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REVIEW

Demystifying the mesenteric root lesions

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Abstract

Objective The aim of this article is to describe the normal anatomy of the root of the small bowel mesentery (RSBM) as well as the multidetector computed tomography (MDCT) features of the various primary and secondary lesions that affect the RSBM.

Results The small bowel mesentery attaches the jejunum and ileum to the posterior abdominal wall, the line of attachment forming the RSBM. Several primary as well as secondary lesions involve the RSBM. The RSBM has anatomical contiguity with the mesocolon and other peritoneal ligaments, which forms a route for the spread of infection, neoplasms as well as several other abdominal pathologies. MDCT plays an important role in the evaluation of mesenteric root lesions.

Conclusion Familiarity with the lesions involving the RSBM and their characteristic appearances on MDCT is important in giving thoughtful differential diagnosis and guiding the treating physician in further management.

Keywords Mesentery · Multidetector computed tomography · Mesenteric panniculitis · Desmoid · Gastro-intestinal stromal tumors · Lymphangioma · Carcinoid

Introduction

The mesentery comprises of double layer of folds of the peritoneum which suspends the small and large bowel loops from the posterior abdominal wall [1]. The small bowel mesentery (SBM) is located in the central portion of the abdomen and attaches to the jejunum and ileum on one side and the posterior abdominal wall on the other. The line of attachment of the SBM on the posterior abdominal wall forms the root of the SBM (RSBM) [2]. It is a bare area, continuous with the retroperitoneal space and contains fat and the superior mesenteric vessels. The RSBM has anatomical contiguity with the mesocolon and other peritoneal ligaments, thus forming a route for the spread of multiple abdominal pathologies. Several primary as well as secondary lesions involve the RSBM. Multidetector computed tomography (MDCT) plays an important role in the evaluation of mesenteric root lesions. Familiarity with the various lesions involving the RSBM and their characteristic appearance on MDCT is important in giving a thoughtful differential diagnosis and guiding the treating physician in further management (Table 1). The aim of this article is to describe the normal anatomy of the RSBM with a note on the recent understanding of the mesentery and to describe the CT features of the primary and secondary lesions affecting the RSBM.

Normal anatomy

The SBM is a broad, fan shaped, fat-laden fold of peritoneum, which attaches the jejunal and ileal loops to the posterior wall of the abdomen through its root. The RSBM is approximately 15 cm long and runs obliquely down and to the right from the duodenojejunal flexure at the level of the second lumbar vertebra up to the ileocecal region in the right lower quadrant at the level of right sacroiliac joint [3].

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Table 1 Classification of mesenteric root lesions

Primary
Solid
Inflammatory Sclerosing mesenteritis
Mesenchymal GIST, lipoma, lipoblastoma, schwannoma, leiomyoma
Sarcomas Liposarcoma, leomyosarcoma, fibromyxoid sarcoma, fibrosarcoma
Miscellaneous Desmoid tumor, extra-pleural solitary fibrous tumor, extramedullary hematopoiesis
Cystic
Lymphangioma, duplication cyst, mesothelium cyst, cystic teratoma, cystic neurogenic tumor
Miscellaneous
Hematoma, vascular lesions (arteriovenous fistula, aneurysm and thrombosis), mesenteric edema
Secondary
Direct spread Carcinoma of pancreas, duodenal and jejunal malignancies, gastro-intestinal carcinoid, acute Pancreatitis
Extension along neighboring ligaments Gastric carcinoma, pancreatic carcinoma, descending colon cancer, GIST from adjacent organs, Biliary malignancies
Peri-neural spread Carcinoma of pancreas, distal common bile duct cancer
Lymphatic spread Lymphoma, Nodal metastasis from other malignancies, Infections, Crohn's disease, Sarcoidosis, Castleman disease
Hematogenous Metastasis from melanoma, breast cancer, lung Cancer
Intraperitoneal seeding Peritoneal carcinomatosis, tuberculosis, amyloidosis, lymphomatosis, primary peritoneal mesothelioma

It provides a suspension that prevents the intestine from collapsing into the pelvis, and this anchoring is assisted by vascular connections [4]. The RSBM is a bare area, which is continuous with the retroperitoneal space and contains the origins of the superior mesenteric artery (SMA) and superior mesenteric vein (SMV), surrounding neural plexus and lymphatics. Superiorly, the RSBM is continuous with the hepatoduodenal ligament, along the SMV and portal vein. Anteriorly, it is continuous with the transverse mesocolon and posterolaterally with the ascending and descending mesocolons (Fig. 1). This anatomical continuity with other peritoneal ligaments and mesocolons is responsible for the transcompartmental spread of several pathologies in the abdomen. There is an abundance of neural plexuses in the RSBM surrounding the peripancreatic vasculature in the form of the pancreatic capital plexus 1 and 2 [5]. This along

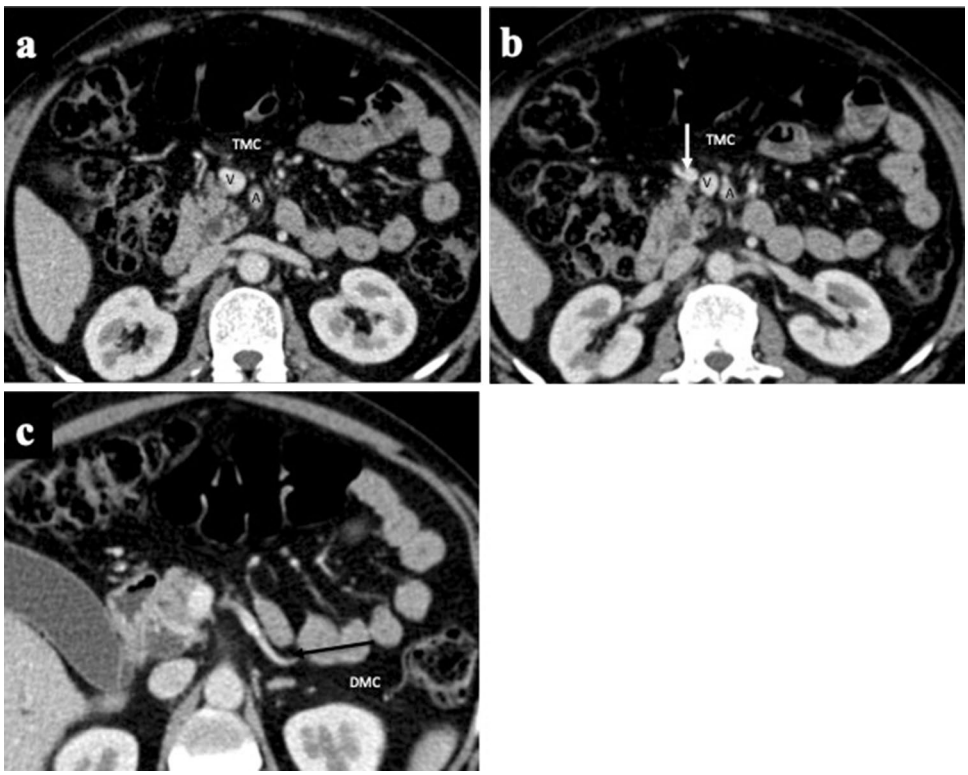

Fig. 1 **a** Axial contrast-enhanced computed tomography (CECT) of the upper abdomen showing the normal mesenteric root anatomy. **b** The root of the small bowel mesentery (SBM) is contiguous with the right side of the transverse mesocolon (TMC) in the vicinity of the gastrocolic trunk (white arrow). **c** The left side is contiguous with the descending mesocolon (DMC) which contains the inferior mesenteric vein (black arrow). A—superior mesenteric artery, V—superior mesenteric vein

with the perivascular lymphatics forms another pathway for the spread of diseases into the SBM.

Primary mesenteric root lesions

Primary mesenteric root lesions are rare and mainly mesenchymal in origin [6]. They can arise from fat, connective tissue, lymphatics, or peritoneum. They may either be detected incidentally and or present with non-specific symptoms. Clinical findings and imaging do not always provide a definitive diagnosis and histopathologic confirmation is frequently needed before final management.

Mesenteric panniculitis

Mesenteric panniculitis is a rare, non-neoplastic, fibro-inflammatory disorder of the adipose tissue having a prevalence of 0.6% [7]. Histopathologically, it is characterized by inflammation, fibrosis, and fat necrosis [8]. It is known by various synonyms like mesenteric lipodystrophy, fibrosing mesenteritis, and liposclerotic mesenteritis [9]. The etiopathogenesis of sclerosing mesenteritis is still unclear, although it is associated with several conditions like previous abdominal surgery, autoimmune disease, paraneoplastic syndrome, vasculitis, and infection [10–14]. About 10–15% of these cases are asymptomatic and diagnosed incidentally when CT is done for other causes [7]. Patients present with abdominal pain, systemic symptoms like fever, malaise, and altered bowel habits [11]. Complications include bowel obstruction, obstructive uropathy, mesenteric ischemia, and chylous ascites [11]. On MDCT, the appearance depends on the pathological stage. The earliest stage, represented pathologically by fat necrosis, presents as the "misty mesentery", characterized by increased attenuation of the mesenteric fat in comparison to the normal retroperitoneal fat [15]. The second stage, characterized by infiltration of foamy macrophages, presents as a mass-like area of homogenously or heterogeneously increased fat attenuation on CT that does not displace the surrounding mesenteric vascular structures [7] (Fig. 2). There are few important signs of mesenteric panniculitis described in the literature [16]. The "tumoral pseudocapsule" sign refers to the presence of a peripheral curvilinear band of soft tissue attenuation limiting the heterogeneous mesenteric mass from the surrounding normal mesentery. The "fat halo" sign refers to the preservation of normal fat density in the fatty tissue surrounding the mesenteric vessels [16, 17]. In the last fibrotic stage, it presents as a mass, like other mesenteric tumors, which may infiltrate the adjacent structures. This stage is indistinguishable from tumors unless a biopsy is performed. Calcification and necrosis are seen in the mass forming type [18]. Differential diagnosis includes lymphoma, carcinoid, peritoneal carcinomatosis, and fibromatosis. Treatment in symptomatic cases include medical, in the form of analgesics, glucocorticoids, tamoxifen, pentoxyphylline, or in severe cases, surgical excision.

Mesenchymal tumors

Gastro-intestinal stromal tumors (GISTs)

Primary GIST's of the mesenteric root are rare. GISTS are a heterogeneous group of gastro-intestinal smooth muscle tumors arising from the interstitial cells of Cajal. Extra-gastro-intestinal stromal tumors (EGISTs) are more in common patients over 50 years of age and arise in the omentum, peritoneum, and mesentery [19]. It is now believed that most of the mesenteric root GISTs are primarily intestinal mural tumors that dislodge from the bowel wall due to extensive overgrowth [20]. Most of these tumors show similar histopathology as classic GIST [20]. MDCT shows a large mass in the mesentery showing central necrosis with no abdominal lymphadenopathy or ascites (Fig. 3).

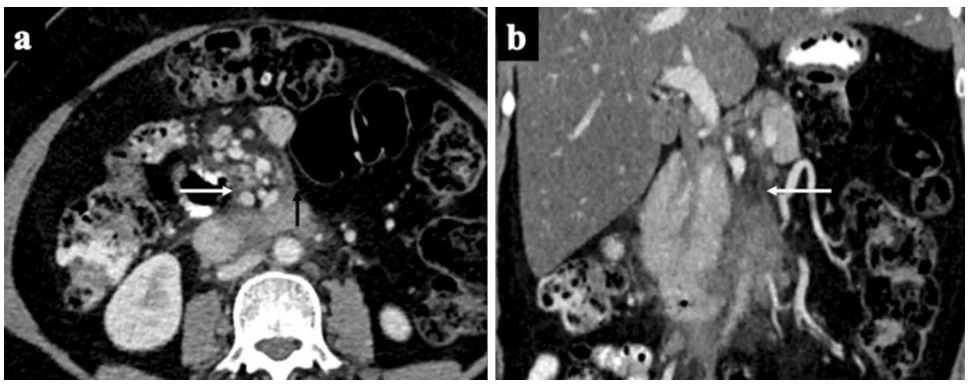

Fig. 2 Mesenteric panniculitis in an 40-year-old female presenting with abdominal pain. Axial (**a**) and coronal (**b**) contrast-enhanced CT images showing increased attenuation of the fat around the mesenteric vessels (white arrows) with the formation of a pseudocapsule (black arrow)

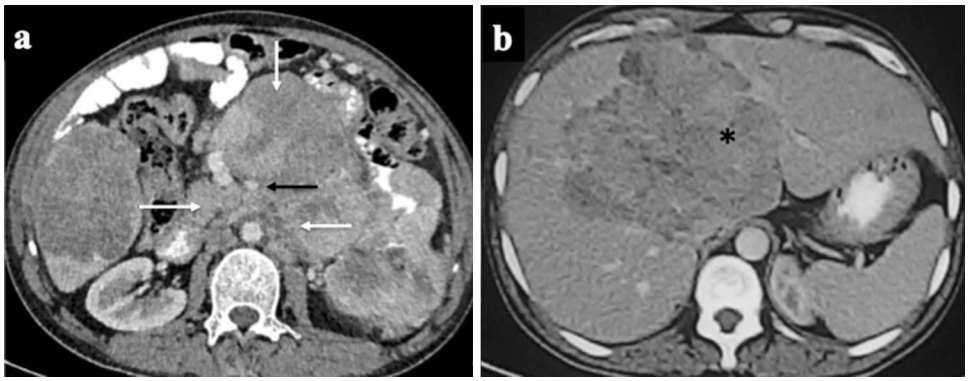

Fig. 3 Malignant mesenteric root GIST in a 40-year-old male. **a** Axial CT image showing heterogeneously enhancing mass lesion (white arrow) in the mesenteric root, encasing the superior mesenteric artery (black arrow). **b** Axial CT image showing heterogeneously enhancing mass lesion in the liver suggestive of metastasis (Black asterisk)

Fig. 4 Mesenteric pseudotumor in a 41-year-old male presenting with gradually increasing lump in the abdomen for the last 25 years**.** Axial CT image showing a well-defined heterogeneously enhancing mass lesion (white arrows) in the mesentery and the mesenteric root showing multiple calcifications (black arrow)

Other mesenchymal tumors

Other mesenchymal benign tumors like lipomas, lipoblastomas, and schwannomas are also seen rarely. Lipomas and lipoblastomas are fat-containing lesions. Lipoblastomas are commonly seen in young children and can present with volvulus or abdominal distention [21]. Schwannomas are also rarely seen in mesenteric root [22].

Inflammatory myofibroblastic tumor

Inflammatory myofibroblastic tumor (IMT), once thought as a pseudotumor, is now recognized as a rare tumor that is at high risk for local recurrence and based on recent cytogenetic studies, has a small risk for distant metastasis. IMT of the mesentery and the mesenteric root is uncommon and tends to occur in children and young adults [23, 24]. 50–70% of IMT demonstrate mutations in the anaplastic lymphoma kinase (ALK) gene [25]. Histopathologically, it consists of spindle cells with inflammatory cells in the background [26]. The clinical presentation of IMT is non-specific and may include fever, weight loss, and palpable abdominal mass [27]. On MDCT, these lesions are typically hypo or isoenhancing depending on the proportion of myxoid or collagenous stroma [8]. Dense central calcifications may be seen rarely (Fig. 4) [28]. Contrast enhancement pattern shows early peripheral enhancement due to vascular tissue and delayed central enhancement of the fibrotic components [8, 27, 29]. Large tumors may show central necrosis. Rarely, IMT shows aggressive growth patterns such as vessel encasement and bowel infiltration. Differential diagnosis includes desmoplastic small round cell tumor (DSRCT), Castleman disease, and Burkitt lymphoma.

Teratoma

Teratomas take origin from totipotent cells and may give rise to neoplasms that contain epithelium, muscles, bone, fat, and other tissues in varying proportions [30]. Involvement of the mesenteric root is rare. Patients are usually asymptomatic or can present with abdominal or flank pain secondary to mass effect [31, 32]. CT scan is most useful as it detects calcification and fat within the lesion. Teratoma will show solid enhancing components within. Presence of macroscopic fat, calcification and solid enhancing component strongly suggests the diagnosis of teratoma (Fig. 5). Although the presence of a fat-fluid level is highly specific for teratoma, fat-fluid level can also be seen in well-differentiated liposarcoma of the retroperitoneum [30]. Surgical resection remains the mainstay of therapy and it is required for making the definitive diagnosis.

Desmoid tumor

Mesenteric desmoid is a component of the spectrum of deep abdominal fibromatosis [33]. SBM is the most common site of intra-abdominal fibromatosis. Mesenteric desmoids show no age or gender predilection and are often associated with Gardner's syndrome [33, 33]. Previous abdominal surgery is an important risk factor for the development of mesenteric

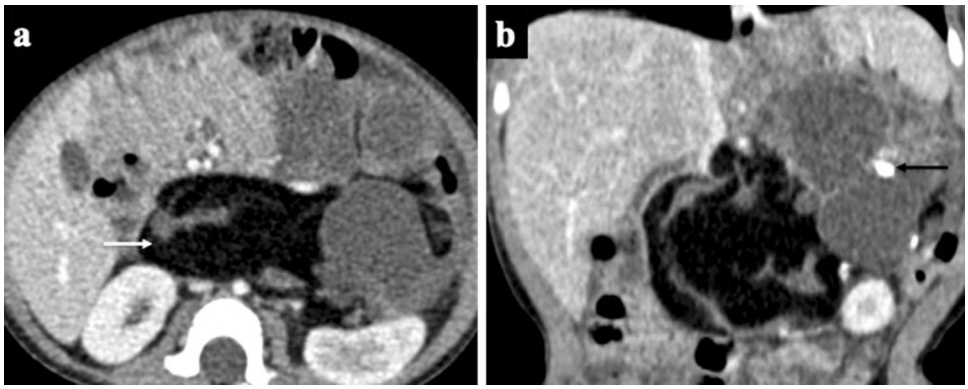

Fig. 5 Mature teratoma in a 10-year-old female patient with Down's syndrome**.** Axial (**a**) and coronal (**b**) venous-phase images showing a large, oval fat-attenuating lesion (white arrow) with internal soft tissue strands in the mesenteric root. There are few foci of calcification within the lesion (black arrow)

desmoid in patients with Gardner's syndrome [34]. Patients usually present with abdominal pain, lump, bowel obstruction, perforation, or gastro-intestinal bleeding [35]. On histopathology, these tumors show fibroblasts in the background of abundant collagen fibers and myxoid stroma. Mesenteric tumors appear as soft tissue masses with well-demarcated or poorly-defined borders, strands radiating into the adjacent mesenteric fat or a "whorled appearance" of fibrosis growing into the mesenteric fat [36, 37]. Infiltration into adjacent organs or growth into the abdominal wall musculature and psoas muscle is not uncommon. On MDCT, most mesenteric root desmoids are isoattenuating relative to skeletal muscle although large lesions may display areas of low attenuation caused by necrosis (Fig. 6). Larger size, multiplicity, and invasion of the adjacent structures are some of the features that may help to differentiate mesenteric desmoids from sclerosing mesenteritis or lymphoma [17]. Intra-abdominal desmoids are difficult to resect and sometimes may be unresectable in view of extensive vascular or bowel invasion. Medical treatment and radiotherapy are usually given in these cases.

Extra-pleural solitary fibrous tumor

Solitary fibrous tumors are most commonly seen in the pleura. Rarely, they can be seen in the RSBM as well. These tumors show male preponderance with the average age of presentation being 54 years [38]. These are usually submesothelial in origin. On histology, they are comprised of spindle cells in a background of collagenous tissue with a characteristic overlying layer of mesothelium. On imaging, they usually present as a well-defined mass with solid and cystic components [38, 39].

Mesenteric sarcoma

Primary soft tissue sarcomas of the RSBM are very rare. Leiomyosarcoma, liposarcoma, and fibrosarcoma are the commonly encountered entities. The commoner entity is primary retroperitoneal sarcoma infiltrating into the mesentery. Leiomyosarcoma of the RSBM arises from smooth muscle cells of the blood vessels in the mesenteric root [40]. These are aggressive tumors with an overall survival rate of 20–30% [40]. Patients usually present with non-specific symptoms like abdominal discomfort or lump. On MDCT,

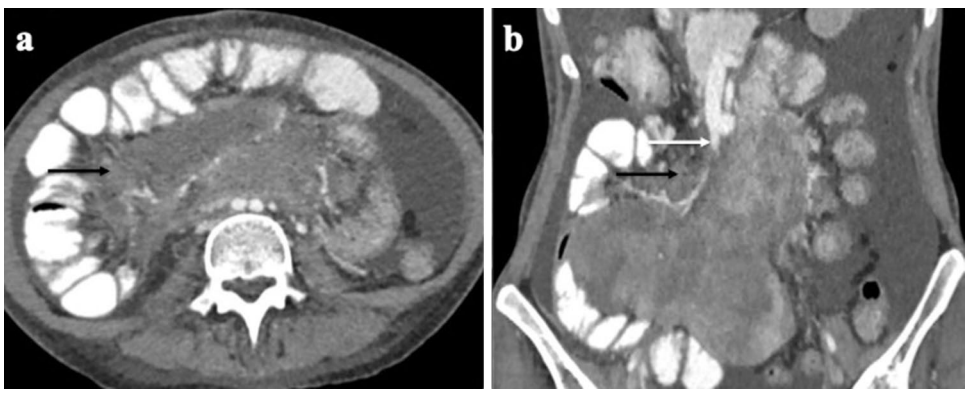

Fig. 6 Fibromatosis in a 45-year-old male with abdominal pain and distension. Axial (**a**) and coronal (**b**) contrast-enhanced CT images of the abdomen showing a heterogeneously enhancing mass lesion involving the mesenteric root (black arrows), encasing the superior mesenteric vessels (white arrow). Note is made of ascites

these usually appear as solid masses with necrotic areas within which infiltrate the adjacent structures. Primary liposarcoma of the mesentery is also very rare and shows presence of macroscopic fat. The other sarcomas are very difficult to differentiate radiologically and the final diagnosis is usually determined on histopathology.

Extramedullary hematopoiesis (EMH)

Extramedullary haematopoiesis refers to the formation of blood cells outside the normal marrow. It is usually seen in disorders associated with bone marrow failure or ineffective erythropoiesis. Peritoneal, mesenteric, and bowel involvement with EMH is rare [41]. It usually manifests as diffuse soft tissue infiltrating the entire mesentery with involvement of the small bowel. Ascites and mesenteric lymphadenopathy can be associated findings. Rarely it can present as serosal deposits or bowel wall masses mimicking malignancy [42]. CT usually shows diffuse infiltration of the mesentery with soft tissue that shows mild enhancement with the occasional presence of fat (Fig. 7) [42]. Differential diagnosis includes peritoneal carcinomatosis, peritoneal lymphomatosis, and tuberculosis. Biopsy is needed for definitive diagnosis.

Fig. 7 Extramedullary hematopoiesis in 39-year-old male patient of myelofibrosis. Axial contrast-enhanced CT image showing mildly enhancing infiltrative soft tissue mass involving the root of the mesentery (black arrow) and the omentum (white arrows)

Mesenteric root hematoma

Mesenteric root hematomas are usually seen with blunt abdominal trauma, after surgery, in patients on anticoagulation, blood dyscrasias, and with mesenteric ischemia [43]. Acutely, a mesenteric hematoma can appear as a focal or diffuse high attenuation mass (40–90 HU) on a non-contrast scan which does not show any enhancement (Fig. 8). A mesenteric root hematoma should become less dense (< 20 HU) by 2–4 weeks. It is self-limiting in majority of the cases. High density and homogeneous attenuation helps differentiate it from tumors.

Mesenteric root edema

Mesenteric root edema is seen in disorders like cirrhosis, chronic renal failure, hypoproteinemia, and congestive heart failure or may be due to vascular abnormalities like portal hypertension and portal or mesenteric vein thrombosis [44]. It gives the appearance of a misty mesentery. Due to fluid infiltration, the mesenteric fat attenuation increases to the − 40 HU to − 60 HU range from the normal range of − 100 HU to − 160 HU [44]. Another finding is the loss of the sharp interface between mesenteric vessels and mesenteric fat (Fig. 9). The increased attenuation in such cases needs to be differentiated from other pathologic conditions, such as infiltration by a malignant neoplasm, mesenteric

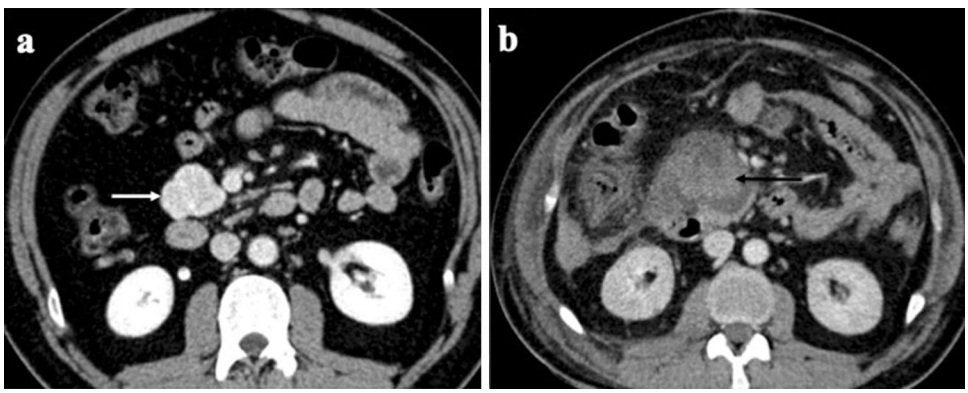

Fig. 8 Hematoma in the mesenteric root in an operated case of pancreatic insulinoma in a 22-year-old male. **a** Axial arterial-phase image showing exophytic intensely enhancing lesion in the head of pancreas (white arrow). **b** Post operative axial venous-phase CT image showing a well-defined collection with internal hyperdense contents (black arrow) suggestive of hematoma in the mesenteric root

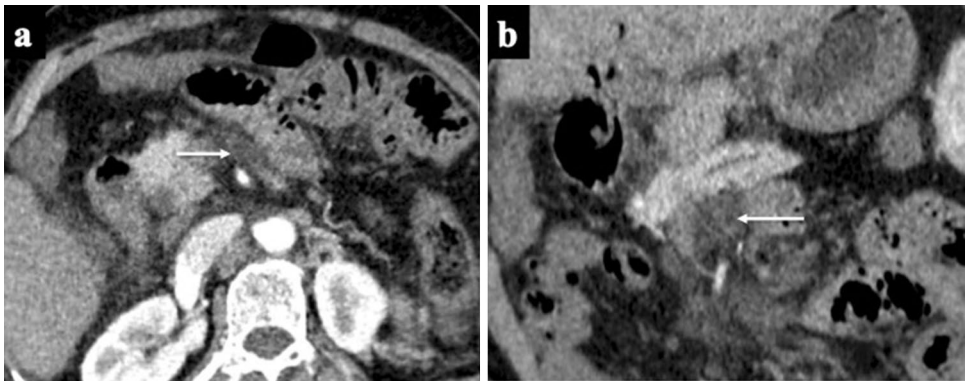

Fig. 9 Mesenteric congestion in a 65-year-old female patient with chronic liver disease. Axial (**a**) and coronal (**b**) contrast-enhanced CT scans showing fluid collection (white arrows) and fat stranding surrounding the mesenteric vessels

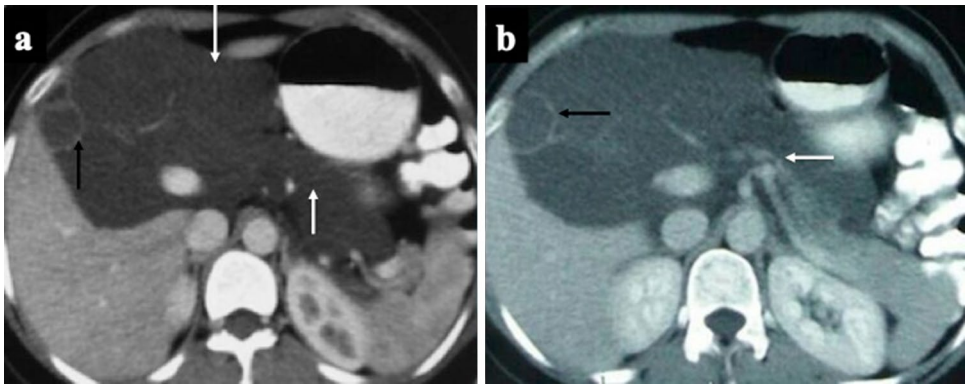

Fig. 10 Mesenteric root lymphangioma in a 31-year-old female. **a** and **b** Axial venous-phase images show lobulated thin-walled cystic lesion in the mesenteric root (white arrow) showing a few thin enhancing internal septa (black arrows)

inflammation, or SMA dissection. Mesenteric edema, secondary to mesenteric vein thrombosis, is usually focal and confined to the involved bowel loops [5, 44].

Cystic lesions

Cystic lesions of the RSBM include lymphangioma, duplication cyst, enteric cyst, and non-pancreatic pseudocyst. Lymphangioma shows multiple internal septations (Fig. 10). It insinuates between the bowel loops and rarely causes bowel obstruction. Presence of hemorrhage within can pose a diagnostic dilemma [45]. Enteric duplication cysts can detach from the bowel loop into the mesentery. These lesions contain all the normal layers of the bowel wall and show the gut signature on ultrasonography. On MDCT, they appear as hypodense cystic lesions with enhancing thick wall. Enteric cysts, non-pancreatic pseudocysts, and mesothelial cysts are seen as unilocular fluid attenuating lesions with an imperceptible wall [45, 46]. Certain tumors are also cystic on imaging like cystic teratoma, cystic neurogenic tumor, and cystic mesothelioma. Most of these tumors are multiseptated with thick irregular walls [45].

Vascular lesions

Vascular lesions of the mesenteric root include SMA aneurysm, SMA dissection, arterioportal fistula, thrombosis of SMA or SMV, and dilated venous varices in portal hypertension [5]. SMA aneurysms are usually atherosclerotic or mycotic in etiology. Rarely, they can present as an abdominal mass, although most of them are incidentally detected (Fig. 11). Depending on the etiology, location and size of the aneurysm, the treatment is either surgical or endovascular intervention [47].

Secondary SBM lesions that spread via the SBM root

Direct extension

Carcinoid tumor

Carcinoid tumors are neuroendocrine tumors which arise from the enterochromaffin cells of the gastro-intestinal tract [48]. Distal ileum is the most common site. Most of the carcinoid tumors involving the RSBM are actually metastatic nodes with a primary in the small bowel. Primary carcinoid

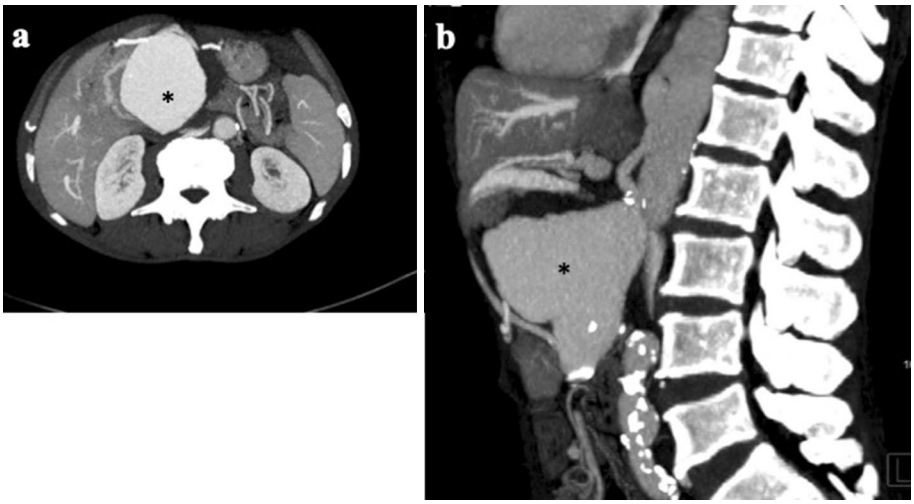

Fig. 11 45-year-old male patient presenting with a pulsatile abdominal lump. Axial (**a**) and sagittal (**b**) maximum-intensity projection CT images showing a large aneurysm (black asterisk) arising from the superior mesenteric artery with associated atherosclerotic changes in the aorta

tumor of the mesentery is very rare. They usually present with abdominal pain or features of carcinoid syndrome. Carcinoid syndrome usually develops in 10% of the cases who have hepatic metastasis [8]. On imaging, the primary lesion is usually seen as a hyperenhancing plaque or nodule in the small bowel. The mesenteric root lesion is seen as a spiculated soft tissue mass with calcification in about 70% of cases. The serotonin released by the tumor causes mesenteric fibrosis causing a spoke-wheel appearance with tethering of the small bowel loops [49]. Sclerosing mesenteritis is a differential diagnosis for this appearance. In the absence of liver metastasis or non-visualization of the primary lesion, it is very difficult to differentiate the two and biopsy is often needed. However, preservation of halo around mesenteric vessels favors the diagnosis of sclerosing mesenteritis [17].

Other tumors

The pancreas is a retroperitoneal organ with no fibrous capsule. Hence, lesions arising from the pancreas show direct invasion of the adjacent structures like RSBM, which makes resection of these tumors very difficult. Malignant tumors of duodenum and jejunum can rarely invade the mesenteric root directly with encasement of mesenteric vessels (Figs. 12, 13, 14, 15) [5].

Extension along the neural plexus

Invasion of neural plexus is very frequent in pancreaticobiliary cancers, found in almost 90% of the cases [5]. Root of the mesentery is one of the pathways for peri-neural spread of the pancreatic cancer, particularly of the uncinated process, that infiltrates along the peri-neural fascicles within the SBM, along the SMA and the transverse mesocolon [50]. Neural plexus invasion is recognized on CT scans as an areas of soft tissue cuffing or stranding around the SMA (Fig. 16) [50].

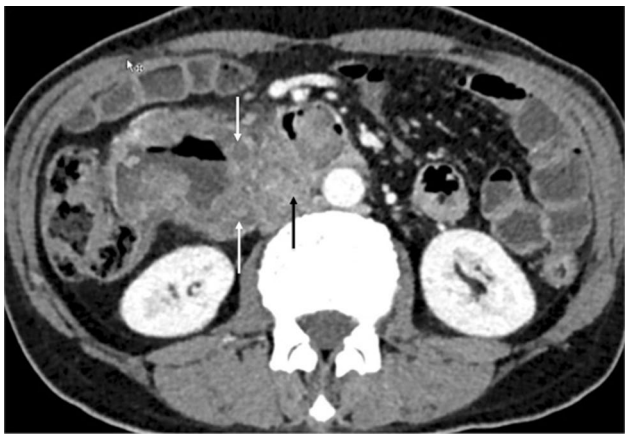

Fig. 12 Carcinoma of the second part of duodenum in a 56-year-old male presenting with abdominal pain and loss of appetite. Axial contrast-enhanced CT image showing heterogeneously enhancing wall thickening of the second part of the duodenum (white arrows) with contiguous infiltration into the mesenteric root (black arrow)

Fig. 13 Carcinoma of the head of pancreas in an 85-year-old female presenting with progressive jaundice. Axial contrast-enhanced CT image showing an ill-defined hypodense mass in the pancreatic head extending into the mesenteric root (white arrows) with upstream dilatation of the main pancreatic duct (black arrow)

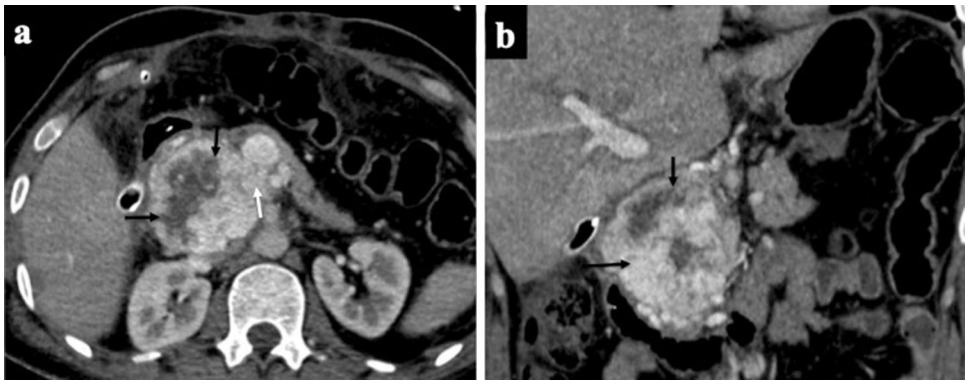

Fig. 14 Neuroendocrine tumor of the head of pancreas in a 40-year-old male presenting with abdominal pain and weight loss. Axial (**a**) and coronal (**b**) contrast-enhanced CT images showing an intensely enhancing mass in the pancreatic head (black arrows) extending into the mesenteric root and abutting the superior mesenteric vessels (white arrow)

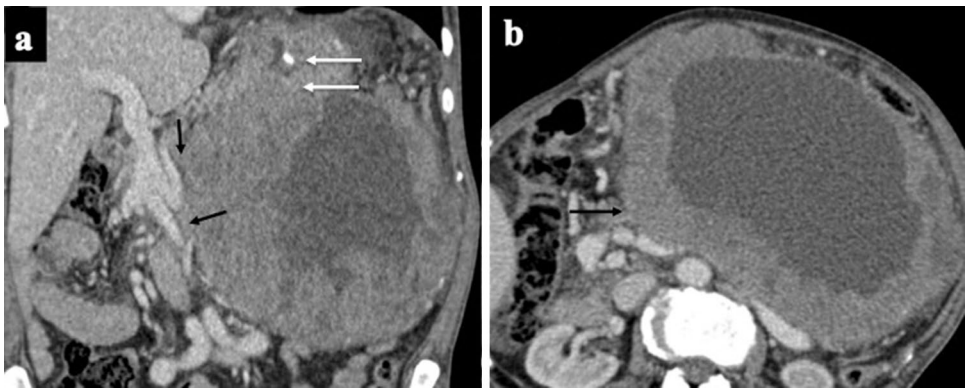

Fig. 15 Gastro-intestinal stromal tumor (GIST) in a 70-year-old male. Coronal (**a**) and axial (**b**) contrast-enhanced CT images showing a heterogeneously enhancing mass arising from the greater curvature (white arrows) of the stomach and involving the mesenteric root (black arrows)

Extension along neighboring ligaments

Pancreatic cancer usually extends to the RSBM and its ligaments, like the hepatoduodenal ligament, splenorenal ligament, and gastrosplenic ligament, directly or via the transverse mesocolon [5]. Moreover, hepatobiliary or gastroduodenal cancer can involve the RSBM via the hepatoduodenal ligament. Carcinoma of the descending colon or retroperitoneal sarcomas involve the RSBM via the transverse mesocolon or descending mesocolon [51].

Extension along lymphatic vessels

Lymphatic spread is also a common mode of spread of tumors in the mesentery and mesenteric root usually manifested by the enlargement of local mesenteric nodes (Figs. 17, 18). The nodes may be homogeneous or necrotic, and discrete or conglomerate depending on the etiology.

Lymphoma

The most common malignancy affecting the mesentery and its root is lymphoma. Approximately half of the patients with non-Hodgkin lymphoma present with enlarged mesenteric lymph nodes. Chronic lymphocytic leukemia can

Fig. 16 Peri-neural spread of cholangiocarcinoma in a 36-year-old female. Axial contrast-enhanced CT image showing homogenous soft tissue around the superior mesenteric artery (black arrows). Primary tumor is not shown in the figure

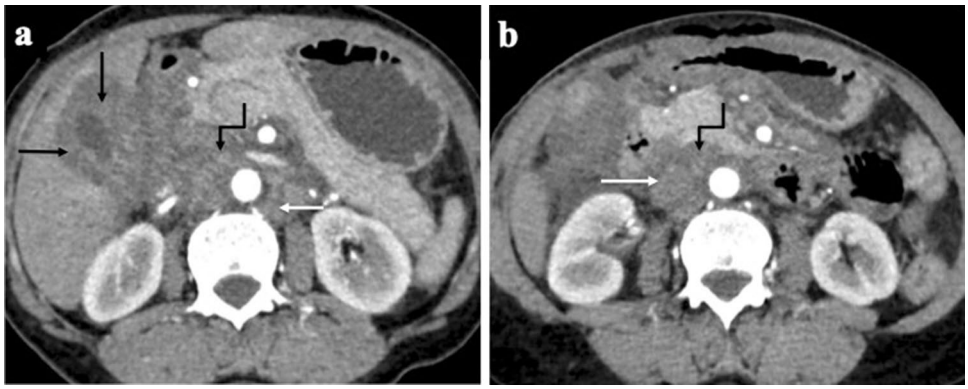

Fig. 17 Metastatic lymph nodes in the mesenteric root in a 42-year-old female patient of carcinoma of the gall bladder. **a** Axial contrast-enhanced CT image showing diffuse wall thickening of the gall bladder (black arrows). **b** Multiple necrotic lymph nodes are seen in the mesenteric root (Curved black arrow) and in the aorto-caval and para-aortic regions (white arrows)

Fig. 18 Metastatic lymphadenopathy in the mesenteric root in a 25-year-old patient with seminoma of the testis. Axial contrast-enhanced CT image showing a homogenously enhancing conglomerate lymph nodal mass in the mesenteric root and in the retroperitoneum (white arrows), displacing the superior mesenteric artery (black arrow) and encasing the abdominal aorta (curved black arrow)

also produce marked mesenteric lymphadenopathy [52]. On MDCT, multiple well-defined, discrete, or coalesced homogenous nodes are seen, that encase the mesenteric vessels to produce the "sandwich sign" [53] (Fig. 19). Post chemotherapy, necrosis and calcification can be seen in these nodes. Coexisting retroperitoneal lymphadenopathy strongly favors the diagnosis of lymphoma [54].

Other malignancies

Other malignancies like lung cancer, breast cancer, ovarian cancer, and melanoma can metastasize to the mesenteric lymph nodes. However, these nodes show a lesser degree of enlargement compared to that seen in lymphoma [52].

Non-neoplastic causes

Tuberculosis, atypical mycobacterial infection and many bacterial infections can produce mesenteric lymphadenopathy [55]. A useful differentiating feature from lymphoma is that lymph nodes in these conditions are discrete and localized. Tubercular nodes show peripheral rim enhancement with central necrosis (Fig. 20) [55]. Low attenuation discrete nodes are seen in Whipple's disease. Hyperenhancing nodes are seen in Castleman disease [56]. Sarcoidosis, celiac sprue, Crohn's disease are some inflammatory diseases that can cause mesenteric lymphadenopathy.

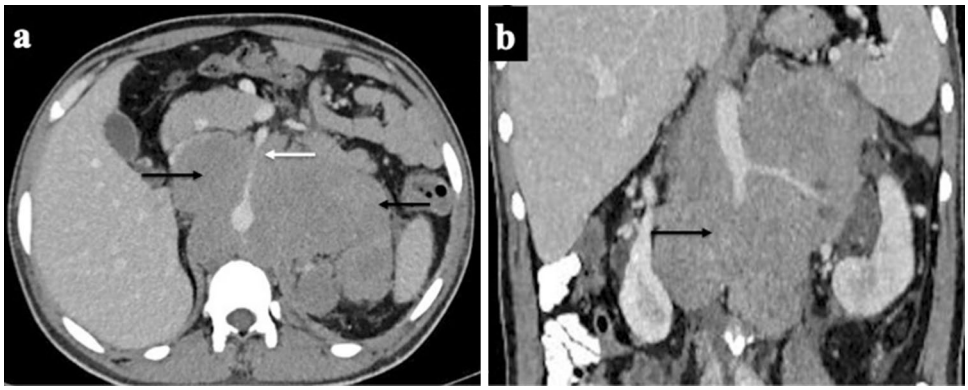

Fig. 19 Non-Hodgkin lymphoma (NHL) in 45-year-old male with abdominal pain. Axial (**a**) and coronal (**b**) contrast-enhanced CT images showing a homogenously enhancing mass in the mesenteric root (black arrows) encasing the superior mesenteric artery (white arrow)

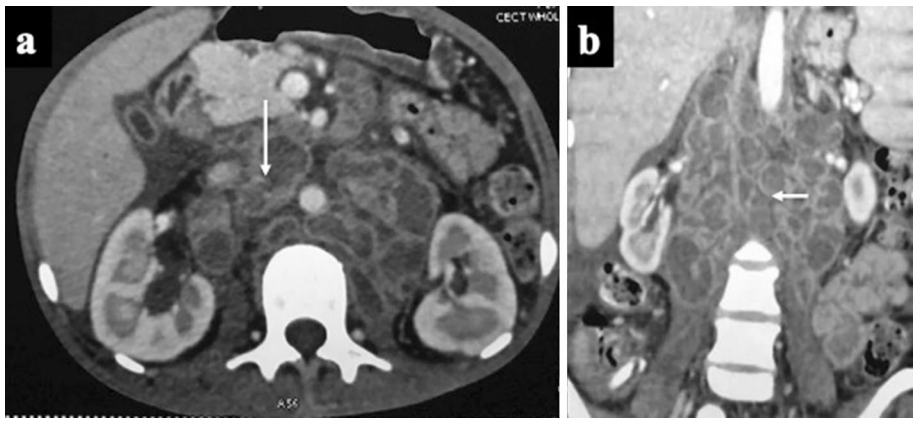

Fig. 20 Tuberculosis in a 32-year-old female presenting with fever and weight loss. Axial (**a**) and coronal (**b**) contrast-enhanced CT images showing multiple conglomerate nodes in the mesenteric root with central necrosis and peripheral rim enhancement, suggestive of tuberculosis (white arrows)

Conclusion

RSBM is the line of attachment of SBM to the posterior abdominal wall and communicates with the retroperitoneal space. It forms a route for the spread of multiple pathologies in the abdomen. It is involved by numerous primary and secondary pathologies. MDCT occupies the center stage in the evaluation and characterisation of these pathologies and in guiding proper management.

Compliance with ethical standards

Conflict of interest We authors declare that there are no disclosures to make.

Ethical approval This review article does not need IRB clearance.

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