Laparoscopic stripping of endometriomas: a randomized trial on different surgical techniques. Part I: Clinical results

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BACKGROUND: Laparoscopic surgery has become the gold-standard treatment for ovarian endometriomas. The objective of this trial was to evaluate different procedures for the laparoscopic excision of ovarian endometriomas with the stripping technique. METHODS: Forty-eight patients with ovarian endometrioma were enrolled in two consecutive independent randomized trials. Two different techniques were analysed at the initial adhesion site (circular excision and subsequent stripping versus immediate stripping). Two different techniques were analysed at the ovarian hilus (stripping versus coagulation and cutting). Operative time and technical difficulties were prospectively evaluated. Histological analysis was performed in three portions of the cyst wall and the results of the histologic study are reported separately. RESULTS: At the initial part of the stripping procedure, the technique of circular excision and subsequent stripping appeared to be more easily performed than the technique of direct stripping (P < 0.01), although operative times were comparable between the two techniques. At the hilus, the two techniques utilized appeared to be comparable both for easiness of procedure and operating times. CONCLUSIONS: In this prospective, randomized study, different techniques used during the stripping procedure appeared to be comparable in terms of operative times and complications. One technique used at the beginning of the procedure (circular excision followed by stripping) was easier to perform.

Key words: endometrioma/endometriosis/laparoscopy/ovarian surgery/randomized trial

Introduction

In recent years, laparoscopy has become the gold-standard for the treatment of ovarian endometriotic cysts (Daniell et al., 1991; Donnez et al., 1996; Sutton et al., 1997; Yuen et al., 1997). When compared to traditional surgery by laparotomy, operative laparoscopy is associated with shorter hospital stay, faster patient recovery, decreased costs (Luciano et al., 1992) and lower incidence of de novo adhesion formation (Luciano et al., 1989, 1992; Lundorff et al., 1991; Operative Laparoscopy Study Group, 1991).

Several laparoscopic techniques have been described as alternatives for the endoscopic treatment of ovarian endometriomas: cyst wall laser vaporization preceded or not by medical therapy (Brosens et al., 1996; Donnez et al., 1996; Sutton et al., 1997), drainage and bipolar coagulation of the cyst wall (Beretta et al., 1998) and stripping of the endometrioma wall (Reich and McGlynn, 1986; Martin, 1991; Canis et al., 1992). Several authors have questioned the stripping procedure as it may be associated with excision of ovarian tissue adherent to the cyst wall, with consequent loss of follicles (Brosens et al., 1996; Donnez et al., 1996). However, in a randomized clinical trial, stripping, when compared to drainage and coagulation, has been associated with better clinical outcomes, such as time to symptom recurrence and pregnancy rate (Beretta et al., 1998). To date, ovarian stripping remains the most frequently adopted surgical technique for the treatment of ovarian endometriomas (Nezhat et al., 1989; Muzii et al., 1996; Canis et al., 2003), even if the procedure has not yet been properly standardized. Different surgical techniques may be used, for example, at the beginning of the procedure, i.e. at the initial adhesion site, or at the end of the stripping, when the cyst is closer to the ovarian hilus (Martin, 1991).

The objective of this trial was to compare two different surgical techniques at the beginning of the stripping procedure (at the cyst original adhesion site) and two different techniques at the end of stripping procedure (where the cyst is closer to the ovarian hilus). Evaluation of the surgical difficulty as judged by the surgeon, operative times and complications are hereby reported. The pathological results of this
Materials and methods

The objective of this report was to evaluate different surgical techniques that can be used during the laparoscopic excision of ovarian endometriomas with the stripping technique. Two different techniques were used at the cyst original adhesion site with the ovarian fossa, once the ovary has been mobilized from the pelvic sidewall, and two different techniques were used at the end of the stripping procedure, where the cyst is closer to the ovarian hilus.

This prospective, randomized, single blind, clinical trial was conducted in an academic department specialized in gynaecologic surgery. Institutional Review Board approval was obtained, and the participants were given oral and written information, and signed a consent form. All follow-up visits and data collections were performed within the department.

Eligible women were patients between 21 and 35 years of age with no clinically significant present, or past, systemic disease, with a BMI between 18 and 30 kg/m², and no history of previous abdominal surgery. Greatest diameter of the cyst measured by ultrasound at time of surgery had to be at least 3 cm. After ultrasound diagnosis of a suspected ovarian endometriotic cyst, the patients were observed for at least three spontaneous menstrual cycles before hospital admission for surgery.

Exclusion criteria were preoperative clinical suspect of non-endometriotic ovarian cysts, and severely distorted pelvic anatomy at surgery (i.e. large size uterine fibroids, severe adhesions, congenital abnormalities, etc.) which required additional surgical procedures besides endometrioma mobilization and stripping, with consequent elongation of operating times and possible conversion to laparotomy. Patients were excluded from data analysis if conversion to laparotomy was necessary, if the procedure was aborted, or if endometriosis was not confirmed at pathology.

Upon hospital admission, all patients were submitted to a detailed general and gynaecologic history, complete physical examination, urine pregnancy test, blood chemistries and transvaginal ultrasonography. Blood chemistries were repeated on the first post-operative day.

All surgical procedures were carried out by two senior gynaecologic laparoscopists. Operative laparoscopy was performed as follows: after induction of general anaesthesia, a 10 mm laparoscope was introduced through the umbilicus, whereas three accessory 5 mm trocars were placed suprapubically for the introduction of ancillary instruments. After the initial diagnostic evaluation of the pelvis and abdomen and washing with normal saline, if no sign of malignancy was present, the ovary with the endometrioma was mobilized from its adhesion to the ovarian fossa, the site of the initial endometrioma adhesion is fully exposed.

After complete mobilization of the ovary from the ovarian fossa, the site of the initial endometrioma adhesion is fully exposed.

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After identification of the cleavage plane with either technique, the stripping procedure was then continued for the remaining part of the cyst wall in the conventional manner (Muzii et al., 2002), through tractions exerted in opposite directions with twoatraumatic grasping forceps. Towards the end of the stripping procedure, when approaching the ovarian hilus (time 2), a second randomization in the same way as the first one was performed, and the patients were randomized to one of the following procedures (trial 2):

- Stripping at the ovarian hilus: completion of the stripping procedure was performed up to the complete removal of the cyst wall.
- Coagulation and cutting at the ovarian hilus: pre-emptive bipolar coagulation of the final cyst wall pedicle and subsequent cutting with scissors were performed.

At the end of cyst wall excision, whichever the technique used, additional hemostasis was obtained, when necessary, with bipolar forceps applied on the ovarian parenchyma. The end of this step was considered the end of the stripping procedure (time 3). No sutures were used for reapprroximation of the ovarian edges. Total operative time, from pneumoperitoneum induction to placement of last stitch for skin closure, was recorded. Also, partial time for
the first procedure performed with either technique (time 1 to time 2, as described above), and partial time for the second procedure performed with either technique (time 2 to time 3), were recorded. All laparoscopic procedures were videotaped.

At the end of each procedure in the study, the surgeon was asked to judge the procedure as easy, moderately easy, moderately difficult, or difficult.

At the end of surgery, the surgeon removed three separate specimens from the excised cyst wall from the initial, the intermediate and the final part of the procedure for thorough pathological analysis, which is reported in a separate study (Muzii et al., 2005).

The outcomes evaluated in this trial were: difficulty of procedure as subjectively evaluated by the surgeon, operating time for each technique utilized, complications during surgery for each technique utilized, post-operative complications and recurrence rates.

Follow-up was conducted within the department performing a clinical exam and a transvaginal ultrasound at 1, 3, 6 and 12 months post-operatively.

**Statistical analysis**

A formal sample size calculation was performed using as the primary outcome the presence or absence of ovarian tissue removed along with the endometrioma wall with the stripping procedure. The sample size utilized (24 versus 24 observations) was selected in order to detect, with 80% power at the 0.05 alpha level, a difference of 34% in the rate of presence of ovarian tissue inadvertently

**Figure 3.** A circular rim of ovarian tissue is excised from the initial adhesion site before starting the stripping procedure.

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**Figure 4.** Flow diagram of the progress through the phases of the trial.
excised, given a reference rate of 54%, reported in our previous study (Muzii et al., 2002).

Parametric tests were used after having evaluated the normal distribution of the data to be analysed. The Student’s t-test was used for continuous parametric variables and the χ²-test was used for categorical variables. When evaluating the surgical difficulty in four degrees (easy, moderately easy, moderately difficult and difficult), conditions for the use of the χ²-test could not be met, and two degrees were combined together (easy/moderately easy and moderately difficult/difficult) in order to use the Fisher’s exact test. The Mann–Whitney test was used for non-parametric data. Statistical significance was set at a P value less than 0.05.

Two computer randomization lists were independently generated for the choice of the strategy to adopt at the initial adhesion site and at the final hilus site. Treatment arms were written and enclosed in two separate groups of sequentially numbered sealed envelopes by a third party. The envelopes were opened in the operative theatre after the patient had been enrolled after cyst mobilization, just before approaching the initial adhesion site (time 1), and at the final hilus site (time 2).

Results

Between January 1, 2000 and December 31, 2001, 54 consecutive patients, aged 21–35 years, were assessed for eligibility preoperatively. Six patients were excluded intraoperatively for the presence of pelvic adhesions that severely distorted pelvic anatomy. All the remaining 48 patients were eligible. The participant flow diagram is shown in Figure 4.

Trial 1: At original adhesion site with the ovarian fossa (direct stripping versus circular excision): Twenty-four patients were enrolled in each arm. No significant difference in terms of patient age, BMI and cyst size was present between the two groups (Table I).

The beginning of the stripping procedure was overall considered easy or moderately easy in most cases (26/48, 54%). Direct stripping was judged easy or moderately easy in 8 of 24 patients (33%) and moderately difficult or difficult in 16 of 24 (67%). Circular excision and subsequent stripping was judged easy or moderately easy in 18 of 24 patients (75%) and moderately difficult or difficult in 6 of 24 (25%). The surgical difficulty between the two techniques as judged by the surgeon was significantly different (P < 0.01). However, operating times were not significantly different between the two techniques (Table II).

Trial 2: Close to the ovarian hilus (completion with the stripping technique versus bipolar coagulation followed by cutting with scissors): Twenty-four patients were enrolled in each arm. No significant difference in terms of patient age, BMI and cyst size was present between the two groups (Table III).

Completion of cyst excision in the last part of the procedure, close to the ovarian hilus with either procedure, was overall considered a simple procedure in half of the patients (24/48, 50%).

Completion of stripping was judged easy or moderately easy in 14 patients of 24 (58%) and moderately difficult or difficult in 10 of 24 (42%). Bipolar coagulation followed by cutting with scissors was judged easy or moderately easy in 10 patients of 24 (42%) and moderately difficult or difficult

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*Fisher’s exact test: easy/moderately easy versus moderately difficult/difficult.

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<td>Mean age (range) (years)</td>
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in 14 of 24 (58%). No significant difference in difficulty and operating times were identified (Table IV).

No intra-operative complications occurred for any technique at any step of the stripping procedure. No post-operative severe complications occurred. Forty-two patients were discharged within 24 post-operative hours. In six patients, hospital discharge was delayed to 48 post-operative hours on patient demand. At 12 months follow-up, one ovarian endometrioma recurrence was recorded in a patient treated with direct stripping at the ovarian fossa adhesion site and bipolar coagulation close to the hilus.

Discussion

Treatment options in case of endometriosis include expectant management, medical treatment, surgery, or a combination of the above, depending on patient’s age, severity of symptoms, desire for childbirth and stage of disease. In case of ovarian endometriotic cysts, surgery should be the mainstay of treatment since these patients respond poorly to medical treatment (Muzii et al., 1996).

Laparoscopy should be considered the gold-standard approach to endometriomas, whereas the choice of which laparoscopic technique to be used is still a matter of debate (Jones and Sutton, 2000; Vercellini et al., 2003).

A randomized trial comparing stripping versus fenestration and bipolar coagulation of the endometrioma wall has shown that stripping was superior in terms of symptom recurrence and subsequent fertility rate (Beretta et al., 1998). However, one problem with this study (Beretta et al., 1998), which is the only randomized study published so far on the comparison of stripping versus fenestration and laser ablation or bipolar coagulation of cyst wall, is that the results obtained in the fenestration/coagulation arm are inferior to the results obtained in other nonrandomized studies with the same procedure (Jones and Sutton, 2001), possibly reflecting differences in the surgical techniques used.

A major concern that remains is the loss of follicles associated with the stripping procedure (Brosens et al., 1996; Donnez et al., 1996). Poorer performance in IVF protocols (Garcia-Velasco et al., 2004) and a reduction in ovarian volumes after surgery (Exacoustos et al., 2004) have been reported.

When performing the stripping procedure for the treatment of ovarian endometriomas, various techniques may be adopted at the beginning of the cyst excision procedure at the initial adhesion site, and at the end of the procedure, near the ovarian hilus (Martin, 1991), but no consensus is present on which of these techniques should be considered the standard.

In the present study, we evaluated the different techniques that can be used when stripping the endometrioma wall from the ovary in order to identify a technique that could be easier to perform or more protective of the normal ovarian parenchyma. At the beginning of the stripping procedure, after complete mobilization of the ovary and exposure of the adhesion site, the surgeon may find it easier to remove a small circular rim of tissue around the adhesion site in order to begin the stripping procedure in a clearer field, where the endometrioma wall is less adherent to the healthy ovarian tissue. In our study, in 75% of the cases the procedure was judged easy or moderately easy after removing a circular rim of ovarian tissue, compared to 33% when direct stripping was attempted without circular excision. Operative times, however, were only marginally reduced when using the former approach. The downside of this procedure is that the surgeon is intentionally removing part of the ovarian cortex together with the cyst wall. It is reassuring to know from the pathological results of the present trial (Muzii et al., 2005), however, that in this part of the specimen the ovarian tissue appears to be thin and with scanty primordial follicles. Therefore, the circular excision of a small portion of the ovarian cortex should not be considered a significant harm to the operated ovary. In addition, no significant difference in terms of presence of ovarian tissue and ovarian quality was present in the intermediate part of the cyst wall between groups that had begun stripping with different surgical techniques (Muzii et al., 2005). This suggests that the correct surgical plane can be identified with both techniques.

When approaching the hilus, in nearly 70% of all specimens, higher functional stages of follicular development can be recognized (Muzii et al., 2005). Therefore, even if the cyst pedicle constitutes a small part of the cyst wall, it is the part of the stripping procedure where thicker and more functionally mature strips of ovarian tissue are inadvertently excised along with the endometrioma cyst wall. In this site the surgeon should be maximally conservative in the surgery he or she is performing in order to avoid long-term functional damage. Martin (1991) has suggested that when the cyst wall approaches the hilus, stripping may produce excessive bleeding when the hilar vessels are torn, and that a surgical alternative could be the pre-emptive coagulation of the cyst pedicle, with subsequent cutting with scissors. We therefore randomized two surgical techniques at the hilus (stripping versus bipolar coagulation and cutting), and the two techniques appeared to yield comparable results in terms of surgical ease, operating times, specimen quality, and disease recurrence.

In conclusion, when excising the endometrioma wall with the stripping technique, the excision of a circular disk around the original adhesion site may render the procedure simpler, although operating times and complications are not significantly improved. When approaching the ovarian hilus, the different techniques used in this study did not influence the surgeon’s performance, evaluated as surgical ease in obtaining the correct cleavage plane, duration of operation, intraoperative complications or post-operative endometrioma recurrence. The stripping procedure for endometriomas, whichever the technique used, appears to be a safe option for the laparoscopic treatment of endometriomas.

References


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