Treatment of Uterine Myomas by Radiofrequency Thermal Ablation: A 10-Year Retrospective Cohort Study

Reproductive Sciences
2015, Vol. 22(5) 609-614
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DOI: 10.1177/1933719114556481
rs.sagepub.com

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Abstract

Patients' selection criteria, effectiveness, and safety of radiofrequency thermal ablation (RFTA) therapy for uterine myomas (UM) were assessed using a 10-year retrospective cohort study. From July 2001 to July 2011, a total of 1216 patients treated for UM were divided into 2 groups. Group A consisted of 476 premenopause patients, average age 36.5 ± 8.5 years, average number of myomas 1.7 ± 0.9 , and average diameter of myomas 4.5 ± 1.5 cm, and group B consisted of 740 menopause patients, average age 48.5 ± 3.5 years, average number of myomas 2.6 ± 1.3 , and average diameter of myomas 5.0 ± 2.5 cm. Average follow-up period was 36.5 ± 11.5 months. At 1, 3, 6, 12, and 24 months after RFTA, average diameters of myomas in group A were 3.8, 3.0, 2.7, 2.4, and 2.2 cm, respectively, and 47.7% (227 of 476) of patients had tumor trace at 12 months after RFTA. In group B, the results were 4.7, 3.7, 3.3, 2.3, and 2.3 cm, respectively, and 58.8% (435 of 740) of patients had tumor trace at 12 months after RFTA. Three months after treatment, myoma volumes were significantly reduced in both the groups ($P < .01$), and group B had higher rate of tumor trace at 12 months after RFTA than group A ($P < .05$). Clinical symptoms and health-related quality-of-life outcome (HRQL) were significantly improved after RFTA in both groups and the postoperative recurrence rate of UM was significantly higher in group A at 10.7% (51 of 476) than group B at 2.4% (18 of 740; $P < .05$). Radiofrequency thermal ablation is an excellent minimally invasive treatment for UM smaller than 5.0 cm in diameter.

Keywords

uterine myoma, minimally invasive treatment, radiofrequency thermal ablation, curative effect, complications

Introduction

Uterine myoma (UM) is a common gynecological disease, occurring in 20% of women during their lifetime.¹ Patients with UM may experience anemia, dysmenorrhea, and rectum or bladder bulk symptoms as a result of menorrhagia. The conventional treatment mainly comprises estrogen antagonist and partial or total hysterectomy.²⁻⁵ However, the former is a long-term drug treatment associated with inconsistent efficacy and high recurrence rate, and the latter can cause surgical trauma. Therefore, minimally invasive treatment has become the focus of interest in recent years.

Over the past decade, with the application of laparoscopy and hysteroscopy, minimally invasive treatment of UM has gained popularity.^{6,7} Radiofrequency thermal ablation (RFTA) has been used in the treatment of liver cancer,⁸⁻¹⁰ lung cancer,¹¹ kidney cancer,¹² and spinal pain.¹³ Its value in the treatment of benign gynecological diseases has also been recognized, and the procedure has been widely used for the treatment of dysfunctional uterine bleeding and UM.¹⁴⁻¹⁶ However, for a long time, the use of RFTA in the treatment of UM lacks standard protocol and uniform patient selection criteria, and the reported efficacy and

associated complications are also inconsistent, all of which contribute to the controversy of its application in gynecology.

In this study, we conducted a retrospective cohort analysis of RFTA-treated patients with UM in a large hospital in the past 10 years, to systematically assess the appropriate patient selection criteria, methods of treatment, efficacy, complications, and recurrence rate as well as HRQL.

Materials and Methods

Study Population

Enrollment criteria. The diagnosis of cervical and UM was based on the location of the center of myoma using color ultrasound

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and hysteroscopy. Some of the myomas were visible or had protruded into intrauterine cavity. Patients with the following conditions were included in the cohort analysis: (1) type 1 and 2 cervical submucosal myoma (≤ 6 cm) or cervical intramural myoma (≤ 4 cm), (2) type 0 to 2 uterine submucosal myoma (≤ 5 cm), (3) uterine intramural myoma (≤ 6.0 cm), if there is more than 1 myoma and the largest one has a diameter of 5 cm, the rest of the myomas should be less than 3 cm and the total number of myomas should be ≤ 4 , and (4) single intramural myoma ≤ 4 cm in nulliparous female. Patients with significant acute gynecological inflammation, precancerous lesions (atypia), cancer, subserosal myoma located outside of uterine contour, severe heart, lung, liver, and brain diseases, and nulliparous women with multiple myomas or a single myoma ≥ 4 cm were excluded.

The final cohort included 1216 consecutive patients treated in our hospital from July 2001 to July 2011. The percentages of patients with type 1, type 2 cervical submucosal myoma (≤ 6 cm), and cervical intramural myoma (≤ 4 cm) were 6.3% (76 of 1216), 4.7% (57 of 1216), and 7.5% (91 of 1216), respectively. The percentages of patients with type 0, 1, and 2 uterine submucosal myoma (≤ 5 cm) were 11.8% (144 of 1216), 16.2% (197 of 1216), and 19.7% (240 of 1216), respectively. The percentages of patients with uterine intramural myoma (≤ 6.0 cm) and with more than 2 types of myoma were 22.6% (275 of 1216) and 11.2% (136 of 1216), respectively. To assess the impact of patients' menopause condition on the treatment effect, the patients were divided into 2 groups. Group A consisted of 476 premenopause women with average age of 36.5 ± 8.5 years (range 24–47), and group B consisted of 740 menopausal women with average age of 48.5 ± 3.5 years (range 45–53). All patients had results of cervical cytology (ThinPrep cytologic test), hysteroscopy, endometrial curettage pathology, and HRQL prior to the RFTA treatment.¹⁷ The average posttreatment follow-up was 36.5 ± 11.5 months. All patients provided written informed consent, and the study was approved by the hospital's institutional review board.

Radiofrequency thermal ablation treatment device. We used the Compton BBT-A gynecological RF therapy device (Wuhan BBT Medical Tech Co, Ltd, China; SFDA registration number 2003-3250163) and Compton XVC-III gynecological RF therapy device (Wanzhi Electronics Co, China; SFDA registration number 2005-3250848). The coagulator has been shown in our previous study.¹⁸ Technical and operational parameters were set as follows: $220 \text{ V} \pm 10\%$, $50 \text{ Hz} \pm 2\%$, $p \leq 60 \text{ W}$, $I < 2 \text{ A}$, $600 \text{ kHz} \pm 15\%$, and power setting at 40 W. Temperature is adjustable (60°C – 80°C).

Anesthesia. Diet was prohibited 4 hours before the anesthesia for all patients. The patients assumed a lithotomy position and after conventional vulva vaginal disinfection the patients were given fentanyl citrate (0.05 mg) and einmal propofol (1%, 2.0 mg/kg) intravenously 5 minutes before the procedure by an anesthetist with proper blood pressure, heart rate, and SpO_2 monitoring. Once the patient fell asleep, disappearance of eyelash reflex was confirmed within 2 to 4 minutes. If the RFTA procedure took more than 5 minutes, another 50 mg propofol was given.

Radiofrequency thermal ablation procedure. The standard procedure is first to treat the myomas in the posterior wall of uterine body, followed by the side wall and the anterior wall of uterine body. Once the cervix was located, the coagulator was delivered to the bottom of the uterine cavity according to preoperative hysteroscopy for submucosal myomas, or to the nearest point from the center of uterine intramural myoma, and slowly inserted into the center of myoma under the guidance of color ultrasound imaging (Terason 3000 Ultrasound System; Terason, Burlington, Massachusetts). The position of coagulator was further confirmed by ultrasonic longitudinal and cross-sectional observation. Once the device was turned on, tumor tissue within 1 to 2 cm of coagulator tip gradually changed into dense echo on ultrasound imaging due to thermal coagulation, which then became the indicating point to approach another part of the tumor if the myoma is large. The device stopped automatically after 20 to 60 seconds. No more than 4 myomas were treated every session. For large myoma, after the center was completely coagulated, the procedure was performed at 5 to 6 locations around the center (above, below, left, right, front, and back) before complete coagulation was achieved.

Postoperative care. Patients were closely monitored for vaginal bleeding, abdominal pain, uterine perforation, and other potential complications within the first 24 hours after RFTA procedure. The perforation was suspected if patient developed intraoperative or postoperative hematuria and severe abdominal pain with peritoneal irritation sign. X-ray, CT scan, or cystoscopy was then performed immediately to confirm the diagnosis. If the bowel or bladder perforation was diagnosed, the patient underwent emergent abdominal surgery. Medications or appropriate treatments for uterine spasm, inflammation, and anemia were also provided as needed. Patients were discharged after 24 to 48 hours of observation with detailed instructions of posttreatment care and follow-up schedules.

Evaluation for RFTA. The diameter and volume of myoma were measured by ultrasound. $\text{Volume} = 4/3 \times \pi \times \text{radius}^3$ (the globe design formula). The percentage of volume reduction = $(\text{baseline diameter of myoma}^3 - \text{diameter of treatment area}^3) / \text{baseline diameter of myoma}^3$. For intramural myoma, diameter reduction $\geq 50\%$ or volume reduction $\geq 87.5\%$ and lack of symptoms (menorrhagia, dysmenorrhea, rectum/bladder bulk) at 3 months after the treatment was categorized as cure; diameter reduction between 30% and 50% or volume reduction between 65.7% and 87.5%, along with symptom alleviation, was categorized as significantly effective; diameter reduction between 10% and 30% or volume reduction between 27.1% and 65.7%, along with symptom alleviation, was categorized as effective; diameter reduction $< 10\%$ or volume reduction $< 27.1\%$ was categorized as failure. For submucosal myoma, removal of myoma and elimination of symptoms was categorized as cure, diameter reduction between 50% and 80%, accompanied with significant improvement of symptoms, was categorized as significantly effective, diameter reduction between 20% and 50% was categorized as effective, and diameter reduction $< 20\%$, no improvement in symptoms, was categorized as failure. The effective rate for the

treatment is the sum of cure, significantly effective, and effective rates. For patients with ~2 to 4 myomas, the treatment effect was analyzed according to the largest myoma.

Follow-up. Regular ultrasound examination was performed at 1, 3, 6, 12, and 24 months after RFTA and annually thereafter, up to 60 months. The HRQL questionnaire was surveyed at 6 and 12 months after the treatment.

Data analysis. Statistical analyses were performed using SPSS (Version 13.0). A repeated measures test was used for continuous outcomes such as myoma diameter, volume, hemoglobin level, and HRQL score. Categorical outcomes were analyzed using χ^2 test. $P < .05$ was deemed to be statistically significant.

Results

Study Population and Baseline Characteristics

In group A, the number of myomas per patient ranged from 1 to 3, average 1.7 ± 0.9 . Average myoma diameter was 4.5 ± 1.5 cm (range 3.1–6.0) and average volume of myoma was 47.6 ± 29.5 cm³ (range 15.6–113.0) at baseline. Clinical symptoms mainly comprised menorrhagia-associated anemia (62.8% [295 of 476], hemoglobin 73.3 ± 20.5 g/L), dysmenorrhea (43.7%, 206 of 476), and rectum or bladder bulk symptoms (27.5%, 131 of 476). In group B, the number of myomas per patient ranged from 1 to 4, average 2.6 ± 1.3 . Average diameter and volume of myoma were 5.0 ± 2.5 cm (range 3.0–7.5) and 65.4 ± 47.7 cm³ (range 14.1–220.8), respectively, at baseline. Mean blood hemoglobin was 79.5 ± 20.5 g/L; 39.6% (293 of 740) patients had dysmenorrhea and 34.5% (255 of 740) had rectum or bladder bulk symptoms. The results of cervical cytology showed 72.9% (347 of 476) in group A and 79.6% (589 of 740) in group B were negative for cervical intraepithelial lesion; 27.1% (129 of 476) in group A and 20.4 (151 of 740) in group B were atypical for squamous cells of undetermined significance, which were later verified as inflammation by cervical biopsy. The endometrial curettage pathology showed menstrual period endometrium in 64.3% (306 of 476) and 18.9% (140 of 740) of patients, and simple endometrial hyperplasia (without atypia since it was one of the exclusion criteria in this study) in 35.7% (170 of 476) and 49.3% (365 of 740) of patients in group A and B, respectively, and atrophic endometrium in 31.8% (235 of 740) of patients in group B. The patients who also had complicated with simple endometrial hyperplasia were treated with 2 RFTA ablation procedures according to their menopausal condition.¹⁸ These patients no longer needed medications (such as progestins) after RFTA, and their long-term outcome was confirmed to be effective in both the groups.¹⁸

Effectiveness on Reducing the Size of Uterine Myoma

At 1, 3, 6, 12, and 24 months after RFTA, the average reduction in myoma diameter was 3.8, 3.0, 2.7, 2.4, and 2.2 cm, and the average volume reduction was 39.8%, 70.4%, 78.4%, 84.8%,

and 88.3%, respectively, in group A. In group B, the diameter reduction was 4.7, 3.7, 3.3, 2.3, and 2.3 cm, and the volume reduction was 16.9%, 59.5%, 71.3%, 90.3%, and 90.3%, respectively. Statistical analysis showed that except at 1-month follow-up, reductions in the myoma diameter and volume were significant in both groups at 6, 12, and 24 months follow-up after RFTA ($P < .01$; Figure 1).

In group A, about 47.7% (227 of 476) patients had myoma remaining (significantly reduced tumor with irregular boundaries, heterogeneous echo, indicating fibrotic nodules with possible calcification) ≤ 1.5 cm (equivalent to volume reduction of 96.3%) on the image at 12 months after RFTA. In group B, 58.8% (435 of 740) of patients had myoma remaining at 12 months after the treatment, significantly higher than group A ($P < .05$). In both groups A and B, the tumor continued to shrink from 3 to 6, 12 months after RFTA ($P < .05$), but there was no significant change at 12 and 24 months after RFTA. Hemoglobin levels also improved for both the groups, insignificantly at 1-month follow-up ($P > .05$) but statistically significant at later months ($P < .05$; Table 1).

The Comparison of HRQL Before and After RFTA

At baseline, there was no significant difference between groups A and B on HRQL ($P > .05$). At 3 and 12 months after RFTA, HRQLs were higher than baseline in both the groups ($P < .05$, $P < .01$), and HRQL at 12 months after RFTA was also higher than that in 3 months in both the groups ($P < .05$). In group A, the physical function scores of HRQL at 3 and 12 months after RFTA were all higher than those in group B ($P < .05$, Table 2).

Menopause during follow-up period. In group A, at the end of 60 months follow-up, 15.1% (72 of 476) of patients experienced menopause, while in group B, 75.8% (561 of 740) of patients experienced menopause, which was statistically higher than group A ($P < .05$).

Complications

Complications of RFTA include intraoperative bleeding, postoperative pain, vaginal bleeding, uterine perforation, and neglected and recurrent myoma. The “neglected myoma” means small myoma that is not treated due to reason such as undetected by the color ultrasound imaging. In group A, the major complications by descending order of incidence were intraoperative bleeding, postoperative pain, postoperative bleeding, myoma recurrence, myoma neglect, and pelvic infection. In group B, myoma recurrence had the lowest incidence rate (Table 3). The myoma recurrence rate at 3 months after RFTA was significantly higher in group A (10.7%, 51 of 476) than that in group B (2.4%, 18 of 740). There was no difference in the incidence of other complications between the 2 groups ($P < .05$). There were 3 cases of intestinal perforation. All had multiple intramural myomas and the initial symptom was sudden severe abdominal pain with peritoneal irritation sign, occurring within 24 hours

Table 1. Comparison of the Diameters and Clinical Symptoms of Myoma Before/After RFTA ($\bar{x} \pm s$).^a

Group	N	Baseline	1 Month	3 Months	6 Months	12 Months	24 Months
Group A	476						
Diameter of myoma, cm		4.5 $\pm$ 1.5	3.8 $\pm$ 0.4 ^b	3.0 $\pm$ 0.7 ^c	2.7 $\pm$ 0.5 ^{c,d}	2.4 $\pm$ 0.7 ^{c,d}	2.2 $\pm$ 0.4 ^{c,d}
Hemoglobin, g/L		73.3 $\pm$ 20.5	80.4 $\pm$ 17.1 ^b	86.7 $\pm$ 12.5 ^c	128.2 $\pm$ 21.4 ^{c,d}	129.3 $\pm$ 10.1 ^{c,d}	127.1 $\pm$ 13.9 ^{c,d}
Dysmenorrhea, %		43.7	27.5 ^c	25.4 ^c	11.3 ^{c,d}	7.6 ^{c,d}	6.7 ^{c,d}
Rectum/bladder bulk symptoms, %		27.5	22.7 ^b	13.5 ^c	3.6 ^{c,d}	2.5 ^{c,d}	2.5 ^{c,d}
Group B	740						
Diameter of myoma, cm		5.0 $\pm$ 2.5	4.7 $\pm$ 0.5 ^b	3.7 $\pm$ 0.9 ^c	3.3 $\pm$ 0.7 ^{c,d}	2.3 $\pm$ 0.6 ^{c,d}	2.3 $\pm$ 0.3 ^{c,d}
Hemoglobin, g/L		79.5 $\pm$ 17.6	83.4 $\pm$ 15.4 ^b	90.7 $\pm$ 9.8 ^c	129.1 $\pm$ 20.0 ^{c,d}	127.3 $\pm$ 9.5 ^{c,d}	132.1 $\pm$ 9.8 ^{c,d}
Dysmenorrhea, %		39.6	27.3 ^c	20.4 ^c	9.5 ^{c,d}	6.2 ^{c,d}	5.1 ^{c,d}
Rectum/bladder bulk symptoms, %		34.5	25.3 ^c	10.5 ^c	5.3 ^{c,d}	2.8 ^{c,d}	2.0 ^{c,d}

Abbreviation: RFTA, radiofrequency thermal ablation.

^aGroup A: childbearing age and premenopause patients, average age was 36.5 $\pm$ 8.5 years, average number of myoma was 1.7 $\pm$ 0.9 (range 1-3). Group B: postmenopause patients, average age was 48.5 $\pm$ 3.5 years, average number of myoma was 2.6 $\pm$ 1.3 (range 1-4).

^bCompare to baseline in the same group ($P > .05$).

^cCompare to baseline in the same group ($P < .01$).

^dCompare to postoperative 3-month results in the same group ($P < .05$).

Table 2. Comparison of the HRQL Scores at Baseline and 3 and 12 Months After RFTA ($\bar{x} \pm s$).^a

HRQL	Baseline		3 Months After RFTA		12 Months After RFTA	
	Group A	Group B	Group A	Group B	Group A	Group B
Physical function	57 $\pm$ 17	53 $\pm$ 14	75 $\pm$ 20 ^b	62 $\pm$ 21 ^b	84 $\pm$ 16 ^{c,d}	72 $\pm$ 19 ^{c,d}
Activity limitation	36 $\pm$ 13	49 $\pm$ 22	64 $\pm$ 25 ^b	63 $\pm$ 18 ^b	76 $\pm$ 24 ^{c,d}	73 $\pm$ 29 ^{c,d}
Pain improvement	52 $\pm$ 27	47 $\pm$ 21	65 $\pm$ 19 ^b	67 $\pm$ 22 ^b	69 $\pm$ 22 ^{c,d}	79 $\pm$ 22 ^{c,d}
Social function	54 $\pm$ 23	56 $\pm$ 21	68 $\pm$ 23 ^b	69 $\pm$ 20 ^b	77 $\pm$ 25 ^{c,d}	84 $\pm$ 24 ^{c,d}
Overall health	55 $\pm$ 28	53 $\pm$ 20	65 $\pm$ 24 ^b	69 $\pm$ 17 ^b	79 $\pm$ 26 ^{c,d}	80 $\pm$ 26 ^{c,d}

Abbreviations: HRQL, health-related quality-of-life; RFTA, radiofrequency thermal ablation.

^aLower score means lower health-related quality of life.

^bCompare to baseline in the same group ($P < .05$).

^cCompare 3-month and 12-month postoperative results in the same group ($P < .05$).

^dCompare 12-month postoperative result to the baseline in the same group ($P < .01$).

Table 3. The incidence Rates of Complications Associated With RFTA.^a

Group	N	Intraoperative Bleeding	Postoperative Pain	Postoperative Bleeding	Recurrence	Omission	Infection	Perforation
A	476	24.4% (116)	23.1% (110)	9.9% (47)	10.7% (51)	6.1% (29)	3.6% (17)	0.21% (1)
B	740	28.5% (211)	26.5% (196)	8.8% (65)	2.4% (18) ^b	8.1% (60)	5.4% (40)	0.27% (2)

Abbreviation: RFTA, radiofrequency thermal ablation.

^aIntraoperative bleeding is defined as blood loss > 100 mL; postoperative pain refers to the pain required pain medication; postoperative vaginal bleeding refers to bleeding more than the amount of normal menstrual flow at 24 to 72 hours after RFTA; omission refers to no significant shrinkage of myoma 3 months after treatment; recurrence refers to the occurrence and gradual enlargement of new myoma (≥ 3.0 cm) at other area 6 months after RFTA.

^bThere was significant difference between groups A and B ($P < .05$).

after the procedure. There was no mortality or long-term morbidity during the study period.

Discussion

In recent years, several effective endometrial ablation techniques have been developed for the treatment of severe uterine bleeding, including endometrial ablation under hysteroscopy,¹⁹ thermal balloon, or radiofrequency ablation.^{18,20-22} These procedures are generally safe and effective since the operation is in the uterine cavity, not within the myometrium. In contrast, the treatment of UM using

RFTA requires the insertion of coagulator into myometrium under the monitoring of ultrasound imaging; therefore, the operation is more difficult, and the accuracy of the insertion and successful thermal coagulation of various sizes of myomas directly affect its efficacy. Serious complications including organ perforation can occur. In addition, there is no uniform indication for the treatment of UM using RFTA, which further limits its application.¹⁴⁻¹⁶

Radiofrequency thermal ablation produces thermal effects (60°C-80°C) in lesion tissue, resulting in 3 histological changes in the myoma, that is (1) the death or apoptosis of tissue cells from thermal coagulation, (2) formation of vascular thrombosis

Figure 1. Histological examination before and after RFTA. A, The tissue section of histology of uterine myoma was acquired during transabdominal hysterectomy without undergoing RFTA. B, The tissue section of cervical submucosal myoma immediately removed after RFTA showed hyaline degeneration and necrosis due to thermal coagulation, including gyrate degenerated cell structure. C, The tissue section of a uterine submucosal myoma prolapsed from cervical canals and was removed at 48 hours after RFTA, showed local lymph cell infiltration, peripheral vascular thrombosis. $\times 40$. RFTA indicates radiofrequency thermal ablation.

from biological thermal effect in the blood vessels that supply the myoma, thus stopping the blood supply and causing ischemic necrosis and atrophy of the myoma, and (3) inactivation of the estrogen and progesterone receptors and nerve within the myoma by thermal effect and preventing tumor tissue from growing.²¹

Based on the analysis of a large patient cohort, our study helped define the indication of RFTA in the treatment of UM and confirmed the safety and efficacy of RFTA when used according to the desired indication. This is the unique contribution of this study. For larger myoma or more complicated cases, RFTA may not be effective and the risk of complications may also increase; therefore, surgical resection or other therapy may be more appropriate.

In addition, we also analyzed the impact of patient' age on the effectiveness of RFTA. Patients were divided into 2 groups based on the menopause status and the effects of RFTA on the shrinkage of myoma, improvement in clinical symptoms, and HRQL, and the risk of complications from the procedure was compared. The results indicated that in both groups, myomas continued to shrink at 6, 12, and 24 months after the treatment, and hemoglobin levels were also improved, insignificant at 1-month follow-up but statistically significant at later months. In group B, the percentage of patients with myoma remaining (fibrous scarring) was 58.8%, significantly higher than that in group A (47.7%), suggesting that for menopausal patients, the decreased levels of estrogen and progesterone may improve the efficacy. In addition, HRQL score at 3 and 12 months after RFTA showed significant improvement from baseline in both groups, with the highest being at 12 months. Also, physical function scores were higher in group A at 3 and 12 months compared to group B, suggesting stronger physical function in group A due to younger age.

This study not only assessed the change in diameter but also the volume of myoma to evaluate the treatment effects. The results from the posttreatment ultrasound examination indicated that it was rare for myoma to completely disappear. The best result achieved was "trace" of myoma, which is the fibrotic nodule in the muscular layer after RFTA.

The most serious complication of RFTA is organ perforation, which could be due to improper operation or complexity of multiple myomas, and can involve uterine perforation and damaged bowel, bladder, or other organs. With color ultrasound imaging, the intraoperative organ perforation could be easily identified. However, small intraoperative perforation may be missed. Therefore, if patients complain severe flank or abdominal pain after the procedure, particularly if peritoneal irritation is evident, planned perforation management procedure should be followed immediately. Intrauterine adhesions syndrome¹⁹ mostly occurs after 2 months of treatment and requires regular expansion under hysteroscopy. Remaining and continuing growth (no shrinkage or becoming larger 3 months after the treatment) of myoma are common issues of RFTA, which may be due to the deviation of radiofrequency coagulator from the center of myoma, or incomplete thermal coagulation, thus allowing certain tumor tissues to remain and continue to grow. To prevent this, when the myoma diameter is >3 cm, if the first insertion deviates from the center, the next insertion should target the other side of the myoma.

Despite these concerns, this study showed that complying with the defined indications and guided by ultrasound, a skilled practitioner could use RFTA as a safe and effective treatment approach for UM. Studies have applied magnetic resonance imaging to monitor thermal coagulation ablation and found clear boundaries around damaged tissue, which further supported the safety of this technique.^{23,24} Hysteroscopic resection is suitable for the treatment of types 0 and 1 submucosal myoma but not type 2.^{25,26} On the contrary, RFTA can be considered for submucosal myoma of all types (≤ 5 cm). The disadvantage of RFTA for the treatment of UM is the difficulty to perform pathological examination, which could be considered in the posttreatment follow-up. Further comparative study of hysteroscopy versus laparoscopy in the management of intramural fibroid is warranted.²⁷

Authors' Note

The funding source had no role in the study design, the collection and interpretation of the data, writing of the report, or decision to submit this article for publication.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following no financial support for the research, authorship, and/or publication of this article: The study was funded by the Jinan Military General Hospital and Department of Health.

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