

Pregnancy Following Uterine Artery Embolization with Polyvinyl Alcohol Particles for Patients with Uterine Fibroid or Adenomyosis

Man Deuk Kim,¹ Nahk Keun Kim,² Hee Jin Kim,¹ Mee Hwa Lee²

¹Departments of Diagnostic Radiology, Bundang CHA General Hospital, College of Medicine, Pochon CHA University, 351 Yatap-dong, Bundang-gu, Sunnam-si, Kyonggi-do 463-712, Republic of Korea

²Departments of Obstetric & Gynecology, Bundang CHA General Hospital, College of Medicine, Pochon CHA University, 351 Yatap-dong, Bundang-gu, Sunnam-si, Kyonggi-do 463-712, Republic of Korea

Abstract

Purpose: To determine whether uterine fibroid embolization (UFE) with polyvinyl alcohol (PVA) particles affects fertility in women desiring future pregnancy.

Methods: Of 288 patients managed with UFE with PVA particles for uterine myoma or adenomyosis between 1998 and 2001, 94 patients were enrolled in this study. The age range of participants was 20–40 years. The data were collected through review of medical records and telephone interviews. Mean duration of follow-up duration was 35 months (range 22–60 months). Patients using contraception and single women were excluded, and the chance of infertility caused by possible spousal infertility or other factors was disregarded. Contrast-enhanced magnetic resonance imaging was performed in all patients before and after UFE, and the size of PVA particles used was 255–700 μm .

Results: Among 94 patients who underwent UFE with PVA, 74 were on contraceptives, 6 had been single until the point of interview, and 8 were lost to follow-up. Of the remaining 6 patients who desired future pregnancy, 5 (83%) succeeded in becoming pregnant (1 patient became pregnant twice). Of a total of 8 pregnancies, 6 were planned pregnancies and 2 occurred after contraception failed. Five deliveries were vaginal, and 2 were by elective cesarean. Artificial abortion was performed in 1 case of unplanned pregnancy. There was 1 case of premature rupture of membrane (PROM) followed by preterm labor and delivery of an infant who was small-for-gestational-age. After UFE, mean volume reduction

rates of the uterus and fibroid were 36.6% (range 0 to 62.6%) and 69.3% (range 36.3% to 93.3%), respectively.

Conclusions: Although the absolute number of cases was small, UFE with PVA particles ultimately did not affect fertility in the women who underwent the procedure.

Key words: Arteries, chemotherapeutic embolization—Arteries, uterine—Pregnancy—Uterine neoplasms, therapeutic radiology

Uterine fibroid embolization (UFE) has been reported to be effective in managing symptoms caused by uterine myomas [1–3]. Polyvinyl alcohol (PVA) particles are commonly used for UFE because of their high embolization effect. However, the effects of UFE with PVA particles on fertility and a woman's ability to maintain an intrauterine gestation are still uncertain. Only a few reports exist that concern pregnancy and UFE with PVA particles [4]. Moreover, many gynecologists and interventionalists are reluctant to perform UFE in patients desiring future pregnancy. Some experts [5] have tried gelatin sponge particles instead of PVA particles in women of child-bearing age, but this technique has not yet been generally accepted. The aim of this study was to determine whether UFE with PVA particles affects fertility in patients desiring future pregnancy.

Materials and Methods

Of 288 patients at CHA General Hospital in Korea managed with UFE using PVA particles for uterine myoma or adenomyosis between 1998 and 2001, 94 were enrolled in this study; participants ranged in age from 20 to 40 years. We excluded women >40 years

to decrease confounding factors such as advanced maternal age. Mean duration of follow-up was 35 months (range 22–60 months). Patient data were collected by review of medical records and telephone interviews. Patients who had been using contraception since undergoing UFE and those who had been single until the point of interview were excluded. The chance of infertility caused by the spousal infertility or other factors was disregarded. Ultrasound examinations were performed to evaluate the recurrence of leiomyoma in women who were receiving antenatal care at our institution. Infant birth weight was measured and adequacy of weight according to gestational age analyzed in all cases.

Embolization Procedure and Imaging

The right common femoral artery was used for arterial access in all patients.

Coaxial 3 Fr catheters (Tracker-18 Infusion Catheter; Boston Scientific, Fremont, CA) were used to catheterize both uterine arteries, and embolization was performed until there was complete cessation of blood flow in the ascending uterine artery with residual flow in the lower uterine segment. The size of PVA particles used (Contour; Boston Scientific, Fremont, USA) was 255–700 μm .

Magnetic resonance imaging (MRI) was performed in all patients before UFE and at 3-month follow-up. Views included axial, sagittal fast-spin echo T2-weighted and contrast-enhanced T1-weighted sagittal images. Enhanced MRI was performed 2 min after intravenous infusion of 10 ml gadolinium (Dotarem; Guerbet, Aulnay-sous-Bois, France) with fast low-angle shot sequences (repetition time/echo time 117.3/4.1 msec; flip angle 80°; matrix 140 \times 256; 5 mm section thickness).

Uterine volume measurements were obtained in each patient using MRI and calculation of the formula of a prolate ellipse (length \times width \times depth \times 0.5233).

Results

The details of the pregnant women and their neonates are listed in Table 1. The indications for UFE were uterine myoma ($n = 2$), adenomyosis ($n = 3$), and concomitant myoma with adenomyosis ($n = 1$). Mean age was 30.7 years (range 28–35 years). Mean volume reduction rates of the uterus and fibroids were 36.6% (range 0 to 62.6%) and 69.3% (range 36.3% to 93.3%), respectively, at term follow-up after UFE (Figs. 1, 2). Among 94 patients who underwent UFE using PVA particles, 74 had undergone contraceptive surgeries such as tubal ligation or vasectomy or had used condoms ($n = 74$), 6 were not married, and 8 dropped out during follow-up. The remaining 6 patients had a desire for future pregnancy.

Of these 6 patients, 4 became pregnant once, 1 became pregnant twice, and 1 failed to become pregnant; hence, 5 of 6 (83%) patients succeeded in becoming pregnant. Of the 74 patients who had been using contraception, 2 were incidentally found to have become pregnant because of failed contraception. One of these patients underwent artificial abortion because the pregnancy was unwanted, and the other patient delivered an infant. In total, there were 8 pregnancies

Table 1. Summary of impregnated women and neonates

Patient no.	Age (years)	Obstetric history	Diagnosis	Time interval ^a (months)	Delivery	Preterm	Birth weight of neonate (kg)	Vol reduction of uterus (%)	Comments
1	31	G1P1	Myoma	11	C-section	No	2.8	62.6	Apgar score (8/9) ^b
2	35	G7P2	Adenomyosis	34	C-section	No	3.1	0	Oral contraceptive pill for 33 months after UFE
3	30	G0P0	Myoma	32	NSVD	No	2.7	45.2	Single at UFE
4	28	G2P1	Myoma + adenomyosis	16	NSVD	No	3.4	27.7	Apgar score (8/9) ^b
5	31	G4P2	Adenomyosis	3	NSVD	No	3.2	40.7	Failed contraception
6	29	G1P0	Adenomyosis	12	NSVD	Yes (34 weeks)	1.85	43.5	PROM, SGA
				26	NSVD	No	2.7		Apgar score (8/9) ^b

G, gravida; P, parity; C-section; cesarean section; NSVD, normal spontaneous vaginal delivery; PROM, premature rupture of membrane; SGA, small-for-gestational-age.

^aTime interval from UFE to pregnancy.

^bApgar scores after 1 and 5 min, respectively.

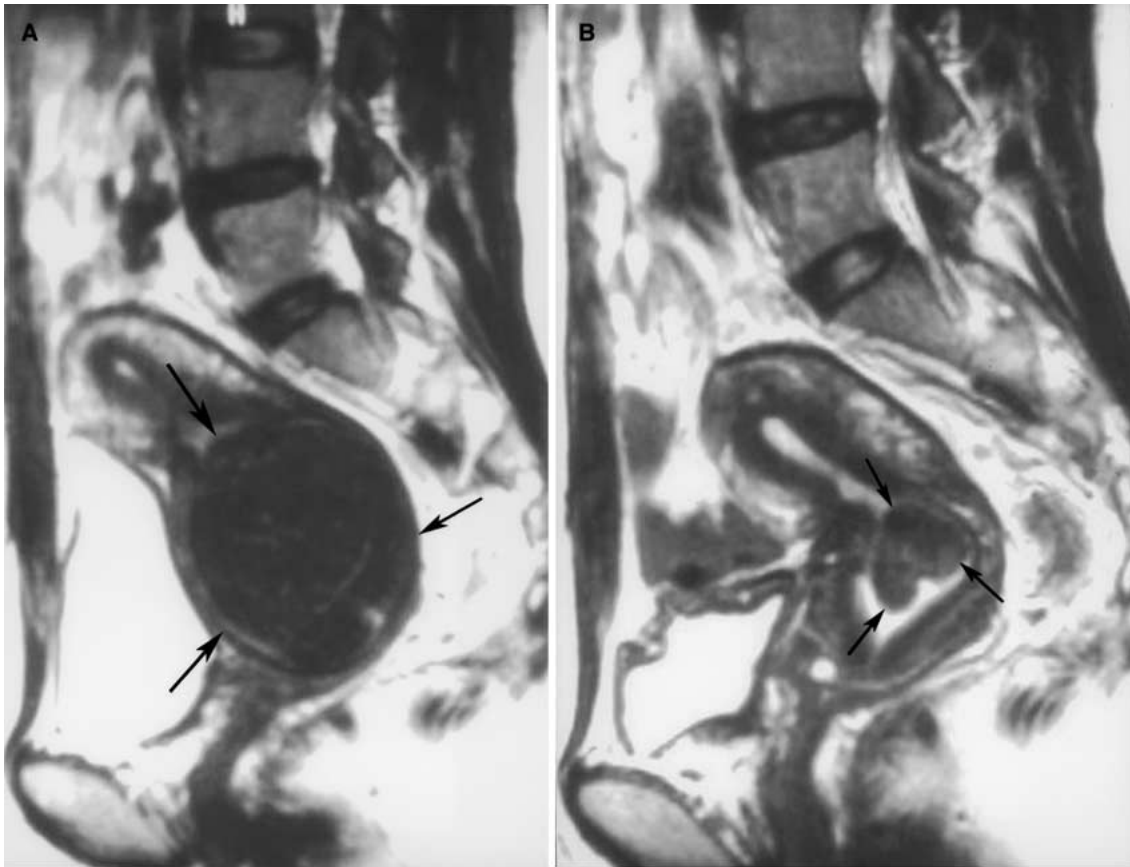


Fig. 1A, B. Patient no. 1 was a 29-year-old woman with submucosal myoma. **(A)** T2-weighted sagittal MR image shows an 8 cm submucosal myoma (arrows). **(B)** At follow-up MRI 3 months later after UFE, a small residual myoma

(arrows) is demonstrated. This patient underwent hysteroscopic myomectomy. After 11 months, she delivered a full-term baby by normal vaginal delivery.

(planned pregnancy in 6 and unwanted pregnancy in 2 patients including 1 case of termination). One woman who was found to be infertile refused an appointment for a detailed examination, so it is uncertain whether the infertility was caused by tubal dysfunction, hormonal abnormality or her husband's possible infertility, or whether it was directly related to UFE. Five infants were delivered vaginally, and two were delivered by elective cesarean section. The indications for the two elective cesarean deliveries were previous cesarean section. There were no early miscarriages. One woman (patient no. 2), who wanted to become pregnant despite using contraception for 33 months after UFE, became pregnant as soon as she discontinued oral birth control.

The average weight of newborns was 2.82 kg (range 1.85–3.40 kg). Deliveries were uneventful, and Apgar scores of 8 and 9 (at 1 and 5 min, respectively) were recorded in 3 infants. There was no evidence of uteroplacental vascular insufficiency or abnormal uterine contraction during labor or postpartum. Six women delivered normally without evidence of small-for-gestational-age or prematurity. One infant was delivered preterm due to premature rupture of membrane (PROM). However, the same patient

had a normal full-term delivery at the next pregnancy. Of the 4 women who were available for antenatal care in our institution, none showed recurrence of myoma during pregnancy. The mean interval between UFE and the beginning of the first pregnancy was 18 months (range 3–34 months).

Discussion

UFE has recently gained acceptance as an effective alternative to surgical treatment that successfully controls symptoms in 85–95% of patients [6–9]. Although controversy still exists regarding the effectiveness of UFE for symptomatic adenomyosis, Siskin et al. [10] described significant clinical improvement in 12 of 13 patients with adenomyosis and concomitant fibroids. In a study by Jha et al. [11] as well as our previous report [12], most patients with pure or dominant adenomyosis had positive outcomes after UFE in view of clinical symptoms and junctional zone thickness.

PVA particles are commonly used for UFE because of their high embolization effect. However, it is not yet certain

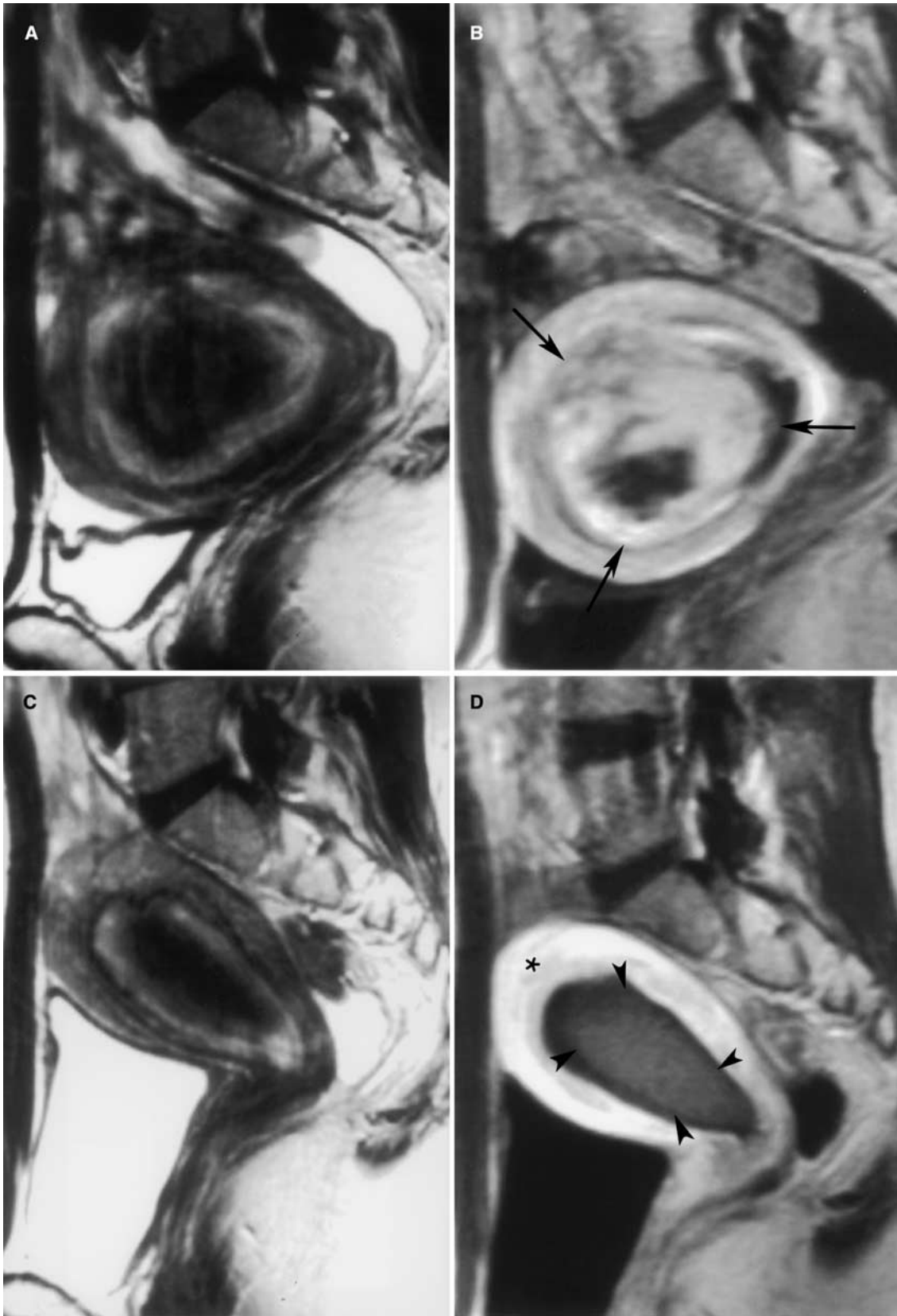


Fig. 2A–D. Patient no. 3 was a 30-year-old woman with submucosal myoma. **(A)** T2-weighted sagittal MR image and **(B)** gadolinium-enhanced T1-weighted MR image show a well-enhancing submucosal myoma (7 cm) (arrows). **(C)** T2-weighted and **(D)** gadolinium-enhanced T1-weighted MR images at follow-up 3 months after UFE reveal volume

reduction of the fibroid and no contrast enhancement (arrowheads), suggesting complete necrosis of a submucosal myoma. Remaining normal myometrium (asterisk) shows enhancement. Thirty-two months later, this woman delivered a full-term baby.

whether fertility is preserved after UFE with PVA particles. Patients considering treatment for symptomatic uterine fibroids are often perimenopausal and do not desire pregnancy [12–14]. Many centers hesitate to perform this procedure on younger patients who desire future pregnancy. Hence, the pregnancy rate after UFE with PVA particles is difficult to estimate correctly. Because they have a proven role in maintaining an intrauterine gestation [15,16], gelatin sponge particles have recently been used as an embolic agent during UFE. Katsumori et al. [17] used gelatin sponge particles in 18 patients and reported an 89% rate of symptomatic improvement and a 45% mean decrease in uterine volume. Nevertheless, larger multicenter studies with longer follow-up must be performed to determine the clinical efficacy of gelatin sponge particles in UFE.

It has been presumed that UFE would detrimentally affect placental function and fetal growth by decreasing uterine vasculature. Devascularization of the myometrium after UFE could also affect postpartum uterine involution. Successful pregnancies have been reported after UFE or bilateral internal iliac artery ligation [18, 19]. In a study by Ravina et al. [4], 12 pregnancies were reported after UFE with PVA particles; most of these patients were >40 years old, all pregnancies were unexpected. In one multicenter study [20], of a total of 555 women 18–59 years old who underwent UFE with PVA particles, 24 pregnancies in 21 women were reported (some of the women became pregnant twice). The pregnancies resulted in 18 live births; there were 4 elective terminations. Three pregnancies were complicated by abnormal placentation such as placenta previa and placenta accreta; hence, close monitoring of placental status is recommended.

The reason for growth of the uterus during pregnancy remains unclear. Poppe et al. [21] reported pregnancy after bilateral UFE with PVA particles mixed with thrombin for uterine arteriovenous malformation. They suggested that normal adaptation of uteroplacental vasculature results in optimal fetal growth and development. In our series, no evidence of uteroplacental vascular insufficiency or uterine contraction abnormality was noted. We conclude that previous UFE does not seem to affect subsequent fertility, pregnancy course, or outcomes. Our preliminary results need to be confirmed by larger population studies.

References

1. Ravina JH, Herbreteau D, Ciraru-Vigneron N, et al. (1995) Arterial embolization to treat uterine myomata. *Lancet* 346:671–672
2. Worthington-Kirsch RL, Popky GL, Hutchins FL (1998) Uterine arterial embolization for the management of leiomyomas: Quality-of-life assessment and clinical response. *Radiology* 208:625–629
3. Goodwin SC, Walker WJ (1998) Uterine artery embolization for the treatment of uterine fibroids. *Curr Opin Obstet Gynecol* 10:315–320
4. Ravina JH, Vigneron NC, Aymard A, Le Dref O, Merland JJ (2000) Pregnancy after embolization of uterine myoma: Report of 12 cases. *Fertil Steril* 73:1241–1243
5. Katz RN, Mitty HA, Stancato-Pasik A, Cooper JM, Ahn J (1998) Comparison of uterine artery embolization for fibroids using gelatin sponge-pledgets and polyvinyl alcohol (abstract). *J Vasc Interv Radiol* 9:194
6. Goodwin SC, Chen G (1998) Uterine artery embolization for uterine fibroids. *Contemp Rev Obstet Gynecol* 10:217–221
7. Walker WJ, Pelage JP (2002) Uterine artery embolisation for symptomatic fibroids: Clinical results in 400 women with imaging follow up. *Br J Obstet Gynecol* 109:1262–1272
8. Spies JB, Ascher SA, Roth AR, Kim J, Levy EB, Gomez-Jorge J (2001) Uterine artery embolization for leiomyomata. *Obstet Gynecol* 98:29–34
9. Goodwin SC, McLucas B, Lee M, et al. (1999) Uterine artery embolization for the treatment of uterine leiomyomata: Midterm results. *J Vasc Interv Radiol* 10:1159–1165
10. Siskin GP, Tublin ME, Stainken BF, Dowling K, Dolen EG (2001) Uterine artery embolization for the treatment of adenomyosis: Clinical response and evaluation with MR imaging. *AJR Am J Roentgenol* 177:297–302
11. Jha RC, Takahama J, Imaoka I, et al. (2003) Adenomyosis: MRI of the uterus treated with uterine artery embolization. *AJR Am J Roentgenol* 181:851–856
12. Kim MD, Won JW, Lee DY, Ahn CS (2004) Uterine artery embolization for adenomyosis without fibroids. *Clin Radiol* 59:520–526
13. Goodwin SC, Vedantham S, McLucas B, Forno AE, Perrella R (1997) Preliminary experience with uterine artery embolization for uterine fibroids. *J Vasc Interv Radiol* 8:517–526
14. Spies JB, Scialli AR, Jha RC, et al. (1999) Initial results from uterine fibroid embolization for symptomatic leiomyomata. *J Vasc Interv Radiol* 10:1149–1157
15. Stancato-Pasik A, Mitty HA, Richard HM 3rd, Eshkar N (1997) Obstetric embolotherapy: Effect on menses and pregnancy. *Radiology* 204:791–793
16. Pelage JP, Le Dref O, Mateo J, et al. (1998) Life-threatening primary postpartum hemorrhage: Treatment with emergency selective arterial embolization. *Radiology* 208:359–362
17. Katsumori T, Nakajima K, Mihara T, Tokuhiko M (2002) Uterine artery embolization using gelatin sponge particles alone for symptomatic uterine fibroids: Midterm results. *AJR Am J Roentgenol* 178:135–139
18. Garner EI, Meyerovitz M, Goldstein DP, Berkowitz RS (2003) Successful term pregnancy after selective arterial embolization of symptomatic arteriovenous malformation in the setting of gestation trophoblastic tumor. *Gynecol Oncol* 88:69–72
19. Mengert WF, Bruchell RC, Blumstein RW, Daskal JL (1969) Pregnancy after bilateral ligation of the internal iliac and ovarian arteries. *Obstet Gynecol* 34:664–666
20. Pron G, Mocarski E, Bennett J, Vilos G, Common A, Vanderburgh L, et al. (2005) Pregnancy after uterine artery embolization for leiomyomata: The Ontario Multicenter Trial. *Obstet Gynecol* 105:67–76
21. Poppe W, Van Assche FA, Wilms G, Favril A, Baert A (1987) Pregnancy after transcatheter embolization of a uterine arteriovenous malformation. *Am J Obstet Gynecol* 156:1179–1180