

Laparoscopic cystectomy of endometrioma: Good surgical technique does not adversely affect ovarian reserve

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Received: 29.10.2013

Review completed: 14.01.2014

Accepted: 16.06.2014

ABSTRACT

BACKGROUND: The damage to ovarian reserve inflicted by surgery for endometriosis represents a major concern in the balance between reproductive benefits and risks. **AIM:** To evaluate the ovarian reserve in sub fertile women after laparoscopic endometriotic cystectomy. **SETTINGS AND DESIGN:** Prospective study, done in Department of Obstetrics and Gynecology, tertiary care hospital between August 2010-2012. **MATERIALS AND METHOD:** Laparoscopic cystectomy performed by stripping technique for endometriotic cysts. Endometriosis was staged according to revised American Society of Reproductive Medicine classification (rASRM). Ovarian reserve assessed by comparing FSH and LH levels, measurement of residual ovarian volume, antral follicle counts and stromal blood flow on second day of menses pre and postoperatively. Cyst wall was evaluated histologically to note the presence of normal ovarian tissue in resected tissue. **STATISTICAL ANALYSIS:** SPSS for Windows version 16.0 (SPSS Inc., Chicago, IL) was used for statistical calculations. Wilcoxon signed test and Pearson Chi – Square test were applied. Significance level was $P < 0.05$. **RESULTS:** Incidence of minimal, mild, moderate, and severe endometriosis was 4.1%, 21.9%, 28.7%, 45.3% respectively. Ovarian reserve was assessed both by ultrasound and biochemical parameters on day 2 of menses; pre and post-operatively. Preoperative and post-operative values; FSH (7.24 ± 1.21 , 7.23 ± 1.51 m IU/ml), LH levels (6.37 ± 1.8 , 6.6 ± 2.3 m IU/ml), residual ovarian volume ($8.5 \text{ cm}^3 \pm 5.3$, $7.4 \text{ cm}^3 \pm 5.8$), antral follicle count (3.3 ± 1.9 , 4.1 ± 1.5) and stromal blood flow ($6.8 \text{ cm/sec} \pm 4.57$, $7.1 \text{ cm/sec} \pm 3.55$) were statistically not significant. Loss of follicle was seen in 27.2% cyst walls on histopathological examination while 72.73% had no loss. **CONCLUSION:** Laparoscopic cystectomy when performed for endometriotic cysts with accurate surgical technique leads to no significant ovarian tissue removal.

KEY WORDS: Antral follicle count, laparoscopic endometriotic cystectomy, ovarian reserve, ovarian volume

INTRODUCTION

Endometriosis is one of the most commonly encountered benign problems in gynecology. Our understanding of endometriosis is incomplete, and controversy continues regarding management of endometriosis. Surgery has a fundamental role to play in the treatment of endometriomas.^[1] The damage to ovarian reserve inflicted by surgery represents a major concern in the balance between reproductive benefits and risks. The absence of a clear plane of cleavage between the cyst and ovarian stroma could result in unintentional removal of the ovarian cortex and loss of follicles with potential reduction

in follicular reserve. Injury may be inflicted to ovarian stroma during hemostasis by electro-surgical coagulation.^[2]

A true ovarian reserve is the number of primordial follicles present in the ovaries. Ultrasound and endocrine measures have been widely accepted as markers of ovarian reserve. The endocrine markers^[3] such as follicle-stimulating hormone (FSH), E2, inhibin B and anti-Mullerian hormone (AMH)^[4] provide information on ovarian reserve of both ovaries as a combined unit, therefore using them as markers of ovarian reserve is still questionable, especially because most cysts are unilateral and that the

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10.4103/0974-1208.138871

intact contralateral ovary can adequately compensate for the affected one in terms of function. Ultrasound assessment^[5] of the total number of antral follicles, ovarian volume and ovarian stromal vascularity are important determinants of ovarian reserve as affected ovary's reserve can be assessed independent of compensation by unaffected normal ovary. Inadvertent removal of normal ovarian tissue can be studied by histopathology of excised cyst wall.^[6]

The aim of this study was to evaluate the effect of laparoscopic endometriotic cystectomy by stripping method on ovarian reserve in sub fertile patients.

MATERIALS AND METHOD

Prospective study, conducted in Department of Obstetrics and Gynecology, tertiary care hospital between August 2010 and August 2012 in patients with ovarian endometriomas requiring surgical removal. A total of 85 women who were subfertile, and underwent laparoscopic endometriotic cystectomy for the first time irrespective of their age, duration of infertility, body mass index (BMI) and were included in the study. Patients who have undergone any prior pelvic surgery were excluded from the study. None of our patients received prior medical management for endometriosis. Preoperatively on day 2 of menses, ovarian and endometrioma volumes, antral follicle counts (AFCs) and stromal blood flow (peak systolic flow) was noted using a real-time ultrasound, 5.0-7.5 MHz endovaginal probe. Color and pulsed Doppler sonography were used to assess the ovarian stromal blood flow. The blood flow velocity waveform from the ovarian artery was recorded at the ovarian hilus. The peak systolic velocity (PSV cm/s) values were electronically computed. All ultrasonographic examinations were performed by the same observer to eliminate the interobserver variations [Figures 1 and 2]. FSH, luteinizing hormone (LH) levels (measured using immuno chemiluminescence method in the laboratory, Rosche

Diagnostics) were also checked on the same day. Normal values as per our laboratory being FSH: 3.85-8.78 mIU/ml and LH: 2.12-10.89 mIU/ml.

All the ovarian cystectomies were performed by the same team of surgeons. Endometriosis was staged according to revised American Society of Reproductive Medicine classification.^[7] For the diagnosis of endometriosis, the criteria of the technical bulletin on endometriosis of the American College of Obstetricians and Gynecologists were followed. The ovary was mobilized, grasped with forceps and an incision made on the antimesenteric surface, away from the ovarian hilus. After identifying the correct plane of cleavage between the cyst wall and the ovarian tissue, traction applied; strong, but nontraumatic with two grasping forceps, so that, the inner lining of the cyst was stripped from the normal ovarian tissue. No ovarian tissue was resected in order to identify the plane. The bed of the cyst carefully inspected to detect possible bleeding zones that may require coagulation with bipolar forceps avoiding excessive diathermy. No sutures were used for ovarian reconstruction.

The endometrioma wall was evaluated histologically. The slides were reviewed by the same pathologist, who was blind to the clinical variables of the patient. Routine hematoxylin and eosin staining was performed on the sections for histopathologic examination. For the diagnosis of endometriosis, the criteria of the technical bulletin on endometriosis of the American College of Obstetricians and Gynecologists were followed.^[8] As per the histopathological examination (HPE) of the cyst wall, the patients were categorized into two groups based on semi quantitative scale of 0-4 grades;^[9] Group 1 included cyst walls showing Grades 0, 1, 2 on HPE analysis, which indicates no loss of follicles and Group 2 included cyst walls showing Grades 3, 4 on HPE analysis, which indicates loss of follicles. Grade 0, complete absence



Figure 1: Endometriotic cyst

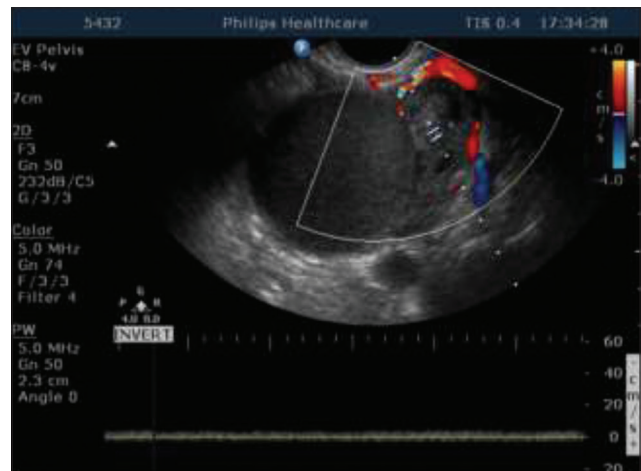


Figure 2: Measuring stromal blood flow

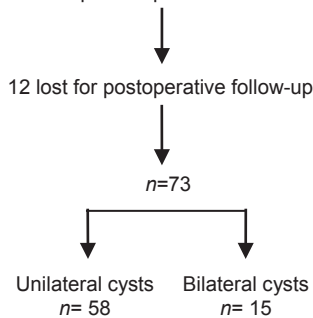
of follicles; Grade 1, only primordial follicles; Grade 2, primordial and primary follicles; Grade 3, some secondary follicles; Grade 4, pattern of primary and secondary follicles as in the normal ovary.

All patients were followed-up postoperatively on day 2 of the next menses for their second evaluation. Ovarian reserve was rechecked by measuring ovarian volume, AFC, stromal blood flow by ultrasound and FSH, LH levels. SPSS for Windows version 16.0 (SPSS Inc., Chicago, IL, USA) was used for statistical calculations. Wilcoxon signed test and Pearson Chi-square test were applied. Significance level was $P < 0.05$.

RESULTS

Of a total of 85 patients recruited for the study, 12 patients lost for postoperative follow-up. Hence, only 73 patients could be studied for postoperative evaluation of ovarian reserve.

Total patients underwent laparoscopic endometriotic cystectomy ($n = 85$)



The mean age of the patients' enrolled being 29.2 (± 3.6) years and mean BMI was 21.6 (± 2.5) kg/m². Primary subfertility was the only complaint in 26% patients. Remaining subfertile patients presented with more than one symptom such as congestive dysmenorrhea, dyspareunia, dull aching abdominal pain, menorrhagia, and dyschezia. All women had regular menstrual cycles.

The incidence of bilateral endometriotic cysts was 20.5% (15/73). Among unilateral cysts ($n = 58$), cysts were more commonly seen in left ovary, incidence being 62% (36/58). Incidence of minimal, mild, moderate, and severe endometriosis was 4.1% (3/73), 21.9% (16/73), 28.7% (21/73), and 45.3% (33/73) respectively. All 15 out of 73 patients with bilateral cysts had moderate to severe endometriosis (Stage 3, 4).

Total number of ovaries with endometriotic cysts were 88 (58 unilateral + 15 bilateral). Mean residual ovarian tissue volume of the operated ovary pre- and post-operatively was 8.5 \pm 5.3 and 7.4 \pm 5.8 cm³ respectively. Mean AFC in ovaries with endometriotic cyst pre- and post-operatively was 3.3 \pm 1.9 and 4.1 \pm 1.5. Mean stromal PSV of the

operated ovary pre- and post-operatively was 6.8 \pm 4.57 and 7.1 \pm 3.55 cm/s, respectively [Table 1]. Mean day 2 FSH and LH ($n = 73$) pre- and post-operatively were 7.24 \pm 1.21 mIU/ml, 6.37 \pm 1.8 mIU/ml and 7.23 \pm 1.51 mIU/ml, 6.6 \pm 2.3 mIU/ml, respectively [Table 2]. There was no significant difference between pre- and post-operative values of ovarian reserve parameters.

Of the 88 endometriotic cyst walls analyzed by semiquantitative scale, 72.73% (64/88) had no loss (Group 1) on histopathological examination (HPE) while 27.2% (24/88) cyst walls showed a loss of follicles (Group 2). Cysts with preoperative diameter ≤ 5 cm showed greater loss of follicles compared with cysts with ≥ 5.1 cm, which was statistically significant [Table 3]. Relationship between severity of endometriosis and loss of follicles were analyzed; out of the 73 patients one patient was excluded from this analysis as she had bilateral endometriotic cyst, which showed disparity between the loss of follicles between right and left ovarian cyst. Of the 72 patients, 26.4% (19/72) had minimal to mild endometriosis, and 73.6% (53/72) had moderate to severe endometriosis. Loss of follicles were 21.1% (4/19) in patients with minimal to mild endometriosis and 32.1% (17/53) in moderate to severe endometriosis, though the loss of follicles were more in moderate and severe endometriosis, it was not statistically significant [Table 4].

COMMENTS

Ovarian endometriomas are common and are regarded as specific manifestation of the disease endometriosis. Laparoscopic cystectomy is the gold standard surgical technique of clinical care for women with endometriosis and pelvic pain or infertility. For years, a debate has been under way as to the most appropriate technique for surgical treatment of endometriomas, comparing the most commonly used techniques^[9,10] cystectomy, fenestration and bipolar coagulation, or fenestration and laser vaporization of the cyst wall or two or three step techniques.^[3] These techniques are usually evaluated in terms of their effect on symptomatic relief, the ovarian reserve, pregnancy rate and the risk of recurrence.^[11] There are significant concerns about the potential deleterious effects on ovarian reserve. Endometrioma surgery carries the risks of 2.4% postsurgical ovarian failure and 30.4% disease recurrence.^[12] A successful operation means not only removal of ovarian pathology, but also maintenance of ovarian function and subsequent pregnancy.

Sonographic assessment of the AFC has been strongly associated with the primordial follicle pool. Ovarian volume can be used as a surrogate measurement of ovarian reserve. Var *et al.*^[13] showed a significant reduction in AFC and ovarian volume following laparoscopic endometriotic cystectomy. Said *et al.*^[14] concluded removal of endometriotic

Table 1: Comparison between preoperative and postoperative ovarian reserve; ultrasound parameters (n=88)

Parameter	Preoperative	Postoperative	Significance*
Residual ovarian volume of operated ovary (cm ³)	8.5±5.3	7.4±5.8	P=0.19
Antral follicle count of operated ovary [†]	3.3±1.9	4.1±1.5	P=0.001
Stromal PSV of operated ovary (cm/sec)	6.8±4.57	7.1±3.55	P=0.488

*Statistical test -Paired t test, P<0.05: significant [†]Wilcoxon signed test, PSV: Peak systolic velocity

Table 2: Comparison between preoperative and postoperative ovarian reserve, biochemical parameters (n=73)

Biochemical parameters (mIU/ml)	Preoperative	Postoperative	Significance*
Day 2 FSH	7.24±1.21	7.23±1.51	P=0.29
Day 2 LH	6.37±1.8	6.6±2.3	

*Statistical test -Paired t test, P<0.05: significant, FSH: Follicle-stimulating hormone, LH: Luteinizing hormone

Table 3: Relationship between preoperative endometriotic cyst diameter and loss of follicles by histopathological examination (n=88)

Preoperative cyst Diameter (cm)	Group 1 (no loss of follicles) n=64 (%)	Group 2 (loss of follicles) n=24 (%)	Total n=88
<5	21 (60)	14 (40)	35
≥5.1	43 (81.13)	10 (18.86)	53

Statistical test: Pearson Chi-Square test P value=0.03 (<0.05)

Table 4: Relationship between intraoperative staging of endometriosis and loss of follicles on histopathological examination (n=72 excluding one bilateral with discrepancy)

Disease severity (rASRM staging)	Group 1 (no loss of follicles) n=51 (%)	Group 2 (loss of follicles) n=21 (%)	Total n=72
Minimal to mild endometriosis	15 (78.9)	4 (21.1)	19
Moderate to severe endometriosis	36 (67.9)	17 (32.1)	53

Statistical test: Pearson Chi-Square test P value=0.45 (<0.05), rASRM: revised American Society of Reproductive Medicine

cysts with the stripping technique is associated with direct trauma to the ovarian cortex with destruction of the follicles. In a study by Ercan *et al.*,^[14] on the 2nd day after surgery a significant increase in the ovarian volume was detected on the operated ovary, which may be the result of edema due stripping procedure. But 3 months after surgery there was no significant difference between the operated and nonoperated ovarian volume. AFCs of the operated side were significantly lower on 2nd postoperative day and persisted 3 months later after surgery. In a study by Celik *et al.*,^[15] comparing to preoperative measurements, the AFC increased both at week 6 and 6 months postoperatively, but there was a significant decrease in serum AMH levels. Ercan *et al.*^[14] studied the pulsatility index (PI) and PSV indices and concluded that blood flow of the operated ovaries decreased

in the short term (2nd day), while they were approaching normal ranges in the midterm (3rd month) follow-ups.

Candiani *et al.*^[16] compared operated and the contralateral intact gonad following laparoscopic endometriotic cystectomy. Ovarian volume was similar in the operated and in the contralateral intact gonad at first ultrasound evaluation; a statistically significant reduction in basal volume was observed at the second assessment, which was attributed to initial ovarian edema, which later disappeared. Total number of follicles and stromal blood flow were similar at both evaluations.

Our study showed no significant difference in ovarian volume after surgery. This result, suggests to us that stripping technique does not have much negative impact on the ovaries in terms of ovarian volume and size. There was no statistically significant difference between the ovarian reserve parameters, which might be the result of gentle surgical technique, meticulous hemostasis, and finding the proper plane. There was insignificant rise in mean AFC in operated ovary, which could be due decompression of normal ovarian tissue by excision of endometrioma.

Loss of follicles as depicted by histopathological examination was seen in 27% (24/88) of operated cyst wall. In the study by Shi *et al.*,^[17] the number of cysts showing follicles were higher in the endometriotic groups than in the group with benign ovarian cysts. Roman *et al.*^[18] have reported, direct relationship between endometrioma size and ovarian parenchyma inadvertently removed during cystectomy. However, inverse relationship was observed in the study by Oh *et al.*^[19] and Romualdi *et al.*^[20] between the cyst size and the number of follicles lost with surgery. In this study, we found inverse relation between cyst diameter and ovarian tissue removed, loss of normal ovarian was more with cyst diameters <5 cm compared with cysts measuring >5 cm. This can be explained by the fact that smaller cysts result in difficulty in stripping from adjacent ovarian stroma and inflammatory activity of the endometriotic tissue results in inadvertent removal of ovarian tissue. Similarly, loss of follicles was more in patients with moderate to severe endometriosis that is 32.1% (17/53) when compared to 21.1% (4/19) of patients with minimal to mild endometriosis, though the difference was statistically not significant.

Laparoscopic endometriotic cystectomy of ovary when performed with accurate surgical technique leads to no significant ovarian tissue removal and thus does not result in reduction of ovarian reserve.

Limitations being the smaller sample size, as only 73 patients with endometriotic cyst formed part of study with high drop outs for follow-up. Serum AMH was not

assessed in all patients because of financial constraints so could not be studied. Larger sample size and longer period of follow-up are necessary to draw conclusions.

REFERENCES

- Hart RJ, Hickey M, Maouris P, Buckett W. Excisional surgery versus ablative surgery for ovarian endometriomata. *Cochrane Database Syst Rev* 2008;(2):CD004992.
- Li CZ, Liu B, Wen ZQ, Sun Q. The impact of electrocoagulation on ovarian reserve after laparoscopic excision of ovarian cysts: A prospective clinical study of 191 patients. *Fertil Steril* 2009;92:1428-35.
- Tsolakidis D, Pados G, Vavilis D, Athanatos D, Tsalikis T, Giannakou A, *et al.* The impact on ovarian reserve after laparoscopic ovarian cystectomy versus three-stage management in patients with endometriomas: A prospective randomized study. *Fertil Steril* 2010;94:71-7.
- Ercan CM, Duru NK, Karasahin KE, Coksuer H, Dede M, Baser I. Ultrasonographic evaluation and anti-mullerian hormone levels after laparoscopic stripping of unilateral endometriomas. *Eur J Obstet Gynecol Reprod Biol* 2011;158:280-4.
- Scheffer GJ, Broekmans FJ, Bancsi LF, Habbema JD, Looman CW, Te Velde ER. Quantitative transvaginal two- and three-dimensional sonography of the ovaries: Reproducibility of antral follicle counts. *Ultrasound Obstet Gynecol* 2002;20:270-5.
- Hachisuga T, Kawarabayashi T. Histopathological analysis of laparoscopically treated ovarian endometriotic cysts with special reference to loss of follicles. *Hum Reprod* 2002;17:432-5.
- Revised American Society for reproductive medicine classification of endometriosis. *Am Soc Reprod Med* 1997;5:817-21.
- Maneschi F, Marasá L, Incandela S, Mazzaresse M, Zupi E. Ovarian cortex surrounding benign neoplasms: A histologic study. *Am J Obstet Gynecol* 1993;169:388-93.
- Muzii L, Bianchi A, Crocè C, Mancini N, Panici PB. Laparoscopic excision of ovarian cysts: Is the stripping technique a tissue-sparing procedure? *Fertil Steril* 2002;77:609-14.
- Alborzi S, Momtahan M, Parsanezhad ME, Dehbashi S, Zolghadri J, Alborzi S. A prospective, randomized study comparing laparoscopic ovarian cystectomy versus fenestration and coagulation in patients with endometriomas. *Fertil Steril* 2004;82:1633-7.
- Muzii L, Bellati F, Bianchi A, Palaia I, Mancini N, Zullo MA, *et al.* Laparoscopic stripping of endometriomas: A randomized trial on different surgical techniques. Part II: Pathological results. *Hum Reprod* 2005;20:1987-92.
- Busacca M, Riparini J, Somigliana E, Oggioni G, Izzo S, Vignali M, *et al.* Postsurgical ovarian failure after laparoscopic excision of bilateral endometriomas. *Am J Obstet Gynecol* 2006;195:421-5.
- Var T, Batioglu S, Tonguc E, Kahyaoglu I. The effect of laparoscopic ovarian cystectomy versus coagulation in bilateral endometriomas on ovarian reserve as determined by antral follicle count and ovarian volume: A prospective randomized study. *Fertil Steril* 2011;95:2247-50.
- Said TH, El Sibai F, Rocca M, Kholif A, Ahmed A, Soliman A. Evaluation of ovarian reserve after surgical treatment of unilateral benign ovarian cyst. *Fertil Steril* 2009;91 Suppl 1:S20.
- Celik HG, Dogan E, Okyay E, Ulukus C, Saatli B, Uysal S, *et al.* Effect of laparoscopic excision of endometriomas on ovarian reserve: Serial changes in the serum antimüllerian hormone levels. *Fertil Steril* 2012;97:1472-8.
- Candiani M, Barbieri M, Bottani B, Bertulesi C, Vignali M, Agnoli B, *et al.* Ovarian recovery after laparoscopic enucleation of ovarian cysts: Insights from echographic short-term postsurgical follow-up. *J Minim Invasive Gynecol* 2005;12:409-14.
- Shi J, Leng J, Cui Q, Lang J. Follicle loss after laparoscopic treatment of ovarian endometriotic cysts. *Int J Gynaecol Obstet* 2011;115:277-81.
- Roman H, Tarta O, Pura I, Opris I, Bourdel N, Marpeau L, *et al.* Direct proportional relationship between endometrioma size and ovarian parenchyma inadvertently removed during cystectomy, and its implication on the management of enlarged endometriomas. *Hum Reprod* 2010;25:1428-32.
- Oh HK, Sin JI, Kim JH, Hong SY, Lee TS, Choi YS. Effect of age and stage of endometriosis on ovarian follicular loss during laparoscopic cystectomy for endometrioma. *Int J Gynaecol Obstet* 2011;114:128-32.
- Romualdi D, Franco Zannoni G, Lanzone A, Selvaggi L, Tagliaferri V, Gaetano Vellone V, *et al.* Follicular loss in endoscopic surgery for ovarian endometriosis: Quantitative and qualitative observations. *Fertil Steril* 2011;96:374-8.

How to cite this article: Bhat RG, Dhulked S, Ramachandran A, Bhaktha R, Vasudeva A, Kumar P, *et al.* Laparoscopic cystectomy of endometrioma: Good surgical technique does not adversely affect ovarian reserve. *J Hum Reprod Sci* 2014;7:125-9.
Source of Support: Nil, **Conflict of Interest:** None declared.

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