

# Absent Sternum as the First Manifestation of Bone Metastasis on Bone Scintigraphy

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**Abstract** The sternum is known as a relatively common site for bone metastases by a variety of malignant neoplasms. The usual finding is increased radiotracer uptake on bone scintigraphy, and cold metastasis is distinctly unusual. In addition, total nonvisualization of the sternum presenting as bone metastasis is extremely rare. We describe two cases with similar findings (absent sternum showing no activity of the sternal segments on bone scintigraphy), which corresponded to metastatic involvement. These findings were shown to be the first manifestation of hepatocellular carcinoma in one patient and bone metastasis in another patient with ovarian cancer.

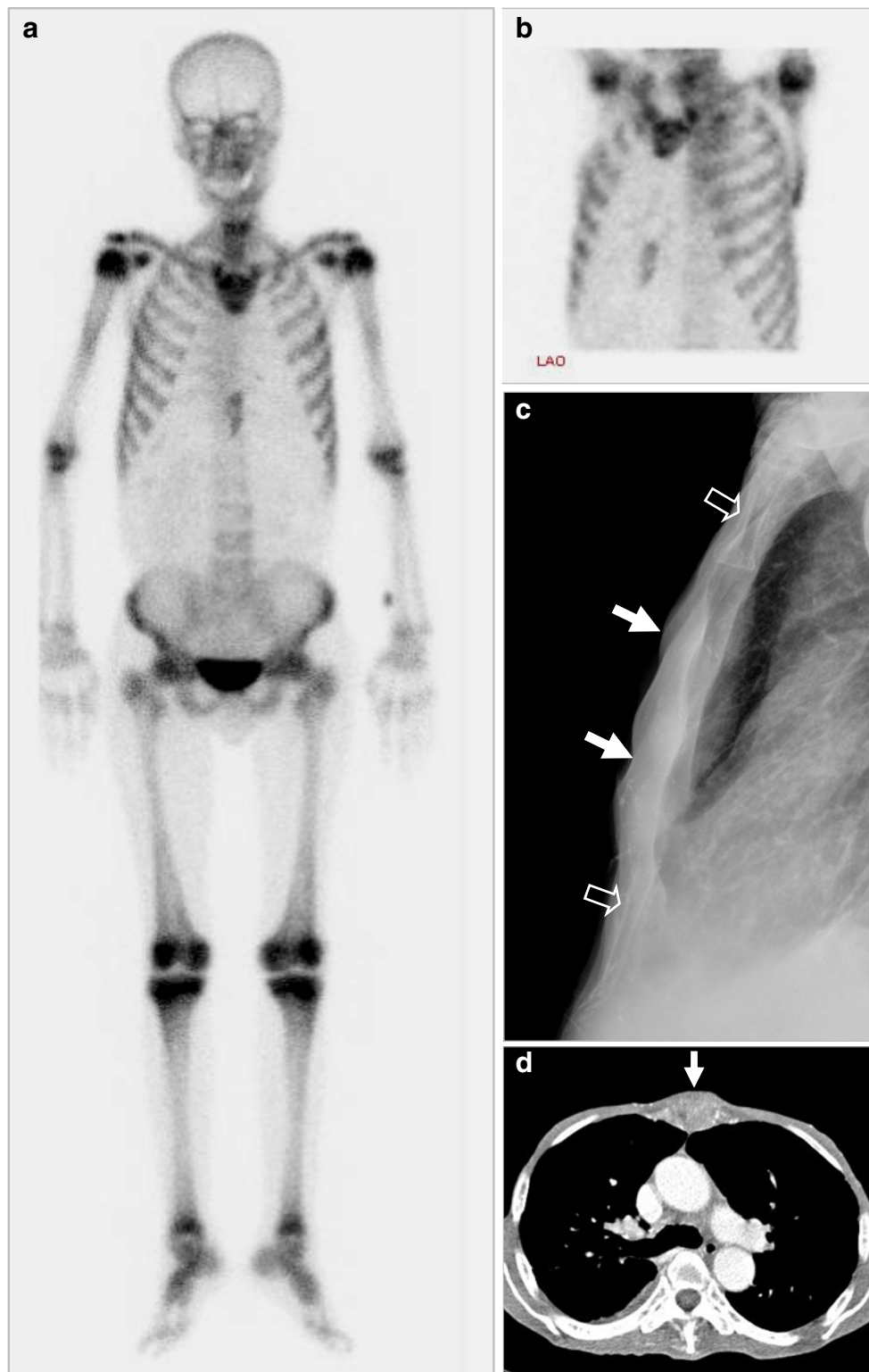
**Keywords** Ovarian cancer · Hepatocellular carcinoma · Bone metastasis · Sternum · Bone scintigraphy

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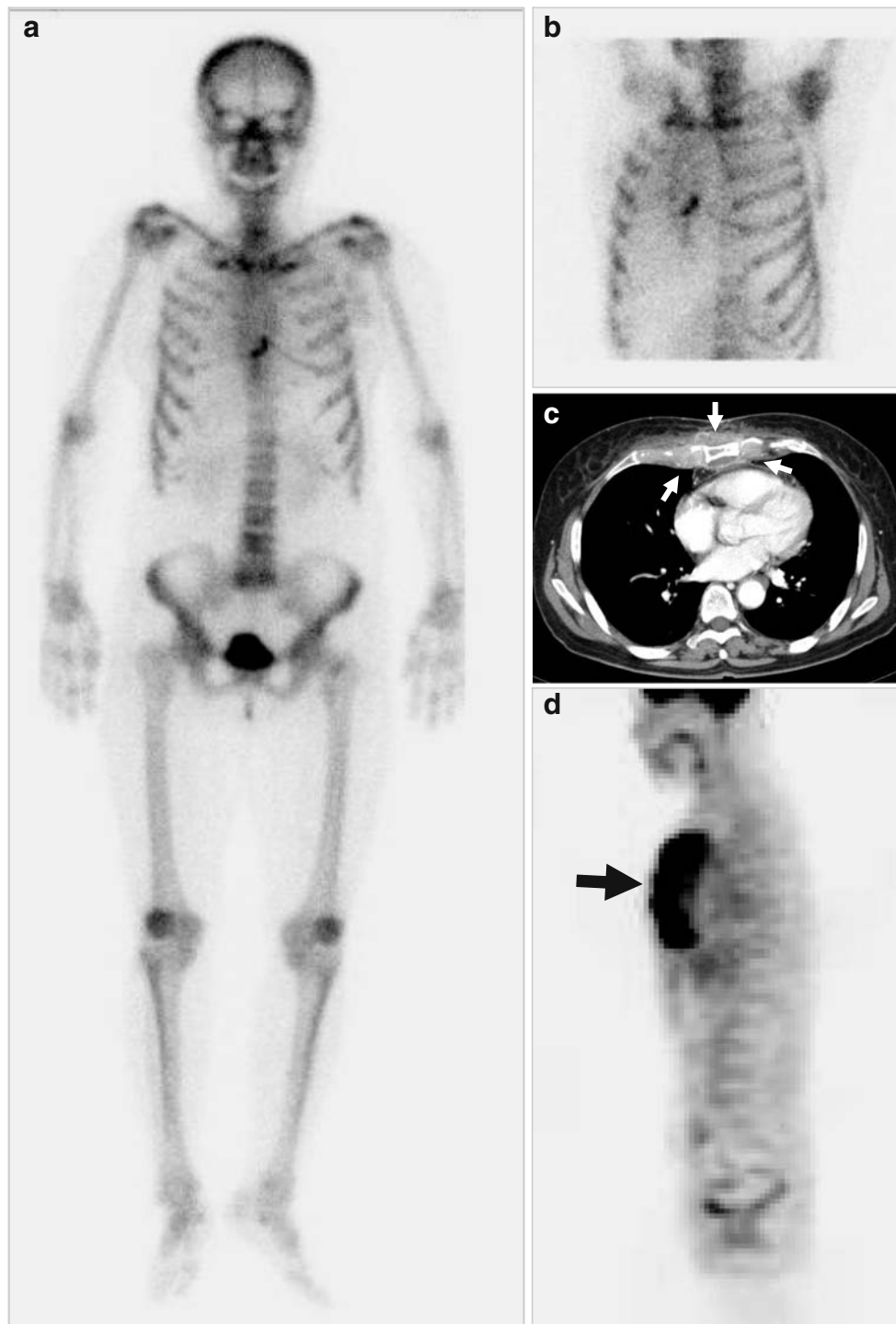
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The sternum is known to be a relatively common site of bone metastasis for a variety of malignancies [1]. The sternal body is the most common site of metastatic involvement, whereas the manubrium and xiphoid process are rarely affected [1, 2]. Sternal metastases are usually visualized as hot spots on bone scintigraphy. Some of the metastases may reveal cold lesions, which appear either as a purely cold areas or as a central cold area with a peripheral rim of increased activity [2–5]. The primary neoplasm for cold sternal metastasis on bone scintigraphy is breast cancer. Multiple myeloma, lung cancer, renal cell cancer, hepatocellular carcinoma (HCC), lymphoma, thyroid cancer, and colon cancer are less common causes [1–4]. Metastases to the sternum are considered to be extremely rare in ovarian cancer [5–9]. Total nonvisualization of the sternal body corresponding to metastatic involvement with disease progression has been reported in a patient with HCC [10]. In contrast to HCC, however, we have not found total nonvisualization of sternal activity presenting as bone metastasis from ovarian cancer. Sternal metastasis can appear infrequently as the initial manifestation of HCC [11, 12] (Fig. 1), whereas it can be a rare, late-appearing finding in ovarian cancer [6–9]. Sternal metastasis as the first manifestation of bone metastasis is even rarer in recurrent ovarian cancer [7–9] (Fig. 2). It has been reported that an absent sternum showing no activity of the sternal segments exclusive of the manubrium on bone scintigraphy resulted from congenital lack of ossification of the sternum in a 12-year-old girl who had orbital rhabdomyosarcoma [13]. However, this finding can also be the first manifestation of a malignant disease in a patient who has no history of malignancy or a bony metastasis in a patient who has a history of malignancy. So, when an absent sternum showing no activity of the sternum is identified on bone scintigraphy, it is necessary to keep in mind that this finding may occur as the first manifestation of metastatic disease or may also represent congenital lack of ossification of the sternum.



**Fig. 1** A 66-year-old man presented with anterior chest swelling of a 2-month duration. He had no other symptoms. **a** Whole body anterior and **b** left oblique images of bone scintigraphy showed nonvisualization of the sternal body with normal activity of the manubrium and xyphoid process. **c** A lateral radiograph of the sternum demonstrated corresponding destruction of the sternal body (*white arrows*) with an intact manubrium and xyphoid process (*open arrows*). **d** Subsequent

CT demonstrated destruction of the sternum and adjacent costal cartilage with an overlying soft tissue mass (*arrow*) and a hepatic mass. Excisional biopsy of the chest wall mass confirmed a metastatic tumor originating from hepatocellular carcinoma. Increased uptake in the shoulders, elbows, hips, knees, and ankles was considered to be malignancy-induced polyarthrititis. In this case, sternal metastasis was the first manifestation of the malignancy



**Fig. 2** A 57-year-old woman who underwent radical hysterectomy with bilateral salpingo-oophorectomy 5 years previously for serous adenocarcinoma of the ovary presented with sternal pain and a left axillary mass of 1-month duration. **a** Whole body anterior and **b** left oblique images of bone scintigraphy showed nonvisualization of the sternal body, including the manubrium. **c** Subsequent CT demonstrated an overlying soft tissue mass with partial destruction of the sternum and costal cartilage (*arrows*) with left axillary lymphadenopathy. **d** Lateral

view of the maximum-intensity-projection image of PET demonstrated a hypermetabolic mass in the sternal body and manubrium (*arrow*). Excisional biopsy of the chest wall mass and axillary lymph node confirmed a metastatic tumor originating from serous adenocarcinoma of the ovary. This is a rare case of sternal metastasis from ovarian cancer as the first manifestation of bone metastasis that developed 5 years after initial diagnosis, which was successfully treated with surgery and chemotherapy

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