

# Uterine Arterial Embolization for the Treatment of Uterine Leiomyomas

Sang Wook Bai<sup>1</sup>, Jin Beum Jang<sup>1</sup>, Do Yun Lee<sup>2</sup>, Kyung Ah Jeong<sup>1</sup>, Sei Kwang Kim<sup>1</sup>, and Ki Hyun Park<sup>1</sup>

Departments of <sup>1</sup>Obstetrics and Gynecology, <sup>2</sup>Radiology, Yonsei University College of Medicine, Seoul, Korea.

**Objective:** The purpose of this study was to establish guidelines for using uterine artery embolization for the treatment of uterine leiomyomas accompanied by adenomyosis in Korea. This study was performed to investigate 1) the effects of uterine embolization on leiomyoma accompanied by adenomyosis, 2) the outcome of uterine embolization according to the embolization materials used, 3) the relationship between the Resistance Index (RI) and the change in uterine volume.

**Materials and Methods:** We performed a retrospective study on 37 women who had uterine leiomyomas accompanied by adenomyosis. Bilateral uterine artery embolization was performed over a period of 17 months in 37 patients (age range 25 - 65) experiencing pain, hypermenorrhea, urinary frequency, etc. due to leiomyomas. Ultrasound imaging was performed before the procedure and at mean 6.9 months after the procedure.

**Results:** All procedures were technically successful. Mean clinical follow-up time was 12.8 months. Minor complications occurred in 82% patients following the procedure. After follow-up imaging, the median uterine volume decreased by 34.4% and the dominant myoma volume decreased by 86%. There was no statistical difference in the uterine volume reduction and the dominant myoma size reduction, whether the occluding agent was polyvinyl alcohol, polyvinyl alcohol plus gelfoam, or gelfoam, and whether the ultrasound measured Resistance Index value before the procedure was low or high.

**Conclusion:** Primary candidates for uterine artery embolization include those with symptomatic uterine leiomyomas, who no longer desire fertility, but who wish to avoid surgery or are poor surgical risks. According to the results of our study, adenomyosis should not be considered as a contraindication for uterine artery embolization. However, because little data is available about the subsequent reproductive potential following this procedure, it should not be routinely advocated for infertile

women. Further investigation is warranted regarding the choice of occluding agent and the role of the Resistance Index.

**Key Words:** Uterine artery embolization, leiomyoma, adenomyosis, occluding agent, resistance index

## INTRODUCTION

Uterine leiomyoma is the most common benign gynecologic tumor which is dependent on estrogen, but its pathogenesis is not clear. 40% of women over 40 years old have leiomyoma and the incidence is 3.9 times higher in African, and Hispanic women than in western women. Usually, it regresses spontaneously after menopause and sometimes it causes dysmenorrhea, menorrhagia and anemia. The overall effect of leiomyoma may be to cause urologic, or neurological symptoms. Furthermore, it may also be the cause of infertility and abortion.<sup>1</sup>

The main treatment for leiomyoma is hysterectomy. In the United States of America, 600,000 cases of hysterectomy are performed annually and in the United Kingdom, 73,000 cases of hysterectomy are performed annually. 25 - 30% of all hysterectomies can be attributed to leiomyoma and total abdominal hysterectomy is the procedure which is generally performed worldwide. In the case of abdominal hysterectomy, 7-10 days of hospitalization and 2-3 months of recovery are required. Various kinds of complications may arise and sometimes transfusion is required. Therefore, many kinds of alternative treatments for saving the uterus have been proposed.<sup>1-3</sup>

Gonadotropin Releasing Hormone-Analogue (GnRH-a) reduces the size of the leiomyoma, but this is reversible after treatment. Thus, it has only

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Reprint address: requests to Dr. Sang Wook Bai, Department of Obstetrics and Gynecology, Yonsei University College of Medicine, C.P.O. Box 8044, Seoul 120-752, Korea. Tel: 82-2-361-5490, Fax: 82-2-313-8357, E-mail: swbai@yumc.yonsei.ac.kr

been used in a limited number of patients.

Since uterine artery embolization for leiomyoma was introduced in 1995, it has been used for the treatment of uterine leiomyoma worldwide. However, few results have been reported concerning the effects of uterine artery embolization on leiomyoma accompanied by adenomyosis and, in particular, the relative efficacy of different embolizing agents has yet to be studied.

Therefore, this study was performed in order to investigate 1) the effects of uterine embolization on leiomyoma accompanied by adenomyosis, 2) the outcome of uterine embolization according to the embolization materials used, 3) the relationship between Resistance Index (RI) and uterine volume change.

## MATERIALS AND METHODS

The study population consisted of 37 patients who had received uterine artery embolization due to uterine leiomyoma accompanied by adenomyosis, who attended the Gynecology Clinic, Yonsei University Medical Center, between May 1998 and October 2000. The existence of uterine leiomyoma accompanied by adenomyosis was diagnosed by the use of an ultrasonogram. The volume of the leiomyoma was estimated by means of an abdominal and/or vaginal ultrasonogram. The volume of the leiomyoma was calculated using the equation  $0.523 \times \text{length} \times \text{width} \times \text{height}$ .

We compared the volume change between pre and postembolization, as well as its dependence on occluding agent. We investigated the relationship between the Resistance Index (RI) in the uterine artery, which is the leiomyoma feeding vessel, and the uterine volume change.

Polyvinyl alcohol and gelfoam were used as occluding agents.

Uterine artery embolization was performed in 29 patients through the right femoral artery, and in 8 patients through the left femoral artery. A 4 French or 5 French glide cobra catheter (Terumo, Tokyo, Japan) was used for angiography. In each case, the uterine artery was embolized by microcatheter (Tracker 325, Boston Scientific, Watertown, Miami, USA). Polyvinyl alcohol (contour,

Boston Scientific, Watertown, Miami, USA) in quantity 350-500  $\mu\text{m}$  and 500-700  $\mu\text{m}$ , embolic material, was used 19 patients. Gelfoam (spongostan, Johnson & Johnson, Gargrave, UK) was used in 6 patients and 7 patients received both polyvinyl alcohol and gelfoam. After embolization, complete uterine artery occlusion was confirmed by angiography. The average procedure time was 90 minutes.

A follow up ultrasonogram was performed at an average of 6.9 months (range 4-15 months) after embolization and the total average follow up duration was 12.8 months (range 6-25 months).

The Pearson correlation coefficient and one-way ANOVA were used for statistical analysis. *p* values of  $< 0.05$  were considered significant. The SPSS statistical software package (9.00, SPSS Incor, Chicago, IL, USA) was used for this analysis.

## RESULTS

The average age of the patients was 40 years (range 25-65) (Table 1). Patients' symptoms were vaginal bleeding (57%), dysmenorrhea (24%), abdominal pain (22%), back pain (8%) and urinary symptoms (11%) (Table 2). 3 patients received pre-embolization GnRH-a, 3 patients received myomectomy before embolization, 10 patients had a contraindication for surgery due to medical illness and 5 patients received embolization for reducing the bleeding during myomectomy (Table 3). 11 patients had no gravidity, and anemia was observed in 29 patients. The average number of leiomyoma was  $1.59 \pm 0.8$ ; 22 patients had intramural leiomyoma, 1 patient had subserosal leiomyoma, 9 patients had submucosal leiomyoma and 5 patients had combined type leiomyoma.

3 patients (8%) showed no change or slightly increased uterine volume and 34 patients (92%) showed decreased uterine volume. The average volume reduction was 34.4% in patients with reduced volume and the average length reduction of leiomyoma was 86%.

There was no statistically significant relationship between uterine volume reduction and RI in the leiomyoma feeding vessel ( $r=0.389$ ,  $p=0.300$ ), or leiomyoma size reduction and RI in the leiomyoma feeding vessel ( $r=-0.253$ ,  $p=0.681$ ).

**Table 1.** Characteristics of Patients Undergoing Uterine Artery Embolization

Characteristics	
Total Number	37
Age	40.0 years (25 - 65)
Initial Hemoglobin	9.9 mg/dL (4.8 - 14)
Initial Hematocrit	30.9% (15.7 - 41.7)
Uterine Volume Reduction (In patients with reduced volume)	34%
Dominant Myoma Size Reduction (In patients with reduced volume)	86%
Duration of Follow-up Sonogram	6.9 months (1 - 28)
Duration of Total Follow-up	12.8 months (1 - 31)

**Table 2.** Current Symptoms of Patients

	Number	Percent
Bleeding	21	57%
Dysmenorrhea	9	24%
Abdominal Pain	8	22%
Back Pain	3	8%
Urinary Symptoms	4	11%
No Symptoms	4	11%

**Table 3.** Indications of Uterine Artery Embolization

	Number	Percent
High Operation Risks	10	27%
Adjuvant to Myomectomy	5	14%
Previous Myomectomy	3	8%
Previous GnRH analogue treatment	3	8%
Not documented	16	43%

There was no statistically significant relationship between uterine volume reduction, leiomyoma size reduction and RI in the right uterine artery ( $r=0.344, 0.363; p=0.210, 0.304$ ), or uterine volume reduction, leiomyoma size reduction and RI in left uterine artery ( $r=-0.469, -0.066; p=0.078, 0.857$ ) (Table 4).

There was no statistically significant relationship between the occluding agent and uterine volume reduction, or leiomyoma size reduction (Table 5).

Post-embolization symptoms was pain (79%), nausea and vomiting (25%) and fever (14%). All symptoms were relieved by the use of conservative treatments.

## DISCUSSION

Ravina et al.<sup>4</sup> first reported a 75% success rate for the use of uterine artery embolization in 16 patients with uterine leiomyoma, and Goodwin et al.<sup>5</sup> reported a 40% reduction in leiomyoma volume and a 60% reduction in leiomyoma size, after uterine artery embolization, during 6 months follow up. Ravina et al.<sup>6</sup> reported a volume reduction of 69% and Bradley et al.<sup>7</sup> reported a 50% volume reduction after uterine artery embolization.

In our study, the failure rate was 8% (3 patients). The uterine volume and the dominant

**Table 4.** Pearson Correlations between Uterine Volume Reduction (UVR), Dominant Myoma Size Reduction (MSR) and Resistance Index (RI) Changes of Myoma Feeding Vessels (MFV), Right Uterine Artery (RUI), and Left Uterine Artery (LUI)

	RI changes of MFV	RI changes of RUI	RI changes of LUI
UVR (n=36)	0.389 ( <i>p</i> =0.300)	0.344 ( <i>p</i> =0.210)	-0.469 ( <i>p</i> =0.078)
MSR (n=29)	-0.253 ( <i>p</i> =0.681)	0.362 ( <i>p</i> =0.304)	-0.066 ( <i>p</i> =0.857)

**Table 5.** Uterine Volume Reduction (UVR) and Dominant Myoma Size Reduction (MSR) after using Different Embolizing Material (Polyvinyl alcohol, polyvinyl alcohol and gelfoam, gelfoam)

	Number	Mean (%)	<i>p</i> value
UVR			
PVA	13	32.2	0.856
PVA + gelfoam	7	27.0	
Gelfoam	5	34.0	
MSR			
PVA	9	58.9	0.296
PVA + gelfoam	6	33.5	
Gelfoam	4	40.0	

leiomyoma size reduction, in patients with a reduced volume, was 34%, and 86%, respectively. Some authors have reported that 90% of patients experienced improvement with regard to dysmenorrhea and pelvic pain after embolization.<sup>5,7,8</sup>

There is some controversy surrounding the leiomyoma volume that is reported following uterine artery embolization. Bradely et al.<sup>7</sup> reported that leiomyoma with a size exceeding 25 gestational weeks was treated well by uterine artery embolization, Goodwin et al.<sup>9</sup> reported that there was no significant relationship between leiomyoma size and treatment outcome, and, after embolization, the uterine volume was reduced from 1390 cm<sup>3</sup> to 510 cm<sup>3</sup>. But Goodwin et al.<sup>10</sup> reported that the success rate for uterine artery embolization was low in large uterine leiomyoma, and McClucose et al.<sup>11</sup> reported that the failure rate was 15% in 300 patients and that the failure rate was very high when the leiomyoma size was over 8.7 cm.

The average volume reduction rate was 34% in our study and this was somewhat lower than that of leiomyoma without accompanying adenomyosis. This difference may be due to the presence of adenomyosis for which the blood supply was

different from that of leiomyoma. Smith et al.<sup>12</sup> reported the high failure rate of adenomyosis by uterine artery embolization, Goodwin et al.<sup>9</sup> reported that 3 of 5 patients who received total abdominal hysterectomy due to failure of embolization were diagnosed as having adenomyosis by pathology. Stancato-pasik et al.<sup>13</sup> reported that all patients refractory to embolization were confirmed as having adenomyosis.

However, Goodwin et al.<sup>9</sup> reported that all 3 patients with adenomyosis were successfully treated with embolization and Siskin et al.<sup>14</sup> reported that 10 of 11 patients with adenomyosis showed a 47% volume reduction after uterine embolization. Judging from our results, uterine artery embolization is a useful tool for the treatment leiomyoma accompanying adenomyosis.

The role of uterine artery embolization as a preoperative adjuvant therapy to reduce intraoperative bleeding is controversial.<sup>15</sup> Even though, the uterine artery embolization reduces intraoperative bleeding, its effect on the uterine healing process is unclear. So far, since no objective data is available, uterine artery embolization as a preoperative adjuvant therapy is not recommended.

According to our findings, there is no signifi-

cant relationship between RI and uterine volume, or size of leiomyoma. However, this may be due to the small sample size used in our study and, consequently, a further prospective randomized study needs to be done in the future.

No studies have been done concerning the relationship between the choice of occluding agents and uterine artery embolization outcome. Though not statistically significant, we noted in our study a trend toward polyvinyl alcohol plus gelfoam being less effective as an occluding agent than gelfoam or polyvinyl alcohol alone. To confirm this relationship, further studies need to be done involving a larger number of patients.

The major complications of uterine artery embolization are postoperative pain and fever. Abulafia et al.<sup>16</sup> reported hematoma, infection, perforation of guide wire, thromboembolism, pelvic pain, and endometritis as postembolization complications. In our case, abdominal pain, nausea, vomiting and fever occurred in some patients, but these were easily treated by conservative methods.

Uterine artery embolization is indicated for the treatment of leiomyoma accompanied by adenomyosis. In the future, it will be necessary to clearly elucidate the relationship between the choice of occluding agents and the outcome of embolization by means of a study involving a larger number of patients, and to evaluate the potential of RI as a predictive factor for therapy.

## REFERENCES

1. Reidy JF, Bradley EA. Uterine artery embolization for fibroid disease. *Cardiovasc Intervent Radiol* 1998;21:357-60.
2. Liu WM. Laparoscopic bipolar coagulation of uterine vessels to treat symptomatic leiomyomas. *J Am Assoc Gynecol Laparosc* 2000;7:125-9.
3. Lee BS, Margolin SB, Nowak RA. Pifenidone: A novel pharmacological agent that inhibits leiomyoma cell proliferation. *J Clin Endocr Metab* 1998;83:219-23.
4. Ravina JH, Herbreteau D, Ciraru-Vigneron N, Bouret JM, Haudart E, Aymard A, et al. Arterial embolization to treat uterine myomata. *Lancet* 1995;345:671-2.
5. Goodwin SC, Vedantham S, McLucas B, Forno AE, Perrella R. Preliminary experience with uterine artery embolization for uterine fibroids. *J Vasc Interv Radiol* 1997;8:517-26.
6. Ravina JH, Bouret JM, Ciraru-Vigneron N, Repiquet D, Herbreteau D, Aymard A, et al. Application of particulate arterial embolization in the treatment of uterine fibromyomata. *Bull Acad Natl Med* 1997;181:233-43.
7. Bradley EA, Reidy JF, Forman RG, Jarosz J, Braude PR. Transcatheter uterine artery embolization to treat large uterine fibroids. *Br J Obstet Gynaecol* 1998;105:235-40.
8. Worthington-Kirsch RL, Popky GL, Hutchins FL Jr. Uterine arterial embolization for the management of leiomyoma: Quality-of-life assessment and clinical response. *Radiology* 1998;208:625-9.
9. Goodwin SC, McLucas B, Lee M, Chen G, Perrella R, Vedantham S, et al. Uterine artery embolization for the treatment of uterine leiomyomata midterm results. *J Vasc Interv Radiol* 1999;10:1159-65.
10. Goodwin Sc, Walker WJ. Uterine artery embolization for the treatment of uterine fibroids. *Curr Opin Obstet Gynecol* 1998;10:315-20.
11. McLucas B, Adler L, Perrella R. Predictive factors for success in uterine fibroid embolization[abstract]. SMIT/CIMIT 11th Annual Scientific Meeting. Boston, Sept. 1999.
12. Smith ST, Sewell LE, Handelsman A. A clinical failure of uterine fibroid embolization due to adenomyosis. *J Vasc Interv Radiol* 1999;10:1171-4.
13. Stancato-Pasik A, Katz R, Mitty HA. Uterine artery embolization of myomas: Preliminary results of gelatin sponge pledgets as the embolitic agent[abstract]. SMIT/CIMIT 11th Annual Scientific Meeting. Boston, Sept. 1999.
14. Siskin GP, Tublin ME, Stainken BF, Dowling K, Ahn J, Dolen EG. Bilateral uterine artery embolization for the treatment of menorrhagia due to adenomyosis. Society of Cardiovascular and Interventional Radiology 25th Annual Scientific Meeting. San Diego, March 2000.
15. Djabbari M, Denys AL, Anquetil C, Levardon M, Menu YM. Preoperative bilateral uterine arterial embolization before multiple myomectomies: Is it unusual to reduce preoperative bleeding [abstract]. Radiological Society of North American Scientific Assembly and Annual meeting. Chicago, Nov. 1999.
16. Abulafia O, Sherer DM. Transcatheter uterine artery embolization for the management of symptomatic uterine leiomyomas. *Obstet Gynecol Surv* 1999;54:745-53.