Ventilation-Perfusion Mismatch Due to Obstruction of Pulmonary Vein

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A lobar perfusion defect in the presence of a normal arterial phase in the pulmonary angiogram may be due to stasis secondary to compression of a pulmonary vein by a hilar or perihilar mass. In this report we present a patient with metastasis to the right lung and hilum by malignant melanoma. A lobar perfusion defect was present in an area of lung that appeared normal by radiograph. This defect was shown to be due to stagnating blood flow reflected by delayed intense capillary phase in that lobe and late opacification of the corresponding draining vein.


A neoplastic mass situated near the lung hilus may be responsible for abnormalities of pulmonary capillary flow detected by perfusion lung scan. Various disease mechanisms acting alone or in combination can explain this phenomenon. These include pulmonary artery involvement by invasion, compression, or thrombosis; regional hypoventilation secondary to bronchial compromise (1); and systemic-to-pulmonary arterial shunts, usually from hypertrophic bronchial arteries. These bronchopulmonary shunts have been demonstrated in both infectious and neoplastic processes by bronchial arteriography (2). Finally, several authors have proposed that a neoplastic mass compressing pulmonary veins may be responsible for abnormalities noted on pulmonary perfusion scans and pulmonary angiography (1,3–5).

The present case, we believe, clearly documents this supposition. In addition, we stress the importance of pulmonary angiography when a pulmonary embolus is suspected in a patient with a hilar mass, since results of ventilation-perfusion scans may falsely suggest pulmonary embolism.

CASE REPORT

A 41-yr-old white male with metastasizing melanoma was admitted on September 28, 1980 for reevaluation of his chemotherapeutic regimen. He first presented with metastatic disease to the brain and lung in March 1980 after a “benign” skin lesion had been removed from his left posterior auricular region in 1975.

During this last admission the patient complained of sudden onset of right-sided pleuritic chest pain. Physical examination, bone scan, and chest radiograph did not reveal any bony or soft-tissue lesions. Previously noted metastatic nodules in the right middle lung field and right hilum were again observed but were unchanged from previous films (Fig. 1, left). At this time arterial blood-gas results were: $pO_2 = 133$, $pCO_2 = 33$, pH = 7.47.

A ventilation-perfusion lung scan was performed to exclude a pulmonary embolus. The scan demonstrated a ventilation-perfusion mismatch involving the entire right upper lung (Fig. 1, right). This was interpreted as showing high probability for a pulmonary embolus, and a pulmonary angiogram was performed.

The angiographic results are illustrated in Fig. 2. A normal pulmonary arterial phase was noted throughout both lung fields. No embolus was detected. There was a prolonged capillary phase in the right upper lobe. The subsequently visualized vein appeared to be compressed by the mass at the level of the enlarged hilum.

The patient’s chest pain resolved spontaneously and he was discharged on chemotherapy.

DISCUSSION

Pulmonary blood stasis secondary to venous compression by a right hilar metastasis in a patient with malignant melanoma was considered to be the cause of the following pulmonary angiographic findings: (a) normal pulmonary arterial phase, (b) delayed and intense capillary phase in the right upper lobe, and (c) late opacification of the corresponding lobar pulmonary vein. Of further interest was the fact that this condition produced a ventilation-perfusion mismatch on lung scan, strongly suggestive of pulmonary embolism. Although abnormalities of arterial flow were not perceived, capillary- and venous-phase abnormalities were clearly demonstrated in the pulmonary angiogram, explaining the abnormal distribution of macroaggregated albumin.

In this setting, a mass compressing a pulmonary vein, with no significant effect upon the adjacent artery or bronchus, can cause a ventilation-perfusion mismatch that usually suggests pulmonary embolus. Thus, although such a mismatch is said to be 92% sen-
sitive for pulmonary embolism (6), one must be aware of the other pathogenic mechanisms that can cause this picture (7–9).

Since pulmonary angiography has excellent specificity—and, properly done, is a very safe procedure, (8,9)—patients with a hilar mass and ventilation-perfusion mismatch should undergo pulmonary angiography before the initiation of anticoagulation. The risk of hemorrhage secondary to anticoagulation is far from negligible: as many as 30% of patients may bleed, with a 2% mortality (8). Finally, necrotic neoplasms may be predisposed to hemorrhage, and anticoagulation in these patients carries further risks.

REFERENCES

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FIG. 1. Left: PA chest radiograph. Right hilar and lower-lobe metastatic lesions. Right: Posterior scintigraphic projections of Tc-99m MAA pulmonary perfusion (A) and Xe-133 ventilation (B). Ventilation-perfusion mismatch is demonstrated in area of right upper lobe.

FIG. 2. Left: Selective right pulmonary angiogram. Normally arborizing vessels. No evidence of pulmonary thromboembolism. Center: Main pulmonary artery angiogram, venous phase. Delayed and intense capillary phase in right upper lobe is associated with lack of visualization of corresponding draining vein, causing some hilar asymmetry. Opacified aorta (A) indicates late venous phase. Right: Same injection as in center illustration; image taken 12 sec after injection. Aorta is no longer opacified. Very late opacification of right upper lobe vein (arrow) is seen.

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