active against Bacteriodes, H. influenzae, N. menigitidis, Salmonella, Ricketsiae, most aerobic gram-positive streptococci, and staphylococci and vancomycin resistant enterococcus

Drug interactions and precautions: Fatal blood dyscrasias occur both after short and long term use; monitor CBC in all patients; use caution in patients with G-6-PD deficiency, hepatic or renal impairment, and neonates; modify dosage in renal and hepatic impairment; inhibits the metabolism of phenytoin, cyclosporine, chlorpropamide, and oral anticoagulants; phenobarbital and rifampin decrease serum chloramphenicol levels; chloramphenicol decreases the intestinal absorption of vitamin B-12

Adverse Reactions: Rash, nightmares, headache, dizziness, peripheral neuropathy, optic neuritis, left ventricular dysfunction, gray baby syndrome (ash grey skin, cyanosis, hypothermia, circulatory collapse, abdominal distension, and coma; associated with serum level ≥ 50 mcg/ mL.), nausea, vomiting, diarrhea, stomatitis, enterocolitis, hemolysis in G-6-PD deficiency, thrombocytopenia, neutropenia, aplastic anemia, bone marrow suppression, hepatitis-pancytopenia syndrome

Neonates:

Intravenous dosage (IM not recommended):

Initial loading dose: 20 mg/kg IV

Maintenance dose: First dose should be given 12 hours after loading dose

Postnatal age < 7 days:

25 mg/kg/day once every 24 hours

Postnatal age > 7 days:

< 2 kg: 25 mg/kg/day once evry 24 hours

> 2 kg: 50 mg/kg/day divided every 12 hours

Infants and children:

Intravenous dosage:

75-100 mg/kg/day divided every 6 hours, maximum dose 4 gm/day

Meningitis:

50-75 mg/kg/day divided every 6 hours

Adults:

Intravenous:

75-100 mg/kg/day divided every 6 hours, maximum dose 4 gm/day

E. Rifampin:

Action: Binds to beta subunit of DNA-dependent RNA polymerase, blocking RNA transcription and inhibits bacterial RNA synthesis

Indications: Treatment of active tuberculosis in combination with other antitubercular agents; treatment of staphylococcal infection in combination with other agents; prophylaxis for contacts with Hemophillus inflenzae type B infection; treatemt of asymptomatic carriers of meningococcal infection

Drug interactions and precautions: Use caution in patients with hepatic impairment and modify dosage in hepatic impairment; use caution with concurrent medications that cause liver injury (i.e., pyrazinamide); decreases plasma levels of Ca^{++} channel blockers, quinidine, digoxin, oral anticoagulants, and barbiturates

Adverse Reactions: Rash, pruritis, urticaria, red-orange discoloration of body fluids, headache, ataxia, dizziness, fever, confusion, myalgia, arthralgia, nausea, vomiting, diarrhea, stomatitis, anorexia, hemolytic anemia, thrombocytopenia, neutropenia, eosinophilia, elevated liver enzymes, hepatitis, cholestatic jaundice, renal failure, interstitial nephritis

♣ Intravenous infusion dose is the same as an oral dose.

Tubeculosis:

Infants and children:

10-20 mg/kg/day in divided doses every 12-24 hours

Adults:

10 mg/kg/day is given once a day, maximum dose 600 mg/day

Prophylaxis of H. Influenzae:

Neonates: (< 1 month)

10 mg/kg/day every 24 hours for 4 days

Infants (> 1 month) and children:

20 mg/kg/day every 24 hours for 4 days, maximum dose 600 mg/day

Adults:

600 mg/day every 24 hours for 4 days.

Prophylaxis of meningococcal infections:

Neonates (< 1 month):

10 mg/kg/day in divided doses every 12 hours for 2 days

Infants (> 1 month) and children:

20 mg/kg/day in divided doses every 12 hours for 2 days, not to exceed 600 mg/dose

Adults:

600 mg/dose every 12 hours for 2 days

Prophylaxis of Staphylococcus aureus (nasal carriers):

Children:

15 mg/kg/day in divided doses every 12 hours for 5-10 days, plus other antibiotics

Adults:

600 mg once daily for 5-10 days plus other antibiotics

Treatment of Staphylococcus aureus infections (combination therapy):

Neonates, infants and children:

5-20 mg/kg/day in divided doses every 12 hours plus other antibiotics

Adults:

300-600 mg twice daily plus other antibiotics

F. Rifabutin:

Action: Binds to beta subunit of DNA-dependent RNA polymerase, blocking RNA transcription, peptide chain initiation, and inhibits bacterial RNA synthesis

Indications: Treatment of MAC (mycobacterium avium complex) tuberculosis in combination with other antitubercular agents; prophylaxis for disseminated MAC in advanced HIV infection

Drug interactions and precautions: Use caution in patients with hepatic and renal impairment; modify dosage in renal impairment (Clcr < 30 mL/minute); decreases plasma concentrations of Ca^{++} channel blockers, quinidine, digoxin, oral anticoagulants, clarithromycin, barbiturates, cyclosporine, itraconazole, and protease and non-nucleoside reverse transcriptase inhibitors; increased serum rifabutin levels with conazoles, clarithromycin, protease inhibitors, and indanivir; so decrease the dosage of ribabutin

Adverse Reactions: Rash, pruritis, urticaia, brown-orange discoloration of body fluids, headache, fever, confusion, seizures, myositis, arthralgia, nausea, vomiting, diarrhea, dysgeusia, anorexia, hemolytic anemia, thrombocytopenia, neutropenia, eosinophilia, elevated liver enzymes, corneal deposits, uveitis

Oral dosage:

Prophylaxis of first episode of MAC in HIV patients:

Children < 6 years:

5 mg/kg/once daily

Children > 6 years:

300 mg once daily

Prophylaxis of recurrence of MAC in HIV patients:

Infants and children:

4 mg/kg/once daily (maximum 300 mg daily) in combination with clarithromycin

Adolescents and adults:

Prophylaxis of first episode of MAC in HIV patients:

300 mg once daily

Prophylaxis of recurrence of MAC in HIV patients:

300 mg daily in combination with other agents

G. Amphotericin B (Conventional drug):

Action: Binds to ergosterol, altering cell membrane permeability of fungi and leads to leakage of cell components and cell death

Indications: Severe systemic infections caused by susceptible fungi, i.e., Histoplasma capsulatum, Cryptococcus neoformans, Blastomyces dermatitidis, Aspergillus species, Mucor species, Sporothrix schenckii, Coccidioides immitis, Torulopsosis glabrata, and Candida species; topical treatment of cutaneous and mucocutaneous candidal infection; topical irrigation for bladder fungal infection; treatment of fungal peritonitis

Drug interactions and precautions: Use IV amphotercin primarily for fatal fungal infections, not for inapparent fungal disease; nephrotoxic drugs potentiate the renal toxicity of amphotericin; increases toxicity of cardiac glycosides, muscle relaxants due to hypokalemic effect of amphotericin; azoles

may induce fungal resistance to amphotericin; severe anaphylactoid reactions are reported with IV administration

Adverse Reactions: Rash, pruritis, urticaria, anaphylaxis, hypotension, hypertension, cardiac arrhythmias, shock, bronchospasm, headache, fever, chills, delerium, seizures, malaise, hypokalemia, hypomagnesemia, nausea, vomiting, steatorrhea, anorexia, anemia, thrombocytopenia, leukopenia, elevated liver enzymes, acute hepatic failure, renal failure, renal tubular acidosis

Dosage:

♣ Avoid confusion between lipid based froms and conventional forms.

(maximum dose for conventional form of drug 1.5 mg/kg/day)

Neonates, infants and children:

Intravenous test dose:

0.1 mg/kg/dose, maximum 1 mg; infuse over 20-60 minutes and if tolerated go to initial therapeutic dose:

0.4 mg/kg/dose given on the same day as a test dose

Incremental therapeutic dose:

Increase the daily dosage by 0.25 mg/kg increments on each subsequent day until desired dose is attained

Maintenance dose:

0.25 mg-1 mg/kg/day given once daily (infuse over 2-6 hours)

Severe and progressive disease may require short-term dose of 1.5 mg/kg/day

Once therapy is established, may administer 1-1.5 mg/kg/dose every other day

Adults:

Intravenous test dose:

1 mg/dose to infuse over 20-30 minutes, if tolerated go to initial therapeutic dose:

0.25 mg/kg/dose given on the same day as a test dose

Incremental therapeutic dose:

Increase the daily dosage by 0.25 mg/kg increments on each subsequent day until desired dose is attained

Maintenance dose:

0.25 mg-1 mg/kg/day given once daily (infuse over 2-6 hours)

Once therapy is established may administer 1-1.5 mg/kg/dose every other day

Children and adults:

Topical (bladder) irrigation:

5-15 mg/dose in 100 mL of sterile water, irrigate bladder with 100-300 mL solution per day, 3-4 times a day for 2-5 days; clamp the catheter for 60-120 minutes and drain the fluid

Administration:

Amphotericin B is administered by peripheral IV infusion over 2-3 hours (range 1-6 hours) at a concentration not to exceed 0.1 mg/mL; in fluid restricted, use concentration not to exceed 0.5 mg/mL in D5W or D10W

♣ Dose adjustments are unnecessary in preexisting renal impairment. In renal impairment related to the drug, decrease the dose by 50% or give less frequently.

H. Amphotericin B (Lipid complex) (Abelcet):

Indications: Treatment of invasive fungal infections in patients intolerant (i.e., serum creatinine > 1.5 mg% during treatment), or refractory (i.e., disease progression despite a total dose of conventional drug of 10 mg/kg) to conventional amphotericin B; treatment of hepatosplenic candidiasis and cryptococcal meningitis

Drug interactions, precautions, and adverse reactions: Similar to conventional drug, renal injury occurs to a lesser degree than conventional drug

Dosage:

♣Avoid confusion between lipid based froms and conventional forms.

(maximum daily dose for conventional form is 1.5 mg/kg)

Children and adults:

2.5 mg-5 mg/kg / given once daily IV infusion

Administration:

Assure serum potassium is > 3.2 mEq/L, not to use in-line filter < 5 microns

Abelcet is administered by IV infusion over 2-3 hours at a concentration of 1 mg/mL in D5W; in fluid restricted, use concentration not to exceed 2 mg/mL in D5W; renal toxicity is dose dependent; no firm guidelines for dose adjustments based on serum creatinine levels

I. Amphotericin B Liposome (AmBiosome):

Indications: Treatment of invasive fungal infections in patients refractory or intolerant to conventional apmphotercin B; empiric therapy for suspected fungal infections in febrile neutropenic (bone marrow transplant, nonlymphocytic leukemia) candidates; treatment of cryptococcal menigitis in HIV patients; visceral leishmaniasis and suspected / proven fungal infection in patients with renal impairment

Drug interactions, precautions, and adverse reactions: Similar to conventional drug; renal injury occurs to a lesser degree than conventional drug

Dosage:

♣ Avoid confusion between lipid based froms and conventional forms.

(maximum daily dose for conventional form is 1.5 mg/kg).

Infants > 1 month, children, and adults:

Empiric therapy: 3 mg/kg/day given once daily IV infusion

Systemic fungal infection: 3-5 mg/kg/day given once daily IV infusion

Aspergillosis: Doses high as 10 mg/kg/day given once daily IV infusion

Cryptococcal meningitis (HIV patients):

6 mg/kg/day given once daily IV infusion

Visceral leishmaniasis:

In immunocompetent patients:

Days 1-5: 3 mg/kg/day once daily

Day 14 and 21: 3 mg/kg/dose

In immunocompromised patients:

Days 1-5: 4 mg/kg/day once daily

Day 10, 17, 24, 31, 38: 4 mg/kg/dose

Administration:

Do not use in-line filter < 1 microns. AmBiosome is administered by IV infusion over 1-2 hours at a final concentration of 1-2 mg/mL in D5W, D10W, D20W; in infants and children use a lower concentration of 0.2-0.5 mg/mL

J. Fluconazole:

Action: Interferes with fungal cytochrome and sterol alpha-demethylation activity, decreasing ergosterol synthesis and inhibiting cell membrane formation

Indications: Systemic candida infections of urinary tract, peritonitis, cystitis, and pneumonias; it is more active against C. albicans than C. parapsilosis, C. glabrata, and C. tropicalis; treatment of esophageal, oral, and vaginal candidiasis; treatment and prophylaxis of cryptococcal meningitis; alternative therapy to amphotericin B in pre-existing renal impairment or as a concomitant drug therapy with other nephrotoxic agents

Drug interactions and precautions: Reduces the metabolism of oral antidiabetic agents and induces hypoglycemia; increases plasma levels of phenytoin, warfarin (prolongs PT), cyclosporine, theophylline, and cisapride (prolonged QT, fatal arrhythmias); azoles may induce fungal resistance to amphotericin; drug associated fatal hepato-toxicity and hepatic injury; exercise caution and modify dosage in renal and hepatic impairment and proarrhythmic states

Adverse Reactions: Rash, pruritis, urticaria, Stebven-Johnson syndrome, anaphylaxis, QT prolongation, torsade de pointes, shock, bronchospasm, headache, seizures, malaise, hypokalemia, hyperlipidemia, nausea, vomiting, diarrhea, abdominal pain, thrombocytopenia, leukopenia, agranulocytosis, elevated liver enzymes, hepatitis, cholestatic jaundice

Dosage:

Oral dose and intravenous dosage is same

Neonates < 14 days:

Same as older infants but administered every 24-72 hours

Neonates > 14 days, infants, and children:

Oropharyngeal candidiasis:

6 mg/kg/day on day 1, 3 mg/kg daily for 14 days

Esophageal candidiasis:

6 mg/kg/day on day 1, 3-12 mg/kg/daily for 21 days

Systemic candidiasis:

6-12 mg/kg/daily for 28 days

Cryptococcal meningitis:

Acute: 12 mg/kg / on day 1

6-12 mg/kg/day for 10-12 weeks after CSF cultures become negative

For relapse: 6 mg/kg/daily

Adults:

Oropharyngeal candidiasis:

200 mg on day 1, 100 mg daily for 14 days

Esophageal candidiasis:

200 mg on day 1, 100-400 mg daily for 21 days

Systemic candidiasis:

400 mg on day 1, 200-800 mg daily for 28 days

Cryptococcal meningitis:

Acute: 400 mg on day 1

200-800 mg/day for 10-12 weeks after CSF cultures become negative

For relapse: 200 mg daily

Vaginal candidiasis:

150 mg oral, as a single dose

Prophylaxis of fungal infections (bone marrow transplants):

IV or oral: 400 mg / day once daily

Dose adjustment in renal failure:

Creatinine clearance (Clcr) 21-50 mL/min: Give 50% of recommended dose

Clcr: < 20 mL/min: Give 25% of recommended dose

Dialysis patients: Give one recommended dose after each dialysis.

K. Itraconazole:

Action: Interferes with fungal cytochrome P450 and sterol alpha-demethylation activity, decreasing ergosterol synthesis and inhibiting cell membrane formation

Indications: Systemic fungal infections (aspergillosis, histoplasmosis coccidioidomycosis, blastmycosis, paracoccidioidomycosis) in immmuno-compromised and non-immuno compromised patients that are refractory or intolerant to amphotercin B; treatment of oropharyngeal and esophageal candidiasis

Drug interactions and precautions: Increases plasma levels of phenytoin, warfarin, (prolongs PT), digoxin, cyclosporine, theophylline, and oral antidiabetic agents; concomitant use increases toxicity of terfandine, lovostatin, and cisapride (produces severe cardiovascular effects i.e., prolonged QT, fatal arrhythmias, cardiac arrest); decreased absorption of drug with concomitant use with proton pump inhibitors, H_2 receptor antagonists and antacids; exercise caution in hepatic impairment, proarrhythmic states, and LV dysfunction

Adverse Reactions: Rash, pruritis, urticaria, toxic epidermal necrolysis, anaphylaxis, ventricular fibrillation, CHF, hypertension, headache, somnolence, dizziness, fever, hypokalemia, adrenal insufficiency, gynaecomastia, nausea, vomiting, diarrhea, abdominal pain, anorexia, thrombocytopenia, leukopenia, elevated liver enzymes, hepatitis, albuminuria

Dosage:

Infants and children:

3-5 mg/kg/day once daily

Prophylaxis of Aspergillus infection:

5-10 mg/kg/day divided every 12-24 hours

Prophylaxis of first episode of Cryptococcus neoformans and Histoplasma capsulatum infection (HIV patients):

2-5 mg/kg/dose every 12-24 hours

Prophylaxis of recurrence of Cryptococcus and Histoplasma infection (HIV patients):

2-5 mg/kg/dose every 12-24 hours

Adults:

Oral dosage:

Life threatening systemic infection and aspergillosis:

600 mg/day in 3 divided doses for 3-4 days

Maintenance dose 200-400 mg/day in 2 divided doses

Maximum dose: 600 mg/day in 3 divided doses

Blastomycosis and histoplasmosis:

200 mg/day once daily and increase by 100 mg/day to a dose of 400 mg/day in 2 divided doses

Oropharyngeal candidiasis:

Swish 10 mL in a mouth once daily, total dose of 20 mL / daily

Esophageal candidiasis:

Swish 10 mL in a mouth and swallow daily, maximum dose of 200 mg/day

Intravenous dose:

Blastomycosis, histoplasmosis and aspergillosis:

200 mg IV twice a day for 4 doses, then 200 mg daily (use of IV dose beyond 14 days is not established)

Switch to oral 200 mg/day for beyond 14 days use

L. Caspofungin:

Action: Inhibits synthesis of beta (1-3) - D-glucan, an esstental component of fungal cell wall

Indications: Treatment of invasive fungal infections (aspergillosis) refractory to conventional amphotericin B, refractory to amphotericin B lipid complex, and itraconazole; treatment of candidemia; treatment of intra-abdominal, pleural, peritoneal, and esophageal candidiasis; empiric therapy for suspected fungal infection in febrile neutropenic patients

Drug interactions and precautions:

Increased drug clearance (decreased levels of caspofungin) with concomitant use of nevirapine, phenytoin, dexamethasone (therefore, increase the dose)

Concomitant use with cyclosporine increases caspofungin blood levels (therefore, decrease the dose); concomitant use with cyclosporine results in elevated liver enzymes and increase in hepatic toxicity (avoid concomitant use)

Rifampin decreases trough levels of drug (increase the dose in adults)

Adverse Reactions: Rash, pruritis, erythema, anaphylaxis, facial swelling, peripheral edema, flushing, bronchospasm, dysponea, headache, fever, chills, insomnia, muscle tremor, paresthesia, hypokalemia, hypomagnesemia, hypercalcaemia, nasuea, vomiting, diarrhea, abdominal pain, nausea, thrombocytopenia, leukopenia, anemia, eosinophilia, elevated liver enzymes (ALT, AST), hepatitis, elevated creatinine, hematuria, proteinuria

Parenteral dosage:

Infants and children < 12 years:

Loading dose of 70 mg/m^2/day on day 1 (maximum dose 70 mg), followed by 50 mg/m^2/day once daily (maximum dose 50 mg/daily)

Children > 12 years, adolescents and adults:

Loading dose of 70 mg on day 1, followed by 50 mg once daily

♣ Adjust the dose in patients taking concomitant enzyme inducers such as:

Receiving concomitant rifampin: 70 mg once daily

Receiving concomitant phenytoin, dexamethasone: 70 mg once daily

Esophageal candidiasis:

50 mg once daily

Dose adjustment in renal failure:

Not needed

Dose adjustment in moderate hepatic impairment:

Decease the dose by 30%

Administration: Intravenous slow infusion over 1 hour at a maximum concentration of 0.47 mg/mL in NS, ½ NS, ¼ NS, RL without dextrose

Do not mix with any other medications

M. Metronidazole:

Action: The degradation product (metabolite) interacts with DNA of susceptible organisms, causing a loss of helical structure and breakdown of the strands, leading to inhibition of protein synthesis and promoting cell death

Indications: Treatment of susceptible anaerobic bacterial and protozoal infections of intra-abdominal, CNS, skin and skin structure, amebic liver abscess, and dysentery; treatment of trichomoniasis,

giardiasis, systemic anaerobic bacterial infections, and antibiotic associated pseudomembranous colitis due to C. difficile.

Precautions and drug interactions: Reduce dosage in liver impairment, but dose adjustment is not necessary in moderate to severe renal impairment; phenobarbital and rifampin may increase metabolism of metronidazole; increases the levels of warfarin, phenytoin, and lithium causing disulfiram-like rections

Adverse Reactions: Rash, metallic taste, nausea, vomiting, diarrhea, xerostomia and furry tongue, discoloration of urine to dark red or brown, leukopenia, peripheral neuropathy, confusion, seizures, hallucinations, insomnia, paresthesias

Dosage:

Neonates: Anaerobic infections:

0-4 weeks (< 1200 g): 7.5 mg/kg every 48 hours (oral or IV)

Postnatal age < 7 days:

1200-2000 g: 7.5 mg/kg/day every 24 hours

> 2000 g: 15 mg/kg/day in divided doses every 12 hours

Postnatal age > 7 days:

1200-2000 g: 15 mg/kg/day in divided doses every 12 hours

> 2000 g: 30 mg/kg/day in divided doses every 12 hours

Infants and children:

Anaerobic infections:

30 mg/kg/day in divided doses (oral or IV) every 6 hours (maximum 4 g/day)

Pseudomembranous colitis:

30 mg/kg/day in divided doses (oral) every 6 hours (for 7-10 days)

Amebiasis:

35 to 50 mg/kg/day in divided doses every 8 hours

Trichomoniasis:

15 to 50 mg/kg/day in divided doses every 8 hours

Adolescents and adults:

Anaerobic infections:

30 mg/kg/day in divided doses (oral or IV) every 6 hours (maximum 4 g/day)

Pseudomembranous colitis:

250-500 mg 3 to 4 times a day for 10 to 14 days

Amebiasis:

500-750 mg (oral dose) every 8 hours

Trichomoniasis:

250 mg (oral dose) every 8 hours or 2 g as a single dose

Helicobacter Pylori:

250-500 mg (oral dose) 3 times a day in combination with amoxicillin and bismuth subsalicylate