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Original article

A retrospective study of residual myomas following laparoscopic myomectomy

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ABSTRACT

Background: With the development of laparoscopic instruments such as the morcellator, a large number of gynecologists have performed laparoscopic myomectomies. In this study, we reviewed all cases in which residual myomas were identified by follow-up magnetic resonance imaging in order to evaluate why any myomas would remain after a laparoscopic myomectomy and to find their most common location and depth within the uterus.

Methods: Patients ($n = 128$) with uterine myomas who underwent a laparoscopic myomectomy between 2008 and 2011 and received follow-up magnetic resonance imaging 3 months afterward were reviewed retrospectively. We analyzed the influence of preoperative gonadotrophin-releasing hormone agonist treatment, as well as the location and depth of the residual myomas within the uterus. The pregnancy rate in all cases was also investigated.

Results: The duration of the preoperative administration of gonadotrophin-releasing hormone agonist was statistically longer in cases where multiple residual myomas were found, compared with cases where a single residual myoma was present. There was no statistical difference in the rate and size of the residual myomas among five different locations within the uterus. The rate of residual subserosal myomas was lowest, compared with two other types, and was statistically lower than residual intramuscular myomas ($p < 0.05$). The pregnancy rate in cases of residual myomas revealed no statistical difference compared with nonresidual cases.

Conclusion: Because the completion of laparoscopic myomectomy without any residual myomas is difficult, informed consent regarding the possibility of their occurrence is necessary, regardless of the number of myomas detected preoperatively. Moreover, intramuscular residual myomas should be given particular attention due to their higher rate of incidence.

Introduction

Laparoscopic myomectomy (LM) has been drawing more attention recently, as it is a less invasive and more cosmetically favored treatment.[1] With the development of laparoscopic instruments such as the morcellator, a large number of gynecologists have used this method to remove myomas.[2] Because LM requires advanced technical skill and sufficient experience on the surgeon's part, it is still the subject of substantial controversy.[2] Reconstructive suturing and uterine wound healing are the two main problems encountered with this operation, and a variety of case reports have described spontaneous uterine rupture during pregnancy after LM.[3]

Moreover, abdominal ultrasound transducers have been used intra-abdominally for women undergoing myomectomies, providing precise location and guidance to prevent residual myomas. Laparoscopic ultrasound transducers, however, are not widely used, thus leading to a loss of *feel* during laparoscopy, and this may also contribute to the occurrence of residual myomas after LM.[4]

Until now there have been no reports concerning residual myomas following LM. In order to evaluate why they would remain

Conflicts of interest: There is no potential conflict of interest with any author.

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after the procedure, and to find their most common location within the uterus, we reviewed all cases where residual myomas were identified by follow-up magnetic resonance imaging (MRI).

Materials and methods

Participants

Cases ($n = 128$) of uterine myoma, between 2008 and 2011, were retrospectively reviewed. We carried out an observation cohort study. In all cases, preoperative MRI was given at the first examination, and follow-up MRI was carried out 3 months after the operation as a general rule. All patients hoped for future fecundity and complained of symptoms such as menorrhagia and infertility. In the infertile patients, LM was carried out when a hysteroscopy confirmed the presence of a deviated uterine cavity due to myoma. Pregnant or menopausal patients were not included in this study. Our institutional review board approved this protocol (No. 72) and its consent form, and we received informed consent for this study from all participants.

Laparoscopic technique and follow-up

All patients underwent a preoperative MRI to determine the location and depth of the myoma. The LM was carried out by making a small incision in the navel through which the laparoscope was inserted. Two or three small, additional incisions were made in the abdomen, and other instruments were inserted through them. Following a local injection of vasopressin, the myoma was removed with a morcellator, and the incisions stitched using PDS-II Vicryl (ETHICON, New Brunswick, New Jersey, US).

We resected all myomas confirmed by the preoperative MRI to be $\geq$ 1 cm. Three months after the LM, all patients underwent a follow-up MRI to confirm the healing of the sutured site. In this study, we confirmed the diagnosis of residual myoma when a myoma >1 cm was identified by the follow-up MRI.

Statistical analysis

Comparisons between the two nonparametric groups were performed with the nonparametric Mann–Whitney U test or parametric unpaired t test or the Chi-square test. The Pearson correlation coefficient was carried out for normally distributed data. Differences were considered to be statistically significant at $p < 0.05$.

Results

Patient characteristics

Of the 128 patients retrospectively studied, residual myomas were identified in 34 patients (26.5%). There was no statistical difference in the ratio of the chief complaints such as desire for a baby, menorrhagia and abdominal distension between the residual and nonresidual groups (Table 1).

Table 1
Chief complaints.

	Residual $n = 34$	Nonresidual $n = 94$	p
Desire for a baby	19	38	>0.05
Dysmenorrhea	13	46	>0.05
Abdominal distension	3	1	>0.05
No symptom	6	0	>0.05

There is overlap.

Table 2
The duration of GnRHa treatment and rate of residual myomas.

	Single myoma $n = 62$	Multiple myomas $n = 66$	p
Preoperative GnRHa treatment	52 (84)	56 (85)	>0.05
Duration (mo)	3.5 ± 1.1	3.3 ± 1.2	>0.05
No. of residual cases	5 (8)	29 (44)	<0.001

Data are presented as n (%) or mean ± SD.
GnRHa = gonadotrophin-releasing hormone agonist.

The influence of preoperative gonadotrophin-releasing hormone agonist treatment on residual myomas

The duration of preoperative administration of gonadotrophin-releasing hormone agonist (GnRHa) showed no statistical difference between cases of single and multiple myomas; however, the rate of residual myoma was substantially higher in cases of multiple myomas than in cases of single myoma ($p < 0.05$; Table 2). In evaluating the effect of GnRHa, patients treated preoperatively with GnRHa showed no statistical difference in the rate of residual myoma when compared with those without preoperative treatment (Table 3).

Regardless of the preoperative diagnosis of a single myoma, a residual myoma was detected in three cases (Table 4). In Patient 1, a small undetectable myoma of 1 cm was adjacent to a large myoma; therefore, a diagnosis of a single myoma was preoperatively made (Fig. 1). In Patients 2 and 3, a preoperative MRI could not detect multiple myomas and, therefore, any residual myomas were not found until a follow-up MRI was carried out. In Patients 1 and 2, in particular, GnRHa was administered for 3 months and 4 months, respectively, before the operation in order to reduce the size of the myoma.

The location and depth of residual myomas

There were no statistical differences in the rate and size of the residual myomas among the five locations within the uterus (Table 5). However, when classified into three locations, such as the cervix, corpus, and fundus, cervical myomas had a higher tendency to remain, as compared with corpus and fundal myomas ($p < 0.05$; Table 5). Concerning depth, the residual rate of subserosal myomas was lowest, compared with the other two types, and was statistically lower than intramuscular myomas ($p < 0.05$; Table 6).

Pregnancy rate following operation

Of the 128 patients who were involved in this study, 57 were receiving treatment for infertility. The pregnancy rate of infertile patients with residual myoma revealed no statistical difference compared with those without residual myoma (Table 7).

Discussion

The recurrence of myomas has been reported to be higher after laparoscopic procedures when compared with the open

Table 3
The effect of preoperative GnRHa treatment.

	GnRHa $n = 108$	Non GnRHa $n = 20$	p
Number of cases of residual myoma	30 (28)	4 (20)	>0.05
Duration of administration	3.4 ± 1.2	—	
Preoperative counts	2.9 ± 2.8	2.1 ± 2.0	>0.05
Residual myoma	1.7 ± 1.2	1.2 ± 1.0	>0.05

Data are presented as n (%) or mean ± SD.
GnRHa = gonadotrophin-releasing hormone agonist.

Table 4
Detail if residual cases in which preoperative diagnosis was single myoma.

Case	Chief complaints	Duration of GnRHa (mo)	Size (cm)	Depth	Location	Residual size
1	Abdominal distention	3	7	Intra muscle	Anterior	1.0
2	Dysmenorrhea	4	4	Subserosa	Posterior	1.5
3	No symptom	0	3	Intra muscle	Posterior	1.0

GnRHa = gonadotrophin-releasing hormone agonist.

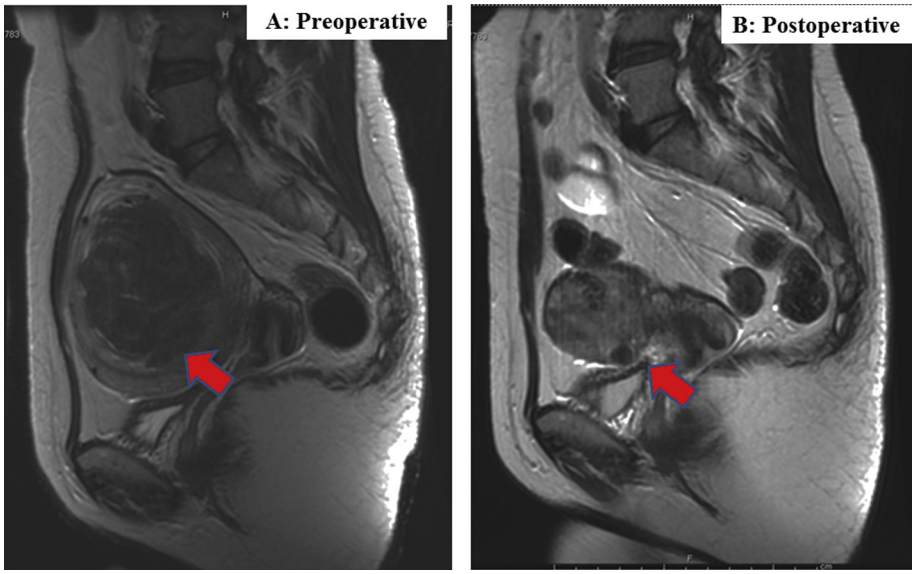

Fig. 1. (A) Small myoma of about 1 cm was not identified in preoperative myoma because it was adjacent to a large myoma. (B) Small myoma was firstly detected at postoperative magnetic resonance imaging.

Table 5
The location of residual myomas.

	Cervix		Corpus		Fundus	p
	Cervix anterior $n = 5$	Cervix posterior $n = 4$	Corpus anterior $n = 150$	Corpus posterior $n = 118$	Fundus $n = 69$	
Size of residual myoma (cm)	1.3 ± 0.3	3.015 ± 0.1	1.7 ± 0.6	1.6 ± 0.7	1.4 ± 0.3	>0.05
No. of residual myomas	2 (40)	2 (50)	25 (17)	20 (17)	6 (9)	>0.05

Table 6
The depth of residual myomas.

	Submucous $n = 24$	Intramuscle $n = 248$	Subserosa $n = 74$	p
Size of residual myoma (cm)	1.6 ± 0.1	1.7 ± 0.5	1.0 ± 1.0	>0.05
Postoperative counts of residual myomas (%)	2 (8%)	51 (20%)	2 (3%)	<0.05

Table 7
Postoperative pregnancy rate of infertile patient.

	Residual	Nonresidual	p
No. of cases (%)	19 (33.3%)	29 (50.8%)	<0.05
Age (y)	32.3 ± 2.8	33.5 ± 3.7	>0.05
No of pregnant cases (%)	6 (31.6%)	11 (28.9%)	>0.05

Data are presented as n (%) or mean ± SD.

technique.[5] However, residual myomas following LM have not been reported so far. For the first time, this study examines residual myomas following LM to evaluate the effectiveness of the technique.

We determined the number of myomas to remove by preoperative MRI; however, this study revealed the limitations of MRI to confirm the correct number of myomas preoperatively. In this study, there were three cases of residual myomas, even when a single myoma diagnosis was made. In these cases, there were two patterns of residual myomas: (1) a residual myoma so close to a larger myoma that it is found for the first time by postoperative MRI; or (2) a myoma is found at a different location after the operation due to the improvement of the deviation following LM.

In general, an LM, is a safe and reliable surgical procedure,[5] but it is not suitable in cases of large cervical myomas.[6] Myomectomy for cervical myomas is problematic because cervical myomas are very close to neighboring structures, such as ureters, uterine arteries, bladder, and rectum. Therefore, advanced laparoscopic technique is necessary to remove cervical myomas completely, in comparison with the removal of other types of myoma.[7] This might be one of the reasons why cervical myomas tend to remain at the site.

Subserosal myomas can be easily detected macroscopically during surgery; therefore, their residual rate was statistically lower in comparison with intramural and subserosal myomas in this study. This is due to the inability to palpate a deeper lesion during laparoscopy. During a laparotomy, the surgeon can touch and detect the myoma, and an appropriate incision can be secured. Small myomas which are not identified by laparoscopy, and which could have been detected and removed through a laparotomy, may increase the residual rate following LM. However, even in cases of laparoscopic assisted myomectomy (LAM), residual myomas were identified in six out of 14 cases (data not shown). Because we do not have data on follow-up MRIs after abdominal myomectomy, whether myomas remain more frequently after LM, compared with laparoscopic assisted myomectomy (LAM) and abdominal myomectomy, remains unknown. Confirming the presence of residual myomas during LM by reviewing preoperative MRI results alone is insufficient. We tried to find residual myomas by transvaginal scanning intraoperatively; however, the high echoic region following myomectomy disturbed the detection of residual myomas. Therefore, residual myomas were identified in about half of cases of multiple myomas (43.9%) in this study. However, in this study, with the exception of one residual cervical myoma measuring 3 cm, all other myomas were around 1.5 cm (Table 5), which would probably not be clinically significant.

Recently, intraoperative ultrasound has been used in a number of nongynecologic surgeries, such as for the resection of the liver, breast, colon, thyroid cancers, vascular surgeries, and minimally invasive neurosurgery.[8,9] A laparoscopic ultrasound transducer can also be used during LM to isolate or identify smaller myomas if necessary.[9]

Studies have evaluated the utility of preoperative treatment with GnRHa before myomectomy[10–12] and concluded that it may increase not only the difficulty of myomectomy but also the likelihood of recurrent/persistent myomas.[13] The American Society for Reproductive Medicine has recommended that preoperative medical treatment with GnRHa agonist should be considered for both women who are anemic and those who might be candidates for a less invasive procedure if the size of their myoma is moderately smaller.[14] If the size of the uterus exceeds the navel height, GnRHa is administered for no less than a few months in order to secure an operative site for laparoscopy.

Until now, the influence of residual myomas on fertility has not been evaluated. In this study, 31.6% of infertile patients who had residual myomas became pregnant within 2 years after LM. Therefore, we have concluded that, in cases where the main myoma is removed, such as those that distort the uterine cavity, residual myomas might not have a negative effect on future fertility.

In conclusion, because the completion of LM without any residual myomas is difficult, informed consent regarding the possibility of their occurrence is necessary, regardless of the number of myomas detected preoperatively. Moreover, intramuscular residual myomas should be given particular attention due to their higher rate of incidence.

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