

# TB Medications:

## *What Nurses Need to Know*

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# Objectives:

## First-line Tuberculosis (TB) Medications

- Medication Dosages
- Side Effects
- Nursing Considerations
- Medication Administration Tips

# TB Treatment before anti-tuberculosis drugs



ORIGINAL TUBERCULOSIS CAMP AT POTTOWATOMIE PARK



## Sanitoriums provided:

- ✓ Fresh air
- ✓ Sunlight
- ✓ Relaxing surroundings
- ✓ Good nourishment

## Rifamycins



Rifampin  
Rifabutin  
Rifapentine

## Isoniazid



## Pyrazinamide



## Ethambutol



## Fluoroquinolones



Moxifloxacin  
Levofloxacin

# First-line Tuberculosis Drugs



## *Why use a Multi-Drug Therapy?*



- *Mycobacterium tuberculosis* (MTB) produces resistant mutations during replication
- Multi-drug TB treatments provide cross-coverage against these various mutations
- Different actions of TB drugs
  - Bactericidal
  - Early Bactericidal
  - Bacteriostatic
  - Sterilizing

# Actions of Anti-TB drugs:

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**Bactericidal**

Directly kills the bacteria

**Early  
Bactericidal**

Early reduction in colony forming units found in sputum; **isoniazid** has the highest EBA

**Bacteriostatic**

Prevents multiplication and growth

**Sterilizing**

Kill off "persisters"; **rifampin** has the highest sterilizing activity

# RIFAMPIN

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- **Bactericidal** (kills bacteria)
  - Highest sterilizing activity against rapidly dividing and semi-dormant bacteria
- **Dose:**
  - Adult: 10 mg/kg/dose ( usually 600 mg PO)
  - Child: 15-20 mg/kg/dose
  - Infant/Toddler: 20-30 mg/kg/day
  - Renal failure/dialysis: no dose adjustment
- **Rapid absorption**
  - May be decreased by high-fat meals
  - CSF penetration
- **Increases metabolism of many drugs**
  - Hormonal contraception, methadone, anti-seizure medications, anti-coagulants, antiretrovirals





# RIFAMPIN: Side Effects

## Orange Discoloration



## GI Upset



## Pruritis



## Hepatotoxicity



## Less Common Side Effects

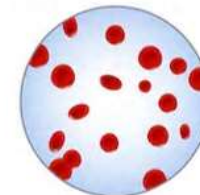
### Flu-like symptoms

< 1% of  
patients  
Usually 3 – 6  
months of  
starting  
treatment

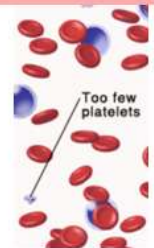
### Hyperbilirubinemia



### Hemolytic Anemia



### Thrombocytopenia





# RIFAMPIN

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- **Monitoring:**

- Liver enzymes AST/ALT if there are symptoms of hepatotoxicity
- Drug concentrations

- **Drug to drug interactions:**

- Certain rifamycins cannot be given with antiretroviral drugs; be sure to consult with an expert
- Ensure patient identifies all other medications they are taking as they may interfere with rifampin

- **Patient Education:**

- Best taken without food, however, can take with a small amount of food for stomach upset

# RIFABUTIN

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- Bactericidal (kills bacteria; same mechanism as rifampin)
- Dose:
  - Adult: 5 mg/kg/dose
  - Children: 5-10 mg/kg/day \* (no pediatric dose has been established)
  - Renal failure/dialysis: no dose adjustment in mild renal insufficiency
  - Dosage adjustment may be required with anti-retroviral therapy
- Substitute for rifampin for patients receiving antiretrovirals
- Penetrates inflamed meninges
- Well absorbed from the GI tract
- Possible toxicity:
  - Leukopenia (decrease WBC's) thrombocytopenia (decrease PLT's) uveitis (redness, irritation, blurred vision, eye pressure)



# RIFAPENTINE

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- Bactericidal activity (kills bacteria; same mechanism as rifampin)
- Approved for treatment of LTBI and more recently for TB disease in a new shorter course treatment regimen; dose varies on treatment regimen
- Adverse effects similar to rifampin



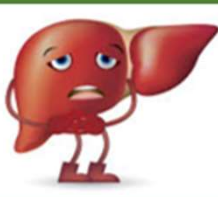



# ISONIAZID

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- **Bactericidal** (kills bacteria)
  - Accounts for majority of ***early bactericidal activity***; greatest early reduction in colony forming units found in sputum
  - Activated by ***katG*** enzyme
- **Dose:**
  - Adult: 5 mg/kg/day (300 mg/daily)
  - Child: 10-15 mg/kg/day
  - Renal failure/dialysis: 300 mg daily or 900 mg thrice weekly
- **Used for treatment of latent TB infection (LTBI) and active disease**



# Isoniazid: Side Effects

<b>Peripheral Neuropathy</b>  Numbness or tingling of fingers and toes	<b>CNS Changes</b>  Restlessness and insomnia	<b>Hepatotoxicity</b>  Increase in ALT/AST	<b>GI Upset</b>  Diarrhea, cramping, nausea, vomiting
<b>Arthralgias/ Joint Pain</b>  Baseline and monthly toxicity screening	<b>Lupus-like syndrome</b> <b>Flu-like symptoms</b> < 1% Weakness, rash, muscle/joint pain, weight loss	<b>Hypersensitivity Reactions</b>  May present with fever or rash	

# ISONIAZID:

## Patient Education and Monitoring

### Patient Education:



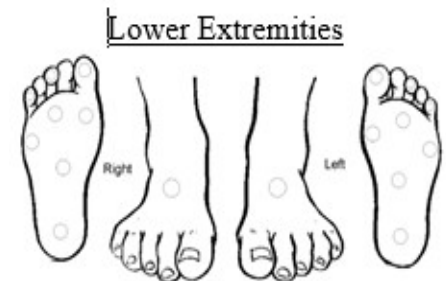
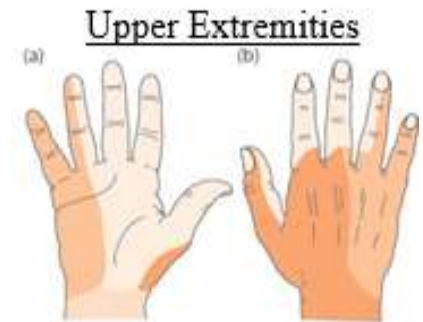
- Avoid alcohol
- Do not take antacids within one hour of medication administration
- Some patients may benefit from supplemental Vit B6
- Drug interactions:
  - levodopa, phenytoin, valproic acid, carbamazepine

### Monitor:

- LFTs: baseline and monthly, especially if underlying liver disease exists
- Therapeutic drug monitoring is recommended if you suspect malabsorption or treatment failure

A stethoscope is placed on a medical lab report. A pink highlighter is visible on the right side of the table.

Urin			g/dL
To			/dL
Alt			
Glob			mg
Total b			U/L
Direct bilirubin	220	H	U/L
AST (SGOT)	340	H	U/L
ALT (SGPT)			U/L
ALP			U/L



# PYRAZINAMIDE

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- **Bacteriostatic/sterilizing agent:**
  - Greatest activity against dormant or semi dormant (slow growing) organisms
- **Dose**
  - Adult: 25mg/kg/day
  - Children: 30-40 mg/kg/dose
  - Renal failure: 25 mg/kg/dose 3 times per week (not daily)
    - Cleared by the kidneys; *dose 3 x week after dialysis*
- **Use in pregnancy/breastfeeding:**
  - In the U.S. PZA is avoided in pregnancy for drug susceptible disease due to lack of data regarding teratogenicity, however
  - Should be used for drug-resistant TB when the isolate is susceptible to PZA
  - When in doubt, please consult with an expert



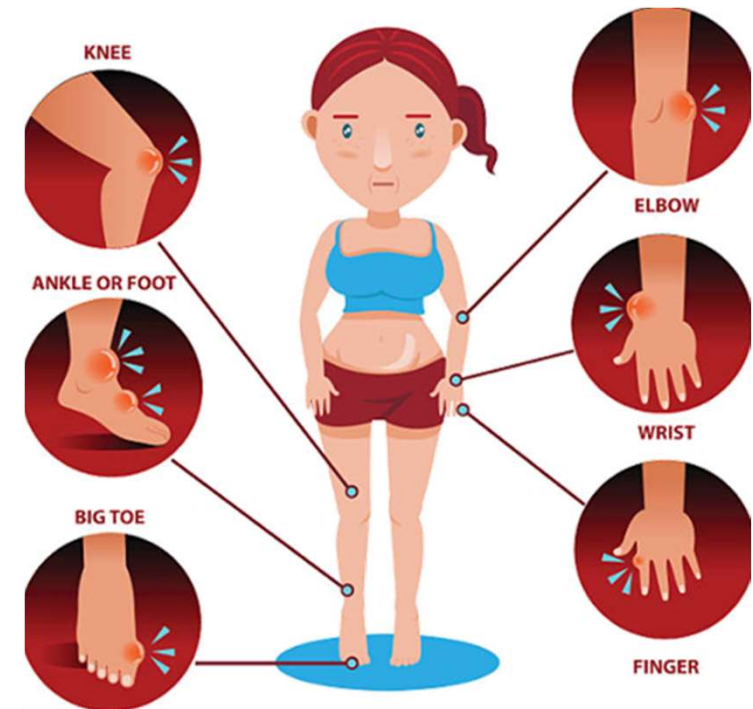


# PYRAZINAMIDE

- **Adverse Reactions:**
  - Gout (hyperuricemia) and arthralgias
  - Hepatotoxicity
  - Rash
  - Photosensitivity
  - GI upset
- **Monitor**
  - Monitor transaminases and uric acid
- **Patient educations:**
  - May be taken with or without food
  - Limit sun exposure
  - Notify nurse or healthcare worker if they experience severe pain or swelling in joints



BS/Glucose		
Cholesterol		
Triglyceride		
HDL-C		mg/dL
LDL-C	12.5 H	g/dL
Uric acid		g/dL
Total protein		g/dL
Albumin		mg/dL



# ETHAMBUTOL

- **Bacteriostatic** (prevents multiplication/growth)
  - Bactericidal only at the high end of the dosing range
- **Prevention of rifampin resistance:**
  - Ethambutol **protects the emergence of rifampin resistance** when INH resistance may be present
- **Dose:**
  - Adults: 15-25 mg/kg/day
  - Children: 15-25 mg/kg/day
  - Renal failure: 15-25 mg/kg/dose 3 x weekly (not daily)
- Remember: EMB can be discontinued as soon as the results of drug susceptibility studies demonstrate that the isolate is susceptible to INH and RIF



# ETHAMBUTOL

- Toxicity

- Retrobulbar neuritis
  - Can be in one or both eyes
- Peripheral neuritis
- Cutaneous reactions (<1%)

- Monitor

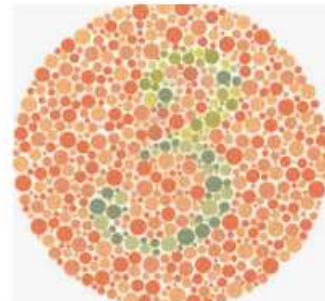
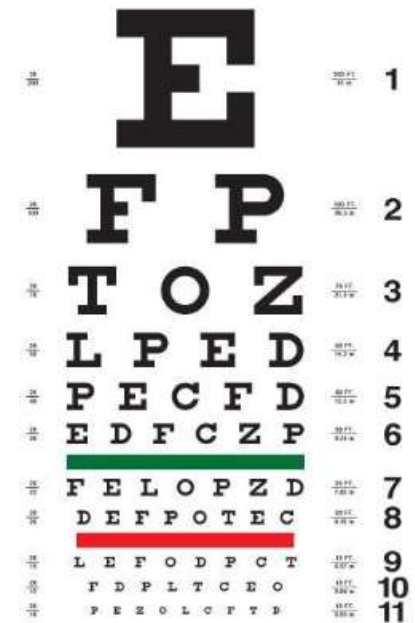
- Baseline and monthly visual acuity (Snellen) and color discrimination (Ishihara) should be performed
- Monitor blurry vision (squinting during exam or difficulty seeing traffic signs)



If changes from baseline occur, stop medication and refer to ophthalmologist

- Patient Education:

- Counsel patient to report any visual changes



# FLUOROQUINOLONES

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## Moxifloxacin



## Levofloxacin



# FLUOROQUINOLONES

## Moxifloxacin

Bactericidal

Metabolized in part by the liver

Dose: 400 mg/day; no dose adjustment required with renal insufficiency

## Levofloxacin

Bactericidal

Excreted unchanged by the kidneys;

Dose: 750-1000 mg/day; adjust dose in renal insufficiency (750-1000 mg/dose 3 times weekly for creatinine clearance < 30 mL/min).

<b>Side Effects</b>	Abdominal discomfort	Diarrhea	Nausea/vomiting	Mouth sores	Headache	Dizziness
	Skin itching	<b>QT prolongation</b>	Blurred vision	<b>Nervousness</b>	Anxiety	<b>Agitation</b>

# Fluoroquinolone Toxicity

- Hepatotoxicity (**rare** with levofloxacin)
  - Reversible transaminase elevation
- Tendonitis/Tendon Rupture; **rare**
  - Usually achilles
  - Risk benefit evaluation
- Neurologic effects
  - Insomnia, dizziness, headache, tremors
- *Patient Education:*
  - Avoid milk-based products or antacids within 2-hours of ingesting medication
  - Avoid vitamin supplements

# Medication Administration Tips for Adults

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Crush meds  
and place in  
applesauce or  
in a drink of  
patient's  
choice

Drink water  
before taking  
medications  
to lubricate  
throat

Try to take a  
couple of pills  
at a time  
rather than  
one by one





# Medication Administration Tips for Children

- Crush medications and mix them into something sweet (contact pharmacy to ensure medication can be crushed)
- Role play medication administration with a stuffed animal
- Medications should be administered within 30 minutes of mixing



# Don't forget to visit Heartland National TB Center: Products and Tools



[Products – Heartland National TB Center  
\(heartlandntbc.org\)](http://heartlandntbc.org)

## Tips for Treating Latent TB Infection in Children

Including Window  
Prophylaxis

### Who should be treated?

- **Children with latent tuberculosis (TB) infection (LTBI)** - where LTBI is defined as a positive TB screening test (tuberculin skin test [TST] or interferon gamma release assay [IGRA] blood test) and no evidence of active disease on chest x-ray (CXR) or physical exam.
- **Children in the window period after exposure** - Children <5 years old who have been in contact with an infectious adult or teen in the past 8 weeks and who have a negative TB screening test are still in the window period for test conversion. These children should have a physical exam and CXR. If there is no evidence of active disease, they should be treated with 'window prophylaxis' and retested 8-10 weeks after the break in contact with the infectious source.
- **Children who are in contact with a source that has drug resistance** - Whether the infectious source has multidrug-resistant (MDR) or other drug resistant TB, children who are exposed or infected should be treated in consultation with an expert in tuberculosis.

### What are the treatment regimens?



- **3HP** - (isoniazid [INH] and rifapentine [RPT]) is approved for children  $\geq 2$  years of age. This regimen allows a child to be treated with only 12 weekly doses of medication.
- **4R** - (rifampin [RIF] daily for 4 months) is safe and effective for children that cannot take 3HP.
- **3HR** - (INH and RIF dosed daily for 3 months) though not used as commonly in the United States (US) as in the United Kingdom, is an effective short-course treatment regimen.
- **6H** - (INH dosed daily or twice weekly [BIW]) is effective, but the least desirable, as only 50% of patients are likely to complete the necessary 6 months course.
- Infants who are exclusively breastfed, pregnant teens and children with poor diets or who are immune suppressed should receive pyridoxine (Vitamin B6) 1-2 mg/kg with each dose of INH.

### What are helpful administration tips?

- To help with swallowing pills, children can practice by swallowing similarly sized candies.
- For children who cannot swallow pills, TB medications can be crushed (or capsules opened) and mixed with a small amount of food (syrup, applesauce, etc.).
- Mixing should be done immediately before dosing and discarded if not administered within 30 minutes of mixing.



### What are the monitoring recommendations?



- Medication doses should be adjusted based on weight change, if needed.
- Children tolerate treatment very well. Routine laboratory monitoring is not necessary unless the child takes other medications metabolized through the liver or has liver disease.
- Children taking other medications or who have underlying liver conditions should have a monthly CBC (complete blood count) as well as a metabolic panel that contains liver function tests (LFTs).
- Children with symptoms that suggest medication toxicity (e.g. recurrent vomiting, decreased appetite, abdominal pain) should have their LFTs checked.

- All TB medications have side effects
- Baseline and monthly assessments for visual acuity and color discrimination aid in preventing toxicities
- When changes from baseline occur
  - Hold medications and reassess the patient to find likely cause
- Be creative when medication administration becomes a challenge



*\*Take  
home message*



*Thank You!*

