A Prospective Multicenter Comparative Study between Myomectomy and Uterine Artery Embolization with Polyvinyl Alcohol Microspheres: Long-term Clinical Outcomes in Patients with Symptomatic Uterine Fibroids

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PURPOSE: To prospectively evaluate the safety and effectiveness of polyvinyl alcohol (PVA) microspheres in patients undergoing uterine artery embolization (UAE) to treat uterine fibroid tumors and to compare the long-term changes in health-related quality of life (QOL) after UAE with the changes seen after myomectomy.

MATERIALS AND METHODS: One hundred forty-six patients with uterine myomas were enrolled into this multicenter study, with 77 patients undergoing UAE with PVA and 69 patients undergoing myomectomy. Six-month follow-up was completed for the myomectomy, whereas 2-year follow-up was completed for the UAE group. Outcomes were assessed with the Uterine Fibroid QOL Questionnaire and based on adverse event incidence, time to return to normal activity, and changes in tumor symptom scores, QOL scores, and menorrhagia bleeding scores. For the UAE cohort, changes in total uterine volume and dominant tumor size on magnetic resonance (MR) imaging were assessed.

RESULTS: In the UAE cohort, 88.3% of patients experienced a reduction of tumor-related symptoms (increase ≥5 points from baseline measurement) at 6 months, with 75.4% of patients in the myomectomy group experiencing similar improvement. Median QOL questionnaire scores at 6 months were found to be significantly higher in patients treated with UAE ($P = .041$), with sustained improvement seen at 12 and 24 months. Both procedures resulted in significant reductions in 6-month menorrhagia bleeding scores, with sustained improvement in the UAE cohort at 12 and 24 months. MR imaging at 6 months revealed significant uterine and tumor volume reductions after UAE ($P < .05$). At least one adverse event occurred in 42% of patients in the myomectomy group, compared with 26% in the UAE group ($P < .05$).

CONCLUSIONS: UAE performed with PVA microspheres was associated with greater sustained improvements in symptom severity and health-related QOL and with fewer complications compared with myomectomy. Six-month MR imaging data demonstrated significant reductions in uterine and tumor volumes, although the degree of tissue infarction after UAE was not assessed with contrast medium–enhanced MR imaging.

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Abbreviations: CEC = Clinical Events Committee, PVA = polyvinyl alcohol, QOL = quality of life, UAE = uterine artery embolization

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A list of the participants in the UAE versus Myomectomy Study Group is provided at the end of this article.

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FOR the past several years, there has been an increasing amount of support in the medical literature for the use of uterine artery embolization (UAE) as a less invasive option for the treatment of symptomatic uterine leiomyomas (1–7). This procedure in general has become validated through single-center case series and multicenter clinical trials, and there has been an effort to explore refinements in technique that can further optimize the success associated with UAE. Importantly, the

most significant change in technique since the introduction of UAE has been the shift from the use of irregularly shaped polyvinyl alcohol (PVA) particles toward the use of spherical embolic agents by most centers in which this procedure is performed. Whereas all of the early literature on UAE involved irregularly shaped PVA particles as the embolic agent, recent studies have reported success associated with the use of spherical embolic agents (8–12).

The purpose of the present study was to evaluate the safety and effectiveness of a spherical embolic agent consisting of PVA (Contour SE Microspheres; Boston Scientific, Natick, MA) in patients undergoing UAE to treat symptomatic uterine leiomyomas. The secondary purpose of this study was to evaluate the outcomes after UAE performed with PVA microspheres and compare them with the outcomes after myomectomy. Most patients in the latter group were described previously by Goodwin et al (13).

MATERIALS AND METHODS

This study was a prospective, multicenter, nonrandomized, cohort-design clinical investigation that was designed to evaluate the safety and effectiveness of PVA microspheres (Contour SE Microspheres) when used in UAE for the management of symptomatic uterine tumors. This particular study represented an additional arm of a previously reported prospective cohort study that compared UAE performed with irregularly shaped PVA particles (Contour PVA Emboli; Boston Scientific) versus myomectomy (13).

The original study (13) was performed at 16 sites in the United States. The additional arm for the present study took place at seven of the original interventional radiology sites, and 10 investigational sites treated patients with myomectomy. Institutional review board approval was obtained at each site, and all patients gave written informed consent before their enrollment into the study. A total of 146 patients were included in an intent-to-treat population that was enrolled into this arm of the study over a 13-month period, with 77 patients undergoing UAE with PVA microspheres and 69 patients undergoing myomectomy. Patients were assigned to receive myomectomy or UAE on the basis of treatment decisions made by the patient after consultation with her physician according to the standard of care at each site. Patients treated in this third arm of the overall study (UAE with PVA microspheres) were compared with the same myomectomy cohort used in the additional study, with the addition of nine myomectomy procedures (13).

Six-month follow-up was completed for both groups (UAE and myomectomy), and 2-year follow-up was completed for the UAE group only. The primary endpoint in the study was an improvement in the Uterine Fibroid Quality of Life (QOL) Questionnaire score (14) from baseline to postoperative month 6 in the patients undergoing UAE. Patients were considered to have received successful treatment at 6 months after UAE if they had an increase of at least 5 points on the QOL questionnaire. This endpoint was chosen by a panel of gynecologists and interventional radiologists before the start of the study.

Several secondary endpoints were assessed 6 months after the procedures so additional comparisons could be made between the UAE and myomectomy groups. These endpoints included the following: overall adverse event rates seen in association with the two procedures, time to return to normal activity, and changes in overall tumor symptom scores, QOL scores, and menorrhagia bleeding scores (15). For the UAE cohort, changes in total uterine volume and dominant tumor size were assessed. Additional long-term follow-up at 12 and 24 months after the procedure consisted of the following: complications, tumor recurrence, symptom recurrence, menstrual bleeding questionnaire, overall tumor symptoms component of the QOL questionnaire, additional treatments, and pregnancy. These items will be followed up at 36 months as well.

Inclusion criteria for this study included patients at least 30 years of age with symptomatic uterine tumors diagnosed with a minimum of history, pelvic examination, and pelvic MR imaging. Symptoms were required to include one or more of the following: abnormal menstrual bleeding, pelvic pain, and/or bulk-related symptoms attributed to tumors (eg, abdominal bloating, gastrointestinal pressure, bladder dysfunction, vaginal pressure, rectal pressure). In addition, patients were required to have menstrual cycles within every 22–35 days, must have had normal Papanicolaou test results within 12 months, and could have not had any drug treatments for uterine leiomyomas within 3 months of the procedure (excluding hormonal contraceptive agents). In addition, patients had to be willing and able to complete the requirements for follow-up for this study.

Exclusion criteria included the presence of hysteroscopically resectable fibroid tumors, an acute pelvic infection or any acute or chronic infection outside the pelvis, a gynecologic malignancy or undiagnosed pelvic mass outside the uterus, unexplained abnormal menstrual bleeding, coagulopathy, history of pelvic irradiation, an American Society of Anesthesiologists score of at least 4, a follicle-stimulating hormone level greater than 40 IU/L measured within 2 months of the procedure, and participation in any other investigational device or drug study. Patients in the UAE group were also excluded if they expressed a desire for future pregnancy or had an abnormal serum creatinine level, uterine arteriovenous fistula, severe contrast agent allergy, or pedunculated subserosal uterine tumor (with attachment to uterus of $<30\%$ of the diameter of the tumor).

All eligible patients were asked to complete the QOL questionnaire. Any patient with a score of 90 points or higher on a scale of 0–100 was excluded unless she was planning to undergo myomectomy for infertility. Additional tools used during the preprocedural assessment included medical and gynecologic history, symptom assessment, and imaging evaluation. Laboratory evaluation for the UAE cohort included measurement of creatinine and follicle-stimulating hormone levels and pregnancy test. In the myomectomy cohort, laboratory evaluations included pregnancy test and measurement of follicle-stimulating hormone and hemoglobin.

All patients participating in this study were required to have a baseline pelvic MR imaging examination completed within 2 months before UAE or myomectomy. These studies were per-