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Original Article

Endometrial Polyps: MR Imaging Features

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The purpose of this study is to evaluate the diagnostic usefulness of magnetic resonance imaging (MRI) characteristics of endometrial polyps in order to differentiate them from other endometrial lesions. MRI was retrospectively reviewed in 40 patients with pathologically proven endometrial polyps. Special attention was paid to the sizes, shapes, margins, internal structures, signal intensities, and post-contrast enhancement patterns. A central fibrous core, intratumoral cysts, and hemorrhage were seen in 30 (75%), 22 (55%), and 14 (35%) patients, respectively. The predominant signal intensity of the lesions showed iso-to slightly low signal intensity relative to the endometrium on T2-weighted images in 36 (90%), low signal intensity on diffusion-weighted images in 32 (80%), and strong or moderate enhancement on enhanced T1-weighted images in 28 patients (70%), respectively. In 32 (80%) patients, the endometrial polyps showed global or partial early enhancement. On dynamic study, rapid enhancement with a persistent strong enhancement pattern was seen in 17 (42.5%) and a gradually increasing enhancement pattern was seen in 17 patients (42.5%). These MRI features can be helpful to distinguish the endometrial polyps from various other endometrial lesions.

Key words: endometrial polyp, central fibrous core, intratumoral cyst, magnetic resonance imaging (MRI), uterus

Endometrial polyps are sessile masses of variable size that project into the endometrial cavity. They may be asymptomatic or symptomatic, causing abnormal bleeding if they ulcerate or undergo necrosis. Tamoxifen therapy is a risk factor for the development of endometrial polyps; polyps develop in 8% to 36% of postmenopausal women treated with tamoxifen [1–4]. Transvaginal ultrasonography (TVUS) is the primary modality for assessing endometrial abnormality. Sonohysterography (saline infusion sonogram) is more accurate than ultrasound (US) alone in making a diagnosis of endometrial polyps [5]. However, these lesions often cannot be separated from the surrounding endometrium because the whole endometrium may appear diffusely thickened. As endometrial thickening is a nonspecific US finding, it should be correlated with the patient's age, symptoms, and hormonal status. To make a specific diagnosis in these circumstances, endometrial cytology, biopsy, and curettage have been the mainstays of preoperative diagnosis. As these procedures are commonly performed in a blind manner, it is not always possible to make a definitive

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diagnosis. Moreover, these procedures are difficult to perform in some cases with vaginal or cervical stenosis.

Because of its excellent soft-tissue contrast resolution and multiplanar capability, magnetic resonance imaging (MRI) can demonstrate morphologic features and the extent of lesions, both of which are useful in making decisions for surgical or hysteroscopic resection. In previous studies, MRI could distinguish most endometrial polyps from carcinomas on the basis of morphologic features, such as "a central fibrous core" or "intratumoral cysts", on T2-weighted images. A stroma of dense fibrous or smooth muscle tissue and glandular cystic dilatation are present in the endometrial polyps. MRI findings on central fibrous core and intratumoral cysts probably reflect these pathological changes. However, the frequency of these findings is variable among the previous reports, and even other endometrial lesions, especially endometrial carcinoma rarely shows these findings [6-9]. Other studies have focused on signal intensities of diffusion-weighted images [10-12], and on the enhancement patterns including dynamic studies [7, 9, 13]. However, the number of endometrial polyps in each of those studies is no more than 9, which is not sufficient to elucidate the imaging features of these lesions.

The purpose of this study is to describe the MRI characteristics of endometrial polyps and to evaluate the usefulness of these characteristics for differentiating these polyps from other endometrial lesions, especially endometrial carcinomas.

Materials and Methods

Population. A waiver of informed consent was granted by our institutional review board because of the retrospective and anonymous nature of this study.

From December 2006 to December 2010, 1350 MR examinations of the female pelvis were performed. Endometrial polyps were found in 45 cases. Five cases were excluded from the study because of insufficient MR examinations; 4 cases lacked a gadolinium-contrast-enhancement study, and 1 case did not undergo diffusion-weighted imaging. A total of 40 cases were finally enrolled in the study. Pathological confirmation was made with transcervical resection in 21 cases, and dilatation and curettage in 19. Eight endometrial polyps were examined *in toto*, and the other 32 cases were examined in fragmented specimens. TVUS was performed in all 40 cases. The preoperative US diagnoses were endometrial polyps in 29 cases, other diseases in 6 (hematoma 2, endometrial carcionoma 2, submucosal leiomyoma 2), and nonspecific endometrial thickening in 2 cases. In 3 cases, endometrial polyps were not detected on US. Transvaginal endometrial cytology was obtained in 37 cases, and the findings were all negative. In 3 cases, cytologic specimens could not be obtained because of cervical stenosis in 2 and a large leiomyoma in one case. Indications for MRI were vaginal bleeding in 16 cases, screening for other disorders in the uterus, ovary, kidney, and pregnancy in 11, menstrual disorder in 5, results of health check-ups in 4, abdominal symptoms in 3, and anemia in one case. Except for one case that was being treated with tamoxifen, none of the cases underwent preoperative therapy.

Magnetic resonance scanning protocol. All MR examinations in the 40 cases were performed on a 1.5-T MR scanner (Intera Nova; Philips Medical Systems, Best, The Netherlands) using a 4-channel phased-array body coil. The menstrual phases of the cases were not taken into consideration in the timing of the MR examinations.

The imaging sequences included the following:

(a) T2-weighted fast spin-echo imaging (T2WI) in sagittal and axial oblique (to the corpus) planes (repetition time [TR]/echo time [TE], 5900/20 ms; echo-train length, 12; matrix size, 272×272; field of view, 28 cm; slice thickness, 3 mm; gap, 0.3 mm; number of excitations, 2). The total time for T2-weighted MR imaging was 2 min 28 sec.

(b) Fat-suppressed T1-weighted fast spin-echo imaging (FS-T1WI) in the sagittal and axial or coronal oblique (to the corpus) plane (TR/TE, 550/10 ms; echo-train length, 3; matrix size, 256×256; field of view, 28 cm; slice thickness, 3 mm; gap, 0.3 mm; number of excitations, 2). The total time for fat-suppressed T1-weighted MR imaging was 2 min 41 sec.

(c) Diffusion-weighted imaging (DWI) with b values of 0 and 1,000 s/mm^2 in the sagittal and axial or coronal oblique (to the corpus) plane using spin-echo-type and single-shot echo planar imaging (EPI) sequences using parallel-imaging. (TR/TE, 3,700/82 ms; matrix size, 128×128; field of view, 28 cm; slice thickness, 3 mm; gap, 0.3 mm; number of excitations, 6; parallel factor, 1.5), and the motion-probing gradients were

applied along all 3 directions (the slice-select, phase-encodings, and frequency-encoding directions). A spectral spatial fat saturation radiofrequency pulse was used to exclude chemical artifacts. The scanning time of DWI for each case was less than 3 min.

(d) Dynamic contrast-enhanced magnetic resonance imaging (dynamic MRI) in the oblique sagittal (to the corpus) plane was performed after bolus injection of gadopentetate dimeglumine by using a three-dimensional fat-suppressed T1-weighted gradient-echo sequence (specifically, a T1-weighted high-resolution isotropic volume exception: THRIVE; Philips Medical Systems,) (TR/TE, 5/2.5 ms; matrix size, 192×192; field of view, 38 cm; slice thickness, 2 mm; gap, 0 mm; number of excitation, 1). Gadopentetate dimeglumine was intravenously administered at a dose of 0.1 mmol per kilogram of body weight. The injection was administered at a flow rate of 2 ml/sec, and scanning was started at the end of injection. The actual sampling times were 25, 70, and 120 sec after injection.

(e) Post-contrast enhanced fat-suppressed T1-weighted imaging (Gd-T1WI) in sagittal and axial oblique (to the corpus) planes (TR/TE, 600/10 ms; echo-train length, 4; matrix size, 256×256; field of view, 28 cm; slice thickness, 3 mm; gap, 0.3 mm; number of excitations 2). The total time for T1-weighted MR imaging was 3 min 30 sec. All images were obtained under free -breathing. A respiratory trigger was not used.

Image analysis. All of the images were retrospectively evaluated by 2 experienced radiologists (H. S. and M. A.) who have 17 and 22 years' experience of interpreting body MRI, respectively.

MRI was evaluated with special attention to morphologic appearance, including the sizes, shapes, margins, internal structures, and signal intensities. The morphological features of endometrial polyps were 1) the presence of a central fibrous core (defined as a low-signal-intensity strip in or at the center of the lesion on T2WI [Fig. 1]); 2) intratumoral cysts (discrete, smooth-walled cystic structures of high signal intensity within the lesion on T2WI [Fig. 1]); 3) hemorrhage (a high signal intensity area in the lesion on FS-T1WI); and 4) the predominant signal intensity of the lesions (the areas without an intratumoral cyst or a central fibrous core) on T2WI, DWI, Gd-T1WI, and dynamic MRI. The predominant signal intensity of the lesions was classified as follows. 1) On T2WI, it was categorized as high, iso, or low intensity compared with that of the normal endometrium. Low signal intensities were subdivided into 2 categories: — slightly low, defined as those whose low intensities were higher than those of the outer myometrium, and markedly low, defined as those whose intensities were lower than those of the outer myometrium. 2) On DWI, it was categorized as high, iso, or low compared with that of the normal endometrium. 3) The degree of enhancement on Gd-T1WI was categorized as strong, moderate, or weak. Strong was defined as greater than the enhancement of the outer myometrium, moderate was defined as equal to that of the outer myometrium, and weak was defined as lower enhancement than that of the outer myometrium.

On dynamic MRI, if the lesion was heterogeneous on T2WI, we avoided placing the region of interest in the very high signal intensity areas because these portions were thought to be cystic or necrotic where little contrast enhancement is expected. Enhancement of the early vascular phase of the dynamic MRI was categorized into 3 patterns: global, partial, and no enhancement. The overall pattern of the dynamic MRI was categorized into 3 types: rapid enhancement with persistent strong enhancement, gradually increasing enhancement, and sustained slight enhancement.

MR features were correlated with histological findings in the cases with characteristic MRI findings, and those with unusual MRI findings. All of the specimens were retrospectively evaluated by one experienced pathologist (F.M.) who has 13 years' experience of interpreting surgical pathology. In the cases with characteristic MRI findings, pathologic specimens were studied with attention to the stroma of dense fibrous or smooth muscle tissue, glandular cystic dilatation, and hemorrhage, which were thought to correspond to the characteristic MRI appearances of a fibrous core, intratumoral cysts, and hemorrhage, respectively. Stroma of dense fibrous or smooth muscle tissue was categorized into 3 patterns: structures larger than 2 mm in diameter, those 1-2 mm in diameter, and those smaller than 1 mm in diameter. Glandular cystic dilatation was categorized into 3 patterns: cystic glands larger than 1 mm occupying more than 30% of the glandular space, those occupying less than 30% of the glandular space, and those with no cystic glands. Hemorrhage was categorized into 2 patterns: larger or smaller than 2 mm in diam-

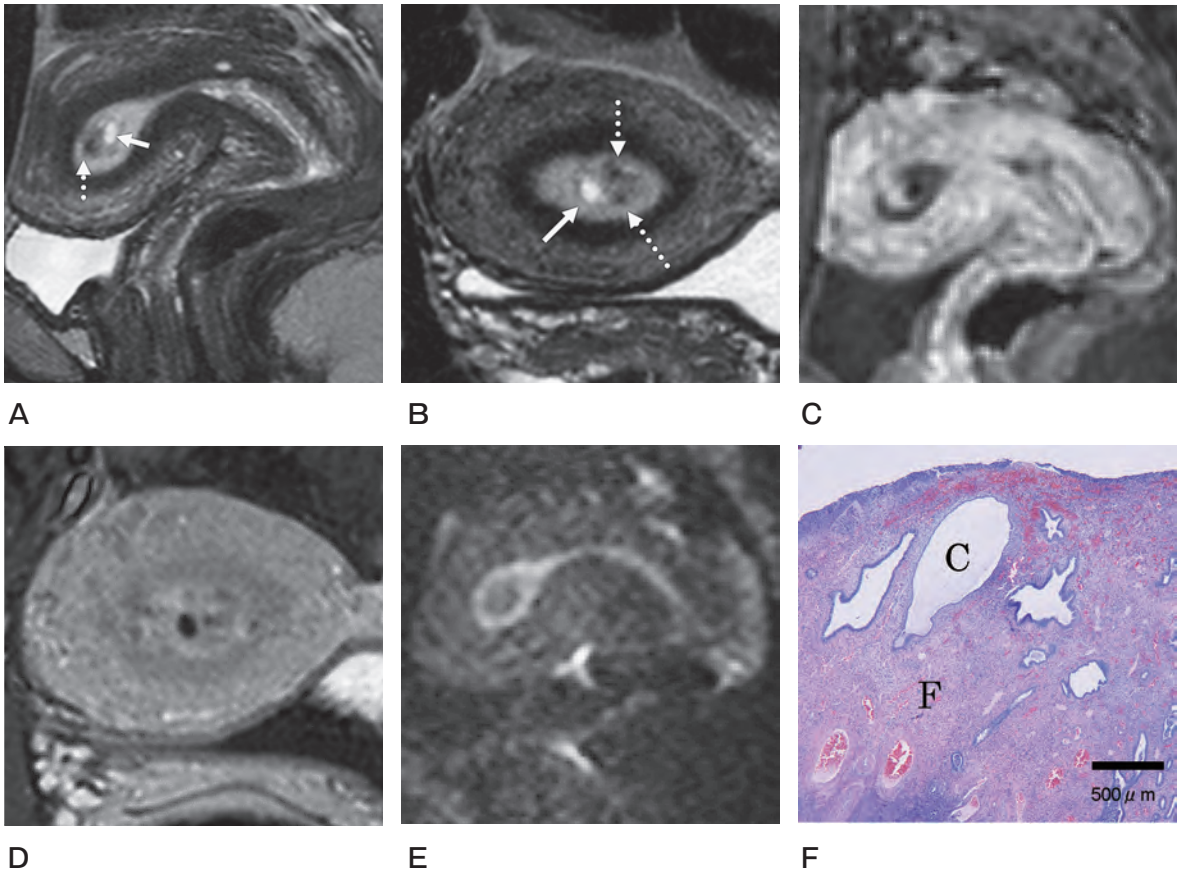

Fig. 1 Endometrial polyp in a 50-year-old perimenopausal woman shows representative MRI findings in a majority of our cases. **A** and **B**, T2WI in sagittal (A) and axial oblique (B) planes shows a polyp with slightly low signal intensity compared with normal endometrium. There are low signal intensity central fibrous cores (dotted arrows) and small high signal intensity intratumoral cysts (arrows); **C**, Early phase image in dynamic MRI in sagittal plane shows global early enhancement. The intratumoral cyst shows no enhancement; **D**, Gd-T1WI in axial oblique plane shows moderate enhancement; **E**, DWI with b value of 1,000 s/mm^2 in the sagittal plane at the same level as in A shows a polyp with low signal intensity compared with endometrium; **F**, Photomicrograph of resected endometrial polyp shows a stroma of dense fibrous tissue (F), glandular cystic dilatation (C), and vascular channel (hematoxylin-eosin staining).

eter. If the histological findings showed different patterns from the MRI findings, we studied the reasons behind the discrepancy.

In the analysis of unusual MRI findings, if the predominant signal intensities showed different patterns from the majority of the cases, we correlated MR features and histological findings in the cases to study the reasons behind those unusual signal intensities on MRI.

Results

The patients were 25 to 77 years of age (mean age, 43.9 years). The average interval between MR scanning and surgery was 66.9 days (range, 4–264 days). On MRI, the maximum short-axis diameter of the lesions ranged from 3 to 44 mm (mean, 14 mm). The margins of the lesions were well circumscribed in 28 (70%) and poorly circumscribed in 12 (30%) cases. The shapes of the lesions were masslike in 26 (65%) and endometrial thickening in 14 (35%) cases (Table 1).

A central fibrous core was present in 30 (75%), and absent in 10 (25%) cases. Intratumoral cysts were present in 22 (55%), absent in 2 (5%), and undetermined in 16 (40%) cases. Hemorrhage was present in 14 (35%), and absent in 26 (65%) cases (Table 2). The results of the predominant signal intensity of the

lesions on T2WI were high signal intensity in 2 (5%), iso-signal intensity in 4 (10%), slightly low signal intensity in 32 (80%) and markedly low signal intensity in 2 cases (5%). On DWI, they showed high signal intensity in 0 (0%), iso-signal intensity in 8 (20%), and low signal intensity in 32 cases (80%). On Gd-T1WI, they showed strong enhancement in 7 (17.5%), moderate enhancement in 21 (52.5%), and weak enhancement in 12 (30%) cases (Table 3). On dynamic MRI, early enhancement of the lesions was global in 10 (25%), partial in 22 (55%) and not present in 8 cases (20%); the dynamic pattern of these was rapid enhancement with persistent strong enhancement in 17 (42.5%), gradually increasing enhancement in 17 (42.5%), and sustained slight enhancement in 6 (15%) cases (Table 4).

On histological examination, stroma of dense fibrous or smooth muscle tissue were larger than 2 mm in diameter in 12 (30%), smaller than 2 mm in diameter in 8 (20%), and absent in 20 (50%) cases. In 30 cases with fibrous core on MRI, stroma of dense fibrous or smooth muscle tissue were larger than 1 mm in diameter in 11 (37%), smaller than 1 mm in diameter in 6 (20%), and absent in 13 (43%) cases. In 10 cases without a fibrous core on MRI, stroma of dense fibrous or smooth muscle tissue showed larger than 2 mm in diameter in 1 (10%), smaller than 2 mm in diameter in 1 (10%), and absent in 8 (80%) cases. For glandular cystic dilatation, cystic glands larger than 1 mm occupied more than 30% of the glandular space in 9 (22.5%), less than 30% of the glandular space in 16 (40%), and no cystic glands in 15 (37.5%) cases. In 22 cases with intratumoral cysts on MRI, glandular cystic dilatation included cystic glands larger than 1 mm occupying more than 30% of the glandular space in 7 (32%), less than 30% of the glandular space in 11 (50%), and no cystic glands in 4 (18%) cases. In 2 cases without intratumoral cysts on MRI, glandular cystic dilatation included cystic glands larger than 1 mm occupying more than 30% of the glandular space in 0 (0%), less than 30% of the glandular space in 0 (0%), and no cystic glands in 2 (100%) cases. In 16 undetermined cases with intratumoral cysts on MRI, glandular cystic dilatation included cystic glands larger than 1 mm occupying more than 30% of the glandular space in 2 (13%),

Table 1 Morphologic characteristics of endometrial polyps on MR imaging

Size	3 to 44 mm (mean, 14 mm)	
Margin	Well circumscribed 28 (70%)	Poorly circumscribed 12 (30%)
Shape	Masslike 26 (65%)	Endometrial thickening 14 (35%)

Data are shown as number of patient (percent).

Table 2 Characteristic of internal structure on MR imaging

	Present	Absent	Undetermined
Central fibrous core	30 (75%)	10 (25%)	—
Intratumoral cysts	22 (55%)	2 (5%)	16 (40%)
Hemorrhage	14 (35%)	26 (65%)	—

Data are shown as number of patient (percent).

Table 3 Predominant signal intensity of lesions on MR imaging

T2WI	High	Isointense	Slightly low	Markedly low
	2 (5%)	4 (10%)	32 (80%)	2 (5%)
DWI	High	Isointense	Low	
	0 (0%)	8 (20%)	32 (80%)	
Gd-T1WI	Strong	Moderate	Weak	
	7 (17.5%)	21 (52.5%)	12 (30%)	

Data are shown as number of patient (percent).

Table 4 Early enhancement and dynamic pattern of lesions on dynamic MRI

Early enhancement	Global	Partial	No enhancement
	10 (25%)	22 (55%)	8 (20%)
Dynamic pattern	Rapid enhancement with persistent strong enhancement	Gradually increasing enhancement	Sustained slight enhancement
	17 (42.5%)	17 (42.5%)	6 (15%)

Data are shown as number of patient (percent).

less than 30% of the glandular space in 5 (31%), and no cystic glands in 9 (56%) cases. Hemorrhage was larger than 2mm in diameter in 29 (72.5%), and smaller than 2mm in diameter in 11 (27.5%) cases. In 14 cases with hemorrhage on MRI, the hemorrhage was larger than 2mm in diameter in 7 (50%), and smaller than 2mm in diameter in 7 (50%) cases. In 26 cases without hemorrhage on MRI, hemorrhage was larger than 2mm in diameter 22 (85%), and smaller than 2mm in diameter in 4 (15%) cases (Table 5).

The predominant signal intensity of the lesions was unusual in 11 cases: 2 cases (5%) showed markedly low signal intensity on T2WI; 2 cases (5%) showed high signal intensity on T2WI; and 8 cases (20%) showed iso-signal intensity on DWI. Of the 2 cases (5%) with high signal intensity on T2WI, one case showed strong enhancement on Gd-T1WI and the other showed iso-signal intensity on DWI. In case 1 [Fig. 2] and case 2, the polyps showed markedly low signal intensity on T2WI. Histological examination of the specimens in these 2 cases showed abundant stroma with large numbers of collagen fibers. In case 3 [Fig. 3], the endometrial polyp showed high signal intensity on T2WI and strong enhancement on Gd-T1WI. Histological examination of this polyp showed abundant edematous stroma with few collagen fibers. In case 4 [Fig. 4], the endometrial polyp showed high signal intensity on T2WI and iso-signal intensity on DWI. Histological examination of the specimen showed glandular cystic dilatation with mucosal fluid collection in the polyp. Of the 8 cases that showed iso-signal intensity on DWI, 1 case (case 4) showed cystic endometrial glandular dilatation with mucosal fluid collection in the polyp, another case (case 5) showed a hemorrhage in the large area of the polyp on histological examination, and histological examination of the polyps in the remaining 6 cases showed multiple endometrial glands embedded in stroma with few collagen fibers that histologically resembled normal endometrium (cases 6 [Fig. 5] to 11) (Table 6).

Discussion

The characteristics of endometrial polyps in our study are summarized as follows. There were high incidences of a central fibrous core, intratumoral cysts, and areas that suggested hemorrhage. The predominant signal intensity of the lesions showed iso to slightly low signal intensity on T2WI, low signal intensity on DWI, and strong or moderate enhancement on Gd-T1WI, respectively. Many polyps showed global or partial early enhancement on dynamic MRI and a persistent strong enhancement, or gradually increasing enhancement patterns.

Histologically, endometrial polyps contain a mixture of 3 elements in varying degrees: a stroma of dense fibrous tissue, thick-walled vascular channels, and endometrial glands. Our results showed higher incidences of a central fibrous core and intratumoral cysts compared to the results of previous studies [7-9]. In 35% of cases, there were areas in the endometrial polyps that suggested hemorrhage. This MRI finding was not reported in the previous studies. As described above, there are thick-walled vascular channels in the stroma, and infarcted polyps may appear hemorrhagic. The hemorrhagic component of the endometrial polyps on MRI may be attributable to these pathological backgrounds. It should be noted that the differentiation between endometrial polyps and polypoid adenomyomas is difficult because both entities have highly-frequent findings of hemorrhage on MRI [14]. In the present study, there were some differences between the characteristic MRI findings and histological findings. The reasons behind these differences between MR and histological findings could be explained by the facts that in 32 cases (80%), histological examinations were made with fragments of endometrial polyps, and in only 8 cases (20%) endometrial polyps could be examined *in toto*. Differences in spatial resolution in MRI and histology, in the menstrual cycle at the time of MRI, and in the interval between MR scanning and surgery could be other factors behind these differences. The higher frequency of hemorrhage in histological findings could be the result of the surgical manipulations during resection.

In approximately 70-80% of the cases, the predominant part of the lesion, which is the area without a central fibrous core or intratumoral cysts, showed slightly low signal intensity on T2WI, and strong or moderate enhancement on Gd-T1WI. Endometrial carcinomas usually show less enhancement compared to the adjacent myometrium [13]. In our study, many of the endometrial polyps showed enhancement equal to or greater than that of the outer myometrium. These enhancement features of the endometrial polyps

could be helpful clues to differentiate these from endometrial carcinoma. Recently, the usefulness of DWI for the differentiation of normal endometrium, benign diseases of the endometrium, and endometrial carcinoma has been reported [11, 12, 14–18]. In our study, many of the endometrial polyps showed low

Table 5 Characteristic MRI findings: Correlations with pathologic findings

Histological findings	Patterns Overall (%)		Characteristic MRI findings		
	Size	Subtotal	Fibrous core		
			Present	Absent	
Stroma of dense fibrous or smooth muscle tissue	≧2mm	12 (30%)	11 (37%)	1 (10%)	
	1–2mm	8 (20%)	6 (20%)	1 (10%)	
	<1mm	20 (50%)	13 (43%)	8 (80%)	
		40 (100%)	30 (100%)	10 (100%)	
	%	Subtotal	Intratumoral cysts		
			Present	Absent	Undetermined
Glandular cystic dilatation	≧30%	9 (22.5%)	7 (32%)	0 (0%)	2 (13%)
	<30%	16 (40%)	11 (50%)	0 (0%)	5 (31%)
	Absent	15 (37.5%)	4 (18%)	2 (100%)	9 (55%)
		40 (100%)	22 (100%)	2 (100%)	16 (100%)
	Size	Subtotal	Hemorrhage		
			Present	Absent	
Hemorrahage	≧2mm	29 (72.5%)	7 (50%)	22 (85%)	
	<2mm	11 (27.5%)	7 (50%)	4 (15%)	
		40 (100%)	14 (100%)	26 (100%)	

Data are shown as number of patient (percent).

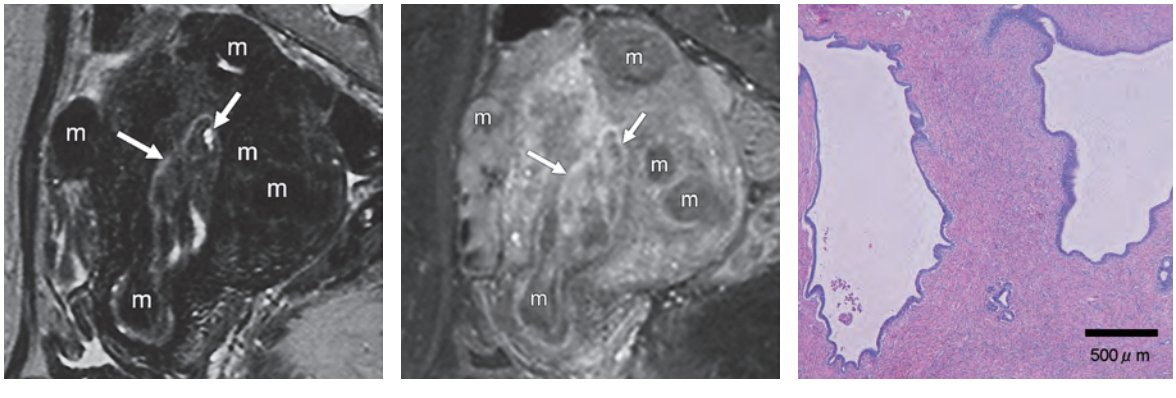

Fig. 2 Endometrial polyp in a 55-year-old menopausal woman shows markedly low signal intensity on T2WI. **A**, T2WI in sagittal planes shows 2 polyps (arrows) of markedly low signal intensity relative to normal endometrium with small high signal intensity intratumoral cysts. Note coexistent myoma (dotted arrow) in endometrium; **B**, Gd-T1WI in sagittal plane shows a weak inhomogeneous enhancement relative to outer myometrium; **C**, Photomicrograph of specimen shows cystic dilatation of glandular ducts and surrounding abundant stroma with collagen-rich fibers (hematoxylin-eosin staining).

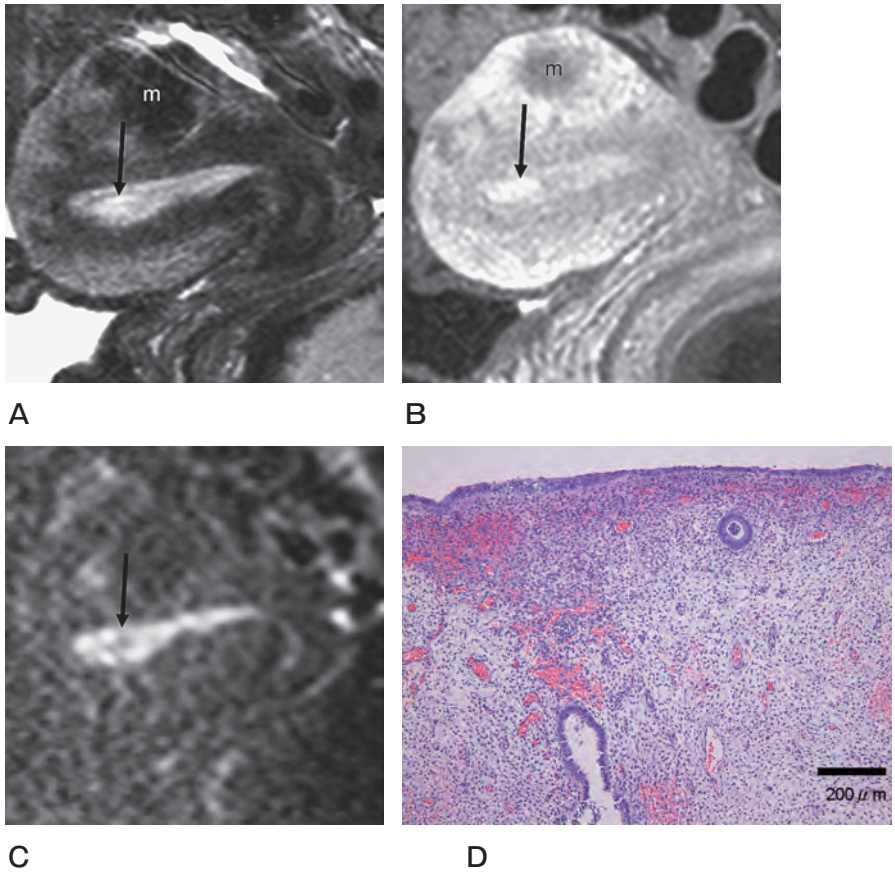

Fig. 3 Endometrial polyp in a 42-year-old premenopausal woman shows high signal intensity on T2WI and strong enhancement on Gd-T1WI. **A** and **B**, T2WI (A) and Gd-T1WI (B) in sagittal and axial oblique (B) planes showed a polyp with high signal intensity and strong enhancement with no central fibrous core or intratumoral cysts. m → myoma; **C**, DWI with b value of 1,000 s/mm^2 in sagittal plane at the same level as in A shows a polyp with low signal intensity compared with endometrium; **D**, Photomicrograph of a specimen shows abundant edematous stroma with few collagen fibers, which could explain the high signal intensity on T2WI and strong enhancement on Gd-T1WI (hematoxylin-eosin staining).

signal intensity compared with the normal endometrium on DWI, which could be used in differential diagnosis for endometrial carcinoma and the normal endometrium because they usually show high signal intensity on DWI [11]. On dynamic MRI, there was global or partial early enhancement in the endometrial polyps, which could be used in the differential diagnosis of endometrial carcinomas, because it usually shows weak enhancement on Gd-T1WI and weak early enhancement on dynamic study [13, 19]. However, endometrial carcinomas are classified into 2 types: type 1 originates from endometrial hyperplasia due to excess estrogen stimulation, whereas in type 2, adenocarcinoma develops in the atrophic endometrium without surrounding the endometrial hyperplasia. Type-2 endometrial carcinoma and carcinosarcoma can each present as a mass with rapid enhancement and a persistent strong enhancement pattern on dynamic MRI [15]. It is difficult to differentiate endometrial polyps from type-2 endometrial carcinomas because both entities have common findings of early enhancement on dynamic MRI.

The correlations between histological findings and MR features in the cases with unusual MR findings suggested various histological backgrounds of different signal intensities in those endometrial polyps. In cases 1 and 2, there were stromata with large numbers of collagen fibers, which are probably the cause of the "masslike" fibrous core with markedly low signal intensity on T2WI. In case 3, an abundant edematous

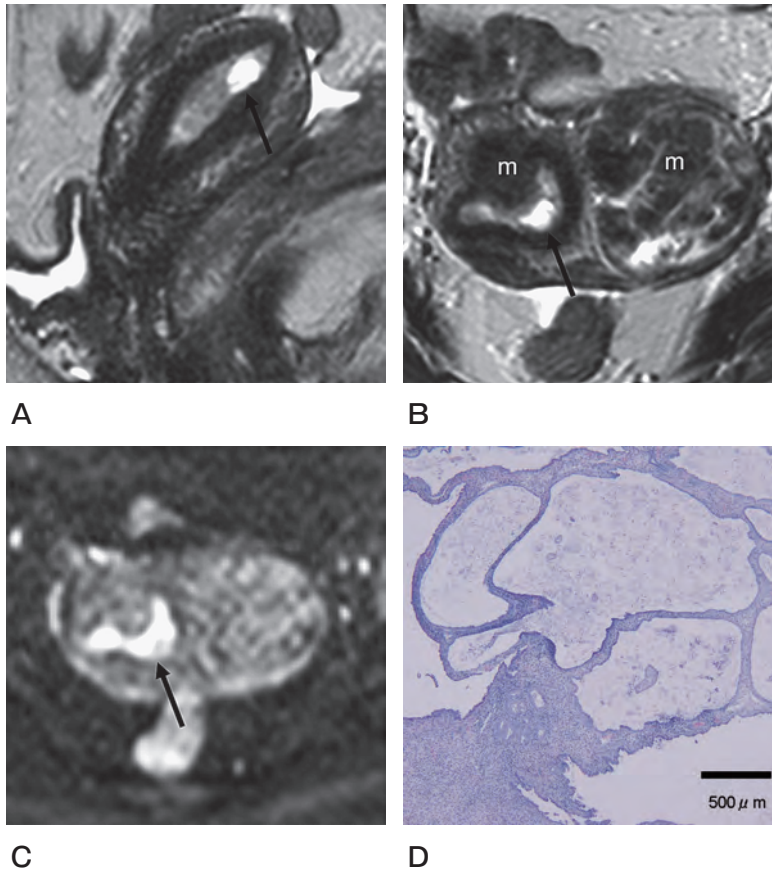

Fig. 4 Endometrial polyp in a 54-year-old menopausal woman shows high signal intensity on DWI. **A** and **B**, T2WI in sagittal (A) and axial oblique (B) planes shows a polyp (dotted arrows) with markedly high signal intensity relative to normal endometrium; **C**, DWI with a b value of 1,000 s/mm^2 in the axial oblique plane at the same level as in B shows iso-signal intensity compared with surrounding endometrium; **D**, Photomicrograph of a specimen shows cystic endometrial glandular dilatation with mucosal fluid collection in a polyp, which could explain the high signal intensity of the polyp on DWI and T2WI (hematoxylin-eosin staining).

Table 6 Unusual MRI findings of endometrial polyps in 11 cases: Correlation with pathologic findings

Case	Unusual MRI findings	Corresponding to histological findings
1,2 (2 cases)	Markedly low on T2WI	Abundant stroma with rich collagen fibers
3	High on T2WI Strong on Gd-T1WI	Abundant edematous stroma with few collagen fibers
4	High on T2WI Iso on DWI	Glandular cystic dilatation with mucosal fluid collection
5–11 (7 cases)	Iso on DWI	Hemorrhage in 1 case Few collagen fibers that resemble the normal endometrium 6 cases

stroma with few collagen fibers and with widening of the extracellular space could explain the high signal intensity on T2WI and strong enhancement on Gd-T1WI. In case 4, glandular cystic dilatation with mucosal fluid collection led to iso-signal intensity on DWI because of the high viscosity of mucosal fluid. In case 5, extensive hemorrhage in the polyp probably caused iso-signal intensity on DWI. In cases 6–11, the

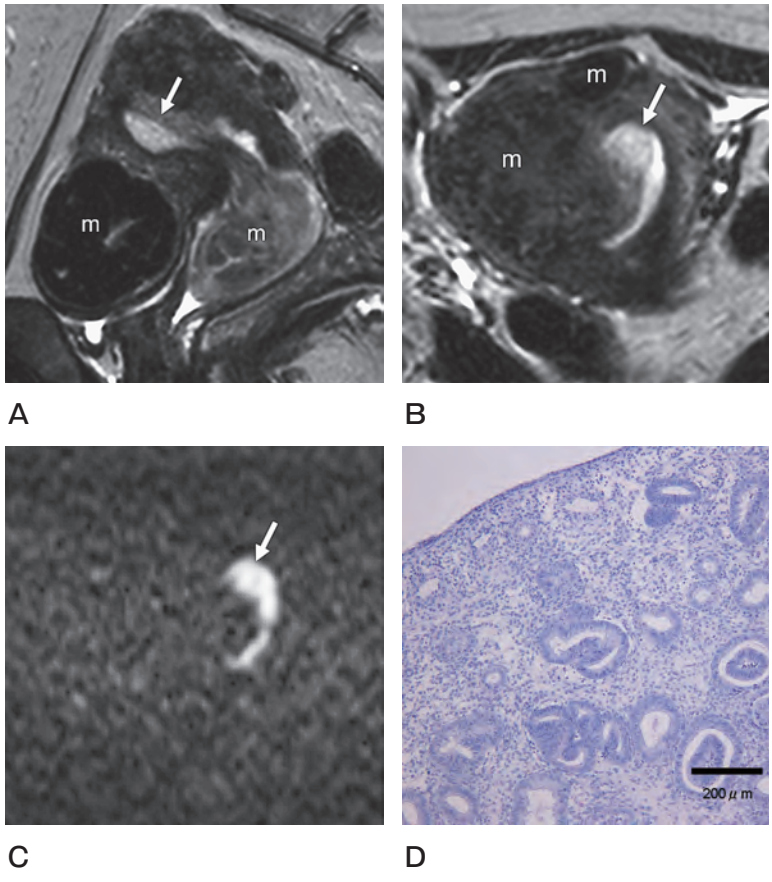

Fig. 5 Endometrial polyp in a 52-year-old menopausal woman shows high signal intensity on DWI. **A** and **B**, T2WI in sagittal (A) and axial oblique (B) planes shows a polyp (dotted arrows) with iso-signal intensity relative to normal endometrium; **C**, DWI with a b value of 1,000 s/mm^2 in the axial oblique plane at the same level as in B showed iso-signal intensity compared with endometrium; **D**, Photomicrograph of the specimen shows multiple endometrial glands embedded in stroma with very few collagen fibers in the polyp, which histologically resembles normal endometrium (hematoxylin-eosin staining). Because of the delivered myoma, a transvaginal endometrial cytologic examination could not be obtained in this case.

polyps resembled normal endometrium histologically. Normal endometrium usually shows high signal intensity on DWI because of the T2 shine-through effect and abundant water molecules in the intracellular space of endometrial stromal cells [11, 16].

There are some limitations to our study. First, in 80% of the cases, pathological examinations were made with fragmented specimens. This carries with it the possibility of sampling error. Second, in our study, ADC (apparent diffusion coefficient) values were not measured. Some studies show that ADC values in endometrial carcinomas are lower than those of other lesions, including endometrial polyps [10-12]. Lastly, in some cases delineation of the polyps was difficult because of the unclear margins of the lesions. This phenomenon may be explained by the fact that some polyps contained few collagen fibers or glandular cystic dilatation, which made the MRI appearance of these polyps similar to the surrounding normal endometrium. Also, the MRI signal of the normal endometrium could have been influenced by patient's age and menstrual cycle.

In conclusion, when the predominant signal intensity of the endometrial polypoid lesion was slightly low on T2WI, low on DWI, showed strong or moderate enhancement on Gd-T1WI, and showed early enhancement on dynamic MRI, endometrial polyp should be the first differential diagnosis. It should be noted that on dynamic MRI the differentiation between endometrial polyps and type-2 endometrial carcinomas

is still difficult because both endometrial polyps and carcinomas show early enhancement.

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