Journal of Cardiovascular Magnetic Resonance®, 2(1), 1–6 (2000)

ORIGINAL ARTICLES

Structure

Organized Pericardial Hematomas: Magnetic Resonance Imaging

Michael A. Arata, Gautham P. Reddy, and Charles B. Higgins

Department of Radiology, University of California, San Francisco

INTRODUCTION

Magnetic resonance imaging (MRI) has been shown to be an effective means of identifying and determining the extent of pericardial and paracardiac masses (1,2). On electrocardiographically (ECG) gated MRI, the appearance of pericardial hematomas is variable depending on their age (2–4). MRI can be used to characterize these masses and distinguish certain innocuous masses, thereby averting surgery in some cases. We report three cases of pericardial hematomas with variable appearances on MRI.

CASE REPORTS

The three patients described below are summarized in Table 1.

Patient 1

A 39-year-old man with history of fatigue for 8 years after blunt chest trauma presented with syncope after a 6-month period during which he experienced an increasing frequency of chest pain. Chest radiographs revealed a large left paracardiac mass with peripheral calcification. Echocardiogram demonstrated a 6-cm mass near the left atrioventricular groove compressing the left atrium. No flow was identified within the mass on Doppler echocardiography. Cardiac catheterization showed no evidence of pseudoaneurysm or coronary-cameral fistula.

ECG-gated MRI showed a 5 × 6 × 6 cm lobulated well-circumscribed mass in the left atrioventricular groove, markedly compressing the left atrium, mitral annulus, and and left ventricle (Fig. 1). The mass was of intermediate sigsignal intensity with peripheral low signal (suggestive of calcification) on the spin echo (SE) T1-weighted images and predominately low signal on the fast spin echo (FSE) T2-weighted images. It did not enhance after intravenous administration of Gd-DTPA. On gradient echo cine MR images, the mass demonstrated signal intensity lower than that of flowing blood, and no blood flow was seen within the mass. As on the SE T1-weighted sequence, it had a dark rim.

Although the diagnosis of pericardial hematoma was indicated by MRI, the patient underwent surgery due to symptoms believed to be secondary to hemodynamic compromise caused by left atrial and ventricular compression. Surgical resection confirmed pericardial hematoma with fibrosis and peripheral calcification.

Patient 2

A 69-year-old man presented to the emergency room with acute chest pain, and emergent cardiac catheteriza-

Received September 4, 1998; Accepted June 9, 1999
Address reprint requests to Charles B. Higgins, Department of Radiology, University of California, San Francisco, 505 Parnassus Avenue, Suite L308, Box 0628, San Francisco, CA 94143-0628.

Table 1

Characteristics of Three Cases of Pericardial Hematoma

Patient	Age (yr)	Sex	Duration	Etiology	T1-Weighted Images	T2-Weighted Images	Enhancement and Flow
1	39	M	8 yr	Blunt trauma	Intermediate with dark foci	Low	None
2	69	M	6 mo	RCA angioplasty	Heterogeneous	N/A	None
3	71	M	2 yr	Aortic dissection repair	Heterogeneous	N/A	None

N/A, not applicable.

tion was performed for presumed inferior myocardial infarction. On coronary angiography, occlusion of the mid right coronary artery (RCA) was identified, and rescue angioplasty was planned. During attempted passage of a guidewire beyond the occlusion, a paracardiac opacity developed. The procedure was terminated, and repeat RCA angiogram revealed contrast extravasation into the area of new paracardiac opacity. On echocardiography, a 7-cm heterogeneous mass was seen adjacent to the RCA. No flow within the mass was demonstrated with color Doppler analysis or with ultrasound contrast agent.

The patient was referred for cardiac MRI for definitive assessment of possible pseudoaneurysm of the RCA. ECG-gated SE images showed a 7.5 × 7.5 × 9 cm heterogeneous mass in the right atrioventricular groove, with severe compression of the right atrium and right ventricle. On SE T1-weighted images, focal areas of high signal intensity were present, consistent with hemorrhage. After administration of Gd-DTPA, the mass did not enhance. Follow-up MRI performed 6 months later (Fig. 2) demonstrated no change, other than the development of internal foci of low signal intensity and a dark rim, corresponding to calcification noted on chest radiographs. Velocity-encoded cine (VEC) phase contrast MR images demonstrated no flow within the mass, consistent with a hematoma rather than a pseudoaneurysm. Because of the absence of symptoms and because the hematoma remained stable in size, the patient did not undergo surgery.

Patient 3

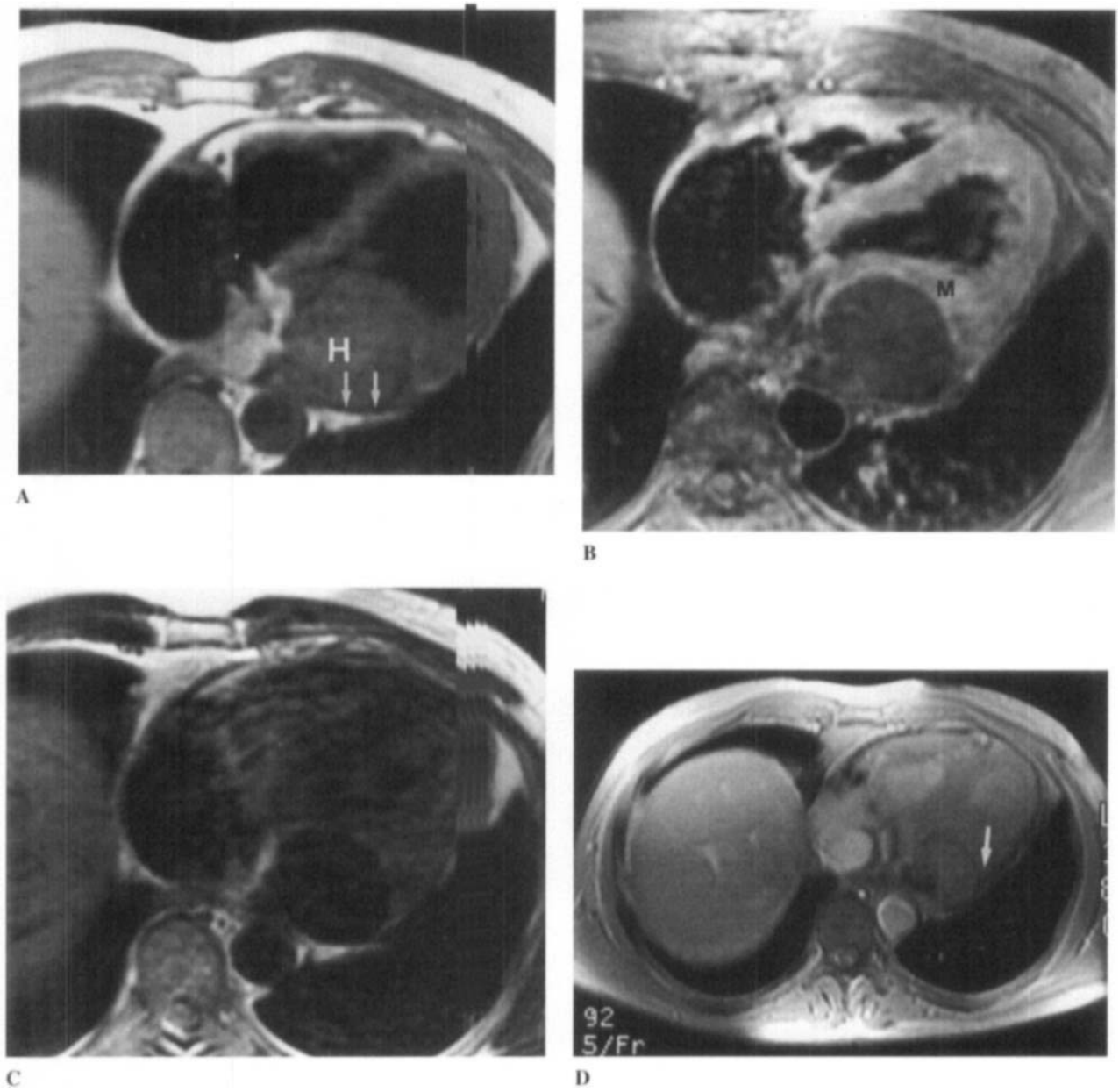
A 71-year-old man underwent repair of Stanford type A aortic dissection. One year later, contrast-enhanced computed tomography of the chest demonstrated a posterior pericardial mass, thought to be a loculated pericardial effusion. Two years after surgery, echocardiography performed for evaluation of atrial fibrillation demonstrated a 4-cm hypoechoic mass near the left atrioventricular groove.

ECG-gated SE MRI showed a 5.5 × 3.5 × 3 cm heterogeneous mass in the left atrioventricular groove, exerting mild mass effect on the left ventricle (Fig. 3). Areas of high signal intensity within the mass on SE T1-weighted images suggested subacute or chronic hemorrhage. After intravenous administration of Gd-DTPA contrast media, there was no enhancement of the mass. Surgical resection was not performed due to the lack of symptoms, the clinical history, and the MR imaging findings, which were consistent with a pericardial hematoma.

DISCUSSION

Evaluation of an intrapericardial or paracardiac mass with MRI relies primarily on localization of the lesion, its signal characteristics, the degree of contrast enhancement, and the presence or absence of blood flow. The location of cardiac/paracardiac lesions is of particular importance, because masses in the pericardium are often hematomas, whereas those in the myocardium are usually neoplasms (1,5). A distinct advantage of MRI over echocardiography is the ability to clearly depict the pericardium and to localize a mass to the pericardial space by identifying it within the pericardium but outside the myocardium (1). A pericardial mass compresses the myocardium, whereas an intramyocardial mass causes focal thickening or distortion of the myocardial wall.

When a mass is localized to the pericardium, the differential diagnosis includes hematoma, pseudoaneurysm, pericardial cyst, and neoplasm (1,6). The composition and MRI appearance of pericardial hematomas depends in part on their age. It has been reported that acute hematomas are homogeneous, with high signal intensity



A B C D

Figure 1. Patient 1: Axial MR images in a 39-year-old man with a history of blunt trauma to the chest. Pericardial hematoma (H) is present in the left atrioventricular groove. (A) Axial SE T1-weighted image (TR 722, TE 20) shows that the mass is of intermediate intensity and contains dark foci internally and a dark rim (arrows), likely representing central and peripheral calcification, seen at the time of surgical resection. (B) Axial SE T1-weighted image with fat suppression (TR 722, TE 20) after administration of Gd-DTPA. Note the lack of enhancement of the mass, which helps to distinguish it from the myocardium (M), which enhances normally. (C) On the axial FSE T2-weighted sequence (TR 2891, TE 90), the mass is of low signal intensity. (D) Axial cine image (TR 92, TE 5). The acute angle of the pericardial interface with the mass (arrow) is consistent with an intrapericardial location of the hematoma.

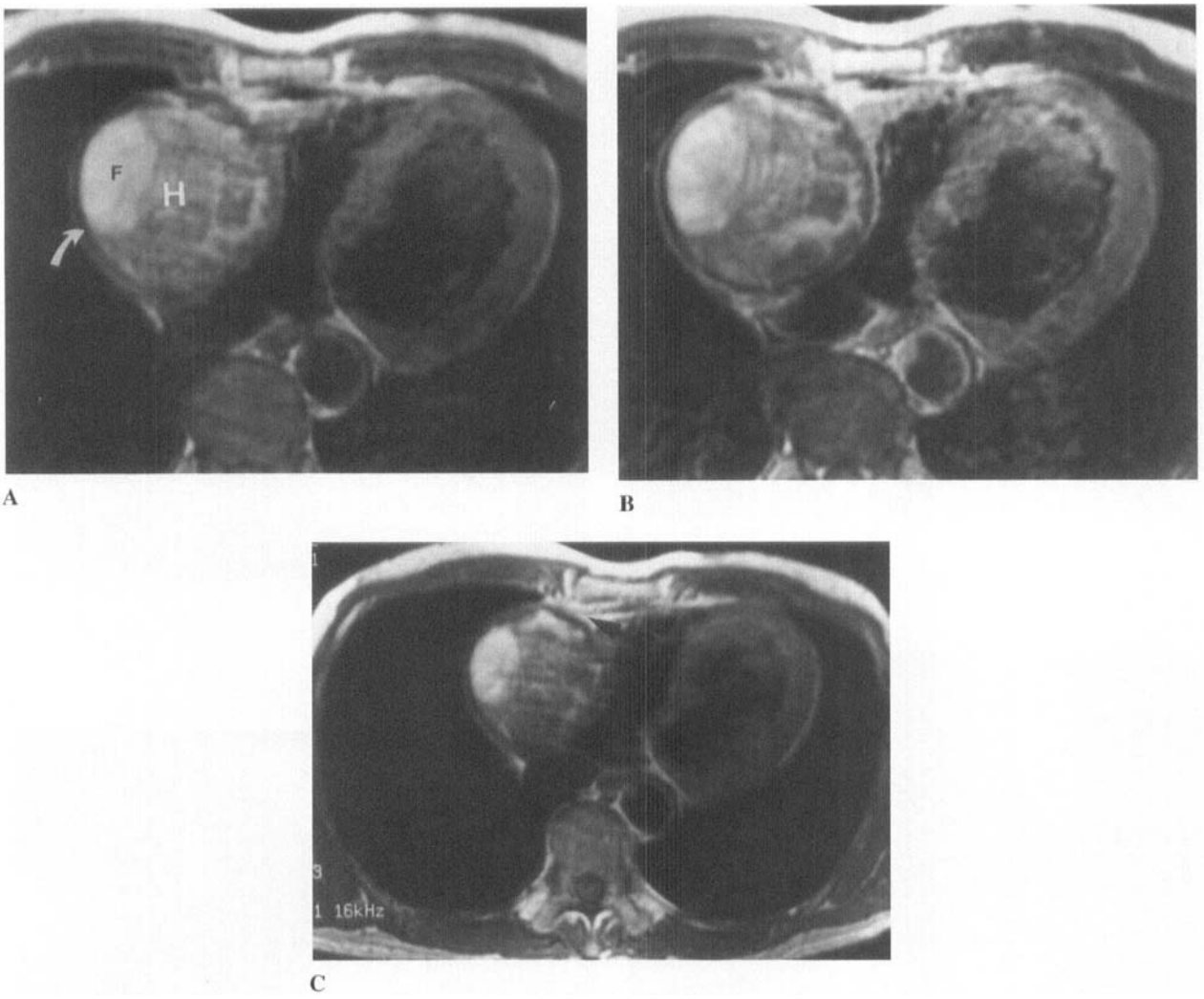


Figure 2. Patient 2: A 69-year-old man with a history of RCA angioplasty, who developed a pericardial hematoma (H) in the right atrioventricular groove. (A) Axial SE T1-weighted image (TR 923, TE 20) demonstrates a heterogeneous mass with areas of high signal intensity, likely hemorrhagic fluid (F), and internal dark foci and a low signal intensity rim (arrow) suggestive of calcification, which was seen on chest radiographs. (B) Axial SE T1-weighted image (TR 952, TE 20) after administration of Gd-DTPA shows that the mass does not enhance. (C) Axial SE T1-weighted image (TR 923, TE 20). The pericardial location is established by the acute angle formed by the junction of the mass and the pericardium (arrow).

on both T1-weighted and T2-weighted images (2,7), whereas subacute hematomas, between 1 and 4 weeks old, typically demonstrate heterogenous signal intensity, with some areas of high intensity on both T1-weighted and T2-weighted sequences (2,8). Chronic organized hematomas are of low homogeneous or heterogeneous intensity. They may contain low-intensity foci or have a dark peripheral rim on T1-weighted and gradient echo sequences. These low-intensity areas may reflect calcification (4,9), although the appearance is nonspecific and may represent areas of fibrosis or hemosiderin. High-intensity areas on T1-weighted or T2-weighted images can correspond to hemorrhagic fluid, even in chronic hematomas (3). Hematomas do not enhance and have no demonstrable internal blood flow on VEC MRI.

A coronary or ventricular pseudoaneurysm may have an appearance on MRI similar to that of a hematoma. A pseudoaneurysm is expected to show internal flow signal

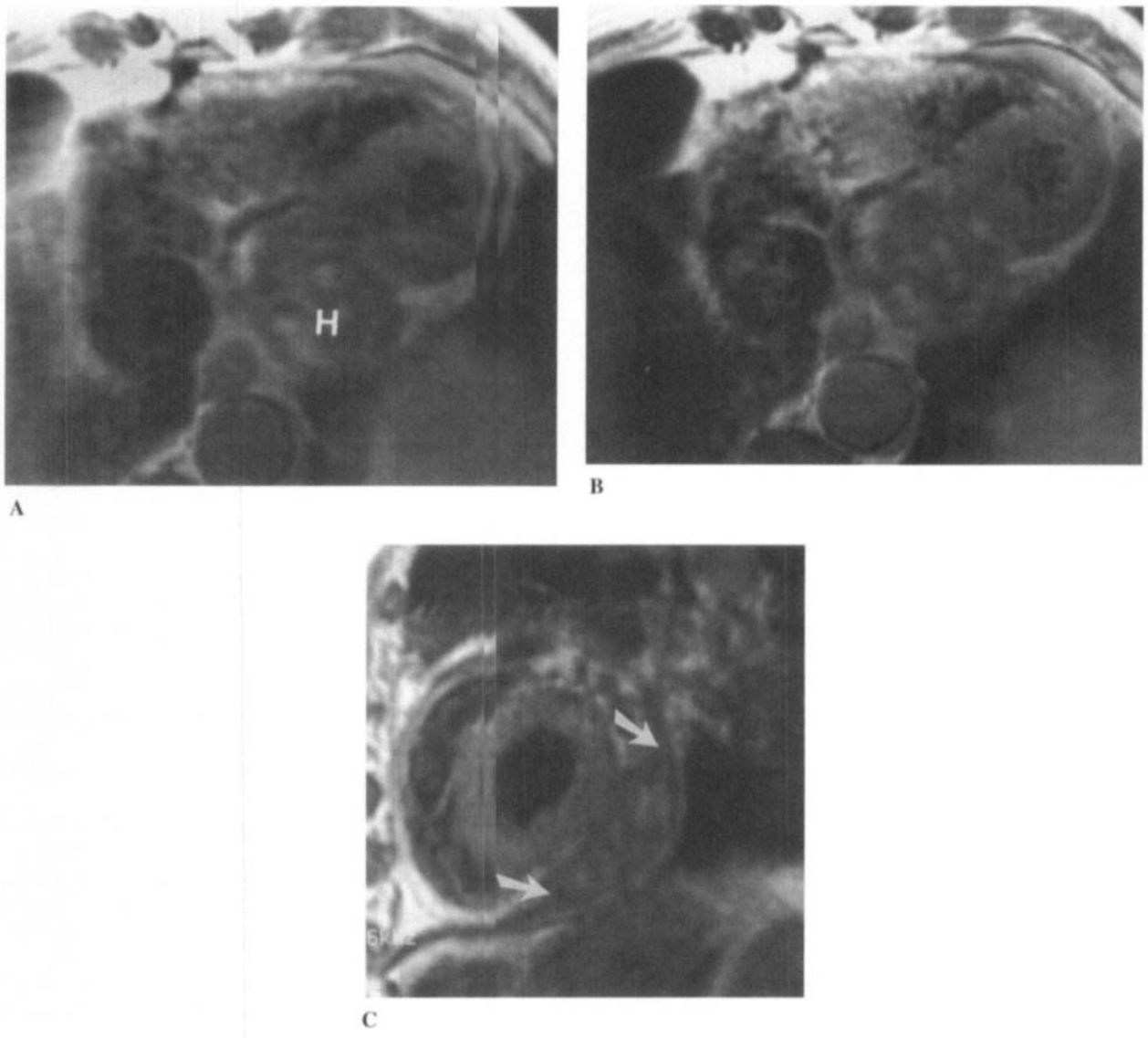


Figure 3. Patient 3: Axial MRI in a 71-year-old man who underwent type A aortic dissection repair 2 years before. Pericardial hematoma (H) is seen in the left atrioventricular groove. (A) Axial SE T1-weighted image (TR 895, TE 20) shows a heterogeneous mass with foci of high signal intensity. (B) Axial SE T1-weighted image (TR 895, TE 20) after administration of Gd-DTPA demonstrates no enhancement of the mass. (C) Sagittal SE T1-weighted image (TR 895, TE 20) confirms the intrapericardial location of the hematoma, which forms acute angles with the pericardium (arrows).

on VEC MRI. Detection of blood flow within the mass is important because some paracardiac masses may represent ventricular or coronary artery pseudoaneurysms. VEC MRI can identify flow (10) and therefore can differentiate pseudoaneurysm from hematoma.

Pericardial cysts are well-defined lesions that usually demonstrate homogeneous low signal intensity on T1-weighted images, homogeneous high signal intensity on T2-weighted images, and no enhancement after administration of gadolinium chelates (6). Increased protein concentration in some cysts may result in bright signal intensity on T1-weighted images. Neoplasms usually enhance significantly after administration of MR contrast media (1), although fibromas may show no significant enhance-

ment or characteristic peripheral enhancement with poor or no central enhancement (11).

Pericardial hematomas have a variety of etiologies, including trauma, hemorrhagic pericarditis, myocardial or arterial rupture, aortic dissection, and iatrogenic causes (4). Iatrogenic causes of hematoma include anticoagulation, cardiac surgery, and cardiac catheterization (4). Because of its multiplanar capability, contrast resolution, and ability to detect flow, MRI is ideally suited for evaluation of pericardial masses. The ability of MRI to assess the possibility of pseudoaneurysm is especially important in patients with a prior history of vascular intervention.

MRI played an important role in diagnosis and management of all three patients (Table 1). In each case, MRI showed that the mass was intrapericardial, located inside the pericardium and outside the myocardium. The degree of chamber compression was clearly depicted. Two masses (patients 1 and 3) were located in the left atrioventricular groove; one of these exerted severe mass effect on the left atrium and left ventricle, whereas the other compressed the left ventricle to a mild degree. The third mass (patient 2), located in the right atrioventricular groove, markedly compressed the right atrium and right ventricle. When severe chamber compression is depicted by MRI, further evaluation should be performed to assess the degree of hemodynamic compromise.

The hematomas in these three patients varied in age from 6 months to 8 years. All three hematomas were heterogeneous on SE T1-weighted images. In both patient 2 (6-month-old hematoma) and patient 3 (2-year-old hematoma), the hematomas contained areas of high signal intensity on T1-weighted images, consistent with foci of hemorrhagic fluid. In patient 1 (8-year-old hematoma), however, there were no areas of high intensity on the T1-weighted sequence, and the T2-weighted images demonstrated predominantly low signal intensity in the mass, consistent with fibrosis, hemosiderin deposition, and calcification. Calcifications were suggested by MRI and confirmed in patient 1 at the time of surgery and in patient 2 on chest radiography, although the hematoma in the latter case was only 6 months old. In patient 3, there were no dark areas suggesting calcification. Thus, the variable MRI appearances of the hematomas likely reflect the differences in their composition, which varies with the age of the hematoma.

ACKNOWLEDGMENT

Supported in part by a research training grant from the National Institutes of Health (no. T32-HL07570) to G.P.R.

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