

Correlations of abnormal ultrasound audio-visual images of ovarian cortex surface and pelvic adhesion in infertile patients

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Summary

Objective: The aim of this study was to evaluate the related factors between abnormal ultrasonic appearance of ovarian and pelvic adhesion in infertile women. **Materials and Methods:** Forty-eight cases were examined with transvaginal ultrasonography (TVUS) if there was pelvic adhesion before surgery (experiment group), and the surgical group was used as control. The specificity of pelvic adhesion was evaluated. **Results:** Thirty-nine cases were abnormal in experiment group and 38 cases were confirmed with surgery, while one case was normal. Nine cases were normal in study group and six cases were confirmed with surgery, while three cases were abnormal. There were 91.7% (44/48) in coincidence rate and 97.4% (38/39) in positive predictive value. **Conclusion:** Infertility in women with pelvic adhesion with abnormal ovarian appearance, may be examined specifically with TVUS

Key words: Laparoscopy; Infertility; Pelvic adhesion.

Introduction

Pelvic adhesion is a common gynecologic disease, often caused by infection, endometriosis, surgical trauma, foreign body reaction, organic ischemia, etc. It could lead to intestinal obstruction, infertility in women, failure in fertility reconstruction surgery, discomfort sexual life, chronic pelvic pain, and increase of secondary operation rate [1]. Infertility is a serious reproductive health problem, with different incidence in different countries and regions [2]. It was pointed out by "2004 birth guide" [3] that tubal is a high-risk factor leading to infertility, accounting for 30%–40% of infertile etiologies. Pelvic adhesion destroys pelvic anatomical structure and limited tubal function, leading to infertility. Pelvic adhesion is usually diagnosed through the laparoscopic surgery, etc. [4], with only very few cases through single ultrasound diagnosis, such as hydrosalpinx and empyema, tubo-ovarian abscess, and inflammatory masses, etc. If pelvic adhesion is diagnosed preoperatively, the pathogeny of infertility could be more accurately assessed and its therapeutic regimen could be made in time, such as assisted reproductive technology, etc. However at present, there is no report revealing clear evidences of pelvic adhesion preoperatively. Then, could a non-invasive method be found to predict the existence of pelvic adhesion?

There are many causes of pelvic adhesion, mainly including damage of peritoneal and serosa of abdominal organs basin, ischemia, and local inflammatory reaction caused by infection, etc. This could be caused by mechanical injury, physical injury, infection, foreign bodies, and al-

lergic reaction, etc. [5-7]. In addition, pelvic adhesion could also be caused by diseases and treatments themselves, such as peritonitis, pelvic inflammation or peritoneal dialysis, etc [8]. From the occurrence mechanism of adhesion, the exudate rich in fibrin could raise macrophages and fibroblasts to inflammation parts; fibrinolytic activity could be declined, stopping the removal of fibrin deposits; hyperplasia of vascular granulation tissue, along with the deposition of collagen and elastin in the fibronectin glycans grid structure in the area of injury, could cause excessive fiber formation, beyond the clear ability of macrophages, thus adhesion could be formatted [9]. Adhesion is constituted by excessive fibrosis caused by accumulation of granulation tissues and fibronectins. Excessive fibrosis tissues could show strong echo under the ultrasonic. When the inflammation of abdominal organs basin spreads around the ovary, the local adhesive lesion attaches to the surface of the ovarian cortex. Compared with the low-echo ovarian acoustic image ovary, could it show an abnormal ultrasound image? What is the correlation of this abnormal ultrasound image along with the occurrence of pelvic adhesion? Could it be used as diagnostic evidences of pelvic adhesion?

In the field of gynecology and obstetrics, ultrasound examination has become one of the essential methods in clinical diagnosis. Compared with abdominal ultrasound, transvaginal ultrasound (TVUS) could not be disturbed by fat, abdomen scar or flatulence, with a high probe frequency and a clear image. Owing to the small volume and changeable position, clear ovarian boundary cannot be easily assessed by abdominal ultrasound. Vaginal probe could be rotated 360 degrees intrapelvically, expanding the vision in order to seek a varied ovarian position. TVUS observation of the ovary could

easily determine its position and show ovarian outline. In the early project funded by the science and technology commissions in Lianyungang City “study on tubal function examined by pelvic imaging techniques through transvaginal B ultrasonic” (invasive operation), there was a kind of ultrasound images closely related to pelvic adhesion. This image could be clearly shown not only in the imaging techniques to pelvic effusion, but also in regular vaginal ultrasound examination. Hence could this kind of ultrasound images be non-invasive evidences of pelvic adhesion?

As the understanding of the pathological mechanisms behind pelvic adhesion deepens and technology advances, vaginal ultrasound has been widely used for ovary examination because of its advantages. This study aimed to explore the correlation of ultrasound audio-visual abnormality on the surface of ovarian cortex and pelvic adhesion in infertile patients, by comparing the results of ovarian audio-visual images with the results of surgery and evaluating the positive predictive value of pelvic adhesion.

Materials and Methods

Objects

There were 48 cases of infertility patients received laparoscopic or laparotomy in Lianyungang Maternity and Child Healthcare Hospital of Jiangsu from December 2006 to May 2008. This study was conducted in accordance with the declaration of Helsinki and with approval from the Ethics Committee of Lianyungang Maternity and Child Healthcare Hospital of Jiangsu. Written informed consent was also obtained from all participants.

Experiment group

The preoperative selected patients were given ALOKA1000 type ultrasonic inspection, with 5.0 MHz of ultrasound frequency vaginal probe. Pelvic scanning had the aim to acquire ultrasound audio-visual images, in which ovarian cortex were described and preliminarily diagnosed by ultrasound imaging on the basis of routine reports. Patients receiving ultrasonic inspection comprised the experimental groups (TVUS groups) and those receiving intraoperative diagnosis comprised the control groups (surgical groups). The surgical groups were subject to routine operation on the abdominal cavity. The anatomical structure was described and the interrelations among the omentum majus, bowel, uterus, ovary, oviduct, and rectouterine fossa were detected. The density degree, the range of pelvic adhesion, the status of Douglas pouch, the adhesion of bilateral ovaries and oviducts to the surrounding tissues, and the presence or absence of oviduct atresia were determined.

Decision criteria

TVUS groups: Normal: The outline border of ovarian cortex was clear or not, without unusual echoes on the surface. Abnormal: the outline border of ovarian cortex was clear or not, with scattered or dense enhanced light point or facula on the cortical surface, with or without pelvic effusion. Surgical groups: Normal: the morphology and anatomy of adnexa uteri were normal, without adhesion. Abnormal: there were different degrees of adhesions in abdominopelvic cavity.

Evaluation indexes

The specificity of experiment groups was evaluated by contrasting results of experiment groups to control surgical groups considered as standard.

Results

Common condition

There were 48 cases of infertility patients, aged 21-45 years, 15 cases of primary infertility, and 33 cases of secondary infertility. Among the 15 cases, there were five cases of tubal identical operation, four cases of polycystic ovary syndrome, two cases of mediastinum uterine, four cases of ovarian cyst, and 33 case of tubal factors.

Results of diagnosed pelvic adhesion in two groups

TVUS groups: among 48 cases of patients, there were 39 cases whose outline border of ovarian cortex were clear or not, with scattered or dense enhanced light points or facula on the cortical surface, with or without pelvic effusion and nine cases were normal.

Surgical groups: among 48 cases of patients, there were 41 cases with different degrees of adhesions in abdominopelvic cavity and seven cases were normal.

Contrast between two Groups: among 39 cases of abnormal ultrasonic inspection, there were 38 cases of adhesion and one normal case confirmed by surgery. Among nine cases of normal ultrasonic inspection, there were six normal cases and three cases with adhesion, as confirmed by surgery. The total coincidence was 91.7% (44/48) and the positive predictive value was 97.4% (38/39).

Discussion

Evaluating tubal normality plays a vital role in the diagnosis and treatment of infertility. Part cases of the infertility patients were diagnosed with a normal oviduct, but confirmed to have different degrees of adhesions in pelvic cavity by following surgeries. These neglected problems could lead to abnormal tubal function and infertility. At present, the methods utilized include tubal liquid instillations, X-ray hysterosalpinography (HSG), etc. Such techniques are easily performed and the unobstruction of oviduct could be preliminarily determined. However, in some cases in which the oviduct is diagnosed unobstructed, while later pelvic adhesion and abnormal tubal function are found in the subsequent surgical results. The anatomical features of female pelvis show interconnection with the external environment through oviduct and uterus, and there are usually three infection paths. One path is an uplink infection along with reproductive organs mucosa, such as gonorrhea infecting cervical mucosa, endometrium, and tubal mucosa. Another path is pathogenic bacteria extending to oviduct along with the portio supravaginalis and cervical retroperitoneal lymphatic system. Initial infected area began with the surface of the oviduct and ovary and the actual infection occurs after miscarriage, in puerperium or when placing intrauterine device. The third path is disseminated through the blood. The focus of infection could infect peritoneum through circulation and then infect oviduct, resulting in tuberculous salpingitis.

Therefore, the female pelvic infection could initially spread to tubal and ovarian surroundings. Meanwhile, the constitution of adhesion could be observed: it was formed by excessive fibrosis as a result of the accumulation of granulation tissues and fibronectins. Owing to the low-echo in ovarian normal ultrasonogram and the hyperecho in normal ultrasonogram of fibrotic tissues, the contrast could be clearly displayed under vagina ultrasound when these fibrotic tissues adhere to the ovarian surface. In this article, 48 cases of infertile patients were compared and a prediction was made whether there would be adhesions in the pelvic cavity through TVUS. As a result, there were 39 TVUS cases with abnormality revealing adhesion; of these, there were 38 cases with confirmed adhesion and one case as normal through surgery. The positive predictive value was 97.4%. It could be confirmed that abnormal images of ovarian surface could be shown by TVUS in order to predict the existence of pelvic adhesion (with scattered or dense enhanced light point or facula on the cortical surface). If corresponding therapeutic regimens are timely made, these patients could avoid delaying the best pregnancy time, which would play an auxiliary diagnosis function to some gynecological pelvic diseases, such as chronic pelvic pain at the same time.

The pelvic structure can be altered by pelvic adhesion. It is one of the causes of infertility due to chronic pelvic inflammation which interferes with the sweeping of the oocyte function of oviduct and the transportation function of fertilized oocytes. The normal anatomical structure of pelvic cavity and unobstruction of oviduct are recovered through adhesiolysis and then function of oviduct is restored. There are many reports regarding the correlation of surgery and pregnancy, part of which have proved the validity of laparoscopy in this field [10-12]; at the same time, Yaron *et al.* reported that 96% appeared with adhesion again after laparoscopic adhesiolysis; only 50% reduced the adhesion scores. While there were still 67% adhesions that reformed in the area of adhesiolysis by secondary laparoscopy [13], other researches proposed that both oviduct lesions and pelvic adhesion had no influence on postoperative pregnancy [12, 14]. Therefore, the pregnancy probability needs to be reasonably evaluated in the treatment of infertility and pelvic adhesion. The problem of fertility needs to be solved through minimally invasive surgery or assisted reproductive technology with a reasonable therapeutic regimen.

There were various classification methods to lesion degrees of pelvic adhesion, such as the scoring methods of oviduct lesions degree combined with organic adhesion degree put forward by Canis *et al.* [11], and the classification standard proposed by American Fertility Society (AFS) [15], but not all of the abnormal images of ovarian surface do show pelvic adhesions by TVUS. This depends on the degrees and positions of adhesion lesions. Firstly, slight adhesion could not form enough fibrosis tissues to show abnormal audio-visual images; secondly, the position of adhesion has nothing to do with ovary. Furthermore, more accurate eval-

uated data can be acquired through comparing the correlation of different degrees of adhesion and abnormal images of ovarian surface according to the classification standard.

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