

Pregnancy outcomes following treatment for fibroids: uterine fibroid embolization versus laparoscopic myomectomy

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Purpose of review

The management of uterine fibroids in patients requiring treatment who desire future fertility remains controversial. Myomectomy has been the most common operative procedure to improve pregnancy rates and outcomes. Uterine fibroid embolization is an increasingly popular, minimally invasive treatment for fibroids. This review aims to provide critical analysis of available data on pregnancy following myomectomy and uterine artery embolization.

Recent findings

Patients with distorted uterine cavities due to submucosal fibroids of more than 2 cm have higher pregnancy rates following hysteroscopic resection. Pregnancy rates following myomectomy, both via laparoscopy and laparotomy, are in the 50–60% range, with most having good outcomes. Pregnancy rates following uterine artery embolization have not been established. Pregnancies following uterine artery embolization had higher rates of preterm delivery (odds ratio 6.2, 95% confidence interval 1.4–27.7) and malpresentation (odds ratio 4.3, 95% confidence interval 1.0–20.5) than pregnancies following laparoscopic myomectomy.

Summary

Both myomectomy and uterine artery embolization are safe and effective fibroid treatments, which should be discussed with appropriate candidates. Pregnancy complications, most importantly preterm delivery, spontaneous abortion, abnormal placentation and postpartum hemorrhage, are increased following uterine artery embolization compared to myomectomy. Although most pregnancies following uterine artery embolization have good outcomes, myomectomy should be recommended as the treatment of choice over uterine artery embolization in most patients desiring future fertility.

Keywords

fibroid, laparoscopic myomectomy, pregnancy, uterine artery embolization, uterine fibroid embolization

Abbreviations

CO	confidence interval
OR	odds ratio
SGA	small for gestational age
UFE	uterine fibroid embolization

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Introduction

For fibroid related information and images, please visit the Jefferson Fibroid Center website: at www.jeffersonhospital.org/fibroid.

Uterine fibroids are a common cause of infertility, sub-fertility, pregnancy wastage and pregnancy complications. The exact mechanism of fibroids' negative effects on fertility is usually multifactorial. Dysfunctional uterine contractility may interfere with sperm migration and ovum transport. Fibroids may cause anatomical uterine cavity enlargement and contour alteration. Additionally, implantation failure may occur due to endometrial vascular disturbance, inflammation and secretion of vasoactive substances [1]. Data on the influence of myomas on implantation is available from studies on patients undergoing in-vitro fertilization [2,3]. In a meta-analysis, Donnez and Jadoul [1] found that submucosal and intramural myomas distorting the uterine cavity impair implantation and pregnancy rates. In this study, women with fibroids but nondistorted cavities had similar pregnancy rates (34%) to controls (40%), while fibroids causing distortion lowered pregnancy rates (9%). Multiple fibroids have also been shown to increase rates of spontaneous abortion (24%) compared to controls or patients with a single fibroid (8%) [4]. Fibroids also increase complications further along in pregnancy, including increasing rates of malpresentation, need for cesarean section and blood loss at delivery [5•].

Until recently, the only treatment available for patients believed to have or be at risk for fibroid-associated infertility or pregnancy complications has been myomectomy, hysteroscopic or abdominal. Patients with distorted uterine cavities due to submucosal fibroids of more than 2 cm have been shown to have higher pregnancy rates following hysteroscopic resection [6]. A meta-analysis by Pritts [7] showed improved pregnancy rates (risk ratio 0.30 improved to 1.72) compared to infertile controls following hysteroscopic fibroid resection.

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Vercellini *et al.* [8] published a meta-analysis of pregnancy outcomes following abdominal myomectomy performed for infertility. Of the 23 studied trials, only nine were prospective and none randomized. Overall, there was a 57% pregnancy rate following abdominal myomectomy. Since this meta-analysis several authors have reported their experience with pregnancy following laparoscopic myomectomy. In 2003, Landi *et al.* [9] reported a cohort of 359 women, in which 72 completed pregnancies had occurred following laparoscopic myomectomy (20%). Of these, 57 were delivered in the third trimester, 46% by cesarean delivery. Malzoni *et al.* [10] followed patients after laparoscopic myomectomy and observed successful pregnancies in 21/26 women, of which 57% delivered by cesarean. No uterine ruptures occurred in either series.

Seracchioli *et al.* [11] published a prospective randomized study comparing myomectomy for infertility via laparotomy and laparoscopy. Following surgery, both groups had similar rates of pregnancy, abortion, preterm delivery and cesarean section (Table 1). These findings have been supported by two more recent case series of 41 patients and 106 patients reporting similar pregnancy rates following laparotomy compared to laparoscopic myomectomy in the range of 50–60% [12,13].

The generally positive outcomes which have been reported in pregnancies following laparoscopic myomectomy are tempered somewhat by an increased risk of cesarean delivery (greater than 50% in most series), and concerns regarding the effectiveness of laparoscopic suturing and risk of uterine rupture. Legitimate concern over uterine rupture persists because of the limited sample sizes of the afore-mentioned series, which lack the power to assess rare adverse events, and several reports of uterine rupture in pregnancies following laparoscopic myomectomy [14–18].

Many experts recommend cesarean section following abdominal myomectomy, whether open or laparoscopic, only if 100% of the myometrium has been incised and the endometrial cavity entered. As the myometrium is responsible for the integrity of the uterus rather than the endometrium, we recommend cesarean section if more than 50% of the myometrial thickness has been

disrupted. This strategy to decrease the risk of rupture during labor may be an especially prudent approach following laparoscopic myomectomy, which may less successfully repair the myometrial wall compared to repair during laparotomy.

In 1995, the first series of patients undergoing uterine artery embolization, also known as uterine fibroid embolization (UFE), as a primary treatment for fibroids was reported by Ravina *et al.* [19]. UFE is a minimally invasive alternative to hysterectomy or myomectomy, which avoids a major intra-abdominal surgery, while allowing uterine preservation, with a shorter convalescence. In the worldwide UFE experience, which now approaches 100 000 cases, this procedure has been shown to be an effective and safe treatment for symptomatic uterine fibroids. UFE has been extensively studied prospectively. Spies *et al.* [20] reported improvement in heavy bleeding in 90% [95% confidence interval (CI) 86–95%] and bulk symptoms in 91% (95% CI 86–95%) at 1 year. Similarly, The Ontario Uterine Fibroid Embolization Trial found significant decreases in median uterine and dominant fibroid volume of 35 and 42%, respectively, following UFE. Ninety-one percent of the 583 patients expressed satisfaction with their procedure, including significant improvement for menorrhagia (83%), dysmenorrhea (77%) and urinary complaints (86%) [21]. UFE may also be safer than hysterectomy and abdominal myomectomy. A multicenter study comparing UFE and hysterectomy for symptomatic fibroids reported overall morbidity occurred more frequently in women in the hysterectomy group compared to the UFE group (34 vs 14.7%; $P=0.01$) [22].

UFE appears to be an excellent treatment option for most women with symptomatic uterine fibroids. Many experts advocate that UFE should be offered along with myomectomy and hysterectomy for all potential candidates [23,24]. In patients desiring future fertility, however, UFE's place is less clear. There are currently no prospective studies with sufficient power to appropriately assess its impact on fertility rates and pregnancy outcomes. Until recently, however, many interventional radiologists advertised UFE in the media and via the internet as a safe and effective treatment for patients with fibroids desiring future fertility. With no studies, other than case reports of a few pregnancies following UFE, and more and more patients desiring future fertility inquiring about this treatment option, we attempted to thoroughly evaluate the available data.

In 2002, our group at Jefferson Medical College reported on pregnancies following UFE by combining all 48 published reports in the world literature at that time and two additional cases from our experience. Data analysis from these 50 pregnancies following UFE

Table 1 Pregnancies following abdominal and laparoscopic myomectomy

	Abdominal myomectomy	Laparoscopic myomectomy
Pregnancy rate [<i>n</i> (%)]	33/59 (56)	30/56 (54)
Abortion rate (%)	12	20
Preterm deliveries (%)	7	5
Cesarean deliveries (%)	78	65
Uterine rupture (%)	0	0

Adapted from [11].

showed that women becoming pregnant after uterine artery embolization may be at significantly increased risk for postpartum hemorrhage, preterm delivery, cesarean delivery and malpresentation compared to the general population [25]. While based on the only available data at the time, one weakness of our study was that we compared pregnancy complications following UFE to rates for the general population, rather than to women with fibroids or those who had undergone myomectomy.

In 2004, we published another study comparing pregnancies following UFE to pregnancies following myomectomy. Laparoscopic myomectomy was chosen over abdominal myomectomy due to its similar length of hospitalization and convalescence, as well as more recently available published series. Pregnancies following UFE had higher rates of preterm delivery [odds ratio (OR) 6.2, 95% CI 1.4–27.7] and malpresentation (OR 4.3, 95% CI 1.0–20.5) than pregnancies following laparoscopic myomectomy. The risks of postpartum hemorrhage (OR 6.3, 95% CI 0.6–71.8) and spontaneous abortion (OR 1.7, 95% CI 0.8–3.9) following UFE were similarly higher than the risks following laparoscopic myomectomy; however, these differences were not statistically significant (Table 2) [26]. Primarily based on our first study, the American College of Obstetricians and Gynecologists recommended in Committee Opinion 293 Uterine Artery Embolization (February 2004) that ‘There is insufficient evidence in the current literature to ensure safety in women desiring to retain their fertility. Furthermore, pregnancy-related outcomes remain understudied. Therefore, the procedure should be considered investigational or relatively contraindicated in women wishing to retain fertility’ [27].

Since the publication of our study comparing pregnancy outcomes following UFE and laparoscopic myomectomy, several series of patients attempting pregnancy following UFE have been published. In a follow up to the initial results of the Ontario Multicenter Trial, Pron *et al.* [28^{*}] reported on the pregnancy outcomes of 21 women out of 555, who conceived a total of 24 pregnancies during the trial period. In this report, six cases ended in

abortion (four spontaneously). Of significance, the authors reported that 50% of the 18 deliveries were accomplished by cesarean section. Rates of preterm birth and small for gestational age (SGA) infants were both 22% (4/18), while abnormal placentation (either placenta previa or accreta) occurred in 17% (3/18). All three of the deliveries complicated by abnormal placentation were further complicated by postpartum hemorrhage, with one resulting cesarean hysterectomy. These findings are consistent with our published experience (Table 2) with regard to preterm birth and cesarean section. The prevalence of SGA infants, abnormal placentation and postpartum hemorrhage in the Ontario Multicenter Trial was 3- to 4-fold higher than previously reported.

Subsequently, Carpenter and Walker [29] published their experience with 26 completed pregnancies following UFE. In this series 10 pregnancies ended prior to 24 weeks (two terminations, one ectopic and seven spontaneous abortions). This spontaneous loss rate of 30% (7/23 desired intrauterine pregnancies) is similar to our reported experience of 24% (Table 2). In the 16 pregnancies continuing past 24 weeks, the prevalence of SGA (7%), cesarean delivery (88%) and preterm delivery (31%) was similar to other published reports. The prevalence of postpartum hemorrhage (20%) was consistent with the Ontario Multicenter Trial, being 3-fold higher than previously suggested.

Four additional cases of delivery following UFE have been reported between 2004 and 2005, all four resulting in a term delivery by cesarean section: two secondary to fetal malpresentation, one electively and one because of fetal growth restriction (2240 g at 40 weeks) [30–32]. The case involving fetal growth restriction was further complicated by placenta accreta.

During myomectomy, fibroids are removed in an attempt to recreate a normal uterus and a nondistorted endometrial cavity. UFE, however, while shrinking the fibroid volume by up to 50% [21], which may be sufficient for symptom relief, may still leave an enlarged uterus with a distorted cavity. Following UFE, patients with

Table 2 Complications in pregnancies following uterine artery embolization and laparoscopic myomectomy for fibroids

Complication	General population (%)	Uterine artery embolization [n (%)]	Laparoscopic myomectomy [n (%)]	Odds ratio	95% Confidence interval	P value
Spontaneous abortion	10–15	12/51 (24)	20/133 (15)	1.7	0.8–3.9	0.175
Postpartum hemorrhage ^a	4–6	2/35 (6)	1/104 (1)	6.3	0.6–71.8	0.093
Preterm delivery ^a	5–10	5/32 (16)	3/104 (3)	6.2	1.4–27.7	0.008
Cesarean delivery ^a	22	22/35 (63)	61/104 (59)	1.2	0.5–2.6	0.662
Small for gestational age ^a	10	1/22 (5)	8/95 (8)	0.5	0.1–4.4	0.541
Malpresentation ^a	5	4/35 (11)	3/104 (3)	4.3	1.0–20.5	0.046

Adapted from [26].

^aCalculations based on number of singleton pregnancies continuing past 20 weeks gestation.

uteri more close to normal size and with nondistorted cavities would be expected to have better pregnancy rates and pregnancy outcomes; however, this has not been studied.

Large prospective studies assessing UFE's impact on future pregnancy rates or pregnancy outcomes are unlikely to be published in the near future. The FIBROID Registry, the largest prospective study to date evaluating women undergoing UFE, closed enrollment in 2002 with 3154 subjects; however, only 130 (4%) of these subjects stated that they definitely planned on attempting pregnancy within 2 years of the procedure [33[•]].

UFE may be preferable over myomectomy for certain patients desiring future fertility. Patients suspected or known to have extensive pelvic adhesions, especially those who underwent prior myomectomy, may be at high surgical risk for hysterectomy. Additionally, some women may wish to avoid intra-abdominal surgery, even when balanced against potential subfertility or increased pregnancy complications. Additionally, patients with extremely large fibroid uteri (above 20 weeks gestational size), who may be at high risk for hemorrhage or hysterectomy during myomectomy, may benefit by a combined UFE, to decrease uterine volume and vascularity, followed by myomectomy several weeks later [33[•]].

Conclusion

In summary, both myomectomy and UFE are very safe and effective fibroid treatments, which should be discussed with appropriate candidates. Data on fertility rates following UFE are limited due to the lack of prospective studies to establish the pregnancy rate among women planning to conceive. Similarly, data on pregnancy outcomes following UFE is limited, due to the lack of randomized studies. Based on available data, certain pregnancy complications, most importantly preterm delivery, spontaneous abortion, abnormal placentation and postpartum hemorrhage, appear to be uniformly increased following UFE compared to myomectomy. Although most pregnancies following UFE have good outcomes, myomectomy should be recommended as the treatment of choice over UFE in most patients desiring future fertility.

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- of special interest
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Additional references related to this topic can also be found in the Current World Literature section in this issue (pp. 466–467).

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