TB and Comorbidities

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May 8, 2025

TB Nurse Case Management • May 6 – 8, 2025 • San Antonio, Texas

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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 and Comorbidities

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Nurse Case Management

May 8, 2025

Agenda

- Tuberculosis (TB) and Human Immunodeficiency Virus (HIV)
- TB and Diabetes mellitus (DM)
- TB in patients with Chronic Kidney Disease (CKD)
- TB in patients with Hepatitis C Virus (HCV)

TB and HIV

WORLDWIDE TUBERCULOSIS IS THE LEADING CAUSE OF DEATH AMONG PEOPLE LIVING WITH HIV.

Patient with TB /HIV and Bipolar Disorder

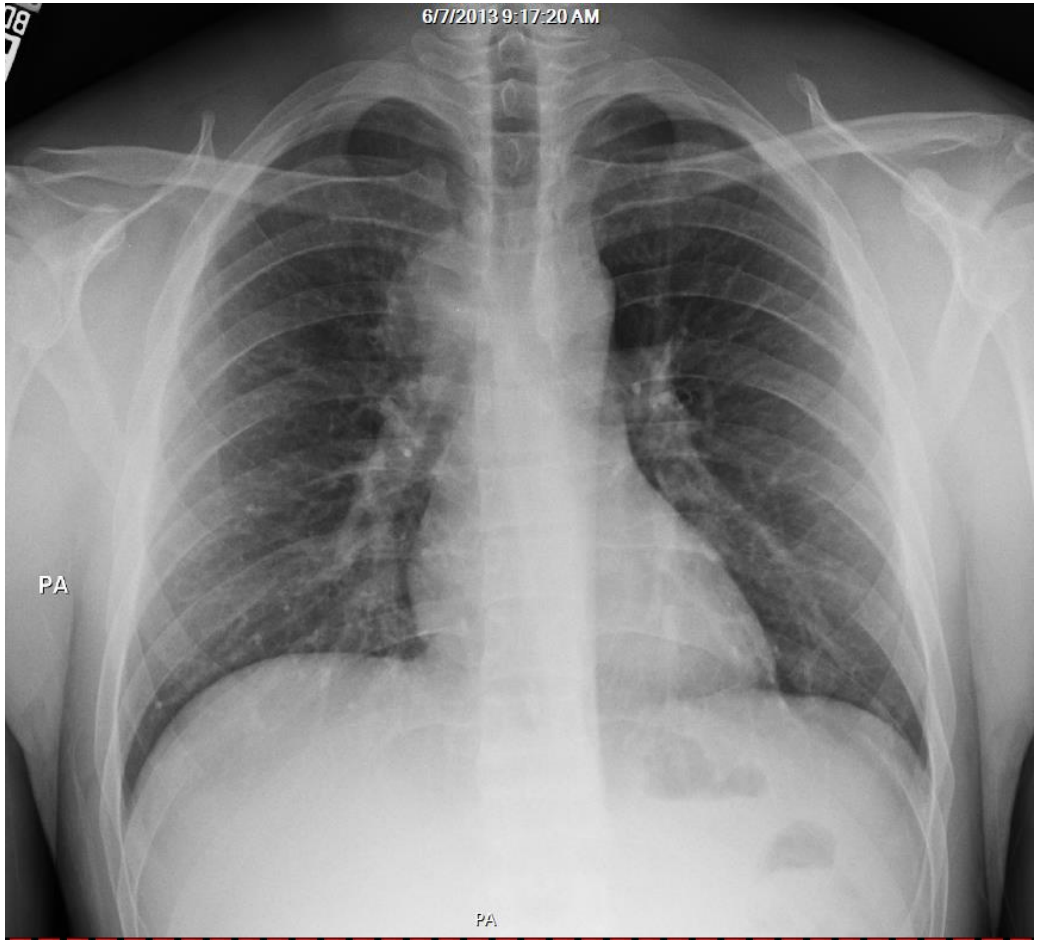
- 30-year-old Hispanic male who was referred to TCID for treatment of pulmonary tuberculosis with history of HIV infection, bipolar disorder, HCV, substance use disorder and lack of housing.
  - Chest X-ray normal
  - Sputum AFB smear negative cultures positive for *MTB, pan-susceptible*.

Hospital Course

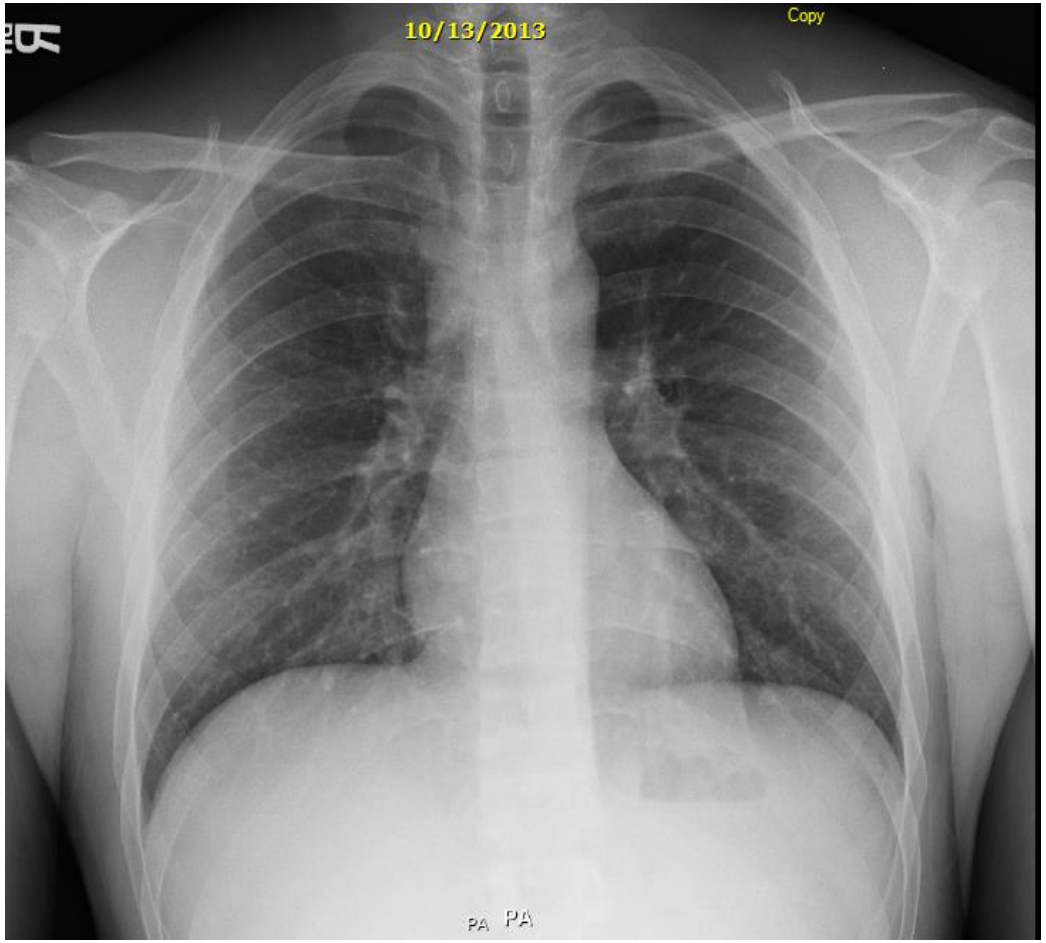
- Admitted to TCID and
  - Started on Rifampin/INH/PZA/EMB
  - Became manic and left against medical advice
- Readmitted under court order one month later

- After 2 weeks was started on antiretrovirals
  - Dolutegravir 50 mg BID and Truvada 1 tab Qday
- Developed IRIS, treated with prednisone

CXR 6 weeks after ART



CXR at the end of Therapy



Treatment Outcomes Person with TB HIV Infection and Bipolar Disorder

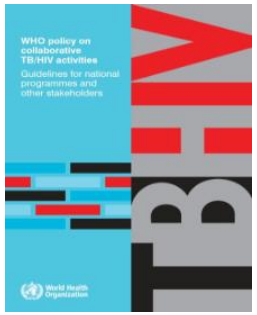
- Completed TB treatment at TCID under court
- Discharged with undetectable HIV viral load
- Discharged with psychiatry and HIV physician follow up

HIV Associated Tuberculosis

- Persons co-infected with TB and HIV are 19 times more likely to develop active TB disease than persons without HIV
- Risk of progression from TBI to TB disease is 10% per year versus 10% lifelong in HIV negative patients
- TB is the leading cause of death among people with HIV

https://www.who.int/tb/areas-of-work/tb-hiv/tbhiv_factsheet.pdf?ua=1

Collaborative TB/HIV Activities: Response & Progress



- HIV testing should be offered to all patients with TB

- Antiretroviral therapy (ART) should be given to all TB patients living with HIV, irrespective of their CD4 counts.

https://www.who.int/tb/areas-of-work/tb-hiv/tbhiv_factsheet.pdf?ua=1

Clinical Presentation
HIV-positive vs. HIV-negative patients

- Driven mostly by degree of immunity

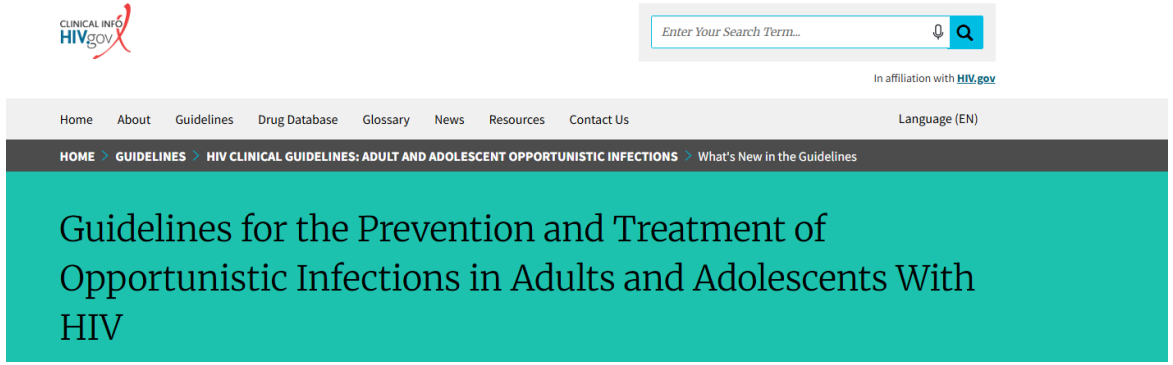
- HIV-positive patients are more likely to have:
- Isolated extrapulmonary localization (53-63% in some studies)
- Primary infection
- Pulmonary basilar involvement
- Hilar or mediastinal lymphadenopathies
- Miliary or disseminated TB
- Normal CXR (8-20% in some studies)

Clinical Microbiology and Infection, Volume 10 Number 5, May 2004

Clinical Presentation of TB in HIV

	Early Stage HIV CD4>200	Late Stage HIV CD4 <200
Clinical picture	Often resembles post-primary pulmonary TB	Often resembles primary pulmonary TB
Sputum Smear	Often positive	More likely to be negative
Chest x-ray	Upper lobe infiltrates with or without cavitation	Infiltrates any lung zone, no cavitation, miliary; normal

Live Documents HIV and TB



https://clinicalinfo.hiv.gov/en/guidelines/hiv-clinical-guidelines-adult-and-adolescent-opportunistic-infections/whats-new

https://clinicalinfo.hiv.gov/en/guidelines

Bacteriologic or histologic exam

- Sputum
  - Three (8-24 hours apart, at least one first thing in the morning)
- Tissue
  - Lymph node biopsy
  - Bone marrow biopsy
  - Tissue biopsy
- Other specimens
  - Urine
  - CSF
  - Peritoneal fluid
  - Pleural fluid (pleural biopsy)

Recommended TB Treatment

- Intensive phase with RIPE for 2 months
- Continuation phase with INH and rifampin for 4 months
- Extend therapy to 9 months for patient with
  - Positive cultures at 2 months or delayed treatment response
  - Patients not receiving ART during TB therapy

https://www.cdc.gov/tb/publications/factsheets/treatment/treatmenthivpositive.htm

ART is Recommended in all HIV-Infected Persons with TB

- Person already on ART, start TB treatment immediately
  - Adjust ART to reduce risk of drug-drug interactions

- ART-naïve patients
  - CD4 count is **<50 cells/mm3**, Initiate ART as soon as possible, but within 2 weeks of starting TB therapy (AI)
  - CD4 count **>50 cells/mm3**, initiated ART within 2- 8 weeks of starting TB treatment (AI)

- With TB meningitis: When initiating ART early, patients should be closely monitored as high rates of adverse events and deaths have been reported in a randomized trial (AI)

https://clinicalinfo.hiv.gov/en/guidelines/hiv-clinical-guidelines-adult-and- adolescent-opportunistic-infections/whats-new May 2025

ART and People with TB meningitis

- ART should be started **after TB meningitis is under control and after at least 2 weeks of anti-TB treatment** to reduce the risk of life-threatening inflammation in a closed space as a result of immune reconstitution (AIII).

https://clinicalinfo.hiv.gov/en/guidelines/hiv-clinical-guidelines-adult-and- adolescent-opportunistic-infections/whats-new May 2025

IRIS
(Immune Reconstitution Inflammatory Syndrome)

- Initial response to therapy then clinical and radiographic worsening due to ART –induced immunity restoration

- Diagnosis of Exclusion, differential includes
  - Treatment failure, drug resistance?
  - Other opportunistic infections
  - Drug reaction

- Treatment
  - Mild cases use NSAIDS
  - More severe cases use steroids
  - Don’t stop TB treatment or ART

Prednisone Dosing for IRIS

- In patients on a rifampin-based regimen: prednisone 1.5 mg/kg/day for 2 weeks, then 0.75 mg/kg for 2 weeks
- In patients on a rifabutin plus boosted PI based regimen: prednisone 1.0 mg/kg/day for 2 weeks, then 0.5 mg/kg/day for 2 weeks
- A more gradual tapering schedule over a few months may be necessary in some patients.
- Pre-emptive prednisone regimen: 40 mg/day for 2 weeks then 20 mg/day for 2 weeks

https://aidsinfo.nih.gov/guidelines/brief-html/4/adult-and-adolescent-opportunistic-infection/325/mycobacterium-tuberculosis

Revised December 18, 2019

Effects of HIV on TB

- HIV and TB → AIDS-defining illness
- HIV infection accelerates TB progression
- HIV increases the risk of extra pulmonary and disseminated TB
- TB is more difficult to diagnose in HIV infected patients
  - Sputum often AFB smear negative
  - Atypical presentation

Neil A. Martinson; Proc Am Thorac Soc Vol 8. pp 288–293, 2011

Effects of HIV on TB

- TB increases the risk of death in HIV + patients
- TB worsens HIV infection
- TB is harder to diagnose in HIV-positive people.
- TB occurs earlier in the course of HIV infection than many other opportunistic infections.
- TB increases HIV viral load

Badri M, Association between tuberculosis and HIV disease progression Int J Tuberc Lung Dis. 2001;5(3):225.

Drug Interactions: Rifamycin and TB Treatment

- Rifampin interacts with many medications use to treat HIV
- Rifabutin can be substituted for rifampin to decrease the drug-drug interaction with ART
- As new ART agents and more pharmacokinetic data become available, these recommendations are likely to change

https://aidsinfo.nih.gov/guidelines/brief-html/4/adult-and-adolescent-opportunistic-infection/325/mycobacterium-tuberculosis

Last updated December 18,2019

Case Management

- Consult an expert in management HIV and TB
- Close attention to adherence to ART and TB meds
- Drug-drug interactions
- IRIS
- Side effects of medications
- TB treatment failure and relapse

https://www.cdc.gov/tb/publications/factsheets/treatment/treatmenthivpositive.htm

TB and Diabetes

IDF Diabetes Atlas 2025 11th Edition

World

2050	852.5 Million
2024	588.7 Million

45% increase

Africa (AFR)

2050	59.5 Million
2024	24.6 Million

142% increase

Europe (EUR)

2050	72.4 Million
2024	65.6 Million

10% increase

Middle-East and North Africa (MENA)

2050	162.6 Million
2024	84.7 Million

92% increase

North America and Caribbean (NAC)

2050	68.1 Million
2024	56.2 Million

21% increase

South and Central America (SACA)

2050	51.5 Million
2024	35.4 Million

45% increase

South-East Asia (SEA)

2050	184.5 Million
2024	106.9 Million

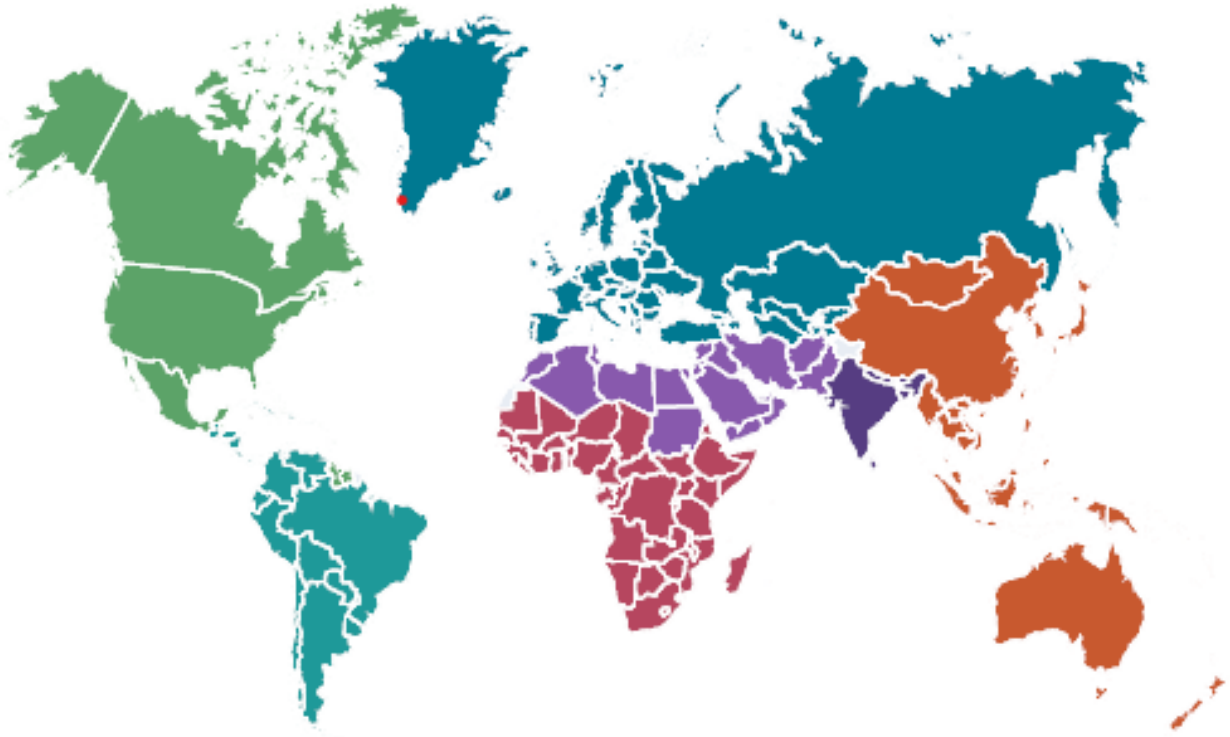
73% increase

Western Pacific (WP)

2050	253.8 Million
2024	215.4 Million

18% increase

Map 1 Number of people with diabetes worldwide and per IDF Region, in 2024–2050 (20–79 years)



Mechanisms of DM and TB Interaction

- DM can cause immunosuppression and increase TB risk
- High BS in diabetes can create a favorable environment for bacteria to grow
- Chronic inflammation associated with DM can damage lung tissue and increase risk of TB development

TB Risk and People with Diabetes

- 1 in 4 people with TB disease also has diabetes
- In 2023, diabetes was the most reported medical risk factor among people with active TB disease
- Patient with diabetes are at increased risk for developing active TB and experience worse treatment outcomes

Diabetes and Tuberculosis

- Incidence of Tuberculosis in diabetic patients is 2-4 x higher
- 80% of people with DM live in developing countries
- 10% of TB cases globally are linked to DM

DM Increase risk of multidrug-resistant TB

- Diabetes is associated with an increased risk of developing multidrug-resistant TB (MDR-TB), which is a more difficult-to-treat form of TB.

- Diabetes is associated with delayed culture conversion

The Impact of Diabetes on Tuberculosis Treatment Outcomes:

- A systematic Review of 33 studies:
  - Diabetes is associated with an increased risk of TB treatment **failure** and **death** during TB treatment.
  - Diabetes is associated with an increased risk of **death – 4.95 greater**- in the studies that adjusted for age and other potential confounding factors.
  - Diabetes is associated with an increased risk of TB **relapse 3.89** greater

Baker et al. Bio Med Central, Medicine, 2011

Challenges Associated with TB Treatment in Diabetes

- Absorption: Gastroparesis and malabsorption
- Comorbidities: CKD, cardiovascular disease, non-alcoholic Steatohepatitis
- Rifampin: Strong hepatic enzyme inducer leading to decreased drug levels of oral medications for DM
  - Sulfonylureas, Thiazolidinediones,

Rifamycins and Anti-Diabetic Agents: Drug-Drug Interactions

General Tuberculosis (TB) Therapy Information

Developed by Kelly Bujnoch, PharmD Candidate 2011 with the assistance of Regina Tabor, RPh, DPh, Robert Petrossian and Barbara Seaworth, MD

Many diabetic medications are metabolized via the Cytochrome P450 (CYP450) enzymatic system in the liver. Rifampin is a potent inducer of the Cytochrome P450 and accounts for many of the drug interactions that occur during TB therapy.

Rifabutin is a weaker inducer of the Cytochrome P450 system, potentially interacting with some of the same medications as Rifampin.

Enzyme induction effects can last 2-4 weeks after discontinuation of rifampin. Glucose levels should be monitored and diabetic medications should be readjusted at the end of treatment.

Brand	Generic	Clinical Effect	Rifampin (RIF) Drug-Drug Interactions	Recommendations
Biguanide (Metformin) Based				
Glucophage®	**Metformin**	↓Production of glucose by the liver ↓Absorption of glucose by intestines ↑Insulin sensitivity	None noted	No contraindications
Glucovance®	**Glyburide+ Metformin**	Glyburide: ↑Secretion of insulin from the pancreas Metformin: ↓Production of glucose by the liver ↓Absorption of glucose by intestines ↑Insulin sensitivity	↓Glyburide levels 39% Metformin: None noted	•Consider glipizide as first choice sulfonylurea to minimize interactions •Increase monitoring •Consider dose adjustment of antidiabetic agents or alternative glucose control therapy. Metformin: •No contraindications
Metaglip®	**Glipizide+ Metformin**	Glipizide: ↑Secretion of insulin from the pancreas Metformin: ↓Production of glucose by the liver ↓Absorption of glucose by intestines ↑Insulin sensitivity	↓Glipizide levels 22% Metformin: None noted	
Janumet®	**Sitagliptin+ Metformin**	Sitagliptin: ↑Secretion of insulin from the pancreas • delays gastric emptying ↓Appetite ↓Glucagon release after meals Metformin: ↓Production of glucose by the liver ↓Absorption of glucose by intestines ↑Insulin sensitivity	May ↓ sitagliptin levels Metformin: None noted	Sitagliptin: • Increase monitoring; interaction may be minimal and require no adjustments Metformin: •No contraindications
Sulfonylurea Based				
Micronase®	**Glyburide**	↑Secretion of insulin from the pancreas	↓Glyburide levels 39%	•Consider glipizide as first choice sulfonylurea to minimize interactions •Increase monitoring •Consider dose adjustment of antidiabetic agents or alternative glucose control therapy.
Amaryl®	**Glimepiride**	↑Secretion of insulin from the pancreas	↓Glimepiride levels 30%	
Glucotrol®	**Glipizide**	↑Secretion of insulin from the pancreas	↓Glipizide levels 22%	
Glucovance®	**Glyburide + Metformin**	Glyburide: ↑Secretion of insulin from the pancreas Metformin: ↓Production of glucose by the liver ↓Absorption of glucose by intestines ↑Insulin sensitivity	↓Glyburide levels 39% Metformin: None noted	•Consider glipizide as first choice sulfonylurea to minimize interactions •Increase monitoring •Consider dose adjustment of antidiabetic agents or alternative glucose control therapy. Metformin: •No contraindications
Metaglip®	**Glipizide+ Metformin**	↑Secretion of insulin from the pancreas Metformin: ↓Production of glucose by the liver ↓Absorption of glucose by intestines ↑Insulin sensitivity	↓Glipizide levels 22% Metformin: None noted	
Avandaryl®	**Pioglitazone + Glimepiride**	Pioglitazone: ↑Insulin sensitivity (body and liver cells) Glimepiride: ↑Secretion of insulin from the pancreas	↓Pioglitazone levels 54% ↓Glimepiride levels 30%	Pioglitazone: •Increase monitoring •Consider dose adjustment of antidiabetic agents or alternative glucose control therapy. •Consider glipizide as first choice sulfonylurea to minimize interaction Metformin: •No contraindications
Duetact®	**Rosiglitazone + Glimepiride**	Rosiglitazone: ↑Insulin sensitivity (body and liver cells) ↓Production of glucose by the liver ↑Cell uptake of glucose Glimepiride: ↑Secretion of insulin from the pancreas	↓Rosiglitazone levels 54-65% ↓Glimiprde levels 30%	Rosiglitazone: •Increase monitoring •Consider dose adjustment of antidiabetic agents or alternative glucose control therapy. •Consider glipizide as first choice sulfonylurea to minimize interaction Metformin: •No contraindications

Rifamycins and Cardiovascular Agents: Drug - Drug Interactions

General Tuberculosis (TB) Therapy Information

Many cardiovascular agents are metabolized via the Cytochrome P450 (CYP450) enzymatic system in the liver . Rifampin is a potent inducer of the Cytochrome P450 and accounts for many of the drug interactions that occur during TB therapy.

Rifabutin is a weaker inducer of the Cytochrome P450 system, potentially interacting with some of the same medications as Rifampin.
Rifapentine is also a potent inducer of CYP450 enzymatic system in the liver with drug-drug interactions of a severity similar to those of rifampin.

Generic	Clinical Effect	Interactions	Recommendations
Angiotensin Converting Enzyme (ACE) Inhibitors			
(Class Effect)	↓blood pressure	RIF: ↓ACEI levels ~30% (poor evidence, no studies)	Increase BP monitoring; Consider ACEI dose adjustment.
Angiotensin Receptor Blockers (ARBs)			
(Class Effect)	↓blood pressure •renoprotective	RIF: ↓ARB levels ~35% (poor evidence, no studies)	Increase BP monitoring; Consider ARB dose adjustment.
Beta Blockers			
metoprolol	↓blood pressure	RIF: ↓metoprolol levels 33%	Increase BP monitoring; Consider dose adjustment.
propranolol	↓blood pressure	RIF: doubled apparent oral clearance	Increase BP monitoring; Consider dose adjustment.
bisoprolol	↓blood pressure	RIF: ↓bisoprolol levels 34%	Increase BP monitoring; Consider dose adjustment.
Calcium Channel Blockers (CCBs)			
nifedipine	↓blood pressure	RIF: ↓nifedipine levels 92-97% (Contraindicated *)	Increase BP monitoring; Consider dose adjustment; Consider switching to other antihypertensive agents with less interaction. *Major interactions occurr between orally administered nifedipine and rifampin. IV administration significantly reduces the potency of the interactions.
amlodipine	↓blood pressure	RIF: theoretically ↓ amlodipine levels	Increase BP monitoring; Consider dose adjustment; Consider switching to other antihypertensive agents with less interaction.
diltiazem	↓blood pressure	RIF: ↓diltiazem levels	Increase BP monitoring; Consider dose adjustment; Consider switching to other antihypertensive agents with less interaction.
verapamil	↓blood pressure	RIF: ↓verapamil levels 93-99%	Increase BP monitoring; Consider dose adjustment; Consider switching to other antihypertensive agents with less interaction.
Thiazide Diuretics			
(Class Effect)	↓blood pressure	none noted	no contraindications
HMG CoA Inhibitors (Statins)			
atorvastatin	↓cholesterol levels ↓stroke •cardioprotective	RIF: ↓atorvastatin levels 80%	Increase BP monitoring; Consider alternate lipid lowering agent to minimize effect; Consider increasing Statin dose; Consider using Rifabutin in place of Rifampin.
rosuvastatin	↓cholesterol levels ↓stroke •cardioprotective	RIF: may ↓rosuvastatin levels	Increase BP monitoring; Consider increasing Statin dose; Consider using Rifabutin in place of Rifampin.
simvastatin	↓cholesterol levels ↓stroke •cardioprotective	RIF: ↓simvastatin levels 82-97%	Increase BP monitoring; Consider alternate lipid lowering agent to minimize effect; Consider increasing Statin dose; Consider using Rifabutin in place of Rifampin.
pravastatin	↓cholesterol levels ↓stroke •cardioprotective	RIF: theoretically ↓statin levels	Increase BP monitoring; Consider alternate lipid lowering agent to minimize effect; Consider increasing Statin dose; Consider using Rifabutin in place of Rifampin.
lovastatin	↓cholesterol levels ↓stroke •cardioprotective	RIF: theoretically ↓statin levels	Increase BP monitoring; Consider alternate lipid lowering agent to minimize effect; Consider increasing Statin dose; Consider using Rifabutin in place of Rifampin.
fluvastatin	↓cholesterol levels ↓stroke •cardioprotective	RIF:↓statin levels ~50%	Increase BP monitoring; Consider alternate lipid lowering agent to minimize effect; Consider increasing Statin dose; Consider using Rifabutin in place of Rifampin.
Ionotropic/Chronotropic Agents			
digoxin	↑cardiac output •heart rate control with atrial arrhythmias	RIF: ↓levels ~30%	Measure digoxin levels prior to rifampin therapy and then intermittently thereafter. Increase digoxin dose as necessry to maintain therapeutic levels.
Antiplatelet Agents			
clopidogrel	↓platelet adhesion	↑metabolism of clopidogril to active metabolite	Monitor for increased antiplatelet effects such as bruising or bleeding.

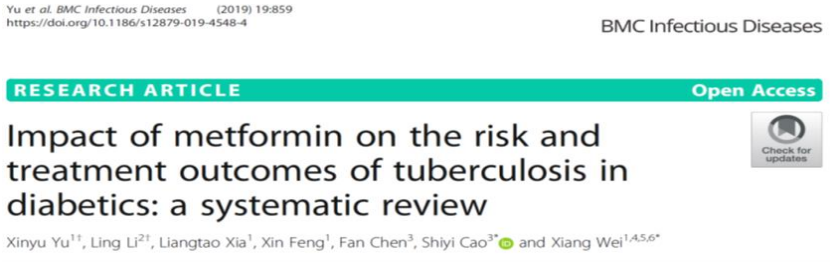
Managing TB in Persons with DM

- TB medication absorption is poor in people with DM
  - Consider drug levels
- Extend TB treatment to 9 months if slow culture conversion or clinical response
- If diabetic nephropathy is present adjusted doses of pyrazinamide and ethambutol
- Administer B6 to prevent INH induced peripheral neuropathy
  - Observe closely for TB treatment failure

Managing DM in Persons with TB

- Check glucose and HbA1C
- Reinforce lifestyle changes diet and exercise
- Refer patients to diabetes clinic for long-term DM care
- Review drug interactions between DM medications and rifampin, adjust doses accordingly

TB/DM and Metformin


Yu et al. BMC Infectious Diseases (2019) 19:859
https://doi.org/10.1186/s12879-019-4548-4

BMC Infectious Diseases

RESEARCH ARTICLE Open Access

Impact of metformin on the risk and treatment outcomes of tuberculosis in diabetics: a systematic review

Xinyu Yu[1†], Ling Li[2†], Liangtao Xia[1], Xin Feng[1], Fan Chen[3], Shiyi Cao[3*] and Xiang Wei[1,4,5,6*]

- Retrospective review of databases through March 2019
- 12 observational studies, 6980 cases

- Results
  - Metformin prescription decreased risk of TB disease among diabetics (TBI to TB disease)
  - Metformin use resulted in higher probability of smear conversion at 2 months
  - Metformin medication during treatment for TB disease reduced mortality
    - Relapse was not reduced by metformin prescription

Benefits of Metformin in TB

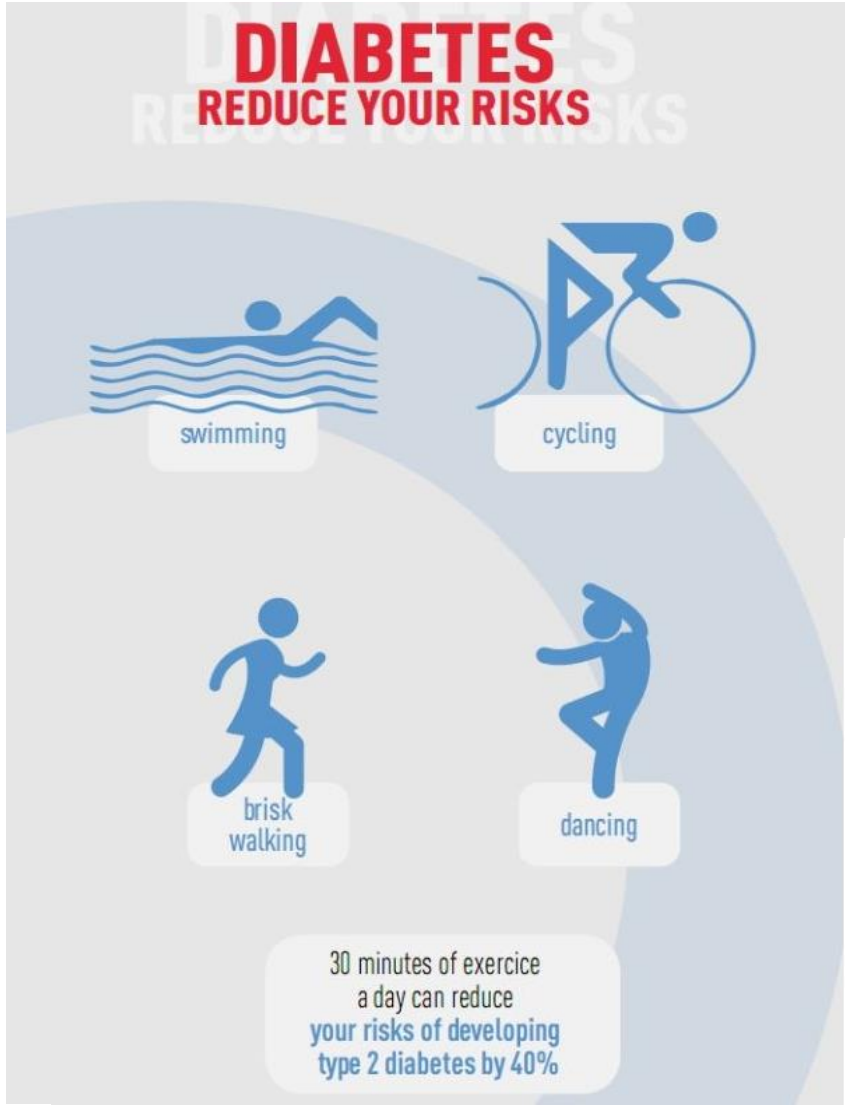
- Lower TB mortality rate
- Increased TB treatment success rate
- Enhanced culture conversion
- Reduced risk of developing active TB

World Health Organization Recommends Bidirectional Screening

- All people with TB should be screened for DM
  - Fasting/random blood sugar or 2 hour glucose tolerance test
  - HgbA1c
- All newly diagnosed patients with DM, need screening for TB symptoms, further workup if clinically and epidemiologically indicated
  - Radiograph
  - Sputum AFB smear, cultures or other tests

Exercise and Diabetes

- Healthy weight
- Balance diet
- Smoking
- Stress and depression
- Waist circumference, High risk for DM and heart disease:
  - > 40 inches for men
  - > 35 inches for women
- Sleeping patterns: Both short <6h and > 9h associated with DM



IDF Federation 2014

Benefits of Physical Activity

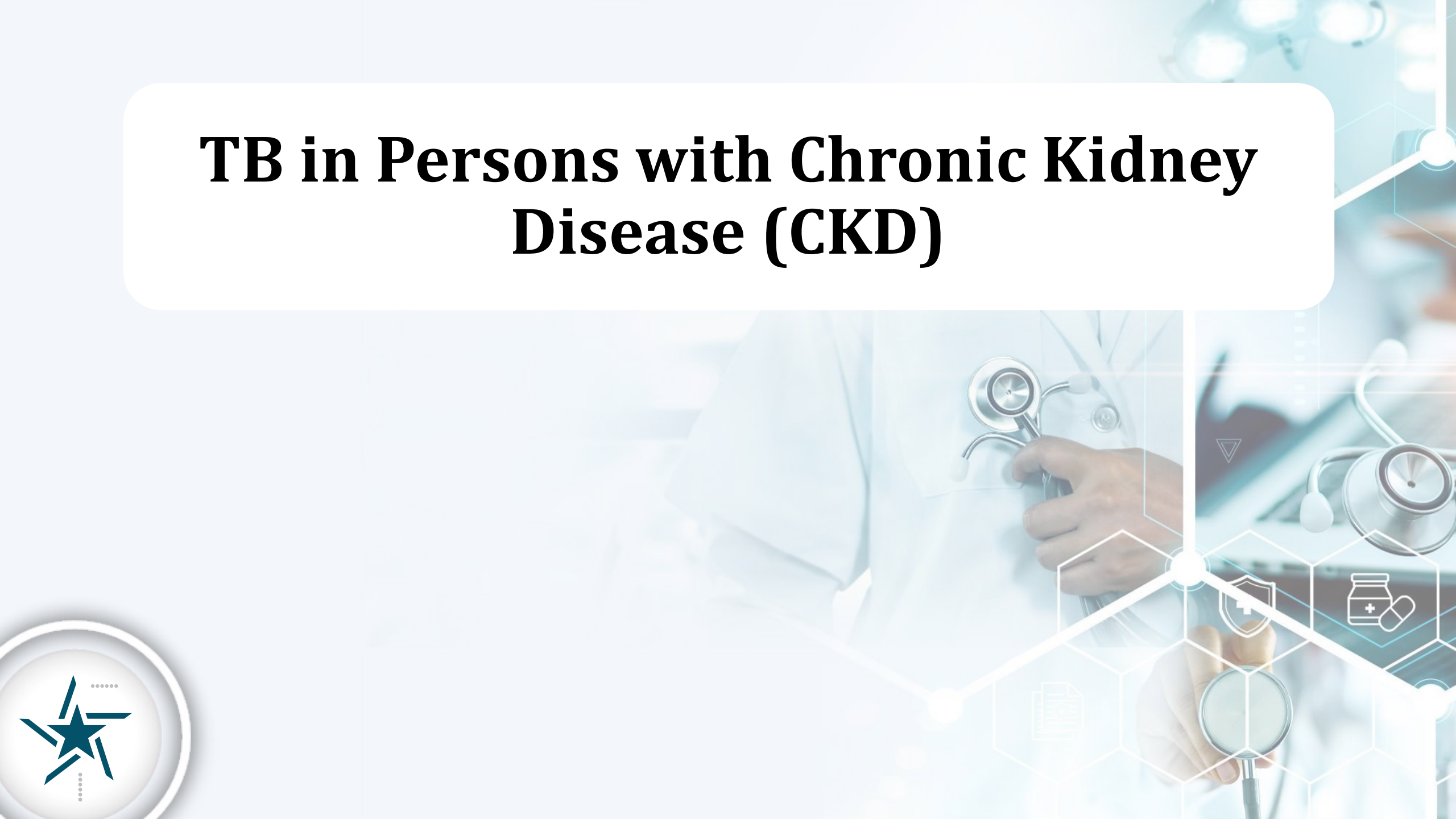
- Lowers risk of HTN, stroke
- Improves mental health and cognitive function
- Prevents weight gain, DM, heart disease and cancer
- If you could package physical activity into a pill, it would be the most effective drug on the market

Not Getting Enough Physical Activity Costs Money

- $117 billion in annual health care costs are associated with inadequate physical activity

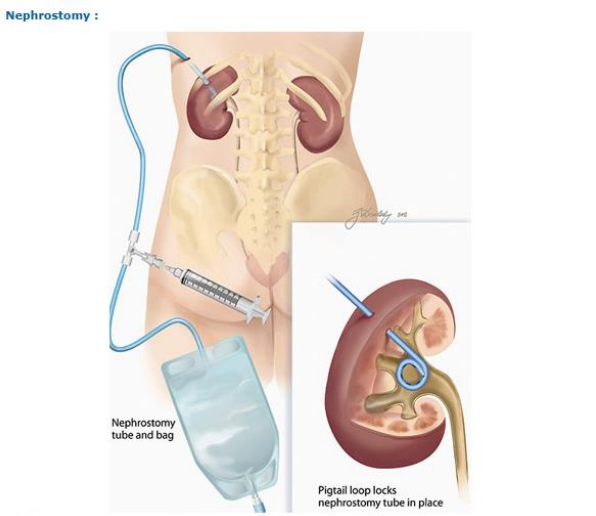
- Only half of adults get the physical activity they need to help reduce and prevent chronic diseases.

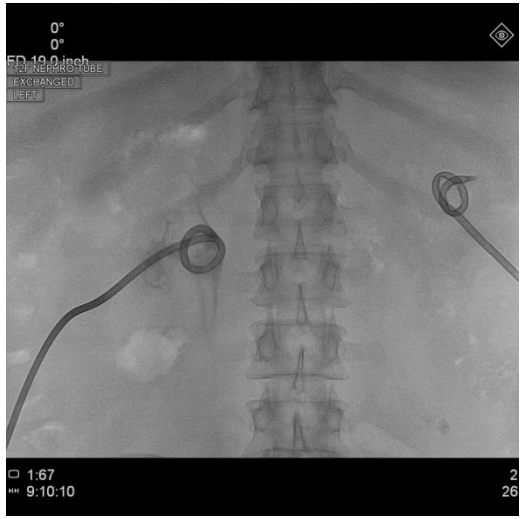
TB in Persons with Chronic Kidney Disease (CKD)



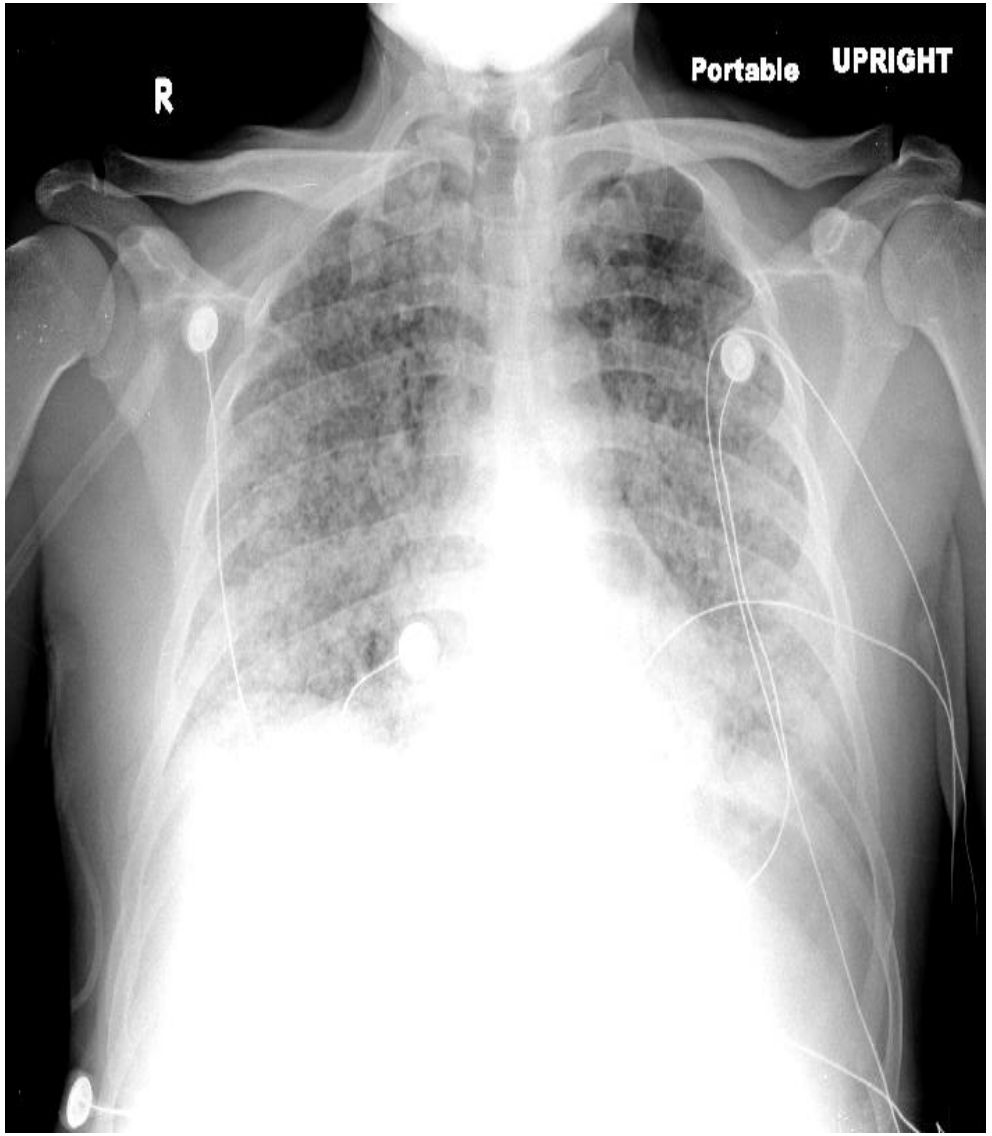
Patient with TB-DM-CKD

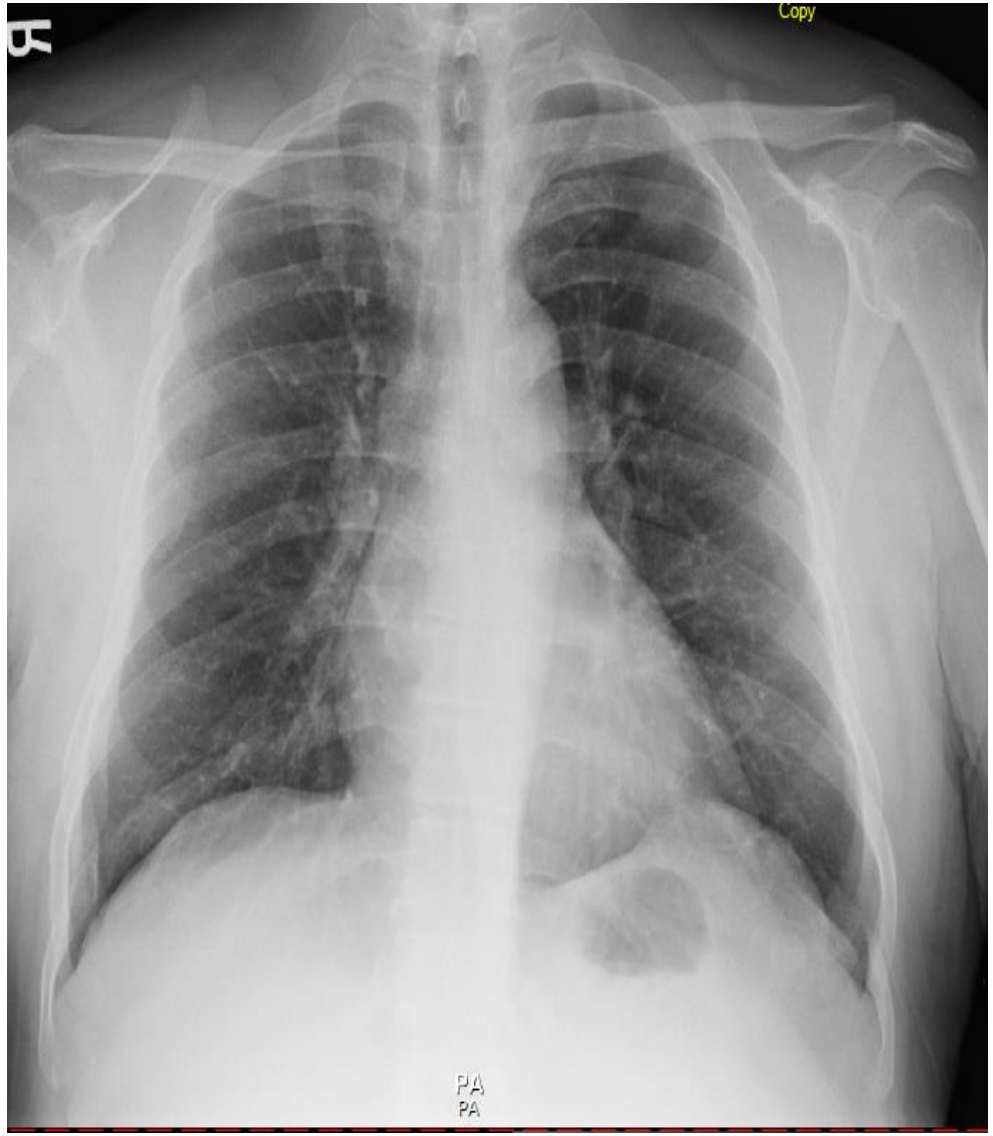
- 46 y/o M with DM disseminated TB involving lungs, both ureters and kidneys
- Kidney failure, creatinine 8, ureteral strictures
- Respiratory failure
- Discharged with bilateral nephrostomy tubes
  - Multiple UTI’s





Initial and End of TB Treatment CXR





Chronic Kidney Disease Increases TB Risk

- Increased risk of progression from TB infection to active TB disease
- Difficulty diagnosing & treating patients on dialysis
- Symptoms often mistaken for complications of dialysis
  - Cough (congestive heart failure, fluid overload), fever (bacterial infection)

TB Screening in Persons with CKD

- TB skin test or IGRA
  - At diagnosis of CKD
  - Thirty days prior to admission to hemodialysis unit
  - Thirty days prior to scheduled renal transplant
  - Annual/periodic
    - If TST negative Two step should be done

Presentation of TB in Persons on Dialysis

- Atypical presentation of pulmonary TB
  - Fever – most common sign!
  - Weight Loss
  - Anorexia
  - Cough (may be present)
- Consider TB Disease in ANY patient with:
  - Recurrent pneumonia
  - Pneumonia not improved within 2 weeks of antibiotics – avoid fluoroquinolones May mask TB!

Presentation of TB in Persons on Dialysis

- Extra pulmonary TB
  - More common in dialysis patients
  - Don’t forget to do SPUTUMS!!
  - Abdominal – (Peritoneal, liver, bowel, adenopathy)
    - TB peritonitis can be difficult to distinguish from bacterial
  - Any site possible - evaluate if abnormal

CXR Findings in Persons with TB and CKD

- In late-stage CKD cavities, upper lobe infiltrates are less common

- CXR may be normal or atypical
  - Infiltrate lower lobes, diffuse, miliary, resembling pulmonary edema, pleural effusions

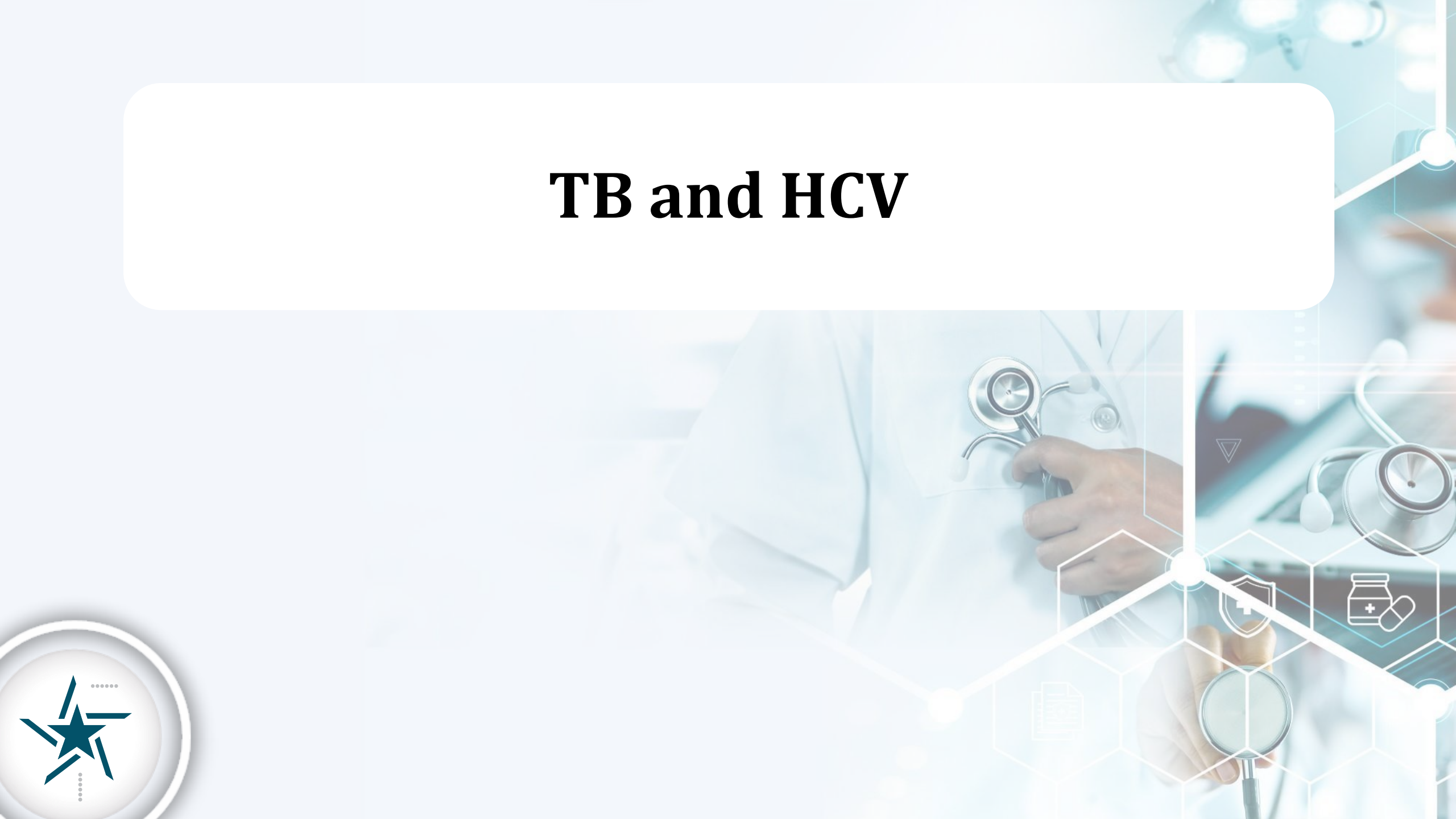
TABLE 15. Dosing recommendations for adult patients with reduced renal function and for adult patients receiving hemodialysis

Drug	Change in frequency?	Recommended dose and frequency for patients with creatinine clearance <30 ml/min or for patients receiving hemodialysis
Isoniazid	No change	300 mg once daily, or 900 mg three times per week
Rifampin	No change	600 mg once daily, or 600 mg three times per week
Pyrazinamide	Yes	25–35 mg/kg per dose three times per week (not daily)
Ethambutol	Yes	15–25 mg/kg per dose three times per week (not daily)
Levofloxacin	Yes	750–1,000 mg per dose three times per week (not daily)
Cycloserine	Yes	250 mg once daily, or 500 mg/dose three times per week*
Ethionamide	No change	250-500 mg/dose daily
p-Aminosalicylic acid	No change	4 g/dose, twice daily
Streptomycin	Yes	12–15 mg/kg per dose two or three times per week (not daily)
Capreomycin	Yes	12–15 mg/kg per dose two or three times per week (not daily)
Kanamycin	Yes	12–15 mg/kg per dose two or three times per week (not daily)
Amikacin	Yes	12–15 mg/kg per dose two or three times per week (not daily)

Treatment of Active TB in Persons with CKD on Dialysis

- Initial Phase (first two months):
  - INH 300mg daily or 900 mg thrice weekly
  - Rifampin 600mg daily or thrice weekly
  - Ethambutol 15-25mg/kg thrice weekly
  - PZA 25-35mg/kg thrice weekly
  - Vitamin B6 50mg thrice weekly
- Continuation
  - INH and Rifampin x 4 – 7 months
- All doses should be given AFTER DIALYSIS

TB and HCV



Hepatitis C and TB

Clinical Infectious Diseases
MAJOR ARTICLE

Association of Treated and Untreated Chronic Hepatitis C With the Incidence of Active Tuberculosis Disease: A Population-Based Cohort Study

- Large population-based cohort study involving 1.8 million adults in the country of Georgia , found a strong association between untreated hepatitis C and the diagnosis of active TB.
- Adults with untreated HCV infection have 3 times increased risk of developing active TB disease.
- Patients with HCV infection benefit from screening for active TB disease and treatment for LTBI.

(Baliashvili et al., 2022)

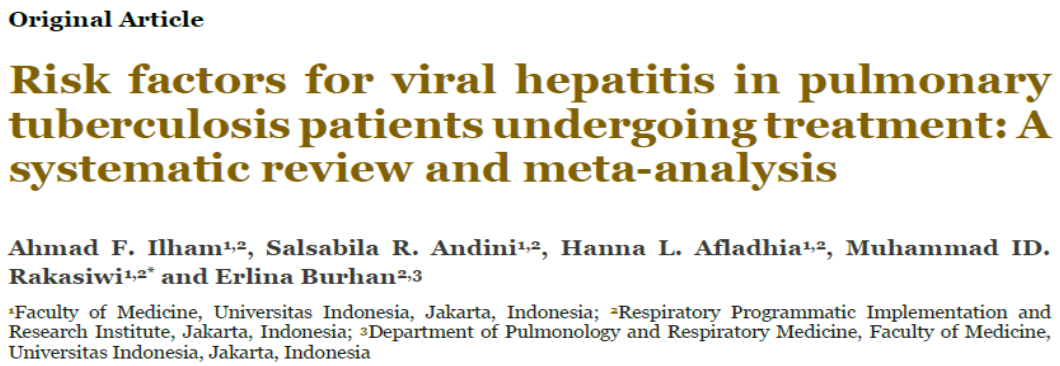
TB and Viral Hepatitis

- TB treatment in patients with viral hepatitis leads to a higher risk of drug-induced liver injury

- TB co-infection viral hepatitis is associated with poorer treatment outcomes and increased mortality

Khan AF, Sajjad A, Mian DA, et al. Co-infection with hepatitis B in tuberculosis patients on anti-tuberculosis treatment and the final outcome. Cureus 2021;13(4):e14433.

Risk factors for Hepatitis B and C in TB patients



Original Article

Risk factors for viral hepatitis in pulmonary tuberculosis patients undergoing treatment: A systematic review and meta-analysis

Ahmad F. Ilham[1,2], Salsabila R. Andini[1,2], Hanna L. Afladhia[1,2], Muhammad ID. Rakasiwi[1,2*] and Erlina Burhan[2,3]

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- HIV, smoking, alcohol consumption, drug use, multiple sexual partners, tattooing, piercing, blood transfusions, dental interventions, homelessness, incarceration, living with prisoners, sexually transmitted infections, and diabetes mellitus are significantly associated with hepatitis B and C in tuberculosis patients

TB Treatment in Patients with Advanced Liver Disease

- Likelihood of drug induced liver injury may be higher

- TB may involve the liver, and hepatic abnormalities may improve with TB treatment

Treatment of Tuberculosis : MMWR, June 20, 2003

TB Regimen Recommended for Persons with Advanced Liver Disease

- Treat with only one potentially hepatotoxic drug
  - Rifamycin should be retained
  - Avoid Pyrazinamide
  - Additional agents include ethambutol, fluoroquinolone, cycloserine, linezolid
- Treatment duration with such regimens should be extended, depending on the severity, disease response and medications used
- Obtain TB expert consultation

Treatment of Tuberculosis : MMWR, June 20, 2003

TB Treatment without PZA in Persons with Liver Disease

- PZA can cause severe and prolonged liver injury

- Treat with INH, rifampin and ethambutol for 2 months follow by a continuation phase with INH and rifampin for 7 months

Treatment of Tuberculosis : MMWR, June 20, 2003

Conclusions

- Encourage patients with TB/ HIV infection to have HIV viremia goal undetectable and discuss TB meds with HIV doctor
- Encourage patients to adhere to ART / diabetes/ BP medications
- Obtain consultation when treating TB patients with HIV infection, DM, CKD and advance liver disease

Conclusions

- TB and diabetes are closely related diseases that can have significant implications for health.
- Diabetes increases the risk of TB development and worsens TB outcomes
- Metformin decreases TB mortality in patients with TB and DM
- TB can exacerbate diabetes and increase BS
- Integrate physical activity every day in every way

Questions?