

## MRI-Histological Correlation of Abdominal and Intra-abdominal Desmoid Tumors

Kuwako KOMAKI, Kayoko OKU, Takenori YAMASHITA,  
Nobunao MAEHARA, Hiroshi SHIRAI, Tsutomu TAMADA,  
Shigeki IMAI, Yasumasa KAJIHARA, Masatoshi KIMOTO\*  
and Tsukasa TSUNODA\*

*Department of Radiology, \*Department of Surgery,  
Kawasaki Medical School, Kurashiki 701-0192, Japan*

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**ABSTRACT.** Magnetic resonance images of two patients with abdominal and intra-abdominal desmoid tumors were correlated with their histopathological findings. The two patients had a history of excision of polyposis coli. MR-images of the three desmoid tumors of the first patient were composed of two different areas of signal intensity. The inner areas of the tumors had isointensity on T1-weighted images and heterogeneous hyperintensity on T2-weighted images, whereas the marginal areas of the tumors had hypointensity on T1-weighted images and extremely hypointensity on T2-weighted images. The inner areas corresponded to a fibroblast-rich and hypervascular areas, while the marginal areas corresponded to abundant, tight and hypovascular collagenous regions. Most of the second patient's desmoid tumor had isointensity on T1-weighted images and moderate hyperintensity on T2-weighted images. This tumor included a central area that had been hypointense on T1-weighted images and extremely hyperintense on T2-weighted images. Most of this tumor was composed of mixed collagen fibers and fibroblasts. The central area consisted of areas of degenerative necrosis and myxoedematous fibroblasts.

Abdominal and intra-abdominal desmoid tumors exhibit two patterns on MR-images. Such findings are due to the relative cellularity, amount and distribution of collagen fibers. We considered the extremely hypointensity finding in the marginal areas on T2-weighted images to be characteristic of MR-images of desmoid tumors.

**Key words:** desmoid tumor — MR imaging — histopathology

Desmoid tumors are categorized into abdominal, intra-abdominal and extra-abdominal types. These are characterized by proliferation of uniform fibroblastic cells and collagen fiber that arise from the fascia or aponeurosis of muscle. They are benign tumors, but may be locally invasive and tend to recur following surgical excision, hence their other name, aggressive fibromatosis.<sup>1,2)</sup>

Recently, opportunities to evaluate desmoid tumors using MR imaging have increased. Extra-abdominal desmoid tumors include elements which show low signal intensity on T2-weighted sequences. Light microscopy correlation has revealed the presence of abundant collagen with decreased signal intensity on T2-weighted sequences.<sup>3,4)</sup>

We correlated the MR images and histopathological findings of two cases

who had abdominal and intra-abdominal desmoid tumors with contrasting MR images.

#### MATERIALS AND METHODS

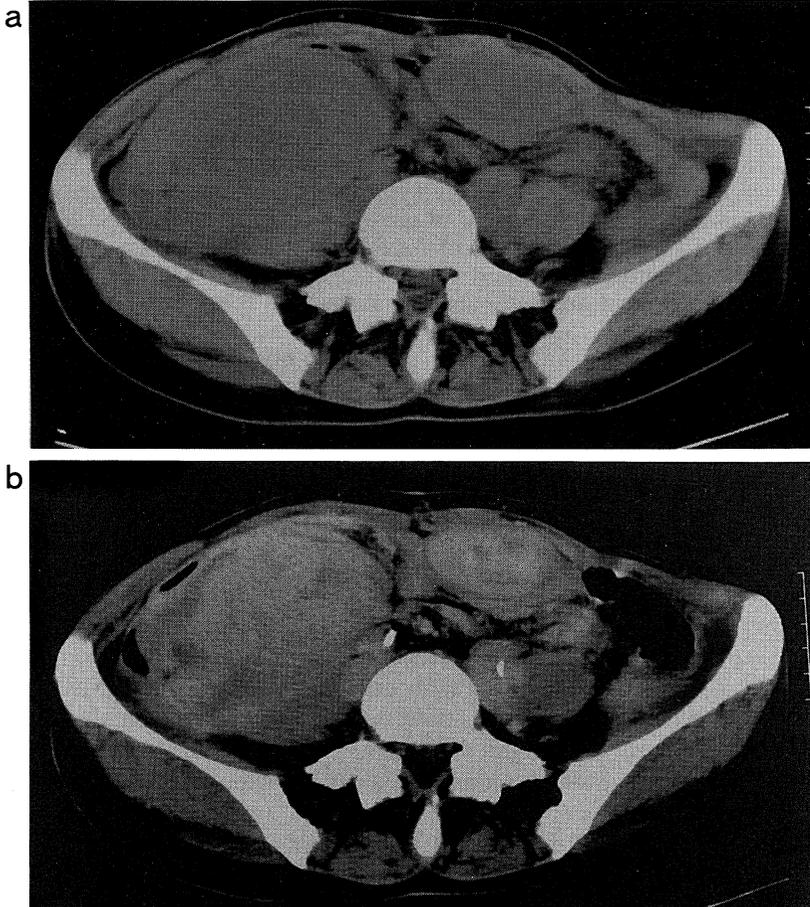
Two patients with four histologically proven desmoid tumors were evaluated by MRI. The examinations were performed on a 0.5 T superconductive magnet. The relative cellularity versus collagen was compared in each of the four lesions and correlated with the MR images.

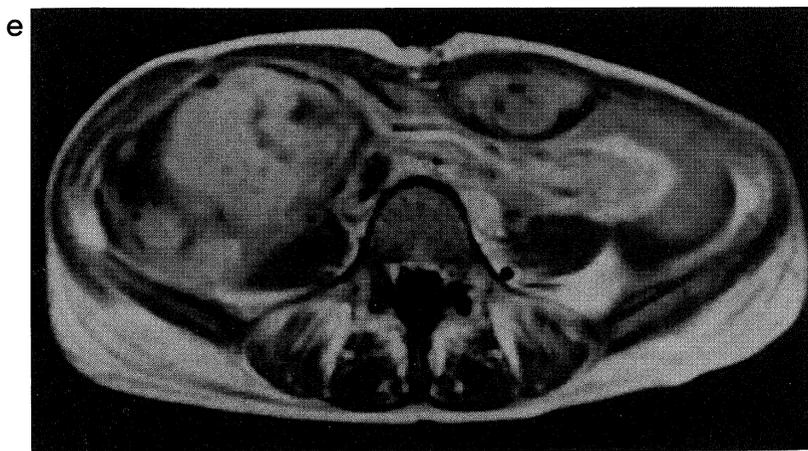
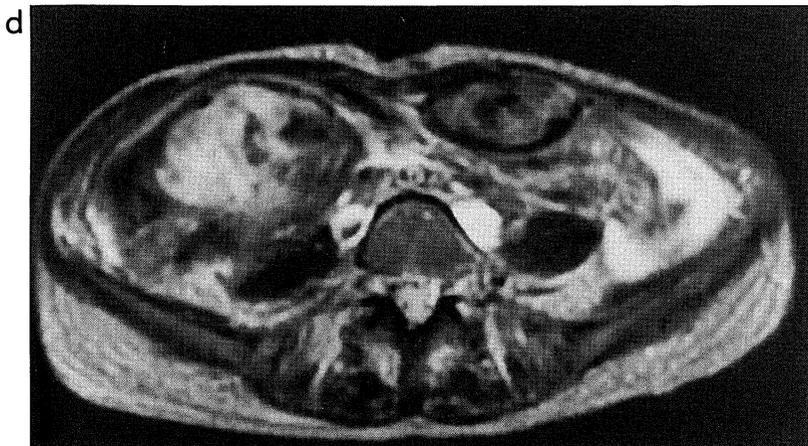
The first patient was a 44-year-old female. She had undergone a total colectomy for polyposis coli with rectal cancer. One year and six months after the operation, two desmoid tumors of the abdominal wall and one of the mesenterium were excised.

The second patient was a 36-year-old male. He had undergone a total colectomy for polyposis coli. Three years after the operation, one desmoid tumor of the mesenterium was excised.

#### RESULTS

The three tumors of the first patient separated two parts on CT, MRI and





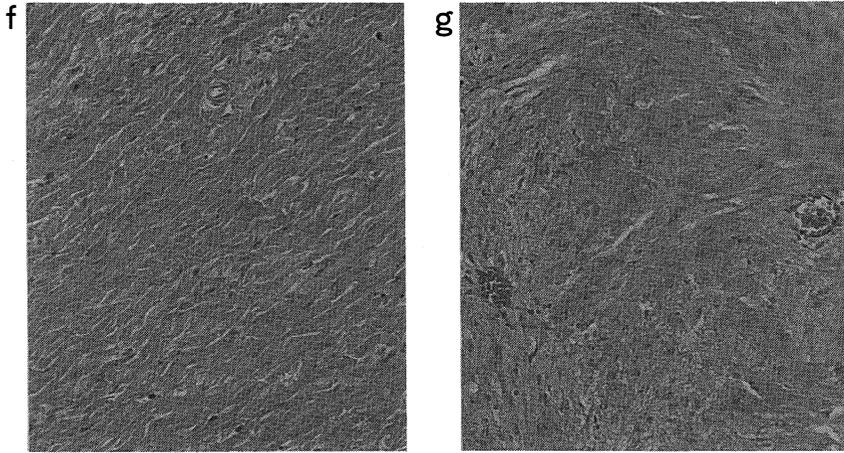


Fig 1. 44-year-old female with abdominal and intra-abdominal desmoid tumors. (a) A plain CT scan demonstrates two well-defined masses with similar attenuation relative to muscle on the mesentery and rectus. (b) A contrast material-enhanced CT scan shows enhanced area in the inner area of the tumors. (c,d,e) MR images. (c) T1-weighted images show two masses with isointense area relative to adjacent muscle in the inner area and an extremely hypointense area in the marginal area. (d) On T2-weighted images, the masses appear as a hyperintense area in the inner area and an extremely hypointense area in the marginal area. (e) Contrast material-enhanced T1-weighted images show enhancement in the inner area. (f,g) Light microscopic findings (H & E,  $\times 100$ ). (f) The marginal area of the tumor consisted of abundant and tight collagen fibers and a few capillaries. (g) The inner area was composed of a fibroblast-rich and hypervascular area.

histopathological findings. A CT scan demonstrated three well defined masses in the mesentery and the left rectus (Fig 1a). Contrast material on the CT slightly enhanced the inner areas on all the lesions (Fig 1b). T1-weighted MR images showed low signal intensity in the marginal areas and intensity similar to that of muscle in the inner areas (Fig 1c). T2-weighted images demonstrated extremely low signal intensity in the marginal areas and heterogeneous high intensity in the inner areas (Fig 1d). The inner areas were also enhanced by contrast material on the MR imaging (Fig 1e). These masses separated clearly into two parts. The marginal areas of these tumors were consisted of abundant and tight collagen fibers. A few very differentiated fibroblasts were scattered in these collagen fibers. These parts had a few capillaries (Fig 1f). On the other hand, the inner areas were composed of rich fibroblasts, increased capillaries and exhibited hypercellularity (Fig 1g). These histopathological findings correlated well with MR images.

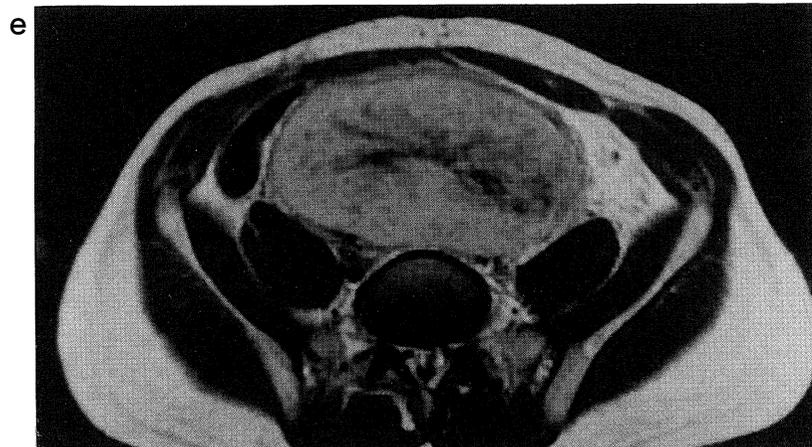
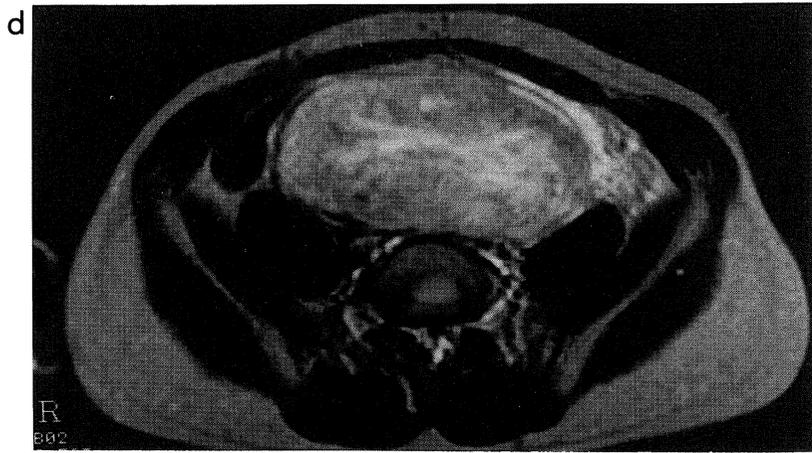
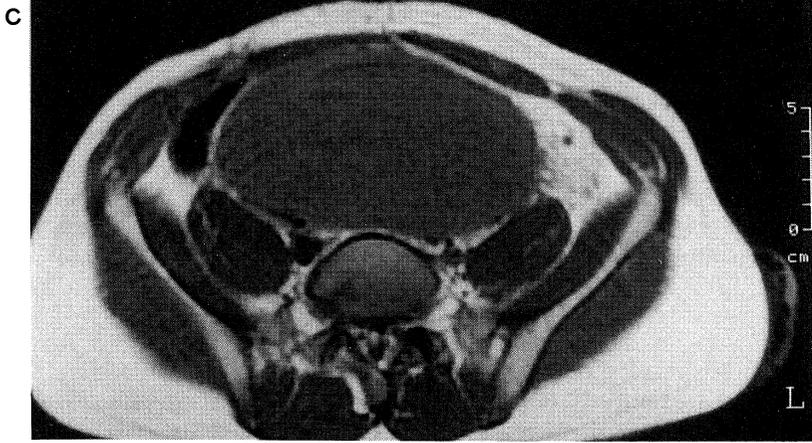
The tumor of the second patient was not clearly separated on CT, MR images and histopathological findings as was that of the first case. A CT scan demonstrated a tumor in the mesentery (Fig 2a). Contrast material slightly enhanced most of the tumor on the CT, but did not enhance in the central area (Fig 2b). T1-weighted MR images of most of the tumor showed slightly high intensity to the muscle (Fig 2c), while T2-weighted images showed moderately high intensity (Fig 2d), and this tumor was enhanced by the contrast material on MR images (Fig 2e). On microscopically, this MR images was made up of mixed collagen fibers and fibroblasts (Fig 2f). High signal intensity on T2-weighted images show increase of the relative water content with the increase

of the cellularity and scattered collagen fibers in this area. In the central area of the tumor, T1-weighted images showed low signal intensity, while T2-weighted images showed extremely high signal intensity. And the contrast material on the MR imaging did not enhance this area. This central area correlated with degenerative necrosis and myxoedematous fibroblasts (Fig 2g). The findings for this tumor differed signal intensity from those of the tumors of the first patient on MR images. The second patient's tumor showed no extremely low intensity area on T2-weighted images. Because, on histopathologically, this tumor did not have the area of the abundant collagen fibers.

### DISCUSSION

The term "desmoid" is derived from the Greek word 'desmos', meaning a band or tendon.<sup>5)</sup> The incidence of desmoid tumor in patient with polyposis coli ranges 3.5% to 13%. Most tumors arise in the mesentery, retroperitoneum and abdominal wall. Occasionally they situated in other sites remote from the abdomen. And intra-abdominal desmoid tumors in polyposis coli ordinarily





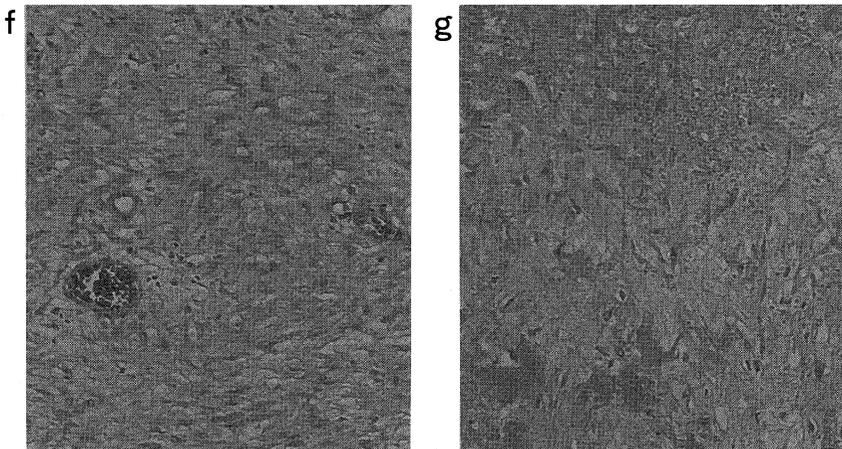


Fig 2. 36-year-old male with intra-abdominal desmoid tumor. (a) A plain CT scan demonstrates a well defined mass with similar attenuation relative to muscle on the mesentery. (b) A contrast material-enhanced CT scan shows enhancement in most of the tumor, except for the central part. (c,d,e) MR images. (c) T1-weighted images show a mass with a slightly hyperintense area relative to adjacent muscle. (d) On T2-weighted images, most of the tumor appear hyperintense or extremely hyperintense in the central area. (e) Contrast material-enhanced T1-weighted images show enhancement in most of the tumor, except for the central area. (f,g) Light microscopic findings (H & E,  $\times 100$ ). (f) Most of the tumor was composed of mixed collagen fibers and fibroblasts. (g) The central area consisted of degenerative necrosis and myxoedematous fibroblasts.

has its onset 1 or 2 years following excision of the diseased colon.<sup>6,7)</sup> Our cases also had polyposis coli and a state of the post-excision of the disease. Desmoid tumors have a tendency to recur postsurgically after excision of the initial tumor(s). Therefore, preoperative diagnosis is important. In this series, we have attempted to establish the typical MR images presentation and histopathological findings of desmoid tumors.

The histology of desmoid tumors is characterized by interlacing bundles of proliferating spindle cells alternating with varying amounts of collagen. The degree of cellularity varies.

The following is the report by Sundaram *et al.* The MRI of soft tissue tumors was variable, but most lesions (40 of 47 lesions) showed high signal intensity on T2-weighted images. In the remaining lesions, which demonstrated low intensity on T2-weighted images, it was considered that this MR finding was based on relative acellularity and abundant collagen.<sup>3)</sup>

Irie *et al*<sup>8)</sup> reported that a marginal area with extremely low signal intensity was a characteristic MRI feature of extra-abdominal desmoid tumors. Hawnaur *et al*<sup>4)</sup> also indicated that marginal area of the extra-abdominal desmoid tumors they examined showed extremely low signal intensity on T2-weighted images because of the existence of tight collagenous lesions.

In our first case, the desmoid tumors had a characteristic MR images as well as extra-abdominal desmoid tumors.

On the other hand, Feld *et al*<sup>9)</sup> reported that most of the extra-abdominal desmoid tumors (7 of 8 lesions) they studied demonstrated increased signal intensity relative to muscle on T2-weighted images.

The desmoid tumor of our second case demonstrated heterogeneous high

intensity but lacked an extremely low intensity area on T2-weighted images.

Abdominal and intra-abdominal desmoid tumors display two patterns on MR images. As for extra-abdominal desmoid tumors, a marginal area of extremely low intensity on T2-weighted images without calcification, hemosiderin deposits and a flow void were thought to be characteristic MR images. However, heterogeneous high signal intensity on T2-weighted images was nonspecific. Therefore, in the differential diagnosis fibrosarcoma, malignant fibrous histiocytoma, rhabdomyosarcoma, synovial sarcoma, liposarcoma, lymphoma, metastases, neurofibroma, neuroma, leiomyoma and hematomas should be considered.

We concluded that the appearance of MR images of abdominal and intra-abdominal desmoid tumors could be categorized into two patterns; One in which the marginal area shows extremely low signal intensity on T2-weighted images and another in which have most of the tumor show a heterogeneous moderately high signal intensity on T2-weighted images. These findings depend on the relative amounts of fibroblast proliferation, collagen fiber and vascularity.

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