Global Hepatic Uptake of ^{99m}Tc -MAA During VQ Scintigraphy Secondary to Synchronous Superior and Inferior Vena Caval Obstruction: a Demonstration of Trans-Portal Venous Collateral Pathways

Oliver Conway · Simon Lloyd · Thomas Grüning

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A 38-year-old woman underwent lung scintigraphy. Injection of technetium-99m macroaggregated albumin (^{99m}Tc -MAA) via the left antecubital fossa revealed global hepatic uptake (Fig. 1). Review of contemporary computed tomography (CT) imaging demonstrated synchronous superior and inferior vena cava (SVC and IVC) obstruction, with formation of systemic-portal venous

collateral pathways (Fig. 2). Systemic-portal venous collateralisation can in rare circumstances lead to focal hepatic uptake of ^{99m}Tc -MAA during lung scintigraphy. This case of global hepatic uptake, secondary to synchronous SVC and IVC obstruction, demonstrates the trans-portal venous collateral pathways leading to this unusual imaging outcome (Fig. 3).

Fig. 1 A 38-year-old woman, at risk of venous thromboembolic disease secondary to Factor V Leiden disorder, was referred for lung scintigraphy (**a**, ventilation scan posterior view). Perfusion scanning (**b**, left posterior oblique view) revealed global hepatic uptake of technetium-99m macroaggregated albumin (^{99m}Tc -MAA). Brain and renal uptake was not observed (not illustrated)

O. Conway (✉) · S. Lloyd · T. Grüning
Derriford Hospital, Plymouth, UK
e-mail: o.conway@nhs.net

Fig. 2 Three-dimensional CT reconstruction demonstrating left-sided systemic-portal collateral venous pathways (*arrowheads* retroperitoneal venous collaterals, *white arrow* dilated inferior mesenteric vein, *black arrow* haemorrhoidal plexus). Review of contemporary CT imaging demonstrated synchronous SVC and IVC obstruction secondary to chronic thrombosis, with formation of systemic-portal venous collateral pathways from superficial thoracic and abdominal wall veins

Conflicts of Interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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Fig. 3 Diagram of proposed systemic-portal venous collateral pathways. The first pathway involves two grossly dilated retroperitoneal veins which ascend to anastomose with a left renal/splenic venous confluence (more commonly recognised in hepatofugal flow in portal hypertension) and then via the splenic vein to the portal system. The second pathway involves the left internal iliac vein, to a confluence between the inferior/middle and superior rectal veins (the haemorrhoidal plexus), then via a dilated inferior mesenteric vein to the splenic vein, and hence to the portal system. Obstruction of the SVC or IVC is typically an acquired condition. In chronic occlusion, venous collaterals must be developed in order to maintain venous return [1, 2]. During lung scintigraphy, ^{99m}Tc-MAA particles are deposited in fine reticular capillary beds in the pulmonary alveolar system. In cases of right-to-left shunt, the radio-labelled protein particles can deposit in non-pulmonary capillary networks, such as brain or renal beds. Focal hepatic uptake from systemic-hepatic shunts secondary to vena cava obstruction is a recognised finding post lung scintigraphy. This has also been seen in lower limb venography [3–6] and upper limb venography [7–13]. Global hepatic uptake is less commonly described, but has been demonstrated following lower limb venography [14–16]. Preferential uptake anteriorly within hepatic segment IV is the most commonly described variant [3–6]. The proposed explanation is preferential blood flow from superficial abdominal veins via paraumbilical veins or a recanalised left umbilical vein to the left portal vein [9]. Focal hepatic uptake is also recognised secondary to internal thoracic to left portal vein anastomosis via the superior vein of Sappey [17]. The dual retroperitoneal systemic-portal venous collateral anastomoses, as well as slow venous flow due to synchronous SVC and IVC occlusion, is the most likely explanation for the global hepatic uptake seen in this case, which highlights the importance of flow dynamics leading to this unusual imaging outcome

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