

Uterine Artery Embolization for Treatment of Uterine Fibroids

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Introduction

Uterine fibroids are by far the most common indication for hysterectomy. Bleeding, pain, pressure effect, or a combination of these symptoms may force some women with these benign tumors to have hysterectomy, but most women with these benign tumors may be monitored without intervention, and some women may be treated medically. Because many women are uncomfortable with the idea of hysterectomy, the past decade has seen increasing interest in alternatives to hysterectomy as pharmacologic and other less invasive surgical procedures have been developed.

By far, the most promising of these new approaches is uterine artery embolization (UAE), an interventional radiologic procedure which is done with the patient sedated but conscious. In this procedure, a single femoral artery is first catheterized. Then, under fluoroscopic control, the catheter is guided into one, then into the opposite uterine artery, and fine, nonabsorbable particles are injected into each uterine artery.¹⁻³

The benefits of the UAE procedure are striking: the risks of major abdominal surgery are avoided, recovery usually takes about one week (compared with six weeks for hysterectomy), and the patient is left with no scar and no psychological issues related to loss of an emotionally charged body part.

Development of UAE

Use of UAE for treatment of fibroids was first reported from France by Ravina in 1995.¹ In a 1997 meeting of the American Association of Gynecological Laparoscopists, two case series with very promising short-term results were presented.^{4,5} Also in 1997, Goodwin³ reported on UAE done in a series of 11 patients at the University of California Los Angeles (UCLA) Medical Center. In these series, after a follow-up period ranging from six months to 20 months, UAE had produced a 40%-80% decrease in mean uterine volume and a 48%-92% decrease in bleeding.^{1,3,5}

Introduction of UAE at Kaiser Permanente

After hearing these presentations, one of us (MLS), an obstetrician/gynecologist, came to believe that this new minimally invasive procedure could become an accepted treatment for fibroids, that patient demand for UAE would probably escalate, and that in this era

of aggressive marketing and the Internet, news of UAE might be disseminated as rapidly as it was for laparoscopic cholecystectomy more than a decade earlier. Both of us (MLS and AJK) felt that Kaiser Permanente (KP) should be a leader in offering this procedure to its members.

But despite our shared enthusiasm for implementing this procedure, we had entered the era of evidence-based medicine and therefore wondered whether it was reasonable to introduce into our clinical practice a new procedure for which the medical literature did not contain an extensive number of case reports nor describe any major follow-up beyond two years. For the following reasons, we concluded that this introduction would be reasonable:

- More than men, women decide on a health plan for themselves and their family.
- Having other options than hysterectomy is extremely important for many women. If KP did not offer this procedure while our competitors did, members might wish to change their health plan, an event which could cause adverse publicity in our community.
- Compared with hysterectomy, on the basis of 1) experience with UAE for treatment of obstetric hemorrhage, 2) embolization data from treating other organ systems, and 3) the limited data available on UAE for treatment of fibroids, UAE appears to result in substantially less morbidity.¹⁻⁸
- Use of interventional radiologists skilled in UAE for fibroids is advantageous because these same skills can save lives in rare cases of obstetric hemorrhage.
- Superficial analysis suggested that UAE would not increase our costs, at least in the short term.
- Permanente physicians wish to be viewed in our community as leaders in implementing minimally invasive surgical procedures.

For these reasons, one of us (AJK)—an interventional radiologist—became the radiology department counterpart to Dr Schwartz in developing UAE within KP. Dr Scott Goodwin (an interventional radiologist) and Dr Bruce McLucas (a gynecologist)—both from UCLA and both having extensive experience with UAE—were willing to share their expertise and helped us to develop UAE protocols and technical aspects of the UAE procedure. In

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July 1998, Dr Klein performed the first UAE procedure for KP in Portland, Oregon.

Kaiser Permanente Protocols for UAE

We first developed an algorithm of care and patient inclusion/exclusion criteria. We then developed a detailed document for informed consent, assembled preoperative and postoperative standing orders for UAE, and standardized the procedure for using UAE to treat fibroids in the angiography suite. We then made this material available on the KP Intranet site, sent material about the UAE procedure to all members of the obstetrics and gynecology department, and worked to gain their support for implementing the UAE procedure. We observed healthy skepticism about the wisdom of incorporating the UAE procedure into clinical practice. Initially, consensus did not exist; however, with the support of the department chiefs and with some trepidation, we proceeded to implement the UAE procedure.

Patient Selection and Care Algorithm

Initially, all patients interested in having the procedure were evaluated by Dr Schwartz; subsequently, other physicians in the obstetrics and gynecology department participated in the program. After screening the patient and reviewing the informed consent document with her, physicians contacted Dr Klein, who reviewed the case, contacted the patient, and scheduled and performed the procedure. After Dr Klein developed sufficient expertise in UAE, he trained our other interventional radiologists, who then became involved in this program. Initially, the authors tightly regulated referrals for UAE and the procedure itself; this precaution was taken for patient safety and because of our concern that any early, adverse incident could result in pressure to discontinue UAE.

Women are candidates for UAE if they have not responded to hormonal treatment (with or without invasive therapy) of symptoms related to uterine fibroids (ie, bleeding, pain, pelvic pressure) and if they desire an alternative to surgical therapy.

Women are not candidates for UAE if they have any of the following: 1) desire for future fertility; 2) poorly controlled diabetes mellitus, vasculitis, or bleeding diathesis; 3) history of pelvic irradiation; 4) active, recent, or chronic pelvic inflammatory disease; 5) rapidly enlarging uterus, especially with a single fibroid; 6) presence of fibroid on a narrow pedicle.

Informed consent is obtained from patients after we discuss with them the risks of the procedure (Table 1). Although this list of risks is lengthy, its thoroughness does not approach that of the well-conducted

preoperative conference associated with hysterectomy. A detailed conference about UAE is conducted by both the gynecologist and the interventional radiologist with the patient preoperatively. Alternatives to UAE (Table 2) are also routinely discussed with patients who are considering having UAE instead of hysterectomy for treatment of uterine fibroids.

Clinical Details of the UAE Procedure

Interventional radiologists currently do UAE as an outpatient procedure using conscious sedation, typically with midazolam and fentanyl. Patients also receive ketorolac tromethamine intravenously to relieve postoperative pain. Prophylactic antibiotics, typically cefazolin or doxycycline, are given intravenously before the embolization procedure. UAE is a sterile procedure done in the angiography laboratory by skilled interventional radiologists using angiographic techniques.

A single groin puncture with catheter placement into the femoral artery is typically all that is required. A 5-French angiographic catheter is placed via the groin and advanced over the aortic bifurcation to the contralateral internal iliac artery, and digital angiography is done to identify the origin of the uterine artery. Typically, to avoid spasm, a 3-French microcatheter is used coaxially to safely catheterize the uterine artery.

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Table 1. Partial list of risks and related information reviewed with patients contemplating UAE instead of hysterectomy

- Because UAE is a new procedure, information about its long-term risks and failure rates is lacking.
- UAE has been reported to produce 80%-90% improvement in clinical symptoms (bleeding, pain, pressure) beyond six months.^{9,10} Thus, women who demand certainty are better served by having a hysterectomy.
- Except in very unusual circumstances, UAE is inadvisable for women who wish to preserve fertility.
- Some researchers have reported a small risk that the uterus is not enlarged by fibroids but instead is enlarged by a malignant tumor (ie, uterine sarcoma).¹¹ Thus, UAE might delay diagnosis of sarcoma and consequently jeopardize survival.
- In some women, a high fever develops after UAE is done.⁹ In most cases, this fever indicates a noninfectious process and is simply the result of tissue ischemia; this phenomenon is called the "Post-Embolization Syndrome."^{2,3,9} However, in some cases, this fever is secondary to a septic process; rarely, after UAE is done, a pelvic abscess develops and necessitates hysterectomy.³ As of December 1999, one published case report of UAE described a death which resulted from postoperative sepsis.¹²
- Early menopause occurs in as many as five percent of women who have had UAE.^{7,13,14}
- UAE carries the usual risks associated with use of intravenous radiologic contrast agents.
- Several months after having UAE, some women spontaneously expel fibroids through the cervix.¹⁵

After the microcatheter has been placed deeply into the uterine artery, this vessel is carefully embolized under fluoroscopic guidance with a solution of polyvinyl alcohol particles mixed with sterile saline and iodinated radiographic contrast medium. We use particles which range from 350 μm to 500 μm in size. If necessary after embolization of the artery with particles, pledgets of an absorbable gelatin sponge may be placed via catheter to complete the embolization. The 5-French catheter is then formed into a "Waltman loop," and the catheter is placed into the ipsilateral internal iliac artery; the embolization procedure is then repeated in the right uterine artery. All catheters are then removed.

The patient is then sent to the Ambulatory Care Unit for postoperative observation and pain control. Most patients may be discharged home on the same day; some patients may require admission to the inpatient obstetrics/gynecology department for intravenous analgesia and observation. Our algorithm of care requires follow-up with pelvic examination and ultrasonography at six to eight weeks and at six months after the procedure.

Results of UAE at Kaiser Permanente

To date, we have done UAE on 29 patients. Of these 29 patients, 28 had pelvic examination and ultrasound evaluation within six to eight weeks after the procedure, six patients were evaluated three months after the procedure, nine patients were evaluated at ≥ 6 months after the procedure, 11 patients were evalu-

ated by phone at ≥ 6 months after the procedure; for six patients, six months had not yet elapsed since the procedure was done. Mean age of patients was 45.3 years (range, 33 years to 56 years). Mean pre-UAE uterine volume was 788 mL (range, 98 mL to 2366 mL). Mean pre-UAE dominant fibroid volume was 209 mL (range, 6 mL to 1021 mL). Of the 29 patients, 28 (97%) were sent home the same day as the procedure. One (3%) of the 29 patients was admitted to the hospital on the day of UAE for pain and nausea. Three (10%) of the 29 patients returned to the hospital within one to three days after having UAE; reasons for return included 1) urinary retention; 2) nausea, vomiting, and low-grade fever; and 3) pelvic pain.

In our series, clinical success—as determined by clinical follow-up examination, imaging follow-up examination, or both—was achieved for 27 of 29 patients: in these patients, fibroid-related symptoms (bleeding, pain, pelvic pressure) improved or resolved. Two (7%) of the 29 patients had clinical failures: one patient had no change in pressure symptoms and had persistent bleeding, and the other patient had temporary decrease in heavy bleeding and continuous fibroid growth after UAE. Four (13%) of the 29 patients became postmenopausal within six months after the UAE procedure.

After having UAE, patients who had follow-up using ultrasound or magnetic resonance imaging (MRI) showed a mean 36% decrease in uterine volume (range, -14% to 80%) at a mean follow-up time of 19.2 weeks (range, seven weeks to 66 weeks). Mean

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Table 2. Alternatives to UAE in women considering having UAE instead of hysterectomy for treatment of uterine fibroids	
Alternative	Comments
Hysterectomy	
Supracervical hysterectomy	Remove most of the uterus but leave cervix in place
Myomectomy	Not recommended; instead, recommend supracervical hysterectomy unless further childbearing is desired
Treatment with gonadotropin-releasing hormone agonist drug (eg, leuprolide acetate) and add-back therapy with norethindrone acetate	Because data on long-term use are lacking, discourage use of this regimen except in perimenopausal women
Treatment with a progestational agent to suppress menstruation	Use if problem is excessive bleeding secondary to fibroids
Endometrial ablation	Use if problem is excessive bleeding and endometrial cavity is not large



decrease in dominant fibroid volume was 50% (range, -1% to 92%). Our results are comparable with those reported by Goodwin⁹ at UCLA: in that series,⁹ at follow-up evaluation conducted a mean 10.2 months after UAE, mean uterine volume had decreased 43%, and mean fibroid volume had decreased 49%.

Discussion

UAE used for treatment of fibroids has received a huge amount of media attention. Many medical institutions have begun practicing UAE and are marketing their expertise in performing this procedure. Several thousand cases have now been reported (4165 cases in the United States as of early October 1999),¹⁶ and many Internet sites feature this subject. Many of these sites are advertisements in search of patients; some sites, such as the Georgetown University Web site (www.dml.georgetown.edu/fibroids/), are extremely informative sources of data. A UCLA Web site (www.fibroids.com) and the Web site of the Society of Cardiovascular and Interventional Radiology (www.scvir.org) are also objective and very informative. Increasing numbers of patients are coming to us requesting UAE on the basis of what they have been hearing in the media and reading on the Internet.

Our success rate and our rate of complications with UAE are comparable with those reported in the medical literature.^{3,9} In our series, > 95% of patients were sent home within eight hours after having the procedure (compared with approximately 67% of patients in other series³).

In our community, the Oregon Health Sciences University and KP have been leaders in implementing and gaining experience with UAE for the treatment of fibroids.

Does the current standard of care require clinicians to offer UAE to any woman who otherwise would have a hysterectomy for uterine fibroids? This is a difficult question to answer, because the community standard of care constantly changes. We suspect that this question may be resolved in the medical-legal arena. For now, we ask ourselves the following question: "Why would a conscientious obstetrician/gynecologist NOT mention the option of UAE to a woman before proceeding to hysterectomy?"

Conclusion

In our opinion, on the basis of current published data, UAE is an effective procedure for treating the symptoms related to a fibroid uterus, although more prolonged follow-up is needed before the ultimate role of this procedure can be established. We believe that all Permanente Medical Groups should

seriously consider developing expertise in this procedure and instituting UAE in their hospitals.

We would be happy to share our detailed algorithms and protocols with our colleagues, and Dr Klein would welcome visits by any of his radiologist colleagues who would like to observe the procedure. The authors may be contacted by e-mail (Martin.L.Schwartz@kp.org and kleinar@adams.mts.kpnw.org). ❖

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