Dupuytren's Contracture:
MR Imaging Findings and Correlation Between MR Signal Intensity and Cellularity of Lesions

Marshall E. Yacoe[1]
Ann Gabrielle Bergman[1]
Amy L. Ladd[2]
Barry H. Hellman[3]

OBJECTIVE. Dupuytren's contracture is a common fibrosing disorder of the hand, which often results in progressive and debilitating flexion contractures of the fingers. Recurrence after surgical release is common and may be related, in part, to the cellularity of the lesion. We describe the MR appearance of Dupuytren's contracture and correlate signal characteristics with the degree of cellularity of the lesion.

SUBJECTS AND METHODS. A total of 11 hands in 10 patients were studied. All patients had surgical resection after MR imaging (median interval, 3 days). The surgical and pathologic findings were correlated with the MR findings. The signal characteristics of the lesions were correlated with the histologic findings.

RESULTS. We found that MR imaging was accurate for detecting Dupuytren's contracture and depicting its extent. The lesions include subcutaneous nodules, usually at the level of the distal palmar crease, and cords that lie parallel and superficial to the flexor tendons. The cords had a uniformly low signal intensity (similar to the signal intensity of tendon) on both T1- and T2-weighted images in 18 of 22 cases, whereas the remaining four cases had a low to intermediate signal intensity on T1-weighted images (a slightly higher signal intensity than that of tendon) and a low signal intensity on T2-weighted images. Histologically, the cords were hypocellular and composed of dense collagen. Most nodules had an intermediate signal intensity (similar to that of muscle) on both T1- and T2-weighted images (10 of 13 cases), usually stippled with focal areas of lower signal intensity. Histologically, these nodules were mostly cellular. Three of the nodules had a low signal intensity on both T1- and T2-weighted images and were hypocellular histologically.

CONCLUSION. We conclude that MR imaging can be used to define palmar involvement in Dupuytren's contracture. The signal characteristics of the lesions correlate with the degree of cellularity of the lesions as seen histologically. The ability to assess preoperatively the cellularity of lesions of Dupuytren's contractures may be of prognostic significance, because highly cellular lesions tend to have higher rates of recurrence after surgery than do hypocellular lesions.

AJR **1993;160:813–817**

Dupuytren's contracture is a fibrosing disorder that primarily involves the palmar aponeurosis of the hand and its extensions, often leading to disabling flexion contractures of the fingers [1, 2]. The diagnosis is made clinically on the basis of characteristic history and physical findings [1–3]. The earliest clinical manifestation is the appearance of a subcutaneous nodule in the palm of the hand, usually at the level of the distal palmar crease. Histologically, nodules are quite cellular, composed of whorls of proliferative myofibroblasts [4, 5]. As the disorder progresses, the overlying skin thickens and retracts, and a collagenous cord forms, producing progressive flexion contracture of the affected ray [3–5]. The condition is treated by surgical release of the debilitating flexion contractures. Recurrence after surgery is common, affecting 30–40% of patients [1, 6–8]; of these, 5–10% require further surgery [1]. Lesions with mitotically active, cellular nodules have a far higher recurrence rate (70%) than do hypocellular

Received August 26, 1992; accepted after revision October 20, 1992.

[1]Department of Radiology, Stanford University Medical Center, Stanford, CA 94305. Address correspondence to A. G. Bergman.

[2]Department of Functional Restoration, Division of Hand Surgery, Stanford University Medical Center, Stanford, CA 94305.

[3]Department of Pathology, Stanford University Medical Center, Stanford, CA 94305.

0361–803X/93/1604–0813

lesions (18%) [6]. Surgery is generally avoided in the early proliferative stage because of the high recurrence rate [6, 7]. We describe the MR appearance of the nodules and cords in Dupuytren's contracture and the correlation between the MR signal intensity and the lesion's degree of cellularity. MR imaging may be of value in predicting the cellularity of lesions and therefore provide prognostic information for patients with Dupuytren's contracture.

Subjects and Methods

Eleven hands in 10 patients were studied. The patients, nine men and one woman (38–79 years old), were consecutive patients operated on for Dupuytren's contracture by two surgeons.

MR images were obtained preoperatively. The median interval between imaging and surgery was 3 days (range, 1 day to 11 months). All but one patient had surgery within 1 month of the imaging.

MR images were obtained with a 1.5-T GE Signa system (GE Medical Systems, Milwaukee, WI) and a transmit/receive wrist coil positioned around the hand. Because of the limited dimensions of the wrist coil, it was not possible to image the entire hand at once. Flexion contractures also prevented axial, but not sagittal, images from being obtained through all the involved fingers. We therefore positioned the coil to image the metacarpal and proximal phalangeal areas. The distal phalanges were not imaged. A 10-cm field of view and three imaging sequences were used: sagittal 300/15 (TR/TE), 3-mm slice thickness, 1.5-mm gap, 256 × 192 matrix, two excitations; axial 300/15 (TR/TE), 5-mm slice thickness, 2.5-mm gap, 256 × 192 matrix, two excitations; and axial 2000/20,70, 5-mm slice thickness, 2.5-mm gap, 256 × 128 matrix, two excitations.

The MR images were interpreted jointly by two radiologists who knew the physical findings but not the surgical or pathologic findings. For each patient, the radiologists recorded the number of lesions and the rays involved. The configuration and proximal and distal extent of each lesion, involvement of deep structures (nerves, blood vessels, flexor tendons, and lumbrical muscles), and the presence and position of nodules were noted. The longitudinal and cross-sectional dimensions of each cord and nodule were measured from the images. The signal characteristics of the lesions were recorded.

Data collected at surgery included the number of rays involved, the proximal and distal extent of the lesions, and the involvement of deep structures. Nine patients were operated on by the same surgeon; one patient had surgery performed by a different surgeon, who reported the findings to us.

The surgical specimens were labeled to indicate the ray from which they were excised, and the margins were marked to indicate the orientation of the specimens in situ.

Pathologic analysis included both gross and histologic examination. Initially, specimens were fixed in 10% formalin, and serial sections were cut perpendicular to the axis of the lesion; measurements were made before processing. Later, specimens were pinned out overnight to fix in 10% formalin and submitted whole in the cassette so that they could be sectioned parallel to the axis of the ray. This procedure enabled us to measure more accurately the nodules and their relative positions in the ray compared with the dense collagenous cords. Sectioned material was stained with hematoxylin and eosin and was examined histologically.

Finally, MR findings were correlated with surgical and pathologic findings. The number of involved rays detected on preoperative MR images was compared with the number of involved rays found at surgery. The configurations of the lesions on MR images (linear, branching, the presence of nodules) were compared with surgical findings. The dimensions of the lesions measured on MR images were compared with the dimensions of the surgical specimens. The MR signal characteristics of the lesions were correlated with the histologic findings in the corresponding areas of nodules and cords.

Results

MR images showed Dupuytren's contracture in 21 of 22 rays with pathologically proved involvement. The lesion that was missed was a cord involving the second ray. This lesion was oriented obliquely to both the sagittal and axial planes of imaging and was not diagnosed on MR images but was diagnosed clinically before surgery. Retrospectively, the lesion was detected on MR images. Thirteen of 14 nodules were detected prospectively. The nodule that was missed was small (7 × 2 mm), hypocellular, and contiguous with a cord. It had a low signal intensity on both T1- and T2-weighted MR images and was not distinguishable from the cord on the available images.

The MR appearance of Dupuytren's contracture reflected variability in the extent and cellularity in the disorder. Cords were present in all 11 hands; a total of 22 cords were detected (Fig. 1). The fourth ray was the one involved most often (10 of 22 cords). Next in order were the fifth ray (six of 22), the third ray (four of 22), and the second ray (two of 22). In all cases, the cords arose proximally from the palmar aponeurosis at the proximal part of the metacarpus and extended distally, superficial and parallel to the flexor tendons (Fig. 1). The length of the cords varied from 10 to 55 mm; cross-sectional dimensions were 2–10 mm. The distal configurations of the cords varied. In the most common configuration (10 of 22), the cords terminated in fine strands extending into the subcutaneous tissues at the distal part of the metacarpus. In many cases (six of 22), the cord terminated in a nodule, either at the distal part of the metacarpus or the proximal phalanges (Fig. 2). In some cases (two of 22), the cord extended into the proximal phalanx as a central cord or terminated in a branching configuration at the distal part of the metacarpus (four of 22), with branches extending into the web space on either side of the ray. The extension of abnormal tissue to deep structures was evident on MR images in six of 22 affected rays. In these cases, fine strands extended to the flexor tendon of the affected ray (three of six rays) or to both the flexor tendon and lumbrical muscle (three of six rays). No vascular or neural involvement was detected either on MR images or at surgery. The dimensions and configurations of cords as determined from MR images corresponded closely to the surgical and gross pathologic findings in all cases.

Nodules were present in nine of 11 hands (Figs. 2 and 3). A total of 14 nodules were detected on pathologic examination; 13 were detected prospectively on MR images. These nodules were located most commonly, in order, at the distal part of the metacarpus (nine), the proximal phalanges

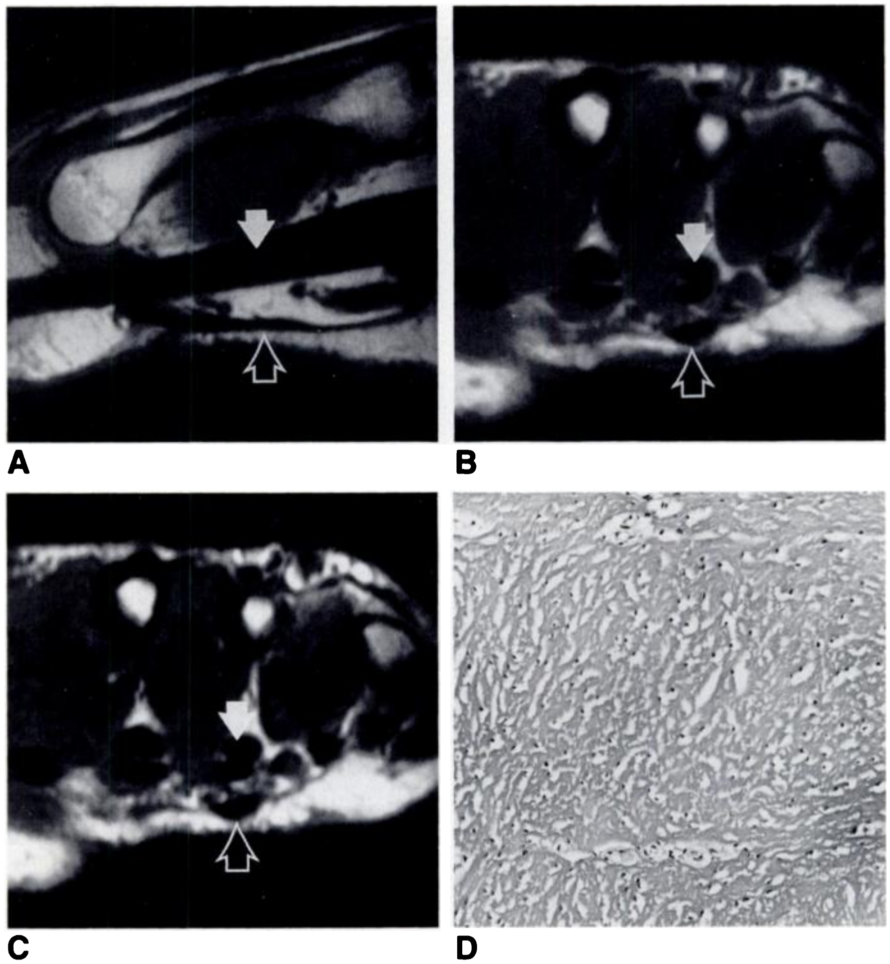

Fig. 1.—Characteristic appearance of cord in Dupuytren's contracture, arising proximally from palmar aponeurosis and coursing distally in palmar tissue parallel to fourth ray.

***A*, Sagittal spin-echo MR image (300/15) at level of fourth metacarpal shows low-signal-intensity cord (*open arrow*) in superficial palmar soft tissues, with flexor tendons (*solid arrow*) of fourth ray deep to it.**

***B* and *C*, Axial T1-weighted (300/15, *B*) and T2-weighted (2000/70, *C*) spin-echo MR images at proximal part of metacarpus show low signal intensity within cord (*open arrows*). Flexor digitorum tendons (*solid arrows*) are deep to cord.**

***D*, Photomicrograph of surgical specimen shows cord is hypocellular, composed mostly of collagen. (H and E; original magnification ×300)**

(three), and the proximal part of the metacarpus (two). The fourth ray was involved most often (eight of 14); next, in order, were the fifth ray (five) and the third ray (one). The nodules were contiguous with cords in all cases and were detected as regions of nodular enlargement, usually with different signal characteristics, as discussed later. The cross-sectional dimensions of the nodules on MR images ranged from 5 × 7 mm to 10 × 12 mm; their lengths ranged from 5 to 20 mm. These measurements were in close agreement with the surgical and gross pathologic findings.

The signal characteristics of the lesions are as follows. The cords had a uniformly low signal intensity (similar to that of tendon) on both T1- and T2-weighted images in most cases (18 of 22, Fig. 1). A pattern of low to intermediate signal intensity (slightly higher than tendon but less than muscle) on T1-weighted images and low signal intensity on T2-weighted images was noted in a few cases (four of 22). The 13 nodules detected by MR images had variable signal characteristics. Most nodules (10 of 13) had primarily an intermediate signal intensity on both T1- and T2-weighted images and were stippled with focal areas of either low or high signal intensity on both T1- and T2-weighted images (Figs. 2 and 3). The rest of the nodules (three of 13) had a uniformly low signal intensity on both T1- and T2-weighted images.

Correlation of the MR signal characteristics of lesions with histologic findings indicated the following. The 18 cords that had a uniformly low signal intensity on both T1- and T2-weighted images were hypocellular and composed mostly of dense collagen (Fig. 1). Four of the 22 cords had a low to intermediate signal intensity on T1-weighted images and a low signal intensity on T2-weighted images. Histologically, these cords also were hypocellular and composed of dense collagen. Of the nodules examined in the present study, 11 of 13 had a heterogeneous intermediate signal intensity on both T1- and T2-weighted images. Histologically, these nodules were either mostly cellular (Fig. 3) or of mixed composition, with regions of cellularity and hypocellular collagenous regions (Fig. 2). Two of 13 nodules had a uniformly low signal intensity on T1- and T2-weighted images and were hypocellular histologically. None of the cellular lesions showed mitotic activity.

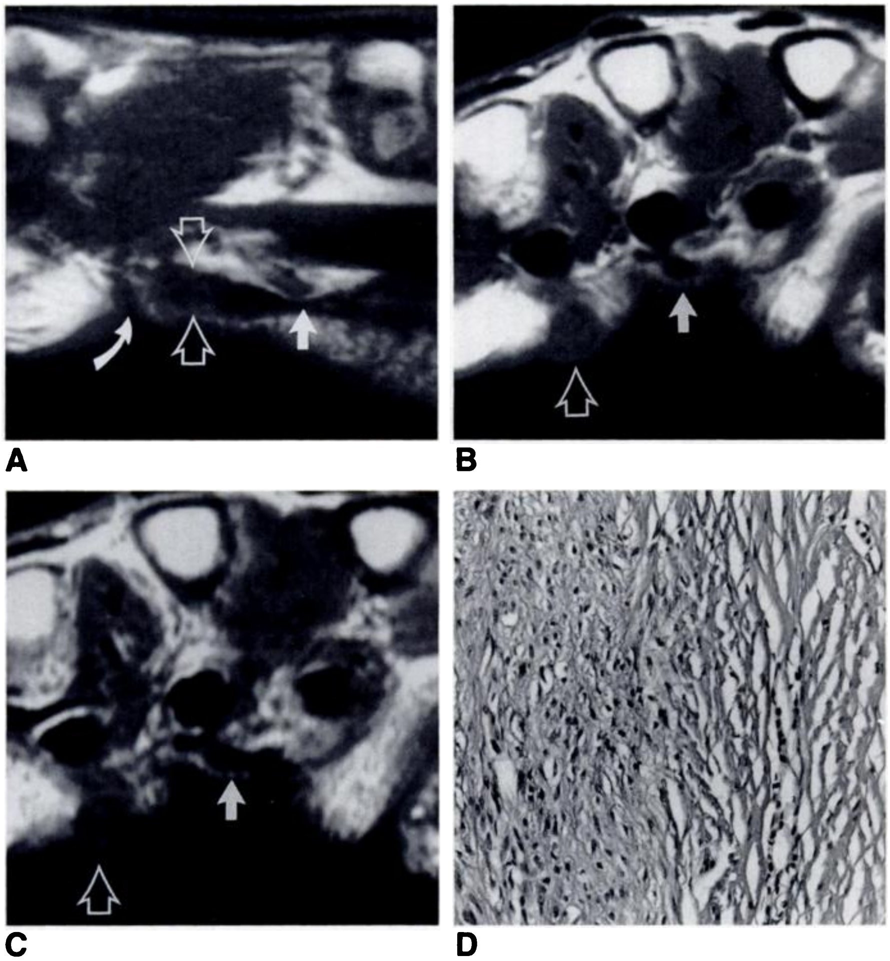

Fig. 2.—Subcutaneous nodule at distal part of fourth metacarpal, close to volar crease (*curved arrow*), in Dupuytren's contracture.

A, Sagittal spin-echo MR image (300/15) at level of fourth ray shows a low-signal-intensity cord (*solid straight arrow*) in superficial palmar soft tissues terminating in a nodule (*open arrows*) at middle to distal part of metacarpus.

B and *C*, Axial T1-weighted (300/15, *B*) and T2-weighted (2000/70, *C*) spin-echo MR images show intermediate signal intensity within nodule (*open arrows*), with mild heterogeneity of signal intensity. Note also lesion (*solid arrows*) of third ray, which has low signal intensity on both T1- and T2-weighted images.

D, Photomicrograph of surgical specimen shows nodule has heterogeneous composition, with cellular regions intermixed with bundles of collagen fibers. (H and E; original magnification ×300)

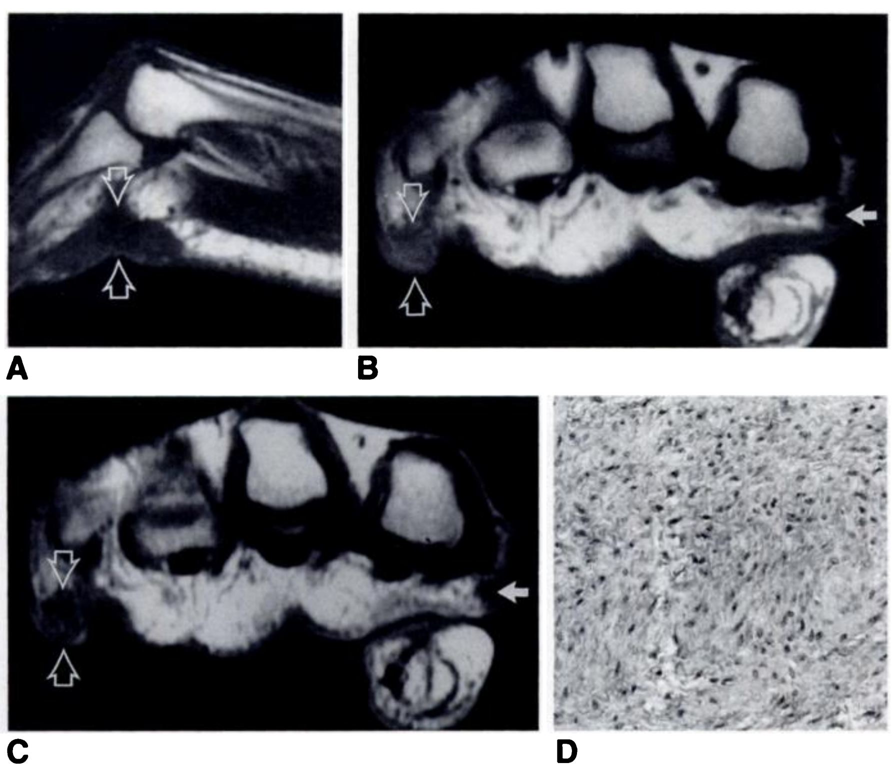

Fig. 3.—Subcutaneous nodule involving fifth ray in Dupuytren's contracture.

A, Sagittal spin-echo MR image (300/15) shows subcutaneous nodule (*arrows*) at level of metacarpophalangeal joint.

B and *C*, Axial T1-weighted (300/15, *B*) and T2-weighted (2000/70, *C*) spin-echo MR images show intermediate signal intensity within nodule (*open arrows*). Also note low-signal-intensity subcutaneous cord of second ray (*solid arrows*).

D, Photomicrograph of surgical specimen shows nodule is uniformly cellular. (H and E; original magnification ×300)

Discussion

The data presented here indicate that MR imaging can be used to detect and define the extent of Dupuytren's contracture. The clinical relevance of this, however, is unclear. As noted earlier, the diagnosis of Dupuytren's contracture is made clinically on the basis of characteristic history and physical findings [1–3]. In the exceptional case when the diagnosis is in doubt, such as early in the course of the disease when a tender subcutaneous nodule is the only clinical finding [3], MR imaging may be useful for distinguishing Dupuytren's contracture from other soft-tissue disorders, such as neurofibroma and giant-cell tumor of tendon sheath. Use of MR imaging to define the extent of the disorder may also be helpful in certain cases for planning what is often an extensive soft-tissue dissection.

A more intriguing outcome of our study is the finding that the signal characteristics of the lesions correlate with the lesions' cellularity. The cellularity of the lesion is one of the factors thought to affect recurrence after surgical resection [3, 6], which is frequent, affecting 30–40% of patients overall, some of whom require additional surgery [7, 8]. Histologic studies have shown that mitotically active, cellular lesions have the highest recurrence rates (70%); next are those that are cellular but not mitotically active (41%); fibrotic hypocellular lesions are least likely to recur (18%) [6]. It has been suggested that surgery should be avoided in the early proliferative stage because of the high recurrence rate [6]. Clinically, early lesions consist of tender subcutaneous nodules but lack the palpable cords, skin retraction, and flexion contractures characteristic of mature lesions. All the patients in our series had clinically mature disease, and none had mitotically active lesions. Therefore, the question whether MR imaging could be used to distinguish early, mitotically active lesions cannot be answered from our study. No preoperative noninvasive test for determining lesion cellularity has been available, however. Our results show that MR images can be used to distinguish mostly cellular lesions from hypocellular lesions. The significant difference in recurrence rate between cellular (not mitotically active) and hypocellular lesions [6] and the ability to distinguish these lesions on MR images suggest that preoperative MR imaging might provide prognostic information on the likelihood of recurrence in a given lesion. Although this is an inviting speculation, follow-up data will be required to substantiate it.

REFERENCES

1. McFarlane RM. Dupuytren's disease. In: McCarthy JG, May JW, Littler JW, eds. *Plastic surgery.* Philadelphia: Saunders, **1990**
2. Hueston JT. Overview of etiology and pathology. In: Hueston JT, Tubiana R, eds. *Dupuytren's disease.* London: Churchill Livingstone, **1985**
3. Smith AC. Diagnosis and indications for surgical treatment. *Hand Clin* **1991**;7:635–642
4. Gabbiani G, Majno G. Dupuytren's contracture: fibroblast contraction. *Am J Pathol* **1972**;66:131–138
5. Iwasaki H, Mueller H, Stutte HJ, Brennscheidt U. Palmar fibromatosis (Dupuytren's contracture): ultrastructural and enzyme histochemical studies of 43 cases. *Virch Arch Pathol Anat* **1984**;405:41–53
6. Rombouts J-J, Noel H, Legrain Y, Munting E. Prediction of recurrence in the treatment of Dupuytren's disease: valuation of a histologic classification. *J Hand Surg [Am]* **1989**;14-A:644–652
7. Adam RF, Loynes RD. Prognosis in Dupuytren's contracture. *J Hand Surg [Am]* **1992**;17-A:312–317
8. Makela EA, Jaroma H, Harju A, Anttila S, Vainio J. Dupuytren's contracture: the long-term results after day surgery. *J Hand Surg [Br]* **1991**;16-B:272–274