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Original Article

Ultrasound-Guided Percutaneous Microwave Ablation for Submucosal Uterine Fibroids

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ABSTRACT **Study Objective:** To prospectively evaluate the efficiency and safety of ultrasound-guided percutaneous microwave ablation (PMWA) in treating symptomatic submucosal uterine myomas.
Design: Self-controlled study (Canadian Task Force classification II-1).
Setting: Single center.
Patients: Twenty-two premenopausal women with 22 symptomatic submucosal uterine myomas.
Intervention: All patients underwent ultrasound-guided PMWA.
Measurements and Main Results: PMWA was performed in 22 premenopausal women with 22 symptomatic submucosal uterine myomas. Mean (SD) patient age was 42 (4.60) years (95% confidence interval [CI], 39.96–44.04). Five symptomatic submucosal uterine myomas were identified as type 0, 7 as type 1, and 10 as type 2. Contrast-enhanced ultrasound and magnetic resonance imaging were performed before and after surgery. Myoma volume, hemoglobin concentration, and scores on the UFS-QOL (Uterine Fibroid Symptom and Quality of Life) questionnaire were recorded before and at 3 and 12 months after ablation. Complications were also recorded. In all patients, therapy was completed with a single ablation. The baseline diameter of the symptomatic submucosal uterine myomas was 4.90 (1.60) cm. Mean myoma volume reduction rate was 81.46% (16.33%) (95% CI, 73.06%–89.86%) at 3 months ($p < .001$) and reached 90.00% (9.79%) (95% CI, 85.07–95.13) at 12 months ($p < .001$). At 3 months after ablation, hemoglobin concentration increased from 88.64 (21.87) g/L (95% CI, 78.94–98.34) to 123.21 (15.77) g/L (95% CI, 115.10–131.32) ($p < .001$), and remained stable at 12 months, with a value of 125.92 (14.90) g/L (95% CI, 117.98–133.86). Scores on the UFS-QOL were comparable, with normal levels observed at 1 year. No major complications were observed. Nine patients were discharged with necrotic masses.
Conclusion: PMWA seems to be effective and safe for treatment of submucosal myomas. Journal of Minimally Invasive Gynecology (2014) 21, 436–441 © 2014 AAGL. All rights reserved.

Keywords: Ablation; Leiomyoma; Microwave; Ultrasound

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Symptomatic submucosal uterine myomas are common benign gynecologic tumors that increase the incidence of abnormal uterine bleeding, heavy menstrual bleeding, and the risk of recurrent early pregnancy loss [1]. They are traditionally treated via abdominal myomectomy or hysterectomy [2]. In the 1970s, Neuwirth and Amin [3] introduced hysteroscopic myomectomy, which was soon applied to symptomatic submucosal uterine myomas. Because of increased risk of perforation and serious injury, this technique is not considered appropriate when the leiomyoma is close to the serosal layer [1]. In addition, hysteroscopic

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myomectomy has some inevitable complications including fluid overload, central nervous system disorders, uterine perforation, and gas embolism [4,5].

Recently, ultrasound-guided percutaneous microwave ablation (PMWA) has been widely used to treat symptomatic myomas and adenomyosis [6,7]. However, no studies have assessed use of PMWA to treat symptomatic submucosal uterine myomas. Thus, the present study was performed to evaluate the efficacy and safety of PMWA for treatment of symptomatic submucosal uterine myomas.

Materials and Methods

Enrollment Criteria

Twenty-two patients with 22 submucosal myomas were recruited from October 2010 to February 2013. Included in the study were women who had completed childbearing, had declined hysterectomy or other conservative treatments, and had uterine myoma–related symptoms (e.g., menorrhagia, pelvic pain, bulk pressure, or urinary frequency). Excluded were those with lack of an appropriate percutaneous access route, history of malignancy, abnormal ThinPrep cytology test results, pelvic infection, or contraindications for intravenous anesthesia. All patients were counselled about the potential risks and benefits of PMWA and possible alternative treatments, and all provided written informed consent. Approval of the PLA General Hospital Institutional Review Board was obtained for this prospective study (ratification No. 20100930-004, registration No. ChiCTR-TRC-10001119).

Patients ranged in age from 32 to 48 years (mean [SD], 42 [4.60] years), and all were Chinese. No patient had a diagnosis of adenomyosis after magnetic resonance imaging and ultrasound. According to the Harlem classification, myomas are classified into 3 types: type 0, pedunculated myomas; type 1, myomas with intramural extension <50%; and type 2, those with intramural extension >50% [8]. In the present study, 5 myomas (22.72%) were identified as type 0, 7 (31.82%) as type 1, and 10 (45.46%) as type 2. Myoma diameter ranged from 2.60 cm to 8.00 cm (4.91 [1.60] cm), and myoma volume ranged from 6.93 cm^3 to 197.74 cm^3 (68.87 [59.97] cm^3). Eleven (64.71%) type 1 and type 2 myomas had diameters >5 cm. Two parts of the UFS-QOL, including the Symptom Severity Score and Health-Related Quality of Life, were used to evaluate the effectiveness of PMWA [9].

Instruments

A microwave tumor coagulator (KY-2000 MW; Kangyou Medical Instruments Co., Nanjing, China), with a frequency of 2450 MHz and capability of continuous ultrasound microwave emission modes, was used for ultrasound. The needle antenna had a 15-gauge external diameter (1.9 mm) and was 18 cm long. The distance from the aperture of the microwave emission to the needle tip was 11 mm, and the emission aperture was 1 mm.

We used the Acuson Sequoia 512 Ultrasound System (Signature 10.2; Siemens Medical Solutions, Inc., Mountain View, CA) with a puncture-guided device and a low MI contrast-enhanced function. The frequency of the transducers ranged from 2.5 to 4.5 MHz.

Contrast-enhanced ultrasonography was performed using 2.4 mL of SonoVue medium (Bracco, Milan, Italy) before and immediately after ablation. The microbubble contrast agent was mixed with 5 mL normal saline solution and was administered via rapid bolus into the median cubital vein, followed immediately by 5 mL normal saline solution.

Preablation Preparation

Before ablation, all patients were admitted to the hospital for essential examinations including routine blood, urine and stool tests, electrocardiography, chest radiography, and contrast-enhanced magnetic resonance imaging. Ultrasonography was performed to assess the volume of the myomas. The mean diameter and volume of the myomas were calculated via ultrasound using the following formulas: *Mean diameter* = (*Length* + *Width* + *Height*)/3, and *Volume* = $4/3 \times \pi \times r^3$, where r is the mean radius at ultrasound (mean diameter/2).

Therapy

Patients were placed in a supine position. Ablation was performed using intravenous ultrasound with the patient under conscious sedation (induction with 1.0 mg midazolam, 0.05 ng fentanyl, and 1.0–1.5 mg/kg propofol; maintenance with 0.4–1.2 mg/kg/hr propofol). All ablation procedures were performed by the same physician (Z.J.), who has performed >500 PMWA procedures. Using real-time ultrasound guidance, the antenna needle was inserted into the

Fig. 1

Sketch of antenna placement. 1 = antenna; 2 = submucosal uterine myoma.