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Original Article

Comparing the Effect of Laparoscopic Supracervical and Total Hysterectomy for Uterine Fibroids on Ovarian Reserve by Assessing Serum Anti-Mullerian Hormone Levels: A Prospective Cohort Study

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ABSTRACT **Study Objective:** To compare prospectively the impact on ovarian reserve of total laparoscopic hysterectomy (TLH) and laparoscopic supracervical hysterectomy (LSH) for treating uterine fibroids as measured by serum anti-Mullerian hormone (AMH) levels.

Design: In this prospective study, 83 patients (aged 38–47 years) with symptomatic uterine fibroids underwent either TLH (n = 40) or LSH (n = 43) with conservation of both ovaries. Of these, 33 patients from the TLH group and 34 patients from the LSH group completed follow-up (Canadian Task Force Classification II-2).

Setting: Hospital.

Patients: Eighty-three patients aged 38–47 years.

Interventions: Patients with symptomatic uterine fibroids underwent either TLH (n = 40) or LSH (n = 43).

Measurements and Main Results: Changes in ovarian reserve were investigated by measuring serum levels of AMH, follicle-stimulating hormone (FSH), luteinizing hormone (LH), and estradiol (E2) before surgery and at 1 month and 4 months after surgery. In both the TLH and LSH groups, serum AMH levels were significantly decreased at 1 month and 4 months postsurgery compared with baseline levels ($p < .001$). The decrease in serum AMH levels was greater in the TLH group than in the LSH group at 1 month postsurgery, but the difference was not statistically significant. The decrease in serum AMH levels was significantly greater in the LSH group at 4 months postsurgery ($p < .001$). In both groups, no significant changes in serum FSH, LH, or E2 levels were seen at 1 month or 4 months ($p > .05$).

Conclusion: Serum AMH levels were decreased significantly at 4 months after hysterectomy, with a greater decrease in the TLH group compared with the LSH group, indicating the prognostic importance of serum AMH level in reflecting ovarian reserve in patients undergoing hysterectomy. Journal of Minimally Invasive Gynecology (2015) 22, 637–641 © 2015 AAGL. All rights reserved.

Keywords: Total hysterectomy; Supracervical hysterectomy; Laparoscopic surgery; Ovarian reserve; Anti-Mullerian hormone

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Uterine fibroids are common benign gynecologic tumors. Total hysterectomy has been widely accepted as the main surgical method for treating various uterine disorders with the main symptom of menorrhagia; however, the use of supracervical hysterectomy, a surgical method that preserves the cervix, has been restricted because of the risk of cervical stump carcinoma. Recent medical advances in cervical screening technology and equipment have reduced the incidence of cervical stump carcinoma to 0.3% after supracervical hysterectomy in patients with

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normal preoperative cervical cytologic examination results [1]. Moreover, the incidence of cervical stump carcinoma can be further reduced to 0.1% with well-conducted postoperative follow-up [2]. Compared with total hysterectomy, supracervical hysterectomy involves substantially shorter operation time, offers a more rapid return to daily activities, has less effect on sexual function, and carries a lower risk of complications, including pelvic organ prolapse [3]. The superior postoperative quality of life has made supracervical hysterectomy a more popular surgical method in clinical practice. In addition, advancement of minimally invasive techniques has made laparoscopic surgery the major surgical approach [4,5].

The ovarian function of patients after supracervical hysterectomy is a major concern in clinical practice. A previous study found an almost 2-fold greater 4-year risk of ovarian failure in women undergoing hysterectomy compared with women with an intact uterus (hazard ratio, 1.92; 95% confidence interval, 1.29–2.86) [6]. However, most previous studies have focused mainly on comparisons of intraoperative blood loss, postoperative recovery time, complications, postoperative sexual function, and pelvic organ prolapse between total and supracervical hysterectomy [7–9], and the effects of these 2 surgical methods on ovarian reserve have not been widely investigated to date.

Follicle-stimulating hormone (FSH) level is the most commonly used index to reflect ovarian function. FSH level fluctuates during the menstrual cycle, however, and thus levels measured at day 3 to 4 of the cycle could range from 4 to 25 IU/L in patients with decreased ovarian reserve [10].

Anti-Mullerian hormone (AMH) is a member of the transforming growth factor-β family. Previous studies have shown that AMH is expressed exclusively in the granulosa cells (diameter $\leq$4 mm) at the preantral follicles and small antral follicles, and that expression of AMH decreases gradually with increasing follicle diameter. In one study, nearly no AMH expression was found in follicles $>$8 mm in diameter, suggesting that AMH is closely associated with the growth of human ovarian follicles [11]. During the past decade, numerous studies have demonstrated the advantages of using serum AMH level as an index for evaluating ovarian reserve [12–14], and the sensitivity and specificity of AMH has been shown to be comparable with that of antral follicle count (AFC), which has substantial superiority over FSH, luteinizing hormone (LH), estradiol (E2), and inhibin-B in evaluating ovarian reserve [15,16]. In addition, serum AMH level generally remains stable throughout the human menstrual cycle [17], which greatly increases the importance of AMH in clinical practice.

In the present study, we aimed to investigate the effects of total laparoscopic hysterectomy (TLH) and laparoscopic supracervical hysterectomy (LSH) on ovarian reserve by assessing serum AMH levels.

Materials and Methods

Patients

In this prospective cohort study, 83 patients with uterine myoma were enrolled between February 2013 and November 2013 at the Department of Obstetrics and Gynecology of Wuxi Maternal and Child Health Hospital, China. Inclusion criteria were definite diagnosis of leiomyoma, age 38–47 years, regular menstrual cycles (cycle length of 25–35 days) in the 6 months before surgery, no history of previous ovarian surgery, and absence of any endocrine disease.

Exclusion criteria were perimenopausal status, based on FSH level; receipt of hormone therapy in the 3 months before surgery; previous hysterectomy along with removal of ovaries; and positive pregnancy test (β-human chorionic gonadotropin $>$3 mIU/mL; all patients were tested irrespective of age or marital status).

The study was approved by the local Institutional Review Board of the Wuxi Maternal and Child Health Hospital. Written informed consent was obtained from all patients before study participation.

Each patient was diagnosed with uterine myoma using transvaginal ultrasonography. The patients had undergone either TLH or LSH according to their condition, surgical principle, and patient preference. Before surgery, cervical DNA and human papillomavirus examinations were performed routinely in all patients, and cervical/vaginal speculum examination and cervical biopsy were performed as necessary to exclude cervical malignant lesions.

Data including age, body weight, gravidity, and information on menstrual cycles were obtained at the time of hospital admission. The duration of operation and amount of intraoperative blood loss (assessed using a graduated blood bag) were documented.

Assessment of Ovarian Reserve

Venous blood samples were drawn within 2 days before surgery and again at 1 month and 4 months after surgery. Samples were stored at -70°C until measurement. Serum AMH level was measured by enzyme-linked immunosorbent assay using a commercially available kit (Diagnostic Systems Laboratories, Webster, TX). The minimal detectable concentration of AMH was 0.006 ng/mL. FSH, LH, and E2 levels were measured using the immunometric technique.

Surgical Procedures

All surgeries were performed using a laparoscopic approach. A 10-mm subumbilical port was made, and pneumoperitoneum was established with CO_2. Three additional 5- to 15-mm ports were subsequently made in the right and left lower quadrants. All procedures were performed under general anesthesia, and the bladder was catheterized.