

## Pregnancy after uterine fibroid embolization: follow-up of 100 patients embolized using tris-acryl gelatin microspheres

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**Objective:** To evaluate pregnancies in women who had previously undergone uterine fibroid embolization.

**Design:** Prospective study.

**Setting:** A city hospital in Spain.

**Patient(s):** A cohort of 100 uterine fibroid embolization patients, 57 of whom wished to preserve their fertility.

**Intervention(s):** Uterine arteries were embolized by using 500–1,200  $\mu\text{m}$  tris-acryl gelatin microspheres. After intervention, patient follow-up was performed at 1 week, 3 months, 6 months, and yearly.

**Main Outcome Measure(s):** The number of pregnancies and course of pregnancy.

**Result(s):** Eleven pregnancies in 10 women (19.2%). The pregnancies resulted in 8 live births, including 4 normal and 4 cesarean deliveries. Early miscarriage occurred in 3 cases (2 patients). None of the 8 newborns was a low-birth weight infant, and gestation lasted  $\geq 37$  weeks in all the patients, except for 1 case of a macrosomic fetus delivered at 33 weeks. There were no cases of abnormal placental implantation.

**Conclusion(s):** Despite the small sample size, uterine artery embolization appears to be [ct appropriate?]{xviable in young women who still want to become pregnant. Larger series and studies comparing uterine fibroid embolization and myomectomy are needed. (Fertil Steril® 2008; ■: ■–■. ©2008 by American Society for Reproductive Medicine.)

**Key Words:** Pregnancy, uterine myoma, fibroid, embolization, uterus, neoplasms

The first report of uterine artery embolization as a treatment for myomata was published in 1995 (1), and since then, a number of studies of women who have undergone this procedure have appeared in the literature (2–15). To date, there have been three reports of randomly controlled trials, two comparing uterine fibroid embolization (UFE) with abdominal hysterectomy (16, 17) and another comparing UFE with myomectomy (18). These have corroborated the efficacy and safety of this new method of treatment vs. conventional surgery. Nevertheless, because of uncertainty about the effects of UFE on fertility, exclusion of women who still want to become pregnant has been recommended, and studies of ovarian function in patients who have undergone the procedure have been called for (19–30). Clinical studies reporting the first cases of pregnancy after UFE began to be published in 2000 (31–41).

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The present study assesses pregnancies occurring in a cohort of 100 women who had undergone UFE as an alternative to surgery. Patients' desire to preserve fertility was not an exclusion criterion, and the pregnancies were documented by means of interviews performed during follow-up.

### MATERIALS AND METHODS

From January 2002 to June 2006, 100 patients with symptomatic uterine myomata were treated using UFE. All patients were white, and their mean age was 39.7 years (range, 27–53 y). A desire to preserve fertility was not a criterion for exclusion, and all the patients were fully informed concerning the uncertainties surrounding the safety of undertaking pregnancy after uterine embolization as well as the potential risks of UFE, including hysterectomy and premature menopause. By way of a standard practice, and to ensure safe pregnancy, all of the patients were advised to wait 6 months after UFE before making any attempt to conceive.

Uterine artery embolization was performed by using 500–1,200  $\mu\text{m}$  Tris-acryl gelatin microspheres (Embosphere Microspheres; Biosphere Medical, Roissy, France). The

preferred endpoint was complete occlusion of flow to the leiomyomata, with slow flow remaining in the main uterine artery, as described by Spies et al. (9). All patients were admitted for overnight care, with pain management according to local practice. Patient follow-up took the form of a clinical assessment by telephone at 1 week, 3 months, and 6 months, with a scheduled visit 1 year after the procedure. All patients were asked to notify the investigators if they became pregnant or if they underwent any subsequent procedures or surgeries. At the end of the study period, 8 patients had been followed up for 3 years; 37 patients, for 2 years; 26 patients, 18 months; and 24 patients, for 1 year; whereas 5 patients had been lost to follow-up.

Table 1 summarizes the procedure and microsphere size and dose in the patients who conceived after UFE.

## RESULTS

Of the 100 patients, 43 had no further interest in giving birth, whereas 57 did want to remain fertile. In the latter group, 39 were <40 years of age, and there were 11 pregnancies in 10 women (19.2%) during the follow-up period after embolization. One patient became pregnant twice. Average age at embolization for this group was 35 years (range: 33–40 y). All 10 of these patients were nullipara, and 7 were nulligravid. Three previously had undergone spontaneous abortion, one of them twice. Mean uterine volume was 602 mL (range: 140–1,379 mL), and mean myoma volume was 324.9 mL (range: 10–1,014 mL). Six of these patients had had a single myoma, whereas four of the patients in this group had had a polomyomatous uterus. Table 2 sets out the patient characteristics for this group and the previous treatments they had undergone.

There were nine spontaneous pregnancies, and two pregnancies were achieved by means of assisted reproduction

techniques. Mean time from embolization to conception was 15 months (range, 5–30 mo). Five pregnancies occurred during the first year, 5 during the second year, and 1 during the 3rd year after embolization. The 11 pregnancies produced 8 live births, with 3 cases of early miscarriage in 2 patients. Four of the births were by vaginal delivery, three spontaneously and one induced. In the latter case, labor induction was performed at 38 weeks' gestation because of aging of the placenta and membrane rupture. Four of the births were by cesarean delivery. The indications for cesarean section were as follows: by decision of the attending obstetrician, at 37 and 41 weeks, respectively, to avoid risk in two patients who had long and painful histories of trying to conceive; in a third patient, at 33 weeks because the patient was an older primipara with preeclampsia, a history of prior myomectomy, and a macrosomic fetus; and in the fourth patient, at 41 weeks after failed labor induction. There were no instances of abnormal placentation. The babies born at term presented no significant neonatal problems and had entirely normal mean birth weights (Table 3).

## DISCUSSION

When UFE first came into use to treat uterine myomata, patients who wanted to remain fertile were excluded under the protocols that were in place at most treatment centers because of questions about the impact of embolization on the ovaries and possible future sequelae for mother and fetus (2, 8, 9, 16, 17, 19–21). For instance, the American College of Obstetrics and Gynecology has advised against usage of this treatment modality for uterine myomata in women who want to preserve their fertility (22). Over the years, studies on utero-ovarian vascularization and on the impact of embolization on ovarian function in UFE patients have shown the risk of

**TABLE 1**

**Procedure and material employed in the embolized patients who subsequently became pregnant.**

Patient no.	Embolization	Size of Embospheres ( $\mu\text{m}$ )	Total dose (cc)
10	Bilateral	700–900 and 900–1,200	12
11	Unilateral <sup>a</sup>	700–900 and 900–1,200	8
15	Bilateral	700–900	3
20	Bilateral	500–700 and 700–900 and 900–1,200	16
33	Unilateral <sup>b</sup>	700–900 and 900–1,200	1.8
34	Bilateral	700–900 and 900–1,200	5.8
36	Bilateral	700–900	7
43	Bilateral	700–900	2.3
44	Bilateral	500–700 and 700–900	4
56	Bilateral	700–900 and 900–1,200	14

Note: Patient no. is the order of embolization in the sample cohort of 100 patients.

<sup>a</sup> Uterine artery absent.

<sup>b</sup> Uterine hypoplasia.

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**TABLE 2****Characteristics of the pregnant patients.**

Patient no.	Age (y)	Pregnancy history	Prior treatment	Uterine volume (mL)	Myoma volume (mL)	Myoma no. and type
10	33	Pregnancies 0, births 0	GnRH	728	379	Poly-IM
11	36	Pregnancies 0, births 0	None	402	303	1 IM
15	33	Pregnancies 1, births 0	GnRH + HR	175	48	1 SUBM
20	33	Pregnancies 0, births 0	Homeopathic	1379	1014	Poly-IM
33	35	Pregnancies 0, births 0	Progesterone	457	266	1 IM
34	36	Pregnancies 1, births 0	None	1148	450	Poly-IM
36	34	Pregnancies 0, births 0	None	491	216	Poly-SUBS
43	40	Pregnancies 0, births 0	Myomectomy GnRH + HR	140	10	1 SUBM
44	36	Pregnancies 2, births 0	None	191	142	1 IM
56	37	Pregnancies 0, births 0	None	912	421	1 IM

Note: HR = hysteroscopic resection; Poly = multiple myomata; IM = intramural; SUBM = submucosal; and SUBS = subserous.

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ovarian failure to be negligible (<1%) in UFE patients who are <40 years of age (23–30).

The first reports of pregnancy after embolization of uterine myomata and studies of a few small series began to appear in the literature in 2000 (31–41). At the time of this writing, barely 100 cases of pregnancy after UFE have been described.

The pregnancy rate of 11% achieved in our cohort of 100 UFE patients was higher than the rates of 3.5% to 6.5% that have been published in the literature for larger series (11, 33, 40, 41), but it should be noted that the percentage of patients <40 years of age was 50% in our study, which is higher than in the other series reported.

Spontaneous abortions are known to increase with maternal age; in the general population, the rates range from

18%, in women in their late 30s, to 34%, in women in their early 40s (42). The 27% spontaneous-abortion rate in our study, considering that ours was a small series, does not appear to be higher than the rate for the general population and is comparable to (40) or slightly lower than (31, 33) the rates reported for other populations, although as we already pointed out in the previous paragraph, the difference in patient age may account for the differences. Nevertheless, age did not appear to be the determining factor in the multi-center Ontario study that reported the lowest miscarriage rate (16.7%) of all studies that have been published to date (41). Accordingly, uterine artery embolization did not appear to significantly increase the first-trimester loss rate.

The four cesarean deliveries represented a 50% cesarean section rate, lower than the rates (between 55.5% and 80%)

**TABLE 3****Pregnancy results.**

Patient no.	Conception	Mo. after UFE	Gestation time (wk)	Delivery mode	Birth weight (kg)
10	Spontaneous	6	Early miscarriage	NA	NA
	Spontaneous	24	Early miscarriage	NA	NA
11	Assisted	30	37	Caesarean	2,760
15	Spontaneous	9	38	Vaginal	3,100
20	Spontaneous	24	38	Vaginal	3,200
33	Spontaneous	18	38	Caesarean	2,880
34	Spontaneous	7	38	Vaginal	3,400
36	Assisted	18	41	Caesarean	3,100
43	Spontaneous	5	33	Caesarean	3,500
44	Spontaneous	18	38	Vaginal	3,860
56	Spontaneous	5	Early miscarriage	NA	NA

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reported in other series (31, 33, 40, 41). This outcome could be ascribable to the different protocols in place at different hospitals.

None of the eight live newborns in our study had a low birth weight, and gestation time reached 37 weeks for all the mothers, except one carrying a macrocosmic fetus (33 wk). In contrast, preterm delivery rates ranging from 10% to 42.8% have been recorded in other studies (31, 33, 40, 41).

Instances of such placental alterations as placenta previa, placenta accreta, and abruptio placentae after UFE have been reported in the literature (33, 40, 41, 43). However, there were no cases of abnormal placental implantation in our patient series.

The number of deliveries in our study was too small to allow us to make any recommendations on delivery management or to draw conclusions, but still the pregnancy rate adds to the growing number of reported cases of pregnancy after uterine artery embolization as a treatment for fibroids and suggests that it may be appropriate to reconsider the contraindication of this procedure for younger women who wish to preserve their fertility. Randomized controlled trials comparing myomectomy and embolization in a younger population desiring pregnancy therefore are needed.

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