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# Pregnancy outcomes after treatment for fibromyomata: Uterine artery embolization versus laparoscopic myomectomy

Jay Goldberg, MD,<sup>a,\*</sup> Leonardo Pereira, MD,<sup>a</sup> Vincenzo Berghella, MD,<sup>a</sup>  
James Diamond, PhD,<sup>a</sup> Emile Daraï, MD,<sup>b</sup> Piero Seiner, MD,<sup>c</sup>  
Renato Seracchioli, MD<sup>d</sup>

Departments of Obstetrics and Gynecology, Jefferson Medical College, Philadelphia, Pa<sup>a</sup>; Tenon Hospital, Paris, France<sup>b</sup>; St. Anna Hospital, Turin, Italy<sup>c</sup>; St. Orsola Hospital, Bologna, Italy<sup>d</sup>

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## KEY WORDS

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**Objective:** The objective of this study was to compare pregnancy outcomes in women with fibromyomata who were treated with uterine artery embolization to the outcomes in women who were treated with laparoscopic myomectomy.

**Study design:** We compiled data from 53 pregnancies after uterine artery embolization and 139 pregnancies after laparoscopic myomectomy. We calculated and compared rates for spontaneous abortion, postpartum hemorrhage, preterm delivery, cesarean delivery, small for gestational age, and malpresentation.

**Results:** Pregnancies after uterine artery embolization had higher rates of preterm delivery (odds ratio, 6.2; 95% CI, 1.4, 27.7) and malpresentation (odds ratio, 4.3; 95% CI, 1.0, 20.5) than did pregnancies after laparoscopic myomectomy. The risks of postpartum hemorrhage (odds ratio, 6.3; 95% CI, 0.6, 71.8) and spontaneous abortion (odds ratio, 1.7; 95% CI, 0.8, 3.9) after uterine artery embolization were similarly higher than the risks after laparoscopic myomectomy; however, these differences were not statistically significant.

**Conclusion:** Pregnancies in women with fibromyomata who were treated by uterine artery embolization, compared with pregnancies after laparoscopic myomectomy, were at increased risk for preterm delivery and malpresentation.

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Uterine artery embolization (UAE) is an increasingly popular alternative to hysterectomy and myomectomy

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\* Reprint requests: Jay Goldberg, MD, Jefferson Medical College, Department of Obstetrics and Gynecology, 834 Chestnut St, Suite 400, Philadelphia, PA 19107.

E-mail: jay.goldberg@jefferson.edu

as a treatment for uterine fibroid tumors. We recently published a study that compiled data and calculated risks for pregnancies after UAE. In that paper we concluded that: "Before uterine artery embolization can be regarded as a safe procedure for women desiring future fertility, additional studies must be performed. Based on limited data, women becoming pregnant after UAE may be at significantly increased risk for postpartum hemorrhage, preterm delivery, cesarean delivery,

and malpresentation.”<sup>1</sup> In that study, complication rates were compared with the general population, rather than to patients who had undergone myomectomy previously. The aim of the present study was to compare pregnancy outcomes in women with fibroid tumors who treated by UAE to the outcomes of women who were treated by laparoscopic myomectomy (LM), another increasingly popular minimally invasive treatment for symptomatic uterine fibromyomata with similar hospitalization and recovery times.

## Material and methods

We recently reported data for all reported cases of pregnancy after UAE.<sup>1</sup> In that publication, the MeSH terms “uterine artery embolization,” “embolization,” and “pregnancy” were used to check Medline for all published reports of pregnancies after UAE. All articles were checked for related references. We attempted to contact all authors to verify data, collect additional information, and add recent cases. Only cases in which UAE was performed for fibromyomata were included in this study. Of the 50 pregnancies in our previously published series, 12 pregnancies were excluded because UAE was performed for indications other than uterine fibroid tumors, including arteriovenous malformation, gestational trophoblastic disease, cervical pregnancy, placenta previa, placenta accreta, and placental abruption. We excluded 1 pregnancy that was terminated electively in the first trimester and 3 other pregnancies because of a lack of available data, which left 38 pregnancies from our original series. Through direct contact with authors, we were able to obtain data on 15 previously unpublished additional cases. We included a total of 53 pregnancies after UAE in this study.

We also obtained data for cases of pregnancy after LM through a Medline search using the MeSH terms “laparoscopic myomectomy,” “myomectomy,” and “pregnancy.” We similarly checked all articles for related references. We identified 3 of the largest previously published series of pregnancies after LM.<sup>2-4</sup> We then contacted the principal author of each series to obtain specific information on each pregnancy. We therefore included a total of 139 pregnancies after LM in this study. Each collaborating author previously obtained Institutional Review Board approval for their series at their respective institutions.

Sociodemographic data (such as patient age) were available for 96% of cases. Data on fibromyoma size were available for 74% of cases. We then determined the rates of 6 different pregnancy complications: spontaneous abortion, postpartum hemorrhage, preterm delivery (<37 gestational weeks), cesarean delivery, small for gestational age, and malpresentation. We obtained complete outcome data for 98% of the cases that were

included in this study. We derived the denominators that were used for each pregnancy complication in the following manner: We based the rate of spontaneous abortion on the total number of spontaneous abortions divided by the total number of pregnancies, excluding ectopic pregnancies and voluntary terminations. We based the rates of preterm delivery, small for gestational age, malpresentation, cesarean delivery, and postpartum hemorrhage on the total number of complications divided by the total number of singleton pregnancies, excluding spontaneous abortions, ectopic pregnancies, and voluntary terminations. We used SAS statistical software (version 8.1; SAS Institute Inc, Cary, NC) for data management and descriptive analyses. We used Fisher’s exact test for statistical analysis. We set 95% confidence intervals at 0.95 and type I error at 0.05 (2-sided). We compared the rates of pregnancy complications after UAE and LM.

## Results

We compiled a total of 139 pregnancies after LM from the 3 separate series.<sup>2-4</sup> In 2 of the studies,<sup>2-3</sup> patients who desired future fertility were followed prospectively after undergoing LM. In the series of 44 cases from Paris by Daraï et al,<sup>2</sup> patients who underwent LM had a history of infertility that lasted a mean of 32 months and had a mean of 1.5 fibroid tumors, with the largest tumor measuring 5.4 cm. In the series of 54 cases from Turin by Seiner et al,<sup>3</sup> patients had a mean of 1.2 fibroid tumors, with the largest measuring 3.9 cm, one half of which were intramural. In the third series, 66 cases from Bologna studied by Seracchioli et al,<sup>4</sup> patients were randomized prospectively to either laparoscopic or abdominal myomectomy. All patients from this series had at least 1 large myoma ( $\geq 5$  cm); of these patients, 47.1% of the cases were intramural. Only patients who conceived after LM were included in our study. There were no uterine ruptures reported in the 3 series.

We included a total of 53 patients with pregnancies after UAE in this study. Of this total, 31 patients (58%) were from the collective experience of Ravina et al in France. Individual characteristics of most of these pregnancies have been previously reported.<sup>1</sup>

Patients who received UAE had a higher mean age ( $37.6 \pm 4.4$  [SD] years) than those patients who underwent LM ( $34 \pm 3.9$  years;  $P = .001$ ; Table I). Patients who received UAE also had a higher median parity ( $0.50 \pm 0.5$  vs  $0.15 \pm 0.4$ ;  $P = .001$ ). Patients who underwent LM had, on average, smaller fibromyomata than those patients who received UAE ( $5.4 \pm 2.4$  cm vs  $8.2 \pm 3.3$  cm;  $P < .001$ ).

We compared pregnancy complication rates after UAE for fibromyomata, after LM, and in the general population (Table II).<sup>5,6</sup> The calculated odds ratios refer to the rates of pregnancy complications after UAE

compared with LM. We calculated the rate of spontaneous abortion by dividing the number of spontaneous abortions over total pregnancies, excluding 3 ectopic pregnancies, 4 therapeutic abortions, and 1 pregnancy in which no outcome data were available (2 of the pregnancies were in the UAE group, and 6 of the pregnancies were in the LM group). This left 51 cases in the UAE group and 133 cases in the LM group (Table II). We based the denominator for the remaining 5 complications on the total number of singleton pregnancies, excluding 8 multiple gestations, 32 spontaneous abortions, and 5 ongoing pregnancies (16 pregnancies in the UAE group, and 29 pregnancies in the LM group). This left 35 cases in the UAE group and 104 cases in the LM group. For the calculation of preterm birth rate, we excluded 3 additional cases with unknown gestational age at delivery from the UAE group. For the calculation of small for gestational age, we excluded an additional 22 cases because of lack of birth weight data (13 pregnancies from the UAE group, and 9 pregnancies from the LM group).

Compared with pregnancies after LM, those pregnancies after UAE for fibromyomata had statistically greater risk of preterm delivery (odds ratio, 6.2; 95% CI, 1.4, 27.7) and malpresentation (odds ratio, 4.3; 95% CI, 1.0, 20.5). The 6% risk of postpartum hemorrhage and 24% risk of spontaneous abortion after UAE, respectively, were 6 and 1.7 times higher than the 1% and 15% risks after LM; but these differences were not statistically significant (odds ratio, 6.3; 95% CI, 0.6, 71.8; and odds ratio, 1.7, 95% CI, 0.8, 3.9). Rates of small-for-gestational-age birth weights did not differ among the UAE group (5%), the LM group (8%), and the general population (10%). In the UAE (63%) and LM (59%) groups, cesarean delivery rates were similar. Both groups had an increased risk of cesarean delivery compared with the general population (25% in the United States).

## Comment

Although no long-term studies have been published, UAE appears to be an effective treatment for symptomatic uterine fibroid tumors. Spies et al<sup>7</sup> reported improvement at 1 year for heavy bleeding in 90% of patients and bulk symptoms in 91% of patients. The prognosis for women who desired future fertility is less clear.

In this study, we found an increased risk of preterm delivery and malpresentation in pregnancies after UAE compared with LM. For these reasons, LM may be preferable for reproductive age women with symptomatic fibromyomata who are contemplating future pregnancies.

Malpresentation (including frank breech, complete breech, single and double footling breech, compound

**Table I** Comparison of characteristics of pregnant women with previous UAE and LM for fibroid tumors

Variable	UAE*	LM*	P value
Age (y)	37.6 ± 4.4	34.2 ± 3.9	.001
Parity (median)	0.5 ± 0.5	0.2 ± 0.4	.001
Largest myoma size (cm)	8.2 ± 3.3	5.4 ± 2.4	<.001

\* Data are given as mean ± SD.

presentations, and oblique and transverse lie) and preterm delivery are complications that are associated with uterine fibromyomata. Although UAE is effective at decreasing fibromyoma size and improving symptoms, it does not eliminate the presence of uterine fibromyomata entirely. Residual fibromyomata after UAE may still distort the shape of the uterine cavity and affect implantation. This distortion may account for the higher rates of preterm birth and malpresentation that are associated with UAE compared with both LM and the general population. Additionally, effects that embolization has on the pliability and ability of the myometrium to stretch and the mechanisms that initiate labor may have significant influence on the increased rate of preterm delivery.

Physicians must take into consideration that the cesarean delivery rate was affected largely in both groups by elective cases, rather than intrapartum complications. Aggregate data in both groups were neither prospective nor randomized. Outcomes, postpartum hemorrhage, and small-for-gestational-age were not defined strictly but were based on each author's report.

A limitation of this study was that we combined the results of multiple separate case series and reported aggregate outcomes. The populations that we were comparing were different in terms of demographic data and medical/surgical treatment. We could not account for this heterogeneity in our statistical analysis.

As previously mentioned, the 2 groups differed in several demographic parameters. Women who underwent UAE were older and had larger fibromyomata; those women who underwent LM were more likely to be nulliparous. Initial fibromyoma locations, which were unavailable for comparison, may have also differed between the groups. Laparoscopic myomectomies were performed for mainly subserosal and intramural leiomyomata, although UAE may also be performed to treat submucosal tumors. We do not know to what degree these factors could have confounded the results.

The FIBROID Registry, the largest prospective study to date that evaluates the cases of women who undergo UAE, closed enrollment in 2002 with 3154 subjects; however, only 130 (4%) of these subjects stated that they definitely planned to attempt pregnancy within 2 years of the procedure (Evan Myers, FIBROID

**Table II** Complications in pregnancies after UAE and LM for fibroid tumors

Complication	General population(%)	UAE(n/N)	LM(n/N)	Odds ratio	95% CI	P value
Spontaneous abortion	10-15	12/51 (24%)	20/133 (15%)	1.7	0.8-3.9	.175
Postpartum hemorrhage*	4-6	2/35 (6%)	1/104 (1%)	6.3	0.6-71.8	.093
Preterm delivery*	5-10	5/32 <sup>†</sup> (16%)	3/104 (3%)	6.2	1.4-27.7	.008
Cesarean delivery*	22	22/35 (63%)	61/104 (59%)	1.2	0.5-2.6	.662
Small for gestational age*	10	1/22 <sup>§</sup> (5%)	8/95 <sup>§</sup> (8%)	0.5	0.1-4.4	.541
Malpresentation*	5	4/35 (11%)	3/104 (3%)	4.3	1.0-20.5	.046

\* Calculations were based on the number of singleton pregnancies that continued past 20 weeks of gestation.

<sup>†</sup> Excludes 3 patients with unknown gestational age at delivery.

<sup>§</sup> Excludes 13 UAE patients and 9 LM patients with no birth weight data available.

Registry, Duke University, personal correspondence, October 2, 2003).

Based on the limited available data, pregnancies after UAE, compared with those pregnancies after LM, may be at increased risk for preterm delivery and malpresentation. Women who seek treatment for fibromyomata and who desire future conception should be counseled about these possible risks. Before UAE can be regarded as a safe procedure for women who desire future fertility, additional studies must be performed, including prospective, randomized comparisons with myomectomy. However unlikely a prospective randomized trial with adequate power to compare pregnancy outcomes after the 2 studied treatments for fibromyomata might be, it is desirable that such a trial be carried out in the future if such comparison is to be realized fully.

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