Ultrasound-guided radiofrequency ablation of an intramural fibroid in a woman desiring fertility with coexisting focal adenomyosis: a case report

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OBJECTIVE: To report the reproductive outcome after ultrasound-guided radiofrequency ablation (RFA) in a woman with an intramural uterine fibroid and coexisting focal adenomyosis who experienced infertility and desired pregnancy.
DESIGN: Case report.
PATIENT: A 40-year-old nulligravid woman with heavy menstrual bleeding, dysmenorrhea, and a history of infertility, defined by failure to conceive after more than 12 months of unprotected intercourse. Transvaginal ultrasound demonstrated a FIGO type 3 intramural fibroid distorting the endometrial cavity and associated focal anterior adenomyosis.
INTERVENTION: Ultrasound-guided transvaginal RFA of the intramural fibroid.
MAIN OUTCOME MEASURES: Changes in fibroid volume and uterine cavity morphology on ultrasound, improvement of clinical symptoms, and reproductive outcome.
RESULTS: The procedure was completed without complications. Follow-up ultrasound showed progressive fibroid volume reduction of 76.9% at 6 months, migration of the lesion away from the endometrial cavity, restoration of normal cavity anatomy, and improvement of sonographic features of focal adenomyosis. Menstrual symptoms improved significantly. Spontaneous conception subsequently occurred, resulting in an uncomplicated term vaginal delivery.
CONCLUSION: This case suggests that ultrasound-guided RFA may represent a minimally invasive, uterus-sparing option for selected women with intramural fibroids and coexisting focal adenomyosis associated with infertility.

Key words: adenomyosis, fertility preservation, radiofrequency ablation, transvaginal, ultrasonography, uterine fibroids

Introduction

Uterine fibroids are the most common benign tumors in women of reproductive age, affecting up to 70% of premenopausal women and frequently associated with abnormal uterine bleeding (AUB), pelvic pain, and impaired fertility, resulting in a substantial clinical and reproductive burden.[1,2] Among fibroid-related symptoms, AUB—most commonly presenting as heavy menstrual bleeding and prolonged menses—is the most prevalent and debilitating manifestation, accounting for approximately 45.7% of cases and often leading to anemia, fatigue, and reduced quality of life.[1]

The pathophysiology of fibroid-associated AUB is multifactorial and involves increased endometrial surface area, abnormal uterine vascularization, and dysregulated angiogenic signaling, particularly involving vascular endothelial growth factor.[2] Adenomyosis frequently coexists with fibroids and represents an additional contributor to AUB, dysmenorrhea, and infertility, potentially impairing uterine receptivity through inflammation, disruption of the endometrial–myometrial junction, and altered myometrial contractility.[3]

Treatment options range from medical therapy to surgery. While hysterectomy provides definitive symptom resolution, it results in irreversible loss of fertility, and myomectomy, although fertility-preserving, remains invasive

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and carries surgical risks including bleeding, adhesions, recurrence, and a small risk of uterine rupture in subsequent pregnancies.[4] The reproductive impact of fibroids depends largely on size and location: submucosal fibroids are clearly associated with adverse reproductive outcomes, whereas intramural fibroids may impair fertility by altering uterine contractility and perfusion, increasing miscarriage risk, and reducing success rates in assisted reproductive technology cycles.[4–7] Intramural fibroids larger than 4 cm have been associated with delayed conception and higher miscarriage rates.[8]

Minimally invasive therapies such as radiofrequency ablation (RFA) have recently emerged as fertility-preserving alternatives.[1] RFA induces localized thermal coagulative necrosis within fibroid tissue, resulting in progressive volume reduction while minimizing damage to surrounding myometrium.[5,9] The present case describes ultrasound-guided RFA in a woman desiring pregnancy with a FIGO type 3 fibroid and concomitant focal adenomyosis, highlighting its potential impact on uterine anatomy and reproductive outcomes.

Case report

Preprocedural assessment

A transvaginal ultrasound (TVUS) examination was performed using a Voluson S-10 system (GE Healthcare, Zipf, Austria) equipped with a three-dimensional transvaginal probe. All examinations were digitally archived as two-dimensional still images, cine loops, and three-dimensional volume datasets.

Uterine fibroids were classified according to the FIGO classification system, based on their relationship with the uterine wall.[10] In addition to FIGO classification, fibroid topography was documented as anterior, posterior, fundal, or lateral.

Fibroid volume was calculated using the standard ellipsoid formula, based on the three orthogonal diameters obtained on TVUS and multiplied by the coefficient 0.523 ($\pi/6$), a method widely adopted in gynecologic imaging and fibroid research for its reproducibility and consistency.[11]

Sonographic features suggestive of uterine adenomyosis were also systematically assessed. A diagnosis of adenomyosis was considered when at least one direct ultrasound sign was identified, including myometrial cysts, hyperechoic islands, subendometrial lines or buds, on two- or three-dimensional imaging.[12]

Procedure

RFA was performed under procedural sedation with continuous ultrasound guidance to ensure accurate needle placement within the fibroid. Prior to ablation, a TVUS-guided core needle biopsy was performed using an 18-gauge, 250-mm automated Tru-cut biopsy needle to obtain tissue for histological confirmation of the lesion. A dedicated needle electrode was introduced transvaginally, and controlled radiofrequency energy was delivered to induce localized thermal coagulative necrosis of the myoma tissue.

The duration of the procedure and intraoperative tolerability were recorded. Postprocedural pain was assessed at discharge using standard clinical evaluation.

Follow-up

Postprocedural follow-up visits were scheduled at 1, 3, and 6 months. At each visit, TVUS was performed to assess changes in fibroid size, volume, vascularization, and relationship with the uterine cavity. Clinical evaluation focused on menstrual bleeding, pelvic pain, and overall symptom perception.

Histological analysis of the sampled tissue confirmed the diagnosis of benign uterine leiomyoma, with no evidence of atypia or malignancy.

Clinical course

The patient was a 40-year-old nulligravid woman who presented with a desire for future pregnancy and moderate dysmenorrhea (visual analog scale score of 5). The patient had a documented history of infertility, defined as failure to conceive after more than 12 months of regular unprotected intercourse. A standard infertility evaluation had previously been performed, including semen analysis showing normal parameters, assessment of ovarian reserve with anti-Müllerian hormone levels consistent with the patient's age, and sonohysterosalpingography demonstrating bilateral tubal patency. No other identifiable male or female infertility factors were identified prior to treatment. Baseline TVUS identified a FIGO type 3 intramural fibroid measuring 45×46×38 mm, corresponding to a calculated volume of 41.1 cm^3. The lesion exhibited typical perilesional vascularization (color score 2) and was in close contact with the endometrial cavity. In addition, there was associated focal anterior adenomyosis (Figure 1, A–C). The patient had no relevant medical comorbidities and no history of previous surgical interventions.

Ultrasound-guided RFA was performed with four targeted applications using a needle electrode with a 20-mm active tip. The total procedure time was 25 minutes, and no immediate complications were observed.

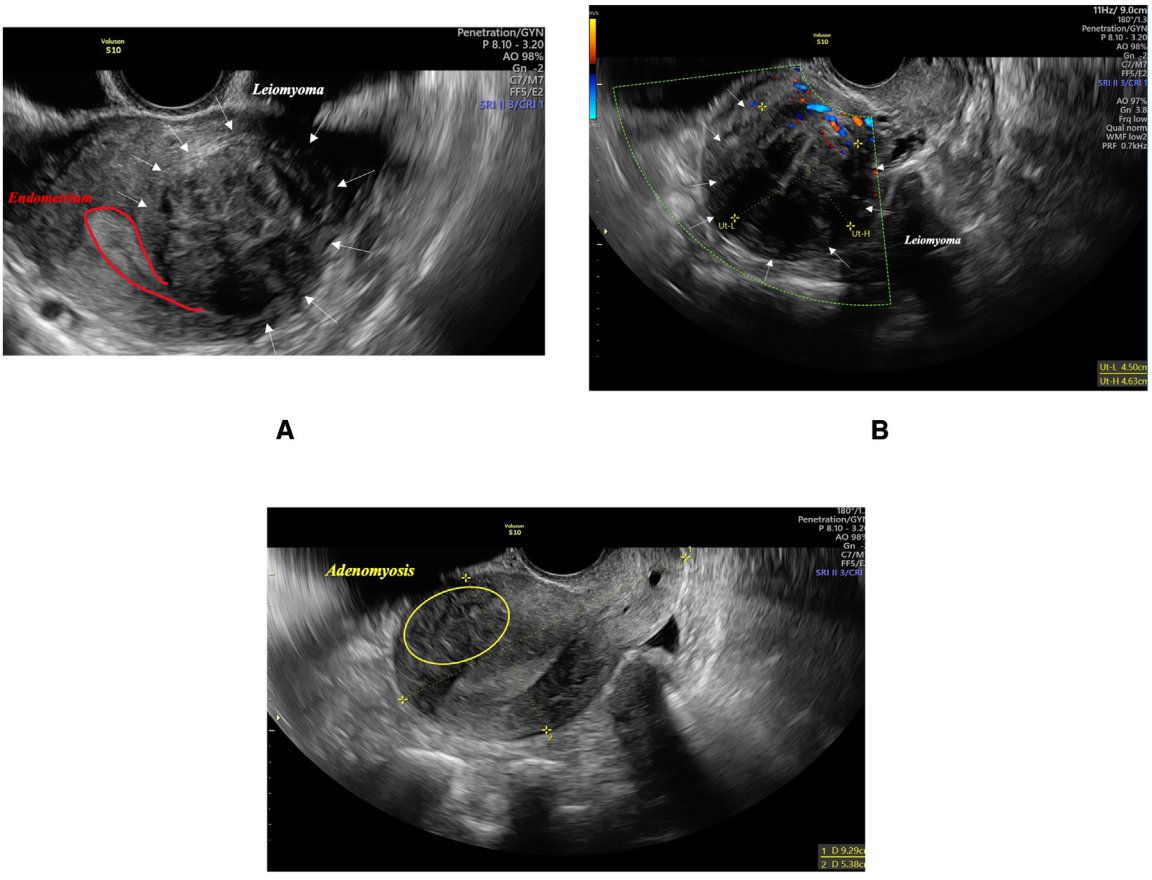
At the 1-month follow-up, TVUS demonstrated migration of the treated lesion to a FIGO type 4 configuration within the anterior uterine wall. The fibroid measured 29×33×31 mm (volume 15.5 cm^3), with persistent perilesional vascularization (color score 2) and reduced intralesional flow (color score 1) (Figure 2). Three-dimensional reconstruction confirmed restoration of a normal uterine cavity, with a convex external contour and absence of cavity distortion.

At 6 months, the anterior-wall FIGO type 4 fibroid further decreased in size to 27×27×25 mm, corresponding to a volume of 9.5 cm^3 and an overall reduction of 76.9% compared with baseline. Vascular patterns remained stable, with low intralesional flow and preserved perilesional vascularity (Figure 3).

Follow-up ultrasound also demonstrated improvement of the focal adenomyosis features, particularly a reduction in the size and number of myometrial cysts and hyperechoic islands in the anterior myometrium.

The procedure was well tolerated, and no adverse or unanticipated events

FIGURE 1
Transvaginal ultrasonography (TVUS) findings before radiofrequency ablation



(A) FIGO type 3 intramural fibroid measuring 45×46×38 mm (volume 41.1 cm^3), showing typical perilesional vascularization (color score 2) and exerting an impression on the uterine cavity in a transverse scan. (B) The same fibroid visualized in a longitudinal scan, demonstrating the well-defined pseudocapsule characteristic of leiomyomas and confirming its clear delineation from the surrounding myometrium. (C) Longitudinal scan of the anterior uterine wall showing focal adenomyosis, characterized by heterogeneous myometrial echotexture with myometrial cysts and hyperechoic islands.

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were observed during the perioperative or follow-up period.

Following last evaluation, the patient conceived spontaneously and subsequently achieved a term vaginal delivery without obstetric complications.

The patient reported significant improvement in menstrual symptoms and pelvic pain during follow-up and expressed satisfaction with the minimally invasive nature of the procedure and the preservation of reproductive potential.

The patient provided written informed consent for the processing of her personal data in accordance with current privacy regulations.

The case was managed in accordance with the Declaration of Helsinki.

Discussion

Management of uterine fibroids increasingly requires an individualized approach integrating imaging findings with patient-specific clinical and reproductive factors. Treatment decisions should consider not only fibroid size and location, but also vascular characteristics, symptom burden, patient age, reproductive intentions, and the frequent coexistence of additional myometrial disorders such as adenomyosis. Within this personalized framework, RFA represents a valuable therapeutic option for selected patients. Fibroids causing distortion of the endometrial cavity, particularly FIGO types 0 to 2, generally require surgical management, preferably via hysteroscopic approaches, to restore cavity anatomy and control bleeding. Similarly, predominantly subserosal fibroids (FIGO types 5–7) associated with compressive symptoms are best managed surgically. In contrast, the optimal treatment of intramural fibroids (FIGO types 3–4) remains less clearly defined and depends on lesion size, symptom severity, and reproductive plans. In this setting, RFA appears

FIGURE 2
One month after the myolysis procedure, transvaginal ultrasonography showed that the lesion had evolved into a FIGO type 4 fibroid located in the anterior uterine wall, measuring 29×33×31 mm (volume 15.5 cm^3), with persistent perilesional CS2 and decreased intralesional vascularity (CS1)

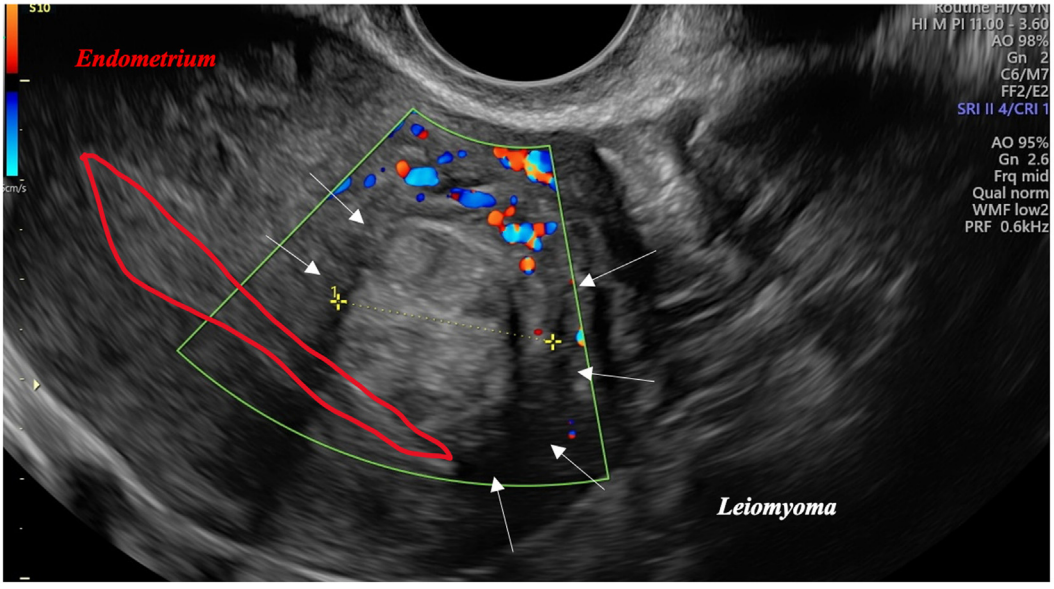

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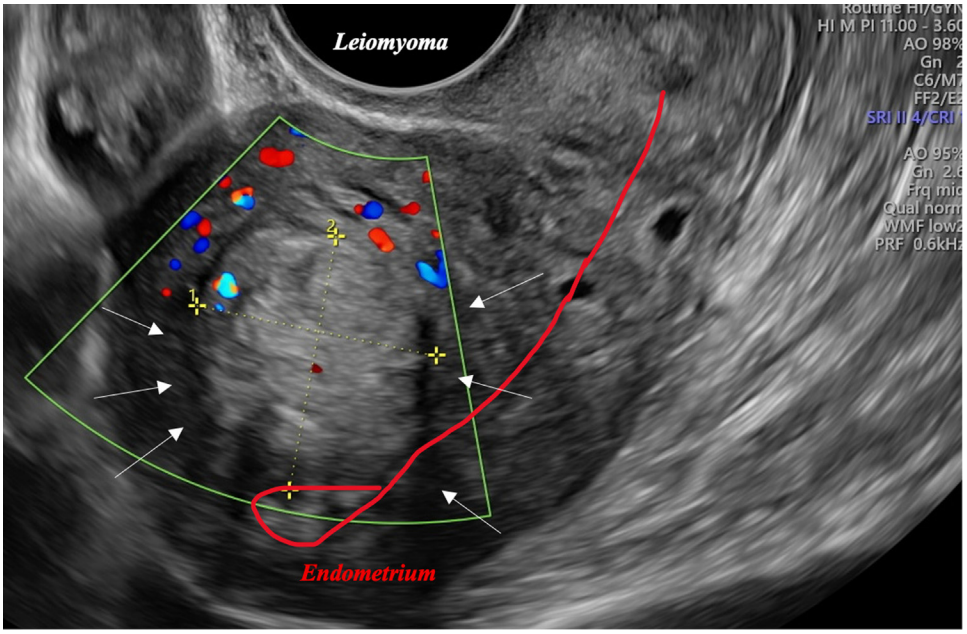
FIGURE 3
Six months after the procedure, the ultrasound examination showed that the anterior-wall FIGO type 4 fibroid measured 27×27×25 mm (volume 9.5 cm^3), corresponding to a 76.9% reduction from baseline, with unchanged vascular patterns (perilesional CS2, intralesional CS1)



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particularly suitable for intramural fibroids frequently implicated in AUB and potential fertility impairment.[10] In women planning pregnancy, therapeutic strategies must aim not only at symptom relief but also at preservation of uterine function and optimization of the intrauterine environment for implantation, both in spontaneous

conception and assisted reproductive technology cycles.[1,8] Beyond mechanical effects, fibroids and adenomyosis may impair fertility through inflammatory and functional mechanisms. RFA has demonstrated efficacy in reducing fibroid volume and associated symptoms while preserving uterine integrity, with reported volume reductions of approximately 40% at 6 months and up to 65% at 12 months, accompanied by significant improvement in AUB.[13] An important feature of RFA is its potential role in the early treatment of small or mildly symptomatic fibroids. Early intervention may limit fibroid progression and cumulative reproductive impact, particularly in younger women. Although intramural fibroids up to 4 to 5 cm are generally considered to have a limited effect on fertility, preventing further growth may reduce the risk of secondary cavity distortion and altered uterine contractility, both associated with impaired implantation and pregnancy outcomes.[8] In the presence of adenomyosis, early intervention may also help limit progressive myometrial remodeling and symptom worsening. From a technical perspective, RFA offers several advantages, including the absence of uterine incision, real-time ultrasound guidance, and relatively short operative times. These features contribute to a favorable safety profile, with reduced risks of hemorrhage, infection, pelvic adhesions, and endometrial injury compared with more invasive surgical approaches.[9,14] The interval between fibroid treatment and subsequent pregnancy is particularly relevant for women of advanced reproductive age or with diminished ovarian reserve.[15] However, current evidence does not define a standardized waiting period before attempting conception following fibroid treatments, including RFA. Available studies report reassuring reproductive outcomes but do not provide clear recommendations regarding optimal timing, highlighting an important gap in current knowledge.[16,17] Another advantage of RFA is its reproducibility, allowing repeated treatments without significant distortion of uterine morphology. This is particularly relevant in a chronic condition such as uterine fibromatosis and may be valuable in patients with concomitant focal adenomyosis, who often require long-term, adaptive management strategies 1. Increasing attention has been directed toward the potential role of ablative techniques in adenomyosis, a condition frequently associated with fibroids and recognized as a cause of dysmenorrhea, heavy menstrual bleeding, and infertility. Ultrasound-based studies have shown that focal or mild adenomyosis is common and clinically relevant, even in younger women, supporting the importance of its identification during conservative management.[18,19] In this context, the present case is noteworthy, as ultrasound-guided RFA was associated not only with fibroid regression and restoration of uterine cavity morphology, but also with improvement of focal adenomyosis features at follow-up. Although firm conclusions cannot be drawn from a single case, several mechanisms could hypothetically contribute to this finding. First, the thermal energy delivered during ablation may exert a local effect on adjacent adenomyotic tissue. Second, reduction of fibroid-related inflammation and abnormal angiogenic signaling may modify the surrounding myometrial microenvironment, potentially contributing to improvement of adenomyosis-related sonographic features Pianeti e 19 dedes. These mechanisms remain speculative, and the present observation should be considered hypothesis-generating rather than evidence of a causal therapeutic effect. Evidence on reproductive outcomes remains limited, and further investigation is warranted.[20] At present, RFA cannot be recommended as standard therapy for adenomyosis but represents a promising and evolving option.[20] Despite these advantages, RFA is not universally applicable. Its efficacy may be reduced in large fibroids, where adequate energy distribution can be limited, and conventional surgical management remains preferable.[21] Myomectomy continues to play a central role, particularly for submucosal fibroids (FIGO types 0−2), large intramural lesions (>4 cm), and symptomatic subserosal fibroids, although it is associated with higher surgical morbidity and longer recovery.

Some limitations of this report should be considered. This study describes a single clinical case, and therefore, no causal relationship between RFA and the observed reproductive outcome can be established. In addition, the interval between treatment and conception was relatively short, with pregnancy occurring 6 months after the procedure. Spontaneous conception may also be influenced by multiple factors, and the specific characteristics of this patient, including her age and nulligravid status, may limit the generalizability of these findings.

Overall, minimally invasive treatment of appropriately selected intramural fibroids—particularly FIGO types 3 and 4 and selected type 5 lesions—in women with reproductive aspirations represents a safe, effective, repeatable, and fertility-preserving option. Expanding indications to include early-stage fibroids and carefully selected cases of adenomyosis may further support proactive, individualized care aligned with patient-centered reproductive planning and long-term uterine health.

Conclusion

This case highlights the potential role of ultrasound-guided RFA as a minimally invasive, fertility-preserving treatment for selected intramural uterine fibroids in the presence of focal adenomyosis. In addition to symptom improvement and substantial fibroid volume reduction, the favorable reproductive outcome suggests that RFA may help maintain a uterine environment compatible with spontaneous conception.

Further studies with larger cohorts are needed to better define patient selection and reproductive outcomes after treatment. ■

CRediT authorship contribution statement

Francesco G. Martire: Supervision, Project administration, Data curation. **Claudia d'Abate:** Writing − original draft. **Eugenia Costantini:** Writing − original draft. **Ilaria Ianes:** Writing −

original draft, Data curation. **Emilio Pieri:** Visualization. **Lorenza Minisci:** Visualization. **Maria De Bonis:** Writing – review & editing. **Lucia Lazzeri:** Writing – review & editing, Data curation. **Errico Zupi:** Writing – review & editing, Supervision, Project administration.

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