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The Role of Radiography in the Diagnosis of PleuropulmonaryTuberculosis in the RadiologyDepartment of the Referral Health Center in Bamako's 6th District.

Résumé

La tuberculose pleuro-pulmonaire est une maladie contagieuse causée par Mycobacterium tuberculosis.La radiographie constitue un outil incontournable pour l'orientation diagnostique.L'objectif était d'étudier l'apport de la radiographie dans le diagnostic de la tuberculose pleuropulmonaire dans le service de radiologie du centre de santé de référence de la commune VI de Bamako.

Il s'agissait d'une étude transversale allant du 1er janvier 2024 au 31 juillet 2025. Etaient inclus dans l'étude tous les patients admis pour radiographie pulmonaire présentant des signes radiographiques évocateurs de tuberculose et dont le diagnostic a été confirmé par un examen biologique. Les données ont été analysés à l'aide du logiciel SPSS. La confidentialité et l'anonymat des patients ont été garanti. La participation des patients était volontaire et l'assentiment des parents ou tuteurs des patients de moins de 18 ans a été demandé.

Au total nous avons colligé 136 répondants aux critères d'inclusion sur 2861 radiographies thoraciques réalisées au service, soit une fréquence de 4,75%. La tranche d'âge de 25-34 ans représentait 31,6%. Le sexe masculin était prédominant dans 75%. Les signes d'imprégnation bacillaire ont été notés dans 98,5%. Les anomalies radiologiques principalement observées étaient l'opacité alvéolaire dans 80,1% suivi de l'opacité interstitielle (69,1%) et la caverne / tuberculome dans 25,7% des cas. Les atteintes étaient bilatérales dans 71,3% des cas avec une prédominance multi lobulaire chez 72,1% des patients.

Nos résultats montrent que la tuberculose pleuropulmonaire demeure fréquente. Le diagnostic est clinico-biologique mais la radiographie permet de faire un bilan lésionnel.

Mots clés : tuberculose pleuropulmonaire, radiographie thoracique, biologie, Mali.

Abstract

Pleuropulmonarytuberculosisis a contagiousdiseasecaused by Mycobacterium tuberculosis. Chest X-rays are an essential tool for diagnostic evaluation. The objective of thisstudywas to assess the role of chest X-rays in the diagnosis of pleuropulmonarytuberculosis in the radiologydepartment of the referralhealth center in Bamako's 6th district.

This was a cross-sectional studyconductedfrom January 1, 2024, to July 31, 2025. The studyincluded all patients admitted for chest X-rays whopresentedradiographicfindings suggestive of tuberculosis and whosediagnosiswasconfirmed by laboratorytesting. Data wereanalyzedusing SPSS software. Patient confidentiality and anonymitywereensured. Patient participation wasvoluntary, and consent wasobtainedfrom the parents or guardians of patients under 18 years of age.

In total, weidentified 136 subjectswho met the inclusion criteria out of 2,861 chest X-rays performed in the department, representing a prevalence of 4.75%. The 25–34 age group accounted for 31.6%. Males werepredominantin 75% of cases. Signs of bacillary infiltration werenotedin 98.5%. The main radiologicalabnormalitiesobservedwerealveolaropacityin 80.1%, followed by interstitialopacity (69.1%) and cavities/tuberculomasin 25.7% of cases. The lesionswerebilateralin 71.3% of cases, with a predominance of multilobarinvolvementin 72.1% of patients.

Our results show thatpleuropulmonarytuberculosisremainscommon. Diagnosisisbased on clinical and laboratoryfindings, but chest X-rays provide a clearpicture of the extent of the lesions.

Keywords:pleuropulmonarytuberculosis, chest X-ray, laboratory tests, Mali.

## 1. Introduction

Tuberculosis (TB) is an infectious and contagiousdiseasecaused by Mycobacterium tuberculosis, alsoknown as Koch'sbacillus (BK). It can affect almostanyorgan, but the

pulmonaryformremains the mostcommon and the mostcontagious. Transmission occursprimarilybetween people, via the air, from patients who are bacilliferous [1].

Standard chest X-ray is an X-ray imagingmodality and serves as the first-line examination for evaluatingpleuropulmonarylesions. It allows for the detection of suggestive pulmonaryabnormalities and guides the patient towardbacteriological tests for confirmation [1].

However, pulmonarytuberculosisremains a major public healthproblem, particularly in low-resource countries whereitsdeterminants are stronglylinked to adverse socioeconomic conditions [2]. According to the World Health Organization (WHO), 10.8 million people contractedtuberculosisin 2023, includingapproximately 6 million men, 3.6 millionwomen, and 1.3 million children. That sameyear, the diseasecausedapproximately 1.25 million deaths, including 161,000 among patients living with HIV [2]. In Europe, itremains a significant public health issue, with more than 16,600 new cases and 33,520 relapse cases in 2023 [3]. In West Africa, it continues to have a significant impact. In Côte d'Ivoire, the 2021 WHO report indicates an incidence of 128 cases per 100,000 inhabitants for all forms of tuberculosis [4].

In Mali, according to the 2024 report from the Sectoral Unit for the Fight Against AIDS, Tuberculosis, and Viral Hepatitis (CSLS-TBH), therewere 6,007 cases of bacteriologicallyconfirmedpulmonarytuberculosis, representing a 4.4% increasecompared to 2023. The mortality rate was 6% [5]. A previousstudy on the role of medicalimaging in the diagnosis of chesttuberculosis at the Point G University Hospital found a prevalence of 4.57% of suspectedchesttuberculosis on computedtomography (CT) in 2021 [6].

The radiographic manifestations of pulmonary tuberculosis are variable and sometimesmisleading. It ischaracterized by alveolar consolidation, cavitary changes, and pleural effusion. During the primary phase of tuberculosis infection, chest X-rays remain normal in more than 15% of patients [7]. Sequelae are dominated by more or lessretractileinterstitialinfiltrates, residualcavities, and fibro-nodularopacities [8].

Early diagnosis and appropriate management of smear-positive patients are essential to

limit transmission, reduce complications, and preventdeathsrelated to the disease. Although the diagnosis of tuberculosisisprimarilyconfirmedthroughbacteriologicalmethods (direct microscopy, culture, molecular tests) or histology, imagingplays a crucial role in the initial evaluation and follow-up of patients. It is in thiscontextthatweinitiatedthisstudy to improve the management of pleuropulmonarytuberculosis.

The objective of the studywas to investigate the role of radiography in the diagnosis of pleuropulmonarytuberculosis in the radiologydepartment of the referralhealth center in Bamako's 6th district.

## 2. Materials and Methods:

This studywasconducted in the radiologydepartment of the referralhealth center in Commune VI of Bamako. It was a cross-sectional studyconductedfrom January 1, 2024, to July 31, 2025. The studyincluded all patients referred to the department for a chest X-ray whopresentedwithlesions suggestive of pulmonarytuberculosis and whosediagnosiswasconfirmed by bacteriologicaltesting. Sampling wasconsecutive. Data wereentered and analyzedusing SPSS version 23.0. Patient participation wasvoluntary, and consent wasobtainedfrom the parents or guardians of patients under 18 years of age. Patient confidentiality and anonymitywereguaranteed.

The examinationswereperformedusing a STEPHANIX bone-lung X-ray machine and a SIEMENS mobile X-ray table.

## 3. Results

In total, weidentified 136 cases of pulmonarytuberculosisamong 2,861 chest X-rays performed in the department, representing a prevalence of 4.75%.

### 3.1. SociodemographicCharacteristics

In thisstudy, male patients accounted for 75% of cases. The 25–34 age group accounted for 31.6% of patients, with a meanage of 36.2 ± 15 years. They weremerchantsin 19.9% of cases. More thanhalf of the patients lived in urban areas, representing 69.1% of cases.

Table 1. Distribution of patients by sociodemographiccharacteristics

sociodemographiccharacteristics

(n =136 cases)

%

Gender

Male

102

75.0

Female

34

25.0

Age group (years)

0 – 14

5

3.7

15 – 24

29

21.3

25 – 34

43

31.6

35 – 44

22

16,2

45 – 54

12

8,8

55 – 64

16

11,8

≥ 65

9

6,6

Occupation

Retailer / Salesperson

27

19.9

Housewife

17

12.5

Student

20

14.7

Farmer / Rancher

12

8.8

Driver

10

7.4

Laborer / Craftsman

24

17.6

Senior citizen

10

7.4

Marabout

4

2.9

Other

12

8.8

Place of residence

Rural area

2

1.5

Semi-urban area

40

29.4

Urban area

94

69.1

3.2. Clinical data

The majority of patients had no priormedicalhistory, accounting for 69.9% of cases. A history of tuberculosiswasreportedin 16.9% of patients. Clinicalfindingsweredominated by signs of bacterial infection in 98.5% of cases and chroniccough lasting more than 15 daysin 92.6% of cases.

Table 2. Distribution of patients based on clinical data

(n =136 cases)

%

Medicalhistory

None

95

69.9

Tuberculosis

23

16.9

Hypertension

5

3.7

Diabetes

3

2.2

Asthma

2

1.5

HIV

1

0.7

Hypertension + Diabetes

2

1.5

Asthma + Tuberculosis

1

0.7

Diabetes + Tuberculosis

1

0.7

HIV + Tuberculosis

3

2.2

Clinicalfindings

Signs of bacterial infection

134

98.5

Chronic cough lasting more than 15 days

126

92.6

Chest pain

106

77.9

Hemoptysis

15

11.0

Shortness of breath

63

46.3

Signs of bacterialinfection: Evening fever, night sweats, weightloss, weakness.

3.3. RadiographicFindings

The mostcommonlyobservedradiographicabnormalitieswerealveolaropacityin 80.1% of cases, followed by interstitialopacity (69.1%) and cavitation/tuberculomain 25.7% of cases. The lesionswerebilateralin 71.3% of cases, with a predominance of multilobarinvolvementin 72.1% of patients.

Table 3. Distribution of patients based on radiographic data.

(n =136 cases)

%

Radiographicfindings

Alveolaropacity

109

80.1

Interstitialopacity

94

69.1

Cavity / Tuberculoma

35

25.7

Miliary

23

16.9

Pleurisy

12

8.8

Location of lesions

Affectedside

Right lung

29

21.3

Left lung

10

7.4

Bilateralinvolvement

97

71.3

Affected lobe

Apical lobe

33

24.3

Middle lobe

19

14.0

Basal lobe

4

2.1

Multilobar

98

72.1

3.4. Bacteriological data

The acid-fast bacilli (AFB) test was positive in 65.4% of patients. Among the 47 patients with AFB-negativesputum, GeneXperttestingwasrequested and returned positive resultsin 100% of cases.

Table 4. Distribution of patients by bacteriological test

Bacteriological tests

N

%

BAAR

(n =136)

Positive

89

65,4

Negative

47

34,6

GeneXpert

n=47

Positive

47

100,0

Negative

0

Figure 1.Anteroposteriorchest X-ray showing a left apical cysticlesion suggestive of pulmonarytuberculosis.

An anteroposteriorchest X-ray of a 28-year-old patient referred for a chroniccough lasting 3 monthsshowing a left apical oval-shapedcavitywith a regular, thinwall (yellowarrow) associatedwithipsilateralpulmonaryalveolaropacities (bluearrow), the appearance of whichis consistent withpulmonarytuberculosis.

The sputumsmear test (acid-fast bacilli) performed on the same patient was positive.

Figure 2.Anteroposteriorchest X-ray showing diffuse bilateralmicronodularpulmonaryopacities suggestive of tuberculousmiliarydisease.

A 34-year-old patient referred for a productive cough, in whom an upright frontal chest X-ray revealed: diffuse bilateralpulmonarymicronodularopacities suggestive of miliarytuberculosis.

The sputumsmear test (for acid-fast bacilli) performed on the same patient was positive.

Figure 3.Anteroposteriorchest X-ray showing a retractileopacity in the right upper lobe, suggestive of pulmonarytuberculosis.

Anteroposteriorchest X-ray of a 50-year-old patient referred for suspectedtuberculosis:aretractileopacity in the right upper lobe (indicated by the yellowarrow) associatedwith a consolidation occupying the uppertwo-thirds of the leftlungfield, all of whichis consistent withpulmonarytuberculosis

The BAAR (Acid-Fast Bacillus) sputumsmearperformed on the same patient was positive

Figure 4. Anteroposteriorchest X-ray showing diffuse reticular-micronodularopacity suggestive of pulmonarytuberculosis.

A 44-year-old patient referred for chroniccough; an anteroposteriorchest X-ray taken in the upright position reveals: Diffuse reticular-micronodularopacityoccupying the uppertwo-thirds of the right lungfield and the upper lobe of the leftlungfield, associatedwith septal thickening and thickening of the bronchial walls

The sputumsmear test (for acid-fast bacilli) performed on the same patient was positive

Figure 5.Anterior-posteriorchest X-ray showing a roundedapicoventralopacity suggestive of pulmonarytuberculosis.

Anterior-posteriorchest X-ray of a 28-year-old patient referred for cough, with a familyhistory of tuberculosis:demonstration of a roundedapico-ventral opacity on the right

sideassociatedwith diffuse reticularopacity in the remainder of the ipsilaterallungfield.
The sputumsmear test (for acid-fast bacilli) performed on the same patient was positive.

Figure 6. Anteroposteriorchest X-ray showing a patchyopacityconfined to the right upper lobe, suggestive of pulmonarytuberculosis.
Anteroposteriorchest X-ray of a 13-year-old patient referred for cough and chest pain showinginhomogeneousopacities, well-defined in the right upper lobe, withsharp and regularborders. These are accompanied by multiple diffuse micronodularlesionsthroughout the remaininglungfields.
The sputumsmear test (acid-fast bacilli) performed on the same patient was positive.

Figure 7. Anteroposteriorchest X-ray showingwidespreadalveolar consolidation in the right upper lobe, suggestive of tuberculouspneumonia.
An anteroposteriorchest X-ray of a 40-year-old patient referred for chest pain and chronic productive coughshowingfoci of well-defined, diffuse alveolar consolidation in the right upper lobe withblurredmargins, consistent withtuberculouspneumonia
The acid-fast bacilli (AFB) sputumsmear test performed on the same patient was positive.

Figure 8. Anterior-posteriorchest X-ray showing apical alveolo-interstitialpneumonia suggestive of acute pulmonarytuberculosis.
Mr. YX, age 45, referred to the department for chroniccough; a frontal chest X-ray revealed progressive alveolo-interstitialpneumonia in the right apical region and the posterior segment of the leftupper lobe, withfindings suggestive of acute pulmonarytuberculosis.

The sputumsmear test (acid-fast bacilli) performed on the same patient was positive

## 4. Discussion

### 4.1. Prevalence of pulmonarytuberculosis on chest X-ray

In total, weidentified 136 cases of pulmonarytuberculosisamong 2,861 chest X-rays performed in the department, representing a prevalence of 4.75%. This proportion issimilar to thatreported by Diallo M. [9], whofound a 5% prevalence of suspectedpulmonarytuberculosis on chest X-rays in hisstudy on the epidemiological, clinical, and radiographic profile of pulmonarytuberculosis in adults at the referralhealth center in Commune V in 2022. Koné A et al. [6] noted a prevalence of 4.57% of suspectedpulmonarytuberculosis on computedtomography (CT) in theirstudy on the role of medicalimaging in the diagnosis of thoracictuberculosis at the Point G University Hospital in 2021. Baddan IB.[10] found a prevalence of 9.3% in hisstudy in Marrakech in 2012. This similarity can beexplained by the comparable demographic and organizational profiles of the centers (practice of screening radiography and referral of suspected cases to specializedunits).

### 4.2. Sociodemographiccharacteristics

In thisstudy, male patients accounted for 75% of cases, with a sex ratio of 3. Kombila et al.[11] reported a rate of 81.8% male patients in theirstudy on the radiologicalfeatures of smear-positive pulmonarytuberculosis in the pulmonologydepartment of the FANN National University Hospital Center in Senegal in 2018. Koné A et al. [6] reported a sex ratio of 2.2 in their 2021 study. This male predominancecouldbeexplained by increasedriskfactors for tuberculosis transmission among men, such as prolongedexposure to public or crowded places (work, transportation) and riskybehaviors (alcoholism, smoking).

The 25–34 age group accounted for 31.6% of patients, with a meanage of 36.2 ± 15 years. Ben Saad-Baouab et al.[12] found a meanage of 33 years in their 2019 study on the role of imaging in the management of multidrug-resistanttuberculosis in Tunisia. In the study by Diallo M. [9], the meanagewas 35 years. An averageage of 37.5 ± 14.9 yearswasreported

by Kombila et al.[11] in Senegal in 2018.

This findingconfirms the assertion thattuberculosisis a diseasethat affects young people in the prime of theirworkinglives, with adverse socioeconomicrepercussions, and underscores the importance of prevention and screening strategiestargeted at thisage group [13].

4.3. ClinicalFindings

Clinicalfindingsweredominated by signs of bacterial infection in 98.5% of cases and chroniccough lasting more than 15 daysin 92.6% of cases. Sylviane et al. [14] reported persistent respiratorysymptomsin 25.5% of patients, dominated by dyspnea and coughin 18.5% of cases, in theirstudybased on the radiographic profile of pleuropulmonarysequelae of tuberculosis at Jamot Hospital in Yaoundé, Cameroon, in 2022. Koné A et al. [6] reportedcoughin 93.7% of patients. Theseresults are consistent with the data from Ben Saad-Baouab et al. [12] in Tunisia, where the predominantsymptomswerecough, followed by sputum production and hemoptysis. Thesefindingsdemonstratethatcough, often productive, remains the primaryclinicalindicator for suspectedpulmonarytuberculosis, particularly in areas of high endemicity.

4.4. RadiographicFindings

The mostcommonlyobservedradiographicabnormalitieswerealveolaropacityin 80.1% of cases, followed by interstitialopacity (69.1%) and cavernouslesions/tuberculomasin 25.7% of cases. In the study by Koné A et al. [6], the radiologicalabnormalitiesfoundwerealveolar consolidation syndrome (61.64%), cavitary syndrome (50.68%), and pleural effusion syndrome in 47.95% of cases. Kombila et al.[11] reported a rate of 59.1% of patients presentingwithcavitarylesions on chestradiography in Senegal in 2018. Infiltrates and nodules were the main lesionsfound, accounting for 50% of cases in the study by Diallo M [9] at the referralhealth center in Commune V of Bamako in 2022. Baddan IB.[10] foundalveolar syndrome in 62.8%, infiltrative opacitiesin 51%, and cavitarylesionsin 46.5% of cases in hisstudy in Marrakech in 2012. In ourseries, the lesionswerebilateralin 71.3% of cases, with a multilobar distribution in 72.1% of patients. In the study by Kombila et al.[11], radiologicallesionswerepredominantlybilateralin 45.5% of cases and extensive in 71.2% of

cases.In the study by Baddan IB.[10], the lesionswerebilateralin 62.8% of cases, with a predominance in the right upper lobe in 74.4% of cases and in the leftupper lobe in 46.5% of cases. This predominance of lesions in the upper lobes couldbeexplained by higher intra-alveolaroxygen pressure, whichisconducive to the growth of Koch'sbacilli.

Conclusion:

Our results show thatpulmonarytuberculosisremains a common condition despite all the national measuresthat have been implemented. Itsdiagnosis must alwaysbebased on an integratedapproachcombiningclinicalfindings, imaging, and laboratory tests. Imaging is an essential tool for guiding the diagnosis, evaluatinglesions, and guiding patient management.

Conflict of interest: The authors of thismanuscriptdeclare no conflict of interest.

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