Imaging in extrapulmonary tuberculosis

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Authors: A. Amodeo¹, C. De Dominicis², I. Casazza³, M. A. Guglietta⁴, E. Teti¹, F. Di Gregorio¹, F. Albo¹, L. F. Calabria³, V. David³; ¹Rome/IT, ²Roma (RM)/IT, ³Roma/IT, ⁴Roma, RM/IT
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Purpose

The aim of this study is to describe the most frequent forms of extrapulmonary tuberculosis (TB) when the lung is not involved or pulmonary imaging is nonspecific.

Although the improvements in diagnosis and treatment, TB still remains a world health problem, especially in developing countries.

Etiology, ways of dissemination

TB is due to *Mycobacterium tuberculosis*, an aerobic non-spore-forming bacillus. The mechanism of destruction is given by cell-mediated hypersensitivity that induces caseous granuloma formation.

The primary site of infection is represented by lung and concerns approximately 70% of cases.

Extrapulmonary infection generally occurs as a result of hematogenous dissemination from a clinically occult pulmonary focus.

Extrapulmonary TB may be confused with a neoplasm or other diseases. As a consequence, an accurate identification becomes important to establish an appropriate therapy.

Methods and Materials

The study entails a retrospective observational database analysis in which we evaluate 39 patients (27 female, 12 male; mean age 45 years-old) admitted to Sant'Andrea Hospital or through Emergency Department (56.4%) or by planned admissions (45.6%), in a period ranged from 2005 to 2012, in order to appreciate extrapulmonary TB manifestations.

Results

Many different extrapulmonary localizations of TB were observed: 59% at lymph nodes; about 13% involved the central nervous system (CNS); 10% at different vertebral levels (Pott's disease) associated with paraspinal muscle abscess; 13% at abdomen (four cases characterized by bowel wall thickening and a case of renal TB); 26% of pericarditis (all but
one accompanied by coexistent pleuropulmonary disease). About 51% was Caucasian people (mean age of 67 years old), 49% non-Caucasian with lower mean age (32 years old). About 49% of all our patients showed also pleuro-pulmonary TB.

We observed a different age incidence of extrapulmonary disease. Young patients affected by extrapulmonary TB were represented mainly by immigrants. Differently, the older patients with extrapulmonary localizations were Italian people.

**Tuberculous lymphadenitis**

Lymphadenitis is the most common extrapulmonary TB manifestation and it mainly involves cervical and supraclavicular lymph nodes; moreover inguinal, axillary, mesenteric or mediastinal involvement are possible too. Typical lymph nodes imaging appearance is a central necrosis visible as a central low attenuation on CT scan. This pattern, however, is not pathognomonic of TB since similar features may be seen also in metastasis, lymphoma and inflammatory diseases. Excisional biopsy with histology, microbiological culture and biomolecular methods remain the goal procedure for definitive diagnosis.

**Pott's disease**

Spinal TB accounts for about 50% of skeletal TB. Typically more than one vertebral body is involved. The lower thoracic and upper lumbar levels are most commonly affected. The infection usually begins in the anterior part of vertebral body, with the involvement of the intersomatic space. Often vertebral erosion can result in anterior vertebral wedge deformation with consequent spinal sagittal deformities as kyphosis.

The infectious disease process can have an extension along the anterior or posterior longitudinal ligament. Paraspinal involvement may include the psoas muscle, with a psoas abscess (Fig. 1). Calcification within the abscess is pathognomonic of tuberculosis. CT and MRI are important to demonstrate small bone focus and extended disease.

**CNS TB**

Usually CNS damage is originated from an hematogenous spread, but it may result also from rupture or an extension of a subependymal focus. Infection may be located in brain, meninges or spinal cord (meningitis, meningo-encephalitis, tuberculomas, and abscesses).

*TB meningitis*
TB meningitis (Figg. 2-4) is the most frequent manifestation among CNS TB manifestations.

The most typical radiologic appearance is a meningeal enhancement interesting basal cisterns, the Sylvian fissure and cerebral sulci. These findings can be detected on CT imaging but they are better seen on MRI examination with gadolinium. Unfortunately this is a nonspecific appearance and it characterizes other infective meningitis or inflammatory diseases. Complications of TB meningitis include:

- hydrocephalus, caused by blockage of basal cisterns due to inflammatory exudates
- ischemic infarct, particularly in the basal ganglia or internal capsule, resulting from occlusion or compression of small perforating vessels.

**Encephalitis**

The encephalitis due to TB infection is a rare extrapulmonary localization associated with high morbidity and mortality. Principal symptoms are fever and clinical signs of neurological deficits. On MRI T2-weighted sequences often reveal a meningeal thickening caused from diffuse leptomeningeal inflammation. Laboratory findings can show the presence of *Mycobacterium tuberculosis* in cerebrospinal fluid.

**Cerebral tuberculoma**

TB granuloma, also known as tuberculoma, is the most frequent intraparenchymal lesion among central nervous system forms of tuberculosis. The most registered localization of tuberculomas is on frontal and parietal lobes. Pathologically aspect of tuberculoma is a central caseation necrosis surrounded by a capsule of collagenous tissue. Patients with cerebral tuberculoma (Figg. 2, 4, 5) can present sings and symptoms of raised intracranial pressure, and focal neurological deficits. On imaging we can observe single or multiple granulomas.

On MRI scan, tuberculoma is hypointense on T1-weighted image with central variable signal intensity T2-weighted image according to the different types of granuloma (noncaseating granuloma, caseating granuloma with a solid center, caseating granuloma with a liquid centre).

**Abdominal TB**

The abdominal localization of TB is case specific. Patients can present various symptoms depending from localization. The more common localizations are: lymphatic system, genito-urinary system and digestive system. Often symptoms are nonspecific and laboratory and instrumental features can suggest a neoplastic disease. CT and MRI can
detect lesions with a high grade of accuracy, but often the final diagnosis request a pathological confirmation.

Abdominal TB (Figg. 6, 7) may involve the gastrointestinal tract, peritoneum, mesenteric lymph nodes, and genitourinary tract. The most common manifestation of abdominal disease caused by TB is represented by lymphadenopathy.

- gastrointestinal TB: thickening of cecum and terminal part of the ileum, ileocecal valve enlarged, and mesenteric lymphadenopathy;
- genital TB involves frequently the fallopian tubes in women, with a bilateral salpingitis.

**TB pericarditis**

A first sign of pericardial involvement (Fig. 8) is represented by pericardial thickening (more than 3 mm). CT can demonstrate thickened and irregular pericardium commonly associated with mediastinal lymphadenopathy. We can also observe sometimes a distension of the inferior cava vein with more than 3 cm diameter. Sometimes pericardial calcification can be seen.

**Images for this section:**
**Fig. 1:** Pott's disease: large, multiloculated abscess extending from the paravertebral right muscle (at the L4 level) to the right dorsal-gluteal region (maximum extension of the fluid collection is 9 cm) causing right iliac bone erosion.
Fig. 2: MRI examination shows: - post contrast T1 leptomeningeal enhancement over the surface of the left fronto-temporal-parietal cortex of inflammatory pathogenesis; - multiple intraparenchymal ring enhancing lesions (the largest one measures 6 mm) located on the left hemisphere of the cerebellar cortex and on the right fronto-temporo-parietal region; - further small intraparenchymal pseudonodules with restriction of water diffusion on DWI are seen in the left temporal cortex.
Fig. 3: Pathological tissue involving the right fronto-parietal region, which extends into the subcutaneous soft tissues (extracerebral fluid collection: about 13 mm)
Fig. 4: Cerebral tuberculoma. Pathological enhancement of the basal cisterns. Leptomeningeal enhancement in the lamina quadrigemina region.
Fig. 5: Cerebral tuberculoma: nodular-enhancing lesion (about 6 mm) in the right cerebral hemisphere with surrounding edema. No restricted water diffusion on DWI images.
Fig. 6: CT with contrast material (axial scans): - multiple lymph nodes (maximum diameter 20 mm) located in the mesenterial adipose tissue; most of them have an hypodense, necrotic core; - thickened and oedematous appearance of the mesentery - distended small bowel loop - thickened walls of the small intestine
**Fig. 7**: Lymph node tuberculosis with severe abdominal effusion.
Fig. 8: Two different patients with tuberculous pericarditis: - enlarged heart; - discrete pericardial effusion.
Conclusion

The most frequent form of extrapulmonary TB was lymph adenopathy: cervical lymph nodes are the most nodal sites involved. Unfortunately lymph nodes imaging is aspecific. Also abdominal TB is a radiologic diagnosis challenge because there is not pathognomonic signs.

Extrapulmonary TB remains a radiological challenge and only a more deep clinical and anamnestic knowledge can help radiologist to identify the disease.

Given the lack of diagnostic criteria of extrapulmonary TB, diagnosis becomes demanding without a high index of suspicion, thus imaging is a cornerstone in early diagnosis.

References


Personal Information