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Hepatic and Splenic Scintigraphy in Idiopathic Systemic Amyloidosis

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Abstract. Technetium-99m sulfur colloid (SC) and Technetium-99m pyrophosphate (PYP) scintigrams in a patient with idiopathic systemic amyloidosis were abnormal. Hepatic SC distribution was nonhomogeneous. Spleen showed reduced SC uptake and a large focal defect at its upper pole. Splenic localization of PYP was seen on a bone scan. On histologic examination the abnormal scintigraphic sites showed heavy amyloid deposition. Splenic localization of skeletal radiotracer due to amyloidosis has not been previously reported.

Introduction

Amyloidosis is a pathological process of obscure etiology in which extracellular deposition of an amorphous eosinophilic substance occurs in various tissues and organs. When sufficiently advanced, accumulations of amyloid engulf and obliterate parenchymal cells resulting in functional failure of the organ. There are few scintigraphic descriptions in the literature of organs involved with amyloidosis (Andujar et al. 1978; Goergen et al. 1976; Sostre et al. 1975; Suzuki et al. 1976). We report a patient with idiopathic systemic amyloidosis who had abnormal liver and spleen uptake of Technetium-99m sulfur colloid (SC) and splenic localization of Technetium-99m pyrophosphate (PYP).

Case Report

A 56 year old man presented with a three month history of progressive dyspnea, ascites and pedal edema. On examination he was cachectic and had hepatosplenomegaly, anasarca and ascites. A grade 3/6 ejection systolic murmur and third and fourth heart sounds were heard over the precordium.

Abnormal laboratory results included total leukocyte count 15,400/c mm, zeta sedimentation rate 67%, total serum protein 4.2 g/dl, albumin 2.4 mg/dl, cholesterol 400 mg/dl, blood urea nitrogen 34 mg/dl, creatine 2.4 mg/dl, alkaline phosphatase 286 IU/l, SGOT 89 IU/l and LDH 356 IU/l. The 24 h urinary protein loss was 4 g. Plasma electrophoresis, peripheral blood smear, blood and ascitic fluid cultures and cytology were nondiagnostic. A bone marrow biopsy showed amyloid deposits but no evidence of plasma cell myeloma. A renal biopsy revealed thickening of glomerular capillary walls, eosinophilic amyloid deposition in the interstitium, obliteration of glomerular capillaries and tubular atrophy. Microscopic findings were typical for renal amyloidosis.

A liver scan (Fig. 1) showed hepatomegaly and nonuniform distribution of SC. The spleen was enlarged and showed decreased SC uptake. A large focal defect was present at its upper pole. On a bone scan (Fig. 2) splenic accumulation of PYP was seen but no skeletal uptake of PYP was apparent.

Two weeks after admission he had pneumonitis due to Bacteroides fragilis. He received four weeks of treatment with antibiotics, digitalis and furosemide, and was discharged free of infection. Two months later he was readmitted for severe renal, hepatic and cardiac decompensation. He developed massive ascites and bilateral pleural effusions and died of acute bronchopneumonia.

An autopsy confirmed the clinical diagnosis of idiopathic systemic amyloidosis. The liver, spleen, heart, kidneys and adrenal glands were enlarged and rubbery hard. The liver weighed 2,800 g and was pale and waxy. Perisinusoidal amyloid accumulation was present in the portal and interlobar areas causing compression, distortion and atrophy of hepatocytes (Fig. 3). The spleen weighed 600 gm and was diffusely involved with coalescant hyaline masses which displaced the follicles and compressed the sinuses (Fig. 4). Interstitial depositions of amyloid were found in the heart, kidneys, thyroid, adrenals, blood vessels and other organs. Specimens from these organs showed positive reactions with periodic-acid-Schiff's reagent and Thioflavin T and birefringence with Congo red, characteristic for amyloid material. Affinity for Congo red was not altered by permanganate preincubation (Van Rijswijk et al. 1979). Electron microscopy showed delicate non-branching fibrils consistent with the ultrastructural morphology of amyloid type AL (Glenner et al. 1972; Van Rijswijk et al. 1979).

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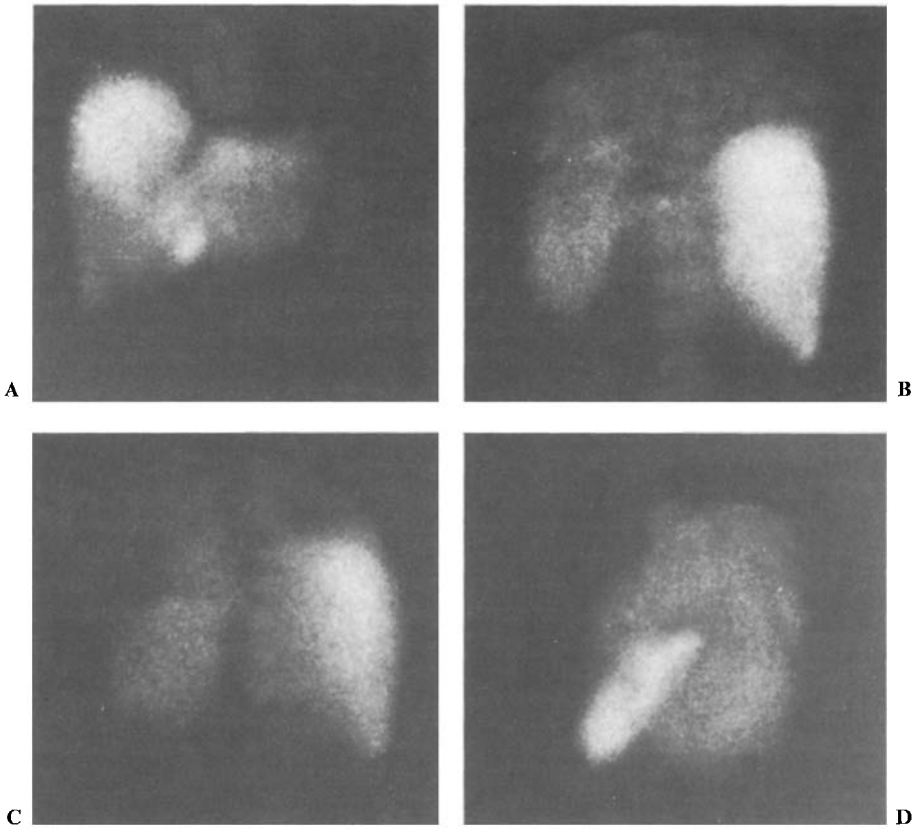

Fig. 1A–D. Technetium-99m SC scintigrams.
A Anterior: Nonhomogeneous hepatic SC distribution due to amyloidosis. Hepatic venous hilum is prominent due to congestive heart failure.
B Posterior: Splenic SC uptake is decreased.
C Left posterior oblique: Focal loss of SC uptake at the upper pole of spleen.
D Left lateral: Splenomegaly

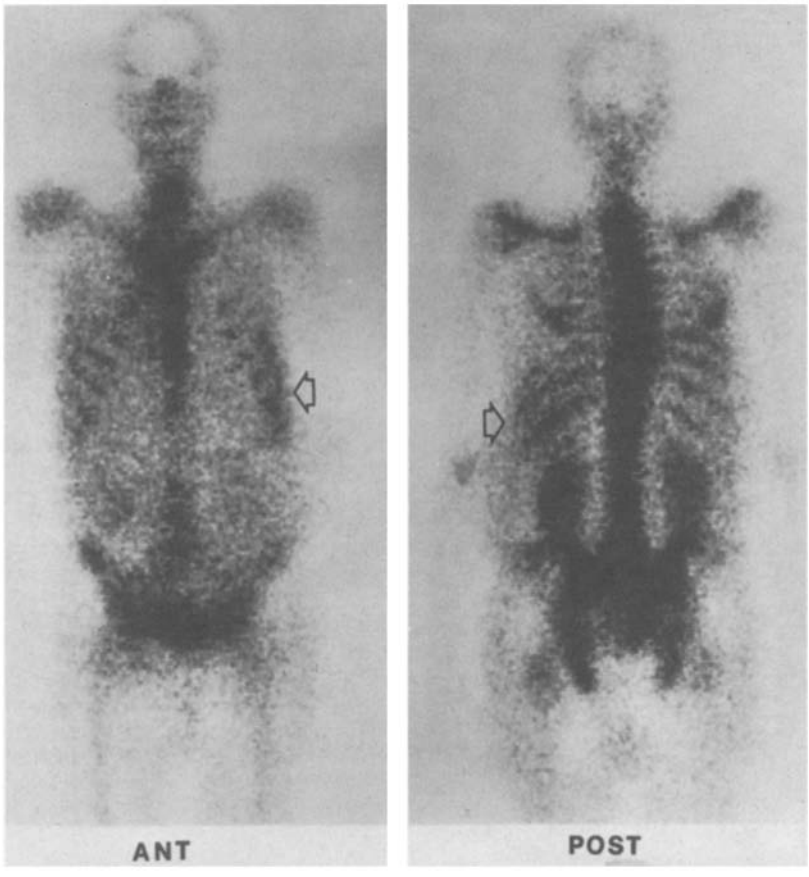

Fig. 2. Technetium-99m pyrophosphate localization in the spleen (*arrow*)

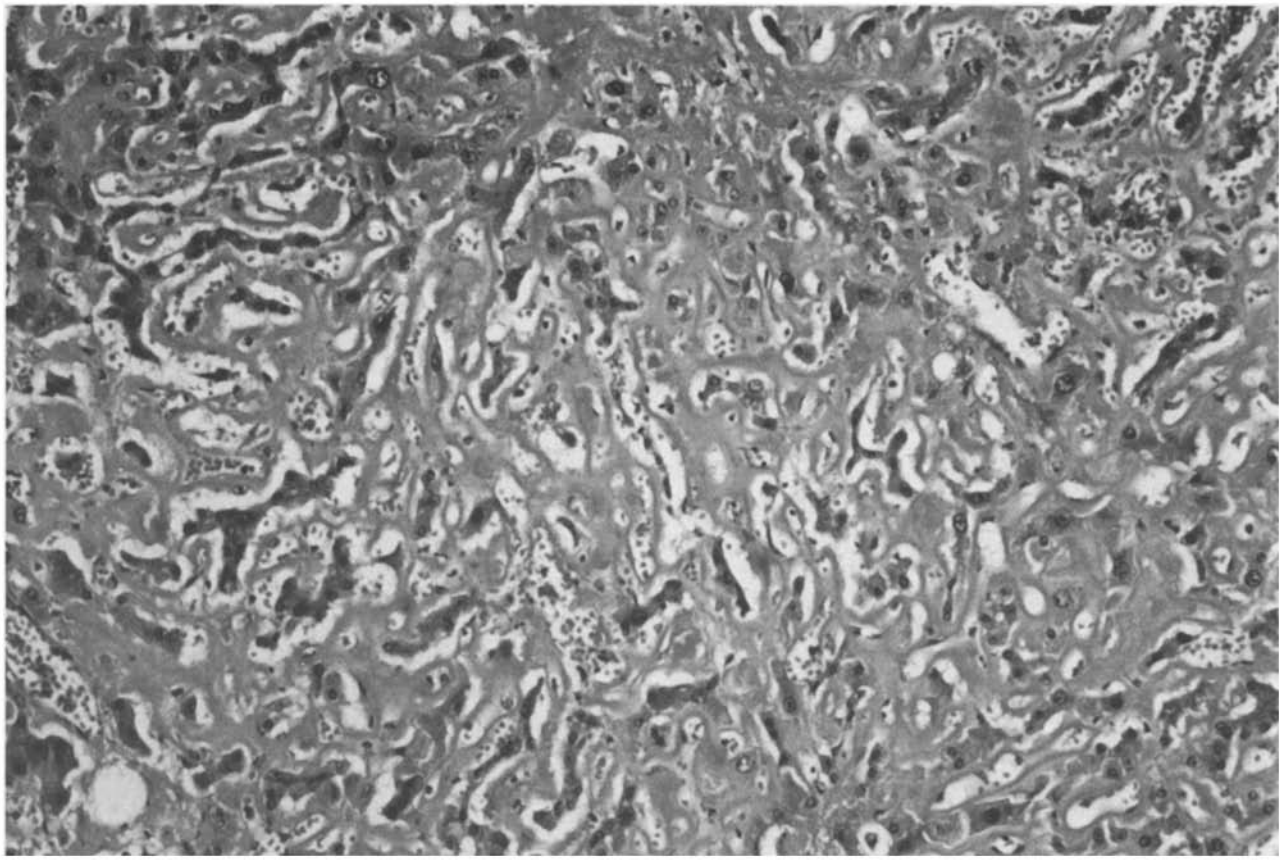

Fig. 3. Massive perisinusoidal accumulation of amyloid in the liver with consequent pressure atrophy of hepatocytes (hematoxylin and eosin $\times 100$)

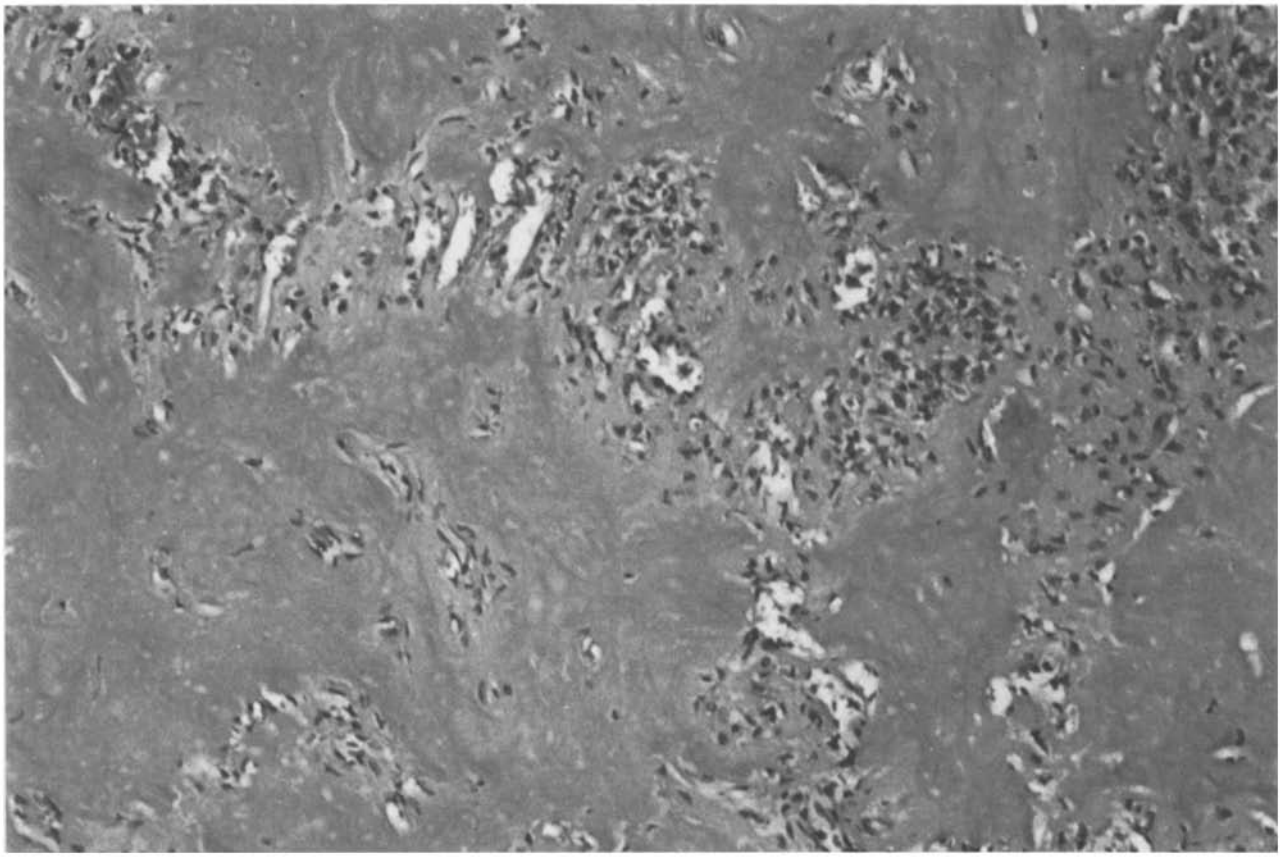

Fig. 4. Effacement of normal splenic architecture by confluent amyloid deposits (hematoxylin and eosin $\times 100$)

Discussion

Systemic amyloidosis may be primary arising on an idiopathic or a heredofamilial basis. It may occur secondary to chronic infection, connective tissue diseases, autoimmune inflammation, neoplasia and metabolic disorders. Primary amyloidosis often affects the tongue and the heart, while secondary amyloidosis frequently involves the kidney, spleen, liver and adrenal glands. Recently amyloidosis was classified by the type of polypeptide chain in the amyloid protein (Glenner et al. 1972) and on the basis of patterns of organ involvement (Isobe and Osserman 1974).

The liver is involved in about half the cases of systemic amyloidosis (Levine 1962). The reported scan findings were variable and nonspecific and include hepatosplenomegaly, nonhomogeneous SC distribution and large focal areas of decreased SC uptake (Sostre et al. 1975). Radiocolloid uptake in the spleen may be normal, decreased or absent depending on the extent of tissue replacement by amyloid. When amyloid deposition is not heavy the scintigrams may be normal. Functional asplenia due to heavy splenic deposition of amyloid has been reported (Sostre et al. 1975).

The SC scan findings in our case were consistent with those reported in the literature. The liver showed nonhomogeneous radiotracer distribution with reduced colloid uptake at sites of heavy amyloid deposition. The focal cold area in the spleen coincided with extensive deposits. Radiographic evidence of calcification in the liver and spleen was lacking in our patient.

Van Antwerp et al. (1975) reported Technetium-99m diphosphonate uptake by biopsy proven amyloid deposits of hip and shoulder joints that showed no radiographic evidence of calcification. Uptake of skeletal radiopharmaceutical by hepatic (Vanek et al. 1977), myocardial (Hauser et al. 1968), skeletal muscle and soft tissue (Bada et al. 1977; Kula et al. 1977; Moyle and Spies 1980) sites of amyloid deposits was known. However, splenic uptake of PYP seen in our case has not been previously reported.

The mechanism of radiopharmaceutical uptake by soft tissue amyloid deposits is not clear. Calcification is known to occur at sites of amyloid deposition, particularly in the lungs and skin. Liver and spleen PYP uptake may reflect radionuclide sensitivity to an early alteration in the local calcium content (Vanek et al. 1977). Silberstein et al. (1975) showed a nonlinear increase in the tissue retention of Technetium-99m diphosphonate with increased calcium content of the tissue. By electron microscopy using pyroantimonate histochemical technique, Kula et al. (1977) demonstrated calcium affinity properties in soft tissue amyloid deposits. In our patient splenic localization of PYP could be due to a similar mechanism.

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