A 33-year-old male with a chest lesion on a routine chest radiograph

A 33-year-old Bahraini male presented at the health centre for a chest radiograph as a part of a routine medical check up for employment. He had no complaints. There was no history of a hospital visit or other major illness. After routine chest radiograph (Figure 1) he underwent a contrast-enhanced CT scan (Figures 2a, 2b) of the chest, as a part of further work-up for the lesion detected on the chest radiograph.

• What does the routine chest radiograph show?
• What would be the likely differentials based on the findings of the routine chest radiograph?
• What are the findings on contrast-enhanced CT scan of the chest?
• What other radiological test could demonstrate this lesion?

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Figure 1. Chest radiograph showing a lobulated mass of uniform density in the right lower hemithorax with connecting vessels radiating to the hilum.
WHAT'S YOUR DIAGNOSIS?

**Figure 2a, 2b.** Contrast-enhanced chest CT scans demonstrating a lobulated enhancing subpleural mass with feeding artery and draining vein.
Diagnosis: Pulmonary arteriovenous malformation (PAVM)

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Radiological Findings
The routine chest radiograph revealed a sharply defined lobulated soft tissue mass of uniform density in the right lower hemithorax with evidence of tubular densities radiating from the hilum. No calcification was noted within the mass. Likely differentials based on chest radiograph would be granuloma, sequestration, metastasis and AVM.

The lesions on the contrast-enhanced CT chest were identified as subpleural nodular, lobulated masses of uniform density in the right lower lobe anteriorly, with a single feeding artery and a draining vein consistent with PAVM.

Another radiological test that could demonstrate the lesion is pulmonary angiography, which helps in defining the number, size, location and angiographic architecture of individual PAVM. Pulmonary angiography is considered the gold standard in the diagnosis of PAVM.

Discussion
PAVMs are rare pulmonary vascular anomalies consisting of abnormal communication between arteries and veins. Since their first description in 1897 by Churton, more than 500 cases have been reported.1,2 More than 80% of PAVMs are congenital in nature and of these, 47% to 80% are associated with Osler-Weber-Rendu disease or hereditary haemorrhagic telangiectasia (HHT). Conversely, it is estimated that overall 5% to 15% of the population with HHT have a PAVM.2,3 Both conditions are congenital and the stigmata of either of these two conditions should alert the clinician to the possibility that they may coexist.

Patients are usually asymptomatic. Some patients may have frank cyanosis, or less severely, orthodeoxia. Symptoms often develop between the fourth and sixth decades of life and are more common in PAVM with HHT rather than without HHT.2,4 The most common complaints in symptomatic patients are epistaxis, caused by bleeding from mucosal telangiectases. Dyspnoea is the second most common complaint followed by haemoptysis, which is the third most common symptom. Epistaxis, telangiectases of skin and mucous membrane and gastrointestinal haemorrhage are common extrathoracic manifestations in patients of PAVM with HHT. The most commonly reported complications relate to the central nervous system, resulting from right to left shunts or coexisting cerebral AVM, with the incidence being 19% to 59%. Such patients may suffer from brain abscess or stroke.2,4,5

About 53% to 70% of pulmonary AVMs are seen in the lower lobes, with the left lower lobe being the most common location. They are found in close proximity to the visceral pleura or embedded in the outer third of lung parenchyma. PAVMs have been
Diagnosis: Pulmonary Arteriovenous Malformations

Figure 2a, 2b. Contrast-enhanced chest CT scans demonstrating a lobulated enhancing subpleural mass with feeding artery and draining vein.

Classified as simple or complex depending upon the number of feeding arteries and veins. Eighty to ninety percent of PAVMs are of the simple type, which is defined as those with a single feeding artery and a single draining vein. There have been cases described with both pulmonary and systemic arterial supply.

The chest radiograph is an important diagnostic tool, not only in diagnosis but also in the follow-up of patients with a PAVM. Ninety percent of PAVMs are shown on a chest radiograph. Their classic radiographic features are a sharply defined round or oval mass of uniform density, frequently lobulated, ranging in size from 1 cm to 5 cm in diameter and more commonly in lower lobes. A radiograph may show connecting vessels radiating from the hilum. Evaluation of a lesion under fluoroscopy during Valsalva and Mueller maneuvers may show pulsations and changes in size, which are highly suggestive of a PAVM.

The contrast-enhanced CT scan is a valuable tool in diagnosis and defining the vascular anatomy of PAVM. It is more sensitive than conventional pulmonary angiography in detecting PAVM (98% vs. 60%). The superiority of CT scanning in detecting PAVM is attributed to the absence of superimposition of the lesion in transaxial views. However, pulmonary angiography is better in determining the angioarchitecture when supplemented with hyperselective angiograms. Pulmonary angiography remains the gold standard in the diagnosis of PAVM, and is usually necessary if resection or embolotherapy is being considered.

Magnetic resonance (MR) imaging of PAVM has been studied less than CT. Most lesions within the lung have a relatively long relaxation time and produce medium to high intensity signals. Rapidly flowing blood in PAVMs and aneurysms results in an absent or minimal MR signal a so-called “flow void,” thus making them indistinguishable from the adjacent air-filled lung on spin-echo MR imaging. For these reasons, spin-echo MR imaging results in reduced sensitivity and specificity for detection of PAVM. However, ultrafast time-resolved 3D MRA is reportedly a better alternative to CT angiography and digital subtraction angiography.

Radionuclide perfusion lung scanning is also a useful adjunct in the diagnosis of PAVM. A positive result at radionuclide scanning is not specific for PAVM, whereas a negative result essentially excludes the diagnosis. Contrast echocardiography is also used to evaluate the cardiac and intrapulmonary shunts, and is able to identify small right-to-left shunts.

The treatment of choice in symptomatic patients includes embolotherapy with coils and/or detachable balloons. Alternatively, all patients with feeding vessels more than 3 mm should be embolized due to the attendant risk of paradoxical embolization. Ninety-six percent of PAVMs are undetectable or reduced in size at follow up obtained one or more year after embolotherapy. No angiography was performed in our patient due to the complete asymptomatic nature of the lesion and because no therapeutic intervention was intended.
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