

The “creeping fat sign”—really diagnostic for Crohn’s disease?

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Abstract

Background Focal or regionally prominent mesenteric fat adjacent to wall-thickened bowel loops can be readily identified by computed tomography. The so-called creeping fat of the right lower quadrant is usually considered to be an important clue for diagnosing Crohn’s disease. However, when the sign is isolated, indistinct, and not set in the proper clinical context, the radiologist should consider other inflammatory conditions of the bowel and its appendages.

Conclusion Controlled studies are needed to confirm the diagnostic use of the “creeping fat sign” in clinical practice.

Keywords Crohn’s disease · Ulcerative colitis · Indeterminate colitis · Sclerosing mesenteritis · Omental infarction

Introductory section

The “creeping fat sign” or fat wrapping refers to the fibrofatty proliferation of mesenteric tissue adjacent to chronic-inflamed bowel loops and has been considered to be a finding characteristic of Crohn’s disease. The sclerolipomatous mesentery may increase in volume by 30% to 40% as compared to normal tissue. It is usually related to mural thickening of the affected bowel segment, transmural inflammation, co-existing lymphadenopathy, and—less constantly—ring-like submucosal fat deposition. The term “creeping” describes the extension of the mesenteric

proliferation towards the root of the mesentery. However, it is not restricted to the abdominal cavity, as creeping fat has been described in the subcutaneous adipose tissue of a patient suffering from vasculitis, too [1].

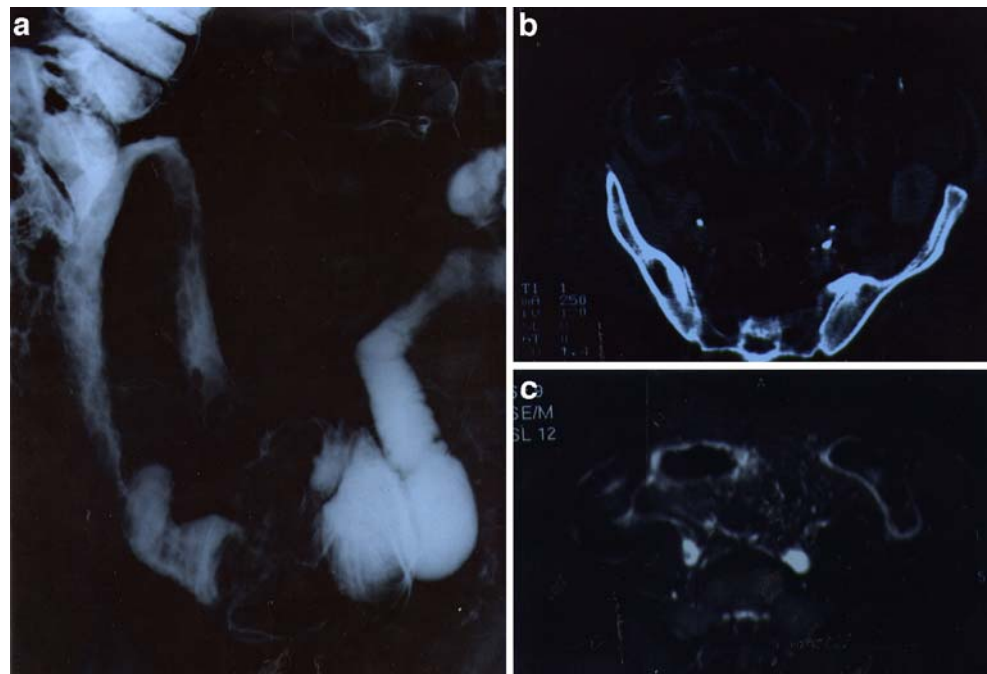
Adipose tissue has recently been defined as a real endocrine organ. A wide variety of products such as adipocytokines, chemokines, leptin, and resistin are expressed and secreted by adipocytes. The metabolic and biochemical properties of visceral adipose tissue make it interesting in the context of intestinal and mesenteric diseases, notably Crohn’s disease, whose pathogenesis may be influenced by pro- and anti-inflammatory adipose-derived secretory products. Schäffler et al. [2] identified creeping fat as a source of increased RANTES/CCL5 and interleukin-10 production in Crohn’s disease when compared to mesenteric adipose tissue specimens resected in patients with colon cancer and diverticulitis. However, the elevated secretion rates turned out to be caused by steroid treatment and not to be attributable to a Crohn’s-disease-specific effect. Just the opposite is true for VEGF [3]. Overall, creeping fat is an important source of VEGF secretion. But Crohn’s disease patients treated with steroids have consistently lower VEGF secretion rates than Crohn’s disease patients not receiving steroids. Surprisingly, in simple diverticulitis, VEGF secretion is down-regulated for unknown reasons.

Imaging features

Fluoroscopy-guided barium studies enable at best indirect evidence of mesenteric fibro-fatty proliferation (Fig. 1). Severe luminal narrowing (“string sign”) of terminal ileum and ascending colon is usually accompanied by displacement of the neighboring bowel loops (“Ω sign”). The

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Fig. 1 The “creeping fat sign”: imaging features.
a Conventional radiography (enteroclysis): luminal narrowing and displacement of the neighboring bowel loops by mesenteric fibro-fatty proliferation (male, 25 years, Crohn’s disease). **b** Computed tomography (axial, enhanced): edematous fatty mass surrounding the wall-thickened and dilated bowel loops (male, 48 years, indeterminate colitis). **c** Magnetic resonance tomography (axial, T1w SPIR, gadolinium-enhanced): abundant mesenteric fat adjacent to inflamed bowel loops (female, 40 years, Crohn’s disease)



interior of the subsequent concavity is considered to be occupied by edematous fat, fibrous tissue, and lymph nodes. CT shows the focal or regionally prominent mesenteric fat adjacent to bowel with a thickened wall precisely. Inflamed mesenteric nodes may sometimes be identified within the fatty mass. MRI is usually inferior to CT in delineating creeping mesenteric fat. Moreover, the inflammatory activity of the bowel wall as determined by contrast-enhanced dynamic MRI seems to be independent of the presence of focal fat proliferation and lymphadenitis [4]. In view of the high degree of radiation exposure by CT scanning, ultrasound should be performed prior to CT despite its inherent restrictions. In select cases, in which radiographic, sonographic, and endoscopic studies are inconclusive for Crohn’s disease, laparoscopy can be useful to correctly diagnose and treat terminal ileitis [5].

Differential diagnosis

For a long time, mesenteric fatty proliferation has been thought of as a pathological finding reported only for Crohn’s disease. Miller et al. [6] described six children

suspected for Crohn’s disease and undergoing laparoscopy, after other studies were inconclusive. In three patients, creeping mesenteric fat of the small intestine was found, and all responded well to treatment for Crohn’s disease. The other three children had Crohn’s disease excluded based on the absence of creeping mesenteric fat, and subsequently other pathological conditions were identified. Certainly, this exclusiveness applies only to its apparent forms and to long-standing Crohn’s disease. Minor as well as atypical variants have been noticed in a variety of bowel disorders and diseases of other abdominal organs (Table 1).

Ulcerative (indeterminate) colitis

Ulcerative colitis may be complicated by a fibro-inflammatory lesion of the intra-abdominal fat tissue, namely, the perirectal fat that is characterized by a spindle cell proliferation of myofibroblastic origin. This entity has been called sclerosing panniculitis [7]. The accompanying hypervascularity is displayed on contrast-enhanced CT as dilatation, tortuosity, and wide spacing of the mesenteric vessels. Indeterminate colitis is referred to a variety of inflammatory bowel disease in which there is difficulty distinguishing between ulcera-

Table 1 Creeping fat: differential diagnosis of underlying diseases

Common	Less common	Rare
Crohn’s disease	Ulcerative (indeterminate) colitis Mesenteric panniculitis Epiploic appendagitis Omental infarction	Sclerosing panniculitis Sclerosing mesenteritis Gastrointestinal complications in renal transplant recipients Idiopathic segmental ureteritis

tive colitis and Crohn's disease [8]. These aspects include linear ulcers, fissures, necroses of the muscular layers, and transmural inflammation, and also creeping mesenteric fat. Indeterminate colitis represents 5% to 10% of chronic inflammatory bowel diseases originally categorized as ulcerative colitis.

Sclerosing mesenteritis

Sclerosing mesenteritis is a rare inflammatory condition of unknown origin that affects predominantly the root of the mesentery [9]. Exceptionally, the periphery as well as the mesocolon may be concerned. The mesenteric fat is involved with a variable amount of inflammation, necrosis, fibrosis, and subsequent encasement of the vessels. Scarring and retraction may result in the development of mesenteric varices as well as ischemia and obstruction of small bowel loops. The chronic form is also referred to as retractile mesenteritis. CT displays a poorly defined mass of soft tissue attenuation producing tiny streaks extending into the abutting fat. Its appearance may also be indistinguishable from that of a carcinoid tumor metastatic to the mesentery and lymphoma.

Mesenteric panniculitis

Unlike sclerosing panniculitis, mesenteric panniculitis is a mostly acute inflammatory disorder not associated with a predisposing condition. Its pathological basis consists in extensive necrosis of the root of the mesentery with subsequent partly diffuse, partly nodular fibrosis. On CT, the disease appears as a solitary well-defined mass of inhomogeneous fatty tissue displacing the adjacent bowel loops. Areas of fibrosis within the inflamed fat appear as linear bands of soft tissue attenuation, an appearance that has been described as "misty mesentery" [10]. Well-defined solid nodes are scattered throughout the mass. Fatty halos surrounding the superior mesenteric vessels without lumen narrowing are a typical but non-specific additional finding, as they are also seen in lymphoma. MRI enables detection of a thin pseudocapsule [11].

Epiploic appendagitis

Epiploic appendages are susceptible to torsion and following ischemic or hemorrhagic infarction due to their pedunculated shape, disproportionate mobility, and restricted blood supply. Infarction results in a focal inflammatory process. Thus, the adjacent mesentery may be involved to a varying degree. CT displays a paracolic oval-shaped mass representing the infarcted appendix epiploica and mild focal thickening and hyperattenuation of the adjacent bowel wall and peritoneal layer. The thrombosed central vessels are rarely visualized. Perifocal fat straining may be pronounced

[12]. Color Doppler sonography may be helpful in delineating the condition [13]

Omental infarction

The pathophysiology of omental infarction corresponds to that of epiploic appendagitis. Torsion or spontaneous venous thrombosis induce critical ischemia of part of the greater omentum, clinically imitating cholecystitis or appendicitis. The right-sided predilection of segmental omental infarction is related to embryologic vascular development which favors right-sided thrombosis [14]. CT demonstrates an inhomogeneous roundish cake-like mass adjacent to the colon and exerting some displacement [15]. Reactive colonic wall thickening is usually slightly relative to the degree of omental abnormality. In the absence of an informative medical history, pre-necrotic omental tissue may be mistaken for creeping fat.

Gastrointestinal complications in renal transplant recipients

Colonic lesions are the most common conditions encountered in gastrointestinal morbidity of renal transplant recipients. Moreover, they are the most fatal ones [16]. The simple most common morphologic diagnosis is segmental ischemic colitis. It may be localized not only at the left colic flexure but also in the right lower quadrant and resemble small bowel inflammatory disease. Lesions are segmental; involved bowel is erythematous and thickened and encircled by creeping peritoneal fat. Viral infections account for more than 25% of the colonic complications.

Idiopathic segmental ureteritis

Tripp et al. [17] give a detailed report on a case of idiopathic segmental ureteritis that presented pathological criteria mimicking Crohn's disease. Apart from mucosal ulceration, transmural chronic fibrosing inflammation, and prominent lymphoid follicles, they discovered "creeping fat" of the ureter involved. As it may be occasionally difficult to distinguish retroperitoneal from mesenteric fat on CT, this nosological entity should be kept in mind when judging pre- and paravertebral focal fatty proliferation.

Conclusion

Extra-parenchymatous fat-containing masses of the abdomen and pelvis represent a broad spectrum of diseases. As long as they are well-defined, the differential diagnosis is usually restricted to fat-containing benign and malignant neoplasms. If fatty proliferation is diffuse and affects mainly the mesentery, inflammatory processes and inflam-

matory complications of underlying other conditions prevail. The most prominent example of mesenteric fatty proliferation is the “creeping fat” adjacent to inflamed bowel loops of the distal ileum. If well marked and set in the proper clinical and radiological context, this sign is virtually pathognomonic of Crohn’s disease. However, when the phenomenon is less pronounced and/or not allied to characteristic features of Crohn’s disease, one should take other inflammatory conditions of the bowel (e.g., indeterminate colitis) as well as the mesentery (e.g., panniculitis) and of adjacent tubular structures (e.g., ureteritis) into consideration. Knowledge of the diseases that can be characterized by creeping fat helps to avoid too early a radiologic diagnosis of the patient’s condition.

Up to now, CT has been the modality of choice to outline mesenteric fat proliferation in the vicinity of inflamed bowel loops. With the ever increasing use of MR imaging, CT will probably be replaced more and more in future. The value of ultrasound exams for delineating creeping fat is limited, even if advanced techniques will be employed.

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