

Obstetric and delivery outcome of pregnancies achieved after laparoscopic myomectomy

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Objective: To assess the risks and outcome of pregnancies and deliveries after laparoscopic myomectomy (LM).

Design: Retrospective study.

Setting: Center of Reconstructive Pelvic Endosurgery, Reproductive Medicine Unit, S. Orsola–Malpighi Hospital, University of Bologna, Bologna, Italy.

Patient(s): A total of 514 patients of fertile age that underwent LM at the Center were selected.

Intervention(s): All the surgical procedures were performed using the same technique employing a vertical uterine incision and avoiding the use of electrosurgery.

Main Outcome Measure(s): Number and outcome of pregnancies achieved after surgery, abortion rate, preterm delivery, gestational age, malpresentation, spontaneous or cesarean delivery, and postpartum hemorrhage. We also paid particular attention to the occurrence of uterine rupture.

Result(s): A total of 158 pregnancies were achieved. There were 43 (27.2%) spontaneous abortions, 4 (2.6%) ectopic pregnancies, and 1 (0.6%) therapeutic abortion. Only 27 patients (25.5%) had vaginal deliveries, whereas 79 (74.5%) underwent cesarean section. No instances of uterine rupture were recorded.

Conclusion(s): Our preliminary results confirmed that LM, performed by an expert surgeon, can restore reproductive capacity, allowing patients to have a successful pregnancy. (Fertil Steril® 2006;86:159–65. ©2006 by American Society for Reproductive Medicine.)

Key Words: Laparoscopic myomectomy, pregnancy outcome, uterine rupture

Myomectomy is traditionally the primary treatment for symptomatic myomas and as a choice for conservative treatment is often requested even when there is no further desire of pregnancy. Myomectomy is an operation increasingly performed by reproductive surgeons, because myomata may contribute to infertility (1–4) and further may be responsible for serious complications during pregnancy (1, 5, 6).

The tendency for women to postpone a first pregnancy until a later age has made laparoscopic myomectomy (LM) an increasingly considered surgical option performed to protect the anatomic integrity of reproductive organs (2, 7). The reliability of this surgical technique has been widely demonstrated (3, 6, 8).

As has been found (9), LM has distinct advantages compared with the abdominal approach: a reduced risk of hemorrhage during operation, a reduction of hospitalization and convalescence, low postoperative pain, and minimal esthetic damage.

Many investigators have evaluated pregnancies achieved after LM (2, 10–14), but some case reports of spontaneous uterine rupture during pregnancy have raised questions con-

cerning the safety of this surgical approach for women who have a desire for future pregnancy (4, 15–23).

The aim of the study was to analyze 158 pregnancies achieved after a consecutive series of 514 LMs performed at the Reproductive Medicine Unit of the University of Bologna.

The main purpose of our research was to contribute to this important issue by providing data on a large number of pregnancies, allowing us to verify, if they exist, factors which may be important in determining a safe conclusion to pregnancies.

MATERIALS AND METHODS

Between January 1998 and December 2003, 514 patients underwent LMs at the Reproductive Medicine Unit of S. Orsola Hospital, Bologna, Italy. All surgical procedures were performed, using the same technique, by four different surgeons.

All of these patients had suffered from uterine fibroids presenting at least a subserous or intramural myoma >3 cm; fibroids were classified as intramural when more than 50% of the fibroid developed in the uterine wall and subserous when more than 50% of the fibroid was covered by the serosal layer. Measurements were made using transabdominal and transvaginal echography. In cases of submucous myoma the endometrial cavity was evaluated with hysteroscopy.

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TABLE 1**Features of patients submitted to laparoscopic myomectomy.**

	n	%
Operated patients	514	100.0
Patients lost during follow up	38	7.4
Patients who wanted a pregnancy	233	48.9
Pregnant patients	127	54.5
Number of pregnancies	158	—

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After myomectomy, and according to the number, size, and location of myomas, patients were asked to wait 4–6 months before attempting to conceive.

Data was collected on the following demographic characteristics: number, size, and location of fibroids, outcome of pregnancies achieved after surgery, abortion rate, preterm delivery, gestational age, malpresentation, spontaneous or cesarean delivery, and postpartum hemorrhage. We also paid particular attention to the occurrence of uterine rupture.

After surgery a group of patients were evaluated regularly (twice a year) at our center. At each follow-up visit a standard gynecologic examination, with transabdominal and transvaginal echography, was performed, and occurrence or outcome of pregnancy was recorded.

A follow-up of patients who had not been examined regularly at our center was attempted by telephone; women who could not be contacted by telephone were sent a questionnaire through the post. Follow up percentages of patients who underwent exam were 50%, those contacted by telephone 40% and those who simply completed our questionnaire 10%.

Those patients who subsequently achieved pregnancy were asked to supply our researchers with a copy of the labor record and of the cesarean section if performed.

Institutional approval was obtained and patients gave their informed consent to participate in the follow-up and collection of data, but, because of the nonexperimental nature of the study, a formal evaluation of the research protocol by the local ethics committee was not requested.

Surgical Technique

All the operations were performed using the same technique reported in our previous studies (24); however, we feel it is necessary to emphasize some important points:

1. A methylene blue test was always performed in order to check tubal patency and to enable the endometrium to be identified during surgery in case of deeply intramural myomata.

2. With the monopolar hook inserted in the central trocar, an incision was performed vertically on the uterine serosa overlying the myoma; due to traction, myoma was exposed and was enucleated according to its cleavage line with claw forceps and scissors. Traction on the myoma with a countertraction on the uterus enabled dissection. Vessels in the connective tissue bridges between the fibroid tissue and uterus were electrocoagulated with bipolar current before being cut.
3. Hemostasis, once the myomas had been enucleated, was achieved by suturing the uterus; we never coagulated the uterine walls before suturing, to avoid tissue necrosis.
4. The uterine walls were sutured in one or two layers, according to the depth of the hysterotomy. The deeper layer was usually performed with a continuous suture by an absorbable monofilament thread 1/0 (Byosyn; Tyco, Milan, Italy), whereas in the external layer separated doubled stitches with intracorporeal knots were used (1/0 or 1, Byosyn; Tyco). Suture of uterine walls was performed also in the case of sessile myomas.

RESULTS

During the study period, 514 women underwent LM at our center; the average length of time of follow-up was 41 months (range 10–82 months).

A total of 38 patients (7.4%) were lost during follow-up.

Of the 476 remaining patients, 243 (51.0%) did not wish to conceive during the follow-up period; 233 women (48.9%) desired a pregnancy and tried to obtain it spontaneously or after assisted medical procreative techniques.

One hundred twenty-seven women achieved at least one pregnancy, and the total number of pregnancies achieved was 158 (Table 1).

Patients' characteristics are reported in Table 2. The median conception time after myomectomy was 17.8 ± 12.5 months.

Forty-four patients (34.6%) of the 127 had only one myoma, 37 (29.1%) had two myomas, and 46 (36.2%) had three

TABLE 2**Outcome of the 158 pregnancies after laparoscopic myomectomy.**

	n	%
Number of pregnancies	158	100.0
Spontaneous abortion	43	27.2
Voluntary abortion	1	0.6
Extra uterine pregnancies	4	2.6
Endo uterine fetal death	1	0.6
Deliveries	106	67.0
Pregnancies in progress	3	1.8

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or more. The average number of removed myomas was 2.55 ± 1.78 .

The average size of the largest myoma removed was 5.44 ± 2.46 cm (range 3–15 cm). Thirty-one women (24.4%) presented subserous myomas, 53 (41.7%) subserous-intramural fibroids, and 38 (29.9%) intramural myomas; 5 patients had intramural-submucous fibroids.

In 10 patients the uterine cavity had been opened during LM (Table 2).

One hundred fifty-three pregnancies (96.8%) were spontaneous, four were achieved after IVF-ET, and one (twin) after intracytoplasmic sperm injection.

Fifty-three spontaneous abortions and one voluntary interruption of pregnancy were recorded; the average age of the group of patients that had abortions was higher (39.7 ± 4.35 years) than that observed in the group of patients who delivered (35.0 ± 3.52 years).

Three patients (2.9%) presented risk of abortion during pregnancy, two of these at the 9th week and one at the 12th week. One patient presented risk of premature labor at the 32nd week; the pregnancy continued, after tocolytic treatment, resulting in a cesarean section at term.

One patient showed at the ninth week, through echography, a suggestive subchorial hematoma for partial amnio-chorial detachment that did not affect the course of the pregnancy, which resulted in a cesarean section at term.

Four extrauterine pregnancies were recorded. One patient had unexplained fetal death in utero at 32 weeks gestation which showed no connection to the history of LM. Three pregnancies were still in progress at the end of the study.

The total number of deliveries was 106 (67.0%). Of 93 patients who gave birth, 9 gave birth twice (Table 3). Twenty-seven were vaginal deliveries (25.5%). Seventy-nine cesarean sections were performed (74.5%); 62 of these were elective because of the presence of uterine scars, infertility length, patient's age, and last but not least the fact that the pregnancy and delivery was strongly influenced by worries of the patients and their gynecologists. Seventeen emergency cesarean sections (16%) were performed: 8 for fetal distress, 2 for premature rupture of membranes, 6 for dynamic dystocia, and 1 for gestational hypertension.

Two premature labors (2%) were verified, and they were carried out through cesarean section at 34 weeks; one of these was performed for fetal distress, and the other was followed by total hysterectomy because of the presence of a high number of large myomas.

No uterine rupture or uterine walls dehiscence was noticed (Table 4). Records of the surgical treatments reported the presence of uterine adhesions in 18 cases (22.8%).

TABLE 3		
Features of 127 pregnant patients after laparoscopic myomectomy.		
	n	%
Age at myomectomy	33.69 ± 3.61	
Parity		
Nullipara	85	66.9
Primipara	42	33.1
Number of myomas		
1	44	34.7
2	37	29.1
≥3	46	36.2
Size of largest myoma (cm)	5.44 ± 2.46	
Number of removed myomas	2.55 ± 1.78	
Type of largest myoma		
Subserous	31	24.4
Intramural	38	29.9
Intramural subserous	53	41.7
Intramural submucous	5	4
Myoma diameter		
<5 cm	40	31.5
>5 cm	87	68.5
Time of conception (months)	17.87 ± 12.51	
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DISCUSSION
Laparoscopic Myomectomy and Pregnancy

Some of the main concerns after LM are obstetric complications, including the high rate of abortion, the risk of malpresentation, premature delivery, uterine rupture during pregnancy, and the wide use of elective cesarean delivery. Despite these adverse events, indirect evidence demonstrates that the pregnancy rate after LM is fairly good, with more than half of patients becoming pregnant after surgery (1, 9–13).

In this study we wanted to evaluate whether pregnancy obtained after LM presents a high rate of adverse consequences, such as morbidity or complications. We report the data gathered on a high number of pregnancies achieved after LM: 158 (to our knowledge the highest number of pregnancies researched and published). As other investigators have demonstrated (1, 25–29), most of the patients conceived between 12 and 36 months after surgery.

In this study the abortion rate is 27.2%, a rate very similar to that reported by Dubuisson et al. (26.2%) (12). The majority of these abortions occurred during the first trimester, as other investigators have reported (12, 30).

TABLE 4**Main features of 106 deliveries after laparoscopic myomectomy.**

	n	%
Mode of delivery		
Spontaneous delivery	27	25.5
Operative delivery	0	0
Elective caesarean section	62	58.5
Cesarean section on emergency	17	16.0
Fetal distress	8	
Premature rupture of membranes	2	
Dynamic dystocia	6	
Gestational hypertension	1	
Perinatal outcome		
Gestational age (wk)	38.20 ± 1.28	
Premature delivery <36 wk	2	2
Ended delivery >36 wk	104	98.1
Intrauterine fetal death	1	0.9
Obstetric complications		
Uterine rupture	0	0
Postpartum hemorrhage	0	0
Hysterectomy (elective postcesarean)	1	0.9

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Li et al. (31) observed a reduction in the miscarriage rate from 60% before myomectomy to 24% after myomectomy. The same results have been reported by Buttram and Reiter (from 41% to 19%) (32).

The abortion rate reported in this study is higher than that observed in the general population (10%–15%), but the causes may be due to different factors such as patient's age.

No correlation was found between the position of the myomas and the spontaneous abortion rate.

Delivery After LM

We evaluated 106 deliveries (67.0% of pregnancies). In 74.5% of cases a cesarean section was performed. Other researchers recorded a high percentage of cesarean section after

TABLE 5**Review: uterine rupture after laparoscopic myomectomy.**

	Number of myoma(s)	Location of myoma(s)	Type of myoma(s)	Size of myoma(s)
Harris 1992 (15)	1	Posterior	—	3 × 2 cm
Dubuisson et al. 1995 (16)	1	Posterior	Intramural	3 cm
Friedmann et al. 1996 (17)	1	Fundal	Intramural	5 cm
Pelosi and Pelosi 1997 (18)	1	Posterior-fundal	Subserous	5 cm
Hockstein 2000 (19)	1	Fundal	Intramural	18 × 9 × 9 cm
Foucher 2000 (20)	3	—	Subserous and sessile	3, 2, 1 cm
Dubuisson et al. 2000 (12)	1	Posterior	Intramural	3 cm
Özgür et al. 2001 (21)	1	Right cornual region	Subserous	3 × 4 cm
Lieng et al. 2004 (22)	1	1 to 2 cm from tubal junction	Peduncolated	4 cm
Asakura et al. 2004 (23)	1	Anterior-fundal	Intramural	—

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myomectomy (1, 2, 13). For some, the presence of uterine scarring indicates the need for cesarean section (17, 29), but others consider that it is not necessarily required (10, 12, 33).

According to various investigators (1, 9, 13, 17, 29) Cesarean Section should be performed when there is the presence of large and numerous myomas, especially if they are found to penetrate the uterine cavity.

Our team does not work in an obstetrics department, so we did not follow the pregnancies of the patients. We noticed a very high number of cesarean sections, probably due to the fact that the published studies may have induced a defensive attitude toward the birth process which is perhaps unnecessary.

We must take into consideration that the cesarean delivery rate was affected largely by elective cases (58.5%) rather than by intrapartum complications. Factors that prompted surgeons to perform cesarean section were presence of uterine scars, infertility length, patient age, and the fact that pregnancy and delivery were strongly influenced by worries of the patient and her gynecologist.

In our opinion, the few cases of uterine rupture reported elsewhere in the last few years may have led to an excessive use of Cesarean Section.

An emergency operation was performed in 16.0% of cases; we evaluated 8 cases of fetal distress, 2 premature ruptures of membranes, 6 cases of dynamic dystocia, and 1 case of gestational hypertension. The rates of those complications are very similar to those observed in the general population and do not seem to be correlated with LM.

In one case a hysterectomy was performed. The patient, who underwent LM at the age of 36, gave birth 24 months

after the operation. An elective cesarean section was performed at week 34 because of the presence of uterine contractions. In agreement with the patient we removed the uterus because of the presence of a high number of large myomas.

One endouterine fetal death at week 32 was recorded. The patient, nullipara, underwent myomectomy at the age of 40 and then became pregnant spontaneously 12 months after the operation; endouterine fetal death occurred without apparent correlation with the surgical procedure.

Vaginal delivery was reported in 26.4% of cases; no deliveries with forceps or vacuum extractor were performed.

Myomectomy and Uterine Rupture

The risk of uterine rupture during pregnancy and labor should always be taken into consideration. On the basis of the earlier studies, this complication is considered rare (2, 12, 14, 34, 35), and the published cases of uterine rupture come from case reports (4, 15–19) (Table 5). It is difficult to determine whether the known cases of uterine rupture occurred with a higher or lower frequency than expected.

Many researchers confirm that it is hard to establish whether the risk of uterine rupture is greater in the cases of abdominal myomectomy (15, 36). In a follow-up study of 100 patients who delivered after LM, Dubuisson et al. recorded a uterine rupture rate of 1% (12).

An analysis of cases reported may give us some indication about the effective risk of uterine rupture during the pregnancy after LM (Table 5). The number, size, and type of myoma did not seem to play an important role in uterine rupture.

TABLE 5					
Continued.					
Hysterotomy sutured	Position of rupture	Size of rupture	Waiting time	Gestational age (wk)	Fetal death
4/0 polyglycolic sutures	Posterior uterine wall	3 × 3 cm	3	34	No
Yes	—	—	—	32	No
Yes	Uterine fundus	—	12	27	No
No	Uterine fundus	—	36	33	Yes
Interrupted sutures	Uterine fundus	4 cm	24	29	No
trough minilaparotom					
No	Left posterofundal	—	60	31	No
One layer using	—	—	14	32	No
stitches of Vicryl 3/0					
No	Right cornual region	3 cm	96	17	Yes
No	1 to 2 cm from tubal junction	4 × 5 cm	2	35.5	No
—	Anterior-fundal	5 cm	5	35.5	No

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With regard to the location of the myoma, we noticed a prevalence of posterior and fundal myoma; two researchers (21, 22) observed uterine rupture after LM of myoma located in the cornual region, next to the tubal junction; in this area the thin wall required an accurate suture in one or two layers, which was also required in the case of pedunculated myoma.

We noted that some researchers did not suture after myomectomy (18, 21, 22), whereas others used a thin thread (12, 15).

The challenge of laparoscopic surgery depends on the surgeon's ability to reconstruct the uterus. It has been noticed that cases of uterine rupture occurred after technical mistakes due to the surgeon's inexperience, for example, the lack of an adequate suture and incorrect use of electrosurgery (16).

Concerns have been raised regarding the ability to suture the uterus laparoscopically with an adequate multilayer closure. Indeed, a correct reconstitution of the incision is fundamental. Especially when myoma is deeply placed or when the uterine cavity has to be opened, the suture must be performed deeply, at myometrium level, and on or between the myometrium and serosa (12).

Some researchers emphasized the risk of beginning pregnancy too soon after LM, such as 2 months (22) or 3 months (15); others did not express this risk in their findings (18, 19, 21).

No cases of uterine rupture occurred during our studies. This is probably due to the technique used, which included a vertical uterine incision and avoided the use of electrosurgery, thereby eliminating myometrium necrosis (15, 16, 18). The suture was always performed on one or two layers with absorbable monofilament 1 or 1/0.

The strategy of uterine incision depended essentially on the location of the myoma. In general, we preferred a vertical incision, because we used the central access (umbilicus) for the suture. The site of the incision and the direction would not seem to contribute to the potential for rupture; however, no precise data exist regarding this point.

Although uterine rupture is probably not completely preventable, adhering to long-established surgical principles enables a reduction of the risks. Our data indicates that this technique may be safe and feasible, if performed by an expert surgeon.

In light of these results, even though further studies will be required to confirm these data, LM gives the possibility not only to restore reproductive capacity, but also to enable the patient to take a pregnancy to a successful conclusion.

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