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Radiological manifestations of splenic tuberculosis: A 23-patient case series from India

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***Background & objectives*: Splenic tuberculosis (TB) is a less common but important manifestation of abdominal TB, especially in India and other developing countries. Its prevalence is increasing with the epidemic of HIV-TB co-infection and subsequent rise in extrapulmonary TB. The range of radiological manifestations of splenic TB is poorly described. Here, we review the ultrasonographic and computed tomographic (CT) images of 23 cases from two large tertiary care centers in India.**

***Methods*: Radiographic images, ultrasonographic in all cases and CT in selected cases, were retrospectively analyzed in a series of 23 patients presenting to two large tertiary care centers in India, with suspected TB and with splenomegaly on physical examination. Images were assessed at baseline and when available following anti-tuberculosis therapy.**

***Results*: The ultrasound and CT findings included, in order of most common: single or multiple hypoechoic focal lesions, splenic abscess, calcifications (on CT), and isolated splenomegaly. Five of the six patients with findings of isolated splenomegaly on ultrasound were found to have lesions on CT.**

***Interpretation & conclusion*: Ultrasonography of the spleen is an affordable, non-invasive imaging modality, which can be helpful in diagnosis of splenic TB and assessment of therapeutic response. Proper use of this imaging modality in splenic TB should help avoid unnecessary CT imaging or invasive procedures. However, this technique is operator-dependent, and, when extensive intra-abdominal involvement is suspected, or the diagnosis is unclear, CT may be necessary.**

Key words Abdominal computerized tomography - abdominal ultrasound - disseminated tuberculosis - extrapulmonary tuberculosis - HIV - splenomegaly - tuberculosis

Mycobacterium tuberculosis (*Mtb*) continues to be one of the world's most prevalent and deadly infectious microbe, killing three million people every year. Yet tuberculosis (TB) is still a diagnostic dilemma, with approximately 50 per cent of all active pulmonary cases negative for acid-fast bacilli on sputum Ziehl-Neelsen stain. Additionally, 20 per cent of all active cases may have extrapulmonary TB (EPTB), further complicating the diagnosis in areas, such as India, where multiple infectious diseases affecting the abdomen are prevalent. The pandemic of HIV/AIDS has magnified these problems, especially that of EPTB; in HIV-co-infected patients, as about 70 per cent of all TB patients may have an EPTB component[1]. AIDS has also greatly expanded the differential diagnosis of patients with EPTB, and sifting through the various diagnostic possibilities is a major challenge. For these reasons, it has become crucial to clinically and radiographically characterize the various extrapulmonary manifestations that this versatile *Mtb* can produce.

One important, though poorly described, manifestation of EPTB is that of splenic TB. Numerous single case reports or small case series have been described, but there have been no attempts to catalogue the varied clinical and radiographic manifestations of splenic TB. Isolated splenic TB is a rare, though important manifestation of TB[2-5], and should be included in the differential diagnosis of fever of unknown origin in a patient from an endemic area[2,6]. However, splenic involvement is much more common in patients with disseminated TB for whom the diagnosis has been made from other sites. The most common form of detection is via a palpable spleen by routine physical examination. The diagnostic workup for patients with suspected TB and splenomegaly on physical examination is broad and complicated by the co-occurrence of multiple other conditions seen in these patients in developing countries (Table I). These diagnoses are more commonly seen in patients with severe AIDS; however, in some series, the most common cause of splenomegaly or ultrasonographic splenic lesions in HIV patients has been TB[7,8].

Table I. Differential diagnosis of splenomegaly in tuberculosis patients

*Fungal**: histoplasmosis, coccidiomycosis, aspergillus, toxoplasmosis
Viral: EBV, CMV
Parasitic: malaria, visceral leishmaniasis, schistosomiasis
*Malignant**: lymphomas, leukemias, Kaposi's sarcoma
Bacterial: pyogenic abscess (most commonly, Gram positive cocci, salmonella, anaerobes)
Mycobacterial: MAC*, TB

*More commonly seen in AIDS
EBV, Espstein-Barr virus; CMV, cytomegalovirus; MAC, *Mycobacterium avium* complex

While invasive procedures such as laparoscopic or open abdominal biopsy with or without splenectomy[2,9] and ultrasound-guided fine-needle aspiration (FNA)[10-12] have their place in diagnostics and therapeutics, non-invasive imaging modalities remain crucial in assessing the likely aetiology of splenic involvement and its response to treatment[8,13-17].

Abdominal ultrasonography is the least costly and noninvasive imaging modality for a case of possible splenic TB, and is especially relevant as a screening tool in resource-poor settings. However, it is operator-dependent. Computerized tomography (CT), on the other hand, is more costly and exposes the patient to a high dose of radiation, and may add little to the differential diagnosis over ultrasound[8]. It is most beneficial in the setting of negative ultrasound or diffuse abdominal disease, as it offers the ability to image the entire abdomen in a single examination[15,18].

The most common findings on ultrasound (US) of the spleen are single or multiple focal hypoechoic lesions, representing granulomas. These lesions may be haemorrhagic or necrotic. Hyperechoic lesions, isolated splenomegaly, perisplenic abscess, and hepatic lesions can also be detected during abdominal ultrasound examination of splenomegaly. The literature on imaging of splenic TB is sparse. Several case reports exist for isolated splenic TB[2,4,5], splenic lesions in AIDS patients[7,8,11,19] and splenic TB as a manifestation of abdominal TB[13,15,18,20]. However, there exists no case series describing the range of ultrasonographic findings in TB with splenomegaly as a predominant feature.

Here, we describe a retrospective case series of the radiological findings of 23 patients with TB and splenomegaly from two large tertiary care centers, one in northern and other in southern India.

Material & Methods

The case records of 17 patients with TB and splenomegaly presenting during the years 1997-2003 to the inpatient unit of the All India Institute of Medical Sciences (AIIMS), New Delhi, and those of 6 patients from Sri Venkateswara Institute of Medical Sciences, Tirupati, two large tertiary care centers in north and south India respectively, were retrospectively reviewed. Patients with history of/having known cause of splenomegaly such as portal hypertension, chronic liver disease, haematological or other malignancies or any other long-standing infections (*e.g.*, kala-azar) or infiltrative disorders were excluded. There were 10 females and 13 males; mean age was 28 yr (range 16-72 yr); mean BMI (kg/m^2) was 17.8 (range 13-23). Two patients were co-infected with HIV. The diagnosis of TB was established by one or more of the following: (*i*) positive smear and/or culture for *Mycobacterium tuberculosis* of sputum (pulmonary) or extrapulmonary tissue or fluid; (*ii*) histological finding of caseating granuloma or acid-fast bacilli in extrapulmonary tissue (peripheral lymph node biopsy/aspirate) or fluid (pleural or ascitic); and (*iii*) highly corroborative clinical picture with response to antituberculosis treatment.

The medical records and ultrasonographic images of these patients were reviewed. Spenic ultrasonographic images were available for all 23 patients whereas CT images were available for only 21 patients during initial diagnosis as well as follow up. The CT and ultrasound parameters varied, owing to the fact that some were from outside private hospitals. At our institutions, CT scans were performed using Siemens Somatom SP Plus 4 or Siemens Somatom AR Star scanner (Erlangen, Germany). Axial sections with 8 mm collimation and 12 mm increments (Somatom SP Plus 4) or 10 mm collimation and 15 mm increments (Somatom AR Star) were used. Eighty ml of intravenous non-ionic contrast was given as a bolus just before the scan. Oral contrast was also used to opacify the bowel.

For descriptive purposes, splenic lesions were classified as either: (*i*) regular, hypoechoic (hypodense on CT) lesions not suggestive of abscess; (*ii*) irregular, anechoic lesions suggestive of abscess; and (*iii*) calcifications. A diagnosis of abscess was made when the lesion showed an appearance of anechoic core on US with a thick, irregular, shaggy wall. On CT, this corresponded to a picture of fluid density core with thick, enhancing walls. On the other hand, hypoechoic/hypodense lesions were those showing relatively homogeneous low density not approaching that of fluid. Findings were further classified on the basis of whether there was a single lesion or multiple (*i.e.*, two or more).

Results

The presenting symptoms of the patients are summarized in Table II, and the extent of TB disease is in Table III. The sonographic characteristics of the cases are summarized in Table IV. Representative radiographs are shown in Figs 1-3. The findings from CT and ultrasound generally corresponded, with ten (43%) of the ultrasonographic and nine (35%) of the CT findings, being regular, hypoechoic lesions. Ultrasound was somewhat less sensitive at detecting splenic abscess, detecting six of the nine abscesses that were imaged by CT. Ultrasound did not detect the two calcified lesions which were detected by CT. There were seven patients for whom only isolated splenomegaly was detected on ultrasound (30%). Of these, on CT one patient showed single, regular hypodense lesions; two showed multiple such lesions; two were detected to have multiple splenic abscesses; and one a single splenic abscess. The seventh patient's CT showed only isolated splenomegaly. Splenectomies were offered to two patients who had persistent lesions on imaging and splenomegaly, one of whom declined.

Discussion

Splenic TB is generally found in patients with severe, disseminated disease. In this cohort and others, the most common mode of splenic involvement is haematogenous. In our cohort, we had five patients with vertebral or psoas TB, which could also be the focus of later splenic spread by contiguity. Generally, either histopathologically or clinically, TB of the spleen is confirmed by involvement of other sites. For this reason, invasive diagnostic modalities often need not be involved in the workup of splenic lesions in TB patients. However, non-invasive imaging modalities, such as ultrasound and computerized tomography, play a fundamental role in the assessment of the extent of organ involvement, need for surgical intervention, and therapeutic response. Ultrasound-guided FNAC may be of considerable use in some cases, though this may be avoided depending upon the clinical picture.

Most typically, splenic lesions present as multiple, regular hypoechoic nodules on ultrasound; this study confirmed that trend. These hypoechoic lesions most likely represent multiple tuberculomas[21]. Irregular hypoechoic lesions typically represent splenic abscess, another important manifestation of splenic TB, especially in HIV disease[22-30].

There are several limitations of this study. As a retrospective analysis of TB and splenomegaly, we

Table II. Presenting features in patients (n=23)

Symptoms	No. of patients (%)
Weight loss	23 (100)
Fever	24 (92)
Anorexia	16 (62)
Cough	13 (50)
Expectoration	6 (23)
Abdominal pain	5 (19)
Vomiting	3 (12)
Headache	3 (12)
Dyspnoea	3 (12)
Altered bowel habits	1 (4)
Physical exam findings	No. of patients (%)
Splenomegaly	23 (100)
Hepatomegaly	13 (50)
Cervical LN	11 (42)
Ascites	6 (23)
Cold abscess	6 (23)
Pleural effusion	5 (19)
Choroidal tubercle	1 (4)

Table III. Classification of tuberculosis cases (n=23)

Supporting diagnostic features	No. of patients
Sputum AFB +ve	16 (70)
Consistent pleural tap & ATT response	2 (9)
Response to ATT only	5 (22)
Extrasplenic involvement	No. of patients
Abdominal LN	11 (48)
Mediastinal LN	10 (43)
Hepatic involvement	10 (43)
Miliary	7 (30)
Cold abscess	6 (26)
Ascites	5 (22)
Psoas abscess	4 (17)
Vertebral	1 (4)
Isolated splenic TB	1 (4)

AFB, acid-fast bacilli; ATT, antituberculosis therapy; LN, lymph node

Table IV. Imaging characteristics in patients

Findings	Ultrasound (n=23) n (%)	CT (n=21) n (%)
Regular, hypoechoic	10 (43)	9 (35)
Splenic abscess	6 (26)	9 (35)
Calcifications	0 (0)	2 (8)
Isolated splenomegaly	7 (30)	1 (4)

could not directly compare these radiological findings with those of other diagnoses. That all these patients were diagnosed with TB indicates that this is the most likely diagnosis for splenic lesions. However, in a cohort from developing countries where multiple abdominal infections occur, especially in those who are immunosuppressed, oakum's razor may not apply, and the patient may carry two diagnoses. Previous studies have shown that ultrasound can be useful in distinguishing benign from malignant processes; anechoic focal lesions and calcified echogenic foci have been correlated with benign processes; multifocal or diffuse solid lesions, with target signs suggested malignancy. In this study, most of the lesions showed the latter pattern at presentation[31].

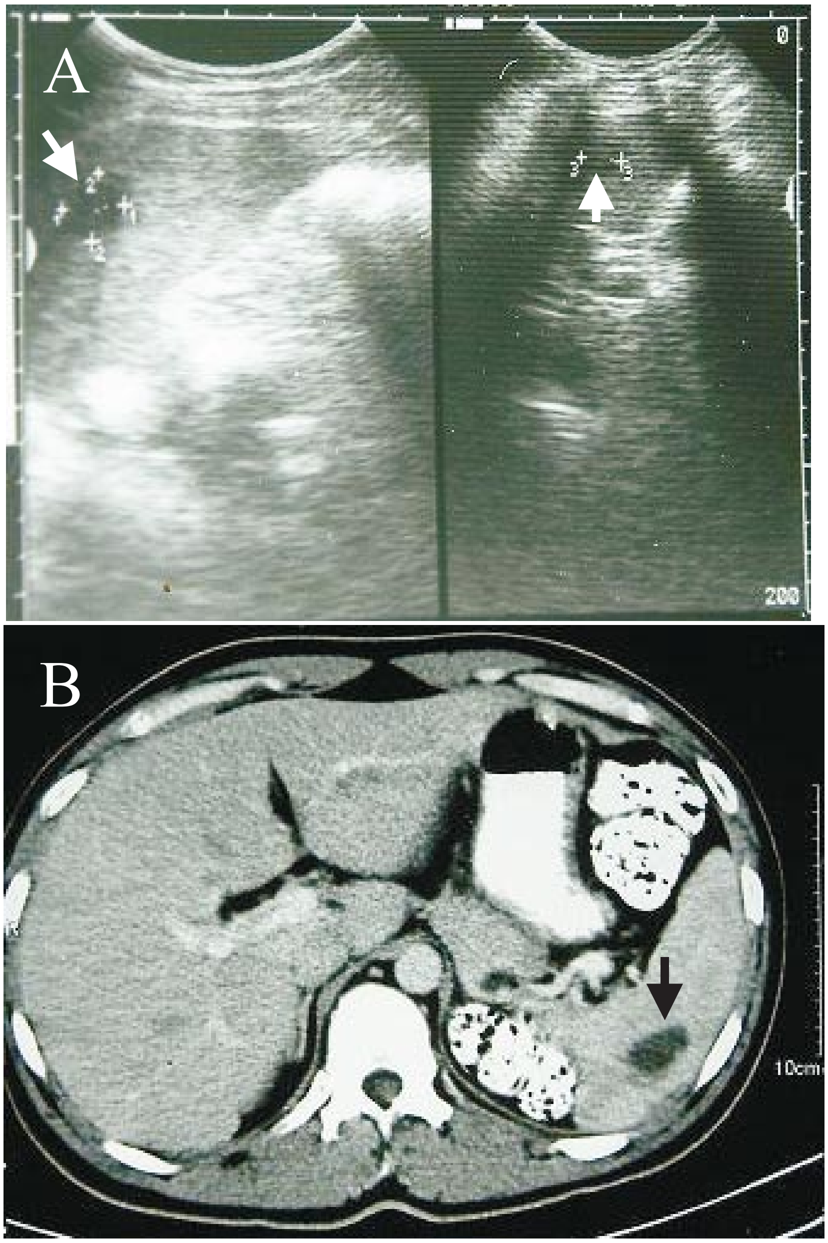

Fig. 1 A, B. Ultrasound shows a large, regular hypoechoic lesion (arrow) located peripherally along the inferior aspect of the spleen (**A**). Contrast enhanced CT (CECT) from the same patient reveals a large irregular hypodense lesion (arrow) in the inferior aspect of the spleen suggestive of an abscess (**B**).

An additional limitation is that the data collection was not uniform for all the patients in the series. As such, CT data were not available for all patients, and some of the CT scans were from outside of our hospital. Because of not being a perspective study, follow-up imaging interval differed amongst patients owing to patients compliance. Further, given that the data collection dates back from 1997, earlier patients could not benefit from the major technological advances in ultrasonography and CT scanning. Further studies, likely prospective, of unbiased cohorts of TB patients with splenomegaly will be necessary to overcome these important limitations.

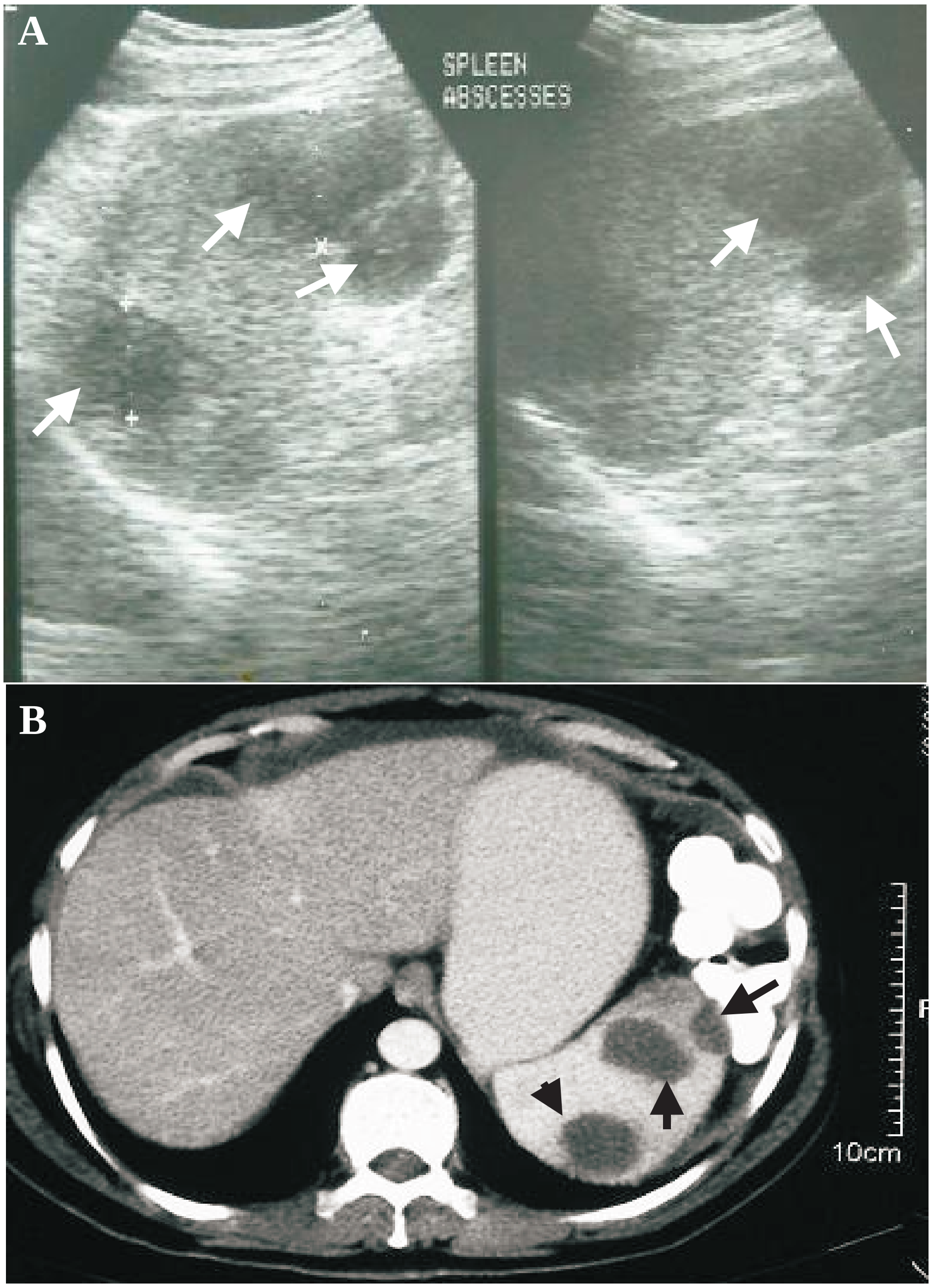

Fig. 2 A, B. Multiple large hypoechoic lesions (arrows) seen on ultrasound (**A**); and confirmed by multiple large hypodense lesions seen within the spleen on CECT of the same patient (**B**).

Despite these limitations several tentative conclusions could be drawn from our results. Our data do provide support to the widely utilized practice of follow up ultrasonographic imaging in where splenic TB, and also support avoiding CT in cases where splenic lesions are well visualized by ultrasound and abdominal involvement is not extensive. The major advantage of ultrasound is that it does not expose the patient to radiation, is inexpensive and can be used to follow patients serially in whom findings were originally detected. The major limitations of ultrasound are that it is operator-dependent and therefore may have low sensitivity. Ultrasound cannot visualize osteotic lesions, which are not uncommon in splenic TB. As such, if splenic lesions are detected on ultrasound and further intra-abdominal or osteomyelytic lesions are not a major concern, then CT may be avoided. When ultrasound fails to detect lesions or ultrasonogaphy and clinical examination suggest possible involvement of bone by contiguity, CT should generally be employed. Other studies have demonstrated that CT may be helpful in differentiating *Mycobacterium avium-intracellulare* complex (MAC) and *M. tuberculosis*[32-34], a distinction crucial in immunocompromised patients. Despite these advantages, CT is a poor modality for serial follow up due to harmful effects of multiple radiation exposures.

Fig. 4 presents a simple clinical algorithm for the work-up of splenomegaly in suspected TB patients. This may provide a framework for clinicians, although it will certainly evolve with research advances at both the clinical and radiological levels.

While ultrasound and CT both are widely available, they have limitations. Further imaging modalities, such as magnetic resonance imaging (MRI) and positron emission tomography (PET) scanning, may be useful in following up patients with persistent lesions on CT or ultrasound but for whom it is suspected that TB has resolved. Both MRI and PET are better capable of resolving stable, fibrotic lesions versus persistent active

Fig. 3. CECT reveals multiple hyperdense (calcified) foci within the spleen (arrow). A small hypodense liver lesion is also noted.

lesions. PET is especially suitable for detecting the activity of the lesions, and its role may expand as it becomes more accessible. This will be crucial in better assessing when to terminate treatment, which is currently, as it was in this cohort, very difficult. Although both options are limited in resource-poor settings, these may useful in select circumstances when available. Further study of these modalities is warranted as they become more widely available.

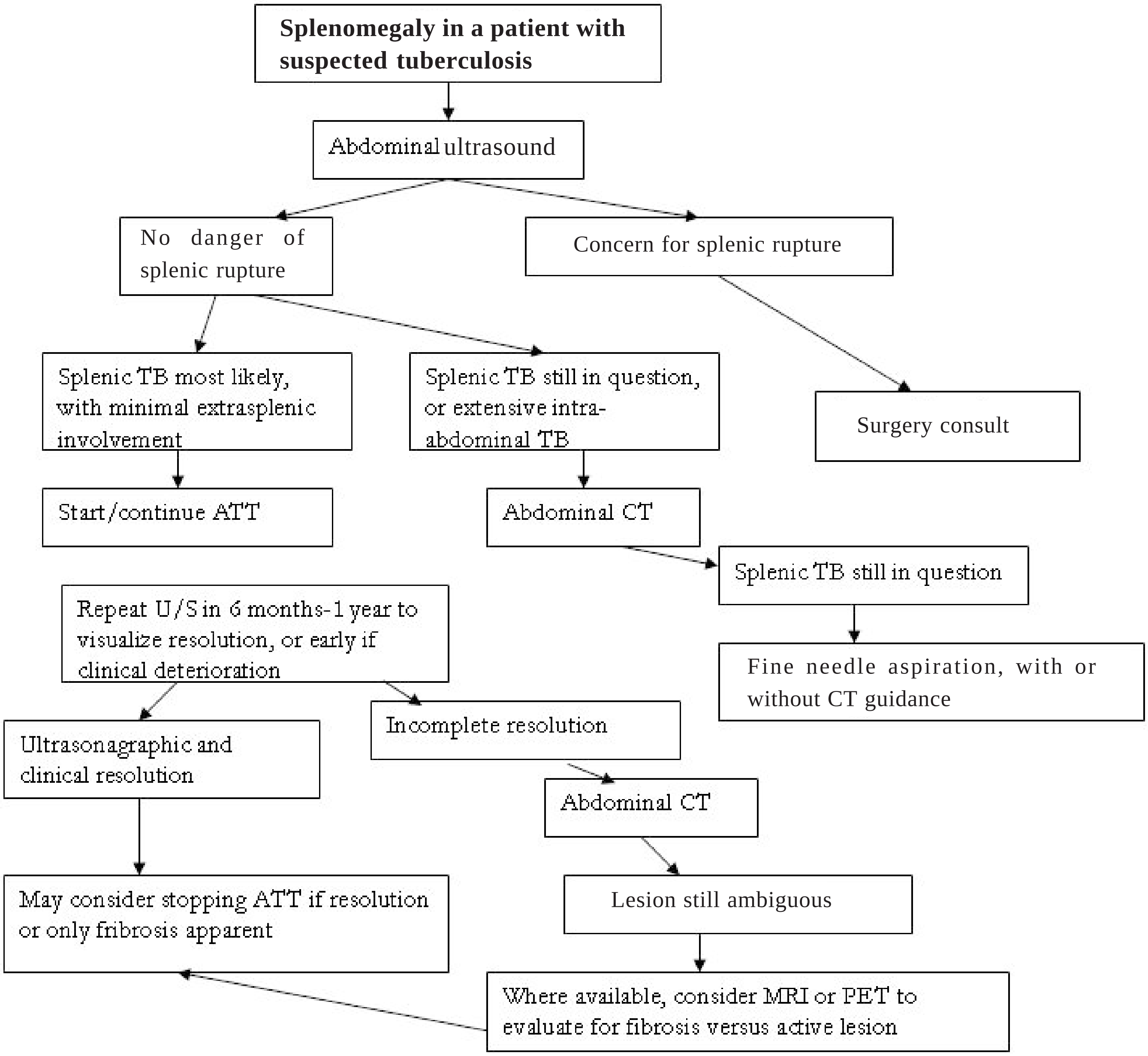

Fig. 4. Algorithm for applying imaging to the diagnosis of splenic TB. ATT, antituberculosis therapy; MRI, magnetic resonance imaging; PET, positron emission tomography.

References

1. Sharma SK, Mohan A. Extrapulmonary tuberculosis. *Indian J Med Res* 2004; *120* : 316-53.
2. Bheerappa N, Sastry RA, Srinivasan VR, Sundaram C. Isolated splenic tuberculosis. *Trop Gastroenterol* 2001; *22* : 117-8.
3. Sheen-Chen SM, Chou FF, Wan YL, Eng HL. Tuberculosis presenting as a solitary splenic tumour. *Tuber Lung Dis* 1995; *76* : 80-3.
4. Singh B, Ramdial PK, Royeppen E, Moodley J, Chetty R. Isolated splenic tuberculosis. *Trop Doct* 2005; *35* : 48-9.
5. Mahi M, Chaouir S, Amil T, Hanine A, Benameur M. Isolated tuberculosis of the spleen. Report of a case. *J Radiol* 2002; *83* : 479-81.
6. Ozaras R, Celik AD, Zengin K, Mert A, OzturkK R, Cicek Y, *et al*. Is laparotomy necessary in the diagnosis of fever of unknown origin? *Acta Chir Belg* 2005; *105* : 89-92.
7. Porcel-Martin A, Rendon-Unceta P, Bascunana-Quirell A, Amaya-Vidal A, Rodriguez-Ramos C, Soria de la Cruz MJ, *et al*. Focal splenic lesions in patients with AIDS: sonographic findings. *Abdom Imaging* 1998; *23* : 196-200.
8. Schinina V, Rizzi EB, Mazzuoli G, David V, Bibbolino C. US and CT findings in splenic focal lesions in AIDS. *Acta Radiol* 2000; *41* : 616-20.
9. Case records of the Massachusetts General Hospital. Weekly clinicopathological exercises. Case 3-1995. A 29-year-old man with AIDS and multiple splenic abscesses. *N Engl J Med* 1995; *332* : 249-57.
10. Venkataramu NK, Gupta S, Sood BP, Gulati M, Rajawanshi A, Gupta SK, *et al*. Ultrasound guided fine needle aspiration biopsy of splenic lesions. *Br J Radiol* 1999; *72* : 953-6.
11. Tarantino L, Giorgio A, de Stefano G, Farella N, Perrotta A, Esposito F. Disseminated mycobacterial infection in AIDS patients: abdominal US features and value of fine-needle aspiration biopsy of lymph nodes and spleen. *Abdom Imaging* 2003; *28* : 602-8.
12. Civardi G, Vallisa D, Berte R, Giorgio A, Filice C, Caremani *M, et al.* Ultrasound-guided fine needle biopsy of the spleen: high clinical efficacy and low risk in a multicenter Italian study. *Am J Hematol* 2001; *67* : 93-9.
13. Malik A, Saxena NC. Ultrasound in abdominal tuberculosis. *Abdom Imaging* 2003; *28* : 574-9.
14. Lundstedt C, Nyman R, Brismar J, Hugosson C, Kagevi I. Imaging of tuberculosis. II. Abdominal manifestations in 112 patients. *Acta Radiol* 1996; *37* : 489-95.
15. Gulati MS, Sarma D, Paul SB. CT appearances in abdominal tuberculosis. A pictorial essay. *Clin Imaging* 1999; *23* : 51-9.
16. Suri S, Gupta S, Suri R. Computed tomography in abdominal tuberculosis. *Br J Radiol* 1999; *72* : 92-8.
17. Wang Y, He G, Zhan W, Jiang H, Wu D, Wang D, *et al.* CT findings in splenic tuberculosis. *J Belge Radiol* 1998; *81* : 90-1.
18. Sinan T, Sheikh M, Ramadan S, Sahwney S, Behbehani A. CT features in abdominal tuberculosis: 20 years experience. *BMC Med Imaging* 2002; *2* : 3.
19. Soriano V, Tor J, Gabarre E, Gros T, Muga R. Multifocal splenic abscesses caused by *Mycobacterium tuberculosis* in HIV-infected drug users. *AIDS* 1991; *5* : 901-2.
20. Batra A, Gulati MS, Sarma D, Paul SB. Sonographic appearances in abdominal tuberculosis. *J Clin Ultrasound* 2000; *28* : 233-45.
21. Kapoor R, Jain AK, Chaturvedi U, Saha MM. Ultrasound detection of tuberculomas of the spleen. *Clin Radiol* 1991; *43* : 128-9.
22. Rendon Unceta P, Amaya Vidal A, Porcel Martin A, Macias Rodriguez MA, Soria de la Cruz MJ, Martin Herrera L. Abdominal tuberculous abscesses in AIDS patients: percutaneous treatment. *Rev Esp Enferm Dig* 1999; *91* : 439-46.
23. Sharma S, Dey AB, Agarwal N, Nagarkar KM, Gujral S. Tuberculosis: a rare cause of splenic abscess. *J Assoc Physicians India* 1999; *47* : 740-1.
24. Dubey SG, Shah NM, Dayavathi, Mangat GK, Shetty PG, Joshi VR. Tubercular splenic abscesses in a patient with AIDS. *J Assoc Physicians India* 1996; *44* : 575-7.

25. Reichel C, Theisen A, Rockstroh JK, Muller-Miny H, Spengler U, Sauerbruch T. Splenic abscesses and abdominal tuberculosis in patients with AIDS. *Z Gastroenterol* 1996; *34* : 494-6.

26. Huang CT, Leu HS, Lee MH. Tuberculous splenic abscess - a case report and literature review. *Changgeng Yi Xue Za Zhi* 1995; *18* : 77-81.

27. Al-Salem AH, Mallapa KK, Qaisaruddin S. Tuberculous abscess of the spleen. *Trop Geogr Med* 1993; *45* : 304-5.

28. Chou YH, Hsu CC, Tiu CM, Chang T. Splenic abscess: sonographic diagnosis and percutaneous drainage or aspiration. *Gastrointest Radiol* 1992; *17* : 262-6.

29. Soriano V, Tor J, Adrados M, Muga R, Laguna F, Clotet B, *et al*. Multifocal splenic abscesses in AIDS-related tuberculosis. *Eur J Med* 1992; *1* : 124.

30. Khalil T, Uzoaru I, Nadimpalli V, Wurtz R. Splenic tuberculous abscess in patients positive for human immunodeficiency virus: report of two cases and review. *Clin Infect Dis* 1992; *14* : 1265-6.

31. Goerg C, Schwerk WB, Goerg K. Splenic lesions: sonographic patterns, follow-up, differential diagnosis. *Eur J Radiol* 1991; *13* : 59-66.

32. Levin DL. Radiology of pulmonary *Mycobacterium avium-intracellulare* complex. *Clin Obest Med* 2002; *23* : 603-12.

33. Wittram C, Weisbrod GL. *Mycobacterium avium* complex lung disease in immunocompetent patients radiography-CT correlation. *Br J Radiol* 2002; *75* : 340-4.

34. Kob DM, Burn PR, Mathews G, Nelson M, Healy JC. Abdominal computed tomographic findings of *Mycobacterium tuberculosis* and *Mycobacterium avium intracellulare* infection in HIV seropositive patients. *Can Assoc Radiol J* 2003; *54* : 45-50.

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