Thai Journal of Obstetrics and Gynaecology
April 2018, Vol. 26, pp.114-121

GYNECOLOGY

Accuracy of Preoperative Sonographic Adnexal Fixation for Prediction of Pelvic Adhesion in Gynecologic Surgery

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ABSTRACT

Objectives: To assess the accuracy of preoperative sonographic adnexal fixation for prediction of pelvic adhesion in gynecologic surgery.

Materials and Methods: This was a descriptive study of 106 gynecologic patients who were scheduled for elective abdominal surgery. Preoperative sonographic adnexal fixation was done. The accuracy of transvaginal ultrasonographic findings suspecting pelvic adhesion, including at least one side of adnexal fixation, in predicting intraoperative adnexal adhesion was calculated. Pelvic adhesion risk factors were also collected.

Results: Sonographic adnexal fixation was found in 81 adnexa. Ipsilateral adnexal adhesion was found intraoperatively in 78 adnexa of this study. Overall, pelvic adhesion prediction based on ultrasonographic finding had an accuracy, sensitivity, specificity, positive and negative predictive values of 74.4, 69.2, 77.7, 66.7 and 79.7 percent respectively. History of pelvic infection and dysmenorrhea were positively correlated with pelvic adhesion (Adjusted OR, 3.50; 95%CI, 1.26-9.75; p = 0.016 and adjusted OR, 2.47; 95%CI, 1.37-4.46; p = 0.003 respectively). However, combined a history of pelvic infection and dysmenorrhea with an ultrasonographic finding showed the most correlation with pelvic adhesion.

Conclusion: Preoperative adnexal fixation on transvaginal ultrasonography accurately identified patients with pelvic adhesions. Furthermore, history of pelvic infection and dysmenorrhea could increase the ability to predict pelvic adhesion.

Keywords: pelvic adhesion, transvaginal ultrasound, prediction, accuracy.

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การศึกษาความแม่นยำของการตรวจคลื่นเสียงความถี่สูงผ่านทางช่องคลอดโดยประเมินการยึดตรึงที่ปีกมดลูกก่อนการผ่าตัด เพื่อทำนายภาวะพังผืดในอุ้งเชิงกรานในการผ่าตัดทางนรีเวช

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บทคัดย่อ

วัตถุประสงค์: *เพื่อศึกษาความแม่นยำของการตรวจคลื่นเสียงความถี่สูงผ่านทางช่องคลอด โดยประเมินการยึดตรึงที่ปีกมดลูกก่อนการผ่าตัด เพื่อทำนายภาวะพังผืดในอุ้งเชิงกรานในการผ่าตัดทางนรีเวช*

รูปแบบการวิจัย: *การศึกษาเชิงพรรณนาเพื่อศึกษาความแม่นยำของการตรวจคลื่นเสียงความถี่สูงผ่านทางช่องคลอด เพื่อทำนายภาวะพังผืดในอุ้งเชิงกราน โดยการตรวจการเคลื่อนที่ของปีกมดลูก กับภาวะพังผืดที่ปีกมดลูกที่พบระหว่างการผ่าตัดในผู้ป่วยทางนรีเวชที่จำเป็นต้องได้รับการผ่าตัดทางหน้าท้อง จำนวน 106 ราย รวมทั้งศึกษาปัจจัยเสี่ยงที่มีผลต่อการเกิดภาวะพังผืดในอุ้งเชิงกราน*

ผลการวิจัย: *จากการศึกษาพบการยึดตรึงที่ปีกมดลูกจากการตรวจคลื่นเสียงความถี่สูงผ่านทางช่องคลอดจำนวน 81 ข้าง มีจำนวน 78 ข้างที่พบภาวะพังผืดที่ปีกมดลูกจริงระหว่างการผ่าตัด และพบว่าการตรวจคลื่นเสียงความถี่สูงผ่านทางช่องคลอดสามารถคาดการณ์ภาวะพังผืดที่พบระหว่างการผ่าตัดจริง โดยมีความแม่นยำ ความไว ความจำเพาะ ค่าทำนายเมื่อผลเป็นบวกและลบ ได้ร้อยละ 74.4, 69.2, 77.7, 66.7 และ 79.7 ตามลำดับ เมื่อผู้เข้าร่วมการวิจัยมีปัจจัยอื่น ได้แก่ ประวัติการติดเชื้อในอุ้งเชิงกราน หรือประวัติการปวดท้องประจำเดือน จะสัมพันธ์กับการคาดการณ์ภาวะพังผืดในอุ้งเชิงกรานด้วย (Adjusted OR, 3.50; 95%CI, 1.26-9.75; p= 0.016 and adjusted OR, 2.47; 95%CI, 1.37-4.46; p= 0.003 ตามลำดับ) อย่างไรก็ตามเมื่อพิจารณาปัจจัยดังกล่าวรวมกับการพบภาวะพังผืดที่ปีกมดลูก จากการตรวจคลื่นเสียงความถี่สูงผ่านทางช่องคลอดจะสัมพันธ์กับการคาดการณ์ภาวะพังผืดในอุ้งเชิงกรานเพิ่มมากขึ้น*

สรุป: *การตรวจคลื่นเสียงความถี่สูงผ่านทางช่องคลอด โดยประเมินการยึดตรึงที่ปีกมดลูกก่อนการผ่าตัดสามารถทำนายภาวะพังผืดในอุ้งเชิงกรานในการผ่าตัดทางนรีเวช และความน่าจะเป็นของภาวะพังผืดในอุ้งเชิงกรานหลังทราบผลการตรวจคลื่นเสียงความถี่สูงผ่านทางช่องคลอดเพิ่มขึ้นเมื่อวิเคราะห์ร่วมกับประวัติการติดเชื้อในอุ้งเชิงกรานและประวัติการปวดท้องประจำเดือน*

คำสำคัญ: *ภาวะพังผืดในอุ้งเชิงกราน, การตรวจคลื่นเสียงความถี่สูงผ่านทางช่องคลอด, ความแม่นยำ, การทำนายผลการตรวจ*

Introduction

General gynecologic surgery, especially hysterectomy, is associated with 6 percent of major complications, including major hemorrhage, bladder injury, and bowel injury[1].

Pelvic adhesion is a significant cause of major complications in gynecologic surgery. Previous study showed arising complication incidence during gynecologic laparoscopic surgery among patients who have undergone previous abdominal surgeries[2]. These comprised of 38.8 percent with intrapelvic adhesions. Pelvic adhesion can cause short term complications such as bowel damage, urinary system damage, conversion to laparotomy, prolonged operative time and hospitalization at 13.4 percent[3-5]. On the other hand, long term complication adhesion formation can affected the patient to postoperative bowel obstruction, chronic pelvic pain and dyspareunia[3-6].

Currently, preoperative assessments play a major role in reducing comorbidity and complication associated with pelvic adhesion. Preoperative imaging such as ultrasonography[7-12], computed tomography scan[13], and magnetic resonance imaging[14,15] were used for adhesion mapping before surgery.

Initially in 1940, ultrasonography was applied in medical technology and has been developed to high efficiency and become widespread[7,8,16]. The resolution of images obtained by vaginal probes enables identification of pelvic pathology, evaluation of mass in pelvic cavity, adnexa, and uterus. Transvaginal ultrasound can be broadly applied to diagnose gynecologic condition with ease. Prediction of pelvic adhesion on transvaginal ultrasonography was used any technique (poor definition of pelvic structure, blurring of ovarian margins, distance of ovary from probe, fixation from the ovary to the uterus)[11,12]. Although, in 2010, Guerriero et al[7] used adnexal fixation on transvaginal ultrasound to predict pelvic adhesion in endometrioma with high sensitivity and specitivity in diagnosis, they could not apply this information to the general population.

The research objective of study was to assess the accuracy of preoperative sonographic adnexal fixation for prediction of pelvic adhesion in general gynecologic surgery. The secondary objective was to find out the other risk factors for prediction of pelvic adhesion.

Materials and Methods

Subjects

This study was conducted from April 2016 to January 2017. A total of 106 gynecologic patients who were scheduled for elective abdominal surgery in Her Royal Highness Princess Maha Chakri Sirindhorn Medical Center (MSMC) were eligible and signed written informed consent. All patients undergone transvaginal ultrasound on the day before surgery by a physician trained by an experienced ultrasonographer. The physician was also blinded about the history or diagnosis of each patient.

The inclusion criteria were as follows: patient who were scheduled for elective abdominal surgery (laparotomy or laparoscopy) with gynecological indication, non-pregnant, had uterus and at least one ovary. The exclusion criteria were as follows: patient who had unstable condition, inadequate ultrasound imaging (enlarged uterus more than 12 week-size), ascites, and patients who had complications after vaginal probe insertion (contact bleeding at cervical mass, virgin).

Data collection

The data collection included baseline characteristics; age, body mass index (BMI), underlying diseases, previous surgery, chronic pelvic pain, menstruation pattern, dysmenorrhea, and previous pelvic infection. All patients underwent transvaginal ultrasonography 1 day before of surgery, using a Samsung Medison,

ultra-compact SonoAce R7, real-time scan with 7 MHz endo-cavity transducers (EVN4-9, field of view: 148°). Vaginal transducer was applied in vaginal canal until semi-coronal view of left or right of adnexa were obtained after the bladder was emptied. The presence of adnexal fixation between ovary and uterus, after gentle probe pressure at vaginal fornix with gentle suprapubic pressure, was considered to have pelvic adhesion. Result of ultrasonography scanning was blinded from surgeon.

On the next day, all patients underwent abdominal surgery in which peritoneum, ovaries and uterus were carefully observed. Pelvic adhesion was classified as either right/ left adnexa. The classification was applies from modified of revised American Fertility Society Classification system (AFS, 1985). The extent and site of pelvic adhesion were recorded by camera during operation.

Statistical analysis

The sample size was calculated with simple formula[17]. Sample size of study based on results of an earlier study by Guerriero et al[7], with 89 percent of sensitivity. The number of 93 patients was required and additional 10% for losing to follow-up. Approximately 103 patients were required.

Demographic data was described with descriptive statistics. Age and BMI were described with mean ± SD. History of pelvic surgery, chronic pelvic pain, dysmenorrhea, pelvic infection and principle diagnosis for surgery were described with percentage.

Risk factors and ultrasonographic findings suspecting adhesion were then compared with intraoperative findings. Chi-square test was used to compare categorical variables with p value of < 0.05 was considered significantly different. To analyze the predictive value of transvaginal ultrasound result in differentiating intraoperative result at same site, sensitivity, specificity, positive and negative predictive values were used.

Then the probability of pelvic adhesions according to the significant variables was calculated by:

Probability of pelvic adhesions = (Posttest odds of disease) / (1+Posttest odds of disease)

Posttest odds of disease = Pretest odds of disease x LR1 x LR2 x ….

Pretest odds of disease = Pretest probability / (1 - Pretest probability)

The calculation of post-test odds of disease depended on the patient's risk factor. If the patient had a history of risk factors, the positive likelihood ratio (LR) was used. However, if the patient had no history of any risk factors, the negative likelihood ratio (LR) was used.

Results

Among 106 patients, 13 patients had one ovary, and remaining 93 patients had both ovaries. Sonographic adnexal fixation was found in 81 adnexa. Adnexal adhesion was found intraoperatively in 78 adnexa. Baseline characteristics were presented in Table 1. The risk factors of pelvic adhesion were presented with percentage. The most common principle diagnosis for surgery was a myoma uteri.

Preoperative adnexal fixation on transvaginal ultrasound could predict pelvic adhesion that showed sensitivity, specificity, positive and predictive value in Table 2. We compared transvaginal ultrasonographic findings, risk factors associated with adhesion and intraoperative finding. History of pelvic infection and dysmenorrhea were positively high correlated with pelvic adhesion (Table 3). The sonographic adnexal adhesion were positively correlated with pelvic adhesion (OR, 7.833; 95%CI, 4.12-14.91; $p < 0.001$). Prevalence of pelvic adhesion was 39.2 percent and the accuracy was 74.4 percent respectively. Probability of pelvic adhesions according to significant variables was calculated and shown in Table 4.

Table 1. Baseline characteristics (n = 106 patients).

Characteristics	
Age (mean ± SD; year)	44.44±10.85
BMI (mean ± SD; kg/m²)	24.33±4.82
Risk factors of pelvic adhesion	
- History of dysmenorrhea (%)	56 (52.8)
- History of pelvic surgery (%)	31 (29.2)
- History of chronic pelvic pain (%)	15 (14.2)
- History of pelvic infection (%)	10 (10.4)
Principle diagnosis	
- Myoma uteri (%)	34 (32.1)
- Malignancy* (%)	27 (25.4)
- Endometriosis (%)	25 (23.6)
- Ovarian cyst (%)	11 (10.4)
- Pre-malignancy** (%)	7 (6.6)
- Chronic pelvic pain (%)	2 (1.9)

* Malignancy: Cervical cancer[11], Endometrial cancer[11] and Ovarian cancer[5]
** Pre-malignancy: CIN3[3], AIS[2] and Endometrial hyperplasia[2]

Table 2. Validity and efficacy of factor to diagnosis pelvic adhesion (n=199 sites).

Factor predict adhesion		Surgical adhesion finding		Sensitivity	Specificity	PPV*	NPV**
		Yes	No				
Sonographic adnexal	Yes (%)	54 (66.7)	27 (33.3)	69.2	77.7	66.7	79.7
fixation	No (%)	24 (20.3)	94 (79.7)				
History of pelvic infection	Yes (%)	14 (70.0)	6 (30.0)	17.3	95.4	70.0	65.1
	No (%)	67 (34.9)	125 (65.1)				
History of dysmenorrhea	Yes (%)	55 (49.1)	57 (50.9)	67.9	56.5	49.1	74.0
	No (%)	26 (26.0)	74 (74.0)				

* Positive predictive value, ** Negative predictive value

Table 3. Risk factors to predict intra-operative pelvic adhesion finding by logistic regression (n =199 site).

Risk factor		Crude OR	95%CI	p value	Adjusted OR*	95%CI**	p value
History of pelvic infection	Yes	4.35	1.59-11.85	0.004	3.50	1.26-9.75	0.016
	No	1	-	-	1	-	-
History of dysmenorrhea	Yes	2.75	1.54-4.91	0.001	2.47	1.37-4.46	0.003
	No	1	-	-	1	-	-

* Adjusted with Chronic pelvic pain, Pelvic infection and Dysmenorrhea
** Confidence interval

Table 4. Ultrasound finding and history of risk factors predict probability of adhesion (n=199 sites).

Factor predict adhesion	Result						
Sonographic adnexal fixation	Yes	Yes	Yes	No	Yes	No	No
History of pelvic infection	Yes	Yes	No	Yes	No	Yes	No
History of dysmenorrhea	Yes	No	Yes	Yes	No	No	Yes
Probability of adhesion (%)	91.8	80.4	72.2	60	48.6	35.5	25.7

Discussion

In general, pelvic adhesion during gynecologic surgery has significant effect on surgical complication, operative duration and intra-operative blood loss. This study showed that preoperative adnexal fixation on transvaginal ultrasonography accurately identified patients with pelvic adhesions. Furthermore, history of pelvic infection and dysmenorrhea could increase the ability to predict pelvic adhesion. So, transvaginal ultrasound was very good predictor of pelvic adhesion when combined with ultrasonographic adnexal fixation and clinical risk factors.

Previous descriptive studies[11,12] on transvaginal ultrasonography reported pelvic adhesion prediction among infertility premenopausal women with a sensitivity between 61.1-64 percent and high specificity between 86-98.2 percent. Our study had a sensitivity of 69.2 percent which was comparable to previous studies. Our study showed less specificity, at 77.7 percent, comparing with previous studies. This might be due to a high incidence of myoma among our population, which could interfere with anatomical location or adnexal movement.

Previous studies have found an association between surgical trauma in causing adnexal adhesion[7, 12]. However, this study did not depict the same association because most patients in the study who had a history of pelvic surgery underwent a cesarean section which may cause minor trauma to the adnexal area.

Pelvic infection in earlier studies was not a strong evidence to predict pelvic adhesion[7]. In this study, however, pelvic infection showed a statistically significant association with pelvic adhesion. This was primarily because pelvic infection in this study was diagnosed by a physician

with a medical record. In contrast, pelvic infection in the previous study was diagnosed only by history taking.

The strength of our study was the double-blinded study. The ultrasonographer was blinded to the history associated with adhesion and the surgeon was blinded to the ultrasonographic result which may decreases selection bias. In addition, our study focused on general gynecologic patients which was different from previous studies which focused on patients who underwent endometritic surgery[7] or those who were categorized as subfertile[8, 11, 12].

This study also had some limitations. There was no data on adhesion grading or scoring. If this information were obtained, it may lead to a better prediction of intra-operative dense adhesion which may lead to various surgical complications. Second, the physicians who assess the adhesion received the same standardized instruction by revised American Fertility Society Classification system, however, this classification was used in endometriosis more than in general patients. The data in this study was a time consuming; it may be temporal effect on intra-observer reliability. Because this study had one ultrasonographer, the skills of ultrasound may increase over time.

Conclusion

In conclusion, preoperative sonographic adnexal fixation accurately identified patients with pelvic adhesions. With additional risk factors such as history of pelvic infection or dysmenorrhea and fixation upon transvaginal ultrasound examinations, pelvic adhesion prediction increased in general gynecologic surgery population. The authors expect this prediction to benefit in forthcoming surgery and reduce intra-operative complications associated with pelvic adhesion. Reduction of surgical complications could be done by appropriate bowel preparation, preparing blood product for resuscitation and timely multidisciplinary intra-operative consultation.

Acknowledgement

The author would like to thank Department of Obstetrics and Gynecology, Faculty of Medicine, Srinakharinwirot University.

Potential conflicts of interest

The authors declare no conflict of interest.

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