

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/radcr

Case report

Value of diffusion-weighted magnetic resonance imaging in the diagnosis of pyomyoma ☆,☆☆

Helena Peris, MD^{a,*}, Javier del Riego, MD^b, Eva Criado, MD^c,
 Rosa Belén García-Chamón, MD^d, Elisenda Vall, MD^a, María Mayoral, MD, PhD^e,
 Amaya Martín, MD^b

^a Department of Radiology, UDIAT Centre Diagnòstic, Parc Taulí Hospital Universitari, Institut d'Investigació i Innovació Parc Taulí I3PT, Universitat Autònoma de Barcelona, Parc Taulí 1, Sabadell, Barcelona 08208, Spain

^b Women's Imaging, Department of Radiology, UDIAT Centre Diagnòstic, Parc Taulí Hospital Universitari, Institut d'Investigació i Innovació Parc Taulí I3PT, Universitat Autònoma de Barcelona, Sabadell, Barcelona, Spain

^c Interventional Radiology, Department of Radiology, UDIAT Centre Diagnòstic, Parc Taulí Hospital Universitari, Institut d'Investigació i Innovació Parc Taulí I3PT, Universitat Autònoma de Barcelona, Sabadell, Barcelona, Spain

^d Department of Pathology, Parc Taulí Hospital Universitari, Institut d'Investigació i Innovació Parc Taulí I3PT, Universitat Autònoma de Barcelona, Sabadell, Barcelona, Spain

^e Diagnostic Imaging Center, Hospital Clínic Barcelona, Universitat de Barcelona, Barcelona, Barcelona, Spain

ARTICLE INFO

Article history:

Received 22 June 2021

Revised 5 October 2021

Accepted 7 October 2021

Keywords:

Pyomyoma

Pelvic ultrasound

Pelvic MRI, Women's imaging

ABSTRACT

Pyomyomas are rare lesions that develop from the suppurative degeneration of ischemic leiomyomas. Pyomyomas can lead to sepsis, so early diagnosis is crucial. Due to their rarity and often nonspecific findings on ultrasonography and computed tomography diagnosis is often delayed. We present a case of a woman who presented with abdominal pain and fever. The computed tomography showed a large hypodense uterine lesion with slight peripheral enhancement without gas in the lesion. The diffusion-weighted magnetic resonance imaging showed restricted diffusion, demonstrating the presence of pus and confirming the diagnosis of pyomyoma. Diffusion-weighted imaging should be done in cases of suspected pyomyomas when computed tomography findings are nonspecific.

© 2021 The Authors. Published by Elsevier Inc. on behalf of University of Washington.

This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

Abbreviations: DWI, diffusion-weighted imaging; ADC, apparent diffusion coefficient; CRP, C-reactive protein.

☆ Acknowledgments: We thank John Giba for help with English and Irmgard Costa, MD, PhD (Department of Pathology) for descriptions of pathology images. Special thanks to the team of radiologists and technologists at our department for data collection.

☆☆ Competing Interests: The authors have declared that no competing interests exist.

* Corresponding author. H. Peris.

E-mail address: hperisalva@gmail.com (H. Peris).

<https://doi.org/10.1016/j.radcr.2021.10.018>

1930-0433/© 2021 The Authors. Published by Elsevier Inc. on behalf of University of Washington. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

Introduction

Leiomyomas are the most common benign tumors of the uterus, being found in 20%–30% of premenopausal women. Leiomyomas often cause pain and/or bleeding [1]. Suppurative inflammation of an ischemic leiomyoma gives rise to a pyomyoma. Because pyomyomas are rare, low clinical suspicion often delays the diagnosis of this potentially lethal complication of leiomyoma [2]. Imaging tests are important to ensure early diagnosis. Computed tomography and ultrasonography (US) are the first-choice imaging modalities for abdominal and gynecological emergencies, but their findings for pyomyomas are usually nonspecific [3,4]. Magnetic resonance imaging (MRI) has high sensitivity and specificity making it potentially useful for the diagnosis of pyomyomas, but its use in emergency settings remains controversial [5]. This report discusses the role of MRI in the diagnosis of pyomyoma, emphasizing the usefulness of diffusion-weighted imaging (DWI) sequences.

Case

A 48-year-old woman (gravida 2, para 0) presented at the emergency department with a 10-day history of lower right quadrant abdominal pain, fever (up to 39°C), and nausea. Her past history included asymptomatic uterine leiomyomas (no history of uterine embolization) and left nephrectomy for xanthogranulomatous pyelonephritis without surgical complications 2 months earlier. She had a correctly positioned intrauterine device in place.

Laboratory findings included an elevated white blood count (24.84×10^9 /L; 90.1% neutrophils, 5.8% lymphocytes), anemia (Hb 10.1g/dL), and increased concentration of C-reactive protein (34.50mg/dL). Urine sediment was negative. Blood and urine cultures were negative. Urine-based pregnancy test was negative.

Contrast-enhanced CT showed an enlarged uterus due to multiple leiomyomas; the largest of these, measuring 8 cm in maximum diameter, had slightly hypodense contents and slight peripheral enhancement (Fig. 1A). No gas, calcifications, or fat were seen in the lesion. The radiology report concluded that it was an intramural leiomyoma with signs of degeneration and that given the clinical context a pyomyoma could not be ruled out. No free fluid was seen in the pelvis. The remaining pelvic masses were described as uterine myomas without signs of complication.

Urgent MRI study to resolve the nonspecific CT findings and clinical suspicion of pyomyoma showed an intramural leiomyoma with a heterogeneous solid central component that was hypointense on T2-weighted images and isoin-

tense on T1-weighted images and showed slight peripheral enhancement on contrast-enhanced images. Remarkable findings included an irregular-shaped component on the periphery of the mass that was hyperintense on T2-weighted images and hypointense on T1-weighted images; this component showed marked restriction on DWI sequences (apparent diffusion coefficient, 0.66×10^{-3} mm²/s). These findings suggested the contents of the lesion were dense fluid compatible with pus that would support the diagnosis of a uterine leiomyoma with ischemic changes and signs of infection, in other words, a pyomyoma (Figs. 1B and C). US-guided aspiration biopsy obtained samples of dense purulent fluid from the peripheral component, confirming the suppurative degeneration of the leiomyoma (Fig. 2).

Intravenous antibiotic (meropenem) treatment was initiated, and total hysterectomy with bilateral salpingectomy was performed. During the surgical intervention, purulent material was observed oozing from the leiomyoma. Gross examination of the surgical specimen identified a heterogeneous nodular intramural lesion (maximum diameter, 5.5 cm) surrounded by a cavity filled with greenish purulent material (Figs. 3A and B). Histologic study confirmed an intramural leiomyoma with extensive ischemic necrosis and marked acute inflammation with foci of abscess formation (Fig. 3C) as well as multiple intramural nodules ranging from 0.6–2.5 cm in maximum diameter composed of firm, pearly white, fascicular-appearing tissue. No macroscopic abnormalities were observed in the fallopian tubes.

After surgery, the patient's condition improved quickly and the laboratory results returned to normal. Cultures of the aspirated material showed growth of metronidazole-sensitive *Bacteroides fragilis*, so she was prescribed a 15-day course of oral metronidazole and discharged from the hospital.

Discussion

Pyomyomas are a rare complication of leiomyomas that present with suppurative changes and ischemic necrosis [3]. Pyomyomas can develop before or after menopause. In premenopausal women, pyomyomas are most common during pregnancy, when they can lead to spontaneous abortion, rupture of membranes, premature delivery, or bleeding, or in the postpartum period [2]. In postmenopausal women, pyomyomas can develop secondary to vascular insufficiency due to hypertension, diabetes, or atherosclerosis [6]. Pyomyomas can also develop secondary to immune compromise, embolization of uterine arteries, or surgical interventions in the uterus [7]. Intrauterine devices are considered a risk factor for pyomyomas [4]. Infection usually spreads upward from the genital tract, but can also be transmitted directly in the endometrial cavity (during surgery) or through blood or lymph vessels [8].

Pyomyomas should be suspected in patients with a history of myomas who develop sepsis in the absence of other foci of

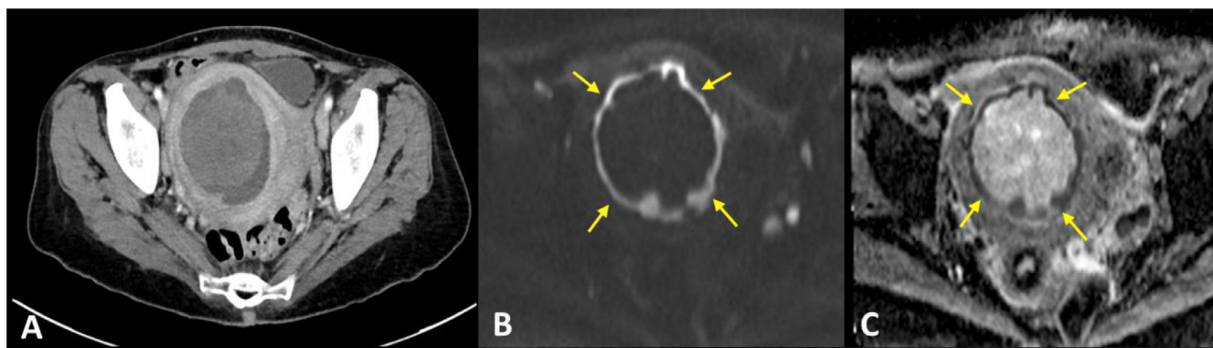


Fig. 1 – Comparison of imaging findings in this case of suspected pyomyoma. Computed tomography (A) shows a hypodense uterine mass. The diffusion-weighted magnetic resonance imaging (B and C) shows marked restriction in the peripheral component, which is hyperintense with a high b-value (800) (arrows in B) and markedly hypointense in the apparent diffusion coefficient map (arrows in C). These findings confirm that the peripheral content is pus.

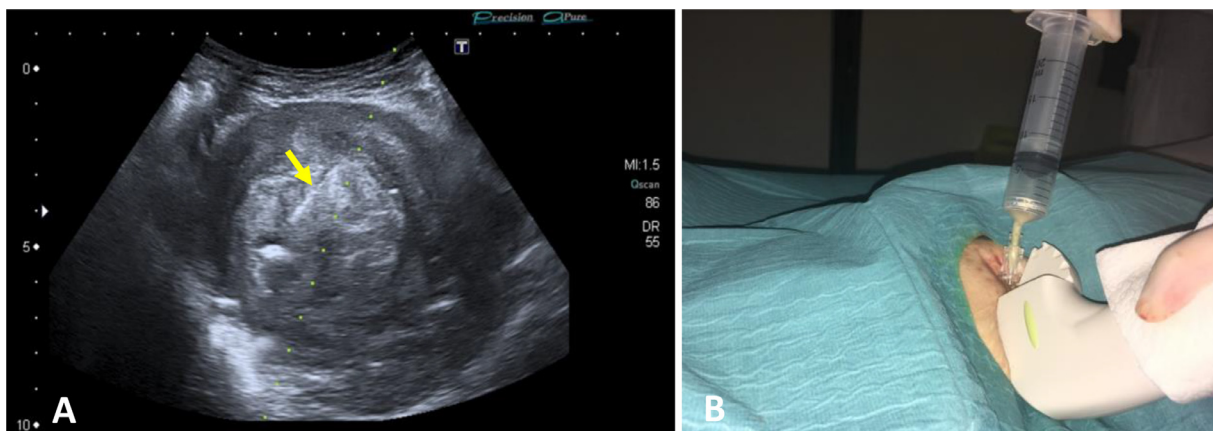


Fig. 2 – Ultrasound-guided aspiration biopsy. Ultrasonography shows a heterogeneous mass in the wall of the uterus with an aspiration needle inside it (arrow in A). Obtaining purulent-appearing fluid (B).

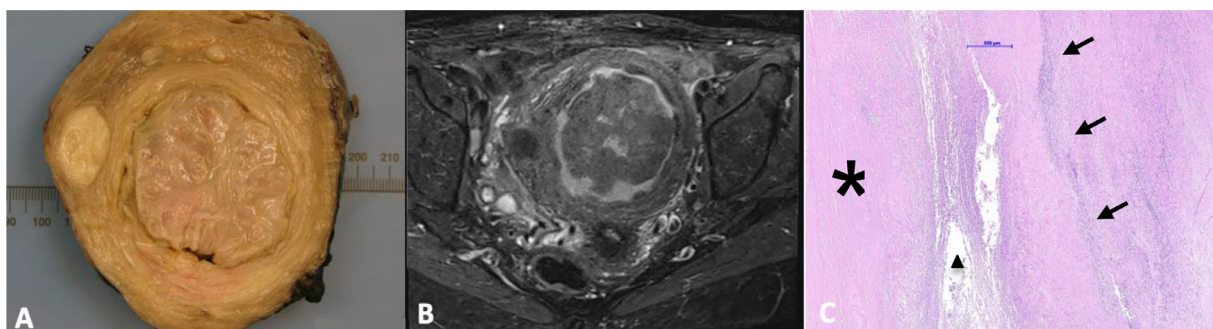


Fig. 3 – Radiopathologic correlation. In the surgical specimen obtained (A), gross examination revealed a heterogeneous intramural nodular formation measuring 5.5 cm in maximum diameter surrounded by a cavity containing purulent material. Note the correlation between the surgical specimen and the visualization of the uterus in a fat-saturated T2-weighted magnetic resonance image (B). Microscopic image (C) shows tissue corresponding to a leiomyoma with extensive degeneration due to ischemic necrosis (asterisk) and the cavity (arrowhead) surrounding the leiomyoma and abundant abscess-forming acute inflammation (arrows) (HE staining, 2.7x).

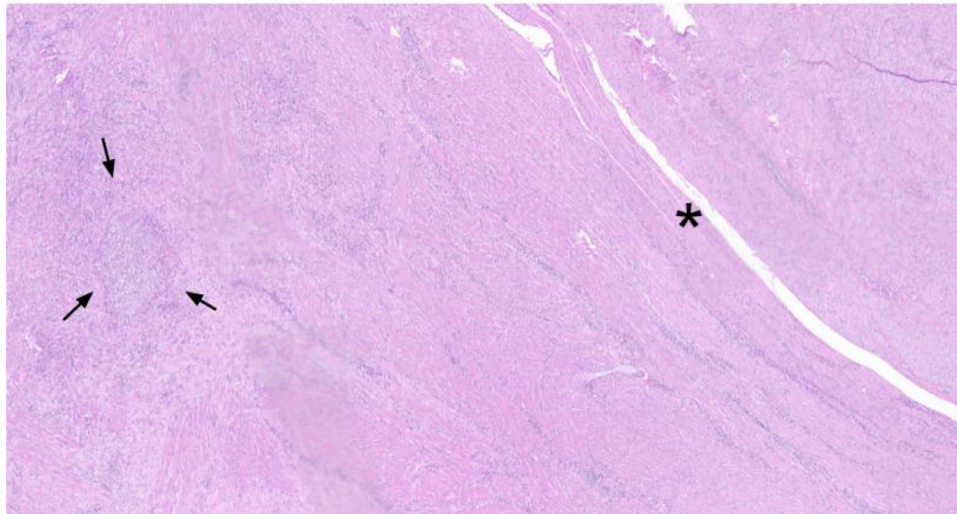


Fig. 4 – Surgical specimen. Myometrium adjacent to the leiomyoma (asterisk) with small collections of neutrophils (arrows) (HE staining, 2x).

infection, even when no recent uterine manipulation has occurred [6,9]. The symptoms and signs are nonspecific and their onset is usually insidious, sometimes developing over a long period [2]. For these reasons, the diagnosis is difficult. Delayed diagnosis can increase the risk of rupture of the pyomyoma and resultant peritonitis [10]. The differential diagnosis of a pelvic mass with a clinical presentation suggestive of infection includes endometritis, pyometra, tubo-ovarian abscess, complicated gynecological neoplasm, and pyomyoma [11].

Imaging tests play an important role in the diagnosis of pyomyomas. CT and US are the usual first-line imaging tests in patients with suspected gynecological or abdominal infections who present at the emergency department; however, their findings in patients with pyomyomas are usually nonspecific [3, 5]. US usually shows a heterogeneous uterine mass with a cystic component [2]. CT usually shows a solid mass with cystic contents and often also shows pelvic inflammatory signs [5]. The presence of gas within the tumor due to the presence of gas-producing microorganisms is specific but uncommon [5,10]. In this case of a suspected pyomyoma, the finding on urgent contrast-enhanced CT studies was an hypodense cystic-appearing uterine mass without other signs of inflammation.

In this context, high sensitivity and specificity of MRI for acute gynecological disease [5] can be useful. Although previous reports have not remarked that MRI increased the specificity for the diagnosis of pyomyoma compared to CT, the MRI studies in those reports did not include DWI sequences. The findings in T1-weighted and T2-weighted sequences cannot distinguish between pyomyomas and other common conditions such as uterine sarcoma or other types of myoma degeneration [5].

DWI analyzes the Brownian motion of water molecules in tissues. The high cellularity in the dense purulent material (pus) in abscesses markedly decreases the movement of water molecules, resulting in increased DWI signal and decreased apparent diffusion coefficient [5,12].

In our case, the location of pus is peripheral, in contrast to intratumoral abscess/necrosis, in which the area of abscessification usually has a central distribution. The surgical specimen showed signs of chronic endometritis attributable to the presence of a DIU, with microscopic foci of neutrophils. There are also foci of neutrophils in the myometrium adjacent to the abscessed leiomyoma. These findings suggest that the mechanism of infection was by contiguous spread from the endometrial cavity because of the presence of the DIU, causing the formation of a virtual cavity with an abscessification process peripherally and a central necrotic component of the leiomyoma (Fig. 4).

Nevertheless, the definitive diagnosis of pyomyoma usually requires histological analysis of the surgical specimen, which shows degeneration of the leiomyoma with pus inside, bleeding, calcifications, and/or changes related to ischemia or necrosis [2]. The diagnosis can also be reached through cultures of the contents of the complicated leiomyoma. In our case, the purulent material obtained from the preoperative US-guided puncture biopsy was considered sufficient to confirm the MRI diagnosis before surgery.

Untreated or inappropriately treated pyomyomas are associated with high mortality (up to 20%) [10]. Consequently, early accurate diagnosis and appropriate treatment are crucial. Most cases are treated with both antibiotics and surgery, whether hysterectomy or myomectomy, depending on the location of the lesion and the severity of the patient's condition [6]. A considerable number of patients are of child-bearing age, so fertility-sparing surgery may be the best option; whenever possible, less radical interventions such as myomectomy or even percutaneous treatment should be considered [8,10].

To our knowledge, this is the first report of the use of DWI sequences to resolve diagnostic doubt about suspected pyomyoma. The findings from DWI and the aspiration biopsy confirmed the diagnosis before surgery. This case illustrates how MRI study including DWI sequences can be very useful for differentiating between different uterine lesions and

determining whether they contain purulent material, especially when no gas is present in the lesion. We think that MRI with DWI sequences should be the imaging technique of choice in all patients with suspected pyomyomas.

Patient consent

The corresponding author for “Value of diffusion-weighted magnetic resonance imaging in the diagnosis of pyomyoma”, Helena Peris Alvà, states that the informed written consent of the patient was obtained. The patient received, agreed and signed the informed consent. The written consent is retained by the author and would be provided to the journal if requested.

Authors' contributions

JD first proposed the idea of writing this manuscript. JD and HP wrote the manuscript and collected the data. All authors participated in the data collection. All authors read and approved the final manuscript.

REFERENCES

- [1] Deshmukh SP, Gonsalves CF, Guglielmo FF, Mitchell DG. Role of MR imaging of uterine leiomyomas before and after embolization. *Radiographics* 2012;32(6). doi:10.1148/rg.326125517.
- [2] Read S, Mullins J. Spontaneous ruptured pyomyoma in a nulligravid female: a case report and review of the literature. *Case Rep Obstet Gynecol* 2018;1–6. doi:10.1155/2018/1026287.
- [3] Obele CC, Dunham S, Bennett G, Pagan J, Sung LY, Charles HW. A case of pyomyoma following uterine fibroid embolization and a review of the literature. *Case Rep Obstet Gynecol* 2016;1–5. doi:10.1155/2016/9835412.
- [4] Iwahashi N, Mabuchi Y, Shiro M, Yagi S, Minami S, Ino K. Large uterine pyomyoma in a perimenopausal female: a case report and review of 50 reported cases in the literature. *Mol Clin Oncol* 2016;5(5):527–31. doi:10.3892/mco.2016.1005.
- [5] Ono H, Kanematsu M, Kato H, Toyoki H, Hayasaki Y, Tatsuhiro F, et al. MR imaging findings of uterine pyomyoma: radiologic-pathologic correlation. *Abdom Imaging* 2014;39(4):797–801. doi:10.1007/s00261-014-0112-2.
- [6] Bagga R, Rai R, Kalra J, Saha PK, Singh T. An unusual cause of postabortal fever requiring prompt surgical intervention: a pyomyoma and its imaging features. *Oman Med J* 2017;32(1):73–6. doi:10.5001/omj.2017.14.
- [7] Rosen ML, Anderson ML, Hawkins SM. Pyomyoma after uterine artery embolization. *Obstet Gynecol* 2013;121:431–3. doi:10.1097/AOG.0b013e31827e8e8f.
- [8] Sirha R, Miskin A, Abdelmagied A. Postnatal pyomyoma: a diagnostic dilemma. *BMJ Case Rep* 2013;2–5. doi:10.1136/bcr-2013-201137.
- [9] Deus Botti C, Vilà Famada A, LleberiaJuanos J, Pubill Soler J, Mestre Costa M, García-Chamon RB. Pyomyoma in a patient with a history of xanthogranulomatous pyelonephritis. *J Gynecol Women's Health* 2019;14(2):555882. doi:10.19080/JGWH.2019.14.555882.
- [10] Pinton A, Aubry G, Thoma V, Nisand I, Akladios CY. Pyomyoma after abortion: uterus conserving surgery is possible to maintain fertility. *Case report. Int J Surg Case Rep* 2016;24:179–81. doi:10.1016/j.ijscr.2016.05.020.
- [11] Magro M, Gafson I. Postpartum pyomyoma: a rare complication of leiomyoma. *J Obstet Gynaecol (Lahore)* 2014;34(2):202–3. doi:10.3109/01443615.2013.844109.
- [12] Woodhams R, Ramadan S, Stanwell P, Sakomoto S, Hata H, Ozaki M, et al. Diffusion-weighted imaging of the breast: principles and clinical applications. *Radiographics* 2011;31(4):1059–84. doi:10.1148/rg.314105160.