Unusual radiologic findings of tuberculosis

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Learning objectives

To illustrate various atypical or life-threatening radiologic manifestations of tuberculosis from head to leg.
Background

Tuberculosis can affect any organ in the whole body and can life-threatened. Because tuberculosis presents as variety of clinical and radiologic findings, it can mimic numerous other disease entities in endemic countries including developing country.

We illustrate various cases of tuberculosis in various organs. A familiarity and clinical suspicion with the various radiologic findings of tuberculosis allow early diagnosis and prevent devastating condition if left untreated.
I. Tuberculous abscess at anterior mediastinum mimicking invasive thymoma

Mediastinal tuberculous abscess may arise from caseous necrosis of mediastinal lymph nodes, or direct extension from the lung (Fig. 1). Tuberculous pericarditis may arise from direct extension from the mediastinum because of the close anatomic relationship between the lymph nodes and the posterior pericardial sac or lung, or by haematogenous seeding (Fig. 2). It complicates up to 1% of cases of tuberculosis. At CT, lymphadenopathy and pericardial thickening with or without effusion may be seen (Fig. 1) [1,2].

II. Tuberculous aortitis with pseudoaneurysm

Tuberculous aortic aneurysm is a rare disease with a high mortality rate. Its prevalent location is the descending thoracic aorta in the patient with disseminated tuberculosis (Figs. 3 and 4). Most tuberculous aneurysm are a pseudoaneurysm type and a contained aortic rupture resulting from aortitis (Figs. 5, 6 and 7). Tuberculous aortic aneurysm usually presented as a pulsatile or palpable mass, chest pain, dysphagia, hoarseness, abdominal pain, back pain, and, if complicated, by a fistula, perforations, bleeding, and rupture [3].

The high mortality associated with this disease is related to perforation of the pseudoaneurysm into adjacent organs causing fatal exsanguination, because most tuberculous aneurysms are usually not diagnosed until rupture developed. Medical treatment alone is not sufficient. Tuberculous aortic aneurysm might develop despite antituberculous therapy, probably due to poor drug penetration into caseous necrotic tissue. Management of tuberculous pseudoaneurysm should include the repair of the lesion on the vessel wall and long-term antituberculous drugs to eradicate the source of infection. Surgery is a standard part of the treatment protocol, but the current trend is toward the endovascular method (Fig. 8) [3,4].

III. Tuberculoma mimicking brain tumor

Most tuberculous infections of the central nervous system are a result of hematogenous spread [1]. Central nervous system tuberculosis may take a variety of forms, including meningitis, tuberculoma, abscess, cerebritis, and miliary tuberculosis. Tuberculoma may be secondary to hematogenous spread of systemic disease or evolve from extension of cerebrospinal fluid infection into the adjacent parenchyma. Parenchymal disease can occur with or without meningitis and usually manifests as tuberculomas. Tuberculomas may be solitary but are more commonly multiple. The frontal and parietal lobes are the most commonly affected regions. On CT, tuberculomas appear as round or
lobular masses with low or high attenuation. They demonstrate homogeneous or ring enhancement and have irregular walls of varying thickness [5].

MR imaging findings vary depending on whether the granulomas are noncaseating, caseating with a solid center, or caseating with a necrotic center. Tuberculomas consisting of noncaseating granulomas are usually hypointense relative to the brain on T1-weighted images and hyperintense on T2-weighted images. The lesions usually demonstrate homogeneous enhancement after gadolinium administration. Caseating granulomatous lesions with a solid center appear relatively hypointense or isointense on T1-weighted images and iso- to hypointense on T2-weighted images. They are typically associated with surrounding edema. The lesion has a hypointense rim on T2-weighted images. Caseating lesions demonstrate rim enhancement at contrast-enhanced T1-weighted MR imaging (Fig. 9). Tuberculomas with a necrotic center demonstrate central hyperintensity on T2-weighted images [1].

IV. Tuberculous cerebritis mimicking miliary metastasis

Rare forms of parenchymal tuberculosis are abscess and cerebritis. Miliary central nervous system tuberculosis is usually associated with cranial tuberculous meningitis. Miliary tubercles appear as numerous round, homogeneously enhancing lesions less than 2 mm in diameter (Figs. 10 and 11). The differential diagnosis of cranial tuberculosis includes other infectious or noninfectious diseases (eg, sarcoidosis, toxoplasmosis, lymphoma, pyogenic and fungal infections), multicentric primary neoplasms (eg, hemangioblastoma, gliomas), and metastases [5].

V. Bowel perforation due to tuberculous ileocolitis mimicking carcinoma

Tuberculous involvement of small bowel is usually associated with peritonitis. Non-specific mucosal ulcers, fold thickening and isolated circumferential stricture are seen on barium studies. And on CT, bowel wall thickening is demonstrated (Fig. 12) [6].

Although bowel perforation due to tuberculosis is quite rare, even in endemic regions, it seems to occur more in children and immune-compromised patients. As the disease process seems to predominate in the terminal ileum, most perforations and masses occur in that region [7].

Intestinal perforation may occur after antituberculosis treatment (Fig. 13). The majority of the perforations are solitary and occur proximal to the site of the stricture. Perforations were on the distal ileum (Figs. 14 and 15). The multiple perforation rate was reported as 10% to 40% [8].

VI. Ileocecal tuberculosis mimicking cancer
The ileocecal region is the most common area of involvement of tuberculosis in the gastrointestinal tract due to the abundance of lymphoid tissue. Ileocecal involvement is seen in 80%-90% of patients with abdominal tuberculosis. Thickening of the valve lips or wide gaping of the valve with narrowing of the terminal ileum (the Fleischner sign) has been described as a characteristic of tuberculosis (Fig. 16). Associated mesenteric lymphadenopathy with central necrosis was usually seen. The cecum classically becomes amputated. Amputation and focal stricture of the intestine, omental fat infiltration and ascites can also mimic carcinoma, but cecal carcinoma rarely extends beyond the ileocecal valve (Fig. 17). Other differential diagnosis for ileocecal tuberculosis includes amebiasis, lymphoma and Crohn disease [1,5].

VII. Tuberculosis granuloma in greater omentum mimicking gastric submucosal tumor

Lymphadenopathy is the most common manifestation of abdominal tuberculosis. The mesenteric, omental, and peripancreatic lymph nodes are most commonly involved. The nodes are usually large and multiple and most commonly demonstrate peripheral enhancement with central areas of low attenuation at contrast-enhanced CT (Figs. 18 and 19) [1].

Omental involvement is classified as nodular, smudged or caked and thickened [6].

VIII. Female genital tuberculosis mimicking malignant pelvic tumor

Genitourinary tuberculosis is the most common manifestation of extrapulmonary tuberculosis. Tuberculosis may involve the genitourinary tract as a secondary site following hematogenous dissemination from the lungs. Genital tuberculosis affects both males and females. Diagnostic criteria for female genital tuberculosis include endometrial adhesions with deformity and obliteration of the endometrial cavity, obstruction of the fallopian tubes with multiple areas of constriction, and calcified lymph nodes in the adnexal region. Fallopian tubes are affected in 94% of women with genital tuberculosis (Figs. 20 and 21). Salpingitis caused by hematogenous dissemination is almost always bilateral. A tubo-ovarian abscess that extends through the peritoneum into the extraperitoneal compartment suggests tuberculosis. Advanced tuberculous endometritis can cause severe uterine adhesions (Fig. 22) [1,5].

IX. Tuberculous osteomyelitis with abscess of tibia in child

In endemic areas, children are more likely than adults to be affected, often through exposure to adults infected with tuberculosis. Skeletal tuberculosis is uncommon and represents 10-20% of all extrapulmonary tuberculosis [5,9].
In children, the main route of infection in skeletal tuberculosis is through hematogenous spread from a primary source. The site of the primary infection is often unknown. The skull vault, hands, feet and ribs are most commonly involved. In children, metaphyseal foci can involve the growth plate. On radiographs, soft-tissue swelling, osteopenia, osteolytic foci with poorly defined edges, and varying amounts of sclerosis are seen in all forms of tuberculous osteomyelitis (Fig. 23). Several radiological patterns may be seen, with the cystic form being the most commonly reported form. An infiltrative pattern of tuberculous osteomyelitis may sometimes be seen. This pattern resembles Ewing’s sarcoma, fungal infection and chronic pyogenic osteomyelitis.

Also, CT and MR imaging demonstrate the extent of the active infection and its complications. Tuberculous osteomyelitis can be mimicked by pyogenic or fungal infections. A helpful feature in distinguishing tuberculous from pyogenic infection is that transphyseal spread occurs in the former; however, fungal infections can also extend across the physis [5,9]. On MR, normal fat marrow signal on T1-weighted images is replaced by low signal intensity and corresponded with high signal intensity on T2-weighted images. The lesion shows enhancement on T1-weighted images after contrast administration. Necrotic areas of bone show increased signal intensity on T2-weighted images and lack of central enhancement (Figs. 24, 25, 26 and 27) [10]. The diagnosis is usually made after considerable delay, and radiographic changes are seen at clinical presentation. In contrast, in pyogenic infection, radiographic changes occur 2-3 weeks after presentation [1].

X. Hepatosplenic tuberculosis mimicking lymphoma in a child

Tuberculosis of the liver and spleen is most likely secondary to hematogenous dissemination of the primary form of the disease. At radiography, hepatosplenic tuberculosis may appear micronodular (miliary) or macronodular. Miliary hepatosplenic disease manifests as multiple tiny, low-attenuation foci on CT and multiple hypoechoic nodules on US (Figs. 28, 29 and 30). The macronodular form is rare and manifests as diffuse liver or splenic enlargement with multiple low-attenuation lesions or a single tumorlike mass. On contrast-enhanced CT, early-stage lesions may demonstrate central enhancement whereas more advanced lesions may demonstrate calcification. The differential diagnosis for miliary hepatosplenic tuberculosis includes metastases, fungal infections, sarcoidosis, and lymphoma. The macronodular form can simulate metastases, abscess, and primary malignancy [1].
Fig. 0: Figs. 1 and 2. Tuberculous abscess at anterior mediastinum. Axial and coronal contrast-enhanced CT image reveal anterior mediastinal cystic mass with thick wall (arrows) extending to the left anterior superior pericardial cavity and left pleural effusion.

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**Fig. 0:** Figs. 1 and 2. Tuberculous abscess at anterior mediastinum. Axial and coronal contrast-enhanced CT image reveal anterior mediastinal cystic mass with thick wall (arrows) extending to the left anterior superior pericardial cavity and left pleural effusion.

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Fig. 0: Fig. 3. Tuberculous aortitis. The initial CT scan of the chest shows a periaortic soft tissue density (arrow) with small pseudoaneurysm.

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**Fig. 0:** Fig. 4. Tuberculous aortitis. Axial CT scan with lung window setting demonstrates numerous fine, discrete nodules bilaterally in a random distribution, suggesting military tuberculosis.

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Fig. 0: Figs. 5 and 6. Tuberculous aortitis. At two months follow-up, axial and coronal CT scan of the chest show descending thoracic aortic aneurysm with rupture (arrows).

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**Fig. 0:** Figs. 5 and 6. Tuberculous aortitis. At two months follow-up, axial and coronal CT scan of the chest show descending thoracic aortic aneurysm with rupture (arrows).

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**Fig. 0:** Fig. 7. Tuberculous aortitis. Aortogram demonstrates a 3.5 cm false aneurysm arising from the lateral wall of the descending thoracic aorta.

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Fig. 0: Fig. 8. Tuberculous aortitis. After the stent graft placement, there is no contrast media extravasation into the mediastinum, and there is no endoleak on follow up angiography. The subclavian artery is also preserved.

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Fig. 0: Fig. 9. Cranial tuberculoma. Contrast-enhanced axial and coronal T1-weighted MRI show multilobular mass with hypointense necrotic center and peripheral contrast enhancement (arrow) in left medial temporal lobe. Differential diagnosis includes pleomorphic xanthoastrocytoma, ganglioglioma, pilocytic astrocytoma, oligodendroglioma, astrocytoma.

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**Fig. 0:** Figs. 10 and 11. Cranial miliary tuberculosis. Axial and coronal contrast-enhanced T1-weighted MR image show multiple small round enhancing nodules (arrows) in both cerebella and cerebral hemispheres.

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**Fig. 0:** Figs. 10 and 11. Cranial miliary tuberculosis. Axial and coronal contrast-enhanced T1-weighted MR image show multiple small round enhancing nodules (arrows) in both cerebella and cerebral hemispheres.

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Fig. 0: Fig. 12. Ileocolic tuberculosis with perforation. Axial CT scan demonstrates diffuse bowel wall thickening with mucosal enhancement, especially ascending colon and transverse colon. Small bowel dilatation, ascites, and peritoneal thickening are also seen.

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**Fig. 0:** Fig. 13. Ileocolic tuberculosis with perforation. After three weeks, axial and coronal contrast enhanced CT scan show large localized pneumoperitoneum and fluid collection with peripheral rim enhancement and air-fluid level (arrow).

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**Fig. 0:** Figs. 14 and 15. Ileocolic tuberculosis with perforation. Axial and coronal CT scan show focal bowel wall defect at distal ileum communicating with abscess cavity (arrows).

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**Fig. 0:** Figs. 14 and 15. Ileocolic tuberculosis with perforation. Axial and coronal CT scan show focal bowel wall defect at distal ileum communicating with abscess cavity (arrows).

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**Fig. 0**: Fig. 16. Ileocecal tuberculosis. Axial contrast-enhanced CT image shows thickened ileocecal valve and circumferential wall thickening of the cecum and the terminal ileum (arrow).

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**Fig. 0:** Fig. 17. Ileocecal tuberculosis. Axial CT scan obtained caudal to Fig.16 demonstrates large amount of ascites with nodular peritoneal enhancement, and dirty omental fat infiltration (arrow).

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**Fig. 0**: Fig. 18. Tuberculous granuloma. Contrast enhanced axial CT scan shows 4.4 x 8 cm densely calcified mass (arrow) between left hepatic lobe and anterior wall of the stomach. Differential diagnosis might include gastric GIST with calcification.

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Fig. 0: Fig. 19. Tuberculous granuloma, Photography of gross pathologic specimen. The specimen consists of a large calcified lymph node with internal fibrosis.

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Fig. 0: Fig. 20. Female genital tuberculosis. Gadolinium enhanced T1 weighted axial MR image demonstrates about 3 cm tubular lesion with rim enhancement at the right adnexa (arrow).

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Fig. 0: Fig. 21. Female genital tuberculosis. PET CT scan shows rim enhancing tubular lesion with intense FDG uptake at the right adnexa (arrow).

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Fig. 0: Fig. 22. Female genital tuberculosis. The gross pathologic specimen shows irregular thickening of endometrium. Both tubes are dilated and contain pus.

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**Fig. 0:** Fig. 23. Tuberculous osteomyelitis. Plain radiograph of the left knee shows well-defined osteolytic lesions in the medial subarticular region of the upper tibia with epiphysis involvement. Surrounding marginal sclerosis is also noted.

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Fig. 0: Fig. 24. Tuberculous osteomyelitis. Axial T1 weighted MRI shows an irregularly marginated hypointense lesion within the medial epiphyseal region of the tibia.

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**Fig. 0:** Fig. 25. Tuberculous osteomyelitis. Fat-saturated axial T2 weighted MRI shows hyperintensity of the lesion. Some areas of hypointensity are seen within the lesion, which may be due to the presence of fibrinous material.

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Fig. 0: Figs. 26 and 27. Tuberculous osteomyelitis. Gadolinium enhanced fat saturated axial and coronal T1 weighted MRI show rim enhancement of the lesion.

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**Fig. 0:** Figs. 26 and 27. Tuberculous osteomyelitis. Gadolinium enhanced fat saturated axial and coronal T1 weighted MRI show rim enhancement of the lesion. The lesion shows involvement of epiphysis and metaphysis.

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**Fig. 0:** Figs. 28 and 29. Hepatosplenic tuberculosis. Axial and coronal contrast-enhanced CT scan demonstrate multiple round, low-attenuation lesions with rim enhancement (arrows) in the liver and spleen.

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**Fig. 0:** Figs. 28 and 29. Hepatosplenic tuberculosis. Axial and coronal contrast-enhanced CT scan demonstrate multiple round, low-attenuation lesions with rim enhancement (arrows) in the liver and spleen.

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**Fig. 0**: Fig. 30. Hepatosplenic tuberculosis. Ultrasound demonstrates multiple low echoic nodules (arrow) in the spleen.

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Conclusion

Tuberculosis can affect any organ system in the body and can be devastating if left untreated. The unusual finding of thoracic and extrathoracic tuberculosis can mimic numerous other disease entities. A high degree of clinical suspicion and familiarity with the various radiologic manifestations of tuberculosis might be helpful for the exact diagnosis and appropriate therapy.
Personal Information
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