



## CASE REPORT

### Bone superscan in initial staging of gastric adenocarcinoma

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#### ABSTRACT

A 37-year-old woman presented with dyspepsia, bone pain, and significant weight loss. Endoscopy revealed an infiltrative gastric body mass, and histology confirmed signet ring cell gastric adenocarcinoma. A contrast-enhanced CT scan showed peritoneal carcinomatosis and multiple lytic-sclerotic skeletal metastases. A whole-body Technetium-99m methylene diphosphonate ([<sup>99m</sup>Tc]Tc-MDP) scan revealed a "superscan" pattern, characteristic of widespread bone metastases. While bone scintigraphy is sensitive for detecting osteoblastic metastases, the superscan pattern can be mistaken for a normal scan, particularly in gastric cancer patients where it's an uncommon finding. Our brief review of the literature illustrates this infrequently observed phenomenon may occasionally occur in gastric cancer, especially in symptomatic patients.

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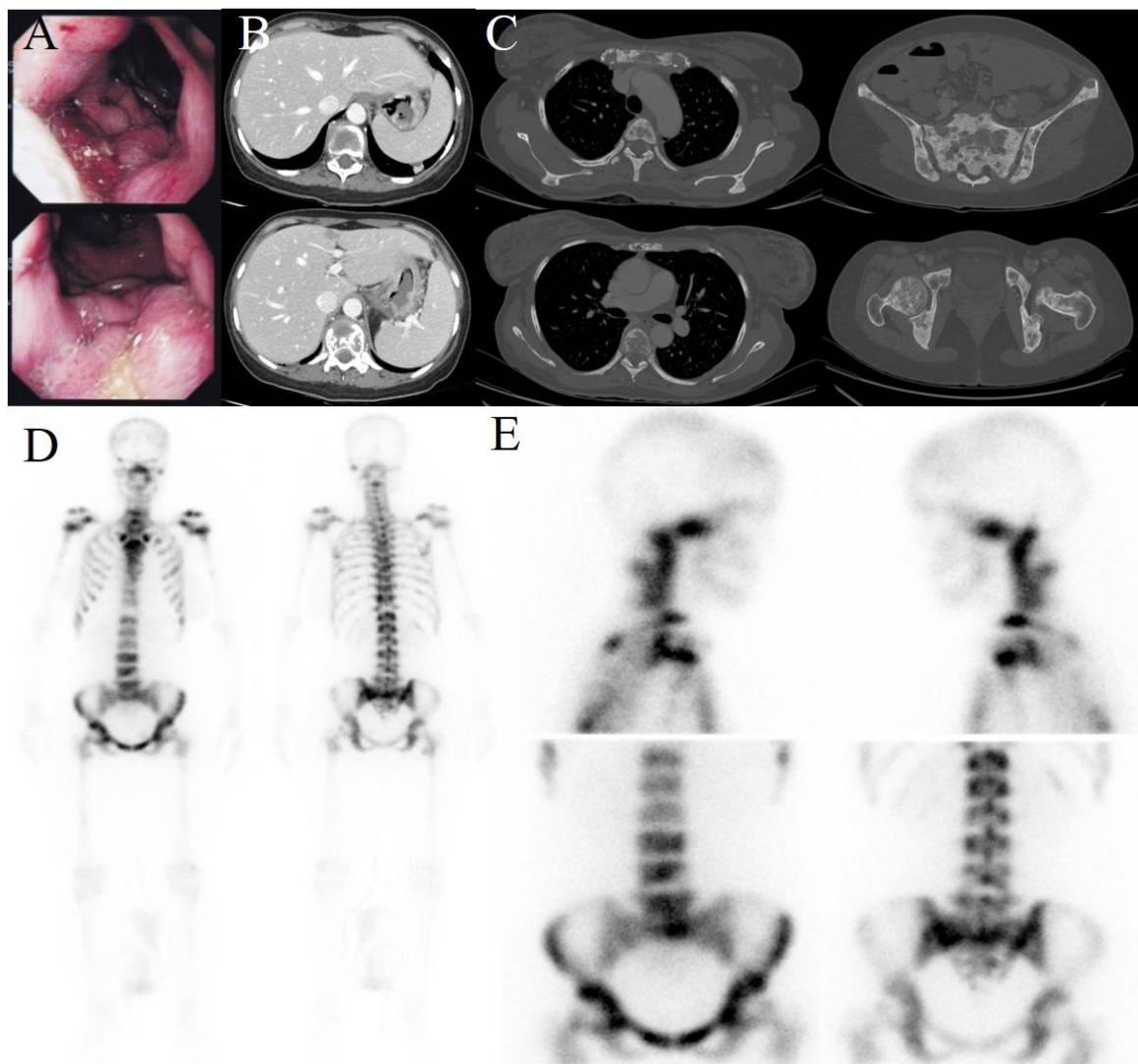
## INTRODUCTION

Technetium-99m methylene diphosphonate ( $^{99m}\text{Tc}$ )-MDP is a highly sensitive imaging modality in the evaluation of skeletal metastasis, especially for osteoblastic lesions. Superscan, is a rare phenomenon which can occasionally occur and is defined as diffuse and prominent bone uptake which has a broad differential diagnosis [1]. Here we report a case of gastric cancer in which this pattern was observed at the initial staging of the disease suggesting diffuse skeletal metastases.

## CASE PRESENTATION

A 37-year-old woman presented with dyspepsia, bone pain and significant weight loss. An endoscopic evaluation revealed an infiltrative mass

in the proximal portion of the gastric body (Figure 1A). Biopsy results indicated the presence of signet ring cell type gastric adenocarcinoma. A contrast-enhanced CT evaluation demonstrated wall thickening in the gastric body (Figure 1B), along with fat stranding and ascites, suggesting peritoneal carcinomatosis. Additionally, diffuse lytic-sclerotic skeletal metastases were identified (Figure 1C). A whole-body  $^{99m}\text{Tc}$  Tc-MDP scan (Figure 1D) was subsequently conducted given her bone pain and CT scan findings, which revealed a pattern consistent with "superscan". Both whole-body (Figure 1D) and static images (Figure 1E) demonstrated relatively homogeneous and diffuse increased uptake of  $^{99m}\text{Tc}$  Tc-MDP throughout the skeleton, accompanied by non-visualization of the kidneys and high target-to-background ratios.



**Figure 1.** (A) Endoscopic assessment shows an infiltrative mass in the proximal portion of the gastric body. (B) Wall thickening of the gastric body on the contrast-enhanced CT images. (C) Bone window of the CT images demonstrates diffuse lytic-sclerotic skeletal metastases. (D) The whole-body scan shows diffusely increased MDP uptake in the axial and proximity of the appendicular skeleton as well as negligible renal and soft tissue uptake. (E) The static images of the skull and pelvic region clearly shows the increased MDP uptake in the axial skeleton

## DISCUSSION

Bone scintigraphy is highly sensitive for detecting osteoblastic metastases, but the superscan pattern can be misinterpreted as normal by inexperienced readers. Superscans can result from metastatic, metabolic, or hematologic conditions. Metabolic etiologies often exhibit characteristic features, including symmetrical uptake, distal appendicular uptake, periarticular uptake on bone scans, as well as osteolytic lesions on CT, ribs pain, and hypercalcemia [1, 2]. In a previous study, it was reported that a bone superscan occurs in 2.6% of gastric cancer patients, and its manifestation during initial staging is extremely uncommon [3-6]. Furthermore, a study indicates that gastric cancer accounts for 6.25% of bone superscan cases [7]. The metastatic pattern of gastric cancer varies according to the pathological subtype and anatomical location. Cardia cancers are more likely to metastasize to the lungs, brain, and bones, while non-cardia cancers tend to metastasize more frequently to the peritoneum. On the other hand, Signet ring adenocarcinomas more frequently metastasize to the peritoneum, bone, and ovaries, while they metastasize less often to the lungs and liver compared to generic adenocarcinomas. Given these differences, it's better to consider bone scan imaging particularly in patients with cardia cancers and those diagnosed with signet ring adenocarcinomas, as these subtypes have a higher propensity for bone metastases [8]. A chest, abdomen, and pelvic contrast-enhanced CT scan is the preferred modality for initial staging [9]. Given the rarity of bone involvement in gastric cancer, with a reported incidence ranging from 3.5% to 10%, bone scans are generally performed only in symptomatic cases and are not routinely utilized. However, early detection of bone involvement through bone scans can guide appropriate management and avoid futile interventions including surgery or radiotherapy [10]. We conducted a systematic search of the PubMed database using the following search terms: (Stomach Neoplasm\*[tiab] OR Gastric Neoplasm\*[tiab] OR Stomach Cancer\*[tiab] OR Gastric Cancer\*[tiab]) AND (Bone\*[tiab] OR Condyle\*[tiab]) AND (metastas\*[tiab]). This strategy was designed to identify case reports and studies related to bone superscan occurrences in gastric cancer. Our findings (summarized in Supplementary Table 1) indicate that these cases are more frequently reported in Asia, likely due to the region's highest incidence of gastric cancer [11, 12]. However, new emerging functional imaging modalities, including FAP (fibroblast activation protein)-targeted imaging, are being developed for

use in gastric cancer and may help overcome the limitations of previously employed functional imaging techniques, such as [ $^{18}\text{F}$ ]F-FDG PET/CT and [ $^{99\text{m}}\text{Tc}$ ]Tc-MDP scans [13-16].

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