Developments in Techniques for Laparoscopic Myomectomy

Alfonso Rossetti, MD, Ornella Sizzi, MD, Flavia Chiarotti, MSc, Giuseppe Florio, MD

ABSTRACT

Objectives: Conflicting opinions about laparoscopic myomectomy (LM) are still present regarding indications and risks related to reproductive outcome. We reviewed our 13-year experience (1) to identify risk factors or changes in methods that have improved our myomectomy technique and (2) to evaluate how the learning curve and improved surgical devices influenced our procedures, and (3) to study the myomectomy scar with a power color Doppler ultrasound (US).

Methods: From January 1991 to December 2003, we studied 332 patients who underwent laparoscopic myomectomy. We analyzed, as the learning curve, how the introduction of the Steiner morcellator, the use of vasoconstrictive agents, and different techniques of suturing have influenced parameters such as operating time and blood loss.

Results: We performed 332 single or multiple myomectomies for symptomatic myomas. Most patients (47%) had more than one myoma, with a maximum of 8 per patient (average myomas removed for patients: 2.23, range 1 to 8). Myoma size ranged from 1cm to 20 cm (mean, 60.20±SD27.1 mm). Myomas <4cm were removed during myomectomy for larger ones. The conversion rate to laparotomy was 1.51%. The average drop in hemoglobin concentration was 1.06±SD0.86 g/100 mL (range, 0.7 to 2.2 g/100 mL). No blood transfusions were required. No major intraoperative complications occurred. The duration of the procedure ranged from 30 minutes to 360 minutes (mean, 124±SD52.6). The dimensions of the myomas removed increased with experience (4.91±SD2.2 cm of the earlier cases to 6.76±SD2.7 of the latest group, P<0.000). The learning curve positively influenced the length of the procedures in the first cases. The introduction of electromechanical morcellation in 1996 reduced the procedure time. Data showed significantly reduced Hb drop after the introduction in 1998 of vasoconstrictive agents (ΔHb 1.62 g/100 mL versus 0.95; P<0.001). The running suture offered few advantages in terms of procedure time. However, the drop in hemoglobin was advantageous (ΔHb 1.1 g/100mL vs 0.61, P<0.01). The overall rate of intrauterine pregnancy following LM was 65.5%. No uterine ruptures occurred. We had 2 serious postoperative complications:

Conclusion: With increased experience, the technical improvements and clinical results have changed our approach and decision making regarding laparoscopic myomectomy. Our results and extremely low conversion rate suggest that laparoscopic myomectomy is a safe and reliable procedure even in the presence of multiple or enlarged myomas.

Key Words: Laparoscopic myomectomy, Morcellator, Learning curve, Vasoconstrictive agents.

INTRODUCTION

Laparoscopic myomectomy is no longer a new procedure. Kurt Semm reported the first laparoscopic myomectomy in 1979. Recognized and at last proved advantages are those related to minimal-access surgery, such as fast recovery and reduced postoperative pain and adhesion formation. Nevertheless, laparoscopic myomectomy is still a debated operation whose feasibility, indications, and risks are still matters of discussion. We statistically reviewed our experience over a 13-year period to identify risk factors or changes in methods that have improved our myomectomy technique, to evaluate how the learning curve has influenced our procedures, and to study the myomectomy scar with a power color Doppler ultrasound (US).

METHODS

From January 1991 to December 2003, we followed 332 patients who underwent single or multiple myomectomies for symptomatic myomas. We included in the study only patients who signed an informed consent and agreed to follow-up. We divided the patients into 3 groups: Group A
(1991 to 1995), which represents the pioneering years, when electro-mechanical morcellation was not available and the learning curve was steep; Group B (1996 to 1997), identified by the introduction of the Steiner electromechanical morcellator. The morcellation time was less demanding and by that time the learning curve was considered completed; and Group C (1998 to 2003) marked by the introduction of the use of vasoconstrictive agents, years during which different types of sutures were experimented with and more challenging myomectomies were performed.

Diagnosis of myomas was achieved by transvaginal and abdominal ultrasonography. Hysteroscopy was performed when ultrasounds showed the probable involvement of the endometrium. Indications were infertility, recent and significant uterine enlargement, and symptoms (pelvic pain, menometrorrhagia and abnormal bleeding). Inclusion criteria were age ≤42 years, the presence of at least 1 symptomatic myoma ≥4cm, the number of myomas ≤8, and the absence of submucous myomas that could be removed by hysteroscopy. All patients received general anesthesia. Two surgeons performed all surgical procedures. For each patient, the total operating time was recorded from the anesthesiology charts. Laparoconversion was defined as the substitution of laparoscopy by laparotomy for intraoperative complications or difficulties in completing the procedure. Hemoglobin drop and the incidence of febrile morbidity (indicated by a temperature of ≥38°C in 2 consecutive measurements ≥6h apart, excluding the first 24h) were reported. The length of hospital stay, in days of hospitalization after surgery, was noted. Comparisons among the 3 groups were made especially regarding operative time, myoma characteristics, and blood loss. To try to avoid confounding factors like number of myomas and myoma type and size, we considered for comparison only those patients with 1 intramural myoma 6 cm to 8 cm in diameter. Transvaginal ultrasound (US) examination was performed before and after surgery (to verify the adequate healing of the myomectomy scar). We studied vascularization of the uterine wound after laparoscopy by means of transvaginal color Doppler ultrasonography in comparison with vascularity of the contralateral intact myometrium. In this way, it was also possible to check for defective healing (hematomas, indentations) along the uterine scar in the immediate postoperative period. Transvaginal color flow Doppler was used to study myometrial and fibroid arterial supply. The equipment used was Esote Biomedica color Doppler AU4 IDEA with a transvaginal multi-frequency (5 to 6.5 to 7.5 MHz) probe for imaging and a pulsed Doppler system (3.5 to 4.7 MHz) for blood flow analysis. Wall filters (100 Hz) were used to eliminate low frequency signals. Blood flow impedance expressed as resistance index (RI), pulsatility index (PI), and blood velocity were preoperatively calculated from the fifth to the eighth day of the menstrual cycle to study blood flow in the main arteries supplying identifiable fibroids and in the arteries of the contralateral myometrium. Thirty patients were randomized for laparoscopic or laparotomic myomectomy. Examinations were performed before, between 7 and 15, and between 30 and 45 days after the surgery. Blood flows were measured in the arteries supplying the myomectomy wound and in the arteries of the contralateral myometrium. Serial sonographic examinations were performed so as to determine the morphology and volume of the “scars.”

**Statistical Analysis**

All results are expressed as mean ± standard deviation (SD). Statistic analysis was made by using the unpaired Student t test for the comparison of means between 2 groups (significance, P<0.01).

For multiple comparison, the pair-wise t test was used. The Pearson χ² test was used for the comparison of percentages between the groups.

P<0.016 was considered the limit of statistical significance.

**Technique**

Myomectomies were performed with the standard technique7 with 3 ancillary suprapubic ports. Two suprapubic access routes (5 mm and 10 mm) were inserted lateral to the deep inferior epigastric arteries and slightly higher than usual: the accessory trocars should be inserted sufficiently high enough to provide an easy approach to the myomas for the laparoscopic instruments. A third trocar (5mm) was inserted in the midline, level to or higher than the other 2.

The uterus was always cannulated (MUR 18, Sofar, Trezzano Rosa, Italy) to allow correct exposure of the myomas and strong countertractions during enucleation and suturing. For pedunculated myomas, bipolar forceps and scissors were used for the smaller ones; otherwise, the pedicle was secured by using a pretied or extracorporeally tied loop and coagulated and transected with bipolar forceps and scissors. To reduce vascularization and blood loss, starting in 1997, we injected myomas with diluted ornithine vasopressin and now diluted (20IU: 500mL) argipressin. The vasoconstrictive agent was injected laparoscopically between the myometrium and the myoma capsule, looking for the cleavage plane, until blanching occurred.

For subserosal and intramural myomas, a vertical incision (hysterotomy), both for anterior and posterior myomas,
was made on the serosa overlying the myoma down and through the myoma pseudocapsule with a unipolar hook and high cutting current.

After exposure of the myoma, a grasping forceps was positioned to apply traction on the myoma and to expose the cleavage plane. Traction on the myoma applied with tenaculum with a countertraction on the uterus-facilitated dissection. Mechanical enucleation was advised whenever possible. Division of the connective tissues surrounding the myoma was obtained with a unipolar hook or with the Ultrasonic Cutting and Coagulating System (SonoSurg, Olympus, Japan), the latter having the advantage of less tissue charring. The only exception to this technique was in case of unsuspected adenomyosis. In this situation, the cleavage plane does not exist, and excision can only be carried out with a monopolar hook, sharp cutting, or an ultrasonic energy device, paying attention to use electrosurgery close to the myoma and not to the myometrium.

Regarding infra-ligamentous myomas, they usually are to be considered as pedunculated or subserosal myomas arising into the broad ligament. The peritoneum surrounding the myoma was incised. The myoma was gently enucleated by the surrounding areolar tissue. Hemostasis could be achieved with bipolar coagulation of the vessels reaching the myoma, paying attention to dangerous structures, such as the ureter or uterine vessels. As the base of the myoma was reached, coagulation of the blood supply was obtained with bipolar forceps. Eventually the suture was made.

For superficial subserosal myomas, suturing was usually done along 1 plane. For subserosal myomas deeper than 1 cm and for intramural myomas, it was always necessary to make a suture in 2 layers because it consists of bringing the entire thickness of the edges of the myomectomy site together to prevent the formation of hematomas.

We used large, curved needles (CT 1, 30 mm to 40 mm) swaged to Vicryl (1 or 0). For 1-layer sutures, we used interrupted, simple or more frequently cross-stitches, tied intracorporeally. For double-layer sutures, suturing was usually done along different planes: one large stitch reaching the deep layers and one more superficial suture to introflex the serosa. As for double-layer closures, a running suture was used in 10% of cases. It was applied first in the deeper plane, starting from the apex of the myomectomy scar to the base, continuing along the more superficial plane from the base to the apex. The suture was in the end tied intracorporeally with the tail of the running suture.

RESULTS

From January 1991 to December 2003, we were able to follow-up 332 patients who underwent single or multiple myomectomies for symptomatic myomas measuring at least 4 cm in diameter and being ≤8 in number (Table 1). Most patients (47%) had more than one myoma, with a maximum of 8 per patient (average number of myomas removed, 2.23; range, 1 to 8). Myoma size ranged from 1 cm to 20 cm (average 60.20±SD27.1 mm). Myomas <4 cm were removed during myomectomy for larger ones. The conversion rate to laparotomy was 1.51%. We converted to laparotomy in 3 cases because of anesthesiologic problems: in one case because of the number and size of the myomas, in another for a large infra-ligamentous myoma. In both of the last cases, conversions were due to difficulties in mobilizing the myoma in a narrow space. The average drop in hemoglobin concentration was 1.06±SD0.86 g/100 mL (range, 0.7 to 2.2 g/100 mL). No blood transfusions were required. No major intraoperative complications occurred. We had 2 serious postoperative complications: a temporary kidney failure probably due to excessive low blood pressure in the patient during the entire duration of the procedure and a bowel perforation in a patient with multiple retroperitoneal myomas. The duration of the entire procedure ranged from 30 minutes to 360 minutes (mean, 124±SD52.6). The patients did not differ among the 3 groups for age and number of myomas removed. Instead, the dimension of the greater myoma increased with experience (4.91±SD2.2 cm in the earlier cases to 6.76±SD2.7 in Group III, P<0.000). The learning curve positively influenced the length of the procedures in the first cases. Considering the 3 groups, the operating time varied from 142.27±SD58.32 minutes in Group I to 118.66±SD49.8 in Group III (P<0.003). Nevertheless, these data can be confounding because of the numerous variables involved. To avoid them, we considered only procedures for single myoma 6 cm to 8 cm in diameter. In these cases, the operating time varied from a mean of 158 minutes from 1992 to 1993 to 140 from 1994 to 95 (P<0.01). This parameter considered only the learning curve. In fact, the electromechanical morcellator had not yet been used.

The introduction of electromechanical morcellation in 1996 significantly reduced the procedure time. Again considering only procedures for single intramural myomas 6 cm to 8 cm in diameter, the length of the procedure dropped from a mean of 156 minutes in Group I to 107 in Group II (P<0.000), but still the morcellation time of the procedure is unfavorably time consuming. Considering only single myomectomies, data showed a significantly reduced Hb drop after the introduction in 1998 of vaso-
constrictive agents (ΔHb 1.62 g/100 mL vs 0.95; P<0.01). After the enthusiastic first results with the running suture, which made us consider this technique faster than the traditional interrupted suture, more definitive statistical results showed that the running suture had no or even fewer advantages in terms of procedure time. Instead, it had advantages in terms of hemoglobin drop (ΔHb 1.1 g/100 mL vs 0.61, P<0.01).

The preoperative ultrasonographic examinations showed accentuation of the vascularity at the level of identifiable myomas with a decrease of PI and RI, similar to that in previous reports. Diastolic flow in these arteries was always present and increased in comparison with blood flow in the normal myometrium. Thirty patients were randomized for laparoscopic and laparotomic myomectomies and compared for clinical results and postoperative US findings. The 2 groups were homogeneous for preoperative clinical features as well as for myoma volume and number (Table 2). Sonographic evaluations performed 7 days to 15 days after the intervention showed a remark-

### Table 1.

Demographic Characteristics of Patients and Outcome Measures

|                      | Groups I, II, III | Group I | Group II | Group III | Significance† |
|----------------------|------------------|---------|----------|-----------|---------------|
| All Myomectomies     |                  |         |          |           |               |
| No. patients         | 332              | 90      | 33       | 209       |               |
| Patient age (Mean yr SD) | 35.47 ± 4.8     | 35.76 ± 4.2 | 34.36 ± 5.1 | 35.517 ± 4.9 | NS           |
| Myoma no. (Mean ± SD) | 2.238 ± 1.7      | 2.42 ± 1.85 | 1.63 ± 1.16 | 2.25 ± 1.8 | I vs II: P < 0.0065 |
| Myoma diameter       | 6.20 ± 2.7       | 4.91 ± 2.2 | 6.18 ± 1.9 | 6.76 ± 2.7 | III vs I: P < 0.0000; II vs I: P < 0.0163 |
| Operating time       | 124.021 ± 52.2   | 142.27 ± 58.32 | 122.18 ± 35.39 | 118.66 ± 49.8 | III vs I: P < 0.0003; II vs I: P < 0.0012 |
| HB drop (Mean g/mL ± SD) | 1.06 ± 0.8      | 1.11 ± 0.47 | 0.68 ± 0.47 | 1.11 ± 0.9 | I vs III: NS |
| Hospital stay        | 2.0 ± 0.57       | 2.0 ± 0.73 | 1.8 ± 0.58 | 2.04 ± 0.43 | NS           |

*Group I = earlier years; Group II = introduction of electromechanical morcellator; Group III = introduction of vasoconstrictive agents.
†P < 0.016 was considered as statistically significant.

### Table 2.

Randomized Groups for US Color Doppler Study of the Myomectomy Scar Demographic Characteristics and Clinical Outcomes

|                      | Laparoscopy and Laparotomy | Laparotomy | Laparoscopy | Significance |
|----------------------|-----------------------------|------------|-------------|--------------|
| Number of patients   | 30                          | 10         | 20          | NS           |
| Median age [median yr (range)] | 36 (26–42)     | 35 (26–39) | 36 (29–42) | NS           |
| Myoma size [median cm; mean ± SD (range)] | 5; 5.4 ± 3.68 (1–10) | 5; 5.3 ± 3.59 (2–10) | 5; 5.5 ± 3.75 (1–9) | NS           |
| Myomas removed per patient | 1.2                      | 1.4         | 1.1         | NS           |
able accentuation of the vascularity at the level of the myomectomy scar along with a further slight reduction in PI and RI. The following US examinations demonstrated a progressive reduction in this hyper-vascularity that 45 days after the surgery was absolutely indistinguishable from the vascularity of the surrounding myometrium. PI and RI gradually increased to be the same as the indexes in the intact myometrium. The myomectomy wound visualized as only 1 ultrasonic pattern of a highly echogenic area with an ill-defined, heterogeneous myometrial texture. A progressive reduction in scar size was also reported. Moreover, postoperative US examinations showed the absence of hematomas in the site of the myomectomy wound. US findings after laparoscopic or laparotomic myomectomy were comparable (P=0.2).10

The overall rate of intrauterine pregnancy following LM was 65.5%. No uterine ruptures were observed. The pregnancy rate after laparoscopic myomectomy was similar to the pregnancy rate reported after laparotomic myomectomy.

**DISCUSSION**

Laparoscopic myomectomy is still a controversial procedure whose feasibility and indications over the years have been greatly discussed.1, 4, 11, 12 Sensational reports in the literature13–17 focus attention on the wrong techniques or adverse events. Concerns regarding uterine wall integrity and stability after surgery, the undoubtedly long operating time, the supposed higher recurrence rate,6 and the technical difficulties due to myoma mobilization and laparoscopic suturing have made it mandatory to check the technique used and the personal results.

Nine cases of uterine rupture after laparoscopic myomectomy have been reported so far.13–17 Authors cite application of excessive tissue coagulation, difficulties in tissue approximation or use of unsuitable suture size18 with the risk of intramural hematomas, indentations and uterine fistulas as possible contributing factors. The problem raised doubts about how solid the uterine wall is after laparoscopic myomectomy for patients desiring pregnancy. To search into it, we studied vascularization of the uterine wound after laparoscopic myomectomy by means of transvaginal color Doppler ultrasonography. Changes in the uterine scar following laparoscopic myomectomy by means of ultrasonography and Doppler velocimetry of the uterine arteries, measured at the origin of their ascending branch, have been reported19: uterine healing showed a progressive reduction in the size of the scar, with a statistically significant increase in the resistance index value of the ipsilateral uterine artery. Times and conditions of the vascular repair of the uterine “scar” at the site of the myomectomy have not been investigated so far. We studied vascularization of the uterine wound after laparoscopic and laparotomic myomectomy by means of transvaginal color Doppler ultrasonography in comparison with vascularity of the contralateral intact myometrium. In this way, it was also possible to check for defective healing (hematomas, indentations) along the uterine scar in the immediate postoperative period.

Transvaginal color Doppler can be used to study the evolution of the “scar” following myomectomy. The healing process after laparoscopic myomectomy seems to be as safe and uneventful as after laparotomic myomectomy: the size of the uterine wound decreased steadily from the day after the procedures to day 30 to 40 when it was possible to assess the healing process. Vascularization in the site of the myomectomy scar was also comparable after laparoscopic and laparotomic procedures.

Results of this study make us believe that the risk of uterine rupture is more related to incorrect technique for tissue approximation rather than to endoscopic suturing itself.

After reports of uterine ruptures following LM in case of removal of pedunculated or subserosal myomas using electrosurgery only,15, 16 now we always apply sutures or endoscopic loops. Suturing is usually done along one or two layers depending on the depth of the incision. The edges of the myomectomy site have to be thoroughly reapproximated to avoid dead spaces and to prevent the formation of hematomas. We used large, curved needles (CT 1, 30 mm to 40 mm) swaged to Vicryl (1 or 0). In fact, the use of unsuitable suture size (Vicryl 3 zero) has been considered one factor predisposing patients to uterine ruptures reported in the early cases.6, 14 The running suture was demonstrated to obtain a lower Hb drop (0.61 vs 1.1 g/100 mL; P<0.01) but needs good teamwork and coordination between surgeon and assistant. We had the impression that this kind of suture was quicker, but after a review of the statistical analysis avoiding confounding factors, it appears to take longer.

Some authors4, 20 suggest that no more than 3 or 4 myomas with a diameter <7cm to 8cm are to be removed, but others believe in individual choice based on pathologic findings and surgical skill21. At the present time, we choose not to perform laparoscopic myomectomies with more than 5 to 7 large myomas because in these cases we believe that the procedure is excessively time-consuming and that the surgeon can miss the smaller myomas after the uterus has been incised and repaired in too many
places. In these cases, if a minimally invasive approach is still advocated, uterine artery embolization may be the best choice. Moreover, in case of more than 3 or 4 myomas, patients should be informed of the higher risk of recurrences.

During the first years of the survey, we treated patients with an elevated number of large myomas with GnRH analogs to facilitate the surgery, reducing myoma volume. We did not notice an improvement in the surgery given that preoperative treatment with GnRH may increase difficulties in identifying and dissecting the cleavage plane between the myoma and its pseudocapsule. According to Dubuisson,22 GnRH analogs are one of the preoperative factors that were found to be independently related to the risk of conversion and, moreover, we had very strong suggestions of a greater chance of not detecting myomas because of their shrinkage after therapy with a higher risk of recurrence in GnRH analog-treated patients.7

At the moment, we only treat women with serious anemia due to persistent menometrorrhagia to improve hemoglobin concentration before surgery. To reduce vascularization and blood loss, starting in 1997, we injected myomas with vasoconstrictive agents. Our data showed significantly reduced Hb decline (P<0.001) after the use of vasoconstrictive agents.

The use of diluted vasoconstrictive agents has allowed the minor use of electrosurgery to achieve hemostasis and dissection in favor of sharp dissection. Nowadays, we recommend mechanical enucleation of the myoma with minimal or no use of electrosurgery given that authors11,18 reported application of excessive tissue coagulation as one of the possible contributing factors to uterine rupture after LM.

Since 1993, several systems of electromechanical morcellation have been available; nevertheless, myoma morcellation is still the most time-consuming part of the entire procedure. Operative time was significantly positively correlated with the dominant myoma diameter and the number of myomas. Considering the myoma as a spheroid, its volume will exponentially increase while increasing its diameter. The proposed posterior colpotomy is not suitable and does not correspond to the requirements of minimally invasive surgery. Furthermore, an infectious risk is involved that can lead to delayed postoperative healing with intraabdominal adhesions.

The learning curve has positively influenced only the enucleation-suturing part of the procedure and the capability to approach bigger myomas that were previously discarded. The conversion rate and complication rate have not differed over the years.

On the other hand, the improvements in morcellation systems and grasping forceps, the end of the learning curve in suturing, the increased confidence given by good results reported worldwide have allowed a reduction in operating time and the completion of more demanding myomectomies. Table 3 shows how the experience has modified the approach to myomectomy over the years. Over the last 15 years, the gained experience and the clinical results have changed our approach and decision making regarding laparoscopic myomectomy. Our satisfactory outcomes and extremely low conversion rate (1.51%) suggest that laparoscopic myomectomy is a safe and reliable procedure even in the presence of multiple or

| Pedunculated myomas | Bipolar forceps | Monopolar or bipolar current Suture or endoscopic loop |
|---------------------|----------------|------------------------------------------------------|
| Vasoconstrictive agents | No | Diluted ornithine vasopressin and now, diluted (20 IU:500 ml) argipressin. |
| Enucleation | Mostly with electrosurgery | Mostly mechanical |
| Suture | Vicryl 0 Single layer | Vicryl 1 or 2 Two layers, single or continuous |
| Morcellation | Manual | Electromechanical |
| GnRH analogs for myomas >6 cm | Yes | No, only with persistent menometrorrhagia or Serious anaemia |
| GnRH analogs for myomas >10 cm | Yes | Only in case of difficult mobilization |

Table 3. Developments in Techniques of Myomectomy
enlarged myomas. Moreover, our pregnancy rate and pregnancy outcome indicate that both wish for pregnancy and infertility before surgery are not exclusion criteria for the laparoscopic approach.

**CONCLUSION**

Laparoscopic myomectomy, when performed by an experienced surgeon, may be a safe technique and may offer comparable results with those obtained with laparotomy. Moreover, considering the high recurrence rate also with laparotomy and the consequent risk of repeated surgery, we think that patients should be offered the least invasive surgical approach available.

**References:**

1. Semm K. New methods of pelviscopy (gynecologic laparoscopy) for myomectomy, ovariectomy, tubectomy and adenectomy. *Endoscopy.* 1979;11(2):85–93.

2. Mais V, Ajossa S, Guerriero S, Mascia M, Solla E, Melis GB. Laparoscopic versus abdominal myomectomy: a prospective, randomized trial to evaluate benefits in early outcome. *Am J Obstet Gynecol.* 1996;174:654–658.

3. Dubuisson J-B, Chapron C, Chavet C, et al. Laparoscopic myomectomy: where do we stand? *Gynecol Endosc.* 1995;2:171–173.

4. Takeuchi H, Kuwatsuru R. The indications, surgical techniques, and limitations of laparoscopic myomectomy. *JSLS.* 2003;7:89–95.

5. Daniell JB, Guerly LD. Laparoscopic treatment of clinically significant symptomatic uterine fibroids. *J Gynecol Surg.* 1991;7:37–40.

6. Nezhat F, Roemisch M, Nezhat CH, Seidman DS, Nezhat CR. Recurrence rate after laparoscopic myomectomy. *J Am Assoc Gynecol Laparosc.* 1998;5:237–240.

7. Rossetti A, Sizzi O, Soranna L, Cucinelli F, Mancuso S, Lanzone A. Long-term results of laparoscopic myomectomy: recurrence rate in comparison with abdominal myomectomy. *Hum Reprod.* 2001;16(4):770–774.

8. Steer CV, Campbell S, Pampiglione JS. Transvaginal color flow imaging of the uterine arteries during the ovarian and menstrual cycles [on CD-ROM]. *Hum Reprod Update.* 1997;3: Item 3.

9. Kurjak A, Kupesic-Urek S, Miric D. The assessment of benign uterine tumor vascularization by transvaginal color Doppler. *Ultrasound Med Biol.* 1992;18:645–649.

10. Rossetti A, Sizzi O, Florio G, Tancredi G, Paparella P, Mancuso S. Power doppler sonographic evaluation of the vascularity of the myomectomy “scar”: comparison between laparoscopic and laparotomic myomectomy. Presented at: World Congress on Gynecologic Endoscopy/1st Annual Meeting of the Israel Society of Gynecologic Endoscopy; March 26–29, 2000; Tel Aviv, Israel.

11. Nezhat F, Seidman DS, Nezhat C, Nezhat CH. Laparoscopic myomectomy today. Why, when and for whom? *Hum Reprod.* 1996;11:933–934.

12. Donnez J, Mathieu PE, Bassil S, Smets M, Nisolle M, Berliere M. Laparoscopic myomectomy today. Fibroids: management and treatment: the state of the art. *Hum Reprod.* 1996;11:1837–1840.

13. Harris WJ. Uterine dehiscence following laparoscopic myomectomy. *Obstet Gynecol.* 80(3 Pt 2):545–546, 1992.

14. Dubuisson JB, Chavet X, Chapron C, Gregorakis SS, Morice P. Uterine rupture during pregnancy after laparoscopic myomectomy. *Hum Reprod.* 1995;10(6):1475–1477.

15. Hashbargen U, Summerer-Moustaki M, Hillenmann P, et al. Uterine dehiscence in a nullipara, diagnosed by MRI, following use of unipolar electrocautery during laparoscopic myomectomy: case report. *Hum Reprod.* 2002;17(8):2180–2182.

16. Pelosi MA 3rd, Pelosi MA. Spontaneous uterine rupture at thirty-three weeks subsequent to previous superficial laparoscopic myomectomy. *Am J Obstet Gynecol.* 1997;177(6):1547–1549.

17. Hockstein S. Spontaneous uterine rupture in the early third trimester after laparoscopically assisted myomectomy. A case report. *J Reprod Med.* 2000;45(2):139–141.

18. Seidman DS, Nezhat CH, Nezhat F, Nezhat C. The role of laparoscopic-assisted myomectomy (LAM). *JSLS.* 2001;5(4):299–303.

19. Seneira P, Gaglioti P, Volpi E, Cau MA, Todros T. Ultrasound evaluation of uterine wound healing following laparoscopic myomectomy: preliminary results. *Hum Reprod.* 1999;5:391–395.

20. Dubuisson J-B, Chapron C. Uterine fibroids: place and modalities of laparoscopic treatment. *Eur J Obstet Gynecol.* 1996;65:91–94.

21. Cittadini E. Laparoscopic myomectomy: the Italian experience. *J Am Assoc Gynecol Laparosc.* 1998;5:7–9.

22. Dubuisson JB, Fauconnier A, Fourchotte V, Babaki-Fard K, Coste J, Chapron C. Laparoscopic myomectomy: predicting the risk of conversion to an open procedure. *Hum Reprod.* 2001;16(8):1726–1731.