Clinical History:

A 41-year-old man underwent emergent exploratory laparotomy after left hypochondrium penetrating trauma, which showed hemoperitoneum with gastric perforation, transverse mesocolon laceration and inferior mesenteric artery section. During a long postoperative period the patient developed persistent symptoms of intestinal obstruction that led to several CT and a relaparotomy.

Imaging Findings:

On 7th-day patient developed abdominal distension and recurrent vomiting. CT performed on 12th-day (Fig.1) revealed gastroduodenal obstruction with transition point in proximal jejunum.

Given the lack of improvement surgery was performed on 18th-day. Re-laparotomy revealed multiple hard, stony adhesions over previous surgical bed.

Persistent intestinal obstruction symptoms led to a new CT on 35th-day (Fig.2) that showed findings consistent with heterotopic mesenteric ossification. Due to the technical difficulties in the previous surgery, a conservative management course was pursued through total parenteral nutrition, bisphosphonates and steroids. Progressive clinical improvement was observed, and oral tolerance was successfully reintroduced on 42nd-day. The patient was discharged in good condition on 60th-day.

Follow-up CT (Fig.3) 11 months after showed progression of ossification with extensive formation of cortical and trabecular bone in previously affected areas, although the patient had remained asymptomatic. He was followed up
Discussion:

Heterotopic ossification (HO) is the formation of bone in the soft tissues. Heterotopic bone formation in mesentery is an extremely rare form of HO with approximately 50 reported cases in the literature.[1] The ossification of the abdominal scar is more common than heterotopic mesenteric ossification (HMO), although the incidence of these entities is unknown.

The pathophysiology of HO is not well established, although it has been postulated to be due to osteoblastic metaplasia of multipotent mesenchymal cells in response to severe inflammatory stimulus due to trauma, or occasionally it can also be due to traumatic or surgical implantation of bone or periosteum into the soft tissue.[2]

HMO occurs predominantly in men, usually in mid to late adulthood. In nearly all of the cases described, abdominal surgery or trauma preceded HMO and most patients present with bowel obstruction or fistula, [3] although asymptomatic cases have been reported.[1]

The time frame from initial injury to heterotopic bone formation is unknown. The clinical symptoms usually appear 2 or 3 weeks after abdominal trauma or surgery (range, 4 days to 2 years). [4]

Radiologically, HMO characteristically manifests in its early stages as multiple linear and branching, high attenuating structures within the mesentery and omentum. Over time these high-attenuating structures mature into bone with a discernible trabecular and cortical architecture, often with central fatty marrow. Many of these lesions displayed a “wishbone” or “bird’s foot” morphology. [5] Recognition of this finding allows a confident and accurate diagnosis of HMO. It should be differentiated from other entities such as oral contrast leakage, active extravasation of intravascular contrast from bleeding vessels, retained surgical material and dystrophic calcification within mesenteric neoplasms, particularly mucinous neoplasms and carcinoid tumours.[5]

Because HMO is a rare entity, the optimal treatment strategy is not established. In asymptomatic cases, watchful waiting is recommended. Surgical intervention is reserved for symptomatic patients because of the concern that HO will recur and possibly worsen with repetitive surgery.[6] Besides, surgical intervention with complete excision of ossified tissue has been shown to be associated with significant morbidity and mortality.[7] Pharmacologic agents including nonsteroidal anti-inflammatory drugs (NSAIDs, in particular indomethacin), bisphosphonates, or even radiotherapy after surgery have been used to reduce local recurrence.[6] In our case, the conservative treatment including bisphosphonates and steroids successfully solved the intestinal obstruction, avoiding another surgical operation, but heterotopic ossification continues progressing.

Written informed patient consent for publication has been obtained.

Differential Diagnosis List:  
HETEROTOPIC MESENTERIC AND ABDOMINAL MIDLINE INCISION OSSIFICATION, Oral contrast leakage, Active extravasation of intravascular contrast from bleeding vessels, Retained surgical material, Dystrophic calcification within mesenteric neoplasms, particularly mucinous neoplasms and carcinoid tumours.

Final Diagnosis:  HETEROTOPIC MESENTERIC AND ABDOMINAL MIDLINE INCISION OSSIFICATION

References:

Description: Axial contrast-enhanced CT image shows gastric (G) dilatation. Note also the increased density of the properitoneal fat underlying the abdominal midline scar (open arrows). Origin: Radiology Emergency Department of Hospital Universitario 12 de Octubre. Madrid. Spain.
**Description:** Axial contrast-enhanced CT image demonstrates gastroduodenal obstruction with duodenal (D) dilatation and transition point in proximal jejunal loops (arrow), which show diffuse wall thickening and small wedges of fluid (*) between them. **Origin:** Radiology Emergency Department of Hospital Universitario 12 de Octubre. Madrid. Spain.
Description: MPR sagittal reconstruction shows increased density of the properitoneal fat underlying the abdominal midline scar (open arrows), without calcifications or ossifications. Origin: Radiology Emergency Department of Hospital Universitario 12 de Octubre. Madrid. Spain.
Description: Axial CT image with positive oral and intravenous contrast demonstrates gastric (G) distension and extensive ossification of abdominal midline scar (open arrows) with cortical and trabecular bone pattern clearly seen. Origin: Department of Emergency Radiology, Hospital Universitario 12 de Octubre, Madrid, Spain.
**Description:** Axial CT image demonstrates gastroduodenal obstruction with duodenal (D) distension and collapsed jejunal loops, which showed a distorted and encapsulated appearance (circle) as well as with linear and branching calcifications in perivisceral mesentery. **Origin:** Department of Emergency Radiology, Hospital Universitario 12 de Octubre, Madrid, Spain.
Description: Axial CT image with positive oral and intravenous contrast shows the linear calcification on the small bowel mesentery (circle) Origin: Department of Emergency Radiology, Hospital Universitario 12 de Octubre, Madrid, Spain.
**Description:** MPR sagittal reconstruction depicts the linear calcification on the small bowel mesentery (arrows)

**Origin:** Department of Emergency Radiology, Hospital Universitario 12 de Octubre, Madrid, Spain.
Description: MPR sagittal reconstruction shows the progression of the ossification of the abdominal midline incision (arrows) Origin: Department of Emergency Radiology, Hospital Universitario 12 de Octubre, Madrid, Spain.
Description: Axial CT image with positive oral contrast depicts a greater maturation of the mesenteric bone lesion with formation of cortical and trabecular bone (arrows) Origin: Department of Emergency Radiology, Hospital Universitario 12 de Octubre, Madrid, Spain.
Description: Axial CT image with positive oral contrast depicts a greater maturation of the mesenteric bone lesion with formation of cortical and trabecular bone (arrows) Origin: Department of Emergency Radiology, Hospital Universitario 12 de Octubre, Madrid, Spain.
Description: Axial CT image with positive oral contrast and bone window demonstrates the presence of cortical and trabecular bone in the mesentery (arrows) Origin: Department of Emergency Radiology, Hospital Universitario 12 de Octubre, Madrid, Spain.
Description: Maximum intensity projection image with thick slice and bone window demonstrates the heterotopic mesenteric (solid arrows) and midline scar (open arrow) ossifications. Origin: Department of Emergency Radiology, Hospital Universitario 12 de Octubre, Madrid, Spain.
**Description:** CT with volume rendering technique clearly illustrates the heterotopic mesenteric (open arrows) and midline scar (solid arrow) ossifications. Note the similar appearance of the heterotopic mesenteric and abdominal midline incision ossification that the bone skeleton. **Origin:** Department of Emergency Radiology, Hospital Universitario 12 de Octubre, Madrid, Spain.
Description: Abdominal radiograph 3 years later showing mesenteric ossification on the left flank (arrows). Origin: Department of Emergency Radiology, Hospital Universitario 12 de Octubre, Madrid, Spain.