1 Normal Patterns and Artifacts

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Bone Marrow Hyperplasia

Granulocyte colony-stimulating factor is a glycoprotein hormone that regulates proliferation and differentiation of granulocyte precursors. It is used to accelerate recovery from chemotherapy-related neutropenia in cancer patients. Intense increased FDG uptake is commonly observed in the bone marrow and/or spleen following GCSF therapy; however, the bone marrow response to GCSF can be differentiated from pathological infiltration by its intense homogeneous nature without focally increased areas of FDG uptake. Increased FDG uptake attributable to GCSF uptake rapidly decreases following completion of therapy and generally resolves within a month (Fig. 1.1).

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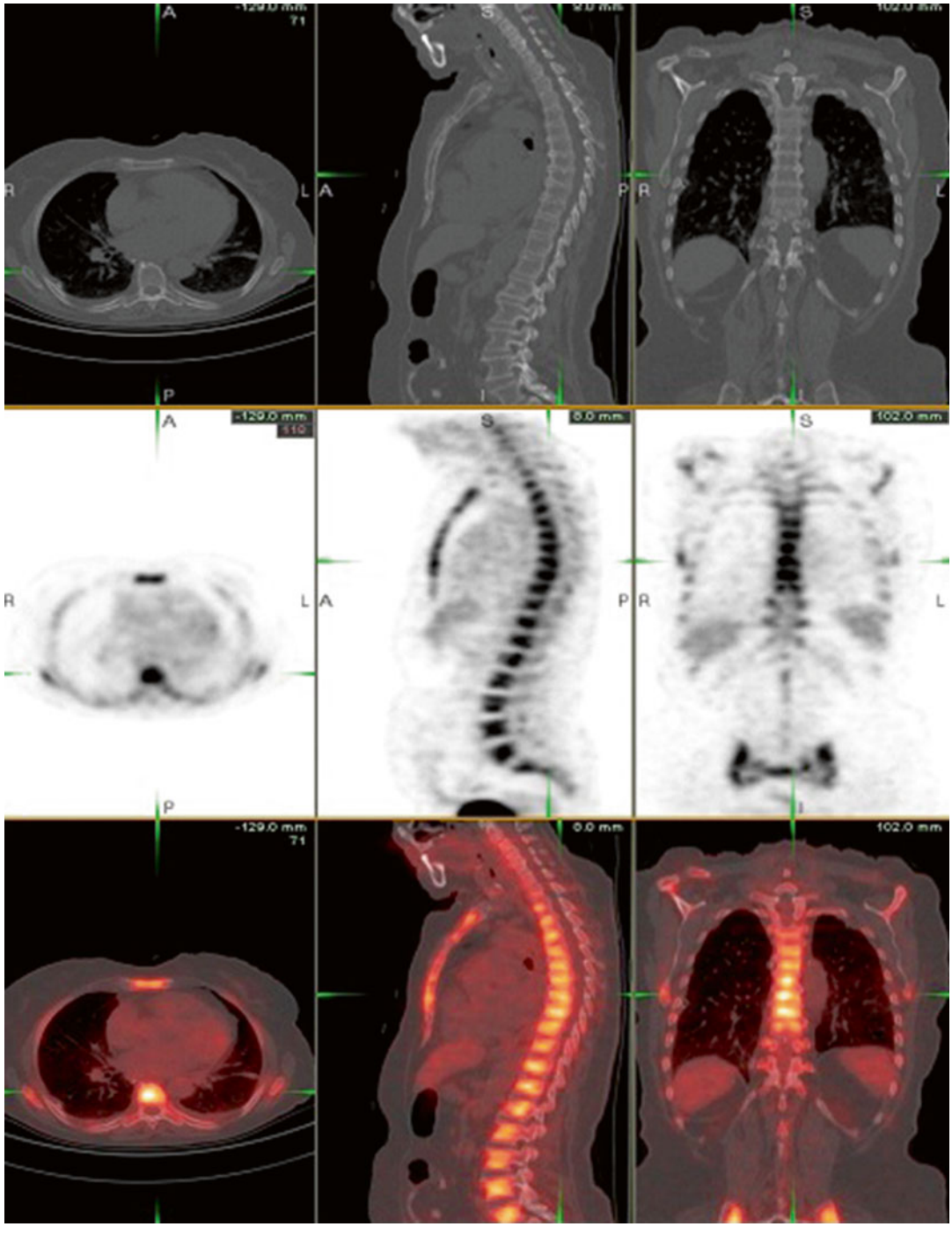


Fig. 1.1

Metal Implants

The presence of metal implants in the body produces streak artifact on CT imaging and degrades image quality. When CT images are used for attenuation correction, the presence of metal results in over-attenuation of PET activity in this region and can result in artifactual "hot spots." Metal prostheses, dental fillings, indwelling ports, breast expanders, and sometimes contrast media are common causes of streak artifact secondary to high photon absorption and can cause attenuation correction artifacts. In order to avoid false positives, particularly when imaging metallic implants, careful attenuation should be paid to the non-attenuation-corrected images, which do not produce this artifact (Fig. 1.2).

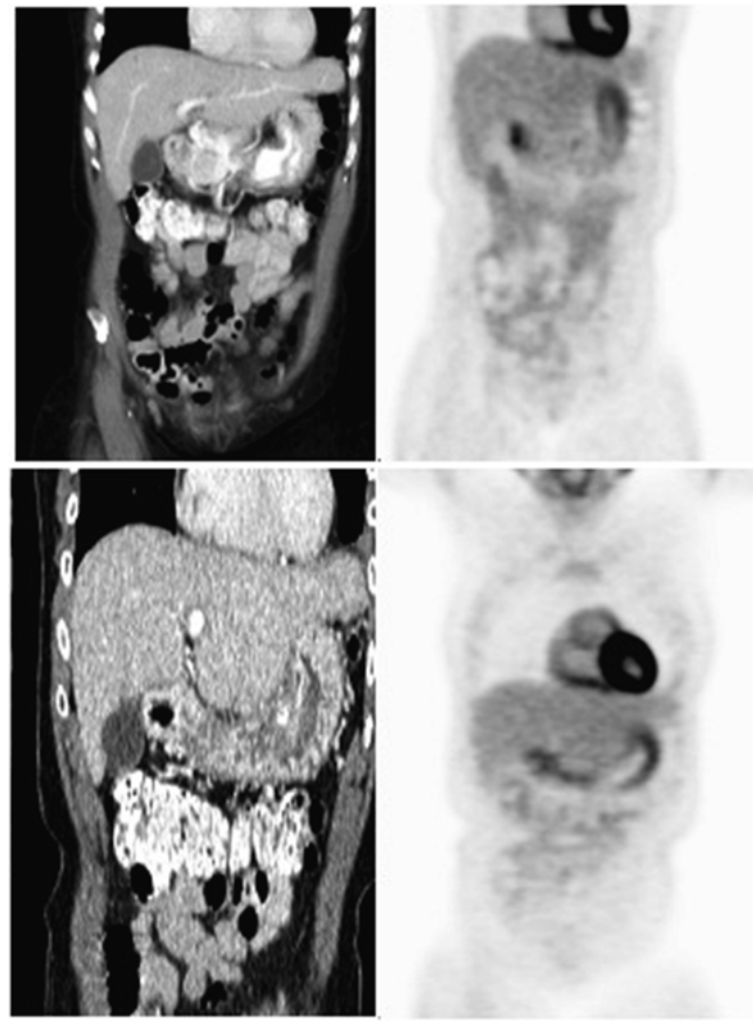


Fig. 1.2

Pacemaker Artifact

See Fig. 1.3.

Epidural Stimulator Artifact

See Fig. 1.4.

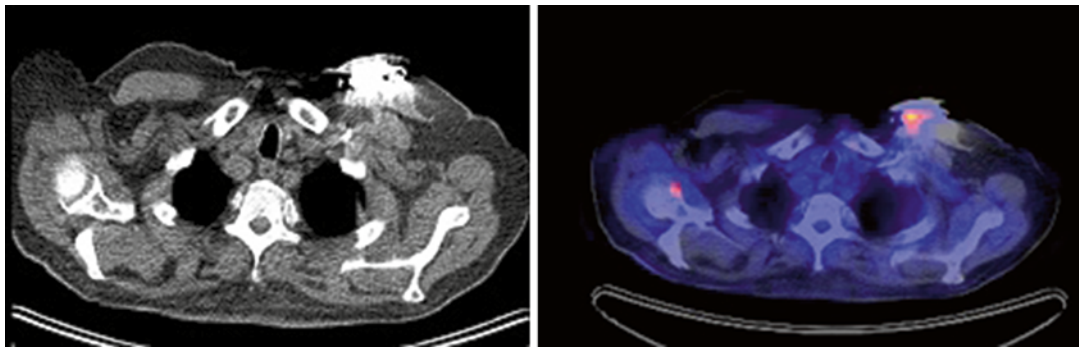


Fig. 1.3

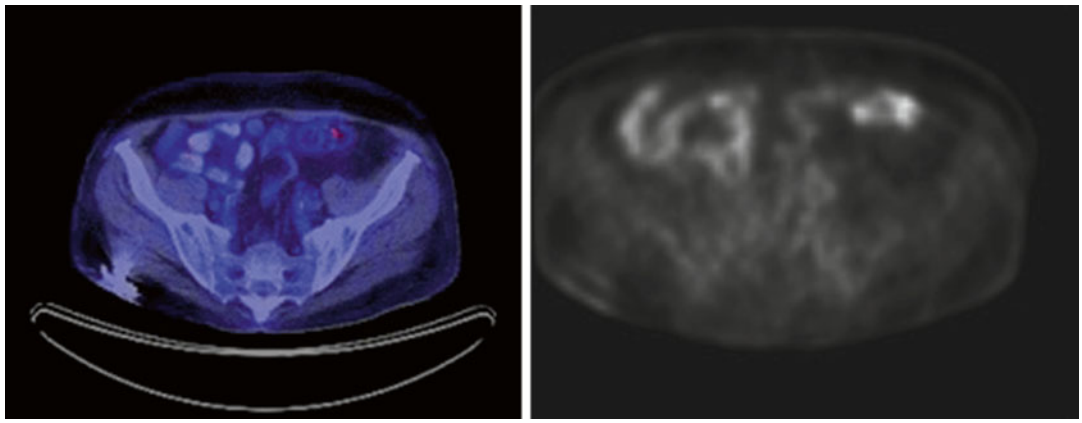


Fig. 1.4

Vascular Uptake [Aorta] and Bilateral Hip Joint with Peripheral Uptake: Inflammatory Degenerative Changes

See Fig. 1.5.

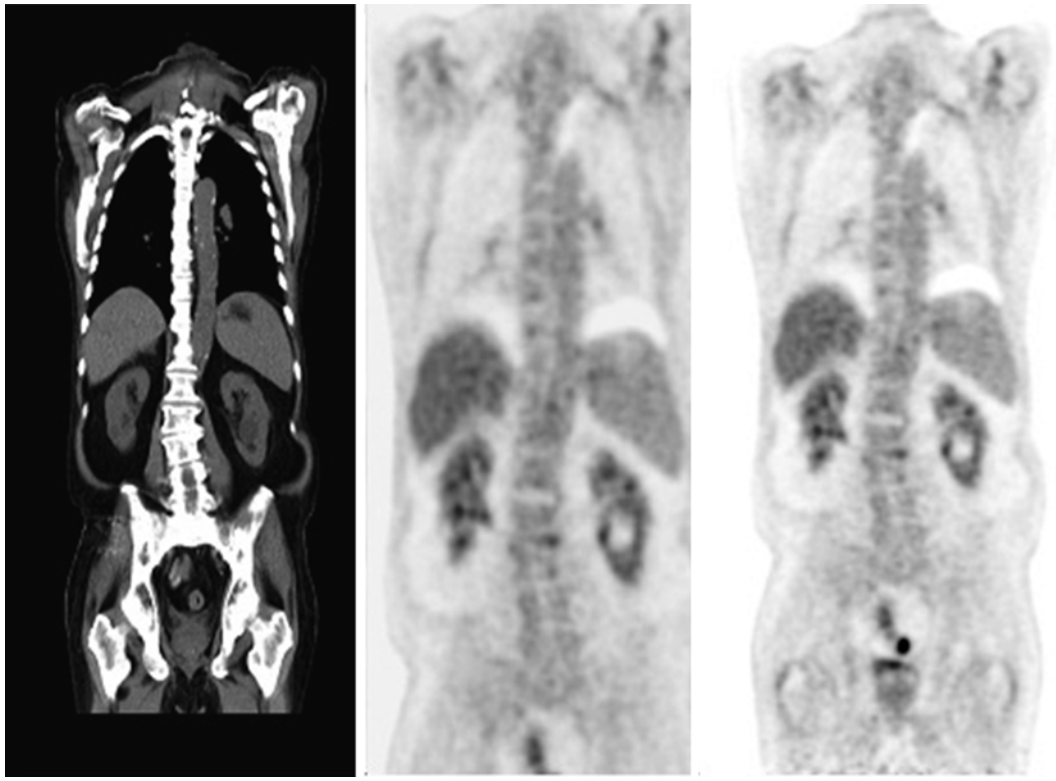


Fig. 1.5

Post-RFA Assessment Lesions

See Fig. 1.6.

Post-RFA of Hepatic Lesion Photopenia (Absent Uptake) on PET Images on the Left Correlating with Low Attenuation Region on CT

Post-RFA (radio-frequency ablation) assessment of lesion PET is useful as it distinguishes treated lesion by whether it is actively metabolizing glucose or dead in the area of destruction (photopenia) (Fig. 1.7).

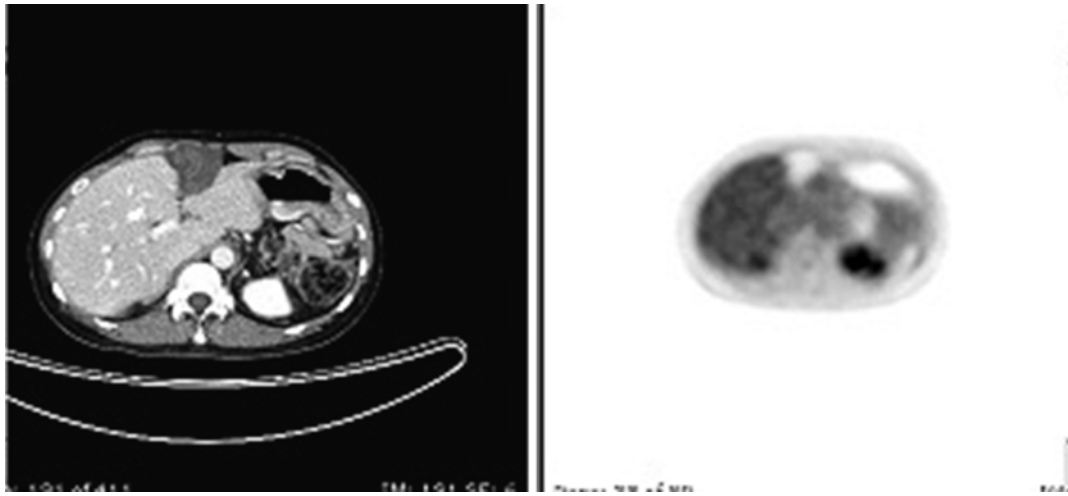


Fig. 1.6

Fig. 1.7

Subclinical Aspiration

Inflammatory changes in the lungs can be noted in asymptomatic patients related to subclinical aspiration (Fig. 1.8).

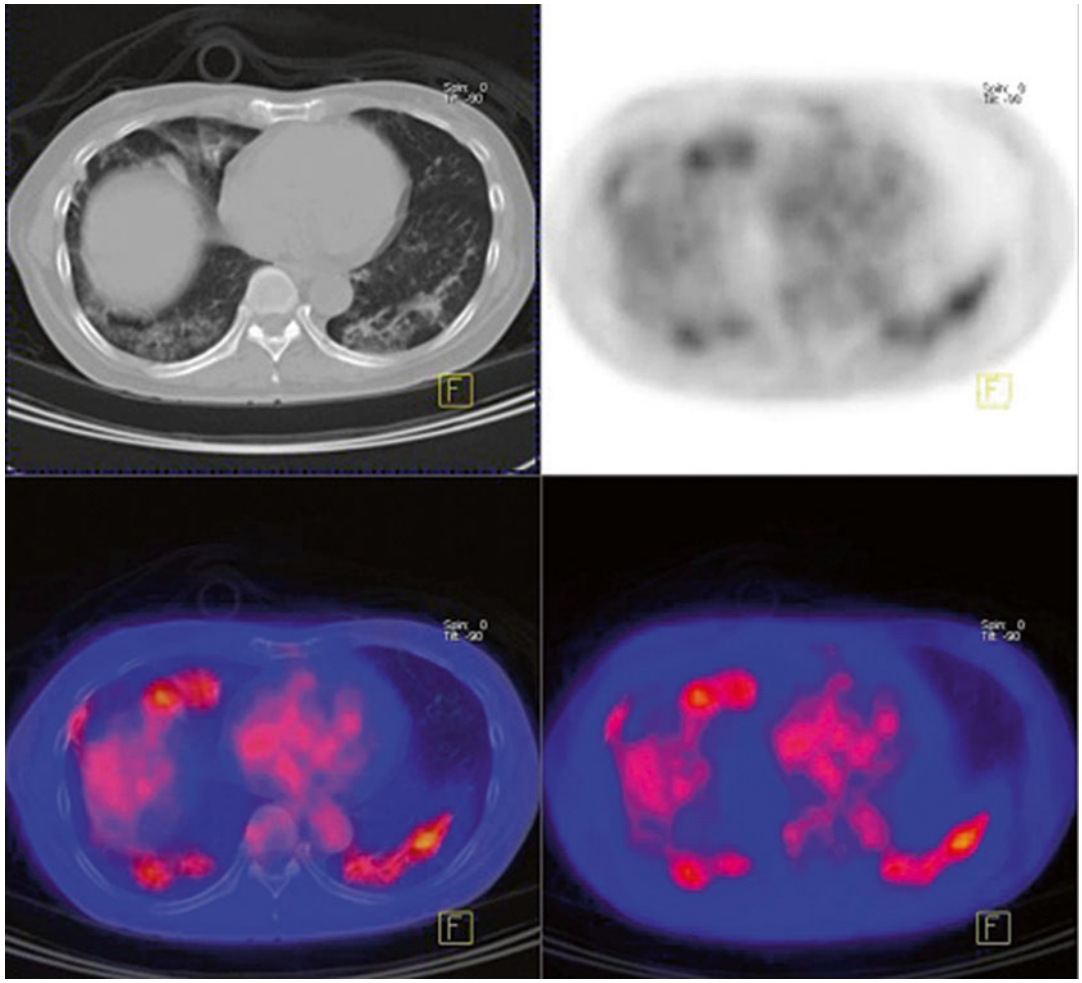


Fig. 1.8

Postradiation Changes in the Mid Spine with Low Bone Mineral Density on CT and Photopenia (Absent Uptake) on PET

See Fig. 1.9.

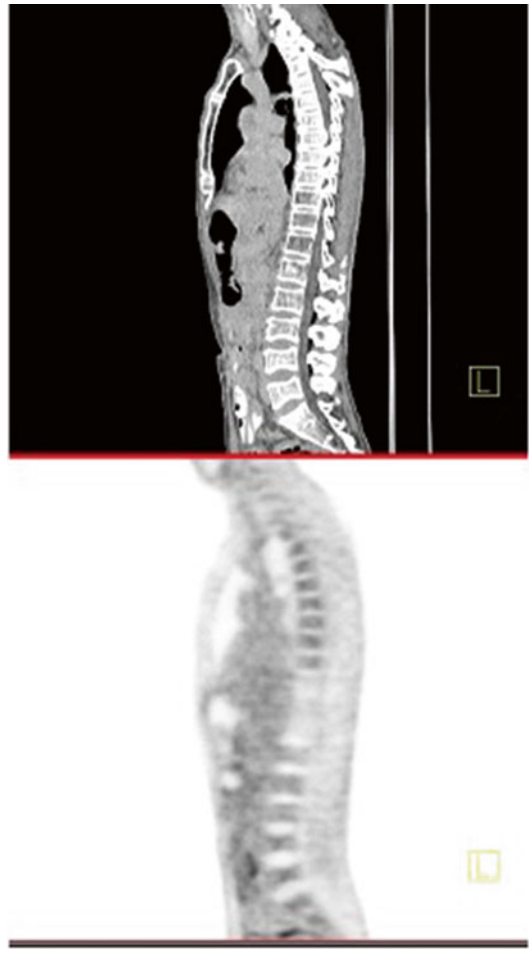


Fig. 1.9

Thymic Hyperplasia Post Chemotherapy

Thymic hyperplasia post chemotherapy is a well-described phenomenon. It is generally seen in children and young adults post chemotherapy. The presence of increased FDG uptake in the anterior mediastinum can be attributed to thymic hyperplasia by identification of a triangular soft tissue density seen retrosternally on CT with a characteristic bilobed anatomical appearance. In the presence of thymic hyperplasia, there is generally preservation of the normal shape of the gland despite an increase in size (Figs. 1.10 and 1.11).

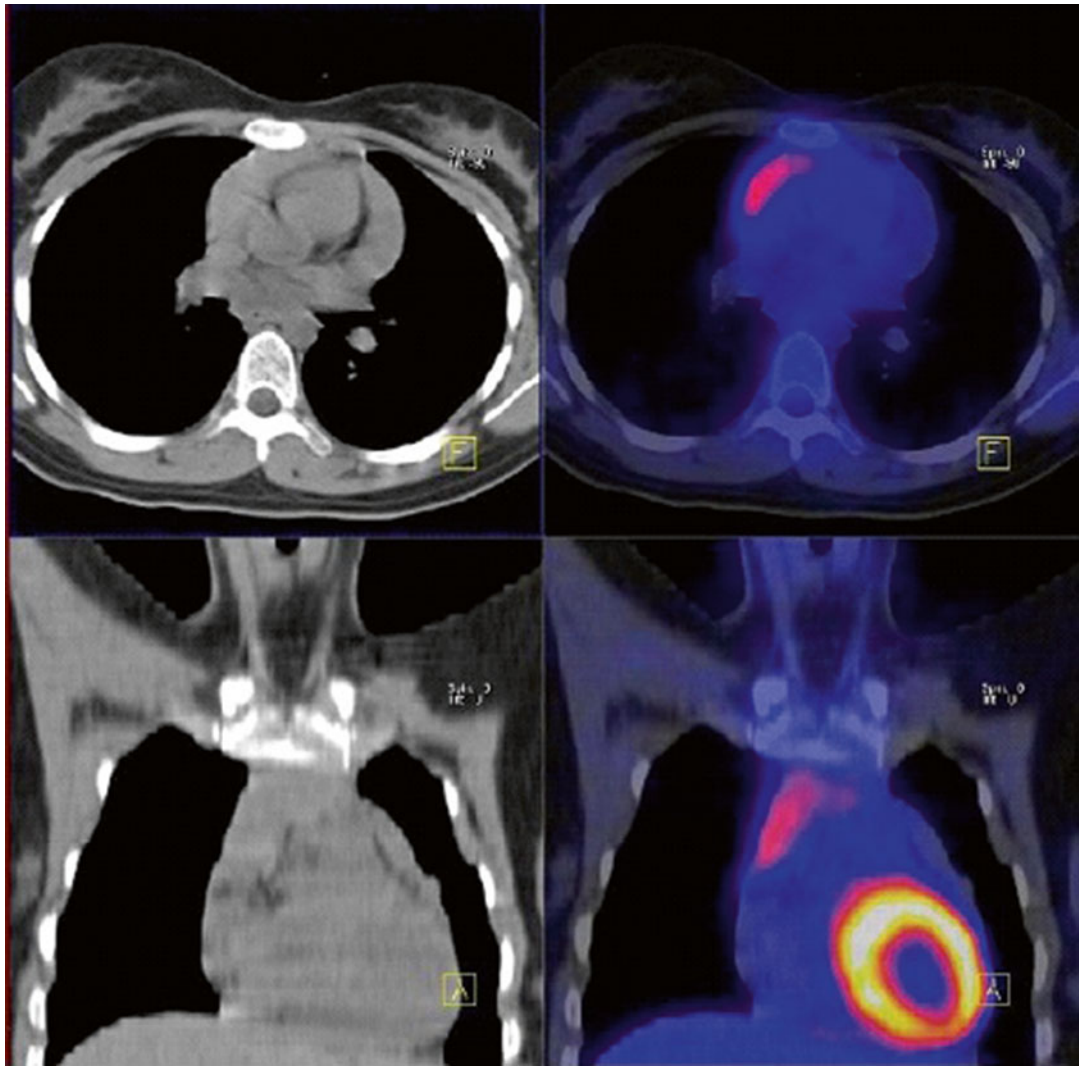


Fig. 1.10

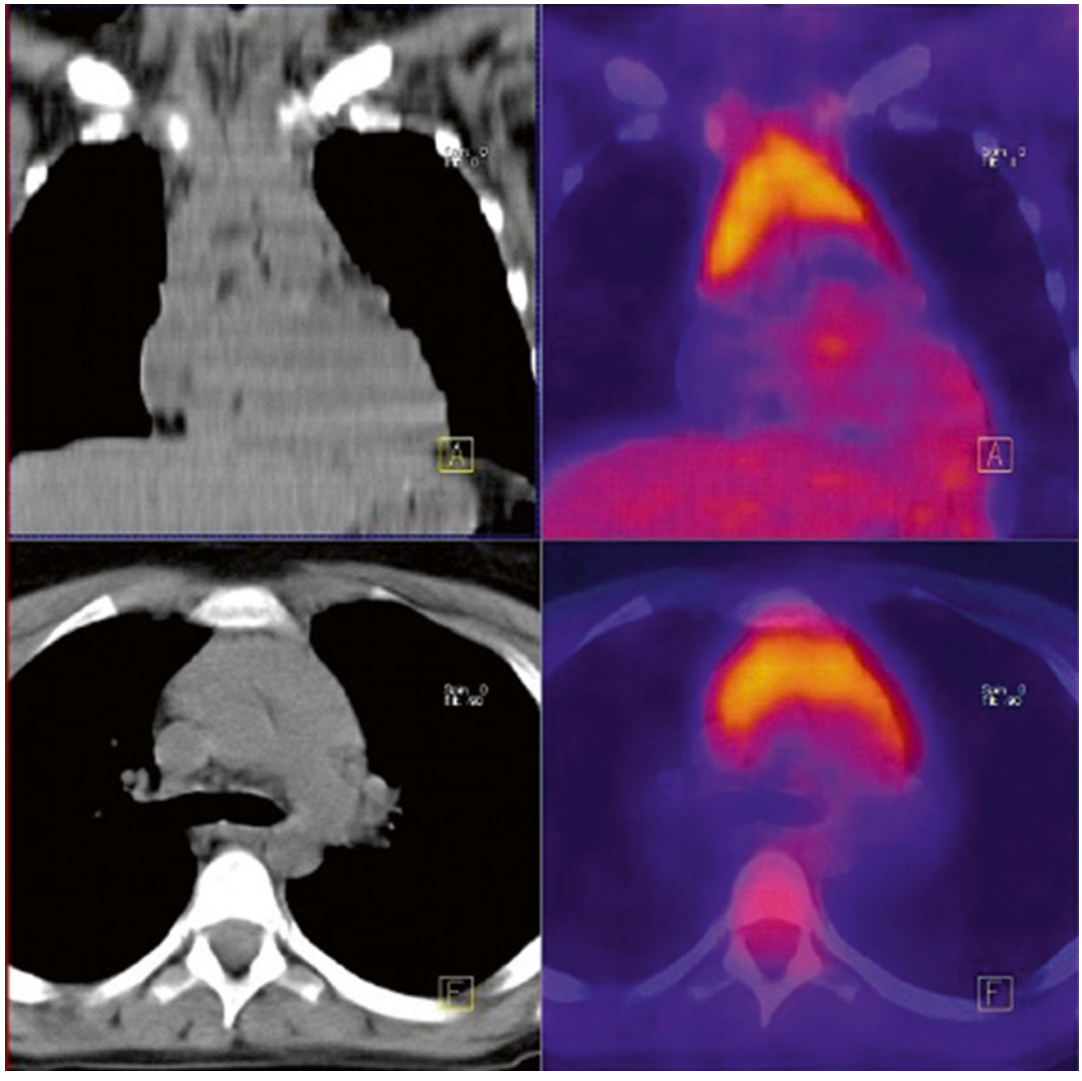


Fig. 1.11

Dextrocardia

See Fig. 1.12.

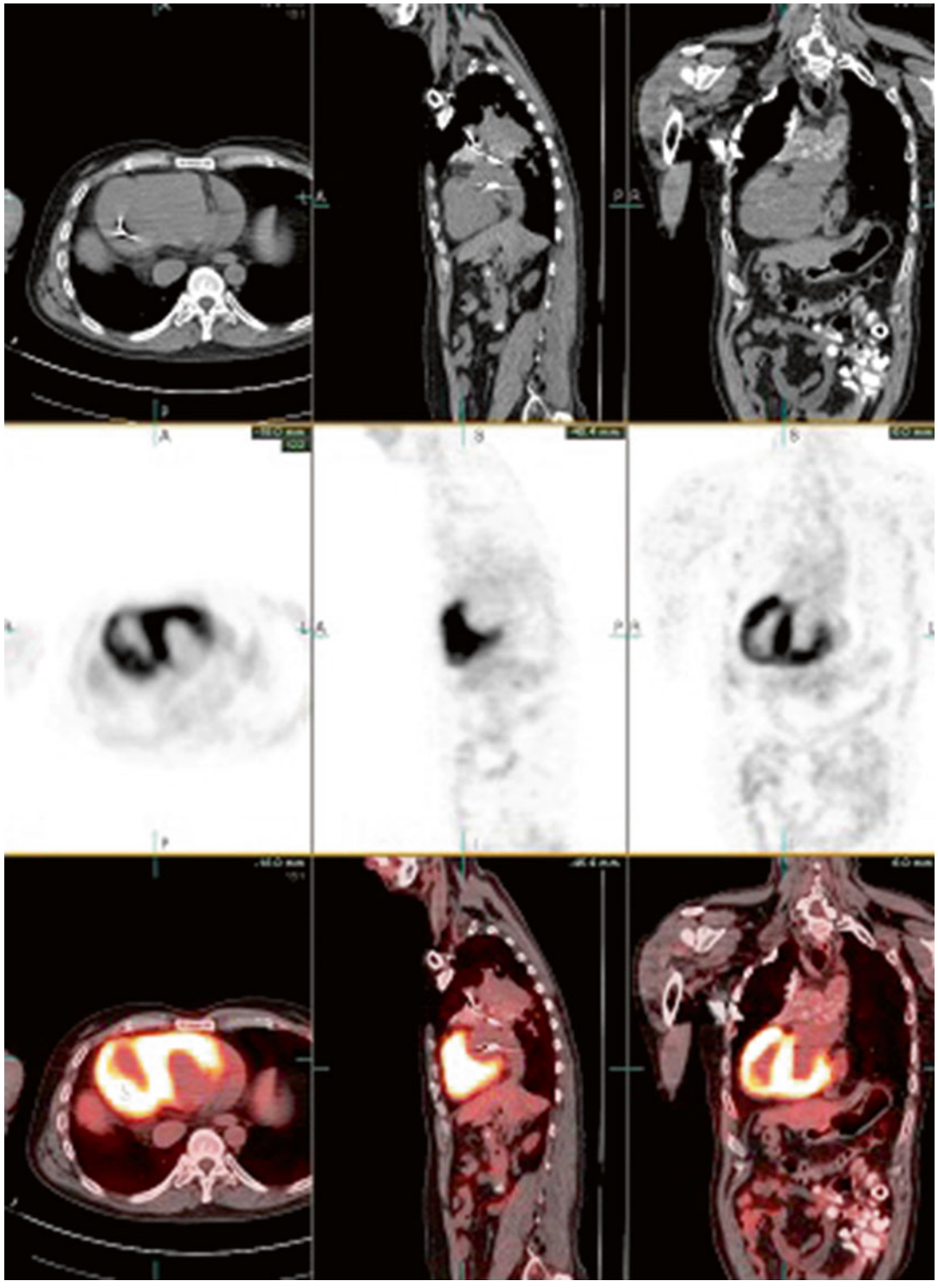


Fig. 1.12

Muscular Uptake Variations on PET/CT Scan

Normal muscles accumulate little ^{18}F-FDG, but muscles exercised just before or around the time of ^{18}F-FDG injection can exhibit intense ^{18}F-FDG uptake. Muscle uptake can be attributed to voluntary or involuntary muscle activity, increased insulin, and surgical interventions. Voluntary muscle activity consists of activities such as talking, chewing, and exercising. Involuntary muscle activity would include labored breathing or muscle spasms/tension. Postradiation treatment or injection-related inflammatory changes in the muscles can also cause F-18 FDG uptake.

Radiation Myositis

See Fig. 1.13.

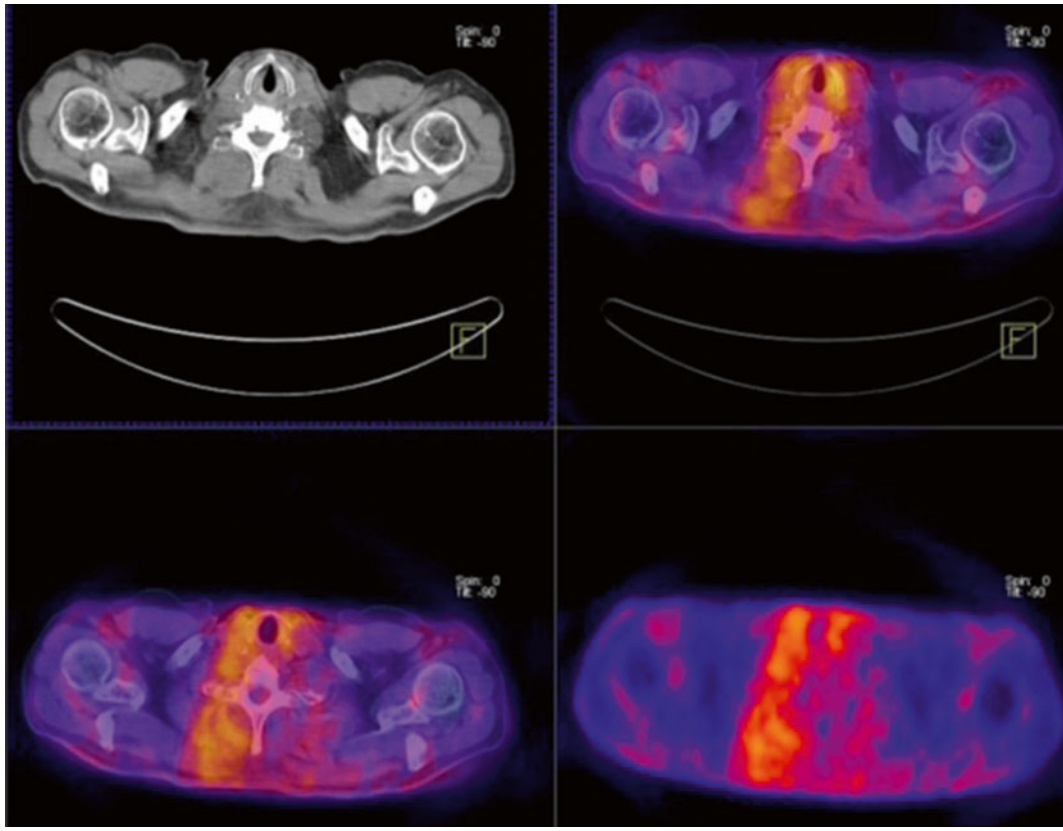


Fig. 1.13

Weight Lifting

See Fig. 1.14.

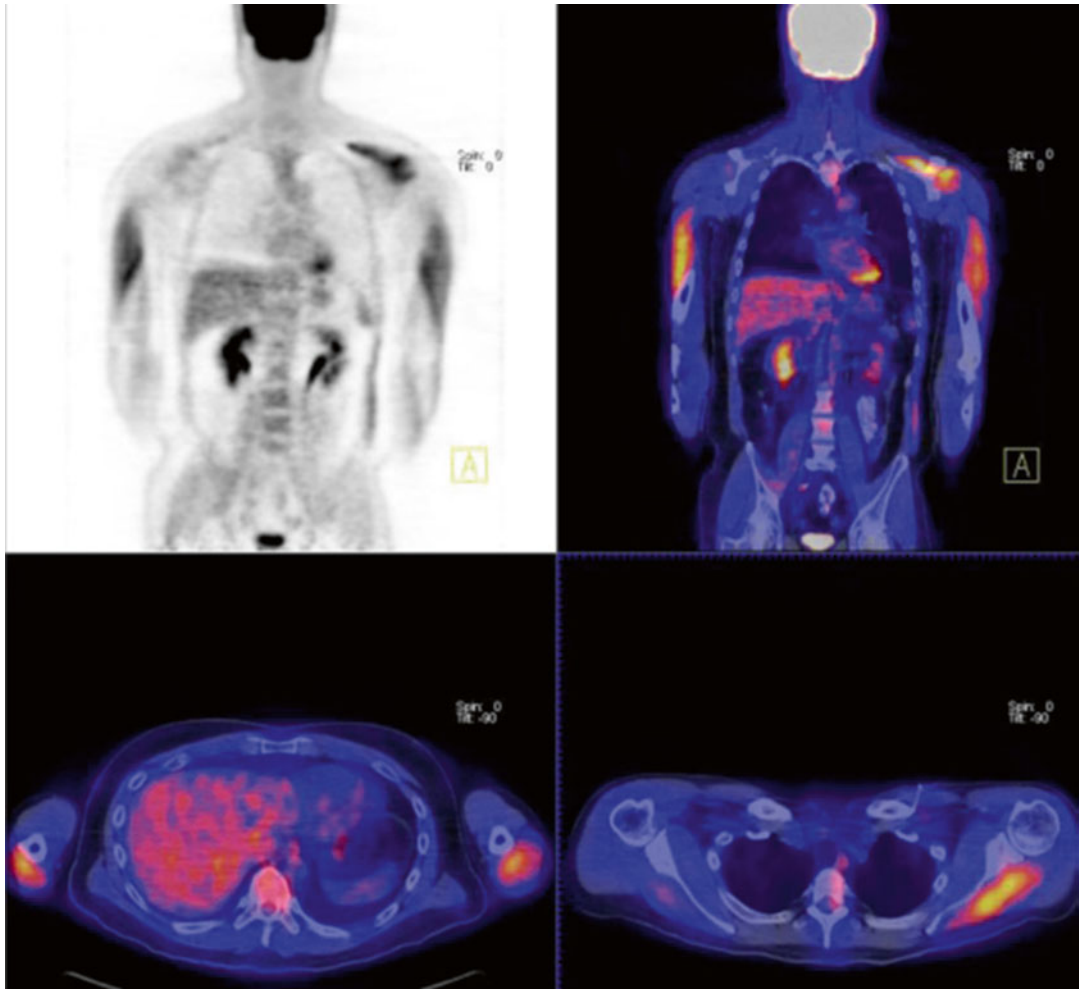


Fig. 1.14

Sit-Ups Prior to Injection

See Fig. 1.15.

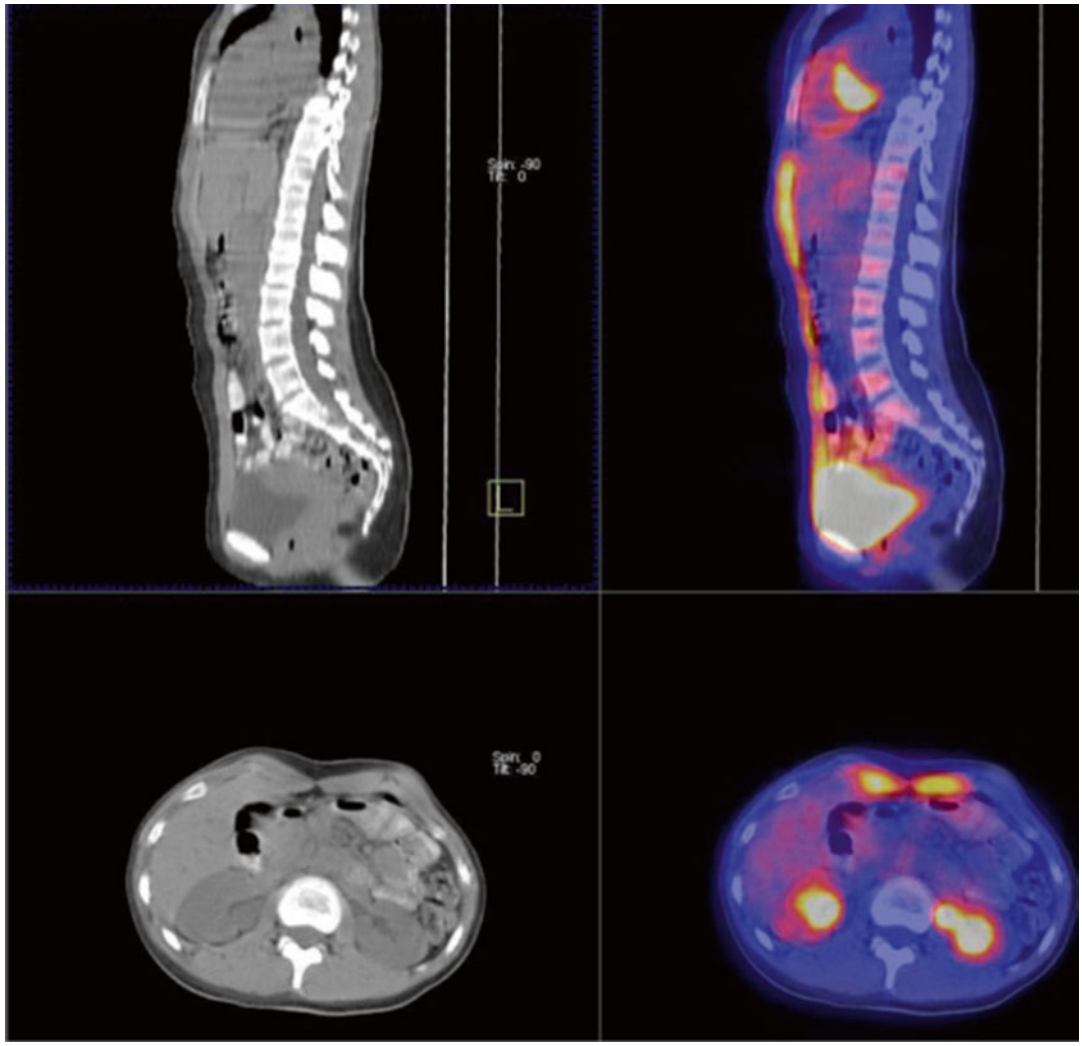
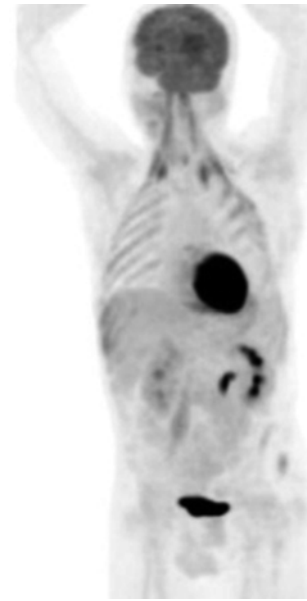


Fig. 1.15

Tense, Cervical, and Intercostal Muscular Uptake

See Fig. 1.16.

Fig. 1.16



PET Uptake Secondary to Inflammatory Changes Post Subcutaneous Injections

Gluteal Subcutaneous Uptake, Postinjection Soft Tissue Changes on CT

See Fig. 1.17.

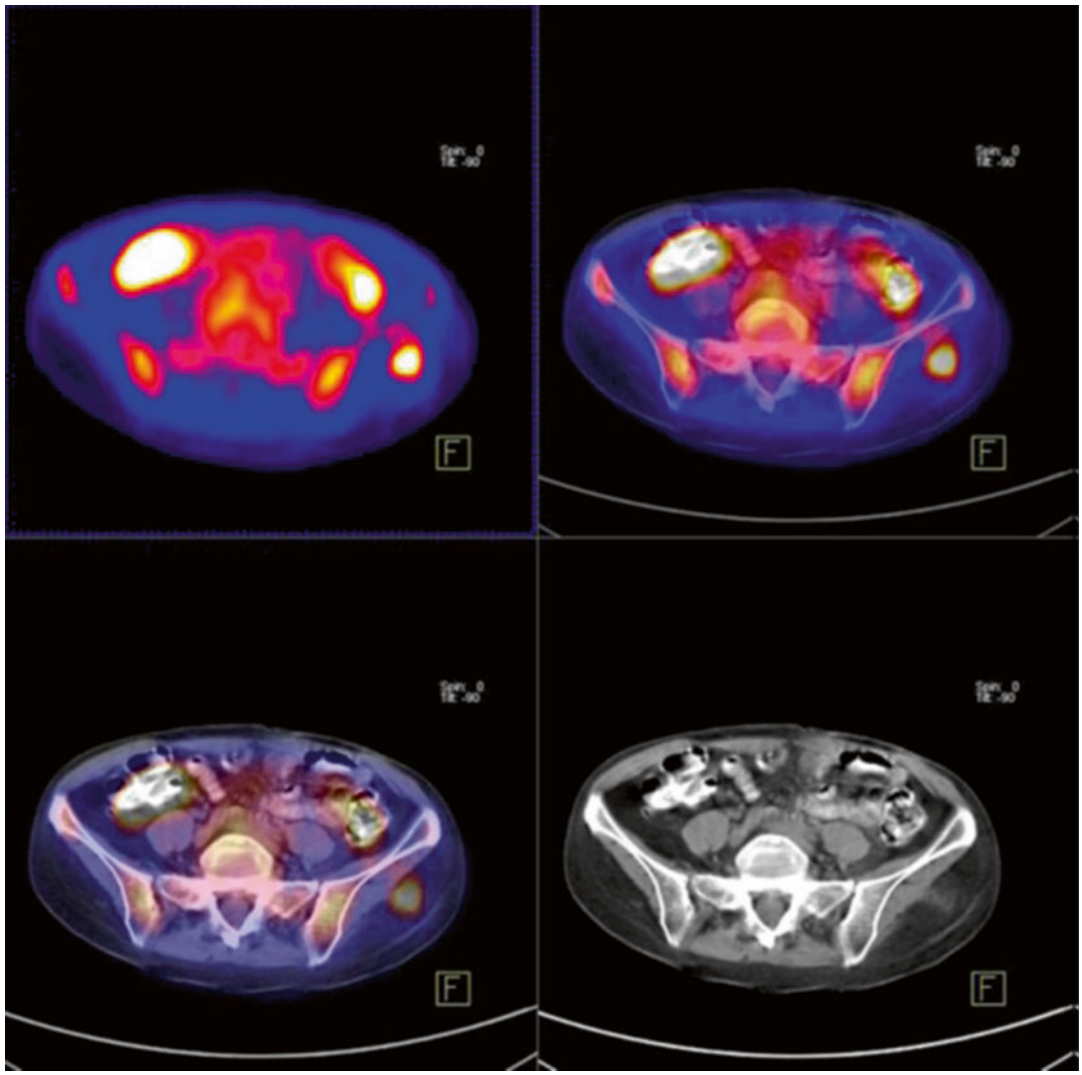


Fig. 1.17

Thigh Subcutaneous Uptake, Postinjection Soft Tissue Changes on CT

See Fig. 1.18.

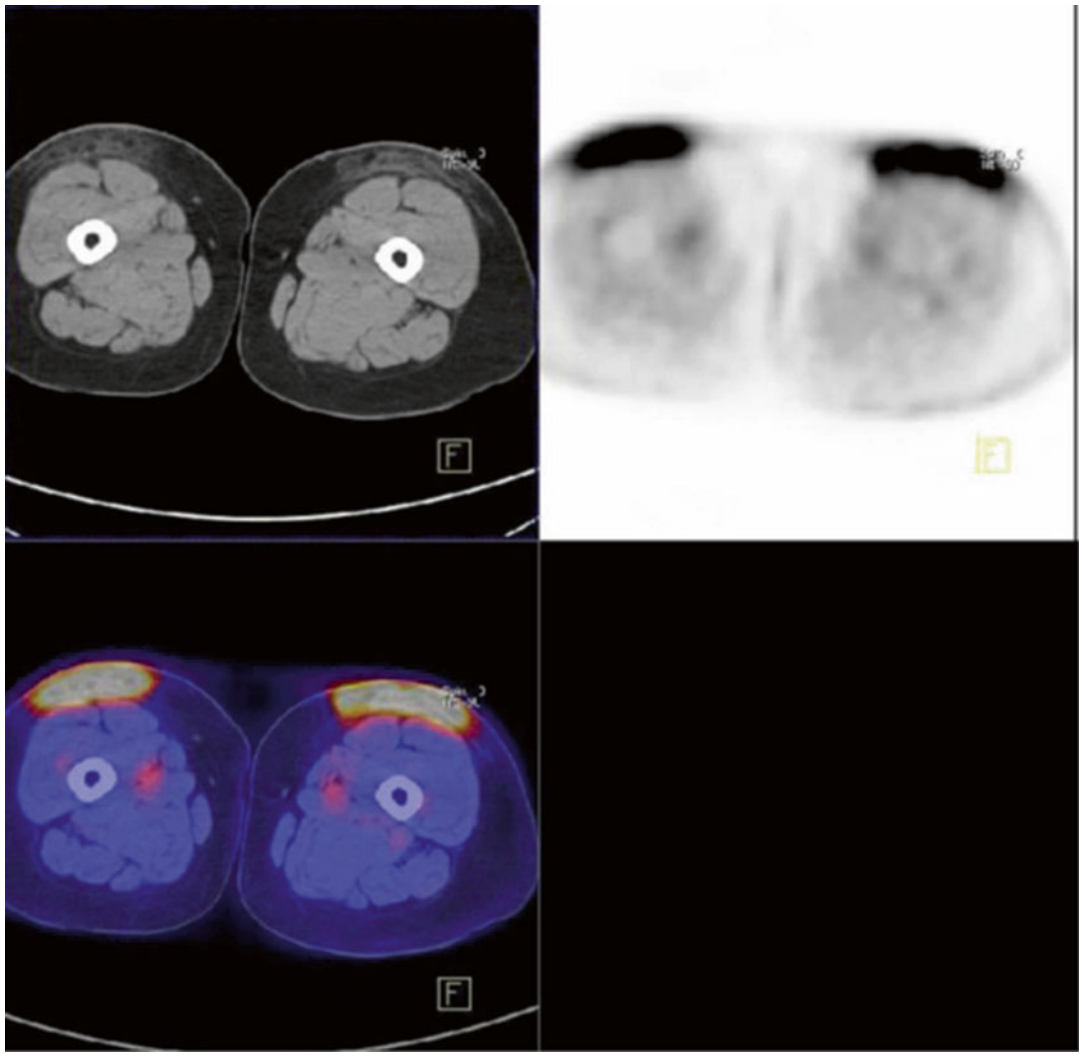


Fig. 1.18

Attenuation Correction Artifact

Vertebroplasty Artifact, Increase Uptake on AC Images (Left) with no Uptake on NAC Images (Right)

Comparison of the attenuation-corrected and non-attenuation-corrected images is important as it demonstrated that the activity was due to an artifact of attenuation correction. The CT scan correlated the site of vertebroplasty to the foci of increased uptake of ^{18}F-FDG. The cement for the vertebroplasty has high density (much denser than normal bone). PET/CT uses the transmission scan from the CT as a density map for attenuation correction of the measured activity. In this case, the attenuation correction algorithm added back too many counts to compensate for attenuation by the extremely dense cement (Fig. 1.19).

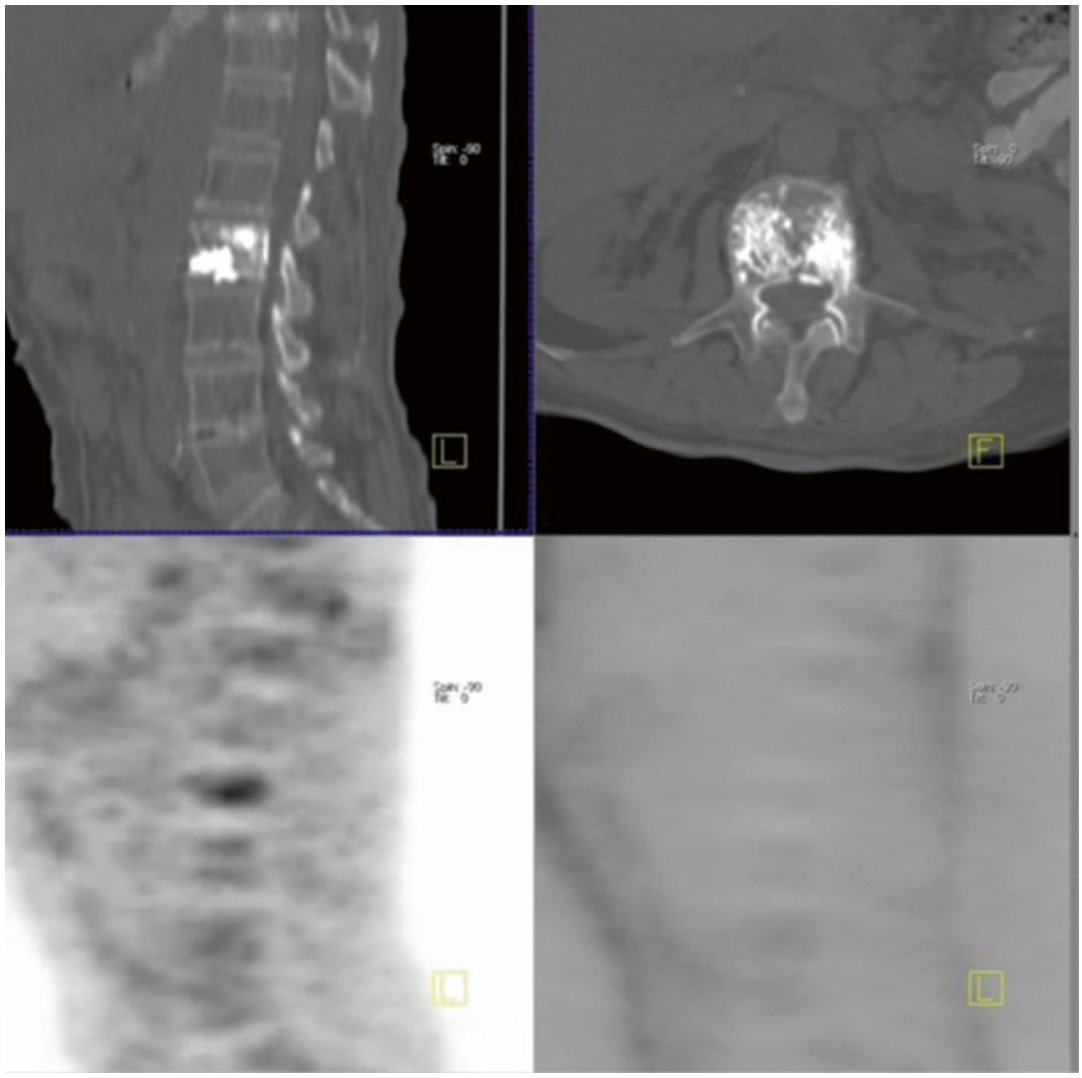


Fig. 1.19