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Prevalence of pelvic adhesions on ultrasound examination in women with previous abdominopelvic surgery

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Abstract

Background: Pelvic adhesions caused many problems ranging from obstructed tubes associated with infertility, to pelvic tenderness, and painful intercourse, to chronic pelvic pain. Curiously, adhesions could be very extensive, yet relatively silent. They might remain silent indefinitely, or long after the causative event, become symptomatic. The aim of the work was to assess the prevalence and location of pelvic adhesions by ultrasonography in women with a history of abdominopelvic surgery and to identify risk factors and symptoms associated with it.

Methods: This prospective observational study was conducted on (110) women at the Department of Gynecology & Obstetrics, Tanta University Hospitals. Starting from September 2019 till July 2022. all cases will included by Special Clinical Tests. Abdominal scar assessment was performed in the operating room while the patient was anesthetized, lying in the supine position under a standard operating light source that was focused on the abdomen and sliding sign will be observed.

Results: As a regard of previous operation done for all patients, 13 patients underwent general operations as appendectomy in 11 patients (10%) and Appendectomy and cesarean in 2 patients (1.8%) while 97 patients underwent gynecological operation as cesarean in 87 patients (79.1%), ovarian cystectomy in 4 patients (3.6%), salpingectomy and cesarean in 2 patents (1.8%), laparoscopy in 2 patients (1.8%) and ovarian cystectomy and cesarean in 2 patients (1.8%). Among 110 patients, there was a negative sliding sign in 18 patients (16.4%) while there was a positive sliding sign in 92 patients (83.6%). there were 51 non symptomizing cases, 9 patients (17.6%) out of 51 patients were with adhesions. There were 59 symptomizing cases, 9 patients (15.3%).

Conclusion: In conclusion, Sliding sign by abdominal or vaginal ultrasound could be used as an accurate and easy diagnostic tool in predicting intra-abdominal adhesions. This technique may aid clinical decisions in patients undergoing repeat CS.

Keywords: pelvic adhesions, ultrasound, previous abdominopelvic surgery

Introduction

Adhesions are fibrous strands/bands of tissue that form during the wound healing process and bind adjacent organs and tissues together that normally are separate. Adhesions could form as a result of surgery involving the peritoneum or abdominal and pelvic organs. Injury to the peritoneum was unavoidable during surgical interventions in the abdominal cavity but could also develop as a result of inflammation or mechanical injury [1]. There are different types of invasive gynaecological procedures, which potentially caused adhesions. Patients undergoing tubal, ovarian or uterine procedures were at high risk. Open surgical interventions in the pelvic area, such as surgical treatment of endometriosis, tumour removal and bowel surgery, were associated with an increased risk due to the trauma caused to the peritoneum [1].

Pelvic adhesions caused many problems ranging from obstructed tubes associated with infertility, to pelvic tenderness, and painful intercourse, to chronic pelvic pain. Curiously, adhesions could be very extensive, yet relatively silent. They might remain silent indefinitely, or long after the causative event, become symptomatic [2].

On the other hand, clinical features such as unexplained weight loss, fever, and night sweats should dissuade against adhesions as the primary etiology. With the exception of increased bowel sounds, tympanism with percussion (when adhesions were obstructive), and tenderness, the physical examination was often unremarkable other than the presence of a laparotomy scar,

which again, should serve to alert the clinician.

There were no specific laboratory tests associated with adhesive disease, but such investigations were needed to rule out other entities. For example, an increased C-reactive protein, profound anemia, or serum liver tests abnormalities should point toward further evaluation for other etiologies [3].

Various means have been proposed to predict adhesions prior to surgery, including analysis of patient characteristics and appearance of the scar [4], as well as the intraoperative peritoneal adhesion index [5]. Dynamic ultrasound techniques such as transabdominal and transvaginal sonographic (TVS) sliding sign have also been used to predict adhesions before surgery [6]. Peritoneal adhesion index (PAI) was a score based on appearance and distribution of peritoneal adhesions, clinicians could assign a peritoneal adhesion index (PAI) ranging from 0 to 30 based on the macroscopic appearance of adhesions and their extent to the different regions of the abdomen, thereby giving a precise description of the intra-abdominal condition [7].

Reduction of risk of laparoscopic trocar complications (vascular, bowel, urological, and uterine injuries) by the choice of safe laparoscopic entry technique, and exploring the relationship between adhesions and chronic pelvic pain and the effectiveness of adhesiolysis in pain control [8].

The aim of this study is to assess the prevalence and location of pelvic adhesions by ultrasonography in women with a history of abdominopelvic surgery and to identify risk factors and symptoms associated with it.

Methods

This prospective observational study was conducted on (110) women at the Department of Gynecology & Obstetrics, Tanta University Hospitals. Starting from September 2019 till July 2022.

Inclusion criteria

Any age group at reproductive period.

All women with a history of one or more abdominopelvic surgery:

Cesarean section. Ectopic pregnancy. Myomectomy., Laparoscopy for infertility assessment. And Appendectomy.

Exclusion criteria

All women who had undergone their last abdominopelvic surgery since less than 12 months before the examination. All women who have had a history of concurrent untreated Pelvic Inflammatory Disease (PID) and recurrent surgery for endometriosis. All patients were subjected to surgical history: Any cervical surgeries, Previous cesarean section and Previous abdominal surgery (number and type of operations, and time since the last operation).

Special Clinical Tests

Abdominal scar assessment was performed in the operating room while the patient was anesthetized, lying in the supine position under a standard operating light source that was focused on the abdomen.

Imaging

Non-Routine (Intended): Transabdominal and transvaginal ultrasound scan using Mindray DC - 30 Diagnostic Ultrasound System with Transabdominal Probe (C5P3) & Transvaginal Probe (CV1P6); by which, ultrasound sliding sign technique was used as a predictor for intra-abdominal and pelvic adhesions.

Examination

A conventional gel was used between the transducer and the skin to achieve acoustic coupling Each patient was examined during normal breathing with an exaggerated inspiratory effort.

Ultrasound examination of the patient was performed in the supine position. The patient was not asked to empty the bladder unless the patient feels uncomfortable with the full bladder. Abdominal ultrasound was performed by a single sonographer (maternal fetal medicine specialist).

At the level of the umbilicus and lower abdominal area, bilateral to the midsagittal line the probe was positioned vertically, and the patient performs deep inhalation and exhalation.

The movement of the outer surface of the myometrium relative to the inner surface of the abdominal fascia was evaluated by at least one centimeter of displacement.

If the patient had a displacement (positive sliding), the patient was in the low-risk category and in the absence of displacement (negative sliding) the patient was in the high-risk category Evaluation of accuracy of sliding sign during the following operation that patient had was recorded.

The technique of the sliding sign

Briefly, in patients with an anteverted uterus, the technique to produce the sliding sign involves applying pressure to the fundus of the uterus (with the operator's non-scanning hand) and/or applying pressure with the tip of the vaginal probe at the anterior fornix. In patients with a retroverted uterus, the technique involves applying pressure with the tip of the probe against the posterior fornix. In both uterine orientations, operators should be assessing the sliding of the posterior uterine and retrocervix serosa against the contents posteriorly. Apart from performing the advanced sliding sign technique, all TVS examinations were basic examinations (assessment of the uterus, ovaries and POD for free fluid) and nomenclature recommended by the International Ovarian Tumor Analysis (IOTA) and Morphological Uterus Sonographic Assessment (MUSA) groups was utilized.

Adhesions were graded according to severity using a standardized scoring system: 0 for no adhesions, 1 for minimal or filmy adhesions, 2 for moderate or thick adhesions, and 3 for absence of free space between the uterus and the anterior abdominal wall (141).

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.

With uncooperative patients, visceral slide was induced by manual ballottement of the abdominal wall. Visceral slide was measured using an electronic scale. Abnormal visceral slide (negative test) was defined as no movement of the viscera or movement less than 1 cm.

The primary study outcome was the correlation between a negative sliding sign and severe adhesions. Secondary outcomes were the association between a negative sliding sign and operative times.

Statistical analysis

Statistical analysis was done by SPSS v25 (IBM Inc., Chicago, IL, USA). Quantitative variables were presented as mean, standard deviation (SD) and range and were compared between the two groups utilizing unpaired Student's t- test. Categorical variables were presented as frequency and percentage and were analysed utilizing the Chi-square test or Fisher's exact test when

appropriate. Pearson or Spearman coefficient correlation (r) was used to estimate the degree of correlation between two variables. P value < 0.05 was considered statistically significant.

Results:

This prospective study was carried out on 110 females in Tanta university hospitals, their age was ranged from 20 years to 50 years with median 26 years. 86 females (78.2%) were ranged from (20-30) years, 19 females (17.3%) were ranged from (31-40) years and only 5 females (4.5%) were ranged from (41-50) years as shown in Table (1)

As a regard of previous operation done for all patients, 13 patients underwent general operations as appendectomy in 11 patients (10%) and Appendectomy and cesarean in 2 patients (1.8%) while 97 patients underwent gynecological operation as cesarean in 87 patients (79.1%), ovarian cystectomy in 4 patients (3.6%), salpingectomy and cesarean in 2 patients (1.8%), laparoscopy in 2 patients (1.8%) and ovarian cystectomy and cesarean in 2 patients (1.8%) as shown in Table (2)

Among 110 patients, there was a negative sliding sign in 18 patients (16.4%) while there was a positive sliding sign in 92 patients (83.6%) as shown in Table (3)

Among 18 patients with adhesion, the site of adhesion was in Vesicouterine pouch in 8 patients (44.4%), in POD in 4 patients (22.2%), between the Uterus and anterior abdominal wall in 4 patients (22.2%) and in ovarian in 2 patients (11.1%) as shown in Figure (1).

The association between symptoms and presence of adhesions was shown in Figure (2), there were 51 non symptomizing cases, 9 patients (17.6%) out of 51 patients were with adhesions. There were 59 symptomizing cases, 9 patients (15.3%) out of 59 patients were with adhesions where the most common symptoms in patients with adhesions were chronic abdominal pain in 4 patients (44.4%) and chronic constipation in 2 patients (22.2%). The association between symptomizing and no symptomizing cases in patients with adhesions and non-adhesion showed no statistically significant difference at ($p=0.936$) also the association between different symptoms in symptomizing cases (Chronic abdominal pain, Chronic constipation, Dyspareunia, Dysuria and Dysmenorrhea) in patients with adhesions and non-adhesion showed no statistically significant difference at ($p=0.195, 1.000, 0.494, 0.148, 1.000$ respectively).

Association between sliding sign and age was shown in Table (4), The median age in negative sliding sign was 28 years while in positive sliding sign was 26 years. the most common age range was (20-30) years represented as 12 patients as a negative sliding sign and 74 patients as a positive sliding sign. The association between sliding sign and age category showed no statistically significant difference between the studied cases at ($p=0.321, p=0.112$) respectively.

According to the association between sliding sign and previous operations, the most common operations were cesarean in 10 patients (55.6%) in negative sliding sign group and 77 patients (83.7%) in positive sliding sign groups and appendectomy in 2 patients (10.5%) in negative sliding sign group and 9 patients (9.8%) in positive sliding sign group. The association between sliding sign and previous operation showed a statistically significant difference between Appendectomy, Cesarean, Salpingectomy, Cesarean, Ovarian cystectomy, Cesarean at ($p=0.017$) as shown in Figure (3).

As a regard the association between sliding sign and number of operations, among 47 patients undergoing only one operation, there were 2 patients (4.3%) in negative sliding sign group and 45 patients (95.7%) in positive sliding sign group. Among 44

patients undergoing 2 operations, there were 10 patients (22.7%) in negative sliding sign group and 34 patients (77.3%) in positive sliding sign. Among 16 patients undergoing 3 operations, there were 3 patients (18.75%) in negative sliding sign group and 13 patients (81.25%) in positive sliding sign group. All 3 patients (100%) undergoing 4 operations were presented in negative sliding sign group. There was a statistically significant association between sliding sign and cases who do one and 4 operations at ($p=0.0003, 0.004$ respectively). as shown in Table (5)

On adhesion presence-based analysis, the diagnostic performance of ultrasound for diagnosis for all patients was summarized in Table (6). Our study showed there were 18 patients with adhesions and 92 patients with no adhesions in surgical pathology. Among 18 patients with adhesions, ultrasound showed 13 patients (72.2%) as Score (3,5) and 5 patients (27.8%) as score (1). Our study showed 95% accuracy with 72% sensitivity and 100% specificity for ultrasound as a regard of surgical pathology.

Table 1: Distribution of all studied cases according to demographic characters:

Age (years):	
Range	20 – 50 years
Median (IQR)	26.0 (22.0 to 29.0)
Age category: (n=110)	
20-30	86 (78.2%)
31-40	19 (17.3%)
41-50	5 (4.5%)

Table 2: Distribution of all studied cases according to previous operations done (Gynecological operation, general operation):

General Operation: (n=13)	
Appendectomy	11 (10.0%)
Appendectomy, Cesarean	2 (1.8%)
Obs. & Gyn. Operation: (n=97)	
Cesarean	87 (79.1%)
Salpingectomy, Cesarean	2 (1.8%)
Laparoscopy	2 (1.8%)
Ovarian cystectomy	4 (3.6%)
Ovarian cystectomy, Cesarean	2 (1.8%)

Table 3: Distribution of all studied cases according to Sliding Sign:

Sliding sign: (n=110)	
Negative Sliding Sign	18 (16.4%)
Positive Sliding Sign	92 (83.6%)

Table 4: Association between Sliding sign and Age:

	Negative Sliding Sign	Positive Sliding Sign	P -value
Age (years)			
Median (IQR)	28.0 (25.0 - 32.0)	26.0 (22.0 - 29.0)	0.321
Age category			
20-30	12 (66.7%)	74 (80.4%)	0.112
31-40	6 (33.3%)	13 (14.1%)	
41-50	0 (0.0%)	5 (5.4%)	

Table 5: Association between Sliding sign and number of operations:

	Negative Sliding Sign (n= 18)	Positive Sliding Sign (n= 92)	FE p -value
Number of operations:			
1 (n=47)	2 (4.3%)	45 (95.7%)	0.003*
2 (n=44)	10 (22.7%)	34 (77.3%)	0.141
3 (n=16)	3 (18.75%)	13 (81.25%)	0.724
4 (n=3)	3 (100%)	0 (0.0%)	0.004*

Table 6: Diagnostic performance of Sliding with Ultrasound and surgical pathology to detect the negative sliding:

Total sample (n=110)	Surgical pathology				Sensitivity	Specificity	PPV	NPV	Accuracy
	Adhesion (n=18)		No adhesion (n=92)						
	No.	%	No.	%					
Ultrasound					72%	100%	100%	95%	95%
Negative	13 (Score 3 & 5)	72.2%	0	0.0%					
Positive	0	0.0%	5 (Score 1)	27.8%					
				92	100%				

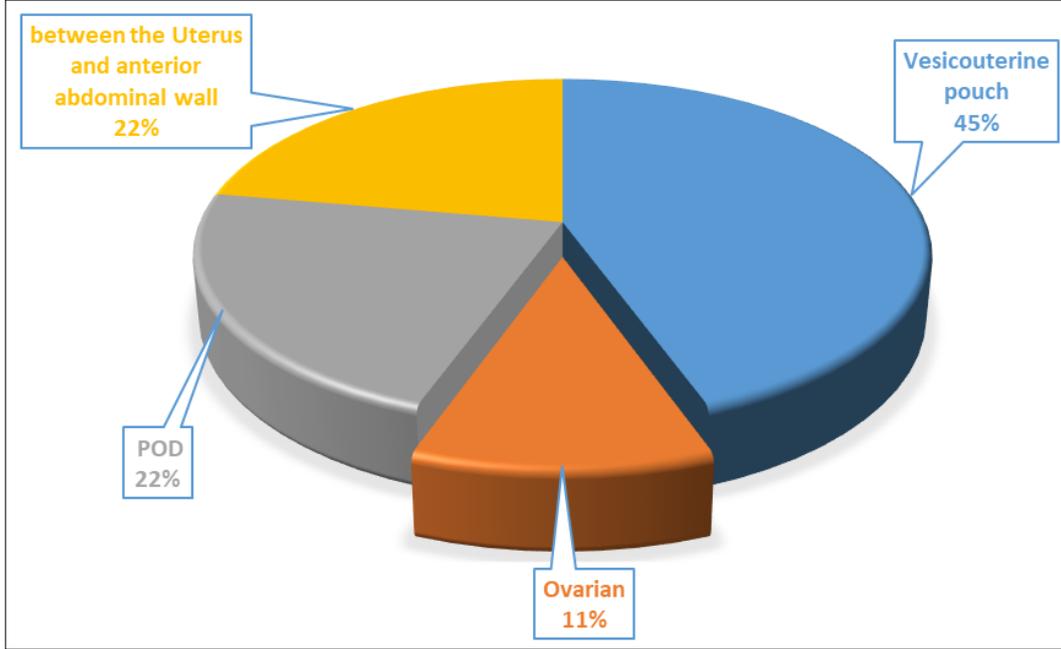


Fig 1: The Distribution of the site of adhesion

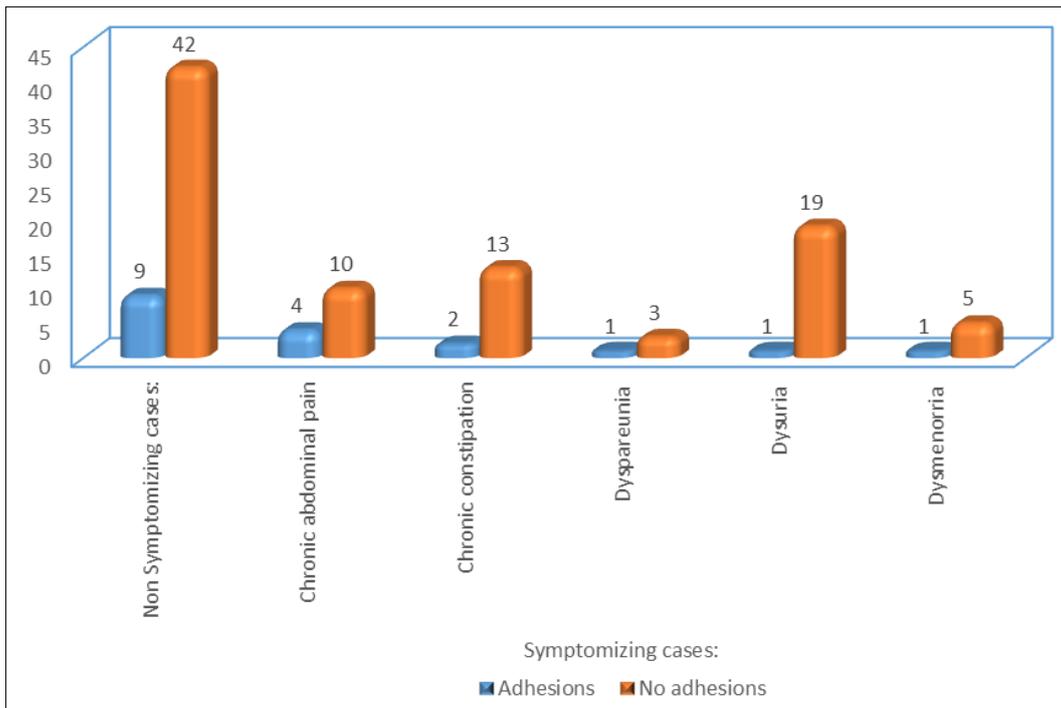


Fig 2: Association between symptoms and presence of adhesion

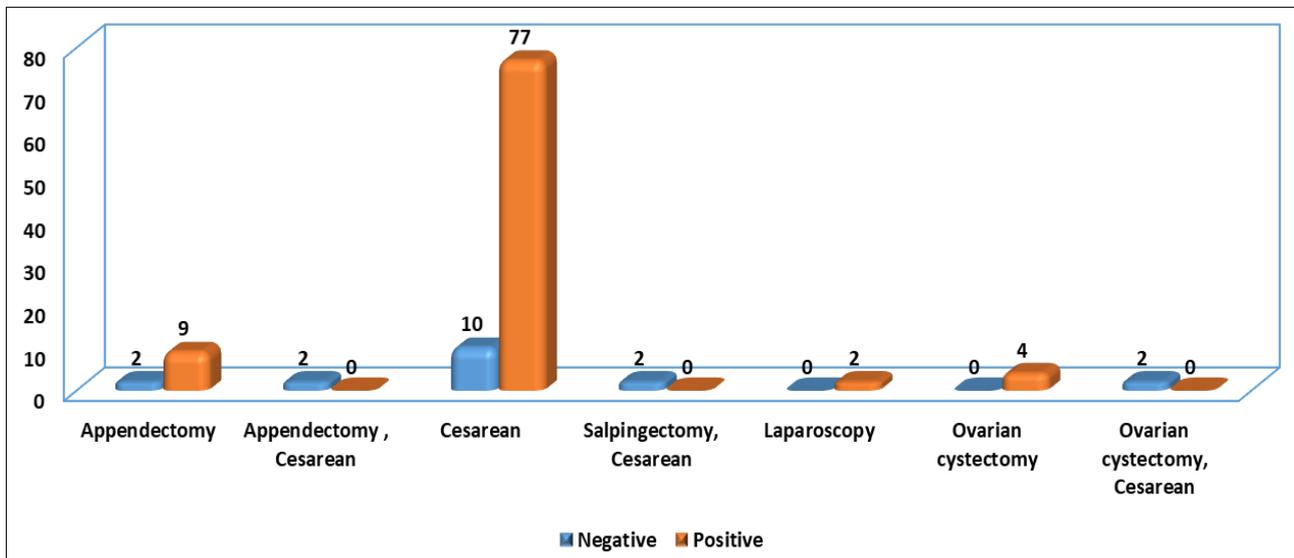


Fig 3: Association between Sliding Sign and previous operations

Discussion

Adhesions, which are abnormal bonds between the surfaces of anatomical structures, can present with varying severity after repeated intra-abdominal or pelvic surgeries. The consequences of these pathological bonds include bowel obstruction, chronic abdominal and pelvic pain, the need for re-intervention, ectopic pregnancy, infertility, and inadvertent organ injury or loss during surgery [9].

In the present study, the median age was 26 years which agree with the study done by Drukker *et al.*, 2018 [10] the median age was 34.4 years and that may be due to the different number of the studied cases.

In the present study, there were 30.9% of the studied cases had G3P2A0 which disagree with Nuamah *et al.*, 2017 [11] who stated that 77.5% of their studied cases had history of grand multiparity. Baron *et al.*, 2018 [12] Stated that the mean gravidity was 5.6 ± 2.7 and mean parity was 3.9 ± 2.4 .

In this study, there were 13 cases had general operation and 97 cases had gynecological operation. That agree with the study done by Moro *et al.*, 2015 [13] who stated that the majority of women had undergone a single previous cesarean section, but (28.6%) of women had a history of additional laparoscopic or open pelvic surgery.

In our study, there were 79.1% of the studied cases had history of cesarean section which agree with Nuamah *et al.*, 2017 [11] who found that 62% (48/78) of their studied cases had two or more CS. Also in another study by Shu *et al.*, 2021 [12] there were 90.2% had history of CS.

In this study, there were a significant positive association in between previous operation (Appendectomy, Cesarean, Salpingectomy, Cesarean, Ovarian cystectomy, Cesarean) and the sliding sign with $P = 0.017$ which coincide with the study done by Drukker *et al.*, 2018 [10] who found that a negative uterine sliding sign is associated with severe intra-abdominal adhesions and a similar association was achieved by combining the sliding sign with a history of previous cesarean delivery adhesions. That also agree with the study done by Baron *et al.*, 2018 [14] who found that six patients had had abdominal surgery other than CS, one of whom had had an appendectomy for acute appendicitis and was found to have severe adhesions.

In this study, adhesions were more frequent in women with a history of multiple cesarean sections and more frequent still in women who had had additional pelvic surgery, such as treatment

of endometriosis. Similar trends were observed by other authors who also described the prevalence of adhesions to increase with increasing number of previous cesarean sections [16, 15].

In the current study, diagnostic performance of sliding with ultrasound had a sensitivity 72%, specificity of 100% and NPV was 100% which near to the results in the study done by Yildirim *et al.*, 2019 [17] who stated that preoperative ultrasound imaging of the visceral slide is highly reliable in predicting anterior abdominal wall adhesions, with a sensitivity of 78.6%, NPV of 94.9% and overall diagnostic accuracy of 86.5%.

Drukker *et al.*, 2018 [10] also found that the sliding sign achieved a similar sensitivity of 56% (95% CI 35%–76%), specificity of 95%, a positive likelihood ratio of 12.1% and a negative likelihood ratio of 46%.

In the present study, there were of those cases which had negative sliding sign, there were 13 cases had positive adhesion diagnosed during surgery which agree with the results in the study done by Shu *et al.*, 2021 [12] who found that of those with absent sliding sign, only eight had dense uterine–abdominal adhesions diagnosed during surgery.

Conclusions

In conclusion, the sliding sign provides a relatively good noninvasive reliable test for prediction of abdominal and pelvic adhesion in women with multiple pelvic surgeries. Prediction of pelvic adhesion can help in selection of subsequent surgery type and preparation and improvements in treatment, thus a decrease in the complications and make the necessary preparations before surgery.

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