

# SIMULTANEOUS ENUCLEATION AND *IN SITU* MORCELLATION OF MYOMAS IN LAPAROSCOPIC MYOMECTOMY

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## SUMMARY

**Objective:** To evaluate the outcome of myoma enucleation by morcellation while it is attached to the uterus (*in situ* morcellation) in laparoscopic myomectomy.

**Materials and Methods:** A total of 82 patients diagnosed with myoma or adenomyosis in 2007 were enrolled. The patients were divided into three groups according to the myoma weight. The operative time, myoma weight, blood loss, duration of hospital stay, and complication experienced were recorded for analysis.

**Results:** The mean myoma weight was  $265 \pm 240$  g and the mean operative time was  $93 \pm 30$  minutes. The patients were divided into three groups: group A with myomas less than 150 g; group B with myomas 150–349 g; and group C with myomas greater than 350 g. The mean myoma weights were  $73 \pm 34$  g,  $214 \pm 52$  g, and  $571 \pm 218$  g for groups A, B, and C, respectively; the mean operative times were  $79 \pm 17$  minutes,  $84 \pm 22$  minutes, and  $121 \pm 32$  minutes, respectively. The operative time increased with myoma weight. Two patients (8%) in group C had excessive intraoperative hemorrhage and one (4%) required a blood transfusion. There was no conversion to laparotomy.

**Conclusion:** *In situ* morcellation was an efficient and safe procedure for removal of large uterine myoma during laparoscopic myomectomy. [*Taiwan J Obstet Gynecol* 2010;49(3):279–284]

**Key Words:** *in situ* morcellation, laparoscopic myomectomy, large myomas

## Introduction

Laparoscopic myomectomy (LM) is an advanced technique, and the difficulties associated with this technique encompass: myometrial wound hemorrhage, enucleation and morcellation of the myoma, and suturing of the uterine wound. The standard technique in LM is as

follows [1]: exposure of operation field and devascularization, incision and enucleation of the myoma by myoma screw, suturing of the uterine wound, and removing the myoma through morcellation. For larger myomas or degeneration of the myoma, these procedures become more time-consuming and difficult; moreover, the risk of intraoperative hemorrhage and conversion to laparotomy is greatly increased [2].

Sinha et al [3] reported a more efficient LM method for large myomas, i.e. enucleation of the myoma by morcellation while it is attached to the uterus. In the present study, we have made a slight modification to Sinha's method of LM and compared its feasibility, safety, and efficacy with standard procedures reported in the literature.



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## Materials and Methods

### Subjects

A total of 82 women were diagnosed with myoma or adenomyosis in 2007 and were enrolled in this study. Cases of pedunculated subserous myomas were excluded. The surgical characteristics measured were: estimated blood loss, myoma weight, and operative time. Patients were then divided into three groups according to the weight of myomas. The average uterine weight of a parous woman is 80 g or more [4]; 150 g (double) and 350 g (quadruple) were taken as the cut-off values to define small, medium, and large myomas in this study. The operative time was defined as the period from the beginning of insufflation to the completion of wound closure. The blood loss was calculated by the difference in the total fluid amount in suction bottles (range, 0–2,000 mL) at the end of operation and the amount of ascites aspirated at the beginning of the operation plus the fluid irrigated during operation. Institutional Review Board approval and patient consent was obtained for this study.

### Surgical technique of *in situ* morcellation (ISM)

Hemorrhage control was usually achieved by subcapsular injection of vasopressin [5,6], bilateral ligation of the uterine artery [7], and bipolar coagulation. The pelvic cavity was inspected before simultaneous enucleation and ISM of the myomas. The location, size, number of myomas, and relation to the fallopian tubes were noted. Vasopressin (0.2 U/mL in normal saline) was infiltrated below the pseudocapsule of the myoma over the protruding surface. A transverse line with equal and adequate distance to the insertion of the fallopian tubes was marked by bipolar coagulation (Figure A). The left margin of the line was held by the traumatic claw forceps of the mechanical Gynecare morcellator (Ethicon Inc., Johnson and Johnson, Somerville, NJ, USA) (Figure B) and a strip of the myoma along the line was progressively morcellated (Figure C). The morcellator movement resembled the peeling of an apple, in which both the entry and exit point should be in view to prevent any inadvertent damage to the pelvic structures (Figure D). As soon as an adequate strip of myoma capsule had been morcellated, the myoma would bulge out spontaneously (Figure E). The traction on the bulging myoma by the claw forceps was countered by the grasp on the wound margin and elevation, causing progressive enucleation of the myoma from its base in the uterine wall (Figure F). With the decreased bulk of the myoma, the subcapsule collapsed and compressed snugly over the myoma. The redundant pseudocapsule could be morcellated away if necessary. Hemorrhage

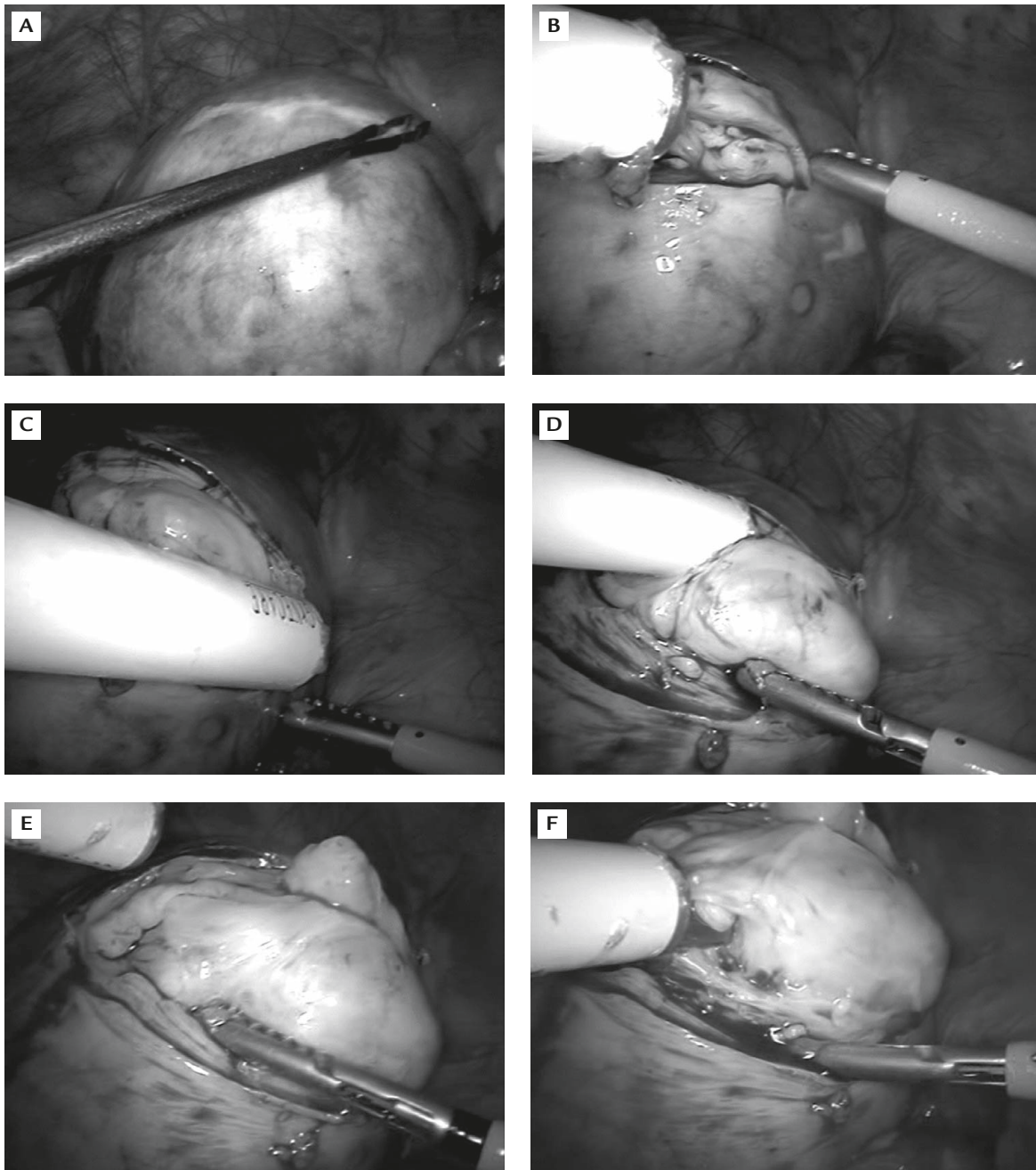
from the myometrial wound was minimal and could be controlled by bipolar coagulation. Subsequently, the myometrial wound was repaired by two layers of interrupted extracorporeal sutures using 1-0 polyglactin 9467 suture (Vicryl; Ethicon Inc.). The outer layer was sutured with the technique proposed by Keckstein [8]. After meticulous hemostasis and thorough cleansing of the uterine wound, an adhesion barrier (Interceed; Ethicon Inc.) was placed over the myoma wound. The 15-mm trocar wound was closed with the Carter-Thomason CloseSure System (CTI-512N, Inlet Medical Inc., Trumbull, CT, USA) to reduce hernias [9]. The difference from Sinha's method was simultaneous enucleation and ISM of myomas without the need of a myoma screw to pull the myoma from the pseudocapsule.

### Statistical analysis

Data were expressed as mean  $\pm$  standard deviation unless stated otherwise. Comparison of selected parameters relating to basic clinical and surgical characteristics were performed by Student's *t* test for continuous variables. All statistical analyses were performed with SPSS version 12.0 (SPSS Inc., Chicago, IL, USA). A *p* value of  $<0.05$  was considered statistically significant.

## Results

A total of 82 patients were enrolled in this study. Table 1 shows the basic clinical characteristics and operative parameters. The mean patient age was  $39.2 \pm 6.8$  years. The weights of the morcellated myomas ranged from 16 g to 1,260 g. The mean myoma weight was  $265 \pm 240$  g and the mean operative time was  $93 \pm 30$  minutes. The patients were divided into three groups for further analysis: patients with myoma weighing less than 150 g (group A); patients with myoma weighing between 150–349 g (group B); and patients with myoma weighing more than 350 g (group C). The mean myoma weight was  $73 \pm 34$  g,  $214 \pm 52$  g, and  $571 \pm 218$  g for groups A, B, and C, respectively. The operative time and estimated blood loss (EBL) increased with myoma weight. Significantly, shorter operative time and less EBL were noted in groups A and B (groups A, B, vs. C, operative time:  $79 \pm 17$  min,  $84 \pm 22$  min, vs.  $121 \pm 32$  min,  $p < 0.001$ ; EBL:  $61 \pm 21$  mL,  $69 \pm 29$  mL, vs.  $179 \pm 167$  mL,  $p < 0.001$  and  $p = 0.002$ ). Two patients (8%) in group C had excessive intraoperative hemorrhage of greater than 500 mL and one (4%) needed blood transfusion. There was no conversion to laparotomy or intraoperative complications. The patients were followed up 7 days, 1 month, and 3 months postoperatively, and no complications were reported.



**Figure.** (A) Transverse line with equal and adequate distance to the insertion of the fallopian tubes is marked by bipolar coagulation. (B) The left margin of the marking line is held by the traumatic claw forceps of the morcellator. (C) A strip of the myoma along the line is progressively morcellated. (D) The morcellator movement is similar to the peeling of an apple, and both the entry and exit point should be in view to prevent any inadvertent damage to the pelvic structures. (E) The myoma will bulge out when an adequate strip is morcellated and a fish mouth appearance is created. (F) Traction on the bulging myoma caused by the claw forceps and the counterforce of the grasp on the wound margin with elevation, causes progressive enucleation of the myoma from its base in the uterine wall.

## Discussion

The standard LM technique enucleates the myoma completely from the uterus before morcellation [1]. However, there is limited space available for the push-pull maneuvers with very large myomas [10]. Standard LM is reputed to be technically difficult, time-consuming,

and involves a higher rate of conversion to laparotomy, ranging from 11.3 % (48/426) [2] to 28% (33/116) [11] or even 41.4% (29/70) [12]. The risk of conversion to laparotomy increases with the size and number of myomas [10,12], especially when they are accompanied by adenomyosis [13]. Therefore, the indications proposed for the standard LM (diameter < 9 cm and

**Table 1.** Baseline characteristics and operative outcome of 82 patients receiving laparoscopic myomectomy with simultaneous enucleation and *in situ* morcellation\*

	Group A (MW < 150 g)	Group B (MW 150–349 g)	Group C (MW ≥ 350 g)	Total
Number of cases	31 (38)	27 (33)	24 (29)	82 (100)
Age (yr)	39.5 ± 7.0 (28–55)	37.6 ± 7.2 (25–52)	40.5 ± 6.0 (30–51)	39.2 ± 6.8 (25–55)
Predominant myoma size (cm)	5.7 ± 1.3 (3–8)	7.9 ± 1.3 (5–10)	11.2 ± 2.2 (8–18)	8.0 ± 2.7 (3–18)
Number of myoma	1.6 ± 1.2 (1–6)	2.8 ± 3.7 (1–20)	4.1 ± 10.0 (1–50)	2.7 ± 5.9 (1–50)
Gravity	1.6 ± 1.7 (0–6)	1.0 ± 1.5 (0–5)	0.7 ± 0.8 (0–2)	1.1 ± 1.5 (0–6)
Parity	1.0 ± 1.1 (0–4)	0.3 ± 0.8 (0–3)	0.3 ± 0.6 (0–2)	0.6 ± 0.9 (0–4)
MW (g)	73 ± 34 (16–145)	214 ± 52 (150–300)	571 ± 218 (355–1,260)	265 ± 240 (16–1,260)
Operative time (min) <sup>‡</sup>	79 ± 17 <sup>§</sup> (55–115)	84 ± 22 <sup>  </sup> (45–120)	121 ± 32 (80–175)	93 ± 30 (45–175)
Estimated blood loss (mL) <sup>‡</sup>	61 ± 21 <sup>¶</sup> (50–100)	69 ± 29 <sup>**</sup> (50–150)	179 ± 167 (50–700)	97 ± 106 (50–700)
Excessive bleeding <sup>†</sup>	0 (0)	0 (0)	2 (8)	2 (2)
Blood transfusion	0 (0)	0 (0)	1 (4)	1 (1)
Hospital stay (d)	3.0 ± 0.4 (2–4)	3.2 ± 0.6 (3–6)	3.5 ± 0.8 (3–6)	3.2 ± 0.6 (2–6)
Conversion	0 (0)	0 (0)	0 (0)	0 (0)

\*Data are presented as n (%) or mean ± standard deviation (range); <sup>†</sup>blood loss ≥ 500 mL; <sup>‡</sup>comparisons of operative time and estimated blood loss were performed by Student's t test; <sup>§</sup>p < 0.001 A vs. C; <sup>||</sup>p < 0.001 B vs. C; <sup>¶</sup>p < 0.001 A vs. C; <sup>\*\*</sup>p = 0.002 B vs. C. MW = myoma weight.

no more than 2 or 3 myomas) are mostly empirical [12,14]. Nezhat et al [15] showed that pregnancy is possible after laparoscopic resection of adenomyosis through a “cytoreduction” procedure followed by myometrial repair. Laparoscopic resection of myometrial adenomyosis has been shown to reduce the symptoms of menorrhagia and dysmenorrhea [16,17]. However, laparoscopic myomectomy for adenomyosis presents a particular challenge for the lack of a clearly defined dissection plane.

One patient in this study had an intramural myoma of 18 cm, which decreased to 12 cm after three doses of gonadotropin-releasing hormone (GnRH). The myoma weight was 710 g, operative time was 175 minutes, and EBL was 350 mL. Using GnRH agonists prior to LM for very large myomas may reduce the myoma size, consequently decreasing the intraoperative blood loss [18]. It is helpful to address the issue of anemia before operation [19]. However, it may increase difficulties in identifying and dissecting the cleavage plane between the myoma and its pseudocapsule, thus increasing the risk of conversion to an open procedure [2]. Furthermore, a degenerative myoma may be too soft to be pulled by traumatic claw forceps or a myoma screw.

Our technique offers certain advantages that help to overcome the following problems: (1) reducing operative time by combining the procedures of myoma enucleation and morcellation, which is valuable for surgeons having to deal with large or numerous myomas; (2) progressively morcellating myomas reduce the uterine size and create more space for the optimal movement of instruments, thus making a myomectomy of

more than 10 cm possible; (3) ISM of the myomas minimizes the risk of missing myomas in the abdomen, especially when there are multiple small myomas; (4) a myoma screw is not necessary to remove the myoma from the pseudocapsule because the myoma spontaneously bulges out following ISM (Figures D–F); (5) ISM makes it easy to separate dense/adhesive myomas from the pseudocapsule after GnRH agonist treatment. In addition, we directly cut and opened the pseudocapsule with a morcellator, to the layer showing the characteristic pearl-white appearance of the tumor. This avoided creating a cleavage plane with unipolar scissors and decreased the smog effect and associated risk of thermal injury [20,21].

Recently published series of LM [3,10,22–25] mainly focused on the operation of medium sized myomas (approximately 6 cm) (Table 2). The mean operative time was about 2 hours in the published series using conventional LM. This could be considered rather long for medium sized myomas. The duration is related to size of the largest myoma, number of myomas removed, depth of penetration in the myometrium, and surgeon's experience [2,13]. According to our experience, myomas larger than 350 g were hard to enucleate from the pseudocapsule in standard LM. However, using our ISM technique, a myoma screw was not necessary to remove the myoma from the uterus because the myoma spontaneously bulges out when adequate strips are morcellated. In our study, the mean operative time for myomas of medium size was only 84 ± 22 minutes (group B, mean diameter = 7.9 ± 1.3 cm), whereas that for larger myomas was about 121 ± 32 minutes (group C, mean



**Table 2.** Reviews of the outcomes of laparoscopic myomectomy in the literature\*

Author	Year	Total cases	Myoma weight (g)	Myoma size (cm)	Operation time (min)	EBL (mL)	Conversion, n (%)	Complication, (n)
Dubuisson et al [2]	2001	426	NS	5.6±2.2	129±57	NS	48 (11.3)	Blood transfusion (3)
Sinha et al [3]	2005							
Conventional		20	584±411	7.6±4.6	123±39	219±111	0 (0)	Blood transfusion (4)
Sinha's method		24	601±361	7.6±4.3	98±27	284±229	0 (0)	Blood transfusion (4)
Altgassen et al [23]	2006	351	NS	5.2±1.9	126±66	0.7±1.4 <sup>†</sup>	1 (0.3)	Blood transfusion (1)
Liang et al [24]	2006	142	NS	4.8±2.1	124±33	118±49	0 (0)	NS
Wang et al [25]	2006	113	200±122	NS	122±59	346±300	0 (0)	Blood transfusion (25); Postoperative ileus (2)
Rossetti et al [10]	2007	332	NS	6.0±2.7	124±52	1.1±0.8 <sup>†</sup>	5 (1.5)	Kidney failure (1); Bowel perforation (1)
Current cases (ISM)		82	265±240	8.0±2.7	93±30	97±106	0 (0)	Blood transfusion (1)

\*Data are presented as n (%) or mean ± standard deviation; <sup>†</sup>hemoglobin decrease. EBL=estimated blood loss; ISM=in situ morcellation; NS=not stated.

diameter=11.2±2.2 cm) (Table 1). The ISM technique deals with large myomas of more than 10 cm easily and efficiently.

It must be noted that morcellation is a dangerous procedure in LM. The blade of the morcellator must always be within the visual field and must be withdrawn when not in use to prevent accidental injury to the viscera or vessels. The myoma should be pulled steadily toward the cutting edge of the morcellator with the claw forceps, rather than pushing the morcellator toward the myomas, to avoid damage to the uterus, fallopian tubes, or ovaries. Before using the technique of *in situ* enucleation and morcellation of myomas, the gynecologist should be experienced and skillful in the standard LM technique. The ISM of myomas can be applied to myomas larger than 8 cm and myomas with degenerated changes.

Although LM for large myomas might be associated with greater EBL, higher frequency of excessive bleeding, and more blood transfusions, using ISM more often could shift them towards an acceptable range. For experienced and adequately trained surgeons, large myomas could be removed easily and efficiently by ISM.

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