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Short Communication

High-intensity focused ultrasound ablation for diffuse uterine leiomyomatosis: A case report

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ABSTRACT

Diffuse uterine leiomyomatosis (DUL) is a rare and unique type of uterine leiomyoma which affects women of reproductive age. While treatments like medication, uterine artery embolization (UAE) and hysteroscopic myomectomy show some effectiveness, hysterectomy is currently the only known treatment capable of eliminating the symptoms of this disease. This case report demonstrates that high intensity focused ultrasound (HIFU) ablation may offer these patients a new treatment strategy that could control the symptoms of DUL and spare the uterus from hysterectomy.

1. Introduction

Diffuse uterine leiomyomatosis (DUL) is an extremely rare and unique uterine leiomyoma [1]. It features symmetrical and even enlargement of uterus and dense distribution of innumerable benign myomas in the myometrium, which could be confluent with ill-defined boundaries, ranging from a few millimeters to several centimeters in diameter [1,2]. The disease is usually found in women of reproductive age, who present with menstrual changes, dysmenorrhea, abdominal masses and pressure, and infertility. The etiology of the disease is poorly understood and it is a condition that is difficult to cure. Hysterectomy remains the standard of care for eradicating the disease. However, for those patients who have reproductive desire, it is necessary to explore an alterative treatment strategy that can preserve uterine function thus fertility. Here, we reported the result of one case of a 38-year-old DUL patient who underwent high intensity focused ultrasound (HIFU) ablation treatment.

2. Case report

A 38-year-old patient (gravida 0, para 0) was admitted to Chongqing Haifu Hospital on November 28, 2011 because of a six-year history of progressively aggravated lower abdominal pain during the menstrual period and a five-year history of menorrhagia. On the second day of the menstrual cycle six years ago, the patient developed lower abdominal pain at a score of 6 out of 10 without obvious predisposing causes for 3 days, complicated with anal tenesmus and discomfort. An ultrasound examination conducted in a local hospital revealed a uterine adenomyoma with a lesion of three-centimeter in diameter. Receiving no specific treatment, the patient was advised to follow-up with gynecologist and prepare for pregnancy. However, since the lower abdominal pain during the menstrual period was progressively aggravated as cycles continued, the patient had to take "analgesics" orally to control the pain. In the follow-up, the ultrasound examination revealed the uterus was progressively enlarged. Five years ago, menstrual volume gradually increased with many blood clots, which had a negative impact on the patient's normal work and life, but the menstrual periods and cycles of the patient showed no significant abnormity. She was subsequently diagnosed with "uterine adenomyosis" and received treatments in several hospitals. She received only symptomatic treatment instead of any other specific treatment since she had childbearing desire. Thus, the symptoms were progressively aggravated over time. The gynecological examination after admission to our hospital showed the size of the enlarged uterus was clinically corresponding to that of 5 months of gestation. The cervix is smooth and the enlarged uterus was moderate in texture, movable, its surface being smooth and free of tenderness, and no marked abnormality in its bilateral adnexa was found by palpation. The blood routine examination revealed that hemoglobin was 65 g/L. Magnetic resonance image (MRI) showed the anteversion of uterus, notably enlarged with the size of 130 * 111 * 92 mm and many myomas presented in myometrium with different size. The entire myometrium was almost pervaded with large numbers of poorly demarcated and confluent

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myomas with a maximum diameter of 4.5 cm. Contrast enhanced MRI revealed heterogeneous enhancement (Fig. 1). Based on the clinical manifestations and imaging data, the patient was diagnosed with "diffuse uterine leiomyomatosis" (DUL). In light of the patient's strong desire for childbearing thus for conserving the uterus, after multidisciplinary discussion and thorough communication with the patient, a treatment decision was made to palliate dysmenorrhea and menorrhagia with multiple sessions of HIFU ablation.

The HIFU ablation was conducted with the Mode-JC 200 HIFU Tumor Therapy System (Chongqing Haifu™ Company). Before treatment, routine bowel preparation and skin preparation were performed, and a urinary catheter was inserted to control the bladder volume with normal saline injection. The patient was positioned prone on the HIFU treatment table, with the anterior abdominal wall in contact with degassed water. The procedure was performed under conscious sedation which was administered with fentanyl combined with midazolam, the dosage of which was calculated based on the patient's body weight. The sonication power of 400 watts was delivered to the target region, the focal point was then moved to the next point when the gray scale change occurred to achieve complete ablation of the planned treatment volume. Vital signs of the patient and related side effects of the treatment were recorded. MRI was used to evaluate the treatment efficacy.

The first HIFU ablation conducted on November 30, 2011 targeted the relatively large myomas adjacent to endometrium. Magnetic resonance image (MRI) obtained one day after treatment revealed a satisfactory session of ablation (Fig. 2). At the three-month follow-up, menstrual volume was reduced by 1/3 and dysmenorrhea was completely relieved. In order to further improve the symptoms, the patient received a second HIFU treatment on March 22 and MRI confirmed a satisfactory ablation volume achieved (Fig. 3). Menstrual volume was progressively reduced to 1/2 of its initial volume and dysmenorrhea did not recur. However, since the patient's hemoglobin was not yet within the normal range, she received the third HIFU treatment on November 7, 2012 (Fig. 4). After the third treatment, menstrual volume, periods and cycles became normal, and no dysmenorrhea was complained. The intermittent follow-up magnetic resonance image (MRI) examinations revealed that uterus was progressively reduced, and anemia was progressively improved (Figs. 5–7). MRI obtained before the fourth HIFU treatment revealed the size reduction of uterus by 39% (Fig. 5). Three months later, blood re-examination revealed that the hemoglobin reached 106 g/L. The examination revealed the size of the uterus was measured at $120 \times 92 \times 75\ mm^3$ by color Doppler, a reduction of 44% of its initial size.

3. Discussion

High intensity focused ultrasound (HIFU) ablation is an emerging non-invasive technology for the treatment of benign and malignant tumors in recent years. Studies have demonstrated its safety and effectiveness in treating uterine fibroids [3,4]. However, to the best of our knowledge, there has been no report on using HIFU ablation to treat DUL. In the present study, we observed that after multiple sessions of HIFU ablation, symptoms presented in this patient with DUL such as dysmenorrhea and menorrhagia were progressively relieved; hemoglobin level gradually increased to the normal level; and the enlarged uterus was progressively reduced. No significant side effects related to HIFU ablation were observed in the patient after repeated treatments, which demonstrated the safety of HIFU ablation for this condition.

The treatment for DUL has been a tough clinical problem for clinicians. Although the possibility of pregnancy is low for DUL patients and hysterectomy could completely relieve the symptoms, those who have childbearing desire still find it difficult to accept the loss of the uterus as a consequence of the procedure. Fedele et al. [5] and Purohit et al. [6] each reported a case of DUL in which the patient had successful pregnancy and delivery after conservative medical treatment with GnRH-a, demonstrating the feasibility of conservative therapies to preserve fertility in patients with DUL. Uterine artery embolization (UAE) is also an alternative therapy for DUL. Scheurig et al. [7] performed UAE therapy on six DUL patients and five of six patients reported marked symptom alleviation. Recently, Koh et al. [8] reported seven cases of DUL whom treated with UAE, a three-month follow-up after UAE revealed that the uterine size was reduced by 50.1% in five patients, one of whom became naturally pregnant five months after UAE treatment. Hysteroscopic myomectomy is another effective conservative treatment for myomas protruding into the uterine cavity. Shimizu et al. [9] reported a case of successful pregnancy to full term delivery after six-month administration of nafarelin acetate and followed by excision of myomas via hysteroscopic myomectomy. In another report, Yen et al. [10] reported that in 5 cases of DUL removed by hysteroscopic myomectomy, 3 patients who

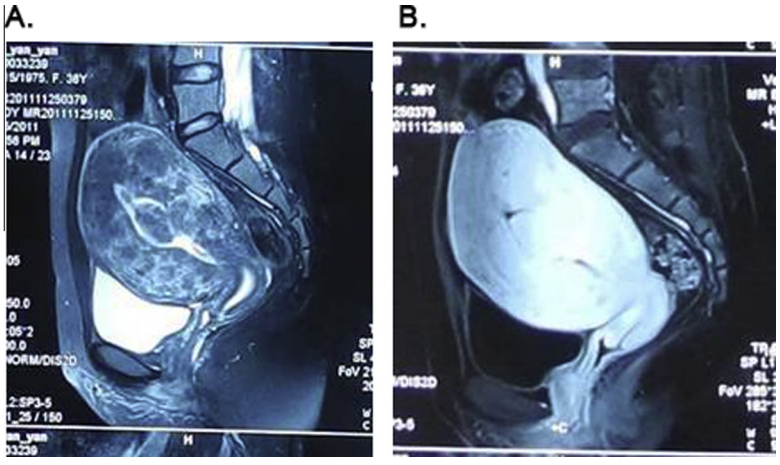

Fig. 1. Magnetic resonance image (MRI) obtained from a 38 years old patient with diffuse uterine leiomyomatosis (DUL): (A) The pre-HIFU treatment T2-weighted image showed that the uterus,130mm × 111mm × 92 mm in size, was pervaded with tumors of varied sizes in the myometrium, which mainly displayed low signal on T2 with no involvement of cervix. The size of the enlarged uterus was clinically corresponding to that of 5 months of gestation. (B) Contrast enhanced MRI revealed significant enhancement of myomas.