The Incomplete Border Sign

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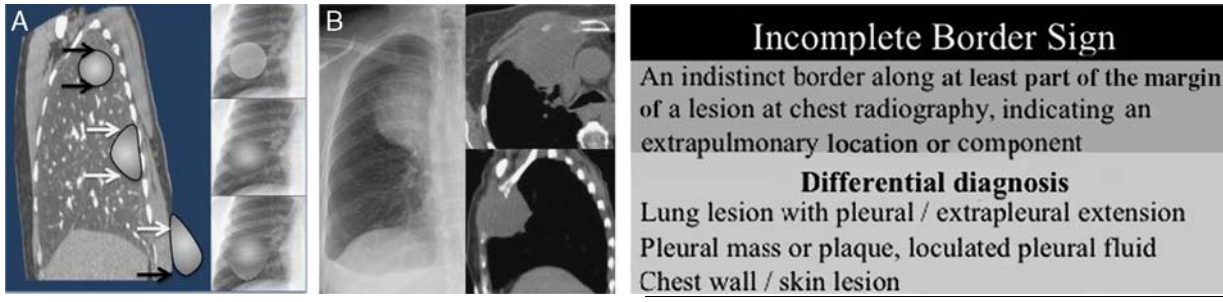

FIGURE 1. A, (Top) *Intraparenchymal mass with sharp border on radiograph.* The X-Ray beam is tangent to the entire lesion margin. (Middle) *Pleural mass with incomplete border.* The X-Ray beam is oblique to the boundary between lung and lesion, and the lesion blends with adjacent soft tissues of similar density. (Bottom) *Chest wall lesion with incomplete border.* The lower border is sharp because the beam takes a tangent to the interface between lesion and air. The upper border is indistinct because of a smooth interface between the lesion and the chest wall. B, *Incomplete border sign.* Right upper lobe mass, primary lung squamous cell carcinoma, invading the pleura and chest wall. The superior margin is indistinct because this border meets the pleura/chest wall and is oblique to the beam. The bottom margin is sharp because the beam is tangential to the interface between lesion and air in the lung.

Appearance: Extrapulmonary lesions often show indistinct borders along at least a portion of their margins at chest radiography. This classic sign has been termed the "incomplete border sign."

Explanation: At radiography, visibility of a sharp border depends on (a) a difference in density between a lesion and adjacent structures, and (b) an edge tangent to the x-ray beam. When not directly adjacent to the pleura, intrapulmonary lesions satisfy both conditions, with a tissue density much greater than surrounding air, and edges tangent to the beam in any projection (Fig. 1, top).

Extrapulmonary (pleural or extrapleural) lesions or lung lesions abutting the pleura do not meet these criteria, often creating an incomplete border. First, the density between the mass and adjacent soft tissue is insufficient to differentiate on radiographs. Second, these lesions often have unique geometry – an oblong shape and obtuse margins conforming to the pleura – creating a smooth gradient of density without a sharp tangent to the beam. The gradually sloping margins of a pleural or extrapleural lesion viewed *en face* may not have *any* discernible borders, as there is no true tangent edge to the lesion (Fig. 1A, middle). Other lesions may have a sharp border along the lesion's interface with air in the lung or outside the thorax, but an indistinct border at the interface with the soft tissues, where a tangent to the beam is not created (Fig. 1, bottom; Figure 1B).

Discussion: Mendelson first used the term "incomplete border sign" as a way to localize abdominal wall and chest wall masses on radiographs.[1] Since then, various authors have highlighted the importance of this sign in differentiating pulmonary versus extrapulmonary lesions.[2–6]

The differential diagnosis for the incomplete border sign is broadly divided into pulmonary lesions with pleural abutment or extension, pleural lesions, and extrapleural lesions. Pulmonary masses involving the pleura and possibly extending to the chest wall can be seen with invasive malignancies and certain aggressive infections. Pleural lesions capable of showing incomplete borders include any pleural mass (e.g. metastasis, fibrous tumor), pleural plaque, or loculated fluid.[6] A pleural effusion within the major fissure can also have an incomplete border on the frontal radiograph, as the lentiform shape and oblique orientation preclude true tangents to the X-ray beam. Extrapleural lesions arise from tissues superficial to the parietal pleura. Rib lesions are probably the most common (such as metastases or rib fractures with hematoma and callus), but lipomas and nerve sheath tumors are also routinely encountered. Nipples or other skin lesions may also simulate a nodule and demonstrate incomplete borders.

The incomplete border sign is created by the unique geometry of an extrapulmonary mass, or extrapulmonary extension of a pulmonary parenchymal lesion. Recognition of the sign can guide the radiologist in formulating appropriate differential considerations for such masses.

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