The pleura are the pair of membranous linings surrounding the lungs. The visceral pleura covers each lung surface, and the parietal pleura covers the inner surface of the thoracic cavity. Normally, the visceral and parietal pleura oppose each other, have negligible material between them, and are so thin as to be nearly imperceptible on computed tomography (CT). Thus, if you can see the pleura between lung and chest wall, it is abnormal. Pleural abnormalities are often associated with pleural effusions, which may obscure underlying solid pleural masses.

The differential for pleural abnormalities includes malignancies (metastases, lymphoma, mesothelioma) and benign (empyema, asbestos-related pleural disease, fibrous tumor, post-pleurodesis inflammation) etiologies.

**POSTPLEURODESIS INFLAMMATION**

Patients with large volume pleural effusions may undergo pleurodesis to help prevent future pleura fluid accumulation. The effectiveness of pleurodesis derives from the pleuritis produced by chemical irritation from talc which is introduced between the parietal and visceral pleural layers. The talc has high attenuation and persists indefinitely following the procedure. If a pleural lesion shows high attenuation on CT in a patient with a history of pleurodesis, this is consistent with postpleurodesis reactive inflammation because less than 10% of pleural malignancies develop calcifications. The chemical irritation from talc also may persist indefinitely, resulting in markedly 18F-fluorodeoxyglucose (FDG)-avid pleural thickening with areas of high attenuation. This may persist for years or decades and should not be confused with FDG-avid pleural metastases. Postpleurodesis inflammation is normally not associated with a pleural effusion. Thus FDG-avid pleural thickening with areas of high attenuation on CT, but without associated pleural effusion, is consistent with benign postpleurodesis inflammation and may persist indefinitely (Fig. 9.1). Follow-up imaging demonstrating new areas of pleural thickening or new pleural effusions is suspicious for recurrent malignancy.

**PLEURAL METASTASES**

Many primary malignancies (most commonly lung and breast cancers) metastasize to the pleura. This appears as pleural thickening or pleural-based masses on CT and is often avid on FDG positron emission tomography (PET). In contrast to postpleurodesis inflammation, pleural metastases are not usually calcified and are often associated with a pleural effusion (Fig. 9.2). In addition, unlike postpleurodesis inflammation, pleural metastases will increase or decrease during the course of treatment. Depending on the size and avidity of the pleural metastases, they may be visible on both the CT and FDG PET (see Fig. 9.2), the FDG PET but not CT (Fig. 9.3), or the CT but not the FDG PET. Pleural metastases may be occult on both CT and FDG PET but diagnosed through sampling of the pleural fluid. In patients with lung, breast, and ovarian cancers, the presence of a pleural effusion should raise suspicion for pleural metastases, even without pleural thickening/masses on CT or appreciable FDG avidity. Pleural fluid sampling may be needed to exclude the presence of pleural metastases.

**PLEURAL MESOTHELIOMA**

Mesothelioma is a rare, highly aggressive malignancy, most commonly originating from the pleura but may also arise from other membranous linings such as the peritoneum and pericardium. On CT, mesothelioma will be seen as pleural thickening or masses, often associated with a pleural effusion. Mesothelioma is usually markedly FDG avid, and the imaging findings are often indistinguishable from pleural metastases. FDG PET/CT may be valuable in mesothelioma by identifying the extent of disease outside of the pleura (Fig. 9.4).
FIG. 9.1 FDG-avid Postpleurodesis Inflammation. (A) FDG maximum intensity projection (MIP) in a patient with history of ductal breast cancer demonstrates marked FDG avidity overlying the lateral right chest wall (arrow). (B) Axial CT and fused FDG PET/CT demonstrate that the avidity corresponds with right pleura thickening (arrow), which at first may be confused with pleural metastases. However, note the multiple high-attenuation foci in the thickened pleura (arrowheads) and the lack of a pleural effusion. These findings are consistent with benign post-pleurodesis inflammation, which may remain stable for many years.

FIG. 9.2 FDG-avid Pleural Metastases. (A) FDG maximum intensity projection (MIP) in a patient with a history of ductal breast cancer demonstrates marked FDG avidity overlying the right chest wall (arrow). (B) Axial PET, CT, and fused FDG PET/CT demonstrate that the avidity corresponds with right pleura thickening (arrow). Note the lack of associated high-attenuation foci and the presence of a pleural effusion (arrowhead) in these FDG-avid pleural metastases. Compare with Fig. 9.1 demonstrating benign postpleurodesis inflammation.

FIG. 9.3 Pleural Metastases Seen on FDG PET but Not CT. Axial PET, CT, and fused FDG PET/CT in a patient with non-small cell lung cancer demonstrate a pleural effusion (arrow), which by itself in a patient with lung cancer raises suspicion for pleural metastases. There is a dependent FDG-avid focus within the pleural effusion (arrowhead), which represents a pleural metastasis, despite no pleural mass on CT.
Here are a few suggestions to help optimize your interpretation of FDG PET/CT of the pleura:

1. Postpleurodesis inflammation appears as FDG-avid pleural thickening/masses with associated high attenuation (talc) foci and usually without a pleural effusion. This may remain stable over many years and should not be confused with malignancy.

2. Pleural malignancy (metastases, lymphoma, mesothelioma) appears as FDG-avid pleural thickening/masses but without high attenuation foci and often with a pleural effusion.

3. Pleural malignancy may be seen on both the FDG PET and CT, the FDG PET only, or the CT only or be occult on both the FDG PET and CT but diagnosed by pleural fluid sampling.

**FIG. 9.4** Pleural Mesothelioma. (A) FDG maximum intensity projection (MIP) in a patient with mesothelioma demonstrates marked FDG avidity overlying the left chest wall (arrow), as well as multiple additional FDG-avid foci (arrowhead). (B) Axial CT and fused FDG PET/CT demonstrate that the avidity corresponds with left pleura thickening (arrow). The imaging appearance of FDG-avid pleural mesothelioma is indistinguishable from FDG-avid pleural metastases. The FDG PET helps to visualize the extent of malignancy outside of the left pleura, in this case involving the right pleural (arrowhead) as well as peritoneal and nodal disease (not shown on axial images).

**SUGGESTED READINGS**


