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Case Report

Extra pulmonary uptake of Tc-99m-MAA Perfusion lung scan as a result of right to left Intra Cardiac Shunt

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Abstract

Extra pulmonary accumulation of Tc-99m-macroaggregate of albumin (MAA) is rarely seen on perfusion lung scan, and has been reported in less than 4% of a study population of nearly 380 patients[1]. It occurs when the agent bypasses the lungs due to a right to left (R-L) cardiac or pulmonary shunt, when it is shunted to the portal vein before reaching the right atrium and ventricle of the heart, and when the agent is degraded to a submicron particle size.[2] When a pharmaceutical problem is excluded, extra-pulmonary uptake implies unusual hemodynamics with a shunt.

A case is reported in which a clinically unsuspected shunt was diagnosed from the lung perfusion scintigraphy.

Case Report

A 25 year old female was referred for a lung perfusion scintigraphy for progressive dyspnoea for the past 3 years. This dyspnoea had progressed to a stage that it was present even on mild exertion and sometimes even on rest for the past 1 ½ months. Her history and clinical findings failed to elicit a definite cause for her symptoms. She was suspected to be suffering from a possible thrombo-pulmonary embolism. For which she was referred to the Nuclear Medicine Department. Her recent chest x-ray was within normal limits. On the pulmonary scan both the lungs showed a normal homogenous uptake of the tracer with no evidence of any segmental or sub-segmental pleural based perfusion defect seen. However the kidneys were seen to be visualized on

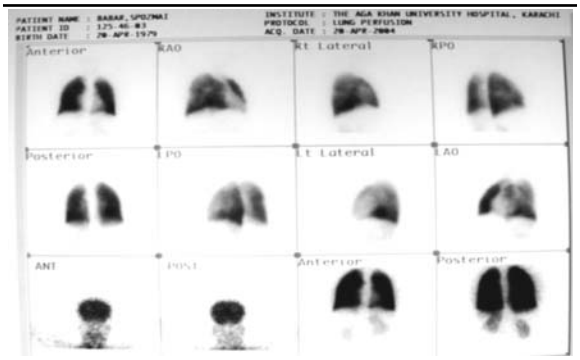

Figure 1. Lung Perfusion Scan with both lung fields showing normal uptake. Uptake of tracer is seen in the brain and in kidneys suggesting a right to left shunt.

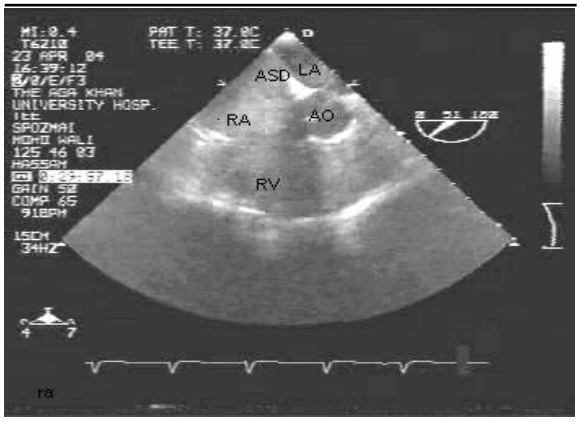

Figure 2. Agitated saline contrast is visible in Left Atrium (LA) due to right to left shunt through ASD.

the scan, and when the head was imaged, significant amount of tracer was seen in the brain (Figure 1). No activity to suggest the presence of free pertechnetate was seen in the thyroid, salivary glands, or the stomach. The patient was subsequently reported to be having a right to left shunt of a most probable cardiac origin. She then underwent a trans-esophageal and trans-thoracic echo-cardiogram where a bidirectional flowing atrial septal defect with pulmonary hypertension was confirmed (Figure 2). Subsequently right heart catheterization also showed atrial septal defect and an anomalous pulmonary venous drainage into the right atrium. Reversibility of pulmonary hypertension was also assessed after 100% oxygen inhalation which was found to be irreversible.

Discussion

Regional pulmonary perfusion is evaluated by imaging the distribution of Tc-99m-MAA. The radiopharmaceutical consists of particles of denaturated albumin, most of which are 20 - 40 micrometer size. Following intravenous injection into a peripheral vein, the radio labeled particles travel through the right atrium and right ventricle, where a thorough mixing occurs. The physiological principle exploited is that the I/V injected micro-emboli will be trapped in the arterioles of the lung in proportion to the regional pulmonary blood flow.[3,4]

From time to time when activity is seen outside the lungs, the question arises as to whether it is due to right to left shunt shunting or to free Tc-99m-pertechnetate in the radiopharmaceutical preparation. The distinction is made by imaging the brain. Tc-99m-pertechnetate and other nonparticulate potential radio contaminants do not cross the blood brain barrier or localize in the brain. Shunted Tc-99m-MAA will lodge in the cerebral circulation.[5, 6]

Shunting is a situation where deoxygenated blood is able to bypass the process of gas exchange and return from the right side of the heart to the systemic circulation. It may result from large vessel abnormalities such as atrial or ventricular septal defect in the heart or occur as result of perfusion of poorly ventilated regions of the lung.[6, 7] In patients with right to left shunt some of the injected particles will be diverted into the systemic circulation and will embolize pre-capillary arterioles throughout the body.[3, 8] A right to left shunt of more than 10% is readily apparent on the scan by identifying activity in organs with high systemic blood flow such as the kidneys and the brain.[9] The hemodynamic significance of the shunt may be anywhere along the spectrum between minor and major and its quantification may be inferred from the perfusion scan.[10-12]

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