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# Liver Uptake on Bone Scan; A Diagnostic Algorithm.

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### Abstract

In this case report, we present a case of liver uptake seen on bone scan due to diffuse metastatic disease from breast carcinoma. We discuss possible etiologies for liver uptake on bone scan and offer a diagnostic algorithm to narrow the differential.

#### Introduction

Hepatic uptake of <sup>99m</sup>Tc MDP is an unexpected finding and should trigger a set of questions by the interpreting physician, as the distinction between technical and pathologic causes is critical to direct further evaluation of the patient.

### Case Report

A 54 year old female with past medical history of right breast cancer, status post mastectomy with breast reconstruction and chemotherapy 2 years prior to presentation developed a fever and was admitted to the hospital for further evaluation. Laboratory studies were remarkable for elevated Alkaline Phosphatase (ALP) of 413 U/L, Aspartate Aminotransferase (AST) of 300 U/L and Alanine Aminotransferase (ALT) of 272 U/L.

As part of the work up, a <sup>99m</sup>Tc methylenediphosphonate (<sup>99m</sup>Tc MDP) bone scan was obtained to evaluate for osseous metastasis. Three hours following intravenous administration of 22 mCi of <sup>99m</sup>Tc MDP, anterior and posterior whole body and spot views were obtained.

### Discussion

Whole body images show abnormal ill-defined radiotracer in the right upper quadrant of the abdomen suggesting liver uptake (fig 1 and 2). A subtle photopenic defect is present over the right upper anterior thorax, corresponding to the patient's known breast implant. Given the patient's history of breast cancer and abnormal liver function studies, concern for metastatic disease to the liver was raised. However, when faced with abnormal liver uptake on bone scan, a regimented interpretation algorithm is strongly suggested, especially when detailed patient history is not present. We recommend the following approach when faced with such a case:

First, determine if the patient has undergone a recent nuclear medicine study which would interfere with the bone scan. Examples include <sup>99m</sup>Tc sulfur colloid or <sup>99m</sup>Tc –labeled WBC scan within the last day, or <sup>111</sup>In WBC or <sup>67</sup>Ga scan within the last week. Additional uptake within the spleen would point toward recent sulfur colloid or labeled WBC injection, whereas activity in the colon would support <sup>67</sup>Ga administration. The next step is to determine if the dose of <sup>99m</sup>Tc MDP was degraded by excess alumina chemical impurity. This results in colloid formation with subsequent liver uptake. The maximum permissible amount of aluminum ion is 10 mcg/mL of <sup>99m</sup>Tc eluate. Diffuse liver uptake with reduced bone uptake supports this conclusion (*1*). Uptake may also be present in the spleen and bone marrow (*2*). Lastly, one should consider if the patient has primary or metastatic liver disease. Heterogenous uptake in the liver is more suggestive of this diagnosis, and the liver may also be enlarged.

Our patient underwent further evaluation with contrast enhanced CT of the chest, abdomen and pelvis which confirmed hepatomegaly with extensive metastases (fig 3). The patient began to

experience mental status changes secondary to hepatic encephalopathy, and less than two weeks after the bone scan, the patient expired.

## Conclusion

When faced with unexpected hepatic uptake on bone scan, the interpreting physician must first exclude technical factors before recommending workup for liver disorders. In particular, chemical impurity with alumina and recent administration of various radiopharmaceuticals can mimic liver pathology. The interpreting physician should use all clues available particularly when sufficient history is not available. This includes high index of suspicion for signs of metastatic disease, search for additional uptake in the spleen and GI tract to suggest prior administration of various radiopharmaceuticals and scrutinizing the distribution of liver uptake.

## References

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2. MacDonald J. Idiopathic hepatic uptake of 99mTc methylene diphosphonate: a case report. *J Nucl Med Technol.* 2001;29:32-36

Figure Legend:

Figure 1. Anterior and posterior whole body images from <sup>99m</sup>Tc MDP bone scan shows heterogenous uptake in the right upper quadrant of the abdomen with morphology suggestive of liver.



Figure 2. Spot anterior view of the thorax and upper abdomen from <sup>99m</sup>Tc MDP bone scan shows better detail of heterogenous liver uptake. Photopenic defect overlying right anterior chest wall corresponds to breast prosthesis.





Figure 3. Contrast enhanced coronal CT shows extensive hepatic metastases with hepatomegaly. Right breast prosthesis is also present.

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