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# Laparoscopic Radiofrequency Thermal Ablation for Uterine Adenomyosis

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## ABSTRACT

**Background and Objectives:** Symptomatic uterine adenomyosis, unresponsive to medical therapy, is a challenging condition for patients who desire to preserve their uterus. This study was an evaluation of the feasibility and efficacy of laparoscopic radiofrequency thermal ablation of symptomatic nodular uterine adenomyosis.

**Methods:** Fifteen women with symptomatic nodular adenomyosis, who had no plans for pregnancy but declined hysterectomy, underwent radiofrequency thermal ablation. Ultrasonography was performed at baseline and at postoperative follow-ups at 3, 6, 9, and 12 months. The impact of uterine adenomyosis–related symptoms was assessed according to the visual analog scale.

**Results:** The median number of nodular lesions treated per patient was 1 (range, 1–2). The median baseline volume of the adenomyosis area was 60 $cm^3$ (range, 18–128). The median reduction in volume was 32, 49.4, 59.6, and 65.4% at 3, 6, 9, and 12 months, respectively. A significant progressive improvement in the symptoms score was observed at the 4 follow-ups.

**Conclusion:** In this study, laparoscopic radiofrequency thermal ablation reduced uterine adenomyosis–related symptoms and volume, with significant relief of symptoms.

**Key Words:** Ablation, Adenomyosis, Dysmenorrhea, Laparoscopy, Radiofrequency

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## INTRODUCTION

Adenomyosis is defined as the benign invasion of endometrium into the myometrium, producing a gradual enlargement of the uterus, with microscopic exhibition of ectopic nonneoplastic endometrial glands and stroma.[1,2] The prevalence of adenomyosis varies widely, with a mean of 20–25%.[3,4] Approximately 20% of cases of adenomyosis involve women of reproductive age (<40 years), with the remaining 80% occurring in women of late reproductive age (40–50 years).[5,6] One-third of women affected by adenomyosis are asymptomatic. In the remaining cases, the most frequent symptom is dysmenorrhea (15–30%).[7–9] The intensity of symptoms generally correlates with the extent of the disease.[10,11]

Diffuse adenomyosis of the uterus, when the whole myometrium or one of the myometrial walls is diffusely involved and the uterus is enlarged and globular, should be differentiated from nodular adenomyosis, a circumscribed nodular aggregate of benign endometrial glands surrounded by endometrial stroma with leiomyomatous smooth muscle bordering the endometrial stromal component. In most cases of nodular adenomyosis the border of the lesion merges to some degree with the adjacent myometrium. Therefore, nodular adenomyosis has poorly defined margins in contrast with leiomyoma, which compress the surrounding myometrium and have clear-cut well-circumscribed margins. The diagnosis of adenomyosis is based on transvaginal ultrasonography (TVUS) and magnetic resonance imaging (MRI). TVUS is observer dependent, but it has a sufficiently high diagnostic accuracy in clinically suspect cases.[12,13] Adenomyosis is an estrogen-dependent condition that responds to medical treatment with antiestrogenic drugs and gonadotropin-releasing hormone agonists (GnRH-a), often resulting in temporary improvement of symptoms. Unfortunately, relapse frequently occurs.[5]

Currently, hysterectomy is the only definitive treatment available. In recent decades, the demand has increased for alternative uterine sparing options to treat adenomyosis. Since 2005, radiofrequency ablation (RFA) has been proposed as an alternative to hysterectomy for the treatment of uterine fibroids.[14,15] The objective of this study was to

evaluate the feasibility and efficacy of RFA of symptomatic nodular adenomyosis.

## METHODS

Premenopausal women with symptomatic nodular adenomyosis that was unresponsive to hormonal therapy, antiinflammatory drugs, progestogens, or oral contraceptives were offered thermal ablation by RFA according to study protocol. Our inclusion criteria were women who did not desire pregnancy but absolutely declined hysterectomy. Exclusion criteria were prior uterine surgery, gynecological malignant pathology in the past 5 years, pelvic inflammatory disease, abnormal coagulation tests, breastfeeding, and current pregnancy.

All patients were informed of the potential risks and benefits of RFA and alternative surgical options, and written informed consent to the surgical procedure was obtained. Preoperative assessment included a transvaginal ultrasonographic evaluation of the number, size, and location of the nodular adenomyosis. The evaluations were repeated 3, 6, 9, and 12 months after the procedure. The impact of symptoms was assessed by asking the patients to use the visual analog scale (VAS) scale to measure the intensity of dysmenorrhea at baseline and at the 4 follow-ups. The protocol of the study was inspected and approved by the Sacred Heart Hospital of Negrar ethics and research committee. The radiofrequency (RF) delivery system (Model 1500; Rita Medical System, Mountain View, California) consisted of an RF generator operating at 460 kHz, maximum power of 250 W, and temperature range of 15 to 125°C. The generator displays the temperature of the needle tip, tissue impedance characteristics, and procedure time. The system is connected by a flexible cable to a 25-cm long 14-gauge needle, with an exposed tip (the primary electrode is named "Starburst"), and 7 extendible prongs (secondary electrodes) at the distal end (**Figure 1**). The prongs are designed to bracket the target tissue when they are deployed laterally with a manual movement that produces a spherical area of coagulative necrosis, with a maximum diameter of 5 cm. The secondary electrodes can be extracted partially or completely, according to the maximum diameter of the lesion. Four of the 7 prongs have a thermocouple on their tips, allowing real-time monitoring of the temperatures of the surrounding tissue. The RF generator produces a voltage between the active RF electrode and the dispersive electrode. The RFA of uterine adenomyomas was performed with the patient under general anesthesia. A 10-mm laparoscopic port was inserted through an umbilical incision. The histologic confirmation of adenomyosis was performed on a tissue sample obtained by needle biopsy (16-gauge, 150-mm Speedybell needle; Biopsybell Medical Devices, Modena, Italy). The needle was inserted in the area of suspected adenomyosis, coded, and sent to pathology for frozen section analysis. The tip of the RF needle was inserted in the same track as the biopsy needle and introduced within the target under simultaneous laparoscopic

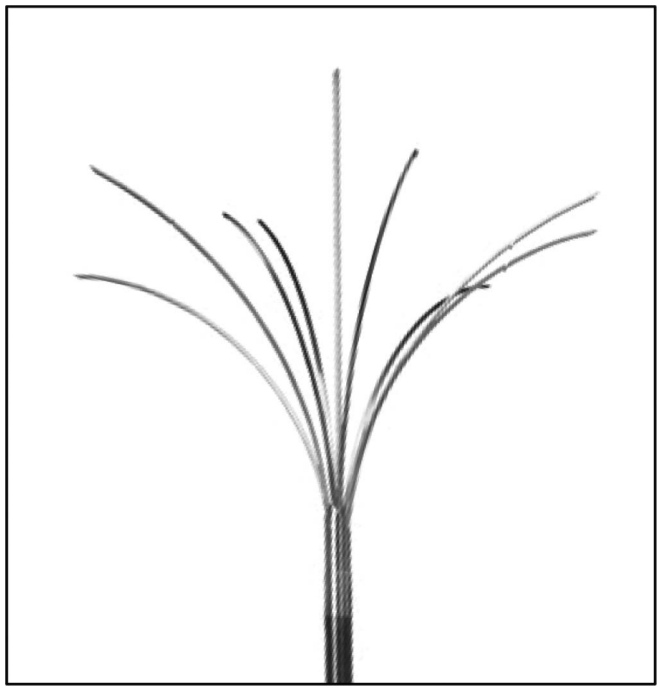

**Figure 1.** Radiofrequency needle electrode with extendible prongs, used for uterine nodular adenomyosis ablation.

**Table 1.**
Patient Demographics

| Characteristic | Data |
|---|---|
| Median age, y (range) | 40.1 (34–46) |
| Median Height, cm (range) | 165.2 (152–179) |
| Median weight, kg (range) | 64.6 (49–88) |
| State of parity, n (%) | |
| Nulliparous | 10 (67) |
| Primiparous | 3 (20) |
| Multiparous | 2 (13) |
| Hormone therapy, n (%) | |
| Oral contraceptives | 9 (60) |
| Progestogens | 4 (27) |
| Contraindications to hormone therapy | 2 (13) |

**Table 2.**
Adenomyosis Volume and Volume Reduction at 3-, 6-, 9-, and 12-Month Follow-ups

| | Baseline (n = 15) | 3 Months (n = 15) | 6 Months (n = 13) | 9 Months (n = 11) | 12 Months (n = 10) |
|---|---|---|---|---|---|
| Adenomyosis volume ($cm^3$) | 60 | 40.8* | 30.3* | 24.2* | 20.8 |
| Volume reduction (%) | 0 | 32* | 49.4* | 59.%* | 65.3 |

*$P < 0.01$ vs previous ultrasonography.

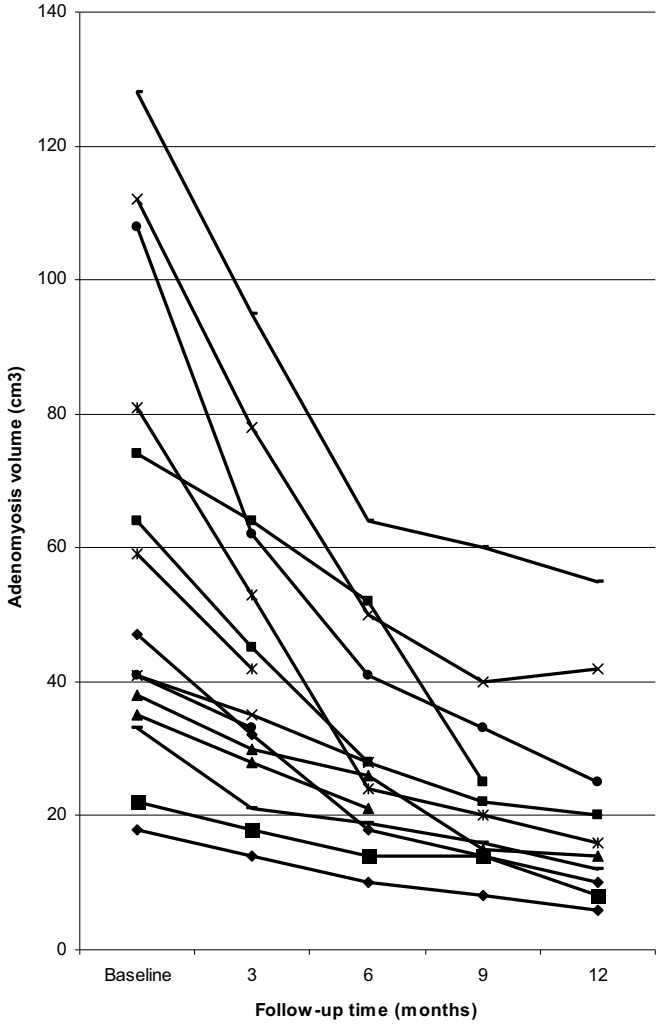


**Figure 2.** Changes in the volume of the adenomyosis during the follow-up after RFA.

and ultrasonographic guidance. The target temperature of the RFA was 98°C. After the treatment, the needle track was coagulated during the withdrawal of the RF device to ensure hemostasis. RFA ablation was performed on all adenomyosis nodules detected by ultrasonography. All procedures were performed by 5 of the authors (SS, GP, AE, VB, and MC). The surgical teams had a consistent experience with similar backgrounds in laparoscopic gynecologic surgery. Analysis was performed with Prism, ver. 4.00 for Windows (GraphPad Software, San Diego, California). Statistical significance was set at $P < .05$.

## RESULTS

During the study period, 23 consecutive patients were enrolled and underwent laparoscopy for suspected uterine nodular adenomyosis. Eight women were excluded because of concomitant pelvic endometriosis or histologic evidence of leiomyoma at biopsy. Patient demographics are presented in **Table 1**. The median number of nodular adenomyosis treated per patient was 1 (range, 1–2). The median baseline volume of the dominant nodular adenomyosis was 60 $cm^3$ (range, 18–128). The location of the adenomyosis was posterior in 8 (53%) cases, anterior in 4 cases (27%), and fundal in 3 cases (20%). The operative time ranged from 15 to 40 min (median, 22 min). No complications, such as bleeding or ureteral or bowel damage, occurred during or after the RFA. Two patients reported mild pelvic pain, but did not require narcotic pain medications. All patients were hospitalized overnight and discharged on the first postoperative day.

The median follow-up time was 9 months (range, 3–12). The median baseline dysmenorrhea pain VAS score was 9 (range, 7–10). The median volume of nodular adenomyosis and the median reduction of the volume during the follow-up period are shown in **Table 2**. **Figure 2** displays the volume changes of the adenomyosis after RFA. The change in dysmenorrhea pain VAS score is shown in **Table 3**. Two of 10 (20%) women who completed the 1-year follow-up period were asymptomatic, 8 of 10 patients (80%) reported VAS score ≤3.

## DISCUSSION

Various medical options have been proposed for symptomatic adenomyosis. Medical therapy, when tolerated,

**Table 3.**
Dysmenorrhea VAS Score at Saseline and 3-, 6-, 9-, and 12-Month Follow-ups

| | Baseline (n = 15) | 3 Months (n = 15) | 6 Months (n = 13) | 9 Months (n = 11) | 12 Months (n = 10) |
|---|---|---|---|---|---|
| VAS score | 9.1 | 5.4* | 3.8* | 2.9* | 2.6 |
| VAS score reduction | 0 | 40%* | 57.5%* | 68.1%* | 71.3% |

*$P < .01$ vs previous assessment.

can be useful for alleviating symptoms. However, suspension of therapy results in recurrence of symptoms.[16–18] Different approaches for symptomatic adenomyosis have been progressively introduced for patients who do not respond to medical therapy or for those with contraindications. The patient's age, symptoms, fertility desires, site and extent of lesion, and surgeon's skills should be considered in choosing the appropriate procedure.

Proposed new therapeutic options consist of endometrial ablation/resection, excision of adenomyomas, laparoscopic myometrial electrocoagulation, uterine artery ligation, uterine artery embolization, and surgery with magnetic resonance–guided focused ultrasonography (MRgFUS).

There are no evidence-based guidelines regarding the treatment of adenomyosis by minimally invasive methods, because experience is mostly based on the treatment of uterine fibroids rather than adenomyosis, and the published studies had a short follow-up.[18,19] In addition, myometrial scar healing after these procedures may be variable and this, along with reduced myometrial volume, may eventually jeopardize fertility.[15–19] Myometrial excision of nodular adenomyosis creates a wedge defect in the myometrium that is repaired by metroplasty that, depending on size, may be approached by laparoscopy, minilaparotomy, or laparotomy.[20,21] This surgical excision may encounter various problems. First, because improvement of symptoms may be transitory, subsequent laparoscopic surgery may be complicated by pelvic adhesions.[21] Second, more healthy tissue than necessary may be removed because of uncertainty in its demarcation from the surrounding normal myometrium. This may result in reduced myometrial thickness and jeopardize fertility.[22]

Myometrial electrocoagulation is a procedure performed by percutaneous insertion of an electrode into the affected tissue. This treatment was proposed for both the focal and the diffuse forms of adenomyosis.[20] However, presumably because of unclear electrical impedance of the coagulated tissue, which may lead to an incomplete treatment of the lesion, the results were found to be inferior to surgical excision.[20–24]

Laparoscopic uterine artery ligation in patients with symptomatic nodular adenomyosis seemed ineffective in reducing symptoms in a preliminary prospective study by Wang et al[25] with 40% of the patients dissatisfied with the procedure. The authors discourage the use of this procedure as a treatment option for adenomyosis.[25]

There is a small body of published data describing the use of uterine artery embolization for the treatment of adenomyosis, with an improvement of symptoms in 79–95% of cases and a reduction in uterine size of 25–42%.[26–31] Three studies demonstrated a favorable clinical response up to 1 year, but there was a considerable rate of recurrence of symptoms (42–54%) during midterm follow-up.[31–34] Moreover, severe postoperative complications including abdominal cramping, dysuria, high fever, and bladder necrosis, occurred 5 days after embolization.[32]

MRgFUS has been proposed as a noninvasive technique for treating soft tissue tumors. In recent years, this technique has been introduced for conservative treatment of uterine fibroids as an ambulatory procedure and has demonstrated precision in target coagulation, while preserving normal myometrium.[35–39]

Recently MRgFUS has been used for thermal ablation of adenomyosis in small patient cohorts with encouraging results at short-term follow-up.[38] Obviously, all 3 previous therapeutic options lacked the histologic examination of the treated tissue.

Data reported by Bergamini et al[14] and Ghezzi F et al[15] for RFA of uterine myomas under laparoscopic guidance seem very encouraging with regard to the decrease in myoma volume, reduction of symptoms, and improvement in quality of life. In these series, no intra- or postoperative complications were described, suggesting that RFA may represent an effective alternative to standard surgical procedures for the treatment of uterine myomas.[14,15]

In a case report, Carrafiello et al[40] also described the use of RFA under ultrasonographic guidance for the treatment of abdominal wall endometrioma in a symptomatic patient. The technique demonstrated effectiveness and safety in this case.

## CONCLUSIONS

The results of our pilot study suggest that RFA is a promising new surgical approach for the conservative treatment of uterine nodular adenomyosis. The small study group and the lack of midterm and long-term follow-up are major limitations of the study that do not allow us to draw definitive conclusions about the efficacy of RFA of uterine symptomatic nodular adenomyosis.

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