Abdominal Tuberculosis: Pathogenesis, Clinical Features, and Diagnosis

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Ashish Gupta

The biggest disease today is not leprosy or tuberculosis, but rather the feeling of being unwanted.

Mother Teresa

Summary

Tuberculosis (TB) is a morbid infectious disorder that can involve multiple organ systems in the body. Pulmonary infection is the commonest site, followed by the abdomen. Abdominal TB can have a varied presentation and generally mimics malignancy in endemic areas. The diagnosis is established after a definitive biopsy. Recent advances in serology and biochemical parameters may aid in non-invasive diagnosis. However, significant overlap in the signs and symptoms of TB and malignancy makes invasive biopsy mandatory.

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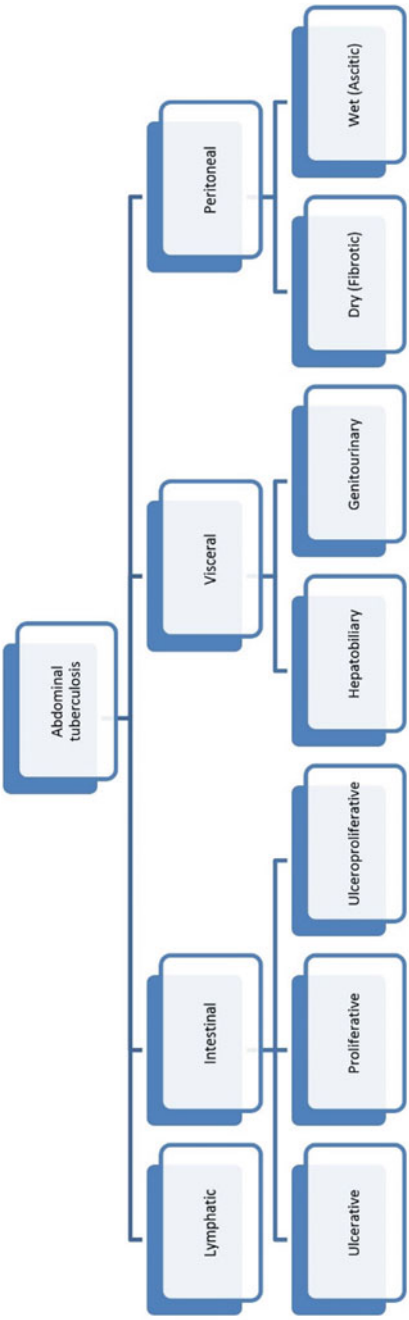
Graphical Abstract



Abdominal tuberculosis classification

Keywords

Abdomen tuberculosis · Gastrointestinal tuberculosis · Miliary tuberculosis · Peritoneal tuberculosis

1 Introduction

Tuberculosis (TB) is a common infection encountered in third-world countries [1]. With increasing immunodeficiency disorders, it is becoming a major health problem in the western world [2]. The pulmonary system is the commonest system infected by *Mycobacterium tuberculosis* (*M. tb*). Concomitant respiratory and abdomen is involved in 15–25% of the cases [3]. There is a significant overlap of symptoms between malignancies as well as TB of the abdomen [4]. Various reports have already been published highlighting diagnostic as well as therapeutic misadventure. A cheap, reliable, and reproducible biomarker can help differentiate these ailments.

TB of the abdomen, being a complex host of multiple viscera, peritoneum, and lymphatics, manifests with a wide range of signs and symptoms [5]. These can range from isolated abdominal pain to a cocoon abdomen in widespread involvement. Radiological tests like ultrasonogram and contrast-enhanced computerized tomogram (CECT) can aid in the diagnosis of TB [6]. Biochemical ascitic fluid analysis can help diagnose the ascitic form of peritoneal TB. Histopathological examination of the peritoneal or the lymph node (LN) biopsy may aid the investigation. The gastrointestinal (GI) system can be approached directly using endoscopes, and a biopsy can be obtained simultaneously. Effective chemotherapeutic agents are available for the non-surgical management of the ailment. However, multidrug-resistant forms of bacilli are widely prevalent in immunocompromised hosts [7].

2 Pathogenesis

M. tb gains its entry into the host through the respiratory route [8]. Further dissemination of the infection in the body depends upon the immunity and nourishment status of the infected individual. Immunosuppression in any form leads to dissemination through lymphatics and blood. The gastrointestinal system is involved after ingestion of non-boiled and infected milk and sputum [9]. The bacteria involve the mucosa and cause ulceration and necrosis. The healing of these ulcers leads to stricture formation [10], whereas transmural necrosis of the bowel wall causes perforation and secondary peritonitis. Visceral involvement, though uncommon, can occur as a result of the miliary process, either through direct involvement through the surrounding peritoneum and LNs or hematogenous dissemination through the portal and hepatic supply in the case of liver and spleen

[11]. The peritoneum is affected directly from the viscera like fallopian tubes, GI system, and rupture of the involved LNs [12].

The ileocecal region is the commonest site involved in the GI tract. The alkaline nature of the fluid, extensive lymphatic tissue, large absorptive surface area, and stasis of the infected fluid due to the presence of the ileocecal valve are hypotheses behind this occurrence [10]. The immunity of the affected patient then decides the clinical form of the infection. It can be either ulcerative, hyperplastic, or ulcero-hyperplastic. The ulcerative form is a sign of underlying immunosuppression and malnutrition. The hyperplastic forms present with a mass typically in the right iliac fossa, which is formed by the omentum, mesentery, and the involved bowel loops [13].

Peritoneal TB can be of the ascitic (wet) type or fibrotic (dry) type [14]. The wet type of peritoneal involvement presents with exudative ascites, and fibrotic form causes omental thickening with nodules and adhesions between the bowel loops. This classification, however, does not help in clinical practice as a significant overlap of both forms is encountered.

Viscera are rarely involved in the tubercular process. These organs are inherently resistant to TB infections as the alkaline nature of the biliary and pancreatic fluid is hostile for *M. tb* [11]. Spleen is involved in the hematogenous spread, and primary splenic TB is rarely encountered [2]. The genitourinary system is the commonest viscera involved and is discussed elsewhere [15]. The bacteria become lodged in the visceral parenchyma, resulting in granulomatous caseation and abscess formation. These features challenge the clinical acumen of the treating physician as they mimic more common benign as well as malignant visceral lesions. These organs are involved as a part of direct involvement, miliary process, or through hematogenous spread. TB in these organs presents as tubercular mass or abscess. The classification of abdominal TB is depicted in Graphical Abstract.

3 Clinical Features

3.1 Generalized Symptoms

The patients with TB present with varied symptoms. It commonly affects individuals between 20 and 40 years of age with equal sex preponderance [10]. Abdominal pain is the most common symptom [16]. It may be colicky in nature due to luminal narrowing. It gets relieved after the passage of flatus. A dull aching character may be noticed in mesenteric or omental lymphadenitis. These patients may also experience loss of weight which is unintentional. Fever may be observed in 25–40% of the cases. Patients with ascites may notice abdominal distension and associated malnutrition. These patients give a history of chronic anemia with other micronutrient deficiencies [17]. Constipation and diarrhea may be observed in a few cases depending on the extent of the luminal compromise and associated mucosal damage.

3.2 Site-Specific Symptoms

3.2.1 Visceral Tuberculosis

Patients with visceral TB may present as pyrexia of unknown origin. These are evaluated, and one may find a focus of abscess in the hepatobiliary system or spleen. Primary visceral involvement without any other focus of TB is rare. Gallbladder (GB) TB may present as malignancy with clinical features like abdominal pain, loss of appetite, and obstructive jaundice with portal lymphadenopathy [4, 11]. Many cases of GB-TB mimicking a malignant GB mass have been reported [18]. The pancreas, when involved by TB, presents as a pancreatic mass with or without obstructive jaundice. Peripancreatic lymphadenopathy, ascites, and peritoneal nodules are common in both malignant as well as tubercular processes [19]. The presence of multiple visceral metastases is a subtle finding of malignancy, whereas mesenteric lymphadenopathy and omental caking and thickening are commonly seen in the tubercular abdomen [11]. These findings are not specific for either of the disease and ultimately land the patient for a morbid surgical procedure.

3.2.2 Gastroduodenal Tuberculosis

The gastric mucosa is inherently resistant to TB infection because of the presence of an acidic milieu [10]. When infected (0.5–2%), these patients may experience epigastric discomfort, perforation, and pyloric stenosis in late cases. Patients with pyloric stenosis may have non-bilious vomiting with weight loss and appetite. Duodenum can be involved either intrinsically or extrinsically by the infected preduodenal LNs [20]. These lesions cause luminal compromise, and patients present with bilious non-projectile vomiting, loss of weight, and abdominal pain [21]. The patients may also present with hematemesis requiring significant blood transfusions. These patients may also suffer choleretic diarrhea secondary to the fistulization of the duodenal mass into the large bowel.

3.2.3 Ileo-Jejunal Tuberculosis

The small bowel is the commonest site of gastrointestinal involvement. As discussed earlier, the presence of a large absorptive area along with the highest concentration of lymphatic tissue predisposes this segment of the bowel to TB [10]. The patients typically present with abdominal pain, which is colicky in nature, and it gets relieved after the passage of flatus. The ulcer might perforate, causing secondary peritonitis. Visible intestinal peristalsis can be clinically noted in case of absolute obstruction. These patients are dehydrated and require surgical correction.

3.2.4 Colonic Tuberculosis

The colon is rarely involved in TB. Human immunodeficiency virus (HIV) infection has led to an increased incidence of colonic TB. The right-sided disease is common, and it is involved as a continuous infection with terminal ileum [10]. The transverse colon, sigmoid, and rectum segmental involvement causes abdominal pain, anemia, rectal bleeding, and obstruction in severe cases. These cases require biopsy for the definitive diagnosis, and surgical correction is warranted in rare cases [22].

3.3 Tubercular Complications

Many patients in endemic areas come to emergency with secondary peritonitis due to bowel perforation or absolute constipation [23]. These patients are dehydrated and hemodynamically unstable. They require aggressive fluid resuscitation, broad-spectrum antibiotics, organ support, and surgery for damage control [24]. The extent of operative procedure and type of surgery depends upon the condition of the involved bowel segment and hemodynamic stability of the patients [25]. The outcome of the aggressive management in these cases is usually dismal, as the mortality varies between 8 and 30% even after recent advances in perioperative care [26]. Many surviving patients have multiple ostomies and experience ostomy-related complications like electrolyte imbalance, peristomal excoriation, stomal prolapsed or retraction, and nutrient deficiencies [27, 28]. These complications depend on the surgical expertise and the segment of the bowel that has been exteriorized.

4 Diagnosis

Diagnosis of abdominal TB is challenging, given the varied clinical and radiological presentation. None of the biochemical and radiological tests is the gold standard for it. Histopathology of the affected tissue may aid in diagnosis to a certain extent. Recent advances like polymerase chain reaction (PCR) can help detect bacterial DNA and diagnose it in many cases [29].

5 Hematological Tests

Blood investigations may show elevated erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), and total leucocyte counts (TLC) [11]. Hypoalbuminemia may occur as a result of loss of appetite and malabsorption. While receiving anti-TB therapy (ATT), liver enzymes may be elevated and must be monitored regularly.

6 Radiological Investigations

6.1 Plain Chest X-Ray

A plain X-ray of the chest may reveal the active focus of pulmonary TB (PTB) in 25% of the cases. Many patients (75%) show a normal chest roentgenogram depicting primary abdominal involvement. Active PTB may show multiple parenchymal infiltrates with pleural effusion and mediastinal widening due to mediastinal lymphadenopathy. In healed cases, multiple fibrotic bands with pleural thickening may be noticed [30].

6.2 Plain Abdomen X-Ray

A plain X-ray of the abdomen may reveal multiple air-fluid levels with dilated bowel loops in case of obstruction. These patients may also show enterolith, which denotes the presence of anon passable stricture in the small bowel. The bowel may be centralized or clumped with a relative scarcity of rectal air. The free air under the diaphragm denotes the perforation of the hollow viscus, and it may result in secondary peritonitis [31].

6.3 Barium Meal

Barium meal (follow-through) is done after ingestion of radio-opaque contrast medium and subsequently taking the radiographic images of the abdominal cavity. It detects any intraluminal strictures and partial obstruction. The barium meal shows multiple strictures with dilated bowel loops in between [9]. These studies should be done with utmost precautions as barium impaction may cause complete obstruction, and free spillage of barium into the peritoneal cavity leads to chemical peritonitis requiring urgent surgical correction [32]. With the advent of computerized cross-sectional imaging, the utility of these historical investigations, even in underdeveloped countries, is reduced to academic purposes.

6.4 Ultrasonogram

Ultrasonogram is widely available nowadays. Operator dependency and low diagnostic yield are the limitations of this modality. It is non-invasive and provides the gross representation of the abdominal viscera. The ultrasonogram shows free fluid and omental caking in the peritoneal form of TB. The lymphatic form of TB might cause enlargement of the mesenteric, celiac, periportal, and retroperitoneal LNs. Matting the lymph nodes leads to mass formation, and an ultrasonogram will reveal a hyperechoic peripheral area with central liquefaction. Calcific speculations may be observed in healed calcified nodes [33].

A visceral form of TB may show a large mass involving the affected organ associated with lymphadenopathy. The mass may have central liquefaction as noticed in large malignant tumors. The lymph node enlargement of the draining area adds to the clinical challenge [4]. Patients with pyrexia of unknown origin may show multiple visceral abscesses, which are also difficult to differentiate from the bacterial abscess [2]. Multiple liver abscesses may also be confused with hepatic plate dysgenesis like polycystic liver and von Meyenburg complexes [34].

Bowel thickening may be noticed in the enteric form of TB. The thickening involves the ileocecal junction primarily. The bowel thickening is also associated with cecal involvement, appendicular thickening, and omental adhesions. Pseudo kidney sign may be seen in pulled up caecal mass when it is seen in subhepatic

space [9]. These signs have significant overlap with other benign conditions and malignancies. Biopsy of the affected segment provides the only chance of differentiation between these conditions.

6.5 Abdomen Contrast-Enhanced Computed Tomography

Cross-sectional imaging like CECT can aid in clinical diagnosis [35]. These investigations provide the image of the viscera along with the associated structures. The imaging assists the clinical judgment and justifies the empirical diagnosis. The cross-sectional imaging shows enlarged mesenteric and celiac LNs [4]. These LNs may be discrete or matted due to TB periadenitis. The matted LN mass might have areas of central caseation necrosis, which on CECT will appear as a hypointense area with peripheral hyperintense rim associated with surrounding stranding [9]. The healed or dead nodes may demonstrate calcifications. Lymphadenopathy is relatively sparse in retroperitoneum, unlike lymphoma, where retroperitoneal lymphadenopathy is a common phenomenon. The biopsy of the affected LN provides the definitive diagnosis.

As described above ileocecal junction and terminal ileum are the commonest site of gastrointestinal TB. CECT of the abdomen in these cases shows a mass in the right iliac fossa, which is formed by the thickened terminal ileum and caecum, matted omentum, small bowel mesentery, and appendix. The mass is inflammatory in nature. The terminal ileum and caecum are pulled up to lie in the subhepatic space [36]. There may be a visualization of dilated small bowel loops along with the intervening strictures. These strictures may be long or small, multiple or single, and passable or non-passable depending on the length of the involved bowel. The free air in the peritoneal cavity signifies the free perforation of the small bowel. CECT enteroclysis may show the direct transit of the oral contrast from the affected segment to the large bowel or distant bowel, signifying the fistulization of the segment into the distal large intestine. These patients present with the passage of loose stools with loss of weight.

Viscera, when involved in the tubercular process, mimic the intraabdominal visceral malignancy or the infective process. The hepatobiliary involvement will be seen as a large mass with heterointense areas [11]. There may be calcifications seen in the periphery of the mass, and it may be associated with portal, periportal, and celiac lymphadenopathy. The presence of ascites and peritoneal nodules may also confuse the clinical diagnosis. Pancreatic TB presents as a large necrotic mass in the head and tail of the pancreas [37]. There may be peripancreatic stranding as well as LN involvement in the peripancreatic areas. The presence of mass with obstructive jaundice or pain favors malignancy, and TB as a primary disease is considered rarely. Spleen is involved in the miliary process, and hematogenous dissemination is commonly seen. Splenic TB may present as multiple splenic hypointense areas signifying splenic abscesses with enlargement [2]. These visceral findings camouflage as malignancy, and all patients are subjected to the intense treatment protocol, only to be a histological surprise.

6.6 Diagnostic Laparoscopy

Minimally invasive surgery has emerged as a useful alternative to the conventional open laparotomy [38]. A minimally invasive approach has led to early recovery, reduced post-operative pain, and scarring. These advantages of laparoscopy have increased its utility in diagnosing abdominal infections as well as disseminated malignancy. Diagnostic laparoscopy is the initial investigation before contemplating the definitive surgery. The presence of whitish nodules over the peritoneum and bowel surface can be seen in TB and metastatic disease as well [39]. Subjecting these deposits for intraoperative frozen section and histopathology has diagnosed TB in many patients.

Diagnostic laparoscopy offers the advantage of viewing the whole intraabdominal cavity, including the pelvis and reproductive organs. The presence of thickened fallopian tubes along with active fimbrial discharge is a sign of active TB pelvic inflammatory disease.

6.7 Ascitic Fluid Tap

Intraperitoneal free fluid can be appreciated in many patients with abdominal TB. The free fluid is exudative in nature. Biochemical analysis of the fluid shows increased proteins with low glucose levels. There may be lymphocytosis, and its yield for acid-fast bacilli (AFB) is very low. Peritoneal biopsy has the highest yield of AFB among peritoneal fluid and biopsy. Raised adenosine deaminase (ADA) (> 37) has typically been associated with abdominal TB [10].

6.8 Nuclear Scans

Nuclear scans have evolved as a diagnostic modality for malignancy. The tumor cells possess a high metabolic rate, and these selectively take up the glucose tracer well [40]. The inflammatory cells lack this capability, and hence inflammatory lesions are less avid on nuclear scans. The peritoneal involvement of TB is seen as diffuse uptake, whereas it is isolated nodular uptake in malignancy. Multiple reports have been published in literature where the abdominal TB has mimicked malignancy, and even in PET-CT presence, TB was diagnosed only after definitive histopathology. Gallium 67 scintigraphy has traditionally been used to initiate and monitor chemotherapy response in abdominal TB [41].

6.9 Histopathology

Histology is the standard gold test for diagnosis. Histology of the tissue shows caseating granuloma with epithelioid and Langhan's cells with AFB [11]. The central caseation is typical of TB in endemic areas. The diagnosis of TB is established only if the following clinical and diagnostic criteria are met:

- demonstration of a caseating granuloma on histology;
- demonstration of AFB;
- isolation of *M. tb* when the tissue is subjected to culture; and
- clinical resolution of disease after the initiation of chemotherapy.

The yield of fine-needle aspiration (FNA) is low compared to the biopsy. The false-negative yield of FNA is 10–15%. A negative test in a patient with typical signs and symptoms should be reassessed, especially in the endemic areas.

7 Treatment

The treatment of abdominal TB primarily comprises ATT. The treatment regimens and complications of ATT have been described elsewhere.

8 Conclusion

TB is an infective disease with high morbidity and mortality, especially in co-infection with HIV. Abdominal TB poses a challenge to the treating physician as it is a great mimicker of abdominal malignancy. Modern-day molecular diagnostic modalities help differentiate these pathologies and initiate the appropriate treatment of the affected patients. Though healed after appropriate chemotherapy, the patients still suffer from the sequel of infections and present with subacute intestinal obstruction, abdominal pain, etc. These patients also prove to be a nightmare for the surgeons who operate them for some other surgical ailment as there are dense adhesions between the bowel and mesentery, patients are malnourished, and the prognosis with these comorbidities is poor.

Core Messages

- TB still affects people, especially in the developing world.
- TB is treatable.
- Surgery is required in rare cases with obstruction or perforation.

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