REVIEW ARTICLES

MESENTERIC PANNICULITIS

PART 1: MDCT - PICTORIAL REVIEW

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Mesenteric panniculitis is an uncommon benign inflammatory condition of unknown etiology that involves the adipose tissue of the mesentery and for which an extremely varied terminology has been used, causing considerable confusion. It can be evaluated as a single disease with two pathological subgroups: Mesenteric Panniculitis (MP), representing the very large major subgroup where inflammation and fat necrosis predominate and Retractile Mesenteritis (RM), much rarely found, where fibrosis and retraction predominate. In histo-pathological terms the preferred terminology is sclerosing mesenteritis. We hereby extensively illustrate the characteristic MDCT findings of MP through pictures selected among a collection of cases constituted over a 5-year period. All patients were scanned with 64-row MDCT equipment. We also review the literature and discuss the differential diagnosis.
The radiological diagnosis of MP was based on classical CT signs described in the literature and comprising: the presence of a well-defined "mass effect" on neighbouring structures (sign 1) constituted by mesenteric fat tissue of inhomogeneous higher attenuation than adjacent retroperitoneal or mesocolonic fat (sign 2) and containing small soft tissue nodes (sign 3). It may typically be surrounded by a hypoattenuated fatty "halo sign" (sign 4) and an hyperattenuating pseudocapsule may also surround the all entity (sign 5). The last two signs are considered inconstant but very specific. The absence of histological verification constitutes the weakness of our study.
The differential diagnosis of MP is extensive and includes all disorders that can affect the mesentery. The most common ones are lymphoma, well-differentiated liposarcoma, peritoneal carcinomatosis, carcinoid tumor, retroperitoneal fibrosis, lipoma, mesenteric desmoid tumor, mesenteric inflammatory pseudotumor, mesenteric fibromatosis and mesenteric edema.
PET/CT is proved useful to correctly exclude mesenteric tumoral involvement in patients presenting with typical MP. The course of MP is favorable in most cases and progression of MP to retractile mesenteritis not only appears very being rare but finally remains doubtful.

Key-words: Mesentery, diseases – Mesentery, CT.

Mesenteric Panniculitis (MP) is an uncommon benign inflammatory condition of unknown etiology that involves the adipose tissue of the mesentery and for which an extremely varied terminology has been used, causing considerable confusion. Now it can be evaluated as a single disease with two pathological subgroups: Mesenteric Panniculitis (MP), representing the very large majority subgroup where inflammation and fat necrosis predominate and Retractile Mesenteritis (RM), rarely found, where fibrosis and retraction predominate. In histo-pathological terms the preferred terminology is Sclerosing Mesenteritis. We hereby extensively illustrate the characteristic MDCT findings of MP through pictures selected among a collection of cases constituted over a 5 years period. All patients were scanned with 64-row MDCT machines. We also review the literature and discuss the differential diagnosis.

Material

The material of this CT pictorial review consists of illustrations chosen among a wide collection of cases constituted over a 5-year-period in our department of medical imaging. Most presented images were obtained with two different 64-row MDCT machines (Lightspeed Ultra and Lightspeed VCT, General Electric, Wisconsin). The collimation was 64 x 0.65 mm with a pitch comprised between 0.516 and 1.375. The 1.25/0.65 mm or 1.25/1.25 axial series were used for axial cineview analysis and dynamic MPR on a Workstation (Advantage Workstation 4.3 and 4.4, General Electric, Wisconsin).

Discussion

Generalities

Mesenteric panniculitis is a benign fibrosing and inflammatory condition that involves the adipose tissue of the mesentery (1-4). This uncommon disorder of unknown etiology is likely underdiagnosed (5). It was first described by Jura (6) in 1924 as "Retractile Mesenteritis" and further labeled as "Mesenteric Panniculitis" by Odgen (7) later in the 1960s. Only few large series have been reported and the literature comprises mainly case reports and studies of small series (8-10). Currently, the pathology has several names: sclerosing mesenteritis, mesenteric lipodystrophy, mesenteric panniculitis, mesenteric sclerosis, retractile mesenteritis, mesenteric Weber-Christian disease, liposclerotic mesenteritis, lipomatosis and lipogranuloma of the mesentery (1, 3, 4, 11-14). This varied terminology has caused considerable confusion (3) but the condition can now be evaluated as a single disease with two pathological subgroups: if

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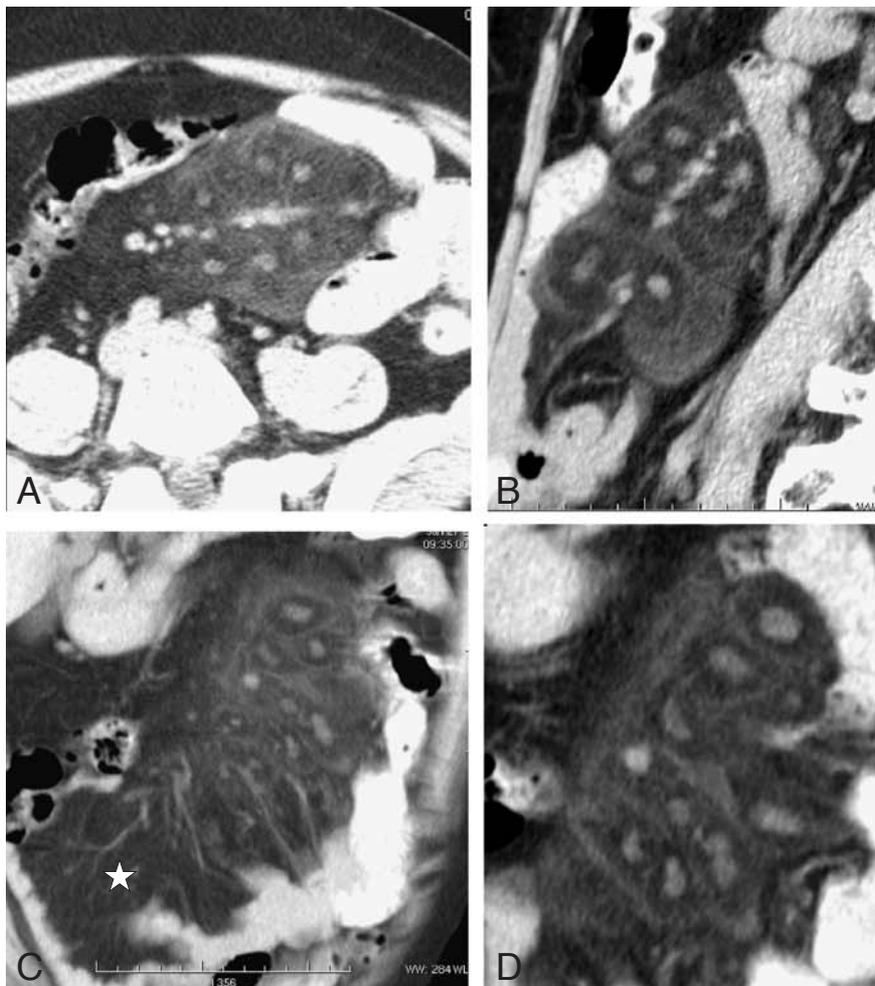E-mail: bcoulier@skynet.be

Fig. 1. — A: axial, B: sagittal and C,D coronal oblique MPR views of a very marked MP found in a 61 year-old man presenting with nonspecific abdominal pain; in this case panniculitis was considered as being idiopathic and unrelated to the spontaneously resolving abdominal pain. All typical signs are found comprising a mass effect, a peripheral pseudocapsule, numerous little hazy and hypodense nodes and a very increased density of fat enlightening the perinodal halo phenomenon. The ileal mesentere typically looks normal (white star).

inflammation and fat necrosis predominate over fibrosis, the condition is known as Mesenteric Panniculitis (MP), and when fibrosis and retraction predominate, the result is Retractile Mesenteritis (RM) (3, 15). MP, the very most frequent and benign situation, could thus represent a sort of "acute" grade of the disease and RM the "chronic" grade but the real kinship between the two entities remains doubtful and speculative (16).

In histo-pathological terms, the preferred terminology is sclerosing mesenteritis (2, 10, 12, 17). It represents the more accurate terme because of the presence of some degree of fibrosis as a common denominator (3, 17). With its different forms of expression slerosing mesenteritis is grouped among idiopathic fibrosclerotic disorders and inflammatory pseudoneoplasms, which include entities such as retroperitoneal fibrosis, sclerosing cholangitis, Riedel's thyroiditis, and orbital pseudotumor. The exact nosologic and pathologic relationships of sclerosing mesenteritis to these disorders are unknown. What unifies these conditions is that they are all masses leading to displacement of surrounding structures or to organ dysfunction caused by compressive growth, and all have histologic findings limited to chronic inflammation and fibrosis (17). Clear statistics based on a real histological proof are unfortunately lacking in the literature. Clinical links may also exist, because many of the conditions coexist in a single patient or have familial trends. Suggested causes are many and varied, with autoimmunity commonly suggested.

The evolution of the disease has been described in three stages (1, 5, 18-19). Stage 1 is mesenteric lipodystrophy, in which mesenteric fat is replaced by sheets of foamy macrophages. Acute inflammatory signs are minimal or non-existent. The disease tends to be clinically asymptomatic and prognosis is good. Stage 2 is mesenteric panniculitis, characterized by inflammatory changes and lymphatic distension with early fibrosis. Histology reveals an infiltrate made up of plasma cells and a few polymorphonuclear leukocytes, foreign-body giant cells, and foamy macrophages. This may be the beginning of symptomatic presentation. Finally, stage 3 is the rare retractile mesenteritis , which shows collagen deposition, fibrosis, and inflammation. Collagen deposition leads to scarring and retraction of the mesentery, which in turn, leads to the formation of abdominal masses and obstructive symptoms. The clear proof of a real kinship between theses three stages is difficult to find in the literature and thus remains doubtful. For this reason, it is our opinion that it is probably better to speak about three types than about three stages of a disease.

Most studies have indicated that the disease is more common in men with a male/female ratio of 2-3:1, more frequent between the 6th and 7th decades of life and several reports have indicated it to be more common in Caucasian men (1, 3, 5, 8, 11, 19). Pediatric cases are exceptional, probably because children have less mesenteric fat when compared to adults.

Its prevalence in abdominal CT examinations has been estimated at approximately 0.6%, commonly appearing as an incidental finding, mostly in middle or late adulthood (3, 12, 14).

The vast majority of cases of Sclerosing Mesenteritis (SM) (comprising the large majority subgroup of MP) are considered as idiopathic and benign (8). The pathogenic mechanism of MP could be a nonspecific response to a wide variety of stimuli (1). Although various causal factors have been identified, the precise etiology remains unknown. The disease is related to many other factors, such as trauma, prior abdominal surgery, mesenteric thrombosis, mesenteric arteriopathy, vasculitis, carcinoid, gardner syndrome, drugs, thermal or chemical injuries, granulomatous disease, avitaminosis, autoimmune disease, rheumatic disease, retained suture material, pan-
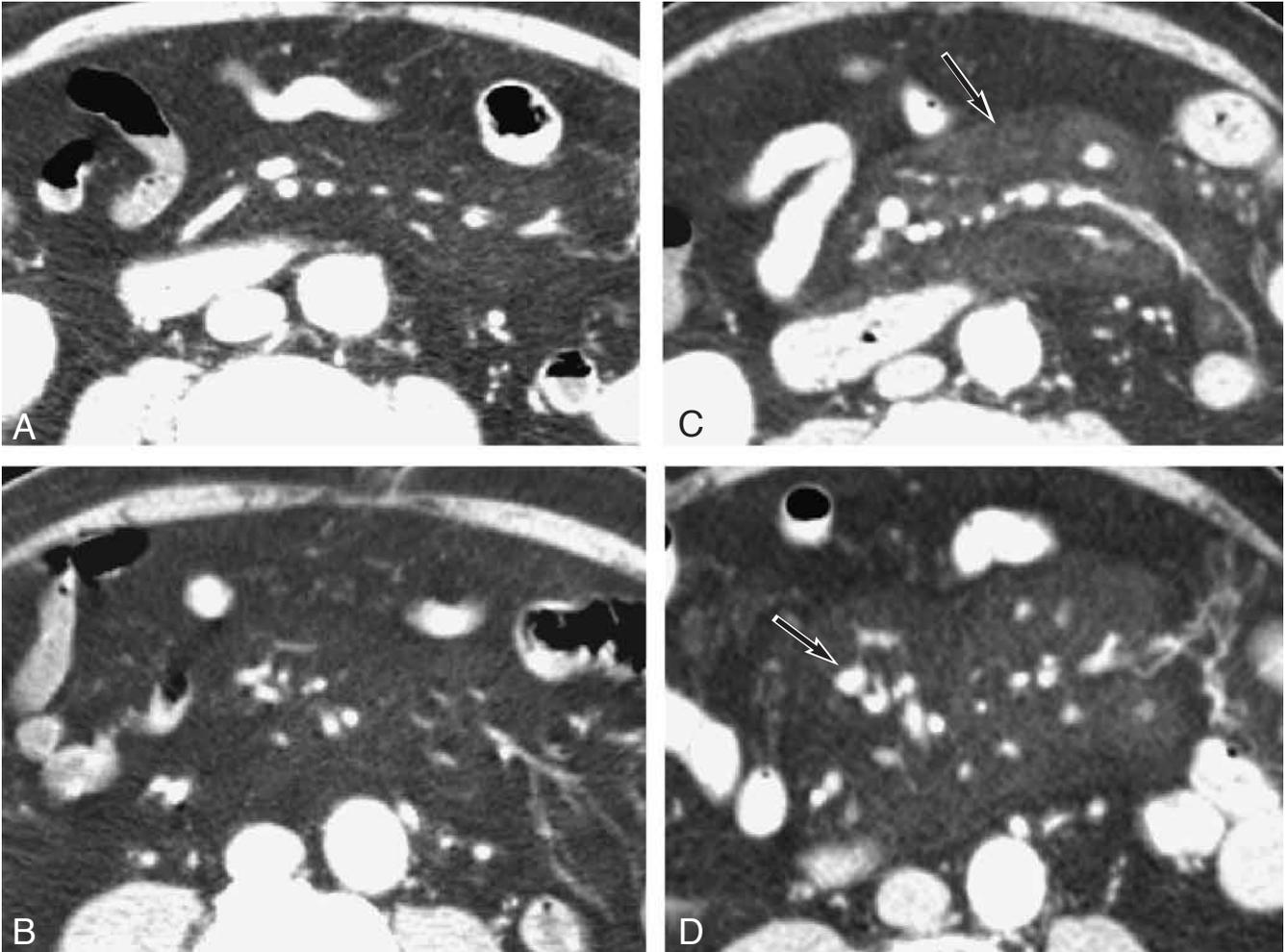
Fig. 2. — A-B and C-D represent two groups of axial views of the mesenteric area obtained within an interval of 14 months in a 50 year-old patient presenting with recurrent colonic diverticulitis. Typical asymptomatic mesenteric panniculitis has developed during the period (black arrows).
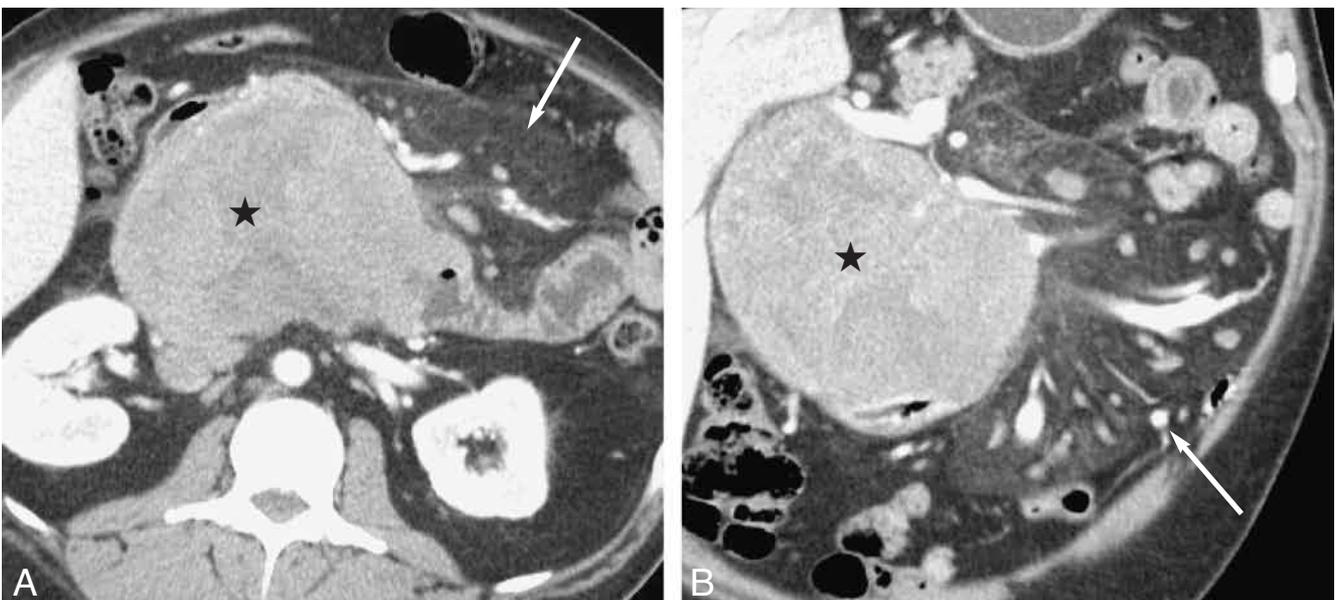

Fig. 3. — A: axial and B: coronal oblique MPR views in a 50-year old male presenting with simultaneous massive duodenal lymphoma (black star) and typical mesenteric panniculitis (white arrow). On follow studies (not illustrated) lymphoma will drastically regress under chemotherapy but panniculitis will remain unchanged. All typical sings are present including the presence of a pseudocapsule.
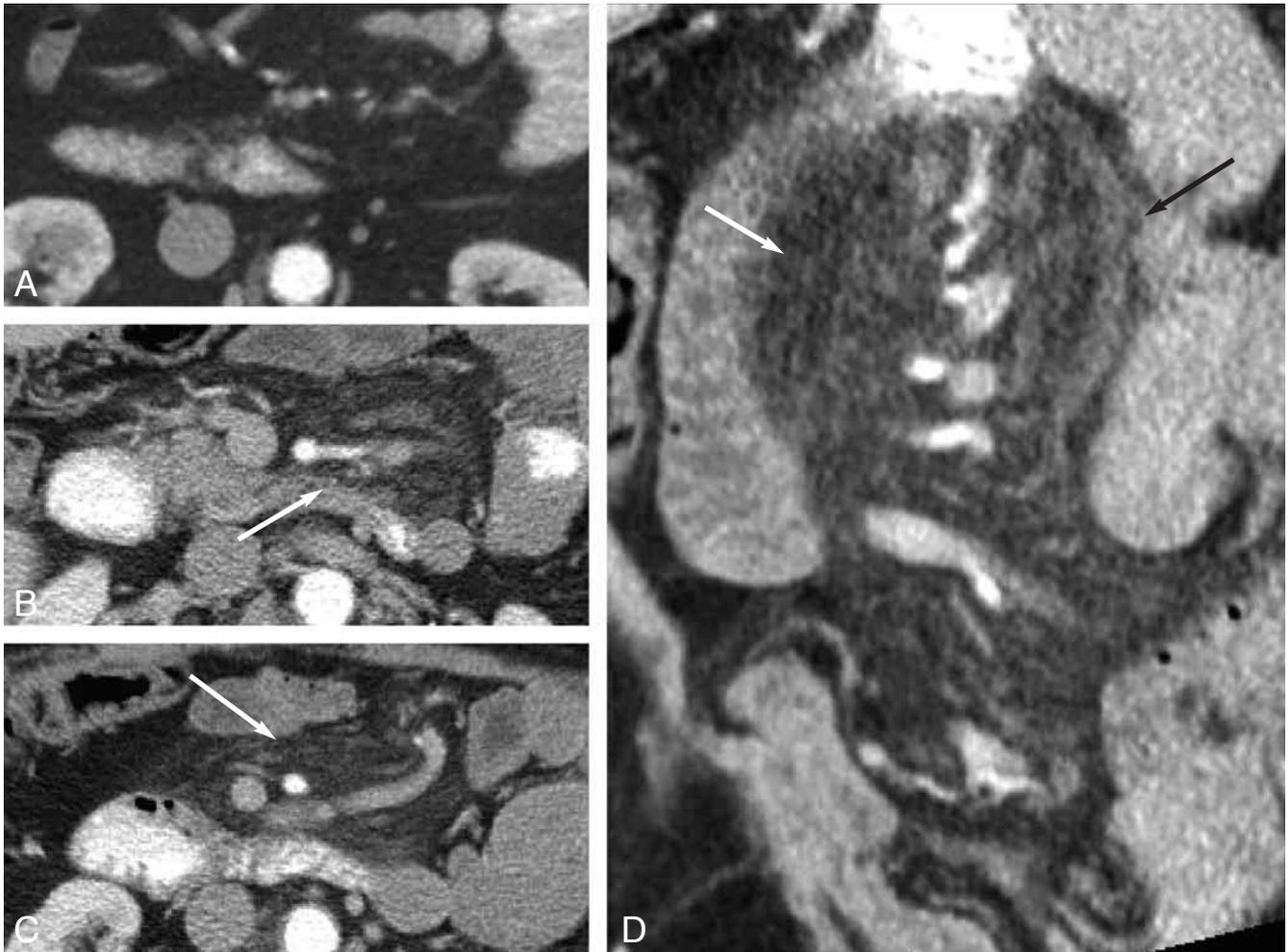
Fig. 4. — A) axial preoperative, B) & C) axial & D) coronal MPR postoperative views of the mesenteric root of a 65-year old man developing typical mesenteric panniculitis (white arrow) with typical pseudocapsule (black arrow) 14 months after Akyama procedure for oesophagal cardia carcinoma. PET/CT evaluation (not illustrated) was normal.

creatitis, bile or urine leakage, hypersensitivity reactions, and even bacterial infection (2, 4, 8, 13-15, 19). Other factors, such as gallstones, coronary disease, cirrhosis, abdominal aortic aneurysm, peptic ulcer, or chylous ascites, have also been linked to this disease (20). More recent studies have shown a strong relationship between tobacco consumption and MP (14). The actually reported rate of trauma or previous abdominal surgery as an etiologic factor is 4.76% (4) (Fig. 4 and 6).

MP has also been associated with a large number of malignant diseases such as lymphoma (Fig. 3 and 7), lung cancer, melanoma, colon cancer, renal cell cancer, myeloma, gastric carcinoma, chronic lymphocytic leukemia, Hodgkin's disease, large cell lymphoma, carcinoid tumor, and thoracic mesothelioma (1, 13-14). In a large but single series MP was related to malignancy in 69% of patients (14). These malignancies

included mostly urogenital or gastrointestinal adenocarcinoma or lymphoma but also breast and lung cancer and melanoma. The pathogenic mechanism linking MP and malignancy remains unknown. It has been then suggested that MP could be an associated and/or causative factor for malignancies. This association with malignancy may also be coincidental or secondary to an autoimmune inflammatory reaction, the mechanism of which has not yet been elucidated.

The same study of Daskalogiannaki et al. (14) also noted that an association between MP and lymphoma (Fig. 7) had been suggested in the previous literature. In any experience, the CT scans of patients with non-Hodgkin lymphoma, especially with mesenteric involvement or enlarged nodes at the root of the mesentery may demonstrate a dirty or cloudy-appearing mesentery that may

simulate MP (Fig. 3, 9, 12). The abnormality may improve or disappear with successful treatment or worsen with progression of the disease. Perhaps this appearance is secondary to obstruction to lymphatic flow or to actual lymphomatous involvement of the mesentery. Sometimes the appearance persists even after the lymphoma has completely resolved, perhaps reflecting residual fibrosis or scarring. The point is that one should carefully assess the mesentery for the specific features described by Daskalogiannaki et al. (14) and the absence of enlarged mesenteric lymph nodes before ascribing the finding to MP and not lymphoma.

PET/CT has been proved useful to correctly exclude mesenteric tumoral involvement in patients presenting with typical MP (12). The reason is that classically no ^{18}F-FDG uptake is seen in MP. In a patient
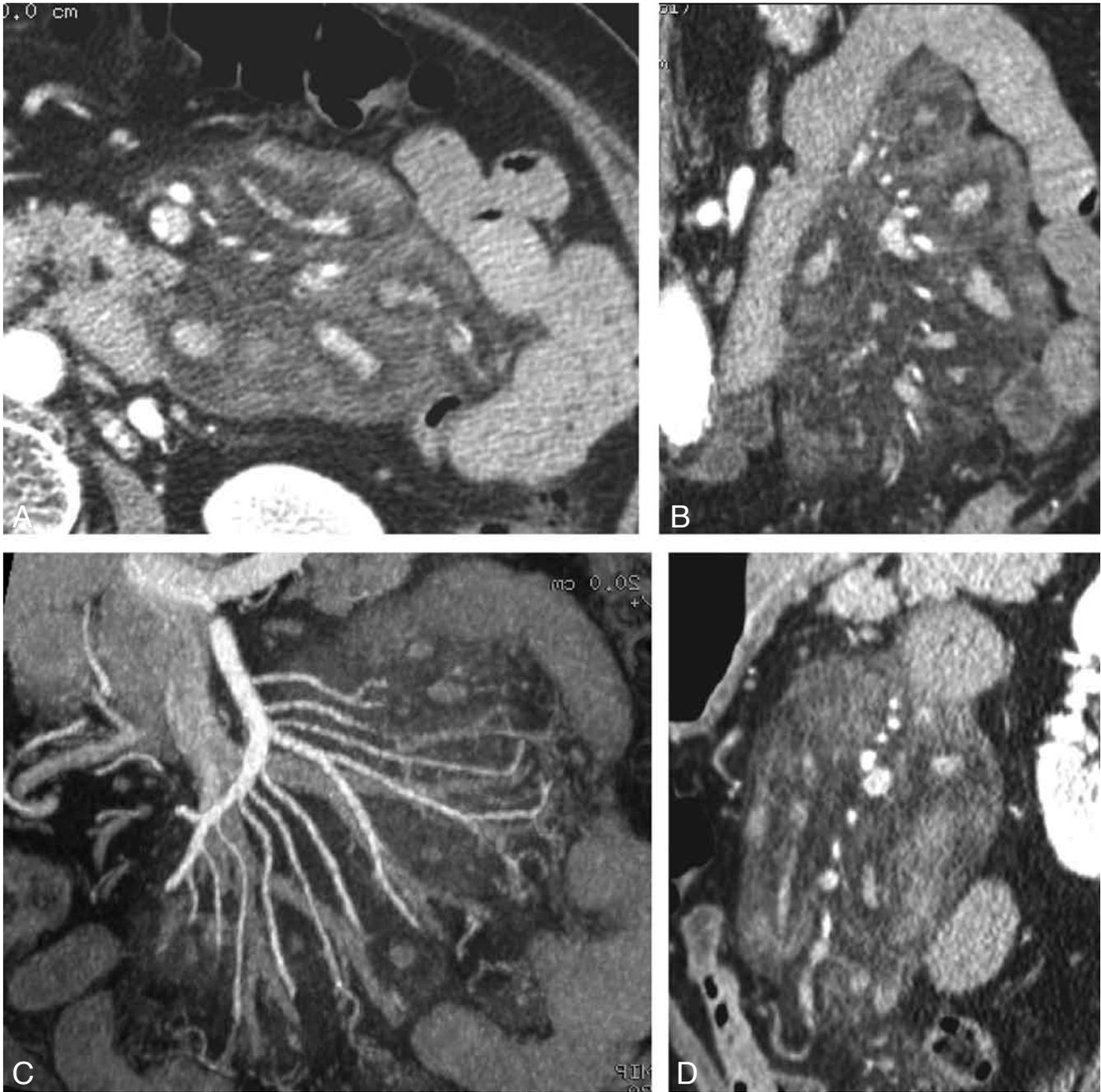
Fig. 5. — A: axial, B: coronal oblique, D: sagittal MPR views and C: coronal oblique MIP view of an extremely marked jejunal mesenteritis panniculitis fortuitously found in a 74 year-old female in a context of inflammatory syndrome of unknown origin. All typical signs are maximally present with a particularly increased density of mesenteric fat enhancing the typical perinodal and perivascular halo phenomenon.

with an oncologic or lymphoma history, the demonstration of ^{18}F-FDG uptake, even in small-sized nodules intermingled within an associated MP, is highly suggestive of neoplastic or lymphomatous involvement of the mesentery (Fig. 6, 8). This increased ^{18}F-FDG uptake may secondarily decrease following a favorable response to treatment. As a consequence if MP is suspected on the CT part of the PET/CT study,

special attention should be paid to the ^{18}F-FDG-avidity of the findings. A negative PET has high diagnostic accuracy in excluding tumoral or lymphomatous mesenteric involvement while increased uptake may suggest the co-existing of metastatic deposits, particularly in patients with lymphoma. Increased ^{18}F-FDG uptake is, however, not tumour-specific as it may be seen in benign inflammatory conditions like sarcoidosis.

Diagnosis

MP was rarely diagnosed before the area of ultrasound and CT (12). The main reason is that most cases of MP are asymptomatic and are incidentally detected on abdominal CT performed for unrelated conditions (3, 12, 14) (Fig. 2). In over 90% of cases, MP involves the small-bowel mesentery, although it may sometimes involve the sigmoid
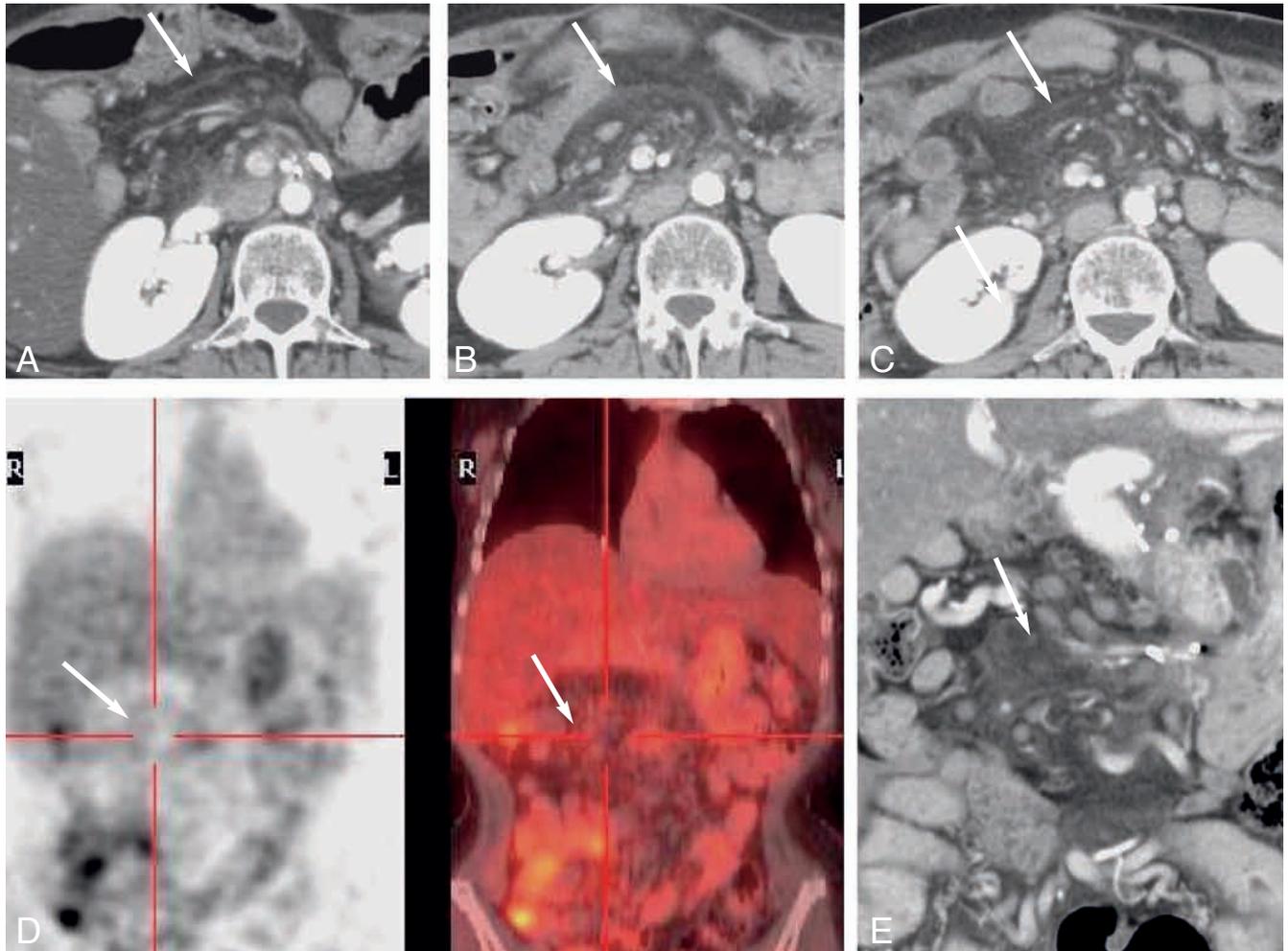
Fig. 6. — A to C a typical pattern of jejunal panniculitis (white arrow) was found on follow-up abdominal CT after whipple procedure for pancreatic adenocarcinoma in this 60-year-old female. The benign nature of this ambiguous panniculitic process – and especially of nodes – was confirmed by 3 negative PET/CT performed during a 14 months period (D). The typical aspect of MP remains present and stable after 3 years (E).

mesentery (1). On rare occasions, it may involve the mesocolon (especially the mesosigmoid), peripancreatic region, omentum, retroperitoneum or pelvis (2, 13, 21). Rare sites described are the mesoappendix, peripancreatic area, omentum and pelvis.

Clinical manifestations of MP are very inconstant and non-specific (2). In as many as half of the cases reported MP has been an incidental finding in asymptomatically presenting patients (2, 8). In "symptomatic" patients, a wide variety of gastrointestinal and systemic manifestations have been associated with this disorder including abdominal pain, abdominal fullnees, nausea, vomiting, pyrexia, diarrhea, constipation, anorexia, weight loss, fatigue, fever of unknown origin, ascites, pleural and pericardial effusion (1-2, 5, 10).

On occasions, the disease may also present with merely a single or multiple palpable masses. Exceptionally, rectal bleeding, jaundice, gastric outlet obstruction, and even acute abdomen have been reported.

MP has been best diagnosed radiologically with multidetector CT and MRI (2, 10, 12-13) (Fig. 1, 5, 9). A single abdominal CT scan may point towards the diagnosis in about half the cases (8). On CT (8, 12, 22), MP appears as a mass of increased-attenuation mesenteric fat containing small soft-tissue nodes, with a maximal transverse diameter directed toward the left abdomen consistent with the orientation of the jejunal mesentery. The mesenteric soft-tissue nodes ranged between immeasurable, numerous small nodules, to discrete nodes measuring up to 0.9 cm in the short axis and

1.9 cm in the long axis. The infiltrated fat typically engulfs the mesenteric vessels and displaces adjacent bowel loops without invading them (3, 13-14). Calcification may be present (13), usually in the central necrotic portion of the mass, and may be related to the fat necrosis. They are a relatively rare finding (3). Cystic components have also been described and may be the result of lymphatic or venous obstruction as well as necrotic change. Two CT findings are considered more specific for the diagnosis of MP as they have not been reported in other mesenteric diseases (3, 5, 23-26): the presence of a tumoral pseudocapsule (found in up to 60% of MP cases) and the "fat ring" sign of hypodense fatty halo surrounding mesenteric nodules and vessels (seen in up to 75% of cases) (5, 8, 12, 27-28) (figures 1, 3,
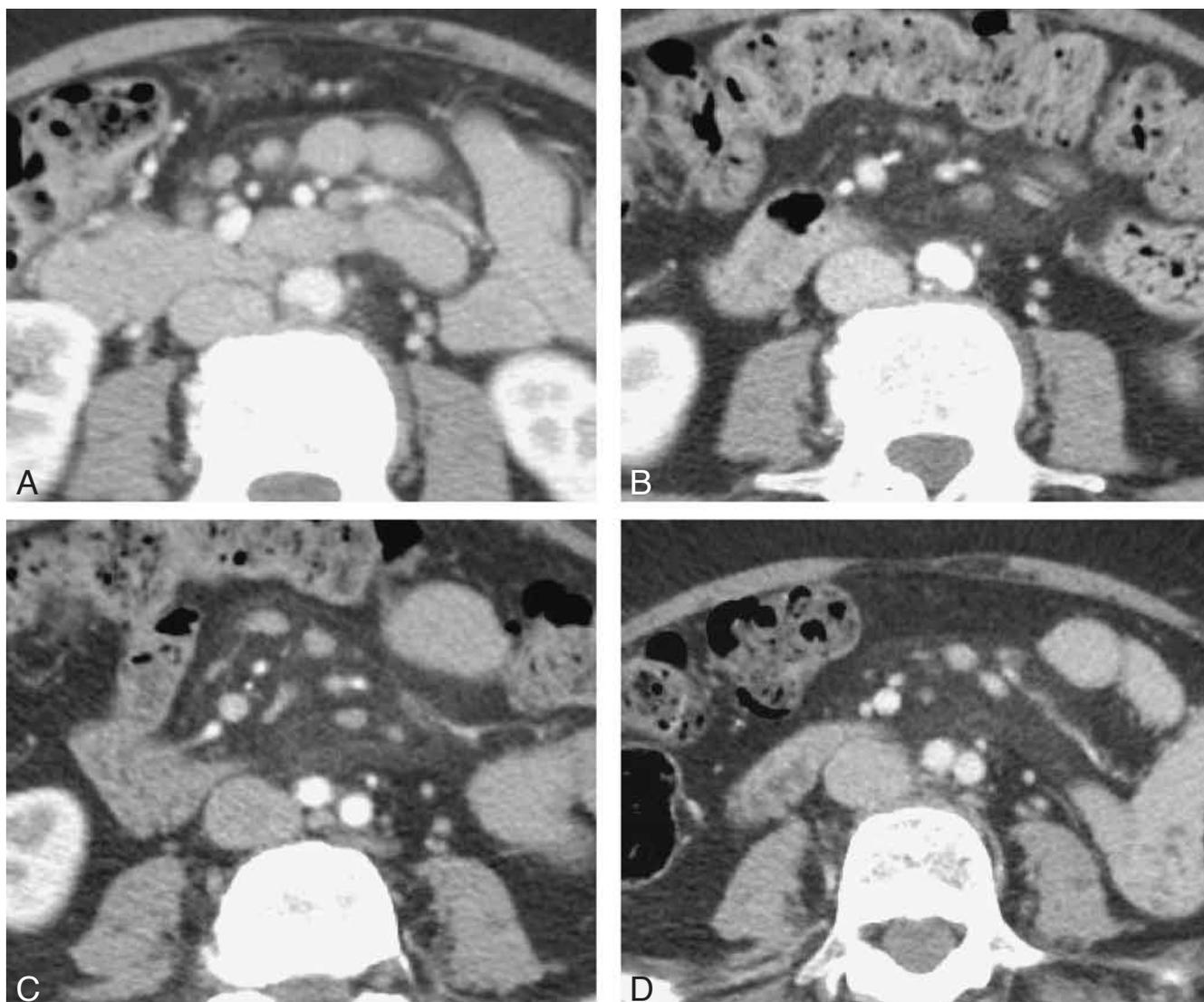
Fig. 7. — A-D represent four axial views obtained at four different periods of the evolution of a lymphoma in a 70-year old female. Moderate mesenteric panniculitis coexists and persists uniformly during the period of observation comprising the initial CT with numerous nodes (A), the CT obtained after a first period of remission (B), another CT illustrating recurrence of the disease with recrudescence of lymphadenopathies (C) and the last CT after a second phase of remission (D).

4, 5). Three-dimensional CT and CT angiography may also aid in diagnosis by providing a better perspective of its complex relation to other mesenteric structures. In our experience multiplanar and 3D CT also demonstrated a peculiar and, to our knowledge, never before described characteristic of the soft-tissues nodes associated with MP: in many cases these nodes appeared unusually irregular, ramified and/or connected to each other by linear densities – dilated lymphatics ducts? – a characteristic not classically found with benign or tumoral nodes (Fig. 9 and 10).

Nevertheless, even if the CT features of MP are well recognized and may suggest the correct diagnosis in the vast majority of cases, they are non-specific and can appear in other conditions such as mesenteric oedema, granulomatous diseases, primary or secondary abdominal neoplasms and lymphoma (12). In cases of MP and known intra-abdominal malignancies, differentiating MP from tumoural involvement of mesenteric lymph nodes is of crucial importance and PET/CT evaluation may be performed in ambiguous cases. The definite diagnosis of mesenteric panniculitis is established by biopsy (5) but it is rarely performed because of the high rate of cases presenting as incidental findings in asymptomatic patients.

Differential diagnosis

The differential diagnosis of MP is broad and includes all disorders that can affect the mesentery (3, 5, 10, 13). The most common are lymphoma, well-differentiated liposarcoma, peritoneal carcinomatosis, carcinoid tumor, retroperitoneal fibrosis, lipoma, mesenteric desmoid tumor, mesenteric inflammatory pseudotumor, mesenteric fibromatosis and mesenteric edema (13).

Unlike MP lymphoma, unless previously treated, will not contain calcification (13). Both conditions can encase mesenteric vasculature, but lymphoma will almost never result in ischemia. If large nodes are

visualized, lymphoma is the more likely diagnosis (Fig. 11). Treated lymphoma may also produce a misty mesentery and simulate the CT appearance of the MP (Fig. 12). The preservation of a halo of normal fat around the involved vessels and nodes – "fat ring sign" – also favors a diagnosis of MP.

The CT appearances of carcinoid tumor and MP can be identical. Both can appear as an ill-defined, infiltrating soft-tissue mass in the root of the mesentery with associated calcification and desmoplastic reaction and both may result in ischemia and obstruction. Again, the "fat ring sign" favors a diagnosis of MP.

In patients with carcinomatosis, mesenteric implants can simulate the CT appearance of MP. Calcification can be present in both conditions, especially if the primary tumor is a mucinous adenocarcinoma (eg, ovarian or colon cancer). However, in patients with carcinomatosis, implants will not be confined to the root of the mesentery but will also be present in the omentum and on the surface of the liver, spleen, or bowel. Ascites is also common in carcinomatosis but is not associated with MP.

Primary mesenteric mesothelioma can produce mesenteric soft-tissue implants that may simulate the CT appearance of MP. However, mesothelioma is usually not confined to the mesentery, and tumor implants will also be seen in the omentum and along the bowel surfaces. Ascites may also be present in mesothelioma but calcification are uncommon.

Mesenteric edema may result from various conditions such as cirrhosis, hypoalbuminemia, heart failure, portal or mesenteric vein thrombosis, and vasculitis. Trauma can also result in edema and hemorrhage in the mesentery. When fluid or blood infiltrates the mesentery, the attenuation of the mesenteric fat increases. This finding may mimic the CT appearance of MP. Mesenteric edema secondary to systemic disease is often diffuse and coexists
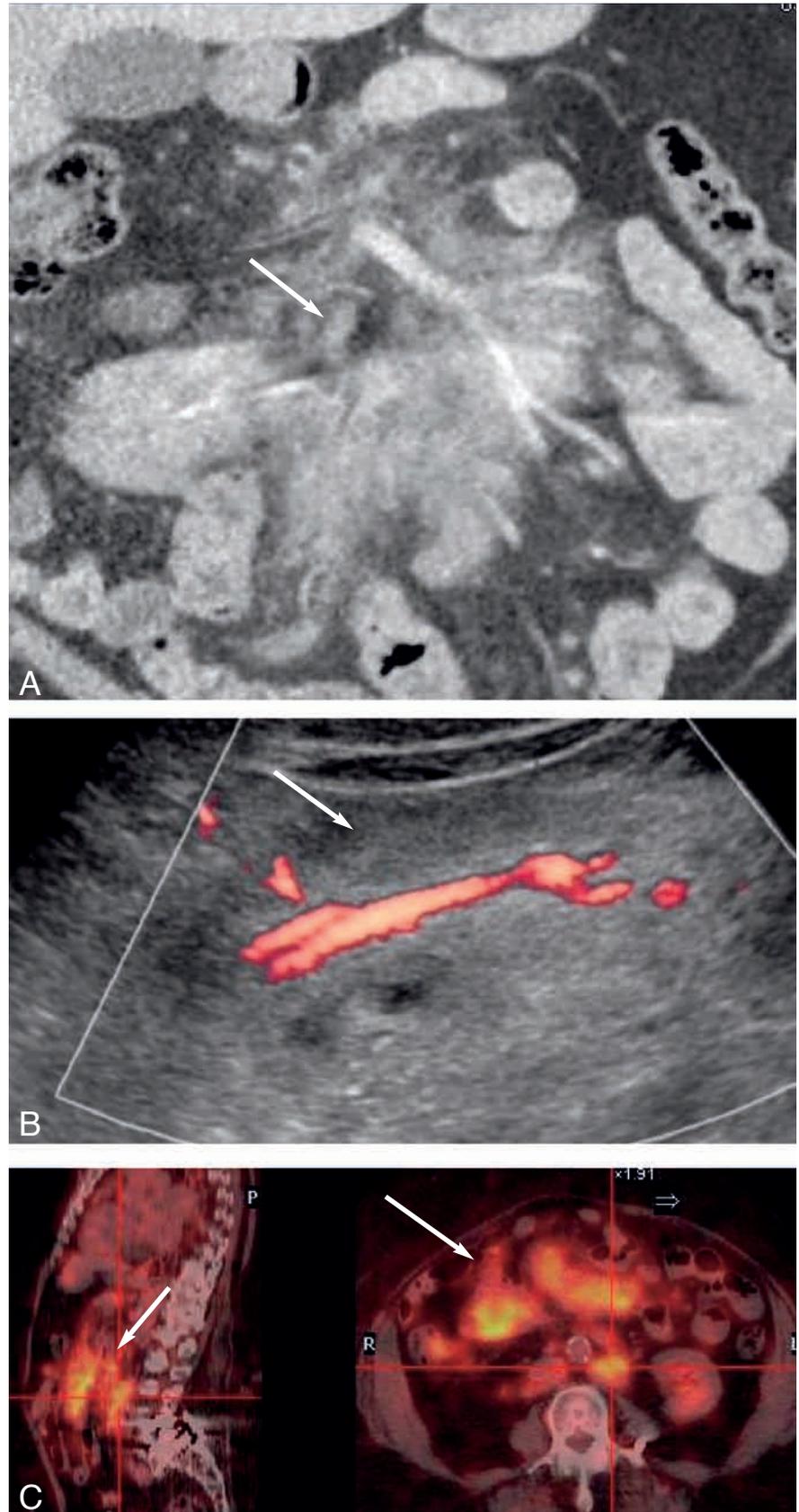

Fig. 8. — A: coronal CT MPR view, B: transverse ultrasound views – with power Doppler – and C: PET/CT views in a very obese 64 year-old female presenting with abdominal follicular lymphoma. Diffuse and non nodular hazy infiltration of the mesenteric root is found (white arrow) mimicking diffuse panniculitis. This infiltration is associated with numerous retroperitoneal aortocaval lymphadenopathies (not illustrated) evocating lymphoma. The definite diagnosis was obtained through histopathologic study of an inguinal node and confirmed by the hypermetabolic nature of the infiltration on PET/CT (white arrows on C).
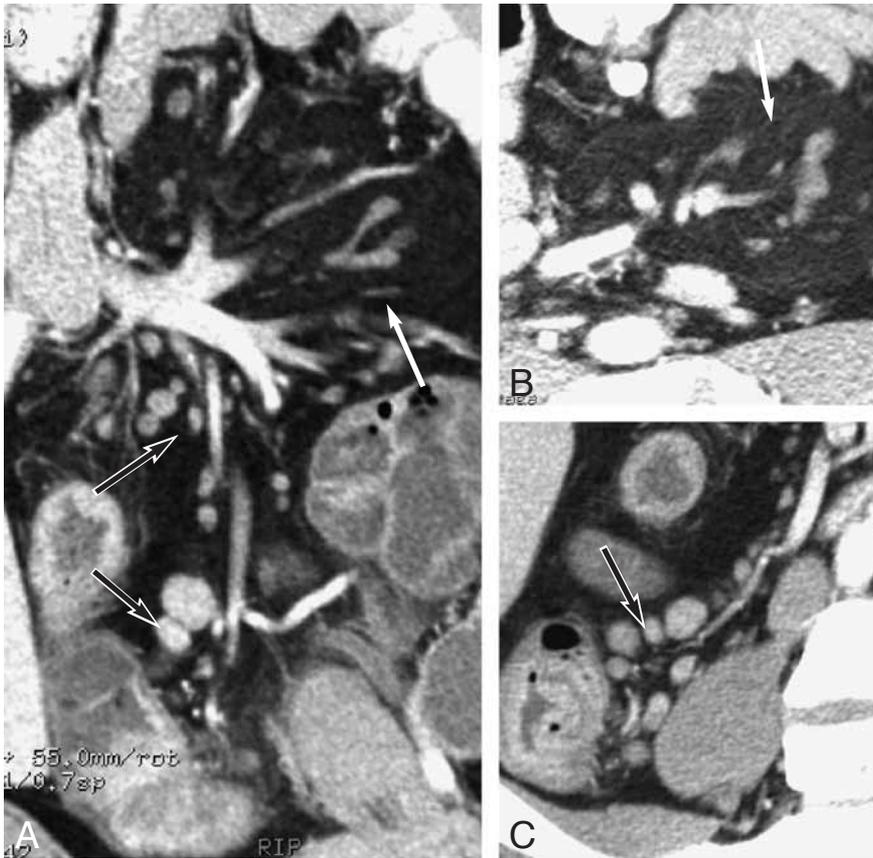
Fig. 9. — A,C: coronal oblique and B: axial MPR views obtained in a 27-year-old patient presenting with ileocolonic Crohn's disease in association with typical jejunal mesenteric panniculitis. The morphology of mesenteric nodes appears different in the two entities: those associated with Crohn's disease (black arrows) appear round, sharply demarcated and rather dense whereas those classically associated with panniculitis (white arrows) appear smaller, irregular, ramified and more hypodense with hazy contours.
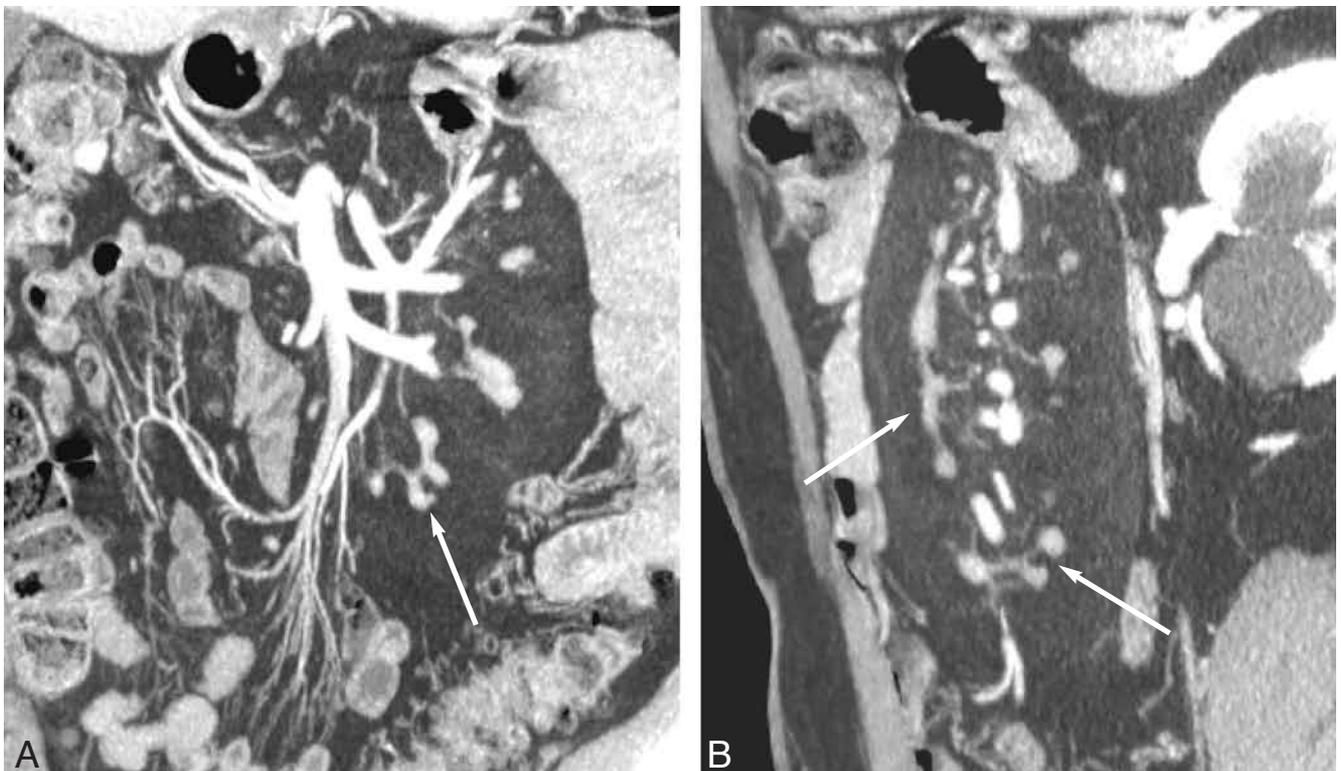

Fig. 10. — A: coronal, B: sagittal MIP views obtained in a 76 year-old man presenting with prostatic neoplasm. A typical jejunal mesenteric panniculitis is visible. Multiples irregular and ramified nodes are found whose aspect differs from more round and regular related to lymphoma (white arrows).
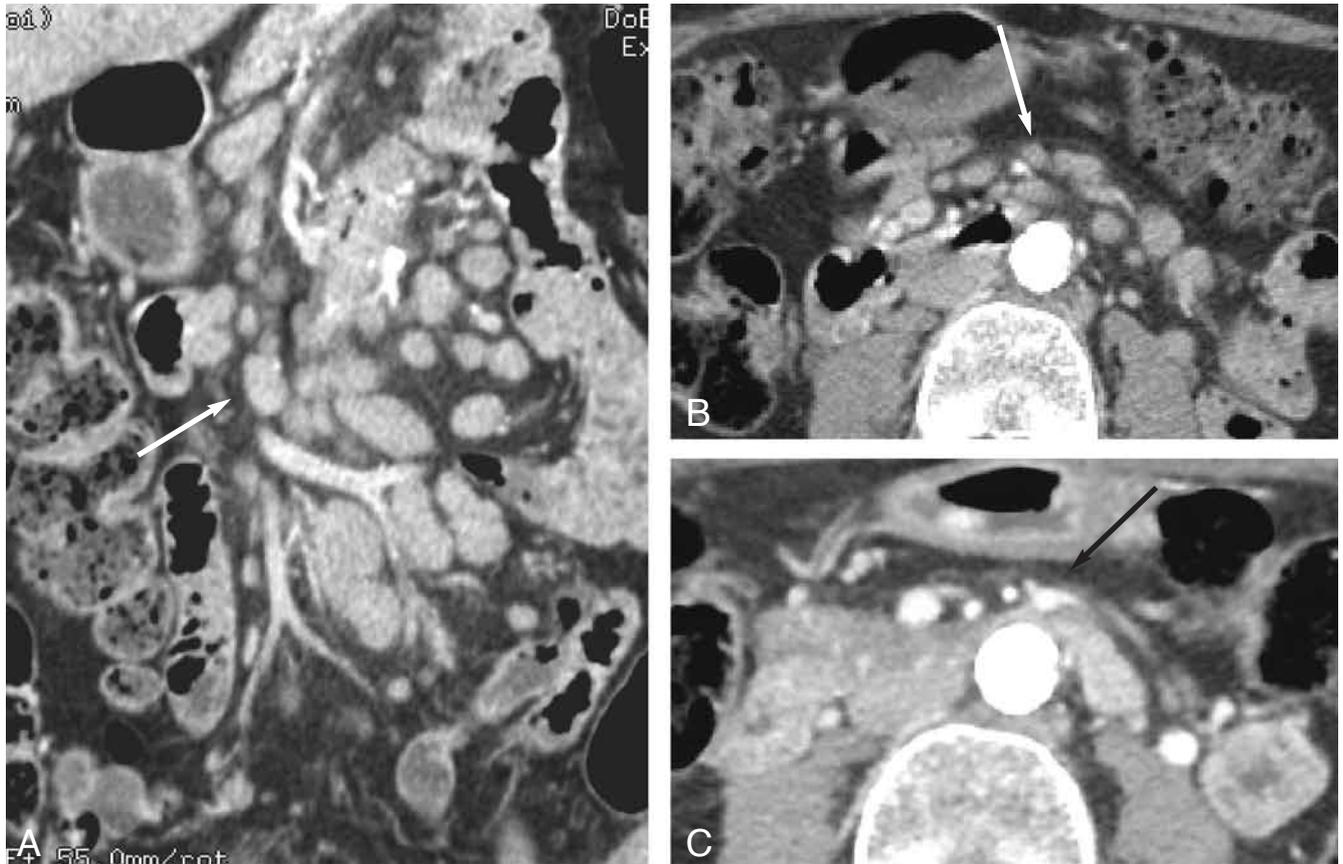
Fig. 11. — Coronal MPR (A) and axial view (B) of a typical abdominal lymphoma with mesenteric involvement (white arrow) in a 56-year-old female. This classical aspect drastically differs from mesenteric panniculitis: the typical pseudocapsule is absent, the fat component is not swollen and remains hypoechoic, the nodes are numerous, dense, round and many entities are larger than 10 mm; the typical halo sign is absent. C: complete normalization after healing (black arrows).

with generalized subcutaneous edema and ascites, which will not be present in patients with sclerosing mesenteritis. Also, the clinical history will often be the clue to the correct diagnosis.

MP must also be differentiated from inflammatory pseudotumor, Crohn's disease with fibrofatty proliferation, and lipogenic liposarcoma (3). The "fat ring sign" and the presence of a pseudocapsule are not described in this last entity.

Evolution

The course of MP is favorable in most cases, because the disease usually progresses slowly and subsides spontaneously. Nevertheless significant morbidity and a chronic debilitating course have been reported in up to 20% of patients (5).

Currently, there is no established regimen for the management of MP (5, 8). The treatment is usually empiric and individualized. No thera-

peutic procedures have yet shown an unequivocal efficacy, and treatment of the symptomatic forms is not well established (3). The indolent forms do not usually require specific treatment. Other authors have also reported a beneficial effect of corticosteroid therapy (5, 8). Other empirically proposed therapy options include tamoxifen, azathioprine, cyclophosphamide, oral progesterone and thalidomide in advance or progressive cases. Surgical resection is generally not recommended and has no beneficial effects, except in cases of intestinal obstruction and other complications, such as ischemia.

The natural course of MP is as inconsistent as its presentation (3, 8). It may partially or completely regress, may follow a long benign nonprogressive stable course or may rarely have an aggressive course that occasionnaly has a fatal outcome. This variability has been observed in both treated and

untreated cases. Predominant lipodystrophy usually has a favorable prognosis, whereas fibrotic cases are thought to have a more negative outcome; chronic inflammation lies in the middle of the spectrum. Real extensive and longitudinal studies are unfortunately lacking to proof these sporadically reported data.

Progression of MP to debilitating retractile mesenteritis is difficult to predict. It seems to remain a very rare event (16) and therefore such a progression may also be considered as doubtful. A real kinship or a complete independence between the two entities remains thus an open question which cannot be unequivocally answered. For this reason the benefit of a systematic follow-up of the many cases that are spontaneously discovered during CT practice is questionable. The major complication are related to a potential but not really proved progressive fibrosis (3): shortening of the mesentere
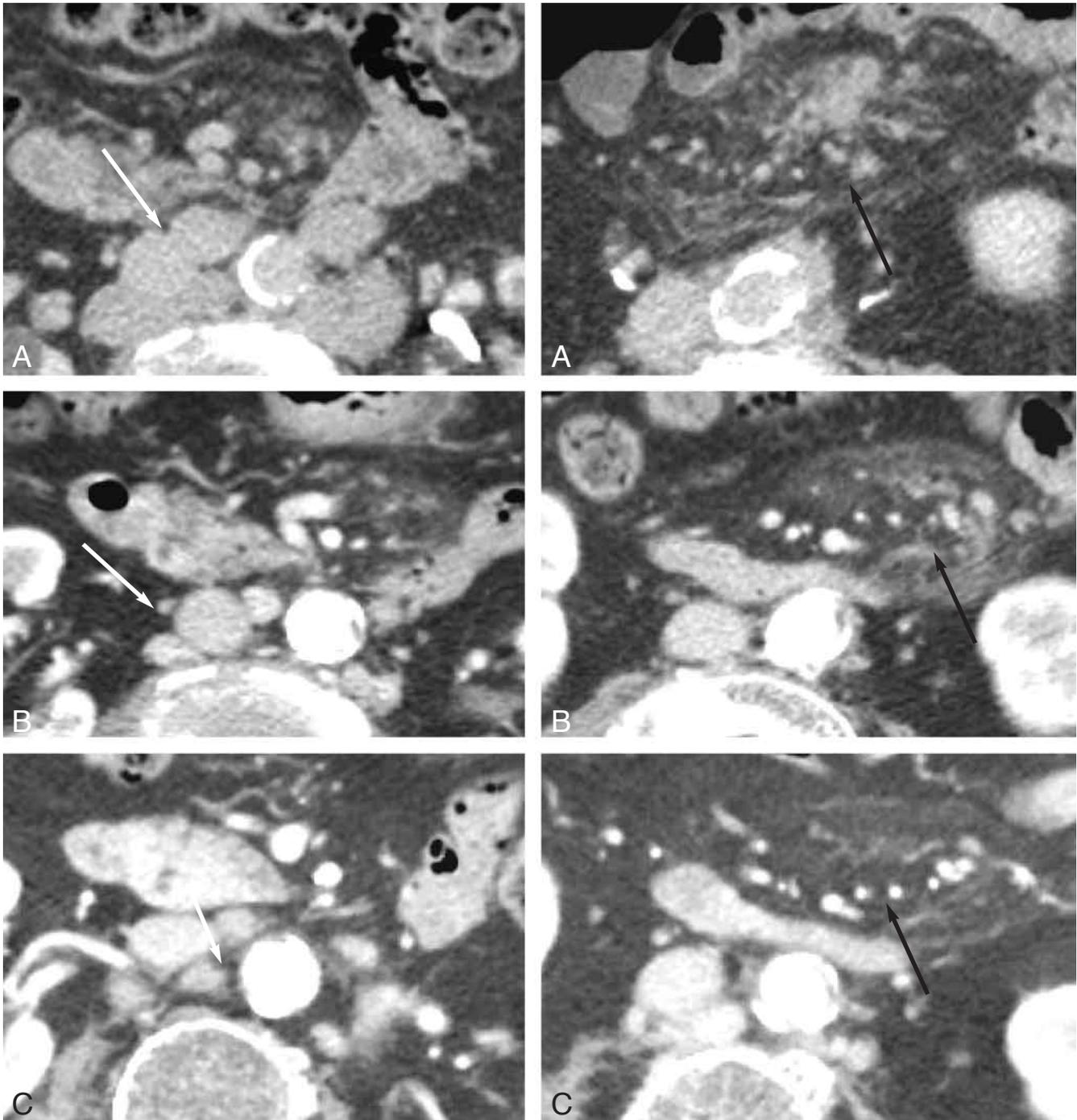
Fig. 12. — 3 groups of axial views (A to C) are obtained at three different stages of the evolution of an abdominal lymphoma under chimiotherapy in a 88-year old female. During treatment a drastic regression the numerous large retroperitoneal lymphadenopathies is observed (white arrows) and the mesentere (black arrow) evolves from diffuse infiltration (A) to complete healing (C) trough a transitory pseudo panniculitic state (B).

and compression of mesenteric vessels with partial or complete intestinal obstruction or ischemia which may require surgery. During a 5 year-period we have not encountered such dramatic evolution of MP to aggressive retractile mesenteritis.

Daskalogiannaki (14) found a great stability of the CT findings of MP in 20/21 patients in which follow-up abdominal CT examinations were available within an interval of 5 months to 3 years. Only one patient showed a slight increase of the fatty mass.

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