

The Sonographic Sliding Sign: can it predict the need for open as opposed to minimally invasive surgery, a case report

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Abstract: The “sliding sign” seen on transvaginal ultrasound (TVS) was originally described to pre-operatively identify adhesions in the pelvis. The absence of freely moving intestine in a whirlwind pattern is consistent with a “negative” sliding sign and increased risk of adhesions. We began using it in pregnant patients with previous cesarean section to see if this information could help alert obstetricians to the presence of dense adhesions to the myometrium, and therefore, guide better management of these patients during child birth. We also theorized that a search for a “sliding sign” trans-abdominally could help guide general surgeons enter the abdomen in patients who had previous abdominal surgery. A patient with a history of previous hysterectomy and oophorectomy who subsequently required colectomy underwent sonographic evaluation for the sliding sign and the absence of the “sliding sign” changed the scheduling of the operative approach from a laparoscopic right colectomy to an open approach. We believe that ultrasonographic evaluation for the “sliding sign” should become standard for all patients with a previous history of abdominal surgery who are being considered for a minimally invasive approach. As ultrasonographic robes with bluetooth capabilities that interface with smart phones become more affordable, it is felt that ultrasonographic examinations could become part of the standard physical exam done by abdominal surgeons.

Keywords: Ultrasound; adhesions; laparoscopy; minimal access surgery; case report

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Introduction

Originally described by Timor-Tritsch *et al.* in 1988 in their book, Transvaginal Sonography, in 1988, the sonographic sliding sign is a dynamic finding that may also have some use for general and colo-rectal surgeons operating on hollow-viscus structures in the pelvis and was termed, “the sliding organs sign.” (1). Although it was initially noted to be potentially able to identify pelvic adhesions in women, we began using this finding in our patients who

had previously undergone cesarean section and were again pregnant and, therefore, at high risk for requiring a repeat cesarean section (*Video 1*) (1). Obstetricians noted that it was invaluable information because patients without sliding viscera were at higher risk of bowel injury and need for prolonged adhesiolysis. This was found to be particularly useful for high risk patients as an increased likelihood of extensive adhesiolysis could delay the surgeon’s access to the uterus during emergency cesarean section.

Upon discussions with our general and colorectal surgical

colleagues, it became obvious to us that this diagnostic study could possibly be useful for patients undergoing re-operative abdominal and surgery in non-pregnant patients. Abdominal ultrasound is a quick, simple and non invasive procedure. As a result, we wondered if ultrasound and the evaluation for a “sliding sign” could be interesting for evaluating the different subcutaneous and sub aponeurotic planes, and perhaps more importantly could also provide information on the mobility of the intestinal loops in relation to the abdominal wall, pelvic floor and the aponeurosis (2,3). In women we also felt that transvaginal ultrasound (TVS) could give additional information for patients undergoing re-operative surgery in the pelvis, such as reversal of a Hartmann’s procedure or ovarian surgery.

The surgical approach of an abdominal cavity can sometimes be difficult when the patient has had multiple procedures. Extensive adhesions can form between the different parts of the digestive tract (colon, intestine and/or abdominal wall). When surgeons are faced with these type of abdominal adhesions found in abdomens that have already been violated, the surgical introduction of a trocar or laparotomy may be responsible for an injury to the digestive tract or great vessels. This can be particularly treacherous in the pelvis, where injuries to the retroperitoneal structures such as the ureters and iliac vessels, and to hollow viscus structures, such as the colon, rectum and small bowel can be especially difficult to repair due to the small size of the pelvis (4). We present the following article in accordance with the CARE reporting checklist (available at <http://dx.doi.org/10.21037/dmr-20-156>).

Case presentation

A 53-year-old female with a history of ovarian cancer who had undergone hysterectomy and bilateral oophorectomy was diagnosed with a sessile polyp in her right colon that could not be resected endoscopically. She was seen for TVS and had a positive sliding sign with good movement of her small bowel in her pelvis. However, although a simultaneous trans-abdominal ultrasound revealed a positive “sliding sign” in the pelvis (*Video 2*), it also revealed concerns for a metastasis and dense adherences to her previous midline incision below her umbilicus (*Video 3*). Sonographic evaluation was performed blindly by two different sonographers, and the video (the one attached to this paper) was retrospectively analyzed by another ultrasound expert. The three were suspecting an adherence to the abdominal wall. The inter- and intra-observer

agreement on this patient was not possible due to patient comfort and convenience. As a result, an MRI was obtained that confirmed a nodule in this area that was concerning for a peritoneal metastasis. Subsequent PET scan confirmed an area of increased SUV activity in this area.

The surgeon who initially was planning a laparoscopic right hemicolectomy instead performed an open right hemicolectomy and safely entered the abdomen higher than originally planned. The surgeon encountered dense and treacherous adhesions in the area concerning for a metastasis that were difficult to take down even with an open approach. If this area was entered via a minimally invasive approach, it is believed that a bowel injury would have occurred. Operative biopsy of the area in question was negative for malignancy. The patient was discharged on post-operative day number 5 tolerating a low fiber diet and having bowel movements. Final pathology of the colon polyp revealed a non-malignant adenoma. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Declaration of Helsinki (as revised in 2013). Informed consent was obtained from the patient.

Discussion

We were able to demonstrate an ultrasound technique that analyzes the mobility of the uterine and aponeurotic serosa in patients who have had a previous cesarean section. This “sliding sign”, involves mobilizing the patient’s uterus during the ultrasound and is able to determine if the peritoneal serosa—bladder and uterus are mobile indicating that there are no significant adhesions of the hollow-viscus structures in the pelvis (1-3). In the event of multiple adhesions between these different serous membranes, the “sliding sign” is absent with a fixed appearance of all the anatomical structures (uterus/bladder).

It is also possible to visualize the small intestinal loops in this anterior cervico-uterine region and the sign is considered “positive” when the viscera are freely moving on dynamic evaluation. During this rarely used ultrasound analysis, small spontaneous movements of the intestine that appear to have a whirlwind-like appearance. This sign could provide information on the mobile nature of the digestive loops next to the region that would be approached surgically. In our patient who had undergone previous hysterectomy there were initially concerns for significant pelvic adhesions, however, the presence of a

sliding sign initially indicated to us that a minimally invasive approach was worth attempting. Luckily for us although only a TVS was requested, the radiologist also decided to perform a trans-abdominal ultrasound due to a perceived restriction of intestinal movement in the peri-umbilical region. This alerted us to the potential presence of a more dense adhesion than would be expected from a patient with previous midline laparotomy.

Now that the era of minimally invasive surgery is in full bloom, it is possible that more re-operative surgeries are begun minimally invasively when, in fact, they should have been begun via an open approach. The search for a “sliding sign” may be a simple and quick sign that may be able to save some patients unnecessary tracer injury. Trocar injuries are notoriously difficult to identify and repair minimally invasively. Even when they are identified intra-operatively and cases converted to a laparotomy, this complication can increase operative times and lead to a waste of resources as both laparoscopic instruments are needlessly opened and utilized. In the absence of a sliding sign on trans abdominal ultrasound in the area of abdominal entry and/or on TVS for pelvic surgery in women, perhaps certain operations that are being considered for laparoscopy should be more strongly considered for upfront laparotomy.

The search for a “sliding sign” on trans abdominal and when possible TVS can be given to the surgeon who can then make a delicate and conscientious decision as to the approach utilized for entry into the anterior abdominal wall and perhaps permit safer minimally invasive entry into the abdomen. Not only can the decision for laparoscopic or open surgery be improved, but perhaps we can better determine which patients should be considered for single incision surgery or standard laparoscopy. Although we do not currently recommend a transrectal ultrasound to look for a “sliding sign”, perhaps this easily identified sign should be looked for when a transrectal ultrasound is indicated for another reason such as after neoadjuvant chemoradiation for rectal cancer.

The sliding sign may be predictive of parietal endometriosis, which most often appears after a procedure (i.e., after caesarian section or hysteroscopy). The extent of deeply invasive endometriosis can be evaluated by the sliding sign if intestinal loops are adherent to the uterus, or if the sliding sign is seen in the pouch of Douglas. However, it can be hard to follow the movement of every part of the intestine for deep endometriosis. Sonography is better at evaluating endometriotic cysts, and MRI has been shown to be better than sonography for evaluating deep

endometriosis. This is why, if the sliding sign is even weakly concerning, we always recommend an MRI for further evaluation.

Transvaginal sonography with a bladder containing a small amount of urine, is the first exam to perform in cases of suspected endometriosis. It is used to map the lesions and to assess the severity of the lesion prior to medical therapy or surgical intervention. Sonographic exam for endometriosis is based on four steps, as described by the IDEA group (International Deep endometriosis Analysis) (5).

First, the analysis of the uterus should describe its mobility as well as its echogenicity looking for adenomyosis. The latter should be detailed according to terms and definitions published in the Morphological Uterus Sonographic Assessment consensus opinion (6). Secondly, an accurate exam of the ovaries for endometrioma or endometriotic spots if seen, should involve a description of their measurements, number and appearance. The position of the ovaries has to be described, as well as their mobility or fixation by applying pressure with the free hand to the probe along the abdomino-pelvic wall and adjacent structures, in order to look for superficial endometriosis and adhesions. Additionally, fallopian distal tubular adhesion, hydrosalpinx and hematosalpinx and peritoneal cysts should be sought and described if found.

The third step is to evaluate the pouch of Douglas using the “sliding side”. A lack of sliding on either the anterior rectal wall or the anterior wall of the sigmoid over the retrocervix or the posterior uterine fundus, should evoke concerns for obliteration of the pouch of Douglas. The fourth step is to search for deep nodules of infiltrating endometriosis in the anterior and posterior compartments, placing the probe on the vagina anteriorly and posteriorly to the fornix of the vagina enabling a proper assessment of these compartments. An acute knowledge of these different sonographic signs may enable a more complete evaluation for adhesions.

The accuracy of preoperative transvaginal sonography should be compared to MRI prior to surgery and compared with surgical findings noted and described in all four quadrants. These signs have already been studied in several papers related to endometriosis (7). However, sonographic sliding signs are poorly known by digestive surgeons. Prior to surgery, a sonography of the abdominal wall focused on the sliding sign could also be helpful. Then, after general anesthesia, the abdominal wall can be easily stretched while another sonography is performed to look for adhesences

along the previous scars and elsewhere in the 4 quadrants. This could ease the surgical access and possibly reduce the incidence of inadvertent bowel injury. Also, rectal adhesences or a rectal lesion could be explored using syringe air insufflation into the anal canal while an abdominal or pelvic sonography is performed potentially enhancing assessment of bowel mobility.

Routine pelvic ultrasound evaluation is for now, exploring the uterus, ovaries and pouch of Douglas. Currently, signs of endometriosis are looked for if the patient presents with fertility issues or pain during menstruation. The sliding sign could be looked for to see if any of the intestines are stuck to the uterus or pouch of Douglas, therefore, leading to a dedicated search for endometriosis or previous pelvic peritonitis or infection. The reality is that the monographer is constantly looking at the movements of the intestine during TVS, the only difference needed would be for the sliding sign to be formally documented in the pelvic ultrasound report.

We also think that these sonographic signs would benefit from more routine evaluation. Inter-/intra-observer agreement and diagnostic accuracy among gynecologic and non-gynecologic ultrasonographers could be evaluated during offline analysis of two-dimensional videos using the dynamic real-time TVS 'sliding sign' technique and then compared to surgical findings in an effort to enhance the pre-operative prediction of adhesences (pouch of Douglas obliteration, adhesences to the abdominal wall).

Absolute anesthetic contraindications to pneumoperitoneum include patients with closed angle glaucoma, intra-cranial hypertension, hypovolemia and right to left cardiac shunts. The surgical contre-indications to minimally invasive surgery depend on the operator and are relative. Although the presence of peritoneal adhesions is only a relative contre-indication to minimally invasive surgery, the presence of adhesions can also greatly influence open surgery. Because of this it is believed that the "sliding sign" may also be of benefit to patients with planned open surgery. It is theorized that routine evaluation of this sign in pre-operative patients may be able to improve the pre-operative evaluation of intra-abdominal adhesions and thereby improve the prediction of operating times. Surgeons are notorious for improperly estimating operating room times, because of this it is believed that this relatively simple and quick test could result in improved OR time utilization and overall efficiency.

This initial case report indicates the potential utility of performing a preoperative trans-abdominal ultrasound

in re-operative abdominal surgery for males, in addition to TVSs in females requiring re-operative pelvic surgery in an effort to identify ideal candidates for minimally invasive re-operative surgery in the abdomen and/or pelvis. Because of this observation, we are planning on a larger series to verify whether or not dynamic transvaginal and trans-abdominal ultrasound examinations can help in the surgical management of patients with a history of previous abdominal surgery requiring subsequent surgery. Our initial patient population is focused on patients who are candidates for Hartmann's Reversals, to see which patients should be considered for laparotomy, standard laparoscopy or trans-stomal single incision approaches (4,8,9).

Conclusions

Transabdominal sonographic evaluation for the "sliding sign" should be sought on patients with a history of previous abdominal/pelvic surgery who are being evaluated for minimally invasive surgery. Due to the existence of inexpensive ultrasound probes, some of which even interface with smartphones, and the relative ease of performing this study it is theorized that evaluation for this sign may become part of the standard abdominal exam done by surgeons. Transvaginal evaluation for the "sliding sign" should also be considered in female patients with a history of previous surgery who are being evaluated for minimally invasive pelvic surgery. It is theorized that the evaluation for this sign may better help predict the best surgical approach to be used and reduce unnecessary procedures, so that general surgical departments can minimize access injuries, the unnecessary waste of laparoscopic and robotic instruments and time in the operating room until the appropriate surgical approach is determined.

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