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POLISH GYNECOLOGY
GINEKOLOGIA POLSKA
ORGAN POLSKIEGO TOWARZYSTWA GINEKOLOGICZNEGO
THE OFFICIAL JOURNAL OF THE POLISH GYNECOLOGICAL SOCIETY

ISSN: 0017-0011

e-ISSN: 2543-6767

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DOI: 10.5603/GP.a2022.0076

Article type: Research paper

Submitted: 2022-05-11

Accepted: 2022-07-24

Published online: 2022-08-22

ORIGINAL PAPER / GYNECOLOGY

Our clinical experience in pelvic magnetic resonance imaging with vaginal contrast

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ABSTRACT

Objectives: Magnetic resonance imaging (MRI) is an important modality for pelvic imaging. Vaginal distension is provided by the use of vaginal contrast in pelvic MRI, and it plays an important role in staging especially cervical and vaginal cancer. The aim of this study is to show whether the use of vaginal contrast material contributes to the diagnosis in pelvic examination.

Material and methods: Between October 1, 2016 and December 30, 2020, a total of 57 patients who underwent pelvic magnetic resonance imaging with vaginal contrast in the radiology clinic were included in the study and evaluated retrospectively.

Results: Cervical cancer was detected in 38 of the 57 patients included in the study, and when the vaginal pre- and post-contrast staging of the patients was performed, the pre-contrast stage was found to be high in six patients (15%). Eight of 38 patients diagnosed with cervical

cancer underwent surgery. When the pathological and radiological staging of the patients who underwent surgery were compared, they were 100% compatible.
Conclusions: The use of vaginal contrast material increases the diagnostic value of MRI in various pelvic pathologies, especially in cervical cancer staging.
Key words: vaginal contrast; magnetic resonance imaging; ultrasound gel; pelvic pathologies

INTRODUCTION

Imaging plays an important role in the evaluation of gynaecological pathologies. Magnetic resonance imaging (MRI) is a non-invasive imaging technique with high spatial and contrast resolution and is the most reliable diagnostic imaging method in the evaluation of pelvic pathologies. MRI is especially useful in evaluating the spread of the disease in gynaecological diseases. In addition, some studies have shown that creating vaginal opacification with intraluminal contrast material increases the diagnostic value and performance of MRI [1–3]. Vaginal opacification is important in evaluating parametrium and fornix invasion in cervical cancer and vaginal cancer, since the vagina collapses in the normal anatomical position [1].

Various liquid and solid materials have been used to visualize the inner contour of the vaginal wall to reduce false-negative MRI results. Solid materials such as tampons are more uncomfortable than liquid ones. They can also cause distension, deformation of surrounding structures, artifacts, and deterioration of image quality. Liquid ones such as ultrasound gel provide better imaging qualities than solid materials by providing vaginal distension without causing deformation of surrounding structures and creating hyperintensity in T2-weighted (T2W) sequences [1, 4, 5]. The sonographic gel is the most preferred intraluminal contrast agent due to its easy availability, well-tolerability, high viscosity, and absence of backflow during intravaginal administration [4].

In this study, the aim is to demonstrate whether the use of vaginal contrast material contributes to the diagnosis in pelvic imaging, especially in cancer staging, based on our own clinical experience.

MATERIAL AND METHODS

Between October 1, 2016 and December 30, 2020, a total of 57 patients referred to the obstetrics and gynaecology outpatient clinic of our hospital with a preliminary diagnosis of cervical pathology and underwent pelvic magnetic resonance imaging with vaginal contrast in the radiology clinic were included in the study and evaluated retrospectively.

MRI technique

Images of all patients were taken with an abdominal coil in the 1.5 T MRI system (Philips Ingenia; Philips Medical Systems, Best, Netherlands) available in our unit. Routine imaging protocol includes sagittal-axial and coronal T2W without vaginal contrast, sagittal and axial T2W with vaginal contrast, axial VISTA, non-fat suppressed and suppressed T1W, axial-sagittal and coronal fat-suppressed T1W with intravenous contrast. Axial images are obtained parallel to the long axis of the cervix.

Vaginal contrast protocol

After the standard pelvic MRI was done, 50 ml of ultrasound gel was applied into the vagina with a foley catheter by a gynaecologist without changing the patient's position. After the gel application, the MRI scan was continued.

Evaluation of images

The images obtained were evaluated retrospectively by a radiologist with seven years of abdominal and pelvic imaging experience with the Osirix MD (Pixmeo Labs, Geneva, Switzerland) software on the imaging monitors in our unit. Images before and after the gel were evaluated for the presence of malignancy, 1. tumour size if any, 2. parametrial invasion, 3. fornix and vaginal wall extension, 4. pelvic wall, bladder, and rectum invasion. Cervical cancer staging was performed according to the staging guideline published by the International Federation of Gynecology and Obstetrics (FIGO) in 2009, and cervical cancer staging for patients after 2018 was performed according to FIGO 2018.

RESULTS

The ages of the 57 patients who underwent pelvic MRI with vaginal contrast were between 31 and 81 years, with a mean age of 55.63 ± 12.45 years. Based on radiological imaging, 38 of 57 patients were diagnosed with cervical cancer and four with endometrial cancer (Fig. 1). Of the patients, six were previously diagnosed with cervical cancer and four of these patients were control patients after radiotherapy and two were control patients after conization, and no pathologies were detected in control imaging. Radiologically, the cervix was normal in seven patients. Biopsy was not performed in one of the normal patients, chronic cervicitis was detected in two patients, and the cervix was normal in four patients. Pathology results were available for all patients after the treatment, except for control patients (number of patients: 6) and one of the patients who were considered normal. Suspected

cervical cancer was diagnosed in one of the patients on pelvic MRI, and the biopsy result was chronic cervicitis. In one patient, there was vaginal prolapse of a myoma uterine. In this case, the cervix could not be evaluated due to the uterine myoma. In this patient, the result of the cervical biopsy was cervical cancer. Eight of 38 patients diagnosed with cervical cancer underwent surgery, and the biopsy results of other patients have confirmed their diagnosis of cervical cancer. When the pathological and radiological staging of the patients who underwent surgery were compared, they were 100% compatible. Thirty patients diagnosed with cervical cancer were receiving treatment in the oncology clinic because they were clinically-radiologically Stage IIA2 and higher. When the images of patients with cervical cancer before and after the gel are evaluated in terms of staging, images before gel lead to overdiagnosis in 15% (6 patients) of the patients, increasing the stage of the patients (Tab. 1). In Table 2, the radiological and pathological diagnoses of the patients who underwent pelvic MRI with vaginal contrast.

DISCUSSION

In recent studies, the use of luminal contrast material in pelvic region MRI has been employed in cervical cancer staging, vaginal cancer, endometriosis patients, and distal rectal cancer staging [1, 4, 6, 7].

Cervical cancer is the 4th most common type of cancer in women and constitutes 6.6% of all cancers [8]. Clinical staging is limited in identifying tumour size, parametrial invasion, and nodal status, which have an important role in determining the overall treatment protocol and prognosis. Imaging plays an important role in staging. FIGO is the basic staging system for the prognostic classification of patients with cervical cancer and planning the treatment strategy. It was last updated in 2018 [9, 10]. Early-stage cervical cancer (IA, IB, and IIA1) is treated with conization, radical hysterectomy, and lymphadenectomy, while radiotherapy is another option in IB2 and IIA1. In the locally advanced stage (IIA2 and higher), platinum-based chemotherapy and radiotherapy are applied simultaneously. MRI has an important role in patient selection for fertility-sparing treatment in the form of radical trachelectomy [11]. This procedure consists of resection of the cervix, parametria, vaginal cuff, and cerclage of the isthmus. Patients are eligible for this treatment if they have tumour confined to the cervix (stage I disease), with no extension to the uterine body, and this evaluation can be accurately made using MRI. MRI has an accuracy rate of 78% in detecting tumours [12]. In the study by Shaker et al. [5], the detection rate of cervical cancer was 70% in MRI without gel, whereas this rate increased to 95% when the intravaginal gel is used. Parametrial invasion causes the

patient to lose the chance of surgery. Studies have shown that parametrial invasion is evaluated better with vaginal opacification [1, 4]. The tumour stage may appear higher in MRI due to oedema, inflammation, or compression [13]. In our study, the majority of the cases consisted of cervical cancer cases, and when the images of these cases that were obtained before and after the gel were evaluated, over-stage cancer was detected in six patients (15%) based on before gel images. In these patients, the stage was increased, considering that there was parametrial invasion in the before gel images.

In the normal anatomical position, since the vaginal walls face each other and the vaginal fornix is found collapsed around the cervix, it is difficult to draw the borders of the vagina and cervix and to determine the tumour contours in MRI. Vaginal contrast material shows high signal intensity on T2W MRI and provides a clear assessment of the inner contours of the cervix, vaginal wall and fornix (Fig. 2, 3). In addition, it is useful in evaluating the vaginal and parametrial invasion of the tumour by distending the vaginal lumen and separating the vaginal walls from each other [1, 5]. Tumour staging is important in deciding the patient's treatment protocol.

In the literature, various solid and liquid materials have been used to provide vaginal distension in pelvic MRI examinations. Solid materials such as tampons can cause deformation of surrounding structures and lead to air artefacts. In addition, due to their stiffness, they cannot completely fill all anatomical spaces [14]. On the other hand, water-based composite materials completely fill the vaginal lumen and provide a clear evaluation of the vagina and cervix contours without causing anatomical distortion. These materials also provide high signal intensity in T2-weighted sequences and provide more comfort to the patient than other materials [15]. In patients with pelvic cancer, as liquid material, Van Hoe et al. [2] used barium, water and maltodextrin/calcium lactate mixture, Akata et al. [1] used barium and saline mixture, and Young et al. [3] and Atcı et al. [4] used ultrasound gel. In these studies, it was determined that the use of vaginal contrast increases the diagnostic value. In a meta-analysis by Unlu et al. [15] investigating the effectiveness of MRI with vaginal contrast in pelvic pathologies, they found that the use of vaginal contrast increased the diagnostic value by 54%. The sonographic gel was used not only in the gynaecological examination but also in rectal examination. In the study of Palmucci et al. [7], in which they performed apparent diffusion coefficient (ADC) measurements before and after ultrasonographic gel for the staging of patients with rectal cancer, a positive correlation was found between the ADC values obtained after the gel, although the cause could not be determined. In another similar study, a statistically significant difference was found in intravoxel incoherent motion

parameters of rectal tumours before and after the gel in patients in whom rectal distension was achieved with sonographic gel [16]. In a study of 63 patients with deep endometriosis, the use of gel increased the sensitivity and specificity of pelvic MRI when transvaginal ultrasonography, non-gel pelvic MRI, and gel pelvic MRI were compared in terms of detecting endometriosis [6].

Various guidelines, such as those of the European Society of Urogenital Radiology, European Society of Gastrointestinal and Abdominal Radiology, and American College of Radiology define vaginal opacification on pelvic MRI as optional, especially for the diagnosis of gynaecological disorders, including vaginal and cervical cancers. [17, 18]. We routinely use vaginal gel in patients presenting with a preliminary diagnosis of cervical cancer in our clinic.

The limitations of our study are that it is retrospective, has a low variety of pelvic pathology, and involves the use of sonographic gel alone as a vaginal contrast material.

CONCLUSIONS

The use of vaginal contrast material increases the diagnostic value of MRI in various pelvic pathologies, especially in cervical cancer staging and post-op treatment follow up.

Conflict of interest

There are no conflicts of interest.

Contribution to authorship

FOK and IK conducted literature search and provided study design. FOK and İK examined the radiological images. ED and SH examined the pathological evaluation. KD examined the gynecological examination. FOK wrote the manuscript and, SK reviewed it. All authors read and approved the final manuscript.

Details of ethics approval

This research complied with the guidelines for human studies and was conducted ethically in accordance with the World Medical Association Declaration of Helsinki. Ethics Committee approval was obtained from Faculty of Medicine, Mustafa Kemal University (18/02/2021, meeting number 3, decision number 25).

Funding sources

There are no funding sources to declare.

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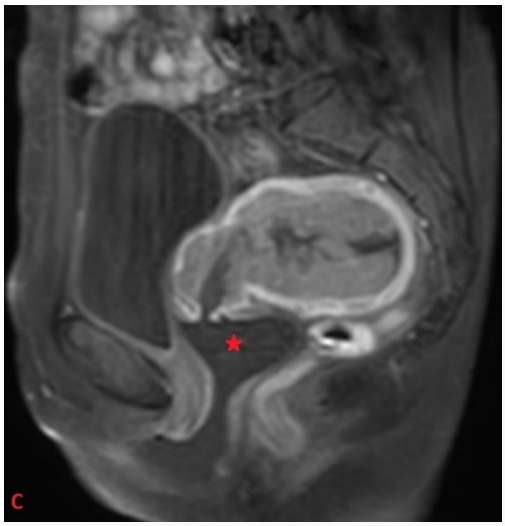

Figure 1. Endometrial cancer. Before vaginal gel (**A**), after vaginal gel (**B**) sagittal T2W and after vaginal gel with post-contrast sagittal T1W MRI (**C**). Vaginal and cervical anatomical structures and cervical extension of endometrial cancer can be seen more clearly in after gel images (asteriks: vajinal ultrasound gel)

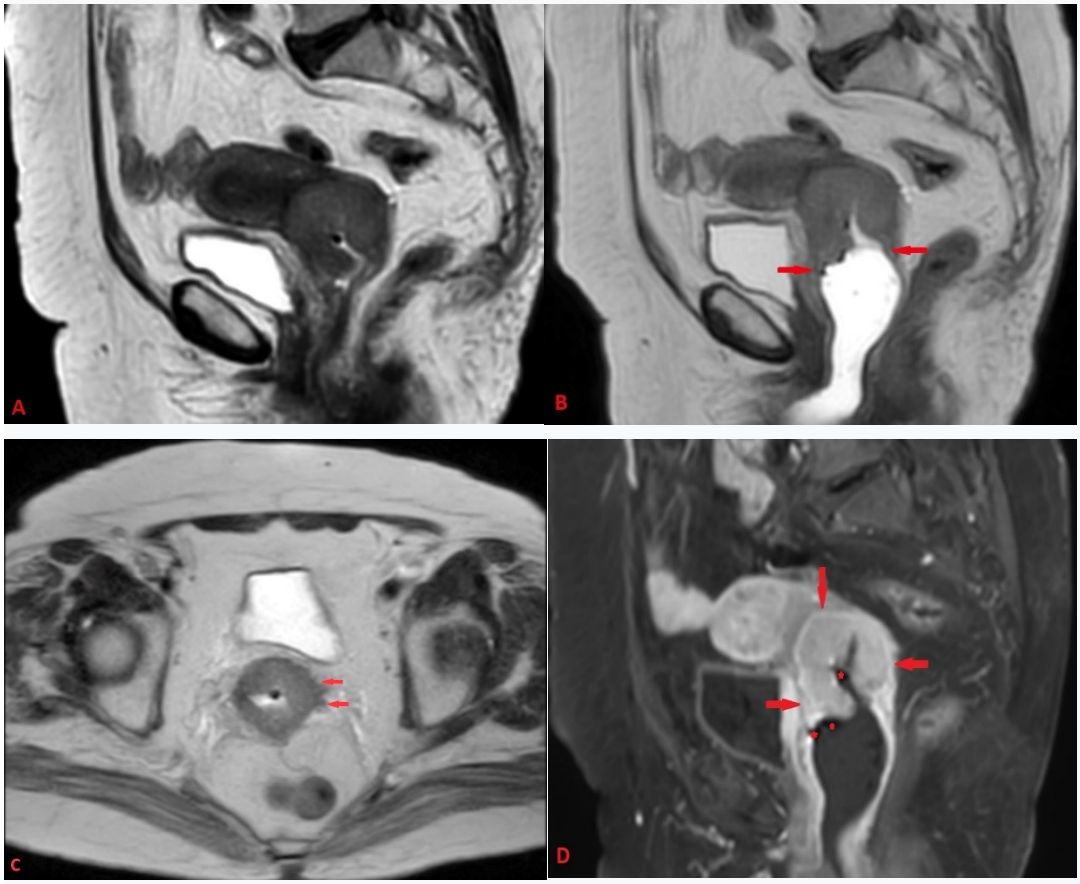

Figure 2. Stage IIB cervical cancer. Before vaginal gel sagittal T2W image (**A**). After vaginal gel sagittal T2W MR (**B**), anterior and posterior fornix involvement is better evaluated (red arrows). Axial T2W (**C**), tumor is seen to invade the parametrium (red arrows). Tumor

borders are clearly observed on sagittal post-contrast T1W image (**D**). (asterix: air bubbles in intravaginal gel)

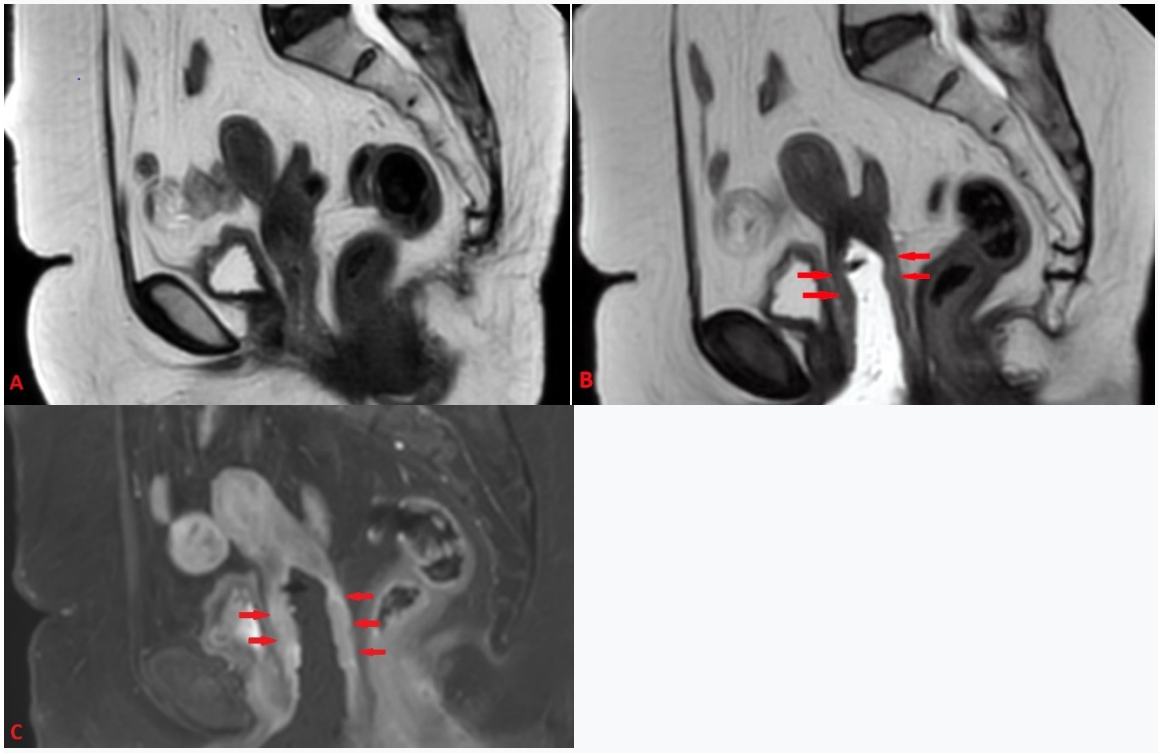

Figure 3. Cervical cancer. While the vagina collapsed in the sagittal T2W image before vaginal gel (**A**), the anterior-posterior vaginal wall thickness (red arrows) showing invasion is seen in the sagittal T2W image after vaginal gel (**B**). Vaginal wall contrast is seen in sagittal T1W (**C**)

Table 1. Patients whose pre-gel and post-gel stages do not match in cervical cancer cases

Number of patients	Pre-gel staging	After-gel staging	Pathological staging
1	IIIB	IIA	
1	IIB	IB1	IB1
1	IIIA	IIA1	
2	IIB	IB2	IB2
1	IIB	IIA1	
6	**Total**		

Table 2. Pelvic pathologies detected on pelvic magnetic resonance imaging with vaginal contrast

Number of patients	Radiological diagnosis	Pathological diagnosis
38	Cervical cancer	Cervical cancer
4	Endometrial cancer	Endometrial cancer

1	Cervical cancer	Chronic cervicitis
1	Vaginal prolapsus of a myoma uterine	Vaginal prolapsus of a myoma uterine, cervical cancer
7	Normal	Chronic cervicitis (2), normal (4)
4	After radiotherapy	
2	After conization	
57	**Total**	