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Effectiveness of ovarian suspension in preventing postoperative ovarian adhesions in patients with severe pelvic endometriosis—a case-control study

Zahra Dehbashi[1,2], Shaheen Khazali[3,4,5], Fateme Davari Tanha[6*], Farnaz Mottahedian[1], Mahsa Ghajarzadeh[7], Saghar Samimi Sadeh[8] and Koorosh Kamali[9]

Abstract

Background: Endometriosis can exert obvious negative effects on women's quality of life.
Excisional surgery is among the most effective treatments for severe pelvic endometriosis. The prevalence of severe pelvic adhesions following a laparoscopic examination of severe endometriosis varies between 50 and 100%. Temporary intraoperative ovarian suspension is a method for the reduction of adhesions is in the treatment of severe pelvic endometriosis. Given the importance and the prevalence of endometriosis and its complications, we conducted the present study to determine more effective adhesion-reducing methods with a view to improving the quality of the treatments provided.

Methods: The present prospective double-blind randomized clinical trial was conducted on 50 women of reproductive age (≥ 19 years) diagnosed with severe pelvic endometriosis on transvaginal ultrasound scans and vaginal examinations at Yas Hospital between 2014 and 2017. Women with severe endometriosis (stage III, stage IV, and deep infiltrating endometriosis) requiring an extensive bilateral dissection of the pelvic walls and the rectovaginal space, with preserved uterus and ovaries, were included in the study.
The preoperative severity of ovarian adhesions was assessed in terms of ovarian motility, measured through a combination of gentle pressures applied with the vaginal probe and abdominal pressures applied with the examiner's free hand. A table of random numbers was used to choose which ovary to suspend. The entire study population received standard general anesthesia. In the laparoscopic examination of the cases with severe endometriosis, both ovaries were routinely suspended to the anterior abdominal wall with PROLENE sutures. At the end of the surgery, one of the ovaries was kept suspended for 7 days, whereas the other ovarian suspension suture was cut.
At 3 months postoperatively, all the patients underwent ultrasound scans for the assessment of ovarian motility and adhesions. The severity of pelvic pain was defined according to a visual analog score. After surgery, infertile women were followed for 2-4 years, and were contacted regarding the infertility treatment. Chemical and clinical pregnancy rates was compered between the two groups.

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* Correspondence: fatedavari@gmail.com
[6]Department of Obstetrics and Gynecology and Reproductive Endocrinology of Women Hospital, Tehran University of Medical Sciences, North Ostadnejatollahi Avenue, Tehran, Iran
Full list of author information is available at the end of the article

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Results: Three months after laparoscopy, the adhesions were mild in 41 (82%) patients and moderate in 9 (18%) on the suspended side, and mild in 12 (24%) patients and moderate in 38 (76%) on the control side ($P < 0.001$). The mean dysmenorrhea score was 6.8 ± 1.5 before surgery and 4.5 ± 1.4 after surgery ($P < 0.001$). The chemical pregnancy rate and clinical pregnancy rate were not different in the suspended and control groups ($P = 0.62$, $P = 0.64$).

Conclusions: The reduction in adhesions via ovarian suspension surgery promises reductions in the complications of endometriosis.

Introduction

Endometriosis is defined as the presence of endometrial stroma and glands outside the uterine cavity. Lesions are often in the pelvis, although they may also occur in the intestine, the diaphragm, and the pleural cavity, and they can cause dysmenorrhea, dyspareunia, chronic pain, and infertility [1, 2]. The most common sites involved are the ovaries, followed by the posterior and anterior cul-de-sac, the posterior broad ligament, the uterosacral ligament, the uterine, the fallopian tube, the sigmoid colon, the appendix, and the round ligament.

The typical symptoms of endometriosis are dysmenorrhea, dyspareunia, pelvic pain, and infertility. Endometriosis can exert obvious negative effects on women's quality of life. Excisional surgery is among the most effective treatment modalities for severe pelvic endometriosis. Although laparoscopic surgery causes less pelvic trauma than does a laparotomy, it is liable to lead to pelvic adhesions in a large number of patients [2, 3]. Pelvic adhesions affect the ovaries and the Douglas cul-de-sac and can cause chronic pelvic pain and dyspareunia, intestinal obstruction, and infertility. The prevalence of severe pelvic adhesions following a laparoscopic examination of severe endometriosis varies between 50 and 100%. Many interventions have been carried out to reduce postoperative adhesions, including the intraperitoneal administration of anti-adhesion solutions and hyaluronic acid and steroidal and heparin medications. The suspension of ovaries to the anterior abdominal wall is also a technique that facilitates their retraction during severe endometriosis surgery [3–6]. The severity of endometriosis is determined via the American Society for Reproductive Medicine (ASRM) classification [7].

The point deserving of note vis-à-vis the prevalence rate of 50 to 100% of postoperative adhesions is that adhesions are the cause of pelvic pain, dyspareunia, and dysmenorrhea. Such chronic pains degrade the efficacy of the treatment and the patient's quality of life in terms of sleep quality and sexual function [8].

A great deal of research has been carried out in search of effective techniques for lessening postoperative adhesions. One of these methods is temporary intraoperative ovarian suspension in the treatment of severe pelvic endometriosis. The success of these modalities hinges upon their effectiveness in alleviating both pains and symptoms of patients, obviating the need for further restorative surgeries, and being economically cost-effective for both patients and health systems.

In a study conducted by Hoo (2014) on patients with severe pelvic endometriosis that needed extensive pelvic dissection to preserve the uterus and the ovaries, both ovaries were routinely suspended, and one of the sutures was removed at the end of the surgery to free the ovary. Next, a new transabdominal suture was reattached as a placebo. The unsuspended ovary was taken as a control. Both sutures were subsequently cut 36 to 48 h after surgery and before patient discharge. Three months after surgery, all the patients underwent ultrasound scans for an assessment of the motility of their ovaries. The mean interval between ovarian suspension and the postoperative ultrasound scan was 99 days. No obvious difference was found in the prevalence of postoperative adhesions between the suspended and the unsuspended (control group) ovaries ($P = 0.23$) [4].

In his study, Ouahba (2004) investigated adhesions and fertility following temporary ovarian suspension in severe endometriosis surgery. The ovaries were unilaterally or bilaterally temporarily suspended to the anterior abdominal wall at the end of the surgery. The mean duration of suspension was 4 days, and there were no complications and prolonged lengths of hospital stay in the patients. Second-look laparoscopy was carried out in 40% of the study population (8 out of 20 patients), which showed reduced adhesions. Two-thirds of the suspended ovaries had no adhesions in the second surgery, although all the ovaries were initially adherent. The author recommended ovariopexy as a simple and effective technique for preventing adhesion in severe pelvic endometriosis surgeries [9].

In a study conducted by Abuzeid (2002), temporary ovarian suspension was performed after laparoscopy in stage III and stage IV endometriosis. This retrospective study was conducted on 20 patients undergoing laparoscopy for infertility. The temporary suspension of the ovaries to the anterior abdominal wall was performed at the end of the surgery to separate the adhesion surface in the first phase of tissue repair (5–7 days). No complications occurred. Following the discharge of the patients with additional infertility factors, 9 women had spontaneous pregnancies. Five women had second-look surgery, which revealed no evidence of adhesion in 80% (4) and minor adhesions in 20% [10].

In a study on severe pelvic endometriosis, the patients' history and clinical findings were combined with transvaginal ultrasound data as a "soft marker" in the assessment of ovarian mobility to predict fixed ovaries secondary to endometriosis at laparoscopy. This study was conducted on 106 women, at a mean age of 33.3 years, candidated for surgery following infertility and pelvic pain assessment. All the women were inquired with regard to dyspareunia and dysmenorrhea. Vaginal and transvaginal ultrasound examinations were carried out preoperatively. The number of fixed ovaries detected with ultrasound (1 or 2 ovaries were fixed or stuck to the iliac artery or the lateral pelvic wall) was compared with that detected with laparoscopy. The author concluded that the combination of clinical and transvaginal ultrasound-based soft marker of ovarian mobility was a valid method for the diagnosis of fixed ovaries secondary to endometriosis [11].

Some previous studies have shown that the postlaparoscopic use of Oxiplex/AP Gel and Seprafilm membrane (an oxidized regenerated cellulose absorbable barrier) in patients with severe endometriosis is effective in reducing the occurrence of endometriosis adhesions [12–14].

Given the importance and the prevalence of endometriosis and its complications, we conducted the present study to determine more effective adhesion-reducing methods with a view to improving the quality of the treatments provided. As second-look laparoscopy was not possible in the present study, only transvaginal ultrasound scans and vaginal examinations in the third postoperative months were used.

Methods

The present prospective double-blind randomized clinical trial was conducted on women of reproductive age (≥ 19 years) diagnosed with severe pelvic endometriosis on transvaginal ultrasound scans and vaginal examinations at Yas Hospital between 2014 and 2017. The study protocol was approved by the Ethics Committee of Tehran University of Medical Sciences. The IRCT code is IRCT201402122576N9. The participants' mean age was 27.7 years. Infertile women's hormone profile was checked on the second or third day of menstrual period. The exclusion criteria were premature ovarian failure, postmenopausal status, and those with various medical diseases. Women with severe endometriosis (detection of endometrioma cysts [an ovarian endometrioma is a cystic mass caused by ectopic endometrial tissue within the ovary] in the ovaries, adhesions in the cul-de-sac, and deep infiltrating endometriosis [DIE] on transvaginal sonography) requiring an extensive bilateral dissection of the pelvic walls and the rectovaginal space, with preserved uteri and ovaries, were included in the study.

The severity of ovarian adhesions before surgery was assessed in terms of ovarian motility, measured through a combination of gentle pressures applied with the vaginal probe and abdominal pressures applied with the examiner's free hand, similar to a bimanual examination. The ovary was considered totally free when it slid without any resistance across the surrounding structures. The same method was utilized in a study by Holland et al. (2010) [15]. Mild adhesions (according to the ASRM classification < 1/3 enclosure with dense adhesions) were defined as those in which a gentle pressure could not separate some of the surrounding structures from the ovary but the ovary could be mobilized from most (> 2/3) of those structures. Moderate adhesions (ASRM 1/3–2/3 enclosure with dense adhesions) were defined as those in which the adhesions to the surrounding structures lessened the ovarian mobility but a gentle pressure caused the structures on two-thirds to one-third of the surface of the ovary to slide across it. In severe adhesions (ASRM > 2/3 enclosure with dense adhesions), a gentle pressure failed to move the ovary or separate it from the structures surrounding it [15].

A table of random numbers was used to choose which ovary to suspend; accordingly, 29 left ovaries and 21 right ovaries were suspended. Apropos of the disease stage, 9 patients were in stage III and 41 in stage IV. The mean diameter of the ovarian endometrioma was 6.6 ± 1.8 cm in all the patients. Endometriosis was bilateral in 16 women and unilateral in 34 (22 left-sided and 12 right-sided) [16]. The whole study population received standard general anesthesia.

The women were placed in the lithotomy position during surgery. The main trocar was inserted through the umbilicus, and the secondary trocars were inserted under direct observation. The uterine and ovarian adhesions to the surrounding structures were resected, and the cul-de-sac was cleared of the DIE lesions. The endometrial masses were removed, and the endometrial lining was sent for pathologic examination. The DIE lesions were shaved off of the intestinal surfaces, and none of the patients underwent intestinal resection and colostomy.

In the laparoscopic examination of the cases with severe endometriosis, both ovaries were routinely suspended to the anterior abdominal wall with PROLENE sutures, which were brought out of the skin so as to facilitate both access to the pelvic walls and the posterior cul-de-sac and the total removal of the lesions. At the end of the surgery, one of the ovaries was kept suspended for 7 days, whereas the other ovarian suspension suture was cut and a new

Table 1 Hormone profile of the two groups

Variable	Suspended group) (mean ± SD)	Control group (mean ± SD)	*P* value
FSH	7.31 ± 1.90	5.86 ± 2.14	0.62
LH	8.42 ± 6.33	4.49 ± 5.26	0.27
E_2	70.21 ± 76.16	56.33 ± 50.16	0.35
AMH	1.28 ± 1.36	1.46 ± 1.12	0.7

transabdominal suture was reinserted at the same site to act as a placebo. Both PROLENE sutures were tightened with a surgical knot placed over the skin. All the patients, therefore, had two abdominal sutures of the same length. The patients and the medical team were blinded to this randomization, and only the surgeon was aware of the suspension site. Both PROLENE sutures were cut on the seventh postoperative day. Length of hospitalization was calculated from time (hour) of patient admission to the hospital to the time of discharge. This time was compared between the two groups. At 3 months postoperatively, all the patients underwent ultrasound scans to assess ovarian motility and adhesions. Adhesion was defined as a restricted ovarian movement on targeted palpation, which combined gentle pressures applied with the vaginal probe and abdominal pressures applied with the examiner's free hand. The sonographer was also blinded to the randomization details. The changes in the patients' clinical symptoms and the severity of their ovarian adhesions were assessed. The severity of pelvic pain was defined according to a visual analog score. After surgery, infertile women were followed for 2-4 years, and were contacted regarding the infertility treatment. Clinical pregnancy was diagnosed with positive β-HCG and observing gestational sac on transvaginal ultrasound. If lab test was positive, but ultrasound did not detect gestational sac, it was called chemical pregnancy. The total number of IVF/ICSI cycles was compared for patients.

Data analysis

The collected data were analyzed in the SPSS software, version 20, using a paired sample *t* test and an independent sample *t* test. A *P* value of less than 0.05 was considered statistically significant. The two-sample *t*-test was used for continuous variables and X_2 analysis was performed for categorical variables.

Table 2 Mean length of hospitalization for the two groups

Variable	Suspended group	Control group	*P* value
Length of hospitalization (h) (mean ± SD)	78.50 ± 15.53	73.50 ± 10.12	0.53

Table 3 Severity of the adhesions in the suspended right and left ovaries 3 months after surgery

	Mild adhesion	Moderate adhesion	Total
Left ovary	24 (48%)	5 (10%)	29 (58%)
Right ovary	17 (34%)	4 (8%)	21 (42%)
Total	41	9	50

Results

The present study was conducted on 50 women at a mean age of 27.5 ± 4.6 years with pelvic endometriosis of stage III, stage IV, or DIE. The mean gravida of the subjects was 1. Nine (18%) patients were in stage III and 41 (82%) in stage IV. Infertility was reported in 38 women (17 patients in the suspended group and 21 patients in the control group). None of the subjects had rectorrhagia. The mean body mass index was 22.5 ± 1.6 kg/m^2. Hormone profile assessment in infertile women showed that the mean of AMH was not significantly different between the two groups (Table 1). (P = 0.7) The mean of FSH, LH, E2 was not significantly different between the two groups on the second or third day of menstrual period (respectively P = 0.62, P = 0.27, P = 0.35). Ten (20%) patients had moderate adhesions and 40 (80%) had severe adhesions. Sixteen (32%) patients had bilateral endometriosis, while 12 (24%) women had unilateral right-sided and 22 (44%) unilateral left-sided endometriosis.

A total of 43 (86%) patients had ovarian adhesions. The mean length of hospitalization was 78.50±15.53 hr in the suspended group and 73.50 ±10.12 hr in the control group with no significant difference (P = 0.53) (Table 2). Three months after laparoscopy, the adhesions were mild in 41 (82%) patients and moderate in 9 (18%) on the suspended side, and mild in 12 (24%) patients and moderate in 38

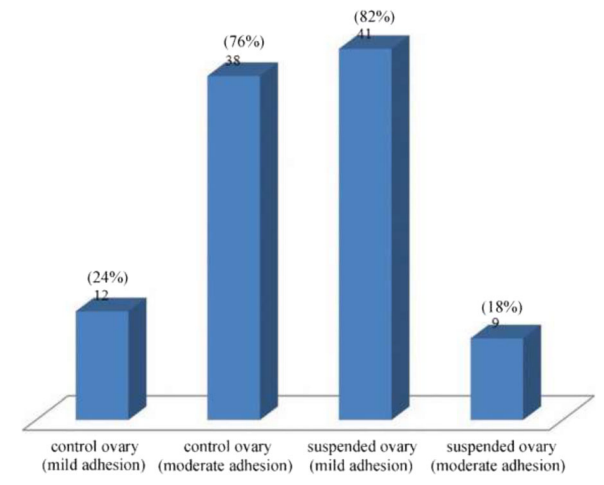

Fig. 1 Severity of the adhesions in the suspended and control ovaries 3 months after surgery

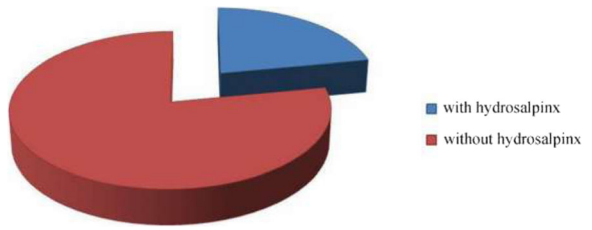

Fig. 2 Prevalence of hydrosalpinx in the patients

(76%) on the control side ($P < 0.001$) (Table 3 and Fig. 1). The ovarian-suspended patients had no more complications than other patients with laparoscopic surgery for endometriosis.

Hydrosalpinx was observed in 11 (22%) patients (Fig. 2).

The mean dyspareunia score was 7.3 ± 1.5 preoperatively and 5.3 ± 1.5 postoperatively ($P < 0.001$) (Fig. 3). The mean dysmenorrhea score was 6.8 ± 1.5 before surgery and 4.5 ± 1.4 after surgery ($P < 0.001$) (Fig. 4). In follow-up of infertile women, all of the patients received assisted reproductive technology. Patients in the suspended group had 36 IVF/ICSI cycles and patients in control group had 48 cycles. The chemical pregnancy rate was not different in the suspended and control groups ($P = 0.62$). The clinical pregnancy rate was not different between the two groups ($P = 0.64$) (Table 4).

Discussion

The results of the present study showed the effectiveness of ovarian suspension in reducing ovarian adhesions 3 months after laparoscopy. Furthermore, according to our visual analog scale, the women's mean score of pelvic pain declined, and the difference between the pre- and postoperative scores was significant even though the ovaries were suspended only on one side.

Adhesions often occur following laparoscopy for pelvic endometriosis and can, thus, compromise the success of this technique. A few studies having been conducted so far have shown that the temporary suspension of ovaries to the abdominal wall can significantly reduce postoperative adhesions. Few studies have compared the outcome of pregnancy in infertile women with severe endometriosis and suspended or unsuspended ovaries. The present study showed chemical and clinical pregnancy rates were not different between these patients ($P = 0.62$, $P = 0.64$). In a study conducted by Hoo et al. (2014), the severity of the adhesions decreased following the short-term suspension of the ovaries (36–48 h). Their results confirmed that a longer period of ovarian suspension reduced the prevalence of postoperative adhesions. Accordingly, in the present study, we performed ovarian suspension for a longer period of 7 days [8, 9].

Various techniques have been drawn upon thus far to reduce postoperative ovarian adhesions, but most of them have proven inadequate. However, taking into account that the first phase of wound healing at levels that can cause adhesions takes between 5 and 7 days, Abuzeid (2002) performed ovarian suspension surgery on 20 patients, 5 of whom underwent a second laparoscopy. The results showed a reduction in postoperative

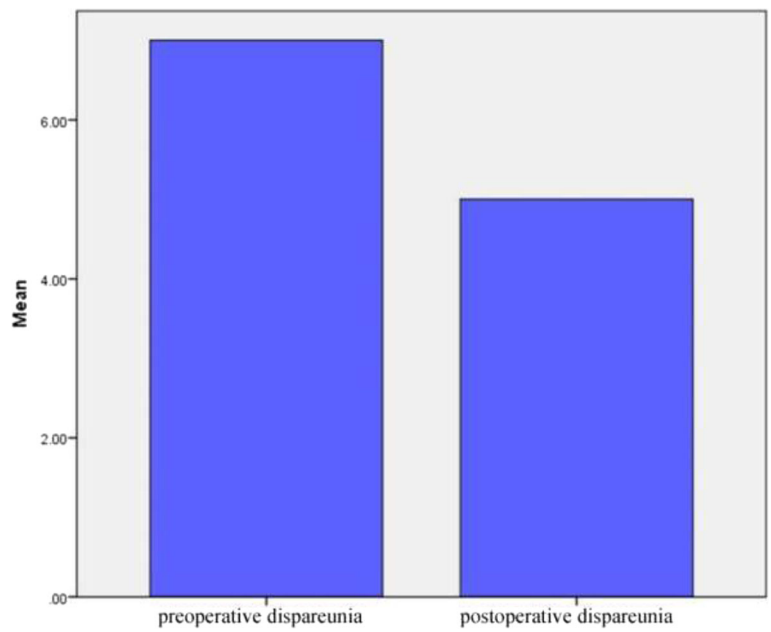

Fig. 3 Dyspareunia before and after surgery

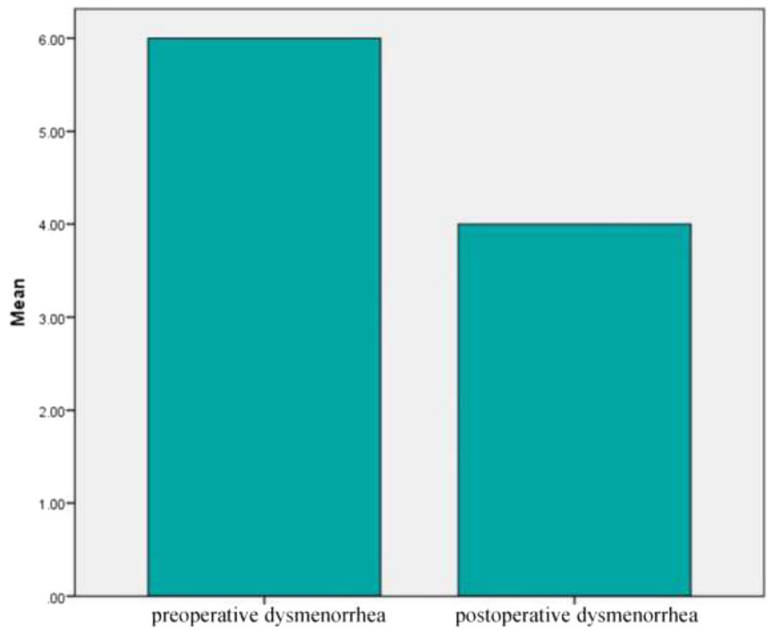

Fig. 4 Dysmenorrhea before and after surgery

adhesions in all the patients. Improved fertility was also observed in these women. Since a second laparoscopy is invasive and ethically cannot be performed in all patients, the author decided to reassess the adhesions with ultrasound on the strength of its accuracy [3].

Ouahba (2004), in an assessment of postlaparoscopic adhesions in the ovariopexy technique in 15 patients with endometriosis, reported a clear reduction in adhesions in 40% of the study population and postprocedural pregnancies in 4 patients [4]. In the present study, we reassessed the adhesions with the aid of transvaginal ultrasound.

Marasinghe combined patients' history and clinical findings with transvaginal ultrasound data as a soft marker in an evaluation of ovarian motility to predict fixed ovaries secondary to endometriosis in laparoscopy and proposed the clinical and transvaginal ultrasound-based soft marker of ovarian motility as a reliable modality for the diagnosis of the fixation of ovaries secondary to endometriosis [11]. In the present study, we used a combination of examinations and ultrasound scans to assess the adhesion levels.

Table 4 Chemical and clinical pregnancy rates between the two groups

Variable	Suspended group (%)	Control group (%)	*P* value
Chemical pregnancy	11	10	0.62
Clinical pregnancy	19	22	0.64

Kamel et al. (2010) studied the factors and methods effective in reducing postoperative peritoneal adhesions and cited factors such as anti-inflammatory medications, antibiotics, mechanical separation, barriers, and gel as suitable adhesion-prevention techniques.

In a study conducted by Wietske (2002) on patients with severe endometriosis, Seprafilm membrane was used following laparoscopy to lessen the incidence of adhesion. This membrane was found to be effective in alleviating the severity of the postoperative adhesions [6].

Mais (1995) reported the efficacy of the use of an oxidized regenerated cellulose absorbable barrier after laparoscopy in reducing the postoperative incidence of ovarian adhesions in patients with severe endometriosis [7]. In the present study, we did not utilize this material and achieved adhesion reduction only through ovarian suspension.

Conclusions

Ovarian suspension surgery appears to be effective in lessening adhesion 3 months after laparoscopy. This technique can ease the severity of pelvic pain, dysmenorrhea, and dyspareunia to some extent. Although the ovaries were suspended only on one side in the current study, the difference between the suspended side and the control side was significant.

The reduction in adhesions via ovarian suspension surgery promises reductions in the complications of endometriosis and surgery.

The strong points of the current study include the facts that all the patients were operated on by the same surgeon

and randomization was meticulously carried out. Nonetheless, the small study population can be deemed the salient limitation of the present investigation.

Since according to previous studies, the ovarian suspension has no complications, does not prolong hospital stay, and does not impose additional costs on patients, it can be used as a method for reducing postoperative adhesions and symptoms of the disease in all laparoscopic surgeries in patients with endometriosis.

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Authors' contributions
ZD contributed to the protocol/project development, developed the literature search strategy, and helped in the manuscript writing/editing. SK contributed to the protocol/project development and management. FDT contributed to the protocol/project development and management, and developed the literature search strategy. FM helped in the data collection and manuscript writing. MG and KK analyzed the data. SS contributed to the protocol/project development. All authors read and approved the final manuscript.

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Availability of data and materials
The dataset is available with the corresponding author.

Ethics approval and consent to participate
The ethics committee approval was obtained before the performance of this study, and all patients consented to be included in or record for this purpose.

Competing interests
The authors declare that they have no competing interests.

Author details
[1]Department of Gynecology and Obstetrics, Tehran University of Medical Sciences, Tehran, Iran. [2]Amiralmomenin Hospital, Zabol, Iran. [3]Centre for Endometriosis and Minimally Invasive Gynaecology (CEMIG), Ashford and St. Peter's Hospital NHS Foundation Trust, Surrey, Chertsey, UK. [4]British Society of Gynaecological Endoscopy (BSGE), London, UK. [5]Royal Holloway, University of London, London, UK. [6]Department of Obstetrics and Gynecology and Reproductive Endocrinology of Women Hospital, Tehran University of Medical Sciences, North Ostadnejatollahi Avenue, Tehran, Iran. [7]Tehran University of Medical Sciences, Tehran, Iran. [8]Department of Anesthesiology, Tehran University of Medical Sciences, Tehran, Iran. [9]Department of Public Health, School of Public Health, Zanjan University of Medical Sciences, Zanjan, Iran.

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