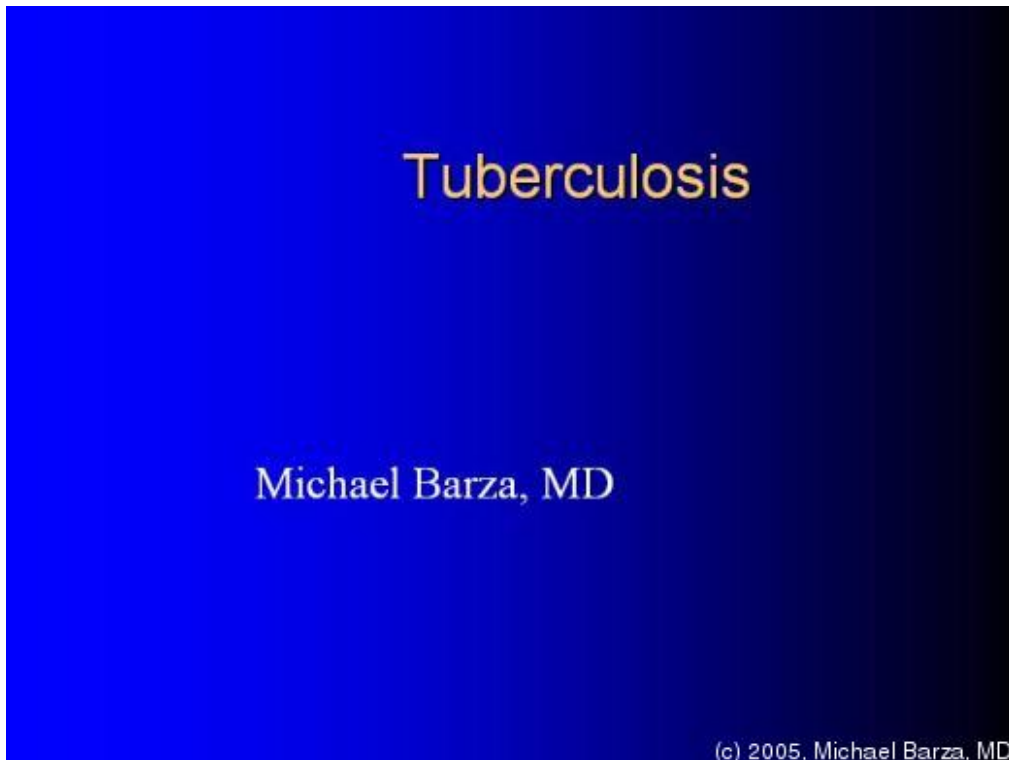


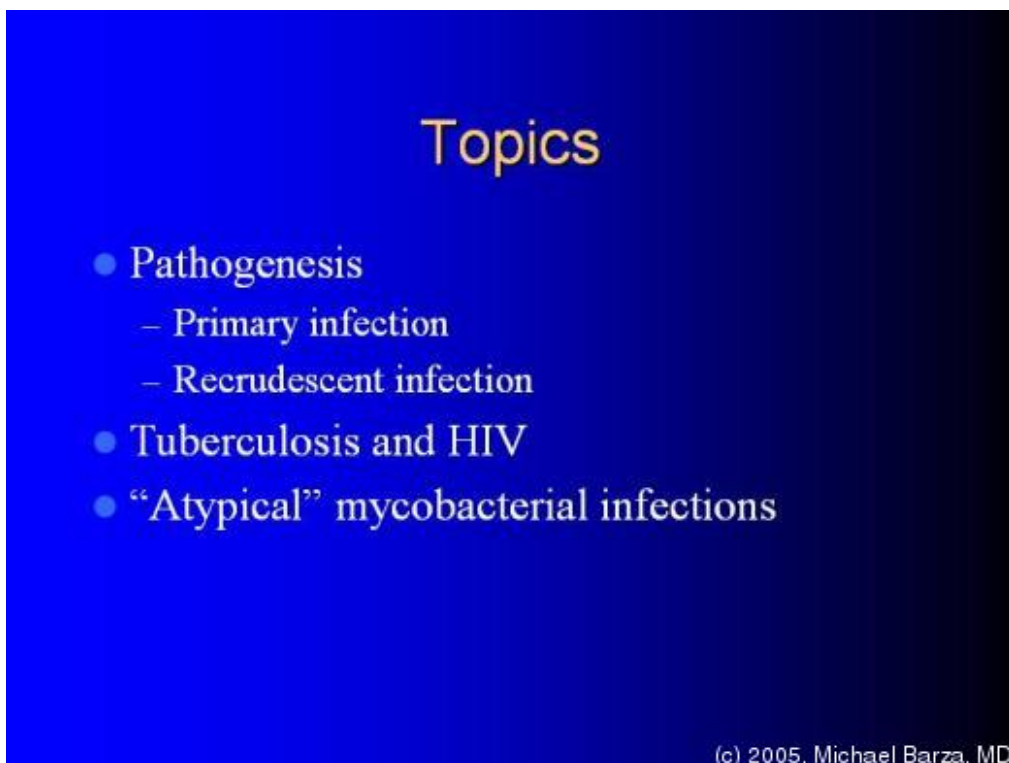
1.

## Tuberculosis



2.

## Topics



3. Sources of TB Infection

## Sources of TB Infection

- Usually by inhalation
  - From coughing patient
  - Rarely during postmortem
- Rarely from draining wound
  - By inhalation or inoculation

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4. Determinants of Infectivity

## Determinants of Infectivity

- Coughing, sneezing
  - Poor ventilation
- Cavitory disease, untreated
  - Can be  $10^9$  bacilli
- Sputum smears positive
  - Longer exposure (1 hr = 1/4 to 1/600)

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5. Primary Infection

**Primary Infection**

- Inhalation – small droplets (2-10  $\mu\text{m}$ )
  - Favors lower lobes
- Waxy capsules non-irritating
- Bacteria multiply in macrophages
  - More rapid growth in non-white races

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6. Spread before CMI Develops

**Spread before CMI Develops**

- Spread to local lymphatics
- “Silent bacillema” seeds distant sites
  - Upper lobes of lung; kidney, bone; meninges
- No symptoms or mild “cold”

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7. Development of CMI

**Development of CMI**

- Most develop CMI in 4-8 weeks
  - Positive PPD skin test (DH)
  - New test: QuantiFERON® (IFN $\gamma$  release in whole blood exposed to PPD)
  - Pleural effusion (rare)
- Infection becomes dormant in 95%
  - “Latent TB Infection”
  - Visible Ghon complex in 25%

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8. Progressive Primary TB

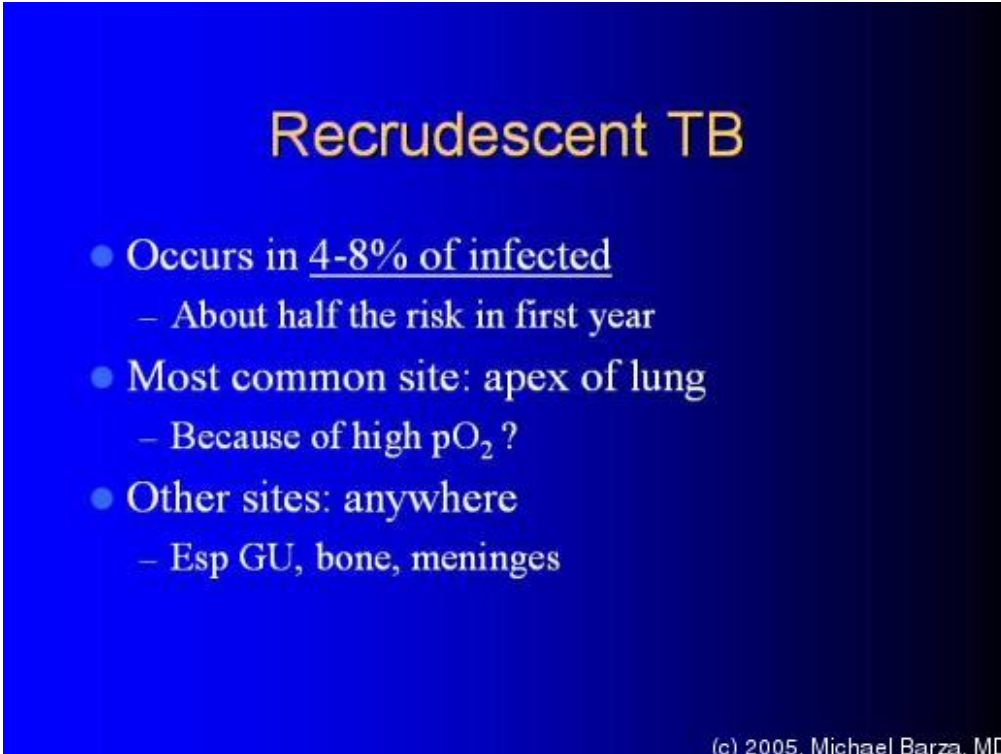
**Progressive Primary TB**

- Rarely, primary infection not controlled
  - Mainly in newborns or immunosuppressed
- Local progression
  - Usually lower lobe of lung
- Dissemination

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9.

## Recrudescent TB



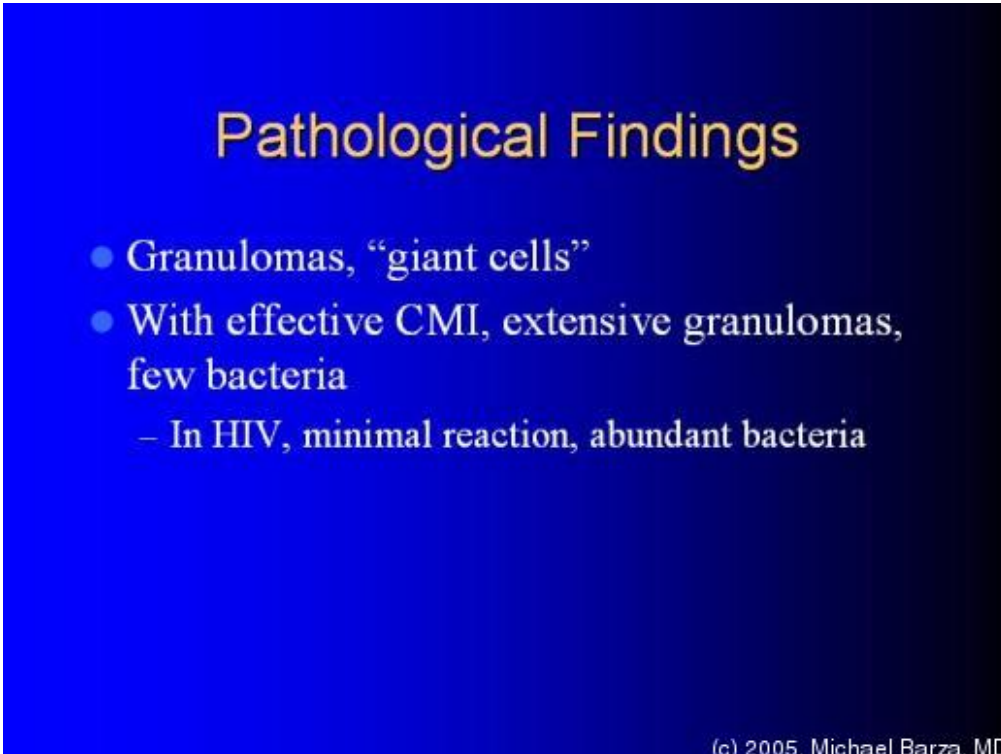
**Recrudescent TB**

- Occurs in 4-8% of infected
  - About half the risk in first year
- Most common site: apex of lung
  - Because of high  $pO_2$  ?
- Other sites: anywhere
  - Esp GU, bone, meninges

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10.

## Pathological Findings



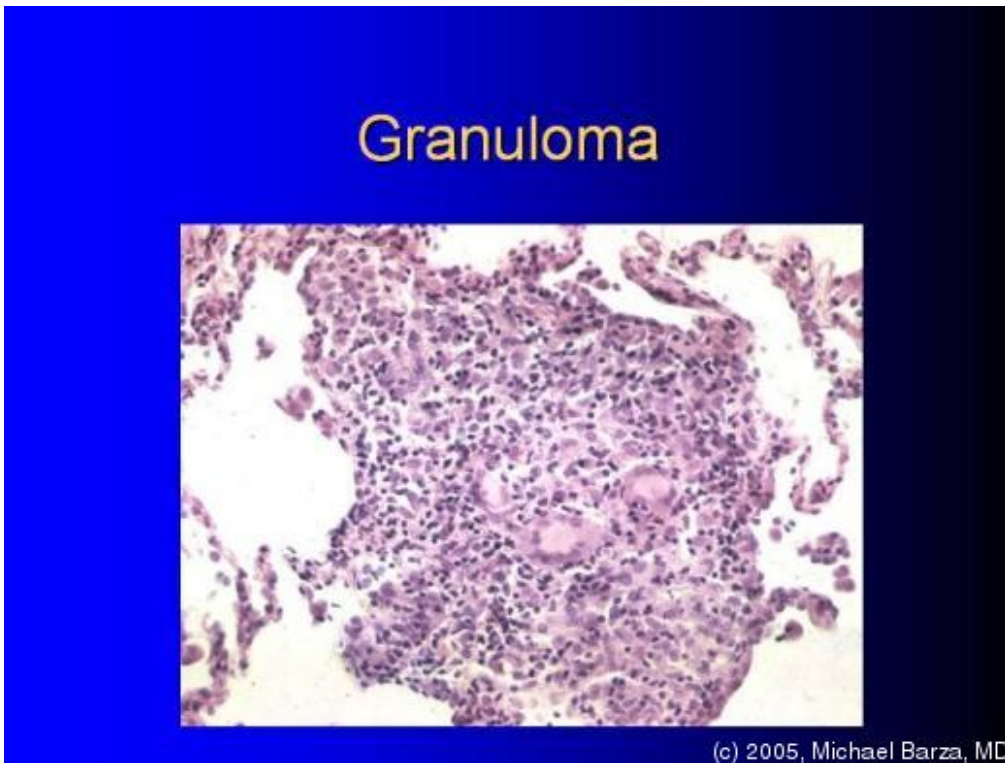
**Pathological Findings**

- Granulomas, “giant cells”
- With effective CMI, extensive granulomas, few bacteria
  - In HIV, minimal reaction, abundant bacteria

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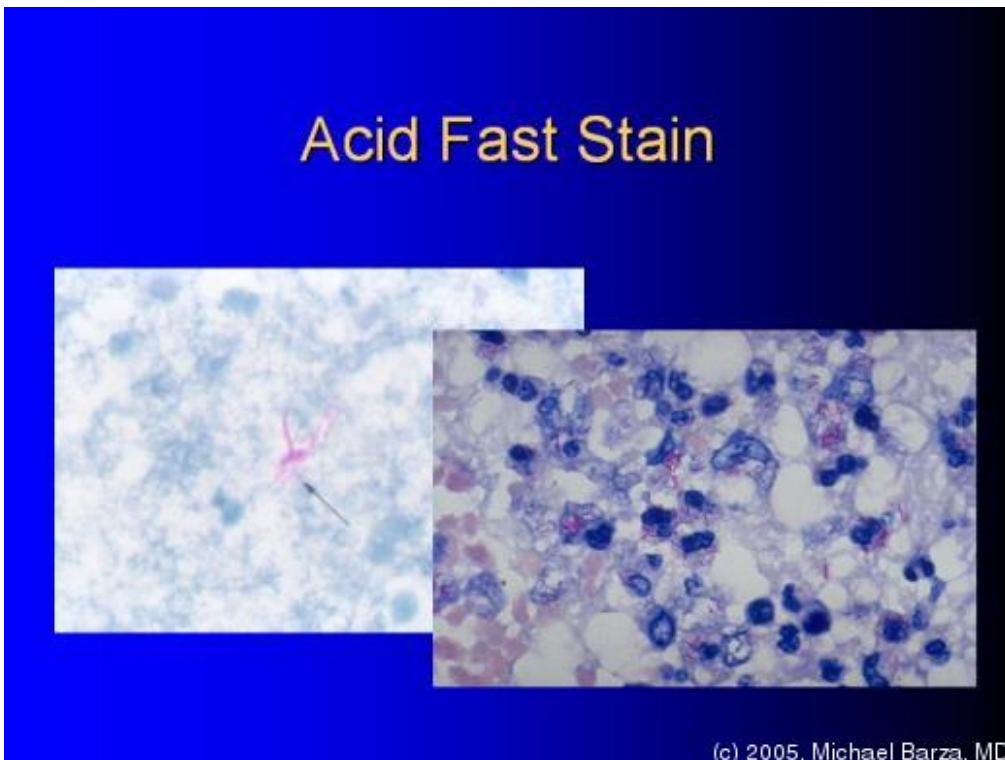
11.

## Granuloma



12.

## Acid Fast Stain



13. Favoring Recrudescence

## Favoring Recrudescence

- Weakening of CMI
  - Steroids
  - HIV (8% per year!)
  - Viral infection
  - Lymphoma, sarcoidosis
  - Alcoholism
  - Old age!

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14. Miliary TB

## Miliary TB

- Occurs when very little CMI
  - Esp. in neonates (primary infection), very old, or highly immunosuppressed
- Widespread involvement of
  - Lungs
  - Bone marrow
  - RES (liver, spleen)

} Biopsy for dx

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15. Most Symptoms Due to CMI

**Most Symptoms Due to CMI**

- If little CMI
  - Few symptoms but infection progresses and spreads through organs → death
- If potent CMI
  - Cytokines cause fever, sweats, weight loss
  - Can reduce symptoms by giving steroids (reduce CMI) at cost of uncontrolled infection

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16. Symptoms Suggesting TB

**Symptoms Suggesting TB**

- Cough > 3 weeks
- Fever, night sweats > 3 weeks
- Weight loss
- Hemoptysis
- Apical (esp. cavitary) lesions

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17. High Risk Populations

## High Risk Populations

- Born in Asia, Africa, Caribbean, Latin America
- Homeless
- Prisoners
- Substance Abusers
- HIV Infected

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18. Tuberculin Skin Test (PPD)

## Tuberculin Skin Test (PPD)

$\geq 5$ mm induration	$\geq 10$ mm induration	$\geq 15$ mm induration
HIV (poor CMI) High suspicion (close contact, fibrotic CXR)	High prevalence ↓ reactivity (steroids, malnutrition)	All others (low probability)

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19. Who Should be Tested for LTBI?

**Who Should be Tested for LTBI?**

- High risk of infection
  - Recent close contact with active TB (including health care workers)
  - Homeless
  - Persons from high-prevalence countries
- High risk of progression
  - HIV
  - ESRD, silicosis, DM, immunosuppressive Rx

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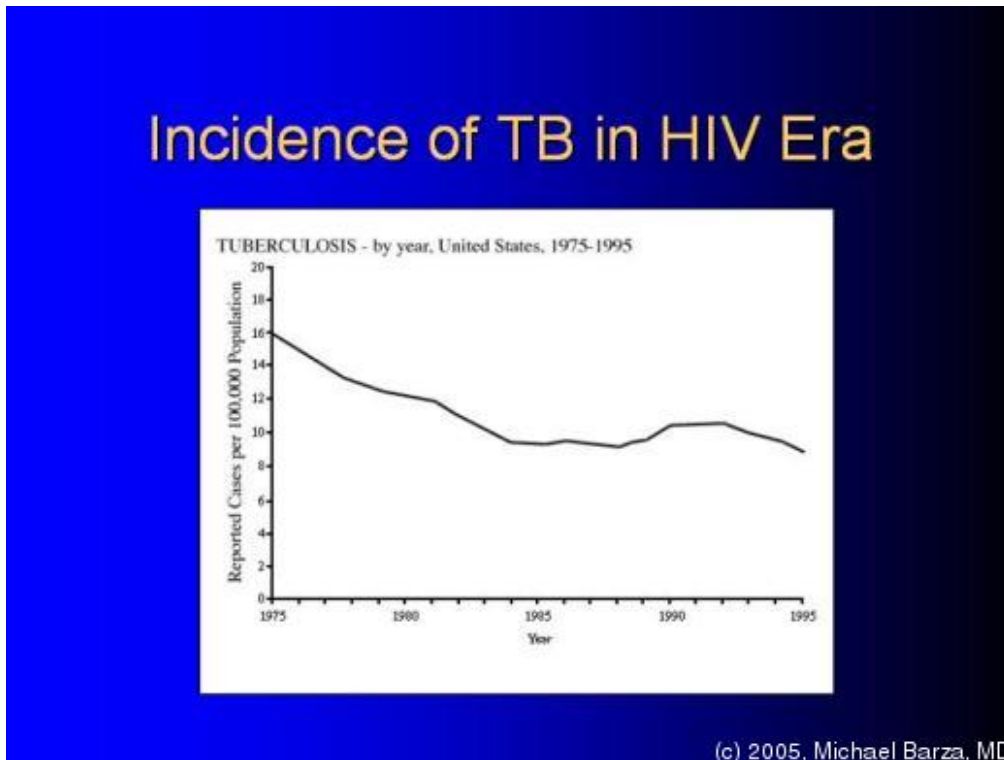
20. More on PPD

**More on PPD**

- Indicates past infection, not necessarily active disease
- Don't attribute to remote BCG (reaction tends to fade)
- 10-20% of pts with active TB have negative PPD for no apparent reason
  - “Anergy” testing not standardized

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21. Incidence of TB in HIV Era



22. TB and HIV

- ## TB and HIV
- TB infection in 3-30% of HIV
    - Depending on geographic area, socioeconomic factors
  - TB can manifest in early HIV
    - Versus other “opportunistic” infections
  - Risk of recrudescence 8% per year!
  - Prophylaxis (1 yr INH) effective
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23.

## Differences in HIV

### Differences in HIV

- Frequently extrapulmonary
  - Hilar adenopathy
  - Pleural effusions
  - Miliary disease (rare)

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24.

## “Atypical” Mycobacteria

### “Atypical” Mycobacteria

<ul style="list-style-type: none"><li>● <b>M. tuberculosis</b><ul style="list-style-type: none"><li>– Person-to-person</li><li>– High virulence</li><li>– PPD +</li><li>– Susceptible to drugs</li></ul></li></ul>	<ul style="list-style-type: none"><li>● <b>“Atypicals”</b><ul style="list-style-type: none"><li>– From environment</li><li>– Lower virulence (most)</li><li>– PPD –</li><li>– Not the usual TB drugs</li></ul></li></ul>
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25.

## Clinical Disease

### Clinical Disease

- Pulmonary, skin, and disseminated
- Immunosuppressed or not
- Pathology similar to TB
- Major groups
  - I: *M. kansasii* and *M. marinum*
  - III: *M. avium* complex (MAC or MAI)
  - IV: *M. fortuitum*, *M. chelonae* (rapid growers)

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26.

## *M. marinum*

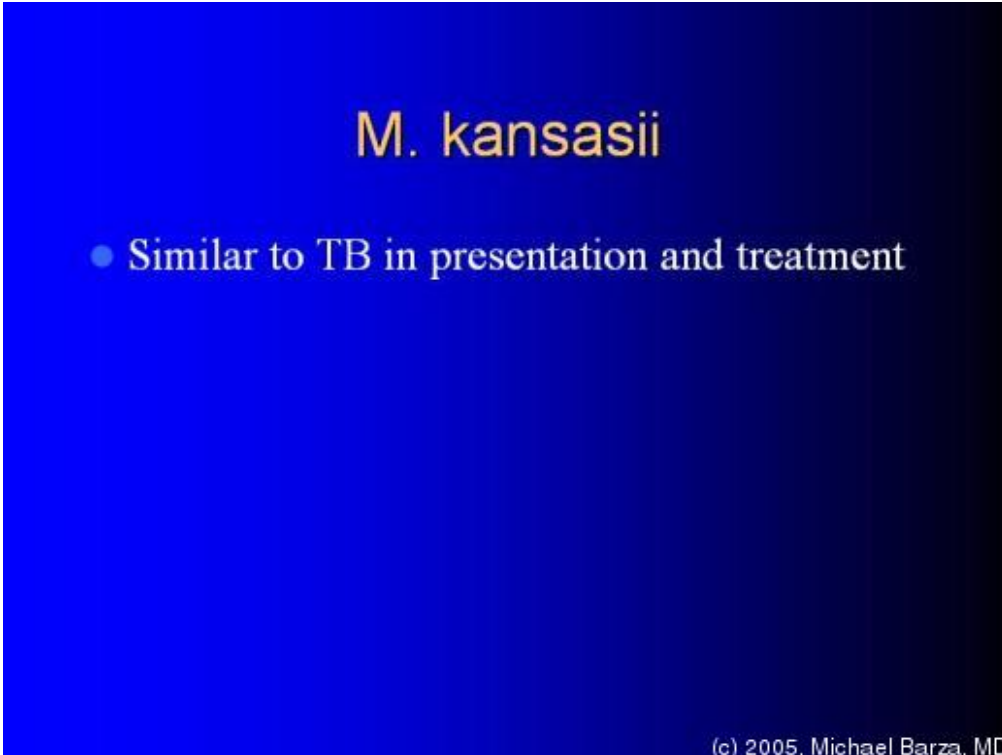
### *M. marinum*

- Swimming pools, fish tanks
- Chronic indurated lesions on hands
- Rx: clarithro + ethambutol and others

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27.

M. kansasii



A blue slide with white text. The title 'M. kansasii' is centered at the top. Below it is a single bullet point: '• Similar to TB in presentation and treatment'. At the bottom right corner, there is a small copyright notice: '(c) 2005, Michael Barza, MD'.

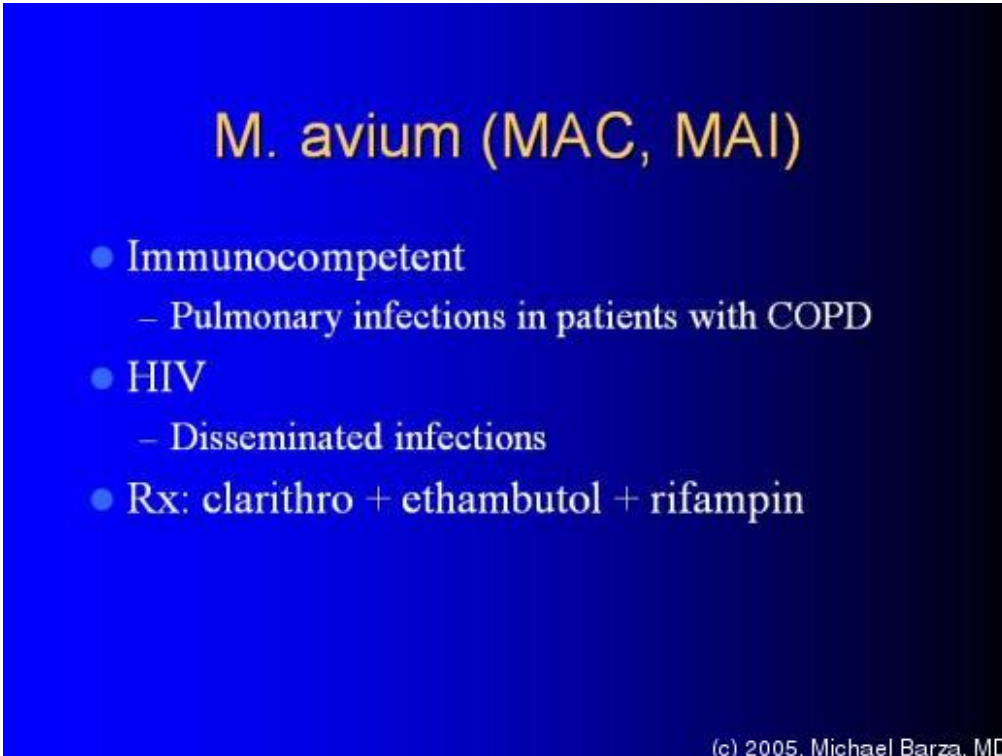
**M. kansasii**

- Similar to TB in presentation and treatment

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28.

M. avium (MAC, MAI)



A blue slide with white text. The title 'M. avium (MAC, MAI)' is centered at the top. Below it are three bullet points: '• Immunocompetent' with a sub-bullet '– Pulmonary infections in patients with COPD', '• HIV' with a sub-bullet '– Disseminated infections', and '• Rx: clarithro + ethambutol + rifampin'. At the bottom right corner, there is a small copyright notice: '(c) 2005, Michael Barza, MD'.

**M. avium (MAC, MAI)**

- Immunocompetent
  - Pulmonary infections in patients with COPD
- HIV
  - Disseminated infections
- Rx: clarithro + ethambutol + rifampin

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29.

M. fortuitum, M. chelonae

**M. fortuitum, M. chelonae**

- Rapid growers (days)
- Iatrogenic soft tissue infections (contaminated surgical mesh, implants)

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30.

Key Points (1)

**Key Points**

- Primary infection
  - Inhalation, lower lobe
  - Silent bacillema seeds organs
  - CMI (healing, PPD +, Ghon complex)
- Recrudescence infection (4-8%)
  - Risk factors (↓ CMI, HIV)
  - Especially apex of lung

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31.

## Key Points (2)

### Key Points (2)

- TB in HIV
  - 8% reactivation per year
  - Often extrapulmonary
- “Atypical” mycobacteria
  - Not person-to-person (don’t isolate pt)
  - Characteristic (*M. marinum* skin; MAC in HIV)

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