



THE VALUE OF SLIDING SIGN IN THIRD-TRIMESTER SONOGRAPHIC EVALUATION OF INTRA-ABDOMINAL ADHESIONS IN PREGNANT WOMEN UNDERGOING REPEATED CAESAREAN SECTION

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Abstract

Objective: to assess the effectiveness of preoperative sliding sign in anticipating pelvic adhesion-related problems in third-trimester pregnant women who have undergone prior abdominopelvic surgery..

Patients and Methods: This prospective observational study was conducted at the Department of Obstetrics and Gynecology at the maternity hospital of Ain Shams University (labor ward and ultrasound unit) between April 2020 and April 2021. The research was carried out on a sample of 315 women who met the specified inclusion criteria and were eligible for elective lower cesarean section at (38-40 weeks) gestation or more. Women were considered to be at a greater risk for intra-abdominal adhesions when the sliding sign was negative. To evaluate pre- and intra-operative evaluation correspondence, the surgeons' reports were compared to the preliminary ultrasound diagnosis after the CS.

Results: We found that among the marked adhesion group, there were 11 patients (47.8%) with positive sliding sign. Among the mild adhesion group, there were 20 patients (87%) with a positive sliding sign, and among the group with no adhesion, there were 248 patients (97.6%) with a positive sliding sign. A high statistically significant difference existed between the adhesion subgroups regarding the sliding sign. There was a statistically significant difference between the sliding sign and the length of hospital stay, as hospital stay in patients with negative sliding signs is longer than in patients with positive sliding signs, such as the p-value (<0.001).

Conclusion: The findings of this study suggest that a straightforward sonographic finding may be used to identify patients with a history of CS who are at risk for developing intra-abdominal adhesions. In patients receiving repeated CS, this new method might aid clinical judgment. The best surgical team should be chosen (experienced obstetricians, general surgeons, and urologists), and there should be access to specialized surgical tools and equipment.

Key Words: Sliding Sign - Intra-Abdominal Adhesions - Repeated Caesarean Section.

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Introduction

During subsequent cesarean deliveries, intra-abdominal adhesions are commonly observed and tend to worsen in both frequency and severity with each successive cesarean delivery. The procedure of adhesiolysis has the potential to cause adverse outcomes such as delayed fetal birth, harm to nearby intestinal structures, and blood loss (1). Surgeons currently face a challenge in accurately predicting the occurrence of intra-abdominal adhesions prior to performing repeat cesarean deliveries. A number of strategies have been proposed, such as the examination of visual aspects of skin scars and consideration of surgical history. Nonetheless, these methodologies exhibit a deficiency in reproducibility, and frequently, there exists an absence of pertinent historical data preceding the initial iteration of cesarean delivery.

Therefore, the potential for severe intra-abdominal adhesions cannot be accurately predicted for an individual woman prior to undergoing a subsequent cesarean delivery. (2)

In cases where there is suspicion of severe intra-abdominal adhesions in women, it may be advantageous to implement certain measures. These include ensuring the appropriate preparation of blood products, assigning surgeons with relevant expertise, seeking preoperative surgical assistance from other medical specialties, and potentially opting for a midline skin incision to access the peritoneal cavity (3)

The sonographic sliding organ sign has demonstrated a significant level of predictive accuracy in the identification of pelvic adhesions among women diagnosed with endometriosis, chronic pelvic inflammation, and infra-umbilical adhesions, prior to undergoing laparoscopic surgery.

In their study, **Sepilian et al. (2007)** employed this particular sign as a prognostic indicator for intraabdominal adhesion prior to cesarean birth. (4)

Objectives:

The objective of this study is to assess the efficacy of preoperative sliding sign as a predictive tool for adhesion-related complications.

Patients and Methods:

The present study, which followed a prospective double-blinded observational design, was carried out in the Department of Obstetrics and Gynecology located within the maternity hospital of Ain Shams University (labor ward and ultrasound unit) between April 2020 and April 2021.

The research was carried out on a sample of 315 women who met the specified inclusion criteria and were eligible for elective lower cesarean section at (38-40 weeks) gestation or more attended Ain Shams University Maternity Hospital. Women enrolled were 20-40 years old, of BMI < 30 kg/m², completed 37 weeks gestation of singleton viable pregnancy, scheduled to undergo an elective lower cesarean section under spinal anesthesia who had previous one or more by Pfannenstiel incision.

Women were excluded if aged > 40 years old, BMI > 30 kg/m² on admission, Placenta accreta spectrum or Emergency cesarean delivery. Women with medical disorders (hypertension, diabetes, cardiac, hepatic, renal), uterine anomalies, fibroids, midline incisions or history of endometriosis (frozen pelvis) were excluded too.

Sampling Method: Systemic random sample

Outcome:

Primary outcome: The correlation between a negative sliding sign and severe adhesions intraoperatively.

Secondary outcomes:

1. Bladder and bowel injury (visceral injury).
2. Blood loss proved by Hemoglobin drop greater than 3 g/dL (difference between preoperative and postoperative hemoglobin levels).

3. Duration of postoperative hospital stay in days (decision of discharge of the patient from the hospital is based on the patient's vital data, bowel motility, and wound quiescence).

Sample Size Justification: Using the PASS 11 Power Analysis and Sample Size Software (2009) edition, a sample size was determined by setting the power at 0.8 and the significance level (α) at 0.05. According to data from a prior study (5), significant adhesions are related with a negative sliding sign (sensitivity 56%, 95% CI 35-76; specificity 95%, 95% CI 93-97). Combining the sliding sign with a history of adhesions from the last operation led to a similar level of accuracy (Sensitivity 64%, 95% CI

43-82; Specificity 94%, 95% CI 92-97). If the Kappa agreement coefficient is 0.80 and the standard deviation is 0.5, we assume a two-sided 95% confidence interval with a width of 0.20. The minimum total sample size, determined by these data, was 315 women. With a 5 percent drop-out rate, this results in a total drop-out inflated sample size of about 315 women.

Ethical considerations:

This study was approved by the department's ethics council at the Faculty of Medicine, Obstetrics and Gynecology, Ain Shams University. Every participant gave their informed consent to participate in the study before to enrollment and after being made aware of its objectives and procedures. The investigator initially obtained the patient's written, signed informed consent before beginning any study-specific operations on any patient. The original informed consent form, which was signed, was kept by the investigator. No laboratory samples, assessment forms, reports, films, or other materials were included in any of the materials that were taken down from the website in order to safeguard subject anonymity. The researcher self-funded the study that constituted the basis for it.

Study Procedures:

All patients were subjected to a review of their personal, past, and current medical and surgical history, obstetric history (including parity, gestational age, and obstetric complications), contraceptive and menstrual history.

Abdominal examination: for determining the fundal level, the foetal position, the presentation, the anticipated foetal weight, the alcohol volume, and any prior scars.

Vaginal examination: to rule out cervical alterations, membrane rupture, and cervical fibroids or polyps.

baseline laboratory tests: Venous blood was collected from each participant to evaluate their blood type, RH, viral markers (HBs Ag, HCV Ab), and coagulation profile (PT, PTT, and INR).

■ **Ultrasound examination:**

Each woman had transabdominal ultrasonography using a VolusonE8/E10 GE Healthcare US system with a 5–9 MHz transabdominal probe. The probe was advanced forward and backward along the scar after being positioned perpendicular to the CSscar. The patient was then instructed to breathe in while watching the uterus slide caudally under the fascia transversalis and parietal peritoneum. A sliding sign was evaluated on a full or empty bladder. Before the sonographic examination, an empty bladder wasn't required as long as the patient was at ease. The woman was thought to have a low chance of adhesions if the uterus moved freely against the abdominal wall. The absence of uterine movement

was interpreted as a negative sliding sign and a high probability of intraperitoneal adhesions in the woman. Women were thought to have a low risk of adhesion when they saw a sliding sign. It was thought that there was a low danger of developing serious adhesions when there was only modest movement. The outcomes of the ultrasound sliding sign assessment were kept a secret from the surgeons performing the CS. In order to determine the relationship between preoperative ultrasound evaluation and intraoperative results, the surgeons' reports were compared to the preliminary ultrasound diagnosis after the CS. A particular form is used to record all surgical findings and to describe adhesions. Adhesions were categorised in this type as mild (filmy), which requires blunt dissection, or severe (dense), which requires sharp dissection. When the colon or bladder was stuck to the anterior wall of the uterus, it made it difficult to reach the uterus and was considered to be a severe adhesion. Filmy, easily separable adhesions were typically termed mild adhesions. Two examiners analysed ultrasound clips of the patients in order to determine the interobserver variability. Patient clips were reexamined without knowledge of the CS report at least two months following the initial US assessment in order to measure the inter-observer variability.

A senior registrar qualified to perform an elective caesarean section performed every caesarean section. Patients received an intravenous antibiotic (1st generation Cephalosporin, such as Cefazolin® 2gms) 30–60 minutes prior to skin incision, and the procedure was repeated in the event of intestinal or bladder injury in patients with severe intraabdominal adhesion or blood loss greater than 1000cc or if the procedure took longer than three hours. When someone is allergic to cephalosporin, ampicillin/sulbactam is used instead. (6).

Statistical Analysis

The data were analysed using SPSS version 20.0, Statistical Program for Social Science. Data in quantitative form were expressed using the mean and standard deviation (SD). The qualitative data were expressed using frequency and percentage. An independent t-test of significance was used to compare two means. The chi-square (2) test was

used to compare the ratios of two qualitative characteristics. Probability (p-value): p values under 0.05 were considered significant, p values over 0.05 were considered insignificant, and p values above 0.001 were considered extremely significant..

Results

Figure 1 shows the flow chart of the patients in the study. Our results show that the mean age of the studied group was 29.43 (± 6.27 SD), the mean BMI was 30.53 (± 2.05 SD), and the mean GA was 39.07 (± 0.90 SD), According to statistics, 116 patients represented (38.7%) had CS once, 163 patients represented (45.3%) had CS twice, 32 patients represented (10.7%), had CS three times and 16 patients represented (5.3%) who had received CS four or more times (**Table 1**).

Among the studied cases, 32 patients had a +ve sliding sign and Hb drop < 1gm, and 235 patients with a +ve sliding sign had a Hb drop of 1-3 gm/dl. There were 11 patients (3.7%) with visceral injury, nine patients with a positive sliding sign, and two with a negative sign. There were 278 patients representing (92.7%) with a positive sliding sign and 22 patients representing (7.3%) with negative sliding signs, and according to adhesion, there were 23 patients representing (7.7%) with mild adhesion and 23 patients representing (7.7%) with marked adhesion. (Table 2).

The relationship between sliding sign and several variables is seen in Table 3. The number of the Previous CS and the existence of a negative sliding sign did not show significant difference ($P=0.849$). A highly statistically significant difference existed between the adhesion density and the sliding sign. The presence of the sliding sign and the visceral injury did not differ significantly ($P 0.001$). The Hb drop rose with the negative sliding sign more than the positive one, and this difference between the sliding sign and Hb drop was highly statistically significant.

The hospital stay is longer in patients with negative sliding signs than in patients with positive sliding signs, as shown by the p-value (0.001), indicating a statistically significant difference between the sliding sign and length of hospital stay. (Table 4)

Fig 1 Flow chart of patients

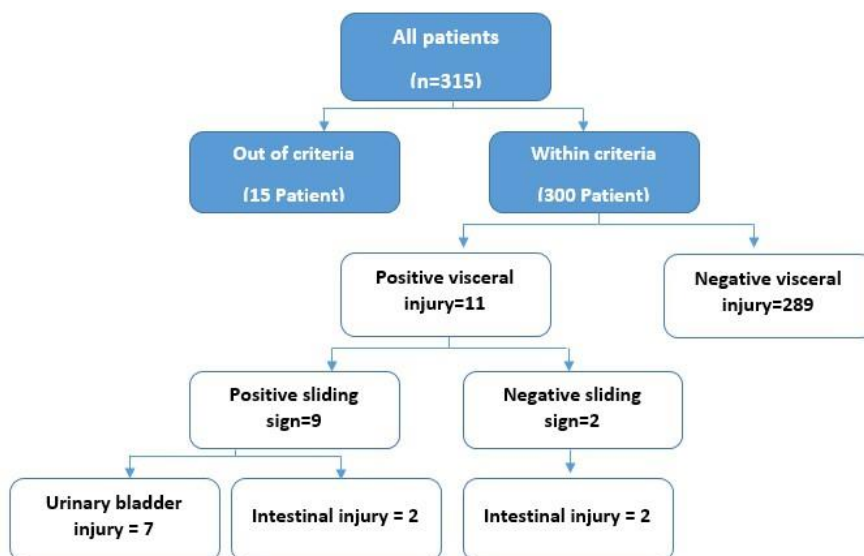


Table 1 demographic and obstetric criteria

Variable	Mean ± Standard Deviation	
Age (20-40years)	29.43 ± 6.27	
BMI (18.5-30.9 kg/m ²)	30.53 ± 2.05	
Gestational age (weeks)	39.07 ± 0.90	
Previous CS	No.	%
Once	116	38.7
Twice	136	45.3
Three times	32	10.7
Four times or more	16	5.3

Table 2: Sliding sign correlation for Hb drop, visceral injury, and intraoperative adhesions.

Variable	No.	%	+ve	-ve
Hb drop				
<1	33	11.0	32	1
1-3	262	87.3	235	27
>3	5	1.7	0	5
Type of Visceral Injury				
No	289	96.3	270	19
Yes	4 (Intestine) 7 (Bladder) Total of 11	3.7	2 (Intestine) 7 (Bladder) Total of 9	2 (Intestine)
Adhesions				
No	254	84.7	248	6
Mild	23	7.7	20	3
Severe	23	7.7	11	12
Sliding sign				
Positive	278	92.7		
Negative	22	7.3		

Severe adhesions (dense) = needs sharp dissection Mild adhesions (filmy) = blunt dissection

Table3: Relation between sliding sign previous CS, adhesions , visceral injury and Hb drop.

Sliding sign		Previous CS								χ^2	p
		Once		Twice		Three times		Four times or more			
		No.	%	No.	%	No.	%	No.	%		
Positive		108	93.1	127	93.4	30	93.8	14	87.5	0.804	0.849
Negative		8	6.9	9	6.6	2	6.2	2	12.5		
Sliding sign		Adhesion								χ^2	p
		Marked		Mild		No					
		No.	%	No.	%	No.	%	No.	%		
Positive		11	47.8	20	87.0	248	97.6			81.78	<0.001*
Negative		12	52.2	3	13.0	6	2.4				
Sliding sign		Visceral injury								χ^2	p
		Yes				No					
		No.	%	No.	%	No.	%	No.	%		
Positive		9	81.8	270	93.3					2.193	0.139
Negative		2	18.2	19	6.7						
Sliding sign		Hb drop								χ^2	P
		< 1		1-3		> 3					
		No.	%	No.	%	No.	%	No.	%		
Positive		32	97.0	235	89.7	0	0.0			42.72	<0.001*
Negative		1	3.0	27	10.3	5	100.0				

X²: Chi square test
p: p value for comparing between the studied groups

Table 4: Relation between sliding sign and hospital stay:

Hospital stay (days)	Sliding sign		t	P value
	Positive	Negative		
	Mean±SD	Mean±SD		
	1.35±1.37	4.90±3.06	5.280	<0.001

Discussion

The prevalence of caesarean sections has significantly increased in recent years. This trend resulted in an increase in complications such as placenta accreta spectrum, intraperitoneal adhesions, and bowel and bladder damage. The goal of this study was to evaluate the preoperative sliding sign's efficacy in spotting problems brought on by pelvic adhesions.

Our data show that the mean age of the study group was 29.43 (6.27 SD), which was lower than the mean ages reported by **Baron et al. (2018)** and **Drukker et al. (2018)**, which were 34.6 1.15 and 34.465.1 years, respectively. It may be because of early marriage in Egypt that it is a bit older than the mean age of 26.7 5.01 years reported by **Yosef et al. (2022)**

In terms of the quantity of prior CS, 116 patients (387.7%) had it once, 163 patients (45.3%) had it twice, 32 patients (10.7%) had it three times, and 16 patients (5.3%) had it four or more times. Similar to this, **Dukker et al.** observed that 123 (33 percent) had more than two CS deliveries, 135 (37 percent) had two, and 112 (30 percent) had only one CS. **Yosef et al. 2022** also found that 43 women (36

percent) had only one past CS delivery, compared to 41 women (34 percent) who had more than two prior CS deliveries, two prior CS deliveries, and two prior CS deliveries, respectively. In contrast, **Baron et al. (2018)** found a larger percentage of caesarean deliveries: eight (13%) had just one, twenty (34%) had two, and thirty-one (53%) had more than two. This could occur as a result of the fact that **Baron et al. (2018)** reported more previous caesarean deliveries than actual caesarean deliveries

Our research revealed that 23 patients (or 7.7%) had notable adhesions and another 23 patients (or 7.7%) had mild adhesions. Similar to this, **Shu et al. (2021)** found that 13.4% showed noticeable adhesions. However, compared to our findings, **Baron et al. (2018)** and **Bukar et al. (2022)** found that the prevalence of marked adhesions was 35.5 and 33.8 percent, respectively. This difference may be due to the diverse ethnic groups studied and their varying susceptibilities to adhesions.

According to our study, 278 patients (92.7%) had positive sliding sign and 22 patients (7.3%) had negative sliding signs. A highly statistically significant difference existed between the adhesion density and the sliding sign. Similarly, **Yosef et al**

2022 reported that 44 participants were found to have intraoperative marked adhesions out of 55 women with negative sliding signs. Whereas, that 66 participants had not intraoperative adhesions out of 66 women with positive sliding sign resulting in Marked adhesions were confirmed in 44 patients intraoperatively whereas 66 ones had positive sliding sign with a sensitivity of 100%, specificity of 86.84% with overall accuracy 85%.

Our findings corroborated those of **Baron et al. (2018)**, who demonstrated 76.2 % sensitivity and 92.1 % specificity, and **Bukar et al. (2022)**, who asserted that the sliding sign has 100% sensitivity and 100% specificity for detecting intraperitoneal adhesions. **Shu (2021)** and **Drukker et al. (2018)**, on the other hand, discovered lower sensitivity, measuring 56 and 53.3 percent, respectively.

The preceding CS count and the presence of a negative sliding sign did not differ statistically significantly, we also reported. Contrarily, a statistically significant difference between the quantity of CS and adhesion was discovered by **Morales et al. in 2007**. This suggests that the density of adhesions increases as the number of CS increases, which is contrary to the findings of our study. This could be explained by the fact that the population and surgeons have different skill sets (9).

Similarly, 329 out of 370 pregnant women who had previously undergone a caesarean section were shown to have positive sliding signs in research by **Nirumanesh et al. (2020)**. The lack of a statistically significant difference between the prior CS count and the presence of a negative sliding sign was also confirmed. On the other hand, **Morales et al. in 2007** found a statistically significant difference between the amount of CS and adhesion. Contrary to our study's findings, this shows that the density of adhesions rises as the number of CS increases. The fact that the general public and surgeons have diverse skill sets may help to explain this (9).

In a study similar to this, **Nirumanesh et al. (2020)** found that a positive sliding sign identified 329 out of 340 patients who had no or mild adhesions on CS procedure and a negative sliding sign identified 16 out of 30 patients who had marked adhesions. The study included 370 pregnant women who had previously undergone a caesarean section. According to our findings, a negative sliding sign had a sensitivity of 56% (95% CI 35-76), specificity of 97% (95% CI 93-97), a positive likelihood ratio of 12.1 (95% CI 6.7-21.8), and a negative likelihood ratio of 0.46 (95% CI 0.30-0.72) to identify severe adhesions (10).

Uterine slippage was missing in 19 people while it was common in 40 women, according to **Baron et al. (2018)**. At the time of surgery, the existence of intra-abdominal adhesions was confirmed in 16 of the 19 individuals assigned to the high-risk group. In contrast, our study's findings are

supported by the fact that 35 of 40 patients had the anticipated reduced risk of adhesions (11).

Due to the fact that patients with negative sliding signs deliver more slowly than those with positive sliding signs, our study demonstrated a statistically significant relationship between the sliding sign and delivery time.

Drukker et al. (2018) found that women with a negative sliding sign experienced a skin incision to the delivery interval that was 6.7 minutes longer than that of those with a positive sliding sign (95 percent CI 3.3-10.0, P,.001). This study found that the median duration from skin incision to skin closure was significantly longer in women with a negative sliding sign than in those with a positive sliding sign (36 minutes [interquartile range 27-49 minutes] vs. 45 minutes [interquartile range 35-75 minutes]; P=5.26) (5).

Similar findings were made by **Nirumanesh et al. (2020)**, who found that the adhesion degree increased with delivery period (P = 0.0001) and delivery period length. It is possible to distinguish between non-adhesion and mild adhesion (10).

The results of this investigation are supported by **Shenhav et al. (2019)**, who found that the mean delivery time was longer in the group with severe (dense) adhesion than in the group without adhesion. The difference was statistically significant (13.0 vs. 8.2 minutes; p = 0.002) and matched the results of this investigation (12). The existence of the sliding sign and visceral injury were not shown to be significantly correlated in this investigation.

The bladder injury sustained during caesarean delivery may be the result of this organ adhesion high in the lower uterine region.

According to research by **Juntunen et al. (2004)**, patients having their fourth to tenth caesarean birth had a considerably higher percentage of bladder attachment than those having their first, second, or third CD (OR, 9.9; CI, 5.0-19.9). Between 0.31 to 0.81 percent of women who have had multiple caesarean deliveries experience bladder damage. This contradicts the Juntunen study, where the sample size, population, and number of CS deliveries (>4th to 10th) are all different (13).

Rahman et al. (2009) found a statistically significant (P = 0.0006) predisposing risk factor for bladder injury during the index procedure in the presence of adhesions in 20 patients (64.7 percent) and scarring from other prior pelvic surgeries in 5 patients (14.7 percent). A significant risk factor for further procedures is post-CS adhesions, which also raises the possibility of bladder and intestinal damage (0.1-0.3%), haemorrhage (0.1-1.4%), and other problems (14).

In our investigation, the relationship between the sliding sign and decreased haemoglobin

was statistically different, with the Hb drop increasing with the negative sign more so than the positive sign. However, the need for a blood transfusion is the same in both groups.

Women with a negative sliding sign have a noticeably higher risk of bleeding (haemoglobin drop greater than three g/dL) than those with a positive sliding sign, according to **Drukker et al. (2018)** (adjusted OR 4.09, 95 percent CI 1.22-13.72, P5.02) (5).

There was no difference in the need for transfusions between the adhesion and non-adhesion groups, according to **Nirumanesh et al. (2020)**. **Rashid** conducted a case-control study on 308 expectant mothers who had had four or more prior caesarean procedures in 2004. He discovered that the two groups' rates of blood transfusion were comparable (44 percent vs. 30 percent; $p=0.30$), which is consistent with this study (10).

Additionally, this study discovered that the mean hospital stay for the positive sliding group was 1.35 days, compared to 4.9 days for the negative sliding group.

Thus, there was a statistically significant difference between the sliding sign and the length of hospital stay, as hospital stay in patients with negative sliding signs is longer than in patients with positive sliding signs, with a p -value (<0.001). Duration of hospital stay due to abdominal adhesions, low hemoglobin requiring blood transfusion, and visceral injury requiring further monitoring of the hospitalized patient.

Similar to our study, **Nirumanesh et al. (2020)** reported that longer delivery times and hospital stays were associated with higher adhesion degrees (10).

According to **Drukker et al. (2018)** in our study, women with a negative sliding sign have a much higher risk of bleeding (haemoglobin loss greater than 3 g/dL), which necessitates a hospital stay for blood transfusion and monitoring (5)

Strengths and Limitations of the study

- The outcomes of the ultrasound sliding sign assessment were hidden from the surgeons performing the CS.
- Bias is eliminated as the same sonographer performed all ultrasound examinations and registrars with the same experience carried out all caesarean sections. The same observer observed all outcomes (1ry and 2ry).

The limitation of our study is a small sample size served as its foundation., but the findings are still helpful regarding the test accuracy of the sliding sign. Second, there was only a moderate interobserver correlation, perhaps as a result of the fact that most inconsistencies surfaced in the first exams, presumably as a result of the learning curve. finally, our findings are qualitative rather than quantitative, which is in line with earlier research

analyzing the sliding sign in conditions such as endometriosis.

The clinical implication of this study: This new simple, cheap, available, noninvasive technique can guide the selection of the best operative team (experienced obstetricians, general surgeons, and urologists) and the availability of special surgical operative tools and equipment.

- **Further studies testing the previous scar appearance for predicting the intraabdominal adhesions comparing it with the sliding sign results.**

Conclusion

The findings of this study suggest that a straightforward sonographic finding may be used to identify patients with a history of CS who are at risk for developing intra-abdominal adhesions. In patients receiving repeated CS, this new method might aid clinical judgment. The best surgical team should be chosen (experienced obstetricians, general surgeons, and urologists), and there should be access to specialized surgical tools and equipment.

References:

1. **Tulandi T, Agdi M, Zarei A, Miner L and Sikirica V (2009):** "Adhesion development and morbidity after repeat cesarean delivery". *Am J Obstet Gynecol*; 201: 56. 1.
2. **Greenberg JA, Walden S, Hammer CM, Grazul-Bilska AT, Vonnahme KA (2011):** "A comparison of barbed and smooth sutures for ovine cesarean delivery: International Journal of Gynecology & Obstetrics; 113(3):215-7.
3. **Reid S, Lu C, Casikar I, Reid G, Abbott J, Cario G, Chou D, Kowalski D, Cooper M, Condous G (2013):** "Prediction of pouch of Douglas obliteration in women with suspected endometriosis using a new real-time dynamic transvaginal ultrasound technique: the sliding sign". *Ultrasound in obstetrics & gynecology*; 41(6):685-91.
4. **Sepilian V, Ku L, Wong H, Liu CY, Phelps JY (2007):** "Prevalence of infraumbilical adhesions in women with previous laparoscopy". *JSL: Journal of the Society of Laparoendoscopic Surgeons*; 11(1):41.
5. **Drukker L, Hen Y, Sela, Reichman O, Rabinowitz R, Samueloff A, and Shen O. (2018):** "Sliding Sign for Intra-abdominal Adhesion Prediction Before Repeat Cesarean Delivery". *Obstet Gynecol*; 0:1-5.
6. **American College of Radiology ACR Appropriateness Criteria (2018):** "Suspected small-bowel obstruction". <https://acsearch.acr.org/docs/69476/Narrative/> (Accessed on July 24, 2019).
7. **Royal College of Obstetricians and**

- Gynecologists (RCOG) (2016):** “Prevention and management of postpartum haemorrhage”. (*Green-top Guideline; No. 52*).
8. **Altman R (2015):** “Advances in NSAID development: evolution of diclofenac products using pharmaceutical technology”. *Drugs*; 75: 859-77.
 9. **Morales KJ, Gordon MC and Bates GW (2007):** “Postcesarean delivery adhesions associated with delayed delivery of infant”. *Am J Obstet Gynecol*; 196: 461.e1– 461.e6.
 10. **Nirumanesh S, Arbabzadeh T, Golshahi F, Moshfeghi M, Shirazi M, Shariat M (2020):** “Accuracy of sliding sign for prediction of adhesions in repeated cesarean section in third trimester and Intra-operative adhesion complications”. *Discov Med*; 24(105): 3024-34.
 11. **Baron J, Tirosh D, Mastrolia SA, Ben Haroush Y, Schwartz S, Kerner Y and Hershkovitz R (2018):** “Sliding sign in third trimester sonographic evaluation of intra-abdominal adhesions in women undergoing repeat Cesarean section: a novel technique”. *Ultrasound in Obstetrics & Gynecology*; 52(5):662-5.
 12. **Shenhav S, Grin L, Kapustian V, Anteby EY, Gdalevich M, Gemer O (2019):** “Quantifying the effects of postcesarean adhesions on incision to delivery time”. *The Journal of Maternal-Fetal & Neonatal Medicine*; 32(15): 2500-2505.
 13. **Juntunen K, Mäkäräinen L, Kirkinen P (2004):** Outcome after a high number (4– 10) of repeated caesarean sections. *BJOG: An International Journal of Obstetrics & Gynaecology*; 111(6): 561-563.
 14. **Rahman MS, Gasem T, Al Suleiman SA, Al Jama FE, Burshaid S, Rahman J (2009):** “Bladder injuries during cesarean section in a University Hospital: a 25-year review”. *Archives of gynecology and obstetrics*; 279(3): 349-352.
- Shu W. 2021.** Predicting intra-abdominal adhesions for repeat cesarean delivery with the ultrasound sliding sign. *Journal of Obstetrics and Gynaecology Canada* 43:1274–1278.
- Bukar M, Mana AU, Ikunaiye N. 2022.** Preoperative sonographic prediction of intra-abdominal Adhesions using sliding sign at repeat caesarean section at the University of Maiduguri Teaching Hospital, Nigeria: a prospective observational study. *BMJ Open* 12:e046334.
- Ali H. Yosef, Alaa Eldin A. Youssef, Ahmed M. Abbas, Ahmed A. Mohamed, Shimaa M. Mostafa & Mostafa N. Ibrahim (2023)** The use of ultrasound sliding sign for prediction of adhesions in women undergoing repeated caesarean section, *Journal of Obstetrics and Gynaecology*, 43:1, DOI: [10.1080/01443615.2022.2114333](https://doi.org/10.1080/01443615.2022.2114333)