

Submitted:
28.11.2018
Accepted:
22.01.2019
Published:
28.06.2019

Ultrasonography of peritoneal tuberculosis

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DOI: 10.15557/JoU.2019.0014

Keywords

ultrasonography,
peritoneal
tuberculosis,
peritoneal thickening,
ascites

Abstract

Purpose: The objective of this work was to describe different presentations of peritoneal tuberculosis on ultrasound. **Materials and methods:** This was a retrospective study conducted between 2008 and 2016 at the Main Hospital in Dakar, and including 38 cases of peritoneal tuberculosis. The tests were performed on Philips Envisor and Hitachi Preirus with 10 and 12 MHz linear transducers. The mean age was 26 years and the sex ratio was 0.8. The diagnosis of peritoneal tuberculosis was based on histological evidence (17 cases), isolation of BK from sputum (5 cases), positive adenosine deaminase in ascites fluid (4 cases) or a favorable clinical course after trial antituberculosis treatment (4 cases). The structures studied were the parietal peritoneum, the mesentery, the large omentum, as well as the characteristics of ascites, and extra-peritoneal lesions. **Results:** Parietal peritoneal involvement was found in 89.4% of patients, including regular diffuse hypoechoic thickening in 70.5% and nodular thickening in 11.7%. Ascites was present in 84.2% of patients. The great omentum showed anomalies in 73.6% of cases in relation to 3 aspects: trilamellar thickening made up of a thick, hyperechoic central layer surrounded by 2 thin peripheral hypoechoic layers in 46.4% of cases; a single-layer hyperechoic thickening in 21.4% of cases; heterogeneous hyperechogenic thickening with hypoechoic nodules in 32.1% of cases. Mesentery abnormalities were noted in 63.1% of patients with hypoechoic thickening. **Conclusion:** Ultrasound with the advantage of safety and accessibility is a reliable technique for the diagnosis of peritoneal tuberculosis. In some cases, it allows for a guided percutaneous biopsy to avoid the use of laparoscopy.

Introduction

Peritoneal tuberculosis is a public health problem in endemic areas⁽¹⁾. It constitutes the most frequent abdominal site (50 to 58% of the abdominal locations) and is the third most frequent of the extrapulmonary locations^(2–4). Clinical manifestations are nonspecific, causing frequent delays and diagnostic wanderings. Ultrasonography is the most common first-line examination of ascites, which is the most common presentation of peritoneal tuberculosis. This work aims to describe different presentations of peritoneal tuberculosis on ultrasound.

Materials and methods

This was a retrospective study conducted between 2008 and 2016, including 38 cases of peritoneal tuberculosis investigated using an ultrasound at DAKAR Principal Hospital. Philips Envisor and Hitachi Preirus machines with linear 10 and 12 Mhz transducers were used. The group consisted of 21 women and 17 men (sex ratio of 0.8). The mean age was 26 years (from 8 to 72 years). A total of 12% of patients had AIDS. The diagnosis was based on:

- histological evidence by laparoscopic peritoneal biopsy (17 cases) or ultrasonography (8) in 25 patients;
- isolation of BK in the sputum in 5 patients;

Tab. 1. *Distribution of clinical signs*

Clinical signs	Number	%
Ascites	29	76%
Fever	24	63%
Abdominal pain	9	23%
Weight loss	26	68%
Surgical table	1	2%

Tab. 2. *Distribution of peritoneal lesions found on ultrasound*

Ultrasound anomalies	Number	%
Parietal peritoneum	34	89.4%
Ascites	32	84.2%
Large omentum	28	73.6%
Mesentery	24	63.1%

Tab. 3. *Distribution of parietal peritoneum lesions on ultrasound*

Anomalies of the parietal peritoneum	Number	%
Regular hypoechoic thickening	24	70.5%
Peritoneal nodules	4	11.7%
Hypoechoic thickening and nodules	6	17.6%

Tab. 4. *Distribution of lesions of the large omentum on ultrasound*

Anomalies of the large omentum	Number	%
Triple layer thickening	13	46.4%
Single layer hyperechoic thickening	6	21.4%
Nodular heterogeneous thickening	9	32.1%

- positivity for adenosine deaminase in 4 cases;
- evocative clinical and ultrasonographic manifestations with a favorable clinical evolution after 9 months of anti-tuberculosis treatment in 4 cases.

The reason of the ultrasound examination (see Tab. 1) was ascites in 29 patients (76%), alteration of the general condition in 26 patients (68%), fever in 24 patients (63%), abdominal pain in 9 patients (23%). One patient had manifestations of peritoneal irritation with abdominal pain and abdominal guarding.

The parameters studied were as follows: involvement of the parietal peritoneum, mesentery, large omentum, the characteristics of ascites and the associated extraperitoneal abdominal involvement. This study was approved by our hospital's ethics committee.

Results

Ultrasound revealed ascites (Fig. 1) in 32 patients (84.2%). It was hypoechoic in all cases and was associated with adhesions in 32%. It was free 68% (Tab. 2).

Parietal peritoneum involvement was found in 34 patients (89.4%) with the type of regular diffuse hypoechoic

thickening greater than 2.5 mm (Fig. 1, Fig. 2) in 70.5% (Fig. 1), peritoneal nodules in 11.7% (Fig. 3) and peritoneal thickening and nodules in 17.6%.

Mesenteric anomalies were reported in 24 (63.1%) cases with hypoechoic thickening of mesenteric leaflets greater than 2.5 mm (Fig. 4) with agglutination of small bowel loops (Tab. 3).

The large omentum was thickened in 28 cases (73.6%) with a diameter greater than 1 cm (Tab. 4) with:

- a trilamellar thickening made of a thick hyperechoic central layer surrounded by two thin hypoechoic peripheral layers (Fig. 5) in 46.4% (13 cases);
- a thickened hyperechoic mono-layer (Fig. 6) in 21.4% (6 cases);
- heterogeneous hyperechoic thickening with hypoechoic nodules (Fig. 7) in 32.1% (9 cases).

Adenopathies were present in 13 cases (34.2%), most often necrotic. Other abdominal lesions were as follows: splenic nodules (14 cases or 36.8%), ileocaecal involvement (1 case), hepatic nodules (2 cases). Pleuropulmonary involvement was reported in 6 cases (15.7%).

Discussion

Peritoneal tuberculosis is the third most common extrapulmonary location, particularly in the African environment⁽⁵⁾. Its frequency is steadily increasing in the industrialized countries due to population migrations and immunosuppressive diseases. Mycobacterium tuberculosis is the main cause⁽⁶⁾.

It is a pathology of young women with a mean age of 28 years in our group and sex ratio of 0.8; as reported by many African authors^(5,7-9).

Peritoneum involvement may occur by haematogenous way from lung miliary tuberculosis, by contamination from swallowed sputum in a patient with pulmonary involvement or by spreading from ruptured abdominal lymphadenopathy⁽¹⁰⁾. More rarely, it may be caused by unpasteurized cow's milk contaminated with Mycobacterium bovis^(11,12).

An association with HIV infection is to be systematically sought with a reported variable frequency in the literature between 14.8 and 87%^(13,14).

The main clinical symptoms include ascites, alteration of the general condition and fever (76%, 68% and 63% respectively in our patients). This predominance is reported almost in all series of the literature^(15,16). Abdominal pain reported in 36%–73.8% of patients is most often moderate^(5,8,17); much more rarely these pains are in the foreground mimicking acute peritonitis⁽¹⁷⁾.

From a biological point of view, ascites is of the lymphocyte type, the dosage of adenosine deaminase (ADA) is positive

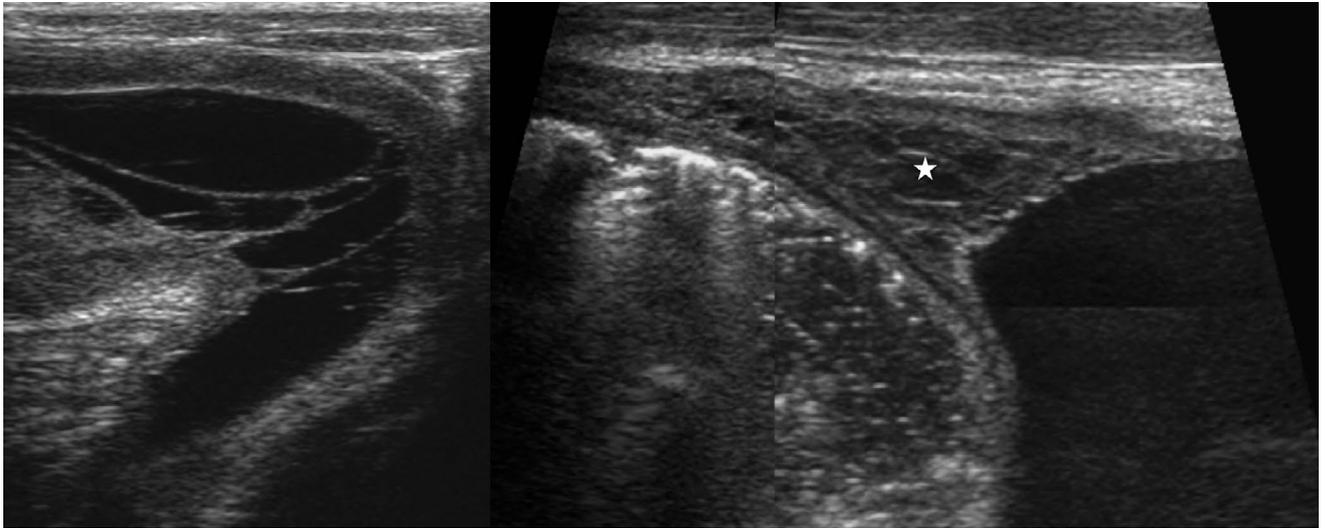


Fig. 1. Lobulated ascites and entero-parietal adhesions (star)

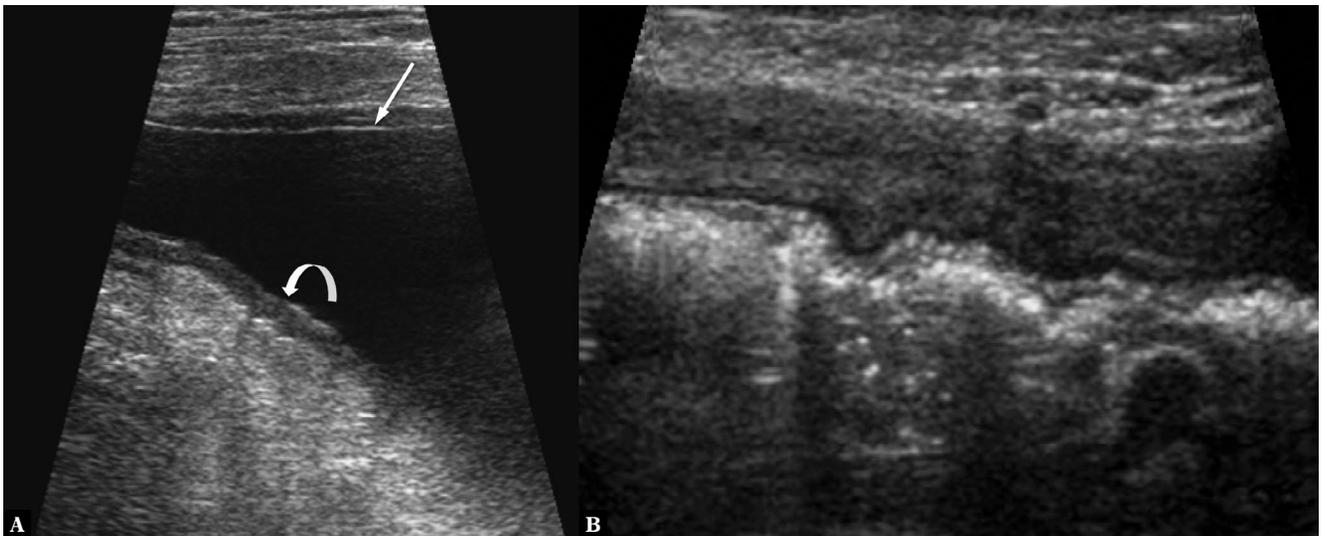


Fig. 2. Thickening of the anterior parietal peritoneum in the presence (A) and in the absence of ascites (B)



Fig. 3. Form without ascites: nodules of the anterior parietal peritoneum (A) and diaphragmatic peritoneum with impression on the liver (B)

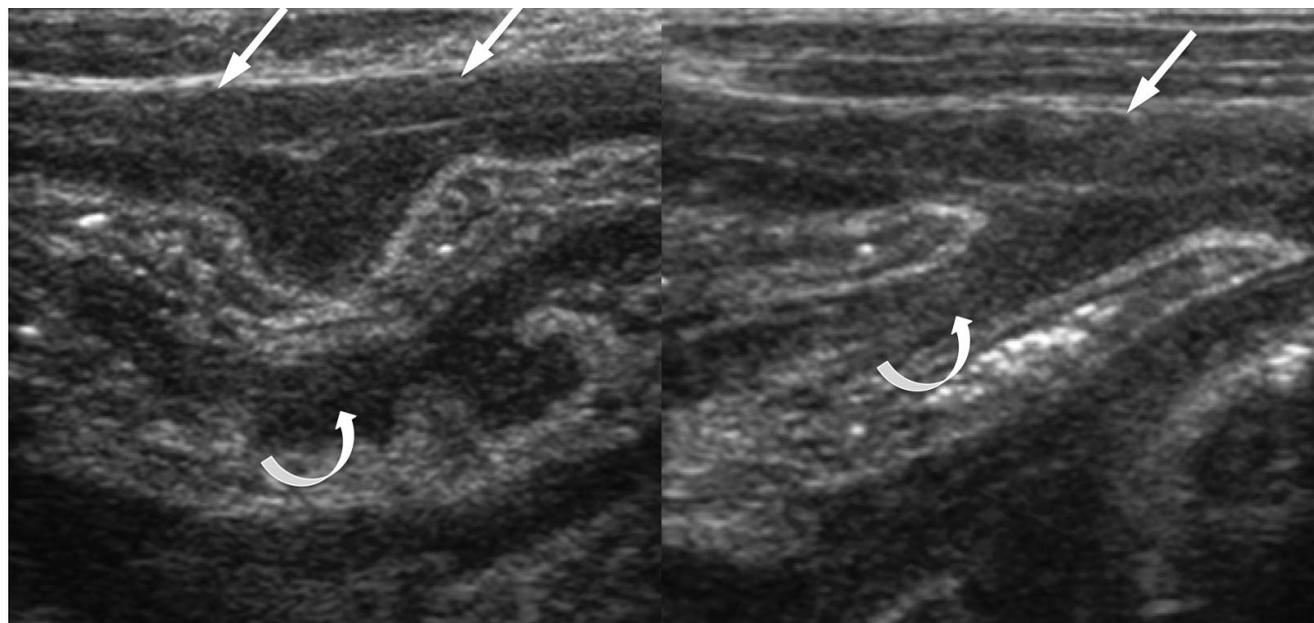


Fig. 4. Hypoechoic thickening of visceral peritoneum of small bowels (mesenteric leaflets) (curved arrow) with agglutination of small bowel loops. Note the involvement of the associated parietal peritoneum (right arrow)

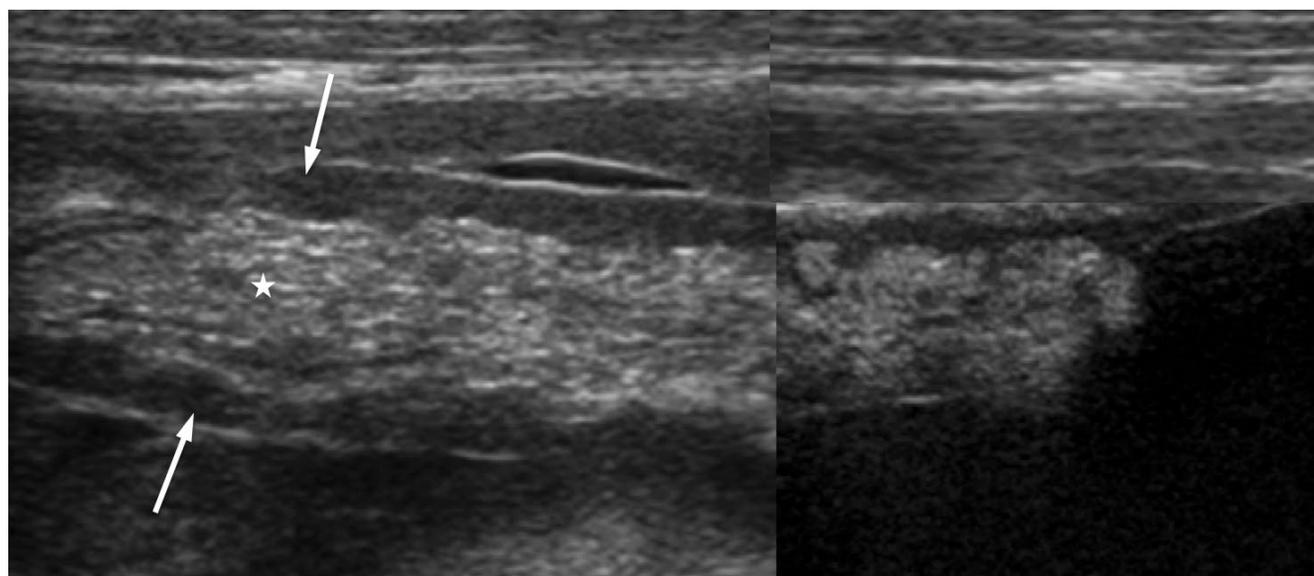


Fig. 5. Large omentum involvement: tri-lamellar thickening with 2 thin hypo echoic peripheral layers (right arrow) surrounding a central hyperechoic thick layer (star)

in 93 to 100%^(18,19). The search for AFB in the ascitic fluid is rarely positive on direct examination with sensitivity between 0 and 6%^(20,21).

Ultrasound is an important tool for the diagnosis of peritoneal tuberculosis due to its accessibility and low cost. It is very important to highlight the peritoneal anomalies, even in the absence of ascites.

Although the diagnosis of certainty requires histological evidence, some peritoneal anomalies are of great diagnostic value, especially in endemic areas. Peritoneal carcinomatosis remains the main differential diagnosis.

Ultrasonography also has the advantage of being able to guide peritoneal biopsy in the case of significant thickening of the large omentum, peritoneal nodules of more than 1 centimeter, thus avoiding a more invasive laparoscopy⁽²²⁾.

All peritoneal structures may be involved: parietal peritoneum, mesentery of small bowels and large omentum⁽²²⁻²⁴⁾. Ascites is the most commonly found; 84.2% in our series, as reported by many African authors^(16,23). It is often divided by septas⁽²⁴⁾. Adhesions are common in laparoscopic series^(8,20,21,25). They are visible on ultrasound only in the presence of ascites in the form of linear septa fixing

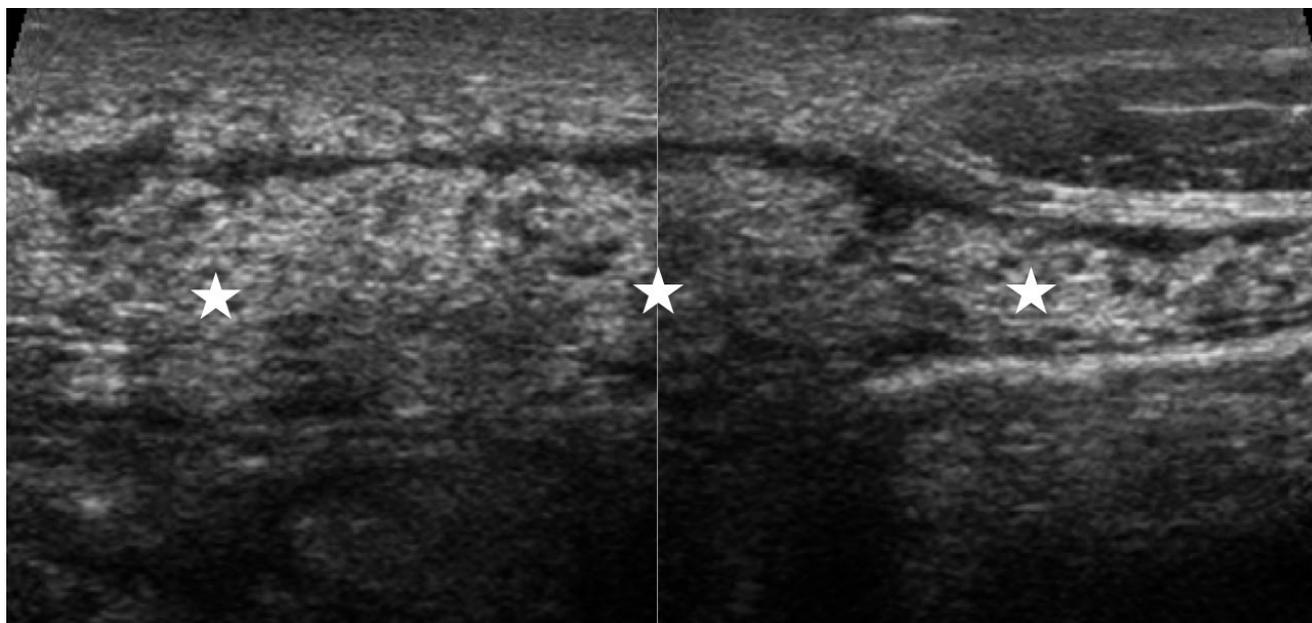


Fig. 6. Large omentum involvement: homogeneous hyperechoic single-layer thickening (arrows)

the wall of small bowels and the anterior abdominal wall. Ascites may be absent at the beginning of the disease or in the so-called dry forms (15.8% in our series). In these situations, careful analysis of the peritoneal cavity reveals suggestive anomalies of the parietal peritoneum, mesentery or large omentum.

Parietal peritoneum is the most affected peritoneal structure (89.4%). The most common finding is a hypoechoic thickening, regular, 4 to 8 mm thick, visible under the anterior abdominal wall. It reflects chronic inflammation of the peritoneal leaflet. It is very suggestive of tuberculosis⁽²³⁻²⁶⁾. It is less common in peritoneal carcinomatosis, where the thickening is most often irregular and nodular⁽²⁷⁾. More rarely, hypoechoic peritoneal nodules, variable in size, sometimes confluent, preferentially located in the

diaphragmatic peritoneum, causing scalloping on the liver and spleen (28% in our series), are found. Some authors, however, report a predominance of these parietal peritoneum nodules^(23,25,28).

The involvement of the large omentum is very suggestive of the disease in our experience. It results in a thickening of the epiploon with 3 aspects, the understanding of which requires recalling the anatomy of the large epiploon. The latter consists of two peritoneal leaflets separated by fat, within which there are lymphoid formations of the OALT system. The most frequent aspect is a trilamellar or triple-layer thickening (46.4%) with a hyperechoic thick central layer corresponding to hypertrophied omental fat, surrounded by 2 thinner hypoechoic layers of 3 to 8 mm (identical to the affected parietal peritoneum) corresponding to the thickening of the 2 peritoneal leaflets. This form has not been reported in the literature to our knowledge, probably due to the age of the studies, some of which were conducted with low frequency probes^(23,28-30). The single-layer or uni-lamellar thickening, homogeneous and hyperechoic, found in 21% in our series, reflects an isolated hypertrophy of the fatty layer without affecting the two peritoneal leaflets. Nodular heterogeneous omental thickening, the most described form in the literature^(12,22,31,32), was found in 32.1% of our series. The nodules, most often hypoechoic, correspond to hypertrophic lymphoid formations. More rarely, they can appear anechoic due to a caseous necrosis. This aspect is less specific in our experience, which can be found in peritoneal carcinomatosis⁽²⁷⁾.

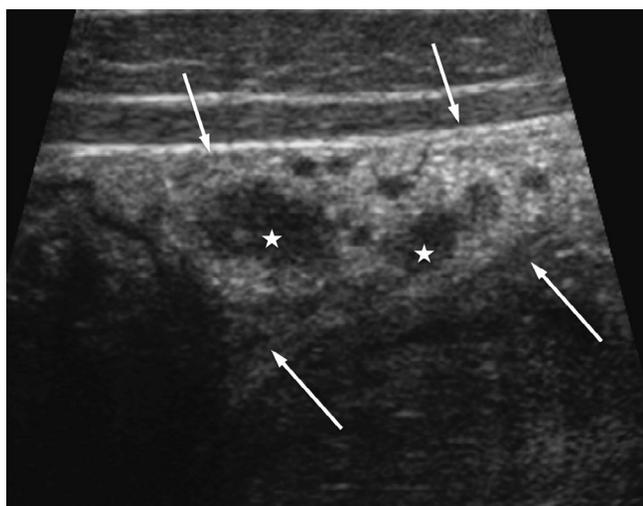


Fig. 7. Large omentum involvement: heterogeneous thickening with hypoechoic nodules (arrow)

The involvement of the mesentery is also very evocative. Its frequency is variable and estimated between 22 and 68% according to studies^(30,31). It results in regular hypoechoic thickening continuing on the visceral peritoneum covering the loops and responsible for small bowel agglutination⁽¹²⁾.

Adenomegaly is found in 34.3% of patients, most often with necrotic appearance; frequency comparable to some African studies^(23,33). Other African authors report a much lower frequency, less than 10%^(5,16). The association with progressive pulmonary tuberculosis is possible⁽⁵⁾. Adnexal involvement mimicking an ovarian malignant mass is frequently reported in the literature^(34,35).

Conclusion

The diagnosis of peritoneal tuberculosis remains a challenge because the clinical symptoms are nonspecific. Biological tests such as adenosine deaminase (ADA) may be useful, but are not always available in developing countries. Ultrasound has the advantage of being cheaper, widely available and easy to perform⁽³²⁾. In

addition, it has high diagnostic cost-effectiveness and may be used in certain situations to guide peritoneal biopsy.

Conflicts of interest

The authors do not report any financial or personal connections with other persons or organizations, which might negatively affect the contents of this publication and/or claim authorship rights to this publication.

Ethical consideration

This article has received the favorable opinion of our hospital's ethics committee.

References

- Rai S, Thomas WM: Diagnosis of abdominal tuberculosis: the importance of laparoscopy. *J R Soc Med* 2003; 96: 586–588.
- Guirat A, Affes N, Rejab H, Trigui H, Ben Amar M, Mzali R: [Role of laparoscopy in the diagnosis of peritoneal tuberculosis in endemic areas]. *Med Sante Trop* 2015; 25: 87–91.
- Bouchentouf R, Eljastimi S, Achour A: La tuberculose péritonéale: à propos de 38 observations. *Rev Mal Resp* 2012; 29: A119.
- Benjazia E, Khalifa M, Hachfi W, Alaoua A, Krifa A, Letaief A *et al.*: Profil actuel de la tuberculose péritonéale: étude d'une série tunisienne de 24 cas. *Rev Med Interne* 2009; 30: S401.
- Fall F, Ndiaye AR, Ndiaye B, Gning SB, Diop Y, Fall B *et al.*: Peritoneal tuberculosis: a retrospective study of 61 cases at Principal hospital in Dakar. *J Afr Hepatol Gastroenterol* 2010; 4: 38–43.
- Improving the diagnosis and treatment of smear-negative pulmonary and extrapulmonary tuberculosis among adults and adolescents. Recommendations for HIV-prevalent and resource-constrained settings. World Health Organization, Geneva 2007. Available from: www.who.int/tb/publications/2006/tbhiv_recommendations.pdf.
- Amouri A, Boudabbous M, Mnif L, Tahri N: Profil actuel de la tuberculose péritonéale: étude d'une série tunisienne de 42 cas et revue de la littérature. *Rev Med Interne* 2009; 30: 215–220.
- Dembélé M, Maïga MY, Minta DK, Traore SA, Sacko M, Traore AK *et al.*: Tuberculose péritonéale dans un service de médecine interne en milieu tropical: aspects clinique, biologique et laparoscopique à Bamako – Mali. *Acta Endoscopica* 2003; 33: 561–567.
- Ait-Khaled N, Emarson D: Tuberculose. Manuel pour les étudiants en médecine. Organisation Mondiale De La Sante 1999. Available from: https://tbrieder.org/publications/books_french/students_fr.pdf.
- Ramesh J, Banait GS, Ormerod LP: Abdominal tuberculosis in a district general hospital: a retrospective review of 86 cases. *QJM* 2008; 101: 189–195.
- Thoeni RF, Margulis AR: Gastrointestinal tuberculosis. *Semin Roentgenol* 1979; 14: 283–294.
- Atzori S, Vidili G, Delitala G: Usefulness of ultrasound in the diagnosis of peritoneal tuberculosis. *J Infect Dev Ctries* 2012; 6: 886–890.
- Thoreau N, Fain O, Babinet P, Lortholary O, Robineau M, Valeyre D *et al.*: [Peritoneal tuberculosis: 27 cases in the suburbs of northeastern Paris]. *Int J Tuberc Lung Dis* 2002; 6: 253–258.
- Sawadogo A, Ilboubo P, Ki-Zerbo GA, Peghini M, Zoubga A, Sawadogo A *et al.*: [Peritoneal tuberculosis and HIV infection. Reflection apropos of 22 cases at the National Hospital of Bobo Dioulasso]. *Bull Soc Pathol Exot* 2001; 94: 296–299.
- Malik A, Saxen NC: Ultrasound in abdominal tuberculosis. *Abdom Imaging* 2003; 28: 574–579.
- Darré T, Tchaou M, Sonhaye L, Patassi AA, Kanassoua K, Tchanguai B *et al.*: Analyse d'une série de 44 cas de tuberculose péritonéale diagnostiqués au laboratoire d'anatomie pathologique du CHU Tokoin de Lomé (1993–2014). *Bull Soc Pathol Exot* 2015; 108: 324–327.
- Ndiaye AR, Klotz F: Tuberculose abdominale. *EMC Gastro-entérologie* 2012; 7: 1–9.
- Sidibé M: Tuberculose péritonéale: étude rétrospective à l'Hôpital Principal de Dakar sur une période de 17 ans [Thèse de Doctorat]. Université El Hadji Ibrahima Niassé, Ecole de Médecine St Christopher Iba Mar DIOP, Dakar 2018.
- Dülger AC, Karadaş S, Mete R, Türkdoğan MK, Demirkıran D, Gültepe B: Analysis of cases with tuberculous peritonitis: a single-center experience. *Turk J Gastroenterol* 2014; 25: 72–78.
- Chow KM, Chow VC, Szeto CC: Indication for peritoneal biopsy in tuberculous peritonitis. *Am J Surg* 2003; 185: 567–573.
- Sanaï FM, Bzeizi KI: Systematic review: tuberculous peritonitis, presenting features, diagnostic strategies and treatment. *Aliment Pharmacol Ther* 2005; 22: 685–700.
- Pereira JM, Madureira AJ, Vieira A, Ramos I: Abdominal tuberculosis: imaging features. *Eur J Radiol* 2005; 55: 173–180.
- N'dri K, Gbazi GC, Konan A, Kouadio, Koffi, N'dri N *et al.*: Apport de l'échographie dans le diagnostic de la tuberculose péritonéale ascitique. *Médecine d'Afrique Noire* 1993; 40: 503–506.
- Portielje JE, van der Werf SD, Mutsaers JA, Lohle PN, Puylaert JB: [Echographic recognition of tuberculous peritonitis]. *Ned Tijdschr Geneesk* 1997; 141: 89–93.
- Dafiri R, Imani F: Tuberculose abdominale. *Encycl Méd Chir (Editions Scientifiques et Médicales Elsevier SAS, Paris, tous droits réservés). Radiodiagnostic – Appareil digestif* 2001; 33-010-A-30: 12.
- Gastli H, Hassine W, Absesselem K, Gharbi HA: [Echographic aspects of peritoneal tuberculosis. Apropos of 14 cases]. *J Radiol* 1983; 64: 325–329.
- Weill FS, Costaz R, Guetarni S, Maltoni I, Rohmer P: [Echographic diagnosis of peritoneal metastases in patients with ascites]. *J Radiol* 1990; 71: 365–368.
- Kedar RP, Shah PP, Shivde RS, Malde HM: Sonographic findings in gastrointestinal and peritoneal tuberculosis. *Clin Radiol* 1994; 49: 24–29.
- Akhan O, Demirkasik FB, Demikarzik A, Gülekon N, Eryilmaz M, Unsal M *et al.*: Tuberculous peritonitis: ultrasonic diagnosis. *J Clin Ultrasound* 1990; 18: 711–714.
- Lee DH, Lim JH, Ko YT, Yoon Y: Sonographic findings in tuberculous peritonitis of wet-ascitic type. *Clin Radiol* 1991; 44: 306–310.
- Batra A, Gulati MS, Sarma D, Paul SB: Sonographic appearances in abdominal tuberculosis. *J Clin Ultrasound* 2000; 28: 233–245.
- Ozkan K, Gürses N, Gürses N: Ultrasonic appearance of tuberculous peritonitis. *J Clin Ultrasound* 1987; 15: 350–352.

33. Heller T, Goblirsch, Wallrauch C, Lessells R, Brunetti E: Abdominal tuberculosis: sonographic diagnosis and treatment response in HIV-positive adults in rural South Africa. *Int J Infect Dis* 2010; 14 (Suppl. 3): 108–112.
34. Tongsong T, Sukpan K, Wanapirak C, Sirichotiyakul S, Tongprasert F: Sonographic features of female pelvic tuberculous peritonitis. *J Ultrasound Med* 2007; 26: 77–82.
35. Gosein MA, Narinesingh D, Narayansingh GV, Bhim NA, Sylvester PA: Peritoneal tuberculosis mimicking advanced ovarian carcinoma: an important differential diagnosis to consider. *BMC Res Notes* 2013; 6: 88.