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Chest CT in pediatric tuberculosis: when, how and why? Are actual guidelines obsolete?

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UNIVERSITÉ DE NICE SOPHIA ANTIPOLIS
FACULTÉ DE MÉDECINE

THÈSE D'EXERCICE DE MÉDECINE

Pour le

DIPLOME D'ÉTAT DE DOCTEUR EN MÉDECINE

Chest CT in pediatric tuberculosis: *when, how and why.*
Are actual guidelines obsolete?

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Par

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Abréviations

ADM	Adenomegaly
CCT	Chest Computed Tomography
CXR	Chest X-ray
IGRA	Interferon Gamma Release Assays
TB	Tuberculosis
TST	Tuberculin Skin Test
YO	Years Old

Introduction

Tuberculosis (TB) remains an important cause of morbidity and mortality worldwide. Children account for 12% of patients [1]. Those younger than 5 years are the most at risk for disseminated TB and TB meningitis, so bear the highest risk of death and sequelae [2]. One of the major practical problems in children is distinguishing latent TB infection from active pulmonary TB. Moreover, early diagnosis is often difficult because the clinical signs are nonspecific and sputum or gastric aspirate sample are rarely positive [3].

The diagnosis is based on close contact with a relative suffering from TB, positive results in tuberculin skin test (TST) or interferon gamma release assays (IGRA) in addition to chest X-ray (CXR) compatible abnormalities. But CXR has a low sensitivity, low specificity and bad inter-observer agreement [4][5][6]. Chest Computer Tomography (CCT) has a better resolution and low-dose examinations are now easily available [7].

French [8] and international guidelines [9] regarding TB suspicion have been elaborated respectively in 2013 and 2016 and exceptionally recommend CCT, in case of radiographic doubts or exposure with a multi-drug resistant TB index case. However, for patients under 2 years old (yo), who are the most at risk of developing severe forms of TB, CXRs are particularly difficult to interpret because of the supine position, the absence of full inspiration and the thymus overshadow. Two studies showed that many infected children with normal CXR had unrecognized active pulmonary TB revealed by CCT, and recommended CCTs for children suffering from latent TB or symptoms [10][11] regardless of their age or the type of TB contact.

The aim of this study is to determine the CCT relevance in TB suspicion for a wider pediatric population than the actual guidelines, in order to adjust the indications.

Material and methods

Patients

We retrospectively reviewed the informatic medical files of 99 patients exposed to TB who visited our Department of Pediatrics, from January 2013 to December 2018. We included all patients who were 0-15 years old with suspected TB. Actual French guidelines define suspected TB as “a person who has inhaled a volume of air potentially contaminated by a patient suffering from contagious TB” (*TB bacilli in the sputum*) [8].

We included patients with an initial CXR report, a following CCT report and complete medical care data. 60 patients could not be included because they had no CCT, 6 had no CXR and/or CCT reports and 6 medical data were missing.

Medical care was decided by the clinicians and was available on the computerized medical records. Diagnoses and treatment were adjusted accordingly to the WHO’s definitions and recommendation [9], as follow:

- Definition of latent TB infection: bacilli of the *M. tuberculosis* complex in the body without clinical or radiological signs of active pulmonary TB, positive reaction to the TST or positive result on the IGRA.
- Definition of active pulmonary TB: increase in the TB bacillus insufficiently controlled by the immune system. The progression may start immediately after a TB infection or by reactivation of a latent infection. The diagnosis is based on the imaging findings.
- Treatment of patients with latent TB infection and patients at risk of progression to active pulmonary TB (less than 2 yo or immunocompromised): 3-months two-drug regimen.
- Treatment of patients with active pulmonary TB: 6-months four-drug regimen.

Chest imaging

The CXR had to be done before the CCT and was performed either internally or externally to our medical center. When performed externally, the CXR was reviewed by experienced pediatric radiologists and/or chest pediatricians.

All CCTs were performed in our center with a helical CT scan (*General Electric Bright Speed*) at the Department of Radiology, using a preset scan protocol. All examinations were made after administration of IV contrast medium. No sedation was needed.

CXR and CCT results were retrospectively evaluated through the reports from experienced pediatric radiologists.

Study

The age, sex, TST or IGRA results and clinical information were recorded when available (table 1).

We collected the CCT's indications and the kind of contact with the index case accordingly to the classical classification of the risk of contamination [8].

- close contact or long delay of exposure
- regular or occasional contact for a short time

Patients were classified into two groups based on their CXR reports:

- group 1 : abnormal CXR: suspicion of active TB infection
- group 2 : normal CXR

CXR were compared to CCT results and discrepancies were recorded. To determine the CCT relevance, our principal criterion was the observation of the medical care decisions based on the CT-report.

As a secondary objective, for the patients diagnosed with active pulmonary TB and treated, we also collected information about follow-up CCTs and their influence on medical care decisions. Information on the patient's clinical condition and delay compared to the previous CCT were recorded.

Statistical Analysis

The analyzes were carried out using the statistical software R. Numerical values of continuous variables were reported as median [Q25-75], and categorical variables were expressed as count. For quantitative variables, the numbers compared being low, a non-parametric test was carried out (Mann-Whitney test). For qualitative variables, a Chi2 test, or a Fisher test in case of small effective, were used [12]. The statistically significant difference was indicated by a *p value* less than 0.05.

Results

Patient characteristics

Our study cohort consisted of 33 patients (median age 14 months; range, 1–156 months). Most patients were less than 2yo (21/33), 8 from 2yo to 5yo and 4 over 5 yo. 18 were girls, and 15 boys, TST or IGRA were positive in 13/32. Among symptomatic patients (10/33),

only 3 were less 2yo and 2 had a normal CXR. The TB exposure was almost evenly split between close contact and regular or occasional contact (table 1).

Imaging characteristics

The CCT indications were most frequently TB exposure in patients less than 2yo without symptom, radiological or biological abnormalities (12/33). Amongst those, 4/11 were cases of close contact. The other CCT indications were symptomatic patients (10/33), radiological abnormalities without symptom (8/33) and latent TB with TST or IGRA positive without symptom (3/33) (table 1).

From the thirty-three patients in our study (fig 1) :

a/ Sixteen CXRs were abnormal (group1)

In this group, 4/16 CCTs were found to be normal which indicated false positives from the CXR. For these cases, CXR abnormalities were unspecific as reported in table 2.

The remainder 11 CTs confirmed the TB diagnosis and specified the extent of the lesions; 3 patients showed mediastinal adenomegalies only and 8 patients also had parenchymal involvement (*parenchymal consolidation or lung nodules*) which in 4 cases were revealed on CCTs. In 6 patients, adenomegalies were not described on CXR but visualized on CCTs (table 2)

For one of the abnormal CXRs, CCT revealed no hilar adenomegaly and a well-defined left upper lobe parenchymal consolidation which led to the differential diagnosis of community acquired pneumonia.

b/ Seventeen CXRs were normal (group 2)

Although the seventeen children had normal CXR, the exposure to TB was considered worrisome enough by the clinicians to indicate a CCT in order to alleviate any doubt; 3/17 CCTs were abnormal despite the CXR reported as normal (table 2). These findings were interpreted as consistent with evolutive active pulmonary TB (fig. 2a, 2b, 3a, 3b).

Clinical characteristics

For the patients showing discrepancies between CXR and CCT, characteristics regarding clinical symptoms, TST or IGRA results, age and contact type are summarized in table 3.

In group 1, 5/5 patients had negative TST or IGRA, 2/5 patients were asymptomatic and 5/5 were less than 2 yo. In group 2, 2/3 patients had positive TST or IGRA, 3/3 patients were asymptomatic and 2/3 were less 2 yo.

Medical care after the first CCTs

In the group 1, CCTs changed the medical care in all patients who demonstrated a discrepancy between CXR and CCT, corresponding to 5/16 of the said patients ($p < .01$).

The children respectively received 3 months two-drugs regimen (prophylactic treatment was given because they were all less than 2 yo) instead of 6 months antitubercular four-drugs regimen. The patient diagnosed with community acquired broncho-pneumonia received appropriate antibiotherapy with favorable clinical outcome.

In the group 2, 3/17 CCTs ($p < .01$) were abnormal and changed the diagnosis from latent TB infection to active pulmonary TB. These three patients received 6 months antitubercular four-drugs regimen instead of 3 months two-drugs regimen.

Follow-up CCTs

Thirteen patients treated for TB underwent a follow-up CCT, performed mean 2 [2-6] months after the first one (*range 1-12*). CCTs were performed for monitoring in 12 patients and for new symptoms in 1 patient.

For the twelve patients with no new symptoms, CCT did not modify medical care.

One patient with pulmonary TB on the first CCT developed cervical adenomegalies during the TB treatment. CCT highlighted increase of mediastinal adenomegalies and resulted in a cervicotomy with adenomegalies resection to rule out a differential diagnosis.

Discussion

French [8] and international guidelines [9] recommend to perform a CXR in patients with suspicion of TB. But for patients younger than 2 yo they are particularly difficult to interpret because of the supine position, the absence of inspiration and the thymus overshadow which could mask or simulate mediastinal lymphadenopathies. Moreover, patients younger than 5 yo are the most at risk for disseminated TB and TB meningitis, so at the highest risk of death and sequelae [2]. In our study, for patients with reported radiological abnormalities, CCT was performed to specify these abnormalities. In 4 cases CCTs were normal, indicating false positives CXRs and in one case, it led to the differential diagnosis of community acquired pneumonia, thus avoiding unnecessary 6 months antitubercular four-drug regimen. For some patients without radiographic abnormalities, the exposure to TB was considered worrisome enough to indicate a CCT. In 3 cases, despite a normal CXR, CCT

revealed mediastinal adenomegalies, pulmonary nodules or a para-vertebral mass, initiating the prescription of an essential 6 months antitubercular four-drug regimen (2/3 patients were younger than 2 yo).

Regardless of the CXR results and the CCT indication, the initial CCT changed the diagnosis and the medical care from active pulmonary TB to latent TB infection or the opposite in a significant number of cases (8/33) mainly in patients less than 2 yo (7/8) and this appeared very relevant given the risk of death and sequelae in this population. CCT also contributed to specify the extent of the disease when abnormalities were reported on CXR, by revealing mediastinal adenomegalies or lung modules not described initially.

TB remains a common disease worldwide with, according to WHO, an estimated number of new cases of 10 million each year. 10 % of these cases occur in children. Children under five yo account for about 50% of pediatric TB cases [1]. In France, the active pulmonary TB remains uncommon. The general trend over the past 30 years has been a regular decrease except for a slight increase of the incidence in 2016 and 2017 [2]. The incidence of new cases for patients under fifteen yo was 3.3/100 000 in France in 2017 [13]. International guidelines were adjusted in 2016 and recommended to perform a CXR in the TB suspicion algorithm but did not mention CCT [9]. US and French guidelines are similar and have remained the same since 2005 and 2013 [14][8].

- Patients over 5 yo only undergo a CXR, if it is normal a TST or IGRA is carried out 8-12 weeks after the last contact with the index case [8].
- Patients under five yo are prescribed CXR and TST immediately taking into account the risk of adverse development, and are classified as active pulmonary TB, latent TB infection, or no criteria for infection. Those without criteria of infection receive prophylactic treatment if they are less than 2 yo or immunocompromised to avoid the evolution to a severe form [8].

CCT indication is, surprisingly, exceptional, only indicated in case of radiographic doubts or of exposure with a multi-drug resistant TB index case [8][15]. Some studies however considered a possible role for systematic CCT in TB suspicion. In an adult population, Kim *et al.* [16] demonstrated that the CXR failed to reveal the adenomegalies in 21% and the parenchymal abnormality in 35% of the patients. Similar conclusions were found by Lee *et al* [17] in 2010. Indeed, most of these studies relate to the adult population and emphasize the superiority of CCT over CXR to diagnose mediastinal adenomegalies.

In a pediatric population, Durmus *et al.* [18] evaluated that CXR and CCT findings of almost all patients screened for TB were consistent and concluded that a routine CCT was not necessary for asymptomatic cases showing only hilar adenomegalies on CXR. But the results of this retrospective study are arguable, as the authors demonstrated that 4.3% patients (n= 2/47) had normal CCT results although their CXR were considered abnormal, so without CCT, they would have been wrongly treated as active pulmonary TB.

Delacourt *et al.* [10] have suggested that enlarged adenomegalies may be detected by CCT in 60% of children with TB infection who were reported to have normal findings on CXR.

In a 2012 study by Garrido *et al.* [19] 116 children younger than 4 yo with positive TST and normal CXR were observed and they concluded that 92.8% had an abnormal CCT, that led to a 6-months four-drug regimen. These studies raise the idea of broadening the indications of CCTs for patients with symptoms or latent TB.

TB imaging features on CXR and particularly on CCT are now clearly established, mostly in the adult population: bronchial wall thickening, lobular consolidation and cavitation (fig. 4a), centrilobular nodules, tree-in-buds (fig. 4b), sub-pleural nodule which can be calcified (Ghon focus) or branching linear structures are all classically reported [20] and may be associated with mediastinal adenomegalies. The lesions are typically found in the apical and dorsal segments of the upper lobes and in the apical segments of the lower lobes given their greatest ventilation [21].

Findings are slightly different in children, for whom the presence of mediastinal or hilar adenomegalies is preponderant [22][23][24]. To depict mediastinal adenomegalies the CXR is of low reliability [4][5][6]. An apparently normal CXR, cannot exclude mediastinal or hilar nodes, especially in children younger than 2 yo given the technical difficulties mentioned earlier. Therefore a normal CXR cannot exclude active pulmonary TB infection [25].

The normal size of mediastinal lymph nodes in children has rarely been studied. Delacourt *et al.* [10] have proposed normal values for their antero posterior axis :

- In the right pre tracheal position, lymph nodes were defined as enlarged if > 5 mm in children < 4 yo or if > 7 mm in children > 8 yo
- In hilar areas, the cutoff points were 4 mm and 6 mm respectively

These cut offs have been approved by Uzum *et al.* [11] who also demonstrated that the lymph nodes had to be considered enlarged from 7mm onwards.

Several types of node enhancement have been described and are suggestive of TB: discreet rim-enhancing nodes with low-density centers (fig. 5) [26][27], rings of enhancement around and within a mass of adenomegalies that were not centrally of low density called “ghost-like ring” [28], or inhomogeneous nodal enhancement [27].

Parenchymal lesions in active TB in children are similar to those found in adults.

We established a clear therapeutic interest for the initial CCT, but specific indications remain to be discussed as for several reasons, it may not be conceivable to realize a systematic CCT to every TB contact or suspicion. CCT is not exempt of risk when it is realized with IV contrast, and they are radiation and cost consequences for each examination performed. Iodinated contrast media should be systematically injected for the mediastinal study in children and this raises concerns regarding allergy, nephrotoxicity and peripheral venous approaches which can be difficult in the younger population. Furthermore, CCT is more ionizing than CXR. The recent development of low dose CCTs is significantly reducing this burden, but it remains a more irradiating examination, especially when realized with contrast media [7].

The financial and material costs of CCTs vs CXR are also to take into account, but for these instances, we believe that international guidelines are difficult to establish because they are significant inequalities from one country to another, regarding TB incidence, medical resources, accessibility to CT scanners and modalities of care. In most European country, TB incidence remains very low and CT scanners are easily accessible, to a cost which depends on the national health care policies. In France, a CXR costs around 30 euros and a CCT 130 euros. All French residents benefit from the “*social security*” covering almost all the medical costs. Patients with no private cover will have to pay 9 euros for a CCT, which is affordable by most of them. There are regional differences for accessibility but usually a CCT can be performed within a week from the request. Because of this facility and a low cost to the patients, clinicians are keen to request frequent CT examinations given their superior resolution and the potential impact on medical decisions. In serious conditions such as pediatric TB, it seems particularly appropriate.

Regarding our secondary objective and the follow-up CCTs group for treated TB patients, none of the CCTs performed impacted the treatment. To our knowledge there is no recommendation for follow-up CCTs in children. Furthermore, persistence of signs of CCT

activity after 6 months of anti-tuberculosis treatment is common (48.8%) and does not seem predictive of relapse in an adult study [29]. On follow-up CCTs, the active lesions, continued to regress until their disappearance involving the notion of “delayed radiological healing”. Furthermore, in the first 3 months after the beginning of treatment, clinical symptoms, adenomegalies and areas of infiltration may actually increase in size despite adequate therapy (fig. 6a, 6b, 6c, 6d). The reason for the progression of the disease is unknown ; it may be related to the effects of the hypersensitivity reaction that normally occurs 2-10 weeks after initial infection [26] and spontaneously resolves afterwards.

The retrospective and monocentric nature of our work is its main limitation. Our cohort consisted of only 33 patients, mostly of less than 2 yo given a selection bias relative to our institution. CCTs and CXR reports provided at the time of the exams were used as our observed results without imaging being reviewed given the purpose of the study and the ambition to reflect usual clinical situation. Examinations were interpreted by different pediatric radiologists, or clinicians, which were not blinded to the previous results or to the clinical findings and this could have distorted the results. Specifically trained physicians for the sole purpose of recognizing TB signs on CXR could have improved the overall initial diagnoses, but this would have biased our objective.

The aim of our study was essentially to try and clarify the benefice of CCTs in the pediatric population with contact, suspicion or during the treatment of TB. The results are striking: we demonstrated that early CCT, regardless of the result of CXR, impacted the treatment in a significant number of cases (8/33) and possibly avoided complications or further contaminations. In 2021, it seems unreasonable to underuse the diagnosis superiority of CCT over CXR in a pediatric population for such a serious disease. However, given the consequences mentioned above regarding the risk, cost and feasibility of CCTs, proposing a CCT to all children with suspicion of TB does not seem reasonable either. The indication should be pondered to the risk; when the contact is recognized as “close” accordingly to the classification of the risks, especially if the patient is younger than 2 yo. In accordance with the guidelines and the previous studies, the CXR could be replaced by a contrast-enhanced CCT for all children with a high suspicion of TB (*symptoms or positivity of TST or IGRA*), radiographic doubts or exposure with a multi-drug resistant TB index case. In the light of our study, it would also be valuable to perform a CCT in case of close contact

with a TB patient (*living in the same place, or who have spent a long time with the index case, in particular by sharing the same limited space on a daily basis*) more particularly in patients under 2 yo. A CXR could still be performed for lighter suspicion or risks.

Conclusion

Regardless of the CXR results, CCT impacted the treatment in a significant number of cases (8/33), avoiding unnecessary 6 months antitubercular four-drug regimen or, more importantly in view of the serious risk in the youngest, indicating the essential antitubercular four-drugs treatment. In the pediatric population, the presence of mediastinal or hilar adenomegalies in active pulmonary TB is preponderant and difficult to depict on CXR given the technical specificities of the youngest age group. Our study showed that it is relevant to perform an enhanced CCT in children with close TB contact in particular when they are younger than 2 yo.

On the contrary, follow-up CCTs in TB patients under treatment did not change significantly the medical decisions.

Annexes

	All patients (n=33)
Age (months)	14 [4.0-36.0] (1-156)
<2yo	21/33
Gender	
Male	15/33
Female	18/33
Initial symptoms	10/33
Cervical adenomegaly and pallor	1/33
Fever	3/33
Cough	8/33
TST or IGRA	
Positive	13/32*
Negative	19/32*
Exposed TB	
Close contact	13/27*
Regular or occasional contact	14/27*
CCT indication	
Exposed TB only	12/33
Close contact	4/11*
Regular or occasional contact	7/11*
<2yo	12/12
Exposed TB + symptoms	10/33
Cough	2/10
Cervical adenomegaly and pallor + radiological abnormalities	1/10
Fever + radiological abnormalities	1/10
Cough + radiological abnormalities	4/10
Cough + fever + radiological abnormalities	2/10
<2yo	3/10
Exposed TB + radiological abnormalities without symptom	8/33
<2yo	5/8
Exposed TB + TST or IGRA positive without symptom	3/33
<2yo	1/3

Table 1 - Patient's characteristics

Quantitative data are presented as median [Q25-75] (minimum-maximum) / Counting data are presented as count

Definition according to the French guidelines :

- *close contact* : people living in the same place, or who have spent a long time with the index case, in particular by sharing the same limited space on a daily basis.

- *regular or occasional contact* : people who attended the index case, but for a short time and less closely.

* Missing data

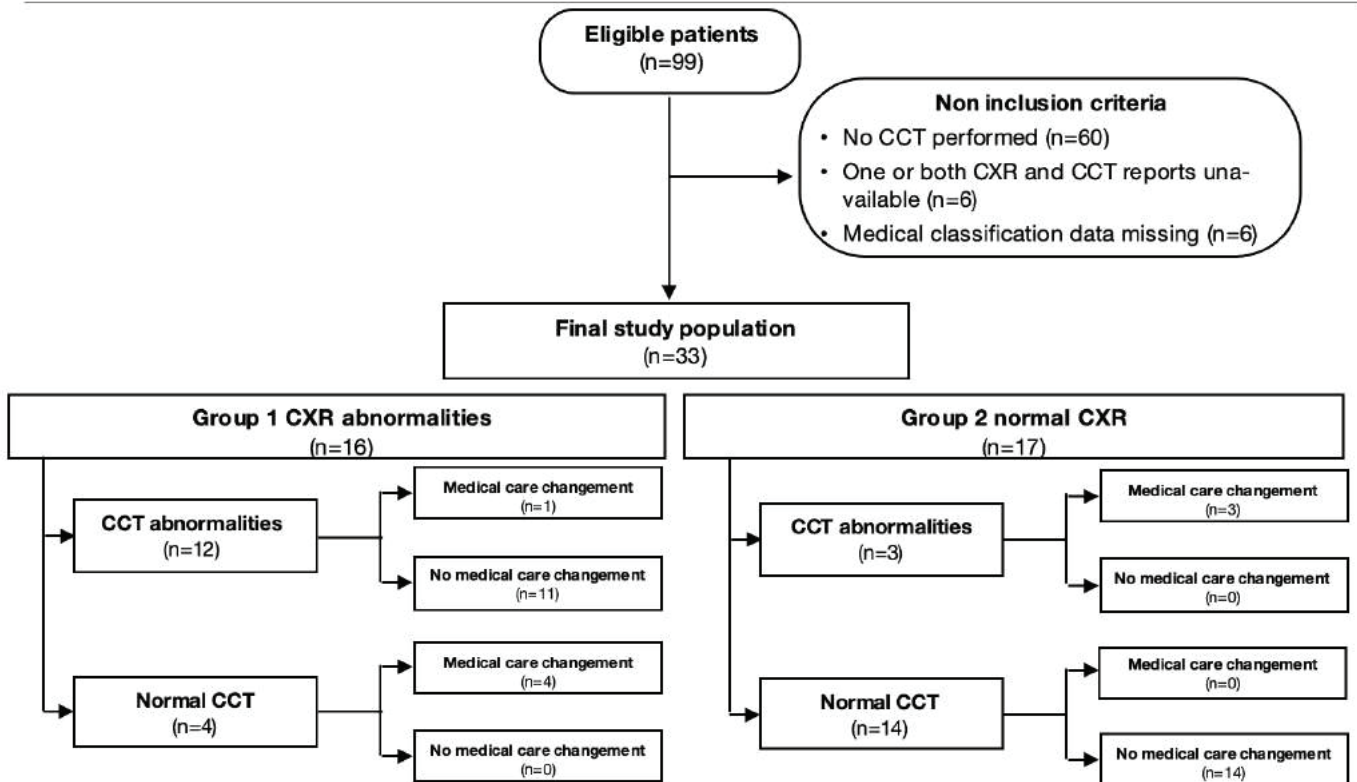


Fig.1 Flowchart of study

CCT Chest Computed Tomography
 CXR Chest X-ray

CXR abnormality	CCT interpretation	Medical care modification
Radiographic abnormalities with normal CCT or differential diagnosis		
Hilar opacity	A few non-specific nodules less than 3mm	From 6-months 4-drugs specimen to 3- months 2- drugs specimen or no treatment
Right inferior lobe condensation	No abnormality	
Peribronchial cuffing		
Peri hilar ADM		
Left upper lobe consolidation, hilar ADM	Left upper lobe consolidation without ADM in keeping with a community acquired pneumonia	From 6-months 4-drugs specimen to pneumonia antibiotic
Normal CXR with CCT abnormalities		
No abnormality	Bilateral hilar adenomegalies (<i>18 mm small diameter</i>) superior mediastinal adenomegalies and bilateral pulmonary nodules up to 5 mm in diameter (<i>Fig 2a, 2b</i>).	From 3- months 2-drugs specimen or no treatment to 6-months 4-drugs specimen
	32 mm para vertebral mediastinal mass which was later explored by MRI (<i>Fig 3a, 3b</i>)	
	Right hilar adenomegaly and a 3mm left lower lobe calcified nodule	
Comparison CXR vs CCT abnormalities		
Right lobe consolidation	Middle lobe consolidation and right hilar adenomegaly	No modification
Peribronchial cuffing	Right hilar adenomegaly and right upper lobe nodule	
Right lobe consolidation	Right upper lobe consolidation, left lower lobe nodule and right hilar adenomegaly	
Peri hilar ADM	Bilateral hilar adenomegalies, mediastinal adenomegalies, middle lobe, right lower lobe, left lower lobe and left upper lobe nodules	
Left lower lobe consolidation	Left lower lobe consolidation	
Mediastinal ADM	Left hilar adenomegaly	
Left lower lobe consolidation	Left hilar adenomegaly	
Peribronchial cuffing + peri hilar ADM	Left hilar adenomegaly	
Left upper lobe consolidation	Left upper lobe consolidation with calcifications and right hilar adenomegaly	
Peribronchial cuffing	Bilateral hilar adenomegaly and right lower lobe nodule	
Bilateral ADM peri hilar	Right hilar adenomegaly and right lower lobe nodule	

Table 2 – Discrepancies and comparison between CXRs and CCTs

CXR Chest X-ray
CCT Chest Computed Tomography
ADM Adenomegaly

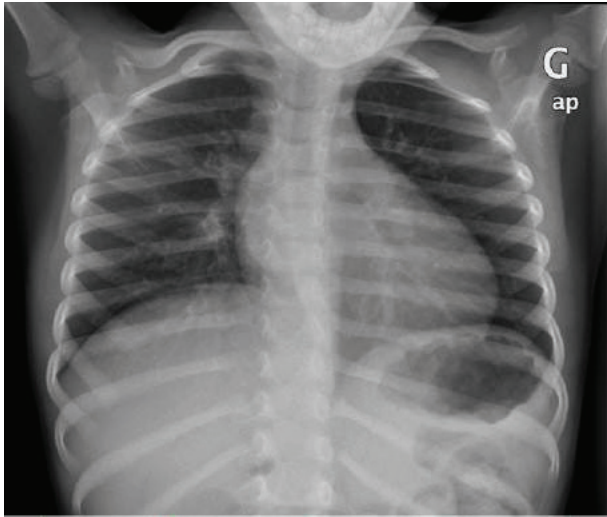


Fig 2a – 4 yo girl, suspected tuberculosis - CXR interpreted as normal

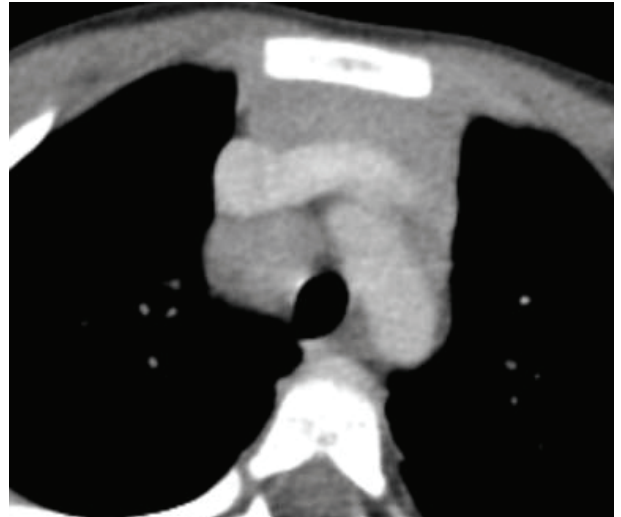


Fig 2b – 4 yo girl, suspected tuberculosis – CCT on mediastinal window showed a superior mediastinal adenomegaly



Fig 3a– 2 months girl, suspected tuberculosis. CXR interpreted as normal

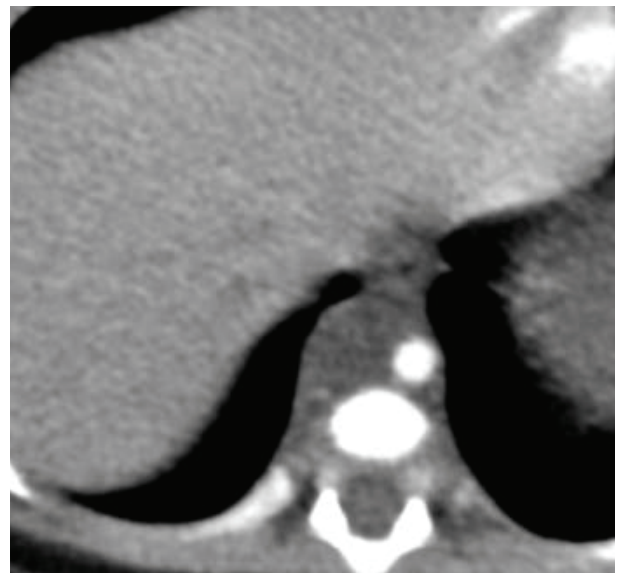


Fig 3b– 2 months girl, suspected tuberculosis. CCT on mediastinal window showed a 32 mm pre-vertebral lower mediastinal mass

	Contact type		TST or IGRA		Symptoms		Age	
	Close contact	Regular or occasional contact	+	-	Yes	No	<2yo	≥2yo
CXR abnormalities (group 1) with normal CCT n=4/16	1			1		1	1	
	1			1	1		1	
	1			1	1		1	
		1		1		1	1	
CXR abnormalities (group 1) with differential diagnosis n=1/16		1		1	1		1	
CXR normal (group 2) with CCT abnormalities n=3/17	*	*	1			1		1
	1			1		1	1	
		1	1			1	1	

Table 3 – Patient’s clinical characteristics

* missing data type contact
 CXR Chest X-ray
 CCT Chest Computed Tomography
 TST Tuberculin Skin Test
 IGRA Interferon Gamma Release Assays

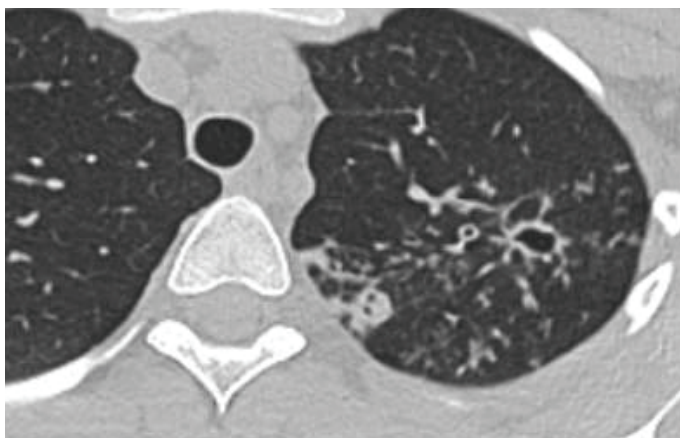


Fig 4a– 14 yo child with active tuberculosis. CCT, lung window shows areas of consolidation, bronchial wall thickening and cavities in the left upper lobe.

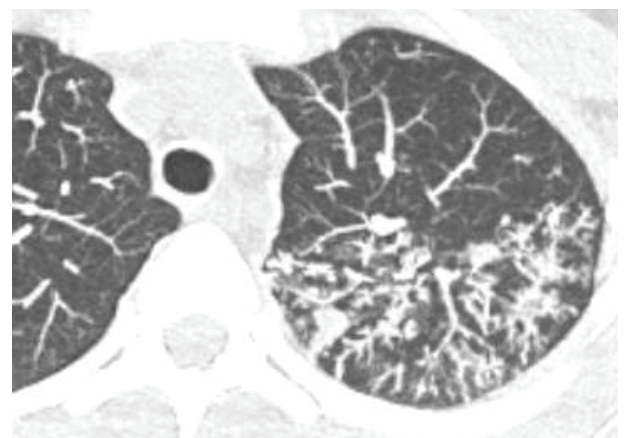


Fig 4b– 14 yo child with active tuberculosis. CCT, lung window with the MIP showing branching linear structure. Micro nodule with tree in bud pattern enhanced by the MIP (Maximum Intensity Projection 5mm)

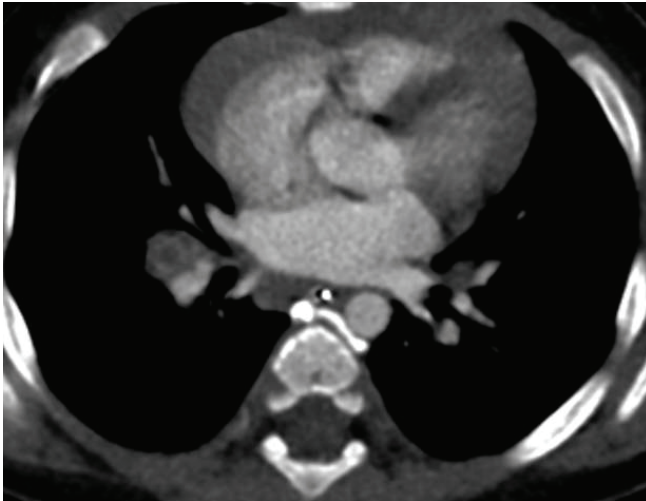


Fig 5– 6 months boy with active tuberculosis. Enhanced CCT, mediastinal window shows a rim-enhancing right inter bronchial adenomegaly with low-density center

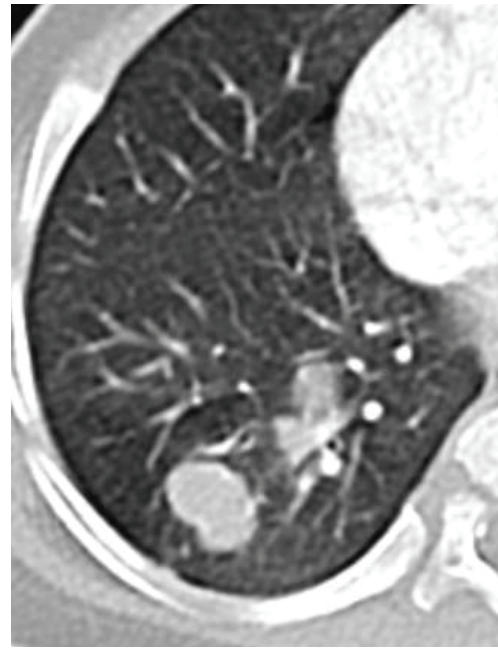
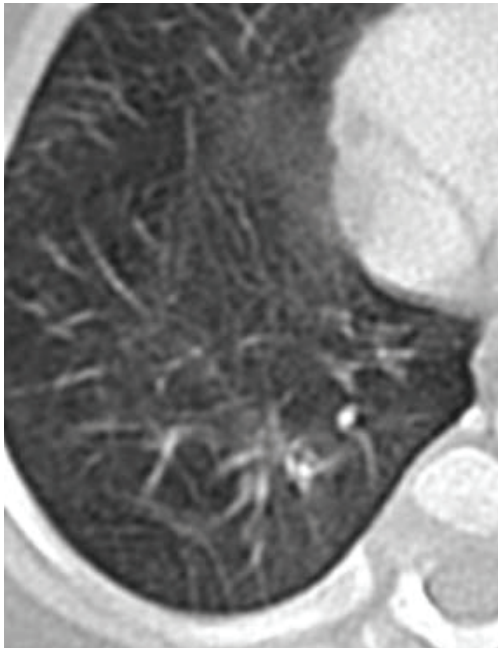


Fig 6 a, b – 5 months girl with active tuberculosis – CCT lung window shows a) a normal right lower lobe at the time of diagnosis. b) one month after the beginning of treatment, apparition of o nodular condensation in the right lower lobe.

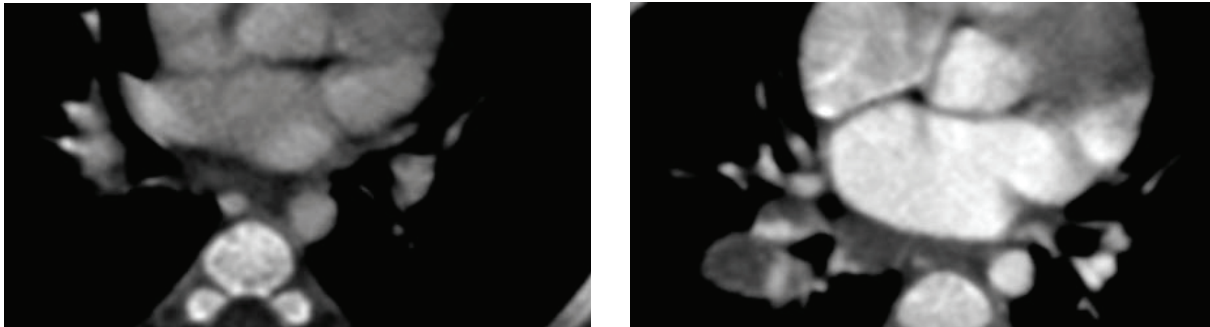


Fig 6 c, d – 5 months girl with active tuberculosis – CCT on mediastinal window shows the apparition of right peribronchial adenomegalies 1 month after the beginning of treatment (6d).

Both parenchymal and hilar abnormalities resolved later without modification of the treatment

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Serment d'HIPPOCRATE

Au moment d'être admise à exercer la médecine, je promets et je jure d'être fidèle aux lois de l'honneur et de la probité.

Mon premier souci sera de rétablir, de préserver ou de promouvoir la santé dans tous ses éléments, physiques et mentaux, individuels et sociaux.

Je respecterai toutes les personnes, leur autonomie et leur volonté, sans aucune discrimination selon leur état ou leurs convictions. J'interviendrai pour les protéger si elles sont affaiblies, vulnérables ou menacées dans leur intégrité ou leur dignité. Même sous la contrainte, je ne ferai pas usage de mes connaissances contre les lois de l'humanité.

J'informerai les patients des décisions envisagées, de leurs raisons et de leurs conséquences.

Je ne tromperai jamais leur confiance et n'exploiterai pas le pouvoir hérité des circonstances pour forcer les consciences.

Je donnerai mes soins à l'indigent et à quiconque me les demandera. Je ne me laisserai pas influencer par la soif du gain ou la recherche de la gloire.

Admise dans l'intimité des personnes, je tairai les secrets qui me seront confiés. Reçue à l'intérieur des maisons, je respecterai les secrets des foyers et ma conduite ne servira pas à corrompre les mœurs.

Je ferai tout pour soulager les souffrances. Je ne prolongerai pas abusivement les agonies. Je ne provoquerai jamais la mort délibérément.

Je préserverai l'indépendance nécessaire à l'accomplissement de ma mission. Je n'entreprendrai rien qui dépasse mes compétences. Je les entretiendrai et les perfectionnerai pour assurer au mieux les services qui me seront demandés.

J'apporterai mon aide à mes confrères ainsi qu'à leurs familles dans l'adversité. Que les hommes et mes confrères m'accordent leur estime si je suis fidèle à mes promesses ; que je sois déshonorée et méprisée si j'y manque.

Background

Actual guidelines recommend a chest X-Ray (CXR) to detect active pulmonary tuberculosis (TB) in children. Chest Computed Tomography (CCT) is rarely indicated, only in case of radiographic doubts or exposure with a multi-drug resistant TB index case. However for patients under 2 years old (yo), which are particularly at risk for severe TB, the CXRs are more difficult to interpret and CCTs have a superior resolution, questioning the interest of replacing the CXR.

Objectives

Primary objective: to determine the relevance of CCT versus CXR in pediatric TB contact or suspicion.

Secondary objective: to evaluate the interest of CCT follow-up during the treatment of children with active pulmonary TB.

Methods

In this monocentric retrospective study, 33 patients (*15 boys, 18 girls; median age 14 months*) exposed to or suspicious of TB were included. All patients had undergone a CXR and a CCT. Patients were separated into two groups based on their CXR report: group 1 for abnormal and group 2 for normal CXR. We studied the discrepancies between CXR and CCT reports, the consequences they induced regarding treatment of the patients and recorded the age, the nature of the contact with the index case and the symptoms. For the patients diagnosed with active pulmonary TB, we also collected information about follow-up CCTs and their influence on medical care decisions.

Results

In group 1 ($n=16$), CCT changed the medical care in 5/16 ($p<.01$), 4 CCTs were interpreted as normal and one diagnosed a community acquired pneumonia rather than TB. In group 2 ($n=17$), 3/17 CCTs were pathologic, ($p<.01$), and, changed the diagnosis from latent to active pulmonary TB. Amongst those discrepancies, 7/8 patients were less than 2 yo which appeared very relevant given the risk of death and sequelae in this population.

Thirteen TB patients were followed-up by CCT, results did not warrant changes of the medical care (0/13).

Conclusion

In accordance with the guidelines and previous studies, CXR could be replaced by a contrast-enhanced CCT for all children with a high suspicion of TB, radiographic doubts or exposure with a multi-drug resistant TB index case.

In children less than 2 yo, CCTs modified the diagnosis and the treatment in a significant number of cases and could be proposed as a first imaging tool in TB suspicion for this population of patients.

Follow-up CCTs during the treatment of TB patients had no medical impact.