Uterine Artery Embolization for the Treatment of Symptomatic Fibroids

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Purpose: The aim of this study was to determine the potential usefulness of uterine artery embolization (UAE) for the management of uterine leiomyoma.

Materials and Methods: Sixty nine patients (mean age; 40.3 years, age range; 31- 52 years) who underwent UAE for symptomatic fibroids (with menorrhagia, dysmenorrhea and bulk-related symptoms) from January 2000 to December 2000 were retrospectively analyzed. The mean follow-up period was 3.5 months (range: 1- 8 months). The fibroids ranged in size from 2.0 cm to 13.2 cm with a mean size of 5.8 cm. We performed embolization using polyvinyl alcohol particles (250- 710μm). The improvement of the clinical symptoms was analyzed. Reduction of the uterine and predominant fibroid volumes was assessed using MRI.

Results: Symptom improvement for the menorrhagia (87.5%), dysmenorrhea (83.3%) and the bulk-related symptoms (79.2%) was reported. Complications included ovarian failure in four patients (5.8% of the total patients, mean age: 43.3 yrs) and infection in three patients (4.3% of the total patients) who underwent conservative management with intravenous antibiotics and analgesics. The volume reduction rate of the uterus and the predominant fibroids after uterine artery embolization were 36.3% and 56.6%, respectively.

Conclusion: UAE is a promising new treatment for symptomatic fibroids and may be a valuable alternative to hysterectomy.

Index words: Arteries, uterine  
Arteries, therapeutic embolization  
Uterus neoplasms, therapy
UAE has emerged as a viable treatment option for patients with symptomatic fibroids, and this technique is successful for controlling symptoms in 85-95% of patients (3-5). The purpose of our study was to evaluate the effectiveness and safety of UAE for its use in the management of uterine leiomyomas.

Materials and Methods

The institutional review board of our hospital gave approval for the entire study, and each patient gave us a written informed consent. A retrospective analysis was performed with the records of 69 patients who underwent UAE for leiomyoma from January 2000 to December 2000 at our institution. The mean age of the women was 42.0 years (range: 27-55 years). The mean follow-up duration was 102 days (range: 42-175 days). The symptoms related to leiomyomas were classified into three categories: abnormal bleeding (menorrhagia), pelvic pain (dysmenorrhea) and bulk-related symptoms (frequency of urination or pelvic heaviness). The women were asked to evaluate the changes of their symptoms after the procedure and also their satisfaction with the procedure and its outcomes. We classified the symptomatic outcomes of menorrhagia and dysmenorrhea as markedly improved, slightly or moderately improved, no change, or worsened as compared with the patient’s condition before the procedure. The patients’ satisfaction with the procedures and outcomes were classified as satisfied and dissatisfied. Embolization was performed through the right femoral artery approach in all patients with use of the Seldinger technique. Nonselective pelvic arteriography was done; if the entire course of uterine artery could not be evaluated, then additional internal iliac arteriography was performed. Following this procedure, both the uterine arteries were catheterized. Co-axial 3 French catheters (Tracker£¬18 Infusion Catheter, Boston Scientific, Fremont, U.S.A.) were used to get as distal as possible into the uterine arteries. Polyvinyl alcohol (PVA) particles (Contour£¬Boston Scientific, Fremont, U.S.A.) mixed with 40 mL of 1:1 saline-contrast mixture was employed as the embolizing material. The size of the PVA particles we used was 250-710 µm. Embolization was performed until there was a complete cessation of the blood flow in the ascending uterine artery with a residual flow in the lower uterine segment. The preprocedural and postprocedural follow-up (mean: 3.5 months, range: 1-8 months) contrast enhanced MRI (1.5 T Supermagnet, Magnetom Vision, Siemens, Erlangen, Germany) of the pelvis were performed for all patients. All the patients underwent axial, sagittal fast spin echo T2 weighted imaging and contrast enhanced T1 weighted sagittal images. The following imaging parameters were used for the T2 weighted imaging: (TR/TE, 3500/99; matrix 256×132; section thickness: 6 mm; intersection gap: 1.8 mm; number of excitations: 3). Enhanced MR imaging was performed 2 minute after the intravenous infusion of 10 mL of gadolinium (Dotarem[r], Guerbet, Aulnay-sous-Bois, France) and the FLASH (Fast low-Angle Shot) sequences were also taken (TR/TE, 117.3/4.1; flip angle: 80°; matrix: 140×256; section thickness: 5 mm).

We calculated the uterine and fibroid volumes by using the formula for a prolate ellipse: length×width×depth×0.5233. The ellipsoid formula was convenient to use for assessing fibroleiomyomas’ size, and this technique has been shown to be reliable for the measurement of uterine volume, as compared with more sophisticated region-of-interest methods (6, 7).

Results

The clinical symptoms and outcomes after UAE are summarized in Table 1. The maximum diameter of the dominant fibroids ranged from 2.0 cm to 13.2 cm, and the mean diameter was 5.8 cm. The most common presenting symptom was menorrhagia, and this was noted in 81.1% of the patients. Menstrual pain was observed in 60.9% of the patients. Bulk-related symptoms such as pelvic heaviness and urinary frequency were encountered in 76.8% of the patients. The menorrhagia and dysmenorrhea improved in 87.5% and 83.3% of the pa-

<table>
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<tr>
<th>Table 1. Clinical Symptoms and Outcomes after Uterine Fibroid Embolization</th>
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<td>Symptoms</td>
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<tr>
<td>Menorrhagia (n=56)</td>
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<td>Improved</td>
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<td>Dysmenorrhea (n=42)</td>
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<tr>
<td>Bulk-related symptoms (n=53)</td>
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patients, respectively. 79.2% of the patients experienced improvement of the bulk related symptoms. MR imaging revealed that the mean volume reduction rates of the uterus and the dominant fibroid were 36.3% and 56.6%, respectively [Fig. 1], as is shown in Table 2.

The increased leiomyoma signal intensity that was seen on the T1-weighted MR images obtained after embolization was thought to result from the hemorrhagic necrosis and the presence of the blood breakdown products [Fig. 2]. Pelvic pain was observed in most women after UAE. This pain was managed with intravenously administered opiates and non-steroidal anti-inflammatory drugs (NSAIDS) such as ketoprofen. No major complications requiring hysterectomy or laparotomy were observed in any of the patients. Four (6.2%) women were amenorrheic after embolization (age range: 40-46

Table 2. Reduction of the Uterine and Dominant Fibroid Volumes (Volume± standard deviation) after UFE

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<th>Pre-UFE</th>
<th>Post-UFE</th>
<th>Mean % change</th>
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<tr>
<td>Uterus</td>
<td>373.9±182.3</td>
<td>215.6±96.8</td>
<td>36.3%</td>
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<tr>
<td>Predominant Fibroid</td>
<td>99.9±87.6</td>
<td>40.3±41.7</td>
<td>56.6%</td>
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Note: Volumes are in units of cm³
UFE: Uterine Fibroid Embolization

Fig. 1. A 44-year-old woman with a broad based submucosal leiomyoma. The T2-weighted and gadolinium-enhanced T1-weighted sagittal images reveal a 7 cm sized leiomyoma and the enhancement is equivalent to that of the surrounding myometrium before embolization (A, B). After embolization, the leiomyoma is no longer enhancing and there is volume reduction of 50.7% (C, D).
yrs, mean age: 43.3 yrs). Six of the women passed their fibroids spontaneously (Fig. 3). Two patients required hysteroscopic assistance to resect the whole fibroid since the residual myomas hung about the orifice of the uterine cervix. Three (4.6%) patients were readmitted because of abdominal pain, fever, leukocytosis, a foul odor from their vaginal discharge and a high suspicion of infection of the necrotic myomas; they were treated by intravenous antibiotics and analgesia. No other clinical sequelae, either early or delayed, were documented as a result of infection. Two patients became pregnant; one patient delivered their baby vaginally and the other patient delivered their baby by elective cesarean section. Ninety-two percent of the women were satisfied with the procedure and its outcome. Ninety-five percent of the women would also recommend this treatment to others.

Fig. 2. A 54-year-old woman with an intramural myoma. The T2-weighted and gadolinium-enhanced T1-weighted sagittal images. Before embolization, an 8.3 cm sized intramural myoma is demonstrated with contrast enhancement (A, B). The angiogram obtained with using the right femoral artery approach shows the selective opacification of the right uterine artery. The fibroid vasculature of the uterus [arrows] is demonstrated (C). After embolization, the increased intensity of the leiomyoma on the T1-weighted MR image results from hemorrhagic necrosis and the presence of blood breakdown products (D). The T2-weighted and gadolinium-enhanced T1-weighted sagittal images reveal that the leiomyoma is no longer enhancing (E, F).
Discussion

Uterine leiomyomas are benign, hypervascular tumors that originate in the intramural portion of the myometrium as an abnormal proliferation of smooth-muscle cells (8). Uterine leiomyomas are the most frequent tumors of the female genital tract; they occur in 20-50% of women who are older than 40 years (9), and these tumors can cause abnormal bleeding, pelvic pain, heaviness and discomfort.

Of the over 600,000 hysterectomies performed annually in the United States, approximately 30% are performed for the treatment of uterine fibroids (2). 20-25% of women who undergo myomectomy will ultimately require an additional surgical procedure (10-12). Hormonal treatment usually fails to control the symptoms or the tumor growth after the treatment is stopped (13). UAE is gaining acceptance as an effective alternative to surgical treatment, and it successfully controls symptoms in 85-95% of patients (3-5). Overall, the mean uterine volume reduction and dominant fibroid volume reduction following UAE were 23%-48% and 43-68%, respectively (14-17).

Postembolization syndrome (pelvic pain, nausea, vomiting) is a common side effect of UAE resulting from tissue ischemia, but most of these symptoms are well controlled with conservative treatment. Other complications include ovarian failure, infection of the necrotic myomas, vaginal discharge and vaginal dryness that is related to non-targeted tissue embolization (14-17).

Uterine necrosis or infection leads to emergency hysterectomy in 1-2% of the cases. Chronic vaginal discharge is one of the frequent complications of UAE, and this results from the persistent drainage of necrotic material into the uterus. The etiology of ovarian failure is not yet clearly understood and it is likely to be a multifactorial process. The following hypotheses have been suggested. 1) The older ovary may have less functional reserve than the younger ovary and therefore, it may be more susceptible to the embolic insult of the material refluxed into the ovarian artery from the uterine artery. 2) Statistical coincidence. Because the natural rate of menopause is approximately 4% in 45-year-old women and 35% in 49-year-old women, some patients may lose their ovarian function even without fibroid embolization. 3) The studies of ovarian function after hysterectomy with sparing the ovary have demonstrated a range of early ovarian failure of 16.7-57.5% (18). There may be a role that a viable uterus plays in the normal ovarian function. Although the aftereffects of UAE on fertility have not been established, successful pregnancies have been reported after UAE (19). In our series, two patients became pregnant with one case delivering their baby vaginally and the other delivering by elective cesarean section.

Although a few studies with positive outcomes after performing UAE for fibroids have been published in the Korean literature, their preprocedural diagnoses and the volume reductions of uterus and myoma following UAE were determined by transvaginal ultrasound (20-22).

To our knowledge, this report is the largest series to de-
scribe UAE for symptomatic fibroids in Korea. Furthermore, all the patients in our series underwent both preprocedural and follow-up MRI. Ultrasonography has been the traditional imaging modality used to assess women with symptomatic fibroids, but this modality has a limited ability to detect coexistent uterine or pelvic pathology, and it typically does not identify infarcted fibroids following UAE. MRI has a high accuracy for distinguishing between fibroids and other uterine diseases such as adenomyosis, and it also has ability to characterize infarcted fibroids and to measure the uterine and fibroid volumes more accurately [23, 24].

In terms of embolic agents, PVA particles and calibrated microspheres are currently widely used. PVA particles tend to clump and form aggregates within the catheters and within the vessels. Calibrated microspheres are associated with a more controlled arterial occlusion and their use can lead to a more effective embolization. However, in a recent study of Spies et al, there were no significant differences between the outcomes of fibroid embolization with using PVA and the tris-acryl gelatin microsphere [25]. Six of our patients experienced vaginal expulsion. They presented with lower abdominal pain during expulsion, and vaginal discharge with small pieces of tissue occurred for several days to several months. After passing the myomas, all of their symptoms were resolved. The exact mechanism of transvaginal expulsion is not clear. The suggested hypothesis is that the shrinkage difference between the myoma and the myometrium following UAE forces the fibroids to be expelled.

The high rates of the women’s satisfaction (92%) and recommendation (95%) to others in our study were directly related to the improvements in their symptoms and to the reduced impact of their disease on their lives.

We concluded that UAE is a promising new treatment and it is safe and effective for treating and controlling symptomatic fibroids.

References