



# **TB Medications: What Nurses Need to Know**

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Has the following disclosures to make:

- No conflict of interests
- No relevant financial relationships with any commercial companies pertaining to this activity





# TB Medications:

## *What Nurses Need to Know*

Presented by:  
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# Objectives:

- **First-line Tuberculosis (TB) Medications**
  - Medication Dosages
  - Side Effects
  - Nursing Considerations
- **Second-line Tuberculosis (TB) Medications**
  - Medication Dosages
  - Side Effects
  - Nursing Considerations



# 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



# First-line Anti-Tuberculosis Drugs



# Fluoroquinolones



Moxifloxacin



Levofloxacin

## Second line Anti-Tuberculosis Drugs

Amikacin, Bedaquiline, Clofazimine, Cycloserine, Ethionamide, Imipenem, Linezolid, Para- aminosalicyclic acid, Streptomycin





## *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** and **PZA** have sterilizing activity



# RIFAMPIN

- **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
  - High Dose: 20-30 mg/kg (serious forms of TB such as meningitis/disseminated)
  - Renal failure/dialysis: no dose adjustment
- **Rapid absorption**
  - May be decreased by high-fat meals
  - Low CSF penetration (10-20%)- requires higher dosing
- **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

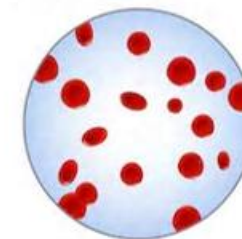
### Flu-like symptoms

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

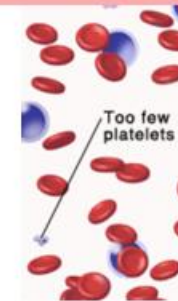
### Hyperbilirubinemia



### Hemolytic Anemia



### Thrombocytopenia



# RIFAMPIN

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- **Monitoring:**

- Liver enzymes AST/ALT if there are symptoms of hepatotoxicity
- Therapeutic drug monitoring is recommended if you suspect malabsorption or treatment failure

- **Drug to drug interactions:**

- Certain rifamycins cannot be given with other medications due to the drug interactions such as antiretrovirals, antiarrhythmics, anticoagulants, antidepressants ; 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



- 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 or any drug with significant interactions
- Penetrates inflamed meninges effectively (*risks vs. benefit*)
- 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 (3HP) 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

## Peripheral Neuropathy



Numbness or tingling of fingers and toes

## CNS Changes



Restlessness and insomnia

## Hepatotoxicity



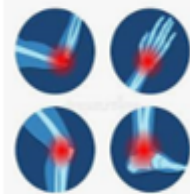
Increase in ALT/AST

## GI Upset



Diarrhea, cramping, nausea, vomiting

## Arthralgias/ Joint Pain



Baseline and monthly toxicity screening

## Lupus-like syndrome

**Flu-like symptoms** < 1%

Weakness, rash, muscle/joint pain, weight loss

## Hypersensitivity Reactions



May present with fever or rash



# ISONIAZID:

## Patient Education and Monitoring

### Patient Education:

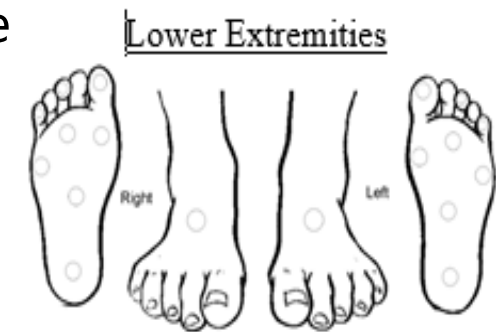
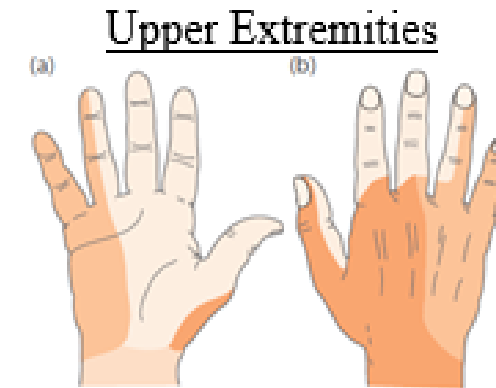


- Avoid alcohol
- Do not take antacids within one hour of medication administration
- Some patients may benefit from supplemental Vit B6
- Drug interactions:
  - levodopa, phenytoin, valproic acid, carbamazepine

### Monitor:

- LFTs: baseline and monthly, especially if underlying liver disease exists
- Peripheral Neuropathy (high- dose INH)
- Therapeutic drug monitoring is recommended if you suspect malabsorption or treatment failure

|                  |       |      |
|------------------|-------|------|
| Urine            |       | g/dL |
| Total            |       | g/dL |
| ALT              |       |      |
| Glob             |       |      |
| Total b          |       |      |
| Direct bilirubin | 220 H | U/L  |
| AST (SGOT)       | 340 H | U/L  |
| ALT (SGPT)       |       | U/L  |
| ALP              |       | U/L  |



# PYRAZINAMIDE

- **Bacteriostatic/sterilizing agent:**
  - Greatest activity against dormant or semi dormant (slow growing) organisms
- **Daily Dosing**
  - Adult: 25mg/kg
  - Children: 30-40 mg/kg
- **Renal Dosing: 3 Times per Week**
  - 25 mg/kg TIW
  - Cleared by the kidneys
  - *If patient on dialysis , provide 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**

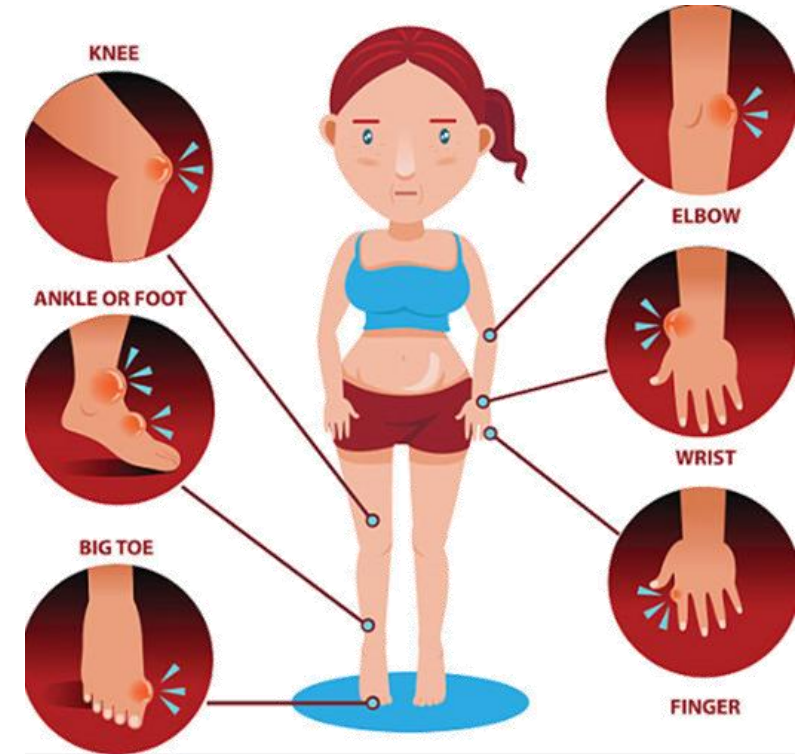
- Monitor transaminases and uric acid

- **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   |        | mg/dL |
| Triglyceride  |        | mg/dL |
| 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 RIF resistance when INH resistance may be present
- **Daily Dosing:**
  - Adults: 15-25 mg/kg
  - Children: 15-25 mg/kg
- **Renal Dosing: 3 times weekly**
  - 15-25 mg/kg TIW
- *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

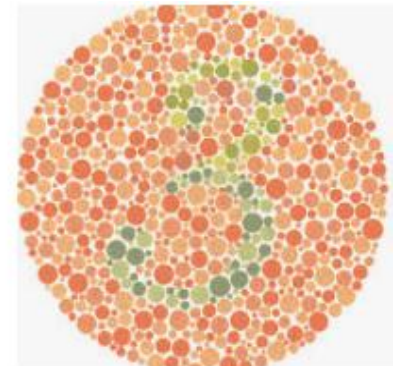
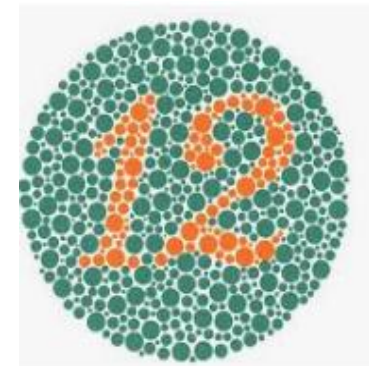
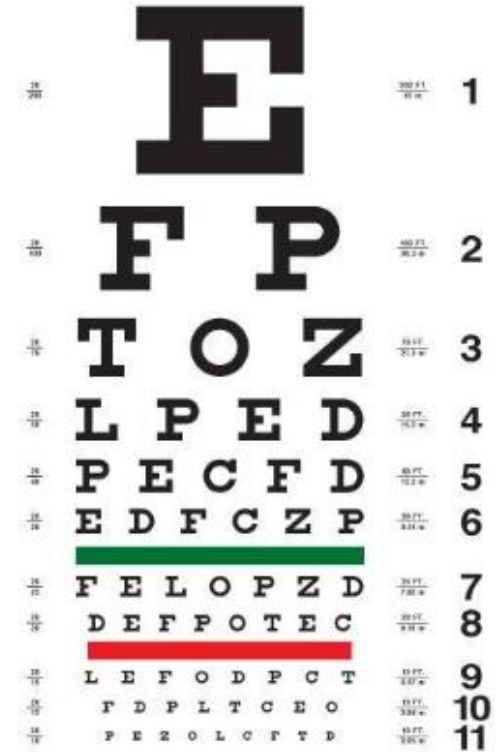
- Retrobulbar neuritis
  - Can be in one or both eyes
- Peripheral neuropathy
- Cutaneous reactions (<1%)

- 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

## 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).

### Side Effects:

Abdominal discomfort, Diarrhea, Nausea/Vomiting, Mouth Sores, Headache, Dizziness, Skin Itching, QT Prolongation, Blurred Vision, Nervousness, Anxiety, Agitation



# 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 and avoid vitamin supplements



# 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 ≥ 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 toxicity assessments for visual acuity and color discrimination aid in preventing toxicities (TB 205 form DSHS)
- When changes from baseline occur
  - Hold medications and reassess the patient to find likely cause
- Patient education



# References

Texas Department of State Health Services Standing Delegation Orders for Tuberculosis Clinical Services Provided by Authorized Licensed Nurses, Fiscal Year 2025





*Thank  
you!*

