Downloaded from http://journals.lww.com/greenjournal by BhDMf5ePHKav1zEoum1tQfN4a+kJLhEZgbsIHo4XMi0hCywCX1AWnYQp/IlQrHD3i3D0OdRyi7TvSFl4Cf3VC1y0abggQZXdgGj2MwlZLeI= on 01/16/2025

Original Research

OPEN

Pregnancy Outcomes After Transvaginal Radiofrequency Ablation of Leiomyomas

Victoria E. Rey, MD, Maria M. Falcon, MD, Ida Ferrara, MD, and Gabriel Yanes, MD

OBJECTIVE: To evaluate pregnancy outcomes after transvaginal radiofrequency ablation of leiomyomas.

METHODS: We conducted a retrospective review of the medical records of 226 pregnant patients after transvaginal radiofrequency ablation of leiomyomas from January 1, 2017, to February 28, 2022.

RESULTS: Patients' mean age was 37.4 years. The preoperative median leiomyoma volume before transvaginal radiofrequency ablation was 52.4 mL, and the median volume reduction at 6 and 12 months was 49.4% and 69.8%, respectively. The median interval time from transvaginal radiofrequency ablation to pregnancy was 9.3 months (interquartile range 5.6–15.1 months). Pregnancy was spontaneous in 78 patients (34.5%) and by assisted reproductive technologies in 148 (65.5%). Miscarriage occurred in 36 patients (15.9%), premature delivery (before 37 weeks of gestation) in 4.1%, and preeclampsia in 4.3%. There was one instance of placenta accreta in a patient with a history of open myomectomy. There were no instances of uterine rupture, placental abruption, or fetal growth restriction. The cesarean delivery rate was 26.4%; the remaining patients had normal spontaneous vaginal deliveries. Patients with a volume of leiomyoma more than 58.6 mL had a longer interval time from transvaginal radiofrequency ablation to pregnancy ($P<.05$). An increased miscarriage rate was observed when the interval time to pregnancy was shorter than 5.7 months ($P<.05$).

CONCLUSION: Pregnancy outcomes after transvaginal radiofrequency ablation of leiomyomas were similar to those of a general population with no instances of uterine rupture, placental abruption, or fetal growth restriction.

(Obstet Gynecol 2025;00:1–8)

DOI: 10.1097/AOG.0000000000005826

It is estimated that 40–50% of women of childbearing age have at least one leiomyoma.[1] Abnormal uterine bleeding is the most common symptom associated with leiomyomas, resulting in anemia in 23% of patients.[2] They are the only cause of infertility in 3% of patients; they contribute to infertility in an additional 5–10%; and they are responsible for recurrent miscarriage in 7% of patients.[3,4] Intramural leiomyomas (International Federation of Gynecology and Obstetrics [FIGO] types 3–5) may be a cause of infertility by preventing implantation, and their removal may not improve pregnancy rates.[5–7]

The delay in childbearing age and patients' demand for less invasive therapeutic options have led to the development of techniques such as radiofrequency for the treatment of uterine leiomyomas.[8] Radiofrequency results in leiomyoma necrosis, which leads to a reduction in leiomyoma volume over time.[9] Transvaginal radiofrequency ablation of leiomyomas is a short outpatient procedure that is performed under sedation to treat multiple leiomyomas with preservation of the surrounding myometrium and no residual scar.[9–13]

Radiofrequency ablation of uterine leiomyomas is widely used for patients who desire future fertility and would like to avoid more invasive surgical techniques. A literature review of pregnancy outcomes after radiofrequency ablation for leiomyomas revealed a total of 127 patients. Radiofrequency ablation was delivered by laparoscopy in 30,[13,14] through a transcervical approach in 89,[11,15] and through a transvaginal route in eight.[16] Results were similar to those of a general population, with no maternal or neonatal

From the Division of Minimally Invasive Surgery, Victoria Rey Clinic, Loyola University, Seville, Spain.

Each author has confirmed compliance with the journal's requirements for authorship.

Corresponding author: Victoria E. Rey, MD, Clinica Victoria Rey, Loyola University, Seville, Spain; reyvic2026@gmail.com.

Financial Disclosure

The authors did not report any potential conflicts of interest.

Copyright © 2025 The Author(s). Published by Wolters Kluwer Health, Inc. This is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

ISSN: 0029-7844/25

complications directly attributed to radiofrequency ablation.

The aim of this study was to evaluate the pregnancy outcomes of 226 patients who conceived after transvaginal radiofrequency ablation of leiomyomas.

Downloaded from http://journals.lww.com/greenjournal by BhDMf5ePHKav1zEoum1tQfN4a+kJLhEZgbsIHo4XMi0hCywCX1AWnYQp/IlQrHD3i3D0OdRyi7TvSFl4Cf3VC1y0abggQZXdgGj2MwlZLeI= on 01/16/2025

METHODS

We conducted a retrospective review of the medical records of 226 pregnant patients after transvaginal radiofrequency ablation of leiomyomas from January 1, 2017, to February 28, 2022, in Victoria Rey Clinic. Preoperatively, all patients desired future fertility and had symptomatic FIGO type 2–5 leiomyomas with benign morphology on ultrasonography. Transvaginal radiofrequency ablation technique can be found in Appendix 1, available online at http://links.lww.com/AOG/D961.

Leiomyoma volume was measured before transvaginal radiofrequency ablation and at 6 and 12 months after treatment. A Voluson E8 ultrasound scanner was used to obtain three measurements of each leiomyoma. The volume was calculated with the formula $4/3\pi \times a \times b \times c$, where a, b, and c are the three measurements. The total leiomyoma volume per patient was the sum of all leiomyoma volumes.

Pregnancy outcomes measured included miscarriage, preeclampsia, preterm delivery, fetal growth restriction, uterine rupture, placental abruption, placenta accreta spectrum, and mode of delivery (vaginal or cesarean). Perioperative outcomes included operative time, time to discharge, time to return to normal activities, and postoperative complications. Postoperative complications were evaluated according to a reproducible and reliable system, the Clavien–Dindo classification.[17] The Ethical Committee of Ministry of Health of the Government of Andalusia (Comité Coordinador de Investigación Biomédica de Andalucía) approved the study.

Frequencies and percentages were reported for categorical variables, and means±SDs, along with 95% CIs, were provided for normally distributed continuous variables. Continuous variables with nonnormal distribution were summarized with medians and interquartile ranges. To compare continuous variables at multiple time points, the Student t test for paired samples was applied for normally distributed data, and the Wilcoxon signed-rank test was used for nonnormally distributed data. Differences in categorical variables (eg, miscarriage and cesarean delivery rates between the assisted reproductive technology [ART] and spontaneous groups) were assessed with χ^2 or Fisher exact tests as appropriate.

For correlations involving initial leiomyoma volume, time to pregnancy, and miscarriage rates, the Spearman rank correlation coefficient (r) was calculated to assess nonparametric relationships, with statistical significance set at $P<.05$. The Pearson product–moment correlation coefficient was used for parametric variables when applicable. The segmented regression test was used to evaluate cutoff points.

All analyses were conducted with SAS 9.4M7.

RESULTS

The mean±SD patient age was 37.4±4.5 years (range 28–47 years). All patients were White and had one or more FIGO type 2–5 leiomyomas. Indications for transvaginal radiofrequency ablation of leiomyomas were abnormal uterine bleeding in 41 patients (18.14%), unsuccessful ART and abnormal uterine bleeding in 151 patients (66.81%), and a history of more than three miscarriages or implantation failure after embryo transfer in 34 patients (15.04%). Patients with other known causes of infertility were excluded from the study. Euploid or donor egg embryos were transferred to 32 patients, and all of the miscarriages analyzed were found to have normal chromosomes.

The median number of leiomyomas was 2.7 (interquartile range 1.3–3.5). A single leiomyoma was ablated in 124 patients (55.8%), and two to five leiomyomas were ablated in 101 patients (44.7%). The median operative time was 12.7 minutes (interquartile range 10.5–25.3 minutes), and the median time to discharge was 145 minutes (interquartile range 120–190 minutes). Patients resumed normal activities after a median of 4.2 days (interquartile range 2.8–6.1 days) (Table 1).

There were no intraoperative complications. Type I postoperative complications were noted in 45 patients (19.9%). Type II occurred in eight patients (3.5%), all of whom experienced a postnecrotic leiomyoma syndrome requiring intravenous dexamethasone and antibiotics for 3 days. Type IIIa complications occurred in 27 patients (11.9%) with FIGO type 2 leiomyomas. They required hysteroscopic removal of a free intrauterine leiomyoma within 26–51 days after the ablation. There were no type IV or V complications (Table 2).

The median leiomyoma volume per patient before transvaginal radiofrequency ablation of leiomyomas was 52.4 mL (interquartile range 22.3–101.7 mL) and at 6 and 12 months was 26.5 mL (interquartile range 12.1–49.8 mL) and 15.8 mL (interquartile range 6.2–33.7 mL), respectively. The median percentage of leiomyoma volume reduction at 6 and

Table 1. Distribution of the Data Collected

Characteristic	Value
Age (y)	37.4±4.5 (28–47)
Myomas (n)	2.7 (1.3–3.5)
Initial volume of myoma (mL)	52.4 (22.3–101.7)
Operative time (min)	12.7 (10.5–25.3)
Volume 6 mo after radiofrequency ablation (mL)	27.5 (15.1–50.2)
Time to discharge (min)	145 (120–190) (90–240)
Time to return to normal activities (d)	4.2 (2.8–6.1)
Volume 1 y after radiofrequency ablation (mL)	19.3 (9.7–31.5)
Time to pregnancy (mo)	9.3 (5.6–15.1)
IVF group	14.7 (7.8–19.3)
Spontaneous group	6.3 (4.2–11.3)
Time to delivery (wk)	38.6±2.1 (35.1–41.1)
IVF group	38.1±1.2 (35.1–39.5)
Spontaneous group	39.2±1.8 (36.2–41.1)

IVF, in vitro fertilization.
Data are mean±SD (minimum–maximum) or median (interquartile range) (minimum–maximum).

12 months was 49.4% (interquartile range 26.8–64.7%) and 69.8% (interquartile range 45.9–82.4%), respectively (Table 3). At a follow-up of 3 and 6 months, 78% and 91% of the 192 patients with abnormal uterine bleeding, respectively, reported normal menstruation.

Spontaneous conception was reported by 78 patients (34.5%). Pregnancy was achieved by ART in 148 patients (65.5%), in vitro fertilization in 27 patients (18.2%), and donor eggs in 121 patients (81.7%). In all in vitro fertilization cases, an euploid embryo was transferred, and all cases had previously undergone unsuccessful ART. There was a significant difference in mean patient age between the spontaneous and ART conception groups (34.5 years vs 39.8 years, respectively, P=.01). Two or more pregnancies were reported by 24 patients (10.6%). Subsequent pregnancies were spontaneous in 14 patients, spontaneous after previous ART pregnancy in three patients, and after ART in six patients. Among the patients receiving ART, 89 (60.13%) underwent two or more separate embryo transfers.

The initial median volume of leiomyomas was significantly higher in the ART group compared with the spontaneous pregnancy group (68.3 mL, interquartile range 40.8–110.5 mL vs 56.5 mL, interquartile range 35.1–84.2 mL, respectively, P=.04). Although the number of leiomyomas was somewhat higher in the ART group (median 2, interquartile range 1–4) compared with the spontaneous pregnancy group (median 1, interquartile range 1–3), this difference was not statistically significant (P=.08) (Table 4).

Table 2. Distribution Data for Postoperative Complications According to Clavien–Dindo Classification[17]

Type of Postoperative Complication	Definition of Type of Complication	Type of Complication	n (%)
I	Any deviation from the normal postoperative course without the need for pharmacologic treatment or surgical, endoscopic, and radiologic interventions Allowed therapeutic regimens are: drugs as antiemetics, antipyretics, analgesics, diuretics, electrolytes, and physiotherapy Also includes wound infections opened at the bedside	Urine infection Bleeding Fever Pelvic pain	45 (19.9)
II	Requiring pharmacologic treatment with drugs other than those allowed for grade I complications Blood transfusions and total parenteral nutrition also included	Postnecrotic syndrome	8 (3.5)
IIIa	Requiring surgical, endoscopic, or radiologic intervention, intervention not under general anesthesia	Hysteroscopic removal of a free intrauterine leiomyoma	27 (11.9)
IIIb	Requiring surgical, endoscopic, or radiologic intervention, intervention under general anesthesia		0
IVa	Life-threatening complication (including CNS complications) requiring IC or ICU management Single-organ dysfunction (including dialysis)		0
IVb	Life-threatening complication (including CNS complications) requiring IC or ICU management; multiorgan dysfunction		0
V	Death of patient		0

CNS, central nervous system; IC, intensive care; ICU, intensive care unit.

Downloaded from http://journals.lww.com/greenjournal by BhDMf5ePHKav1zEoum1tQfN4a+kJLhEZgbsIHo4XMi0hCywCX1AWnYQp/IlQrHD3i3D0OdRyi7TvSFl4Cf3VC1y0abggQZXdgGj2MwlZLeI= on 01/16/2025

Table 3. Reduction of the Volume of Myoma 6 and 12 Months After Transvaginal Radiofrequency Ablation Compared With Baseline

Transvaginal RFA	Myoma Volume (mL)	Crude Difference	*P*
Baseline (pretreatment)	52.4 (22.3–101.7)		
After RFA			
6 mo	26.5 (12.1–49.8)	−25.9 (13.2–51.9)	<.001
12 mo	15.8 (6.2–33.7)	−35.9 (15.9–48.0)	<.001

RFA, radiofrequency ablation.
Data are median (interquartile range) unless otherwise specified.

Downloaded from http://journals.lww.com/greenjournal by BhDMf5ePHKav1zEoum1tQfN4a+kJLhEZgbsIHo4XMi0hCywCX1AWnYQp/IlQrHD3i3D0OdRyi7TvSFl4Cf3VC1y0abggQZXdgGj2MwlZLeI= on 01/16/2025

The median interval time from transvaginal radiofrequency ablation to pregnancy was 9.3 months (interquartile range 5.6–15.1 months) and was statistically longer in the ART group at 14.7 months (7.8–19.3 months) compared with the spontaneous pregnancy group at 6.3 months (4.2–11.3 months, $P<.001$) (Table 4). A positive correlation was observed between the preoperative leiomyoma volume and the interval time to pregnancy ($r=0.73$, spontaneous group $r=0.66$, ART group $r=0.78$, $P<.05$). This correlation was most notable when the leiomyoma volume was greater than 58.6 mL (55.1 mL in spontaneous group, 69.2 mL in ART group). A preoperative leiomyoma volume greater than 58.6 mL appeared as an inflection point at which the relationship between leiomyoma volume and pregnancy time showed a notable change in trend, with a stronger correlation above this cut point ($r=0.77$, $r=0.74$ in spontaneous group, $r=0.82$ in the ART group) than below it ($r=0.43$, $r=0.41$ in spontaneous group, and $r=0.53$ in ART group, $P<.05$) (Fig. 1). No correlation was found between the number of leiomyomas and the time to pregnancy.

The miscarriage rate was 15.9% (n=36), with a higher miscarriage rate in the ART group compared with the spontaneous pregnancy group (17.5% vs 12.8%, respectively, $P<.01$). A negative correlation was found between the interval time to pregnancy and the miscarriage rate in both groups ($r=-0.34$, spontaneous group $r=-0.28$, ART group $r=-0.52$, $P<.05$). The initial leiomyoma volume or number of leiomyomas did not correlate with miscarriage in the spontaneous pregnancy group. However, a statistically increased miscarriage rate was observed in the ART group when the interval time to pregnancy was shorter than 5.7 months ($r=-0.55$ vs $r=-0.36$ behind and above this time, respectively, $P<.05$) (Fig. 2).

The overall cesarean delivery rate was 26.4% (n=51), with a significant difference between the ART and the spontaneous groups (27.0% and 24.0%, respectively, $P<0.01$). The initial leiomyoma volume or number of leiomyomas did not influence the cesarean delivery rate in either group.

Table 4. Comparative Analysis of Clinical and Obstetric Variables Between the Spontaneous and Assisted Reproductive Technology Pregnancy Groups

Variable	Spontaneous (n=78, 34.5%)	ART (n=148, 65.5%)	*P*
Age (y)	34.5±3.3	39.8±5.1	.01
Initial leiomyoma volume (mL)	56.5 (35.1–84.2)	68.3 (40.8–110.5)	.04
Leiomyomas (n)	1 (1–3)	2 (1–4)	.08
Volume reduction (%)			
At 6 mo	37.5±15.2	34.7±18.9	.31
At 12 mo	45.3±14.7	41.9±17.5	.27
Time from RFA to pregnancy (mo)	6.3 (4.2–11.3)	14.7 (17.8–19.3)	.02
Miscarriage rate (%)	12.8	17.5	.01
Cesarean rate (%)	24.0	27.0	.01
Time to delivery (wk)	39.2±1.8	38.1±1.2	.04
Correlation between no. of leiomyomas and time to pregnancy (*r*)	0.31	0.27	.48
Correlation between initial leiomyoma volume and time to pregnancy (*r*)	0.66	0.78	.05
Correlation between time to pregnancy and miscarriage rate (*r*)	−0.28	−0.52	.05

ART, assisted reproductive technology; RFA, radiofrequency ablation.
Data are mean±SD or median (interquartile range) unless otherwise specified.

Downloaded from http://journals.lww.com/greenjournal by BhDMf5ePHKav1zEoum1tQfN4a+kJLhEZgbsIHo4XMi0hCywCX1AWnYQp/IlQrHD3i3D0OdRyi7TvSFl4Cf3VC1y0abggQZXdgGj2MwlZLeI= on 01/16/2025

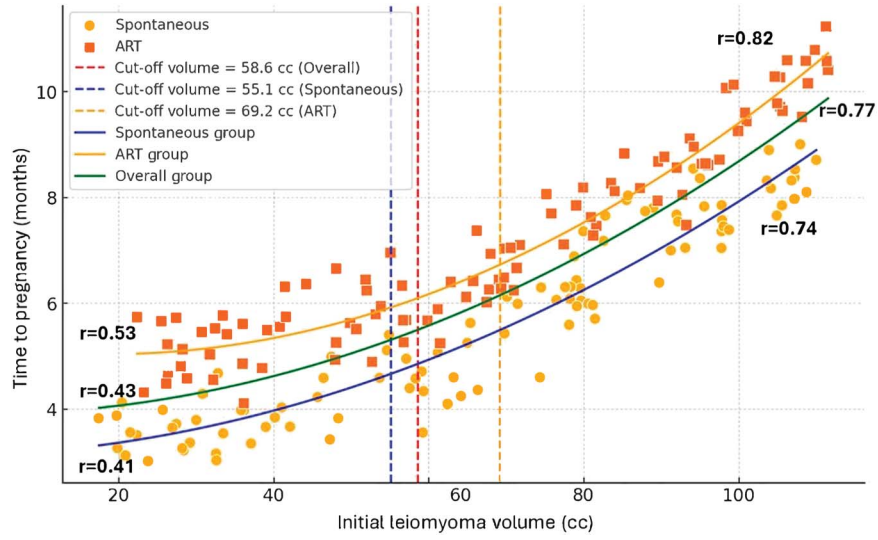


Fig. 1. Correlation of initial volume of leiomyomas with time to pregnancy. ART, assisted reproductive technology.
Rey. Pregnancy Transvaginal Radiofrequency of Leiomyomas. Obstet Gynecol 2025.

There was one instance of placenta accreta discovered during a cesarean delivery at 37 2/7 weeks of gestation in a patient with a previous open myomectomy 2 years before the transvaginal radiofrequency ablation of leiomyomas. One patient required medical treatment for uterine atony after a spontaneous vaginal delivery at 40 3/7 weeks of gestation.

The premature delivery (before 37 weeks of gestation) rate was 4.1% (eight births), with a significant difference between the ART (3.9%) and spontaneous (4.3%) groups ($P<.01$). The preeclampsia rate was 4.3%, similar between the ART (4.4%) and spontaneous (4.1%) groups ($P=.05$).

There were no instances of uterine rupture, placental abruption, or fetal growth restriction.

DISCUSSION

Intramural leiomyomas have been associated with lower pregnancy rates and increased likelihood of miscarriage, and myomectomy has not been shown to improve fertility.[7,18] However, few data exist examining the pregnancy outcomes after radiofrequency ablation of leiomyomas.

This study is the second report examining pregnancy outcomes after transvaginal radiofrequency ablation of leiomyomas. To contextualize these findings, a comprehensive literature search was conducted using PubMed, Embase, and the Cochrane Library. The search covered studies published from January 2000 to September 2024. Search terms included combinations of "pregnancy radiofrequency fibroids,"

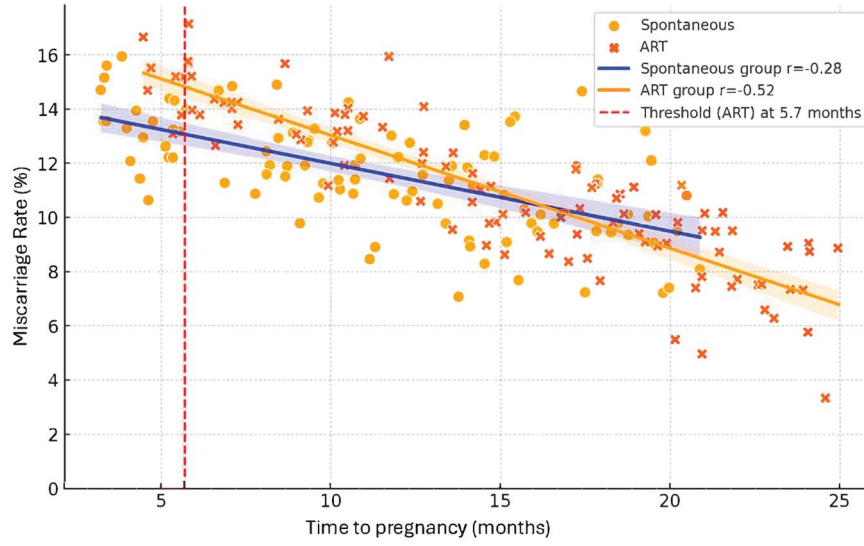


Fig. 2. Correlation of miscarriage with time to pregnancy. ART, assisted reproductive technology.
Rey. Pregnancy Transvaginal Radiofrequency of Leiomyomas. Obstet Gynecol 2025.

Downloaded from http://journals.lww.com/greenjournal by BhDMf5ePHKav1zEoum1tQfN4a+kJLhEZgbsIHo4XMi0hCywCX1AWnYQp/IlQrHD3i3D0OdRyi7TvSFl4Cf3VC1y0abggQZXdgGj2MwlZLeI= on 01/16/2025

"pregnancy radiofrequency myoma," "pregnancy outcomes radiofrequency," "obstetrics outcomes radiofrequency," and "fertility results radiofrequency." The initial report included eight pregnancies,[17] and as in the present series, no obstetric complications were directly attributable to the transvaginal radiofrequency ablation. The reported cesarean delivery rates of 65% after transvaginal radiofrequency ablation of leiomyomas[17] and 75% after the transcervical route[15,16] are higher than our rate of 24%. Cesarean delivery rates, however, are influenced by many other factors.

Abnormal placentation may occur as a result of leiomyoma necrosis secondary to radiofrequency ablation, particularly with those near the endometrium or with a high submucosal component. However, our pregnancy outcomes are similar to those observed in a general population, including premature birth and preeclampsia rates, and similar to those reported after radiofrequency ablation by conventional laparoscopy[14,19] and by a transcervical approach.[16] Placenta accreta spectrum is more common after hysteroscopic myomectomy compared with open and laparoscopic routes.[20] Instances of abnormal placental implantation have been reported after transvaginal radiofrequency ablation of leiomyomas.[17] Our single instance of placenta accreta was most likely secondary to a previous open myomectomy performed 2 years before transvaginal radiofrequency ablation of leiomyomas. No instances of uterine rupture reported have been in pregnancies after radiofrequency ablation.[14–16]

The miscarriage rate of 15.9% after radiofrequency in this series is similar to 15.3% reported in a general population[21] and 13.8% and 18.9% reported after other techniques such as laparoscopic[22] and robotic myomectomy,[23] respectively. A recent study[24] reported a higher miscarriage rate associated with laparoscopic radiofrequency ablation and open myomectomy. This could be a result of a different radiofrequency technique, a higher volume of treated leiomyomas, surgeon experience, or differences in the way that miscarriage data were collected and analyzed.

Confounding factors in all studies, including ours, include patient age and the use of ART, as highlighted by Hartmann et al.[18] The higher miscarriage rate and the longer time to pregnancy in the ART group may be related to the higher incidence of age-related embryonic pathology in this group compared with the spontaneous pregnancies groups.

No previous reports have evaluated the optimal time to proceed with conception after radiofrequency ablation. In the present series, patients proceeded with pregnancy at their discretion. We observed a higher rate of miscarriage with pregnancies starting within the first 5.7 months after transvaginal radiofrequency ablation of leiomyomas. For that reason, it appears advisable to delay conception for at least 6 months after transvaginal radiofrequency ablation of leiomyomas.

We also observed a shorter time to conception in patients with a preoperative leiomyoma volume below 58.7 mL. This seems to be a result of a rapid decrease in leiomyoma volume, reaching nearly 50% at 6 months.

The mean leiomyoma volume reduction of 67.3% at 12 months is similar to the previously reported 78% and 63% with transvaginal[25] and transcervical[26] approaches, respectively. Transvaginal radiofrequency ablation appears to be effective in resolving the abnormal uterine bleeding associated with leiomyomas. We observed that 91% of our patients with abnormal uterine bleeding had returned to normal menstruation at 6 months, which is consistent with previous reports.[12,13,17,27]

Our operating time, 14.3 minutes, is similar to those previously reported with transvaginal radiofrequency ablation of leiomyomas, 25 and 18 minutes, which are shorter than those associated with the transcervical and laparoscopic approaches of 44 and 73 minutes, respectively.[12,22,27,28] However, comparisons are difficult because of differences in volume and location of leiomyomas. The times to discharge and return to normal activities, 2.7 hours and 3.2 days, respectively, are shorter compared with 6.8–10 hours and 20 days reported by a laparoscopic approach.[9,29] There appears to be a general agreement that transvaginal radiofrequency ablation of leiomyomas is associated with shorter operating times and lower complication and recurrence rates compared with other minimally invasive techniques such as uterine artery embolization or magnetic resonance–guided high-intensity focused ultrasonography.[12,17,30]

It should be noted that hysteroscopic removal of free endometrial cavity leiomyomas was required within 3 months after radiofrequency treatment of 27 leiomyomas. All cases were FIGO type 2 leiomyomas, with a high submucosal component and a volume greater than 35 mL, equivalent to a largest diameter of 4 cm. Necrosis of the pseudocapsule, which is in direct contact with the myometrium, appears to be responsible for the detachment of the leiomyoma.

Pregnancy outcomes after transvaginal radiofrequency ablation of leiomyomas in this series were reassuring, with no instances of uterine rupture, placental abruption, or fetal growth restriction. Our

study is limited by its retrospective nature. The pregnancy rate after transvaginal radiofrequency ablation of leiomyomas remains unknown because this study included only those patients who desired pregnancy after radiofrequency ablation and the majority of pregnancies were conceived with some form of ART. To evaluate pregnancy rates and outcomes after transvaginal radiofrequency ablation of leiomyomas, a prospective randomized trial comparing radiofrequency ablation with myomectomy is needed to compared the time to pregnancy, embryo implantation rates, and pregnancy outcomes.

Downloaded from http://journals.lww.com/greenjournal by BhDMf5ePHKav1zEoum1tQfN4a+kJLhEZgbsIHo4XMi0hCywCX1AWnYQp/IlQrHD3i3D0OdRyi7TvSFl4Cf3VC1y0abggQZXdgGj2MwlZLeI= on 01/16/2025

REFERENCES

1. Giuliani E, As-Sanie S, Marsh EE. Epidemiology and management of uterine fibroids. Int J Gynaecol Obstet 2020;149:3–9. doi: 10.1002/ijgo.13102
2. Petraglia F, Dolmans M. Iron deficiency anemia: impact on women's reproductive health. Fertil Steril 2022;118:605–6. doi: 10.1016/j.fertnstert.2022.08.850
3. Metwally M, Raybould G, Cheong Y, Horne AW. Surgical treatment of fibroids for subfertility. The Cochrane Database of Systematic Reviews 2020, Issue 11. Art. No.: CD003857. doi: 10.1002/14651858.CD003857.pub4
4. Erden M, Uyanik E, Polat M, Ozbek IY, Yarali H, Mumusoglu S. The effect of 6 cm sized noncavity-distorting intramural fibroids on in vitro fertilization outcomes: a systematic review and meta-analysis. Fertil Steril 2023;119:996–1007. doi: 10.1016/j.fertnstert.2023.02.018
5. Munro MG. Uterine polyps, adenomyosis, leiomyomas, and endometrial receptivity. Fertil Steril 2019;111:629–40. doi: 10.1016/j.fertnstert.2019.02.008
6. Dolmans MM, Cacciottola L, Donnez J. Conservative management of uterine fibroid-related heavy menstrual bleeding and infertility: time for a deeper mechanistic understanding and an individualized approach. J Clin Med 2021;10:4389. doi: 10.3390/jcm10194389
7. Pritts TL, Ogden M, Parker W, Ratcliffe J, Pritts EA. Intramural leiomyomas and fertility: a systematic review and meta-analysis. Obstet Gynecol 2024;144:171–9. doi: 10.1097/AOG.0000000000005661
8. Bradley LD, Pasic RP, Miller LE. Clinical performance of radiofrequency ablation for treatment of uterine fibroids: systematic review and meta-analysis of prospective studies. J Laparoendosc Adv Surg Tech A 2019;29:1507–17. doi: 10.1089/lap.2019.0550
9. Fasciani A, Turtulici G, Pedullà A, Sirito R. Uterine myoma position-based radiofrequency ablation (UMP-b RFA): 36 months follow-up clinical outcomes. Eur J Obstet Gynecol Reprod Biol 2023;281:23–8. doi: 10.1016/j.ejogrb.2022.12.006
10. Santalla-Hernandez A, Naveiro-Fuentes M, Benito-Villena R, Lopez-Criado MS, González-Paredes A, Fernández-Parra J. Efficacy, complications, and factors predictive of response to treatment with transvaginal radiofrequency ablation for symptomatic uterine myomas. J Minim Invasive Gynecol 2022;29:743–52. doi: 10.1016/j.jmig.2022.01.011
11. Christoffel L, Bends R, Toub D, Schiermeier S, Pschadka G, Engelhardt M, et al. Pregnancy outcomes after transcervical radiofrequency ablation of uterine fibroids with the sonata system. J Gynecol Surg 2022;38:207–13. doi: 10.1089/gyn.2021.0136
12. Rey VE, Labrador R, Falcon M, Garcia-Benitez JL. Transvaginal radiofrequency ablation of myomas: technique, outcomes, and complications. J Laparoendosc Adv Surg Tech A 2019;29:24–8. doi: 10.1089/lap.2018.0293
13. Berman JM, Shashoua A, Olson C, Brucker S, Thiel JA, Bhagavath B. Case series of reproductive outcomes after laparoscopic radiofrequency ablation of symptomatic myomas. J Minim Invasive Gynecol 2020;27:639–45. doi: 10.1016/j.jmig.2019.06.009
14. Keltz J, Levie M, Chudnoff S. Pregnancy outcomes after direct uterine myoma thermal ablation: review of the literature. J Minim Invasive Gynecol 2017;24:538–45. doi: 10.1016/j.jmig.2017.01.009
15. Hansen-Lindner L, Schmid-Lossberg J, Toub D. Transcervical fibroid ablation (TFA): update on pregnancy outcomes. J Clin Med 2024;13:2892. doi: 10.3390/jcm13102892
16. Santalla-Hernandez A, Manzanares S, Naveiro-Fuentes M, Lopez-Criado MS, Fernandez-Parra J. Obstetrics outcomes after ultrasound guided transvaginal radiofrequency ablation of uterine myomas. Obstet Gynecol Int J 2023;14:160–4.
17. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. Ann Surg 2004;240:205–13. doi: 10.1097/01.sla.0000133083.54934.ae
18. Hartmann KE, Velez Edwards DR, Savitz DA, Jonsson-Funk ML, Wu P, Sundermann AC, et al. Prospective cohort study of uterine fibroids and miscarriage risk. Am J Epidemiol 2017;186:1140–8. doi: 10.1093/aje/kwx062
19. Polin M, Hur HC. Radiofrequency ablation of uterine myomas and pregnancy outcomes: an updated review of the literature. J Minim Invasive Gynecol 2022;29:709–15. doi: 10.1016/j.jmig.2022.01.015
20. Lin MW, Hsu HC, Hui Tan EC, Shih JC, Lee CN, Yang JH, et al. Risk of placenta accreta spectrum following myomectomy: a nationwide cohort study. Am J Obstet Gynecol 2024;231:255.e1–10. doi: 10.1016/j.ajog.2023.11.1251
21. Quenby S, Gallos ID, Dhillon-Smith RK, Podesek M, Stephenson MD, Fisher J, et al. Miscarriage matters: the epidemiological, physical, psychological, and economic costs of early pregnancy loss. Lancet 2021;397:1658–67. doi: 10.1016/S0140-6736(21)00682-6
22. Campo S, Campo V, Gambadauro P. Reproductive outcome before and after laparoscopic or abdominal myomectomy for subserous or intramural myomas. Eur J Obstet Gynecol Reprod Biol 2003;110:215–9. doi: 10.1016/s0301-2115(03)00159-3
23. Pitter MC, Gargiulo AR, Bonaventura LM, Lehman JS, Srouji SS. Pregnancy outcomes following robot-assisted myomectomy. Hum Reprod 2013;28:99–108. doi: 10.1093/humrep/des365
24. Allen A, Schembri M, Parvataneni R, Waetjen LE, Varon S, Salamat-Saberi N, et al. Pregnancy outcomes after laparoscopic radiofrequency ablation of uterine leiomyomas compared with myomectomy. Obstet Gynecol 2024;143:612–8. doi: 10.1097/AOG.0000000000005548
25. Arnreiter C, Oppelt P. A systematic review of the treatment of uterine myomas using transcervical ultrasound-guided radiofrequency ablation with the sonata system. J Minim Invasive Gynecol 2021;28:1462–9. doi: 10.1016/j.jmig.2021.04.009
26. Wu XJ, Guo Q, Cao BS, Tan LX, Zhang HY, Cai YR, et al. Uterine leiomyomas: safety and efficacy of US-guided suprapubic transvaginal radiofrequency ablation at 1-year follow-up. Radiology 2016;279:952–60. doi: 10.1148/radiol.2015142537
27. Chudnoff S, Guido R, Roy K, Levine D, Mihalov L, Garza-Leal JG. Ultrasound-guided transcervical ablation of uterine leio-

myomas. Obstet Gynecol 2019;133:13–22. doi: 10.1097/AOG.0000000000003032

28. Jiang X, Thapa A, Lu J, Bhujohory VS, Liu Y, Qiao S. Ultrasound-guided transvaginal radiofrequency myolysis for symptomatic uterine myomas. Eur J Obstet Gynecol Reprod Biol 2014;177:38–43. doi: 10.1016/j.ejogrb.2014.03.017
29. Braun KM, Sheridan M, Latif EZ, Regush L, Maksymowicz A, Weins L, et al. Surgeons' early experience with the Acessa procedure: gaining proficiency with new technology. Int J Womens Health 2016;8:669–75. doi: 10.2147/IJWH.S119265
30. Anneveldt KJ, van 't Oever HJ, Ingrid M, Nijholt IM, Jeroen R, Dijkstra JR, et al. Systematic review of reproductive outcomes after high intensity focused ultrasound treatment of uterine fibroids. Eur J Radio 2021;141:109801. doi: 10.1016/j.ejrad.2021.109801

PEER REVIEW HISTORY

Received September 7, 2024. Received in revised form November 11, 2024. Accepted November 21, 2024. Peer reviews and author correspondence are available at http://links.lww.com/AOG/D962.

Downloaded from http://journals.lww.com/greenjournal by BhDMf5ePHKav1zEoum1tQfN4a+kJLhEZgbsIHo4XMi0hCywCX1AWnYQp/IlQrHD3i3D0OdRyi7TvSFl4Cf3VC1y0abggQZXdgGj2MwlZLeI= on 01/16/2025