ELSEVIER

Canadian Association of Radiologists Journal xx (2012) 1−7

CANADIAN ASSOCIATION OF RADIOLOGISTS JOURNAL

www.carjonline.org

Abdominal Imaging / Imagerie abdominale

Abdominal Extraosseous Lesions of Multiple Myeloma: Imaging Findings

Anto Sedlic, MD[a,*], Christina Chingkoe, MD[b], Kit W. Lee, MBBS[c], Vinnay A. Duddalwar, MBBS[d], Silvia D. Chang, MD[a]

[a]*Department of Radiology, University of British Columbia, Vancouver, British Columbia, Canada*
[b]*Department of Medical Imaging, University of Toronto, Toronto, Ontario, Canada*
[c]*Department of Radiology, University of Melbourne, Victoria, Australia*
[d]*Department of Radiology, University of Southern California, Los Angeles, California, USA*

Key Words: Multiple myeloma; Plasmacytoma; Abdominal; Abdominal computed tomography

Multiple myeloma (MM) accounts for up to 1% of all malignancies and up to 10% of all hematologic malignancies. Patients most commonly present with anemia; hypercalcemia; recurrent infections; and symptoms secondary to bone marrow infiltration, such as bone pain and pathologic fractures [1]. Extraosseous manifestations of MM are rare and found in <5% of patients; radiographic descriptions are limited [2]. Furthermore, the presence of plasmacytomas in patients with known MM suggests further dissemination of the disease, which indicates a worse prognosis [3]. The incidence of extraosseous myeloma may be increasing, likely due to longer patient survival and more-sensitive imaging modalities. Patients with extraosseous manifestations of MM have shorter overall survival and shorter progression-free intervals [3]. The radiologic descriptions of extraosseous myeloma are limited and are reviewed here with examples from our own institution.

Diagnosis of MM

The Mayo criteria [4] include the following:

1. M-protein in serum or urine less than 3 g/dL.
2. More than or equal to 10% monoclonal plasma cells from bone marrow aspirate.
3. Organ-tissue impairment, typically in the form of hypercalcemia, renal insufficiency, anemia, or bony lytic lesions.

Imaging Findings

Liver

Two common computed tomographic (CT) patterns have been reported in cases of hepatic involvement: (1) a single or a few focal hypoattenuating lesions, demonstrating minimal if any contrast enhancement, and (2) diffuse hepatic involvement with innumerable small low-attenuation lesions and hepatomegaly (Figure 1). The most consistent CT finding reported is the lack of calcification [2]. Case reports, however, describe homogenous arterial phase enhancement, with complete washout on the portal venous phase to become hypodense relative to liver parenchyma [5]. However, the lesions may be low attenuation on all 3 phases (arterial, portal venous, and delayed) (Figure 1). On noncontrast CT, the lesions can be hypodense to liver parenchyma (Figure 2). Ultrasound demonstrates a target or bulls-eye lesion, with an echogenic center surrounded by a hypoechoic halo [6]. Hepatic plasmacytomas also can be heterogeneous and primarily hypoechoic on ultrasound (Figure 1D). Magnetic resonance imaging (MRI) has been reported to typically demonstrate homogeneous T2 hyperintensity and T1 hypointensity in cases of hepatic plasmacytomas [5,6]. However, hyperintense T1 lesions also have been described, presumably reflecting high protein content, and enhancement is usually minimal reflecting the hypovascular nature of hepatic lesions [7].

Pancreas

Pancreatic plasmacytoma lesions are most commonly solitary well-defined soft-tissue masses, with rare reports of multiple solid lesions or diffuse involvement, which causes

* Address for correspondence: Anto Sedlic, MD, Department of Radiology, University of British Columbia, 3350 - 950 West 10th Ave, Vancouver, British Columbia V5Z 4E3, Canada.
E-mail address: tonysedlic@gmail.com (A. Sedlic).

0846-5371/$ - see front matter
doi:10.1016/j.carj.2011.12.010

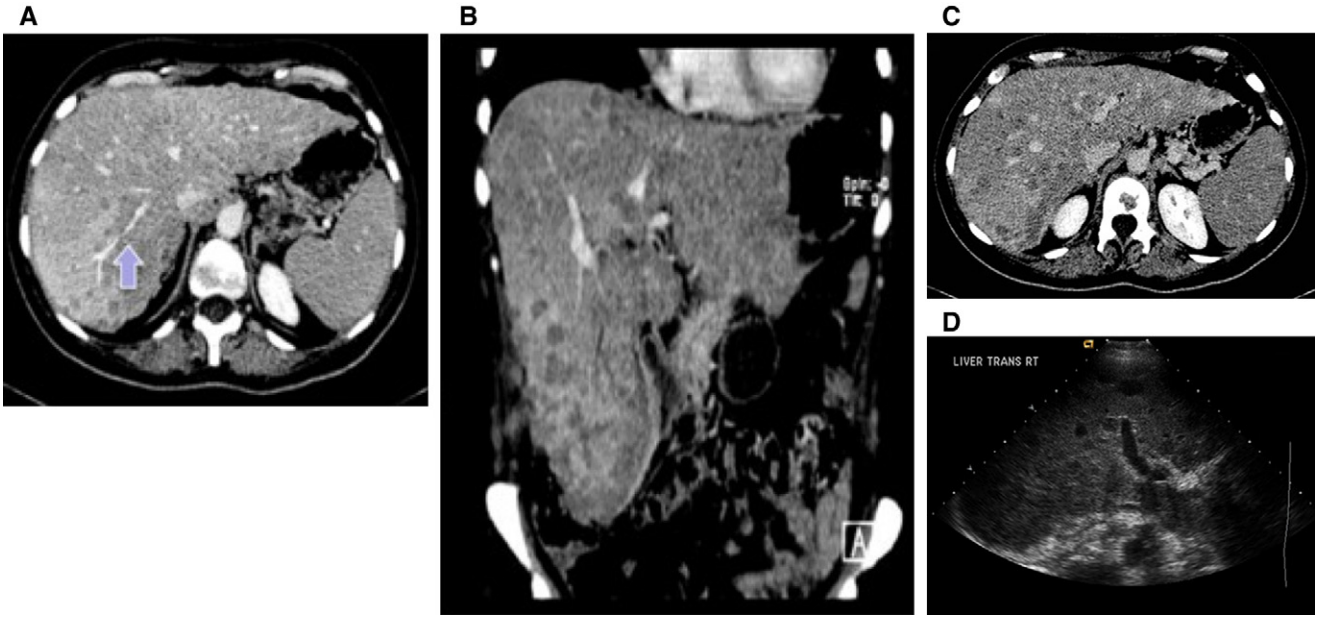

Figure 1. (A, B) Contrast-enhanced portal-venous phase transverse and coronal reformat computed tomography (CT) images in a 54-year-old woman, showing central vein compression (A) (arrow). The diffuse extent of hepatic involvement and hepatomegaly is best demonstrated on the coronal images. (C) Contrast-enhanced delayed-phase CT in the same patient, demonstrating persistent hypoattenuation of the lesions. (D) Transverse ultrasound image of the liver in the same patient, demonstrating multiple hypoechoic heterogeneous nodules throughout the liver.

lobulated enlargement of the pancreas [8]. Ultrasound most commonly demonstrates focal pancreatic lesions as hypoechoic solid masses (Figure 3C) [10]. CT demonstrates focal lesions with variable contrast enhancement. The majority of lesions demonstrate increased enhancement relative to pancreatic parenchyma, which is most conspicuous during arterial phase imaging [9]. The enhancement characteristics may be variable, with some cases demonstrating heterogeneous enhancement (Figures 3 and 4) [2,10]. Enhancing lesions may mimic islet cell tumours, and hypoenhancing lesions can be mistaken for adenocarcinoma [7]. Larger lesions have been described that result in pancreatic duct dilatation and encase the adjacent celiac vessels, further mimicking adenocarcinoma [2]. MRI demonstrates myelomatous pancreatic masses as hyperintense on T2 and hypo- to isointense on T1 relative to the pancreatic parenchyma. As with CT, gadolinium enhancement is usually seen but enhancement patterns are variable [9].

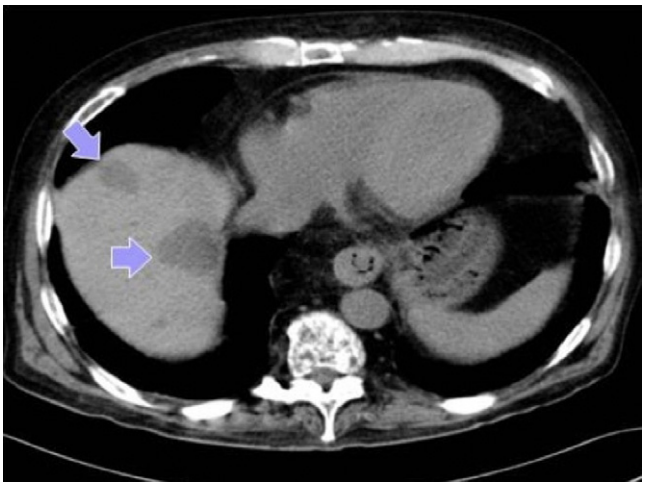

Figure 2. Noncontrast computed tomography in a 62-year-old man, demonstrating 2 focal hypoattenuating lesions in the dome of the liver (arrows).

Gastrointestinal and Peritoneal Findings

The small bowel is the most common site of myelomatous gastrointestinal involvement, followed by the stomach, colon, and esophagus. MM is most commonly seen as mural infiltration, which causes wall thickening and demonstrates variable enhancement (Figure 5) [2,9]. Involvement of the bowel can also manifest as homogeneous soft-tissue masses, which may be eccentric in location, lobulated, mural, or intraluminal [8]. The imaging findings may overlap those of lymphoma, and differentiation of the two by imaging may not be possible [2]. A review of the literature indicates that enhancing nodules are the most common peritoneal manifestation of extraosseous MM, but large heterogeneously enhancing mesenteric masses are also seen (Figures 6, 7, 8A and 8B) [11]. Omental and mesenteric masses may be bulky, demonstrating homogeneous soft-tissue attenuation, which may also mimic lymphoma. These soft-tissue masses commonly demonstrate low T2 signal [8]. Ascites may also be seen, which results in imaging characteristics similar to peritoneal carcinomatosis (Figure 8) [12,13].

Adrenal Masses

Adrenal masses are rare, and descriptions are mostly limited to case reports. On CT, adrenal plasmacytomas are