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Original Article

Hysteroscopic Myomectomy of Large Submucous Myomas in a 1-Step Procedure Using Multiple Slicing Sessions Technique

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ABSTRACT **Objective:** To evaluate the feasibility and efficacy of our technique for resectoscopic removal of large symptomatic submucous myomas.

Design: Prospective study (Canadian Task Force classification II-3).

Setting: A university teaching hospital and a private hospital.

Patients: Forty-nine patients with submucous myomas $\geq$ 4 cm in diameter complaining of abnormal uterine bleeding. Seventeen patients were also complaining of infertility.

Interventions: The intrauterine portion of submucous myomas was resected using the slicing technique. Slicing started at the site of the maximum bulge of the myoma and was continued down to the level of the endometrial surface. Each slicing session lasted for 5 to 10 minutes. After each slicing session, saline infusion was discontinued and restarted alternatively several times to induce rapid changes in the intrauterine pressure (hydromassage) to stimulate uterine contractions. The resectoscope was removed, and ovum forceps was used to extract the myoma fragments. Bimanual massage of the uterus was performed to induce extrusion of the intramural portion of the myoma into the uterine cavity. The same steps (slicing session lasting for 5–10 minutes to excise the portion of the myoma extruded into the uterine cavity, hydromassage, and uterine massage) were repeated several times until complete removal of the myoma.

Measurements and Main Results: The mean diameter of the principle myomas was 51.94 $\pm$ 5.58 mm. The rate of 1-step complete resection of myomas was 91.84% (45/49). Improvement of bleeding symptoms was observed in all patients with complete resection of myomas. Nine of the 17 infertile women conceived after hysteroscopic myomectomy. One-step complete resection of myomas was more frequent in patients with myomas $<$ 6 cm (43/44 [97.73%] vs 2/5 [40%], risk ratio [RR] = 2.44, p = .002), single myomas (39/40 [97.5%] vs 6/9 [66.67%], RR = 1.46, p = .016), principle myomas with a Lasmar score $<$ 7 (32/32 [100%] vs 13/17 [76.47%], RR = 1.31, p = .011), and myomas with less than 50% extension into the myometrium (26/26 [100%] vs 19/23 [82.61%], RR = 1.21, p = .042). The rate of 1-step complete removal of myomas was 95% (19/20) for type II myomas $<$ 6 cm and 0% (0/3) for type II myomas $\geq$ 6 cm.

Conclusion: Our technique of hysteroscopic myomectomy is a safe and effective management for submucous myomas up to 6 cm in diameter. Journal of Minimally Invasive Gynecology (2015) 22, 1196–1202 © 2015 AAGL. All rights reserved.

Keywords: Hysteroscopy; Myomectomy; Submucous myoma

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Uterine myomas (leiomyomas) are the most common tumor of the female genital tract. The incidence of uterine myomas is 20% to 25% in women of reproductive age. Submucous myomas account for 5.5% to 16.6% of all uterine myomas [1]. Submucous myomas are subclassified into type 0, I, and II depending on the degree of intramural involvement. A type 0 myoma is entirely in the endometrial cavity, a type I myoma has its larger portion ($\geq$50%) in the

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endometrial cavity, and a type II myoma has its smaller portion (<50%) in the endometrial cavity [2]. Menorrhagia, metrorrhagia, pelvic pain, dysmenorrhea, and subfertility are common presenting symptoms of submucous myomas. Moreover, submucous myomas are commonly associated with obstetric complications such as abnormal presentation, preterm labor, postpartum hemorrhage, and puerperal sepsis [3].

Before the introduction of hysteroscopic myomectomy by Neuwirth and Amin in 1976 [4], abdominal hysterectomy and myomectomy were the traditional management options for patients with symptomatic submucous myomas not protruding from the cervix. Abdominal hysterectomy was indicated in patients who had completed their family, and abdominal myomectomy was reserved for young patients who desired to retain fertility. Both operations are major operations that are associated with significant perioperative morbidity. In subfertile women, abdominal myomectomy may induce pelvic adhesions, and, therefore, it impairs fertility rather than improves fertility. Moreover, cesarean section is required for delivery after abdominal myomectomy [5].

Because of the technical advances in the field of hysteroscopy during the past 2 decades, hysteroscopic myomectomy has become the treatment of choice in the management of patients with symptomatic submucous myomas. Hysteroscopic myomectomy is a feasible and effective method in the management of patients with symptomatic submucous myoma that is associated with less postoperative pain, shorter hospital stay, and rapid recovery time [1].

Although type 0 myomas are usually removed completely in a 1-step procedure, complete removal of myomas with intramural development (particularly type II) in a 1-step procedure is often difficult. Moreover, several studies revealed that surgical removal of large myomas (4–5 cm) is technically difficult and associated with an increased risk of incomplete removal of the myoma [6]. Some authors recommended a 2-step procedure for type II myomas, and other authors recommended that myomas more than 4 to 5 cm should not be removed by hysteroscopy [7].

Several authors proposed several techniques for complete excision of type II myomas in a 1-step procedure. Mazzon [8] described enucleation of the intramural portion of the myoma by traction and leverage maneuvers using nonelectrical loops (cold loops), Litta et al [9] described an enucleation in toto technique, and Bettocchi et al [10] described the office preparation of partially intramural myomas (OPPIuM) technique. The aim of these techniques is to extrude the intramural portion of the myoma into the uterine cavity. The extruded intramural portion of the myoma can be easily and safely removed by the slicing technique. Moreover, several authors used various maneuvers (rapid change of intrauterine pressure or manual massage of the uterus) or drugs (intracervical carboprost or transabdominal injection of prostaglandin F-2α guided by laparoscopy) to facilitate extrusion of the intramural portion of the myoma into the uterine cavity by stimulating uterine contractions [11–14].

In this study, a combination of techniques (manual massage, hydromassage, and applying traction on the myoma by a resectoscope loop inserted in the cleavage plane between the myoma and the myometrium) was used to facilitate extrusion of the intramural portion of the myoma into the uterine cavity. The aim of this study was to evaluate the feasibility and efficacy of our technique for resectoscopic removal of large symptomatic submucous myomas.

Methods

This prospective study was conducted at the Department of Obstetrics and Gynecology, Cairo University, Egypt, and Women's Medical Center, Cairo, Egypt, between December 2009 and October 2014. Forty-nine patients complaining of abnormal uterine bleeding with submucous myomas $\geq$ 4 cm in mean diameter were recruited for the study. The study protocol was approved by the institutional ethics committees of both hospitals. Patients were counseled about the potential benefits and risks of hysteroscopic myomectomy, and written informed consent was obtained from the patients before surgery.

Exclusion criteria were menopausal status, age younger than 18 years, presence of more than 2 submucous myomas, a myometrial-free margin (thickness of the myometrium between the deepest portion of the myoma and the serosa) < 5 mm, and the presence of contraindication to hysteroscopy (pregnancy, cervicitis, acute pelvic inflammatory disease, and cervical or endometrial cancer).

Before surgery, transvaginal ultrasound examination was performed to measure the dimensions of the uterus and to detect myoma characteristics (ie, location, number, mean diameter, and type of myoma). Moreover, office hysteroscopy was performed to confirm ultrasound findings and to detect the Lasmar score and myoma type according to the European Society for Gynecological Endoscopy classification of submucous myomas [6,15]. Gonadotropin-releasing hormone (GnRH) analogs were not administered preoperatively. Misoprostol (400 μg) (Misotac; Sigma Pharma, Cairo, Egypt) was administered vaginally 3 hours before surgery.

All operations were performed under general anesthesia. The cervix was dilated with a Hegar dilator up to size 9. A bipolar 26F continuous-flow resectoscope (Karl Storz, Tuttlingen, Germany) with a 4-mm 12° fore-oblique telescope equipped with an 8-mm 90° U-shaped sharp cutting loop was introduced into the uterine cavity. The electrosurgical unit was set at an 80- to 100-W cutting current (Autocon II 400, Karl Storz). The uterine cavity was distended by warm saline (NaCl 0.9%) administered by an automatic fluid pump (Endomat, Karl Storz). The rate of saline infusion was 150 mL/min. An inflow pressure of 80 to 100 mm Hg and a suction pressure of 30 to 40 mm Hg were maintained through the procedure. A plastic draping was used to funnel escaping fluids from the vagina into a calibrated container. The intrauterine portion of the submucous myoma was resected using the slicing technique. Slicing started at the site of the maximum bulge of the myoma (the least vascular area) and was continued down to the level of the endometrial surface. The resectoscope loop was inserted in the cleavage plane between the myoma and the myometrium to apply traction on the myoma to induce extrusion of the intramural portion of the myoma into the uterine cavity. Each slicing session lasted for 5 to 10 minutes.

After each slicing session, saline infusion was discontinued and restarted alternatively several times to induce rapid changes in the intrauterine pressure (hydromassage) to stimulate uterine contractions. The resectoscope was removed, and ovum forceps was used to extract the myoma fragments. Bimanual massage of the uterus was performed as described by Hallez [11]. The index and middle figure of the right hand were inserted in the posterior fornix of the vagina to apply pressure on the posterior surface of the uterus, and the left hand was placed on the anterior abdominal wall to apply counterpressure on the uterus. The pressure exerted by the fingers on the myoma induced extrusion of a considerable part of the intramural portion of the myoma into the uterine cavity. Transvaginal ultrasound examination was performed to monitor the progression of myoma resection. Fluid deficit (the difference between the volume of the infused saline and the volume of the saline recovered from the suction bottle and the calibrated container) was measured.

The same steps (ie, slicing session lasting from 5–10 minutes to excise the portion of the myoma extruded into the uterine cavity, hydromassage, uterine massage, fluid monitoring, and ultrasound examination) were repeated several times until complete removal of the myoma as evidenced by the visualization of the pink fasciculate structure of the myometrium.

Bleeding vessels at the base of the myoma were coagulated. The pressure of the distension media was temporary reduced to help in the identification of bleeding vessels at the base of the myoma. At the end of the procedure, transvaginal ultrasound examination was performed to confirm complete resection of the submucous myoma. Myoma fragments were sent for pathological examination. Estradiol valerate (2 mg) was given for 30 days, and medroxyprogesterone acetate (10 mg) was given from days 21 to 30 [1].

An office hysteroscopy was performed 2 months postoperatively to detect the presence of partially resected myomas and intrauterine adhesions. Moreover, transvaginal ultrasound was performed to confirm complete excision of the myomas. Patients were asked to attend follow-up visits every 3 months. They were asked about their menstrual pattern and fertility outcome.

The interval between dilatation of the cervix and removal of the resectoscope (operative time) and fluid deficit were measured. Operative complications such as uterine perforation, cervical injury, bleeding, fluid deficit more than 2000 mL, and air embolism were recorded. Late complications including intrauterine adhesions, abnormal placentation, and uterine rupture in subsequent pregnancies were recorded.

Statistical analysis was performed using the chi-square test or Student's *t* test as appropriate. The Fisher exact test was used when the expected frequency was less than 5. A p value less than .05 was considered statistically significant. Multivariate analysis was performed to detect factors correlated with incomplete resection of the myoma and fluid deficit. All statistical calculations were performed using Excel version 7 (Microsoft, Redmond, WA).

Results

The mean (standard deviation [SD]) age of the patients was 37.61 (4.66) years (range, 31–48 years). Twelve patients (24.49%) were nulliparous, and 37 patients (75.51%) were parous. The mean (SD) body mass index was 27.76 (3.83) kg/m^2 (range, 22–37 kg/m^2). All the patients were complaining of abnormal uterine bleeding, and 17 patients were also complaining of infertility. Forty patients had a single myoma, and 9 patients had 2 myomas. The mean (SD) diameter of the principle myoma was 51.94 (5.58) mm (range, 40–65 mm), and the mean diameter of the second myoma was 22.1 (3.94) mm (range, 12–29 mm). Seventeen of the principle myomas had a Lasmar score $\geq$ 7, 30 of the principle myomas had a Lasmar score of 4 to 6, and 2 principle myomas had a Lasmar score of 0 to 3. Thirteen of the principle myomas were type 0, 13 of the principle myomas were type I, and 23 of the principle myomas were type II (Table 1). The mean (SD) operative time was 65.45 (19.01) minutes (range, 35–112 minutes), and the mean (SD) hospital stay was 6.55 (3.01) hours (range, 4–12 hours). None of the patients had operative complications. The mean (SD) volume of the distension media was 13 273 (3511) mL (range, 1100–18 400 mL), and the mean (SD) volume of fluid deficit was 829 (296) mL (range, 400–1400 mL). None of the patients had fluid overload. Multivariate analysis revealed that myoma size, type and Lasmar score were the main factors correlated with fluid deficit.

Table 1

Patient characteristics

No. of patients	49
Age at time of surgery (years)	37.61 ± 4.663
Body mass index (kg/m^2)	27.76 ± 3.83
Parity, n (%)	
Nulliparous	12/49 (24.49)
Parous	37/49 (75.51)
Number of myomas, n (%)	
Single myoma	40/49 (81.63)
2 myomas	9/49 (18.37)
Size of the larger myoma (mm)	51.94 ± 5.58
Size of the smaller myoma (mm)	21.1 ± 3.94
Lasmar score of principle myoma, n (%)	
Score 0–3	2/49 (4.08)
Score 4–6	30/49 (61.22)
Score 7–9	17/49 (34.69)
Lasmar score of smaller myoma, n (%)	
Score 0–3	5/9 (55.56)
Score 4–6	4/9 (44.44)
Score 7–9	0/9 (0)
Type of principle myoma, n (%)	
Type 0	13/49 (26.53)
Type I	13/49 (26.53)
Type II	23/49 (46.94)
Type of smaller myoma, n (%)	
Type 0	4/9 (44.44)
Type I	5/9 (55.56)
Type II	0/9 (0)
Indication of myomectomy, n (%)	
Abnormal uterine bleeding	32/49 (65.31)
Abnormal uterine bleeding and infertility	17/49 (34.69)

Values are expressed as n/n (%) or mean ± standard deviation.

An office hysteroscopy performed 2 months after hysteroscopic myomectomy revealed the presence of residual myomas in 4 patients. All the incompletely removed myomas were type II myomas and had a Lasmar score ≥ 7. Three of 5 myomas with a mean diameter ≥ 6 cm were incompletely resected. The 4 patients underwent repeated hysteroscopic myomectomy within 3 to 5 months after the primary operation. Bivariate analysis revealed that 1-step complete resection of the myoma was more frequent in patients with myomas < 6 cm (43/44 [97.73%] vs 2/5 [40%], risk ratio [RR] = 2.44, p = .002), single myomas (39/40 [97.5%] vs 6/9 [66.67%], RR = 1.46, p = .016), principle myomas with a Lasmar score < 7 (32/32 [100%] vs 13/17 [76.47%], RR = 1.31, p = .011), and myomas with less than 50% extension into the myometrium (26/26 [100%] vs 19/23 [82.61%], RR = 1.21, p = .042) (Table 2). Multivariate analysis using logistic regression analysis revealed no correlation between myoma size, type, number, or Lasmar score and incomplete resection of myomas.

The mean follow-up period (SD) was 13.18 (4.85) months (range, 6–24 months). Thirty-six patients had marked improvement of bleeding symptoms, and 9 patients had moderate improvement of bleeding symptoms. On the other hand, no improvement of bleeding symptoms was reported in the 4 patients who had residual myomas. Postoperative filmy intrauterine adhesions were detected in 2 patients. These intrauterine adhesions were successfully managed during the office hysteroscopy examination performed 2 months after the initial procedure.

Among the infertile patients, 52.94% (9/17) conceived spontaneously after hysteroscopic myomectomy. One patient had coexistent tubal factor of infertility. The patient did not conceive after an in vitro fertilization–embryo transfer cycle. The mean (SD) follow-up period was 16.47 (4.20) months (range, 12–24 months). The mean (SD) duration between surgery and pregnancy was 7.56 (4.40) months (range, 2–15 months). Four patients delivered by cesarean section, and 3 patients delivered vaginally. Two patients had spontaneous abortion.

Discussion

In this prospective study, we were able to show that the slicing technique combined with manual massage, hydromassage, and applying traction on the myoma by a resectoscope loop inserted in the cleavage plane between the myoma and the myometrium has a high rate of 1-step complete resection for myomas with intramural development. All type 0 and type I myomas were resected completely in a 1-step procedure. The rate of 1-step complete removal of myomas was 95% (19/20) for type II myomas < 6 cm and 0% (0/3) for type II myomas ≥ 6 cm. The results of our study are in line with previous studies evaluating the use of the cold loops myomectomy technique (Mazzon technique), the enucleation in toto technique (Litta technique), and the OPPIuM technique in the management of myomas with intramural extension. In a prospective study including 44 patients with type II myomas, Litta et al [9] used a 90° Collins electrode to make an elliptical incision in the mucosa covering the myoma at the level of its reflection on the uterus until the cleavage plane between the myoma and the uterus was reached. Connective tissue bridges between the myoma and the myometrium were resected. After complete excision of these bridges, the myoma protruded into the uterine cavity and was removed easily by the slicing technique. The rate of 1-step complete excision of type II submucous myomas was 93.18% (41/44) [9]. A prospective study evaluating the use of the cold loops myomectomy technique (Mazzon technique) in a series of 159 premenopausal patients with type

Table 2

Predictors for 1-step procedure

	1-step procedure, n (%)	Risk ratio	CI	p value
Number of myomas				
Single myoma	39/40 (97.5)	1.46	(0.92–2.33)	.016
2 myomas	6/9 (66.67)	1		
Size of the principle myoma				
Less than 6 cm	43/44 (97.73)	2.44	(0.83–7.15)	.002
6 cm or more	2/5 (40)	1		
Lasmar score of principle myoma				
Score 0–6	32/32 (100)	1.31	(1–1.70)	.011
Score 7–9	13/17 (76.47)	1		
Type of principle myoma				
Type 0 and I	26/26 (100)	1.21	(1–1.46)	.042
Type II	19/23 (82.61)	1		

CI = confidence interval.

Values are expressed as n/n (%).

I and type II submucous myomas revealed that the rates of 1-step complete removal for type I and type II submucous myomas were 92% and 85%, respectively [16]. In a prospective study including 59 patients with submucous myomas with intramural development, Bettocchi et al [10] used a bipolar Versapoint twizzle electrode or scissors (Gynecare; Ethicon Inc., Somerville, NJ) to incise the mucosa covering the myoma at the level of its reflection on the uterus. Incision of the mucosa and pseudocapsule was continued until the cleavage plane between the myoma and its pseudocapsule was reached. The aim of this technique (the OPPIuM technique) was to induce extrusion of the myoma into the uterine cavity during subsequent menstrual cycles. Resectoscopic surgery was performed after 2 menstrual cycles, and the extruded myoma was excised using the slicing technique. The rates of complete excision of type I and type II submucous myomas were 100% and 93.75%, respectively [10].

In the present study, myoma size $\geq$ 6 cm was the main factor that hindered the 1-step procedure. Complete resection of the myoma in a 1-step procedure was more frequent in patients with principle myomas smaller than 6 cm in diameter (43/44 [97.73%] vs 2/5 [40%], RR = 2.44, p = .002). Previous studies revealed that a myoma size more than 3 to 5 cm was the main factor associated with incomplete resection of submucous myomas and operative complications. In a retrospective study including 112 patients with type II myomas who underwent hysteroscopic myomectomy using the enucleation in toto technique, the rate of the 2-step procedure was 15.2%. Patients with myomas more than 3 cm in diameter are more likely to have a 2-step procedure [17]. A prospective study evaluating the efficacy and safety of hysteroscopic myomectomy using the cold loop technique in a series of 33 patients with submucous myomas 5 cm or more in diameter revealed that 81.8% of the patients have complete excision of myomas in a 1-step procedure. A Lasmar score $\geq$ 7 and myoma size > 5 cm were significant predictors for a 2-step procedure [18]. In a prospective study including 27 patients with type I and 32 patients with type II submucous myomas (2.96 $\pm$ 0.8 cm in diameter) who underwent hysteroscopic myomectomy using the OPPIuM technique, the rate of the 2-step procedure was 3.39% (2/59). The incompletely resected myomas were type II myomas with a mean diameter more than 4 cm [10]. Litta et al [9] reported that the rate of 1-step complete excision of type II myomas was 97.56% for myomas < 4 cm and 33.33% for myomas $\geq$ 4 cm.

The data presented in this study revealed that hysteroscopic myomectomy was effective in controlling abnormal uterine bleeding in 91.84% of the patients. Previous studies reported that the success rate of hysteroscopic myomectomy in controlling abnormal uterine bleeding ranged between 70% and 97% [19,20]. The success of hysteroscopic myomectomy in controlling abnormal uterine bleeding seems to be influenced by the operation technique, operator skill and experience, and myoma size and type. Fernandez et al [21] reported a 78% rate of bleeding control for myomas smaller than 3 cm and a 14% rate of bleeding control for myomas larger than 5 cm. On the other hand, a prospective study including 30 patients with submucous myomas 5 cm or more in diameter revealed that hysteroscopic myomectomy controlled abnormal uterine bleeding in 94.4% of patients [18].

In the present study, 52.94% of infertile patients conceived spontaneously after hysteroscopic myomectomy. The results of our study are in agreement with previous studies that reported that pregnancy rates after hysteroscopic myomectomy ranged between 29.7% and 58.9% [22,23]. Several factors such as the presence of the additional factor of infertility, multiple myomas, and intramural myomas have a negative impact on the postoperative fertility rate. Fernandez et al [21] reported that the pregnancy rate after hysteroscopic myomectomy was 57% for excised myomas $\geq$ 5 cm and 23% for excised myomas < 5 cm. Jayakrishnan et al [22] reported that the pregnancy rate after hysteroscopic excision of myomas was 50% for excised myomas $\geq$ 3 cm and 24.3% for excised myomas < 3 cm. In the current study, the large size of the removed myomas and the low percentage of patients with additional factors of infertility (5.88%) may be the causes for the high postoperative fertility rate.

In the current study, none of the patients had fluid overload, cervical lacerations, or uterine perforation. Previous studies revealed that hysteroscopic excision of large myomas and myomas with intramural extension are associated with increased risks of uterine perforation, cervical laceration, and intravasation of excessive amounts of distension media. The incidence of major complications in previous studies ranged between 2.75% and 9.01% [16,18].

Cervical lacerations may occur during dilatation of the cervix. The risk of cervical lacerations is increased if GnRH was used preoperatively because of the induced hypoestrogenic state [1]. In the current study, misoprostol was administered preoperatively to facilitate dilatation of the cervix, and GnRH was not administered. Uterine perforation may occur during dilatation of the cervix, introduction of the hysteroscope, excision of the intracavitary portion of the myoma by slicing, or enucleation of the intramural portion of the myoma by using cold loops [1]. In the current study, several measures were taken to minimize the risk of uterine perforation. Patients with a myometrial-free margin less than 5 mm were excluded. A combination of techniques (manual massage, hydromassage, and applying traction on the myoma using a resectoscope loop inserted in the cleavage plane between the myoma and the myometrium) was used to extrude the intramural portion of the myoma into the uterine cavity. The extruded portion of the myoma can be excised easily with the slicing technique without damage to the surrounding myometrium. Moreover, intraoperative ultrasound examination was performed after each slicing session (ie, every 5–10 minutes) to monitor the progression of myoma resection.

Intraoperative ultrasound imaging has been used successfully in monitoring hysteroscopic metroplasty and myomectomy to minimize the risk of uterine perforation and to achieve complete excision of the septum or myoma in a 1-step procedure [24,25]. In a prospective study, Ludwin et al evaluated the usefulness of intraoperative transrectal ultrasound in monitoring hysteroscopic resection of submucous myomas. One hundred and twenty patients with symptomatic submucous myomas were divided into two groups: the hysteroscopic myomectomy under transrectal ultrasound guidance [TRUS] group (n = 58) and the hysteroscopic myomectomy without TRUS group (n = 62). The rate of 1-step complete excision of submucous myomas was higher in the hysteroscopic myomectomy with TRUS group (91% vs 73%, p = .02) [25].

Several preventive measures were followed to reduce the risk of fluid overload. An infusion pressure of saline was less than 100 mm Hg, and a suction pressure of 30 to 40 mm Hg was maintained through the whole procedure. Opened vessels in the base of the myoma were coagulated. Moreover, stimulation of uterine contraction by hydromassage, bimanual massage, and preoperative misoprostol occluded the opened vessels and therefore minimized the intravasation of saline.

Only 2 patients (4.08%) had postoperative intrauterine adhesions. The incidence of postoperative intrauterine adhesions in previous reports ranged between 1% and 13%. Thermal damage of the myometrium and the endometrium surrounding the myoma is the main cause of postoperative intrauterine adhesions [11,15]. The lower incidence of intrauterine adhesions in our study may be attributed to some operative and postoperative measures. Our technique allowed easy and safe removal of the myoma without disruption of the adjacent myometrium and without thermal damage to the adjacent myometrium and endometrium. Moreover, estradiol valerate was given postoperatively for 1 month.

The small sample size was the main limitation of our study. The small number of cases with the 2-step procedure (n = 4) may be the cause of failure of detection of correlation between incomplete resection of the myoma and myoma size, type, number, and Lasmar score by multivariate analysis. Nevertheless, on reviewing the literature, the majority of studies that evaluated the efficacy of hysteroscopic myomectomy in the management of patients with submucous myomas either excluded patients with large myomas (3–5 cm) or included a small proportion of patients with large submucous myomas [1]. Only 1 study included a series of 33 patients with submucous myomas 5 cm or more in diameter [18], and, therefore, our study is the largest study that exclusively included patients with large submucous myomas. The short follow-up period is another limitation of our study. The main aim of our study was to evaluate the efficacy our technique in complete excision of large submucous myomas in a 1-step procedure and not to detect the long-term success of our technique. Numerous studies revealed that the success rate of hysteroscopic myomectomy in controlling abnormal uterine bleeding declines as the duration of follow-up increases [1]. Although the regrowth of the incompletely excised portion of the submucous myoma may be the cause of the recurrence of abnormal uterine bleeding, other factors such as the development of new myomas, the occurrence of dysfunctional uterine bleeding disorders, and coexistent adenomyosis may be the causes of this recurrence. Therefore, we think that a long-term follow-up for the recurrence of abnormal uterine bleeding would not evaluate the efficacy of our technique of hysteroscopic myomectomy because the recurrence of abnormal uterine bleeding may be caused by factors that are independent of the surgical procedure.

The data presented in our study revealed that the efficacy and safety of our technique of hysteroscopic myomectomy are comparable with the efficacy and safety of other techniques of hysteroscopic resection of submucous myomas with intramural development (ie, the cold loop myomectomy technique, the enucleation in toto technique, and the OPPIuM technique). In contrast to these techniques, our technique is simple and easy and requires no special instruments (ie, cold loops). Further randomized controlled studies are needed to compare various techniques of hysteroscopic resection of submucous myomas with intramural development. In conclusion, our technique of hysteroscopic myomectomy is a safe and effective management for submucous myomas up to 6 cm in diameter.

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