Lungs and AIDS: radiological images

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Cascade of infections and cancers that develop as immune system is depleted.

HIV/AIDS prevention and treatment. NIH Stefano Bertozzi and coll.
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<th>CD4+ cell count (× 10⁶ cells l⁻¹)</th>
<th>Pulmonary pathology</th>
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<td>&gt;500</td>
<td>Bacterial pneumonia</td>
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<td>TB (re-infection)</td>
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<td>Lung carcinoma</td>
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<td>200–500</td>
<td>Bacterial pneumonia</td>
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<td>TB (primary)</td>
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<td>Lung carcinoma</td>
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<td>Fungal infections</td>
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<td>Bacillary angiomatosis</td>
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<td>&lt;50</td>
<td>Bacterial pneumonia</td>
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<td>TB (atypical appearances)</td>
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<td>MAC</td>
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<td>CMV</td>
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TB, Tuberculosis; PCP, Pneumocystis carinii pneumonia; KS, Kaposi’s sarcoma; MAC, Mycobacterium avium complex; CMV, cytomegalovirus.
Cambodia:

- 39% TB
- 30% PCP
- 16% Bacterial inf.
- 6% Mycosis
- 5% atypical mycobac.
- 4.7% Strongyloïdiasis
- 0.3% Cancer

Vietnam: similar but very few fungal infections, no atypical mycobacteriae or anguillulosis

Dakar and Bangui: very few PCP, more pneumoniae with *Streptococcus pneumoniae* and *H. influenzae*, Kaposi, more severe illnesses with no diagnosis…

*French national agency for scientific research in AIDS*
The respiratory diseases are frequent (80 % of the cases) and severe during the course of HIV infection.

• They can occur at every clinical stage: from the beginning of AIDS until death.

• The respiratory diseases are numerous:
  - infectious <= immunodepression
  - tumourous
  - others

• The ARV have modified the situation in wealthy countries, and also in limited-resources countries, but, in these countries, lung diseases associated with AIDS remain frequent and severe, and their diagnosis and treatment continue to be difficult.
HIV and lungs: infections are the most important problem

Lung = target for many and severe infections with high incidence of death

This natural evolution can be modified by:

- **prophylactic treatment** => effective on some pathologies (ex: cotrimoxazole and pneumocystosis or toxoplasmosis)

- The use of **antiretroviral treatments**: they are very effective against HIV and can remain effective for a long time if the treatment is correctly adapted and if the patient is compliant.
HIV and lungs: 3 situations

• No prophylaxy against lung diseases and no ARV treatment

• No ARV treatment but possible access to prophylaxy (e.g.: prophylaxy of pneumocystosis by cotrimoxazole)

• ARV treatment is possible: mortality by infectious disease drastically decreases
3 pathologies for 80% of pulmonary infectious diseases in AIDS

- Tuberculosis
- Pneumocystosis
- Bacterial pneumopathies
Respiratory diseases in patients not receiving ARV

**Infectious diseases**

- Pneumocystosis (PCP)
- Tuberculosis
- Bacterial Pneumoniae
- Parasitic pneumoniae
- Fungal pulmonary diseases
- Atypical mycobacteriae
- Viral diseases
Respiratory diseases in patients not receiving ARV

**Infectious diseases**

- Pneumocystosis
- Tuberculosis
- **Bacterial pneumonias**
- Parasitic pneumonias
- Fungal pneumonias
- Atypical mycobacteria
- Viral diseases

- Strepto pneumonias
- H. influenzae
- Others
  - Staph. aureus
  - Ps. aeruginosa
  - Legionnaires’ disease
  - Nocardia asteroides
  - Rhodococcus equi....
Respiratory diseases in patients not receiving ARV

**Infectious diseases**

- Pneumocystosis
- Tuberculosis
- Bacterial pneumonia
- *Parasitic pneumoniae*
- Fungal pneumonias
- Atypical mycobacteriae
- Viral diseases

- Toxoplasmosis
- Anguillulosis
- Leishmaniosiis
- Cryptosporidiosis
- Strongiloïdiasis…
Respiratory diseases in patients not receiving ARV

*Infectious diseases*

- Pneumocystosis
- Tuberculosis
- **Bacterial pneumonia**
- Parasitic pneumoniae
- **Fungal pneumoniae**
- Atypical mycobacteriae
- Viral diseases

- Cryptococcosis
- Aspergillosis
- Histoplasmosis
- Coccidioïdomycosis
- Penicilliosis
Respiratory diseases in patients not receiving ARV

*Infectious diseases*

- Pneumocystosis
- Tuberculosis
- **Bacterial pneumoniae**
- Parasitic pneumoniae
- Fungal pneumoniae
- **Atypical mycobacteria**
- Viral diseases

- **Mycobacterium avium**
- **M. kansassii**
Respiratory diseases in patients not receiving ARV

**Infectious diseases**

- Pneumocystosis
- Tuberculosis
- Bacterial pneumoniae
- Parasitic pneumoniae
- Fungal pneumoniae
- Atypical mycobacteria

**Viral diseases**

- CMV
Possible etiologies according to radiological appearance:

**focalised condensation**

**Frequent pathology**
- common bacterial infection

**Possible pathology**
- Tuberculosis
- mycosis (aspergillosis, cryptococcosis…)
- atypical mycobacteria
- others bacterial infections (*Nocardia, Actinomyces, Rhodococcus equi*..)

**Rare pathology**
- lymphoma
- toxoplasmosis

**Differential diagnosis**
- lung cancer

*courtesy of Mayaud in Girard, Katlama, Pialoux "VIH 2001", éd. Douin Paris*
Possible etiologies according to radiological appearance

**Diffuse lesions**

**Frequent pathology**
- pneumocystosis
- Kaposi’s disease
- tuberculosis

**Possible pathology**
- mycosis (aspergillosis, histoplasmosis, cryptococcosis)
- mycobactérioses atypical mycobacteriaes
- others infections (toxoplasmosis... )
- usual bacterial infections

**Rare pathology**
- intersticial lymphoïd pneumonia

**Differential diagnosis**
- pulmonary œdema
- iatrogenic pneumopathy

courtesy of Mayaud in Girard, Katlama, Pialoux “VIH 2001 “, éd. Douin Paris
Possible etiologies considering radiological aspect:
Normal chest Rx with clinical respiratory signs

Frequent pathology
- Bacterial infection of superior airways
- Opportunistic infection at the beginning (Pneumocystosis)

Possible pathology
- bronchial tuberculous infection
- other opportunistic infections at the beginning (aspergillosis)
- endo-bronchial tumour
- lymphocytic interstitial pneumonia (T CD8 in BAL)

Rare pathology
- HTAP

Differential diagnosis
- pulmonary embolism
- bronchospasm
- lactic acidosis (ARV complications)

With courtesy of Mayaud in Girard, Katlama, Pialoux “VIH 2001”, éd. Douin Paris
Chest X ray  TB  HIV(-) and HIV+  CD4>200  

- more frequent in superior lobes  
- cavities  
- typical nodular infiltrates (in the apex and more or less excavated)

Chest X ray  TB  HIV+ ( CD4 < 200 )

- cavity is rare  
- Frequency of tb pneumoniae and adenopathies (often associated)  
- Lesions in inferior  and  superior lobes  
- Frequency of miliaries

Frequency of extra pulmonary TB
RX chez les patients TB HIV

not severe immunodepression
CD4>200

Severe immunodepression
Male 30 years old
Soldier HIV +

Pneumonia of right superior and middle Lobes.
Hilar adenopathies
AFB x3 negative

Bronchial aspiration and BAL: AFB++

Bronchial endoscopy:
Aspect of fistula from adenopathy
Miliary tuberculosis: HIV+ young woman,
CD4 level: 60/mm3
TB bilateral pneumonia and mediastinum adenopathies in a patient with AIDS. CD4 level: 50/mm$^3$
Absence of cavities
TB, HIV+: double tuberculosis pneumonia; middle lobe and left superior lobe. Mediastine adenopathies
Bilateral tuberculosis pneumonia, in a patient with AIDS. Rapidly deteriorating condition. CD4 level: 35/mm³
Chest X ray with poor quality

Right Alveolar opacity
Possibly excavated
Right hilar adenopathy

AFB+ in sputum
HIV+

Progressive worsening condition

Tuberculosis pneumonia of the right superior lobe

AFB+ in sputum
Left inferior lobe TB pneumonia
(negative silhouette sign with cardiac left edge)

Bulky hilar adenopathy
(positive silhouette sign with aortic arch)
Tuberculosis pneumonia in an HIV+. CD4< 100.
- bilateral lesions
- Right latero-tracheal adenopathies
- Absence of cavities
TB of middle or inferior lobes pneumonias are common among PLHIV
Miliary tuberculosis
HIV+ patient
CD4 level: 70/mm3
Mediastine adenopathies are frequent among PLHIV. Endobronchial fistula with bronchogenic dissemination is possible.
Immune reconstitution inflammatory syndrome: 3 clinical examples
Male HIV +, CD4 level: 50/mm3
October 2006. AFB (-)
DEC 2006: AFB + in sputum
Start TB treatment
CXR on 28/02/2007
(After 3 weeks of ARV treatment)
CXR on 04/04/2007: 7 weeks of ART and TB treatment (Favourable issue after few weeks of associated cortico-steroid treatment)
TB, HIV+, Start TB treatment
Start ARV treatment after 2 months of TB treatment
Severe pericarditis several weeks later
Pericardic drainage and continuation of the TB and ARV treatment
Male, HIV +, TB treatment for 2 months. CXR on the first day of ARV treatment.
D12 of ARV treatment

Small excavation and pneumothorax
D 20 after drainage of the pneumothorax
Paradoxical reactions in the immune reconstitution inflammatory syndrome

- Fever
- Adenopathies
- Ascites
- Pleural or pericardic effusion
- Pulmonary infiltrate or pneumoniae
- Encephalic diseases (tuberculoma)

- Develops after introduction of ARV
- Severity is correlated with the initial Immunodepression (CD4 level)
Several micro-organisms are responsible for lung diseases among PLHIV. Therefore, differential diagnosis of TB in HIV patients are many, and especially pneumocystosis.

Frequency of pneumocystosis
Pneumocystoses
what clinical data?

- HIV infection not known before (80% of cases)
- No prophylaxy with *bactrim* (100% of cases)
- Fever: 38° - 40°C
- Normal pulmonary auscultation (90% of cases)
- No extra-pulmonary signs (90% of cases)
- Interstitial/ alveolar **diffuse opacities** (100% of cases)
- **Hypoxemia** (SaO2 < 90%) 100% of cases

Courtesy of Chan Sarin ANRS1260
Interstitial picture: ground glass attenuation image
Male, HIV +, severe dyspnea, nearly normal auscultation, SaO2 at 86%, interstitial and alveolar diffuse lesions
Bilateral alveolar and Interstitial opacities without cavities
Bilateral alveolar and interstitial opacities without cavities
Male 42 years old, cough, exertional dyspnea, SaO2 92 %; HIV+
BAL: pneumocystosis
CXR: could be considered as normal. Possible ground glass
attenuation image
HIV+, exertional dyspnea, non-productive cough, normal pulmonary auscultation, CD4 level 150/ mm3.

fibroscopy with BAL: Pnn carinii

Pneumocystosis at the beginning of the evolution
Ground glass attenuation visible on the CT scan, not on chest X ray
Man 55 years old. Retired soldier, divorced, for 10 years dyspnea, cough, SaO2 85%. Normal auscultation. Elisa test positive for HIV.

pneumocystis in the bronchio-alveolar lavage
interstitial and diffuse pneumonia with ground glass attenuation

Hypoxemia $\text{SaO}_2 < 90\%$

The pulse oxymeter is a very useful tool, but expensive (600-900 US$)

If no oxymeter, remember that polypnea is proportional to hypoxemia

= PCP

Cotrimoxazole +/- cortisone + oxygen are mandatory to prevent death

Without cotrim. prophylaxy
NTP strategy for TB case finding

Respiratory +/- general symptoms
→ AFB-sputum X 3 (2 days)
If negative → antibiotic (amoxycillin) X 10 days
If patient not improved and new smears negative
↓
CXR (after 2 or 3 weeks)

*If it was PCP, the patient is dead*

In HIV infected patients, CXR must be performed early
bilateral opacities
With excavated nodules

Infectious disease and aids ward. khmero russian hospital
PhnomPenh
Sometimes in AIDS: poly-pathology
Soldier 25 y. old
Confusion, obnubilation with quick onset,
Vomiting then coma
t° 40°C. HIV+

Bronchio alveolar lavage: *P. carinii*
*And St. aureus*
Very severe dyspnea in HIV positive
Not able to produce sputum. Endoscopy with BAL…
One can also see fungal infections: cryptococcosis, histoplasmosis, penicillium marneffei, invasive aspergillosis.
Disseminated histoplasmosis to *H. capsulatum* in an HIV+ patient

BAL: fungal microorganisms in the macrophages
W. 20y. HIV+, cough, dyspnea, t° 38°C
Miliary

AFB -

BAL : Histoplasmosis
Non TB bacterial pneumonia are frequent in HIV infection with moderate immunodepression: Str. Pneumoniae hemophilus….

They are often bilateral
Pneumopathy to pseudomonas aeruginosa. Context of worsening condition and cachexia. (CD4 level: 40/mm³)
Kaposi illness
Kaposi pulmonary images (cutaneous and oral associated lesions)
After one month of bleomycin treatment

After 2 years of ARV treatment
Lymphocitic interstitial pneumonias:
- 2 to 5 years old HIV children (20% of HIV+ children in developed countries)
- Less frequent in adults.
- The diagnosis is difficult: exclude opportunistic infection (Bronchio-alveolar lavage and lung biopsy)
Conclusion

- CXR is an essential tool for diagnosis of lung diseases in PLHIV
- In cases of TB, the chest radio is useful when AFB are negative in sputum (TPM-)
- In cases of PLHIV, in which opportunistic respiratory infections are frequent, Chest radiography is essential for etiologic diagnosis
In cases of acute respiratory disease in PLHIV with AFB(-) in sputum, bronchial endoscopy is useful for diagnosis if a reliable bacteriologic laboratory is available…