


Research Article

A Prospective Study on the Reliability of First-Trimester Ultrasound in Identifying the Gestational Sac Implantation Site

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Abstract

Objectives: Normal and abnormal implantation of the gestational sac may affect obstetrical outcomes. We sought to evaluate whether ultrasound can correctly identify the first-trimester gestational sac implantation wall compared to diagnostic hysteroscopy.

Methods: Consecutive women diagnosed with first-trimester pregnancy loss who opted for surgical termination of pregnancy were prospectively recruited to the study. Pre-operatively, an ultrasound scan was performed to assess for the gestational sac implantation wall. Subsequently, the surgical procedure of diagnostic hysteroscopy combined with suction and curettage was performed. The sonographers were blinded to the hysteroscopy results. The gestational sac implantation wall was determined and compared between the two modalities.

Results: Twenty-three women were included in the study. The median gestational age 9 (range: 6 to 13) weeks, and the median crown-rump length was 7 (range 6-9) mm. In one case, the implantation site was determined only by the U.S. In the remaining, the U.S. and hysteroscopy gestational sac location were identical (21/22, 95%). Thus, the correlation between the sonographic and hysteroscopy findings was 0.96.

Conclusion: Ultrasound is a reliable method for the detection of the early gestational sac implantation site.

Keywords: Gestational sac; implantation; ultrasound scan; hysteroscopy; first trimester

Introduction

An ultrasound scan is commonly performed in the first trimester of pregnancy to confirm the embryo's viability, estimate the gestational age, and establish the gestational sac's intrauterine location. This simple procedure requires relatively little expertise and is typically done in an office setting. During this scan, it is essential to exclude abnormal implantation of the gestational sac, such as implantation on a previous cesarean section scar. Upon diagnosis, refer those women to high-risk expert care. Accordingly, the International Society of Ultrasound in Obstetrics and Gynecology (ISUOG) guidelines state that determining the implantation site is an integral part of the first-trimester scan.[1] Nevertheless, the use of ultrasound for this purpose has not been systematically studied to date.

In this prospective study, we sought to estimate the accuracy of the first-trimester ultrasound scan in identifying the implantation site in women

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undergoing surgical termination of pregnancy for early pregnancy loss. For this purpose, we prospectively compared the ultrasound findings with those of diagnostic hysteroscopy in a blinded design.

Methods

This prospective cohort study was conducted at the Department of Obstetrics and Gynecology of the Shamir Medical Center (previously Assaf Harofe) between July 2021 and August 2022. The study was approved by the institutional review board and was registered at the clinicaltrials.gov database (<https://clinicaltrials.gov/NCT04579796>).

Women aged >18 years were recruited from a separate study in our department to assess the technique of hysteroscopy-guided suction and curettage for early pregnancy loss. In that study, following signed informed consent, diagnostic hysteroscopy was performed in the operative room under general anesthesia to determine the location of the gestational sac's insertion, followed by suction and curettage directed at the implantation wall. Recruitment took place before the scheduled surgical procedure.

Before the surgical procedure, ultrasound scans were obtained to assess the gestational sac location using the transabdominal approach. When that was insufficient for determining the implantation site, a transvaginal scan was added. Two experienced sonographers conducted the scans using equipment from different manufacturers with variable focus 3.5- to 5-MHz curvilinear and transvaginal probes. The implantation site was determined using direct visualization and demonstrating a feeding vessel from the uterine wall to the gestational sac with Doppler flow (Figure 1, Transvaginal ultrasound demonstrating gestational sac implantation in the anterior uterine wall).

On the same day, the surgical procedure combining diagnostic hysteroscopy and suction curettage was performed in the operating room under general anesthesia, as described above. For the diagnostic hysteroscopy, a 30o, 2.9 mm rigid hysteroscope using normal saline as the distention media was used. The implantation site of the gestational sac was observed on hysteroscopy by direct visualization (Figure 2).

The surgical procedure and the ultrasound examination were done by two independent teams who were blinded to the other team's results.

Descriptive statistics are given as frequency (%) for categorical variables and median (range) for continuous variables. We used the Cramer's V correlation coefficient to estimate the correlation between the hysteroscopy and the ultrasound findings. A p-value <0.05 was considered statistically significant. The data were analyzed using SPSS V.25 (SPSS Chicago, IL, USA).

Results

The study included 20 women of those 17 with a singleton pregnancy and 3 with twin's pregnancy. The mean age of the women was 35 (s.d, 4) years. The median gravity was 4.5 (range 1 to 13) pregnancies, and the median parity was 2 (range 0 to 7) pregnancies. At the time of testing, the median gestational age was 9 (range: 6 to 13) weeks, and the median crown to rump length was 7 (range 6 to 9) mm. In 2 cases, we identified the gestational sacs in the cervical canal. The occurrence of incomplete abortion was correctly identified by both hysteroscopy direct observation and ultrasound imaging. The demographic and obstetric characteristics of participants are summarized in Table 1.

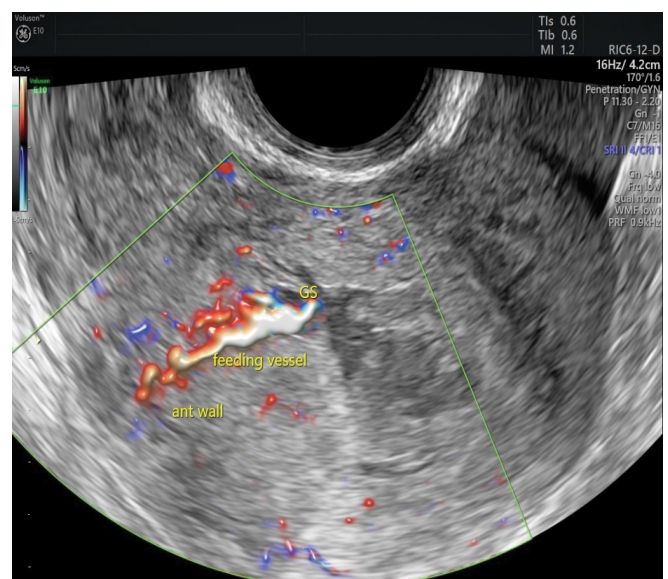


Figure 1: Transvaginal ultrasound demonstrating gestational sac implantation in the anterior uterine wall

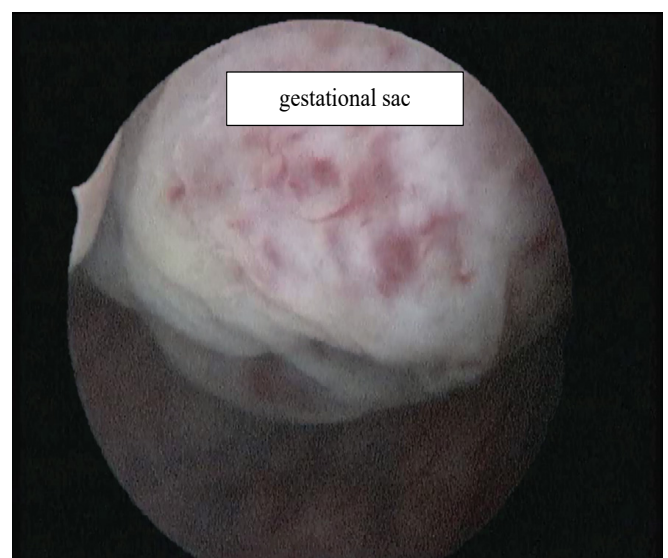


Figure 2: Hysteroscopy demonstrating gestational sac implantation in anterior uterine wall.

On hysteroscopy, the implantation wall was identified in 22 of 23 gestational sacs. In 8 (40%) cases, the gestational sac was identified on the anterior wall, in 9 (45%) on the posterior wall, and 3 (15%) on the fundus. The ultrasound examination identified identical implantation sites, except for one case where the hysteroscopy identified an anterior implantation site while the scan recorded it as posterior (figure 3).

Discussion

Verification of the ultrasound accuracy, compared with direct observation by hysteroscopy to the best of our knowledge, was never tested before. In clinical practice, identifying the implantation site is essential in viable pregnancies. This is especially so in pregnancies among women with a history of cesarean section as they are at high risk of scar pregnancy

Table 1: Demographics and Obstetrics characteristics of the study population

Characteristic	
Number of women	20
Age, median (range), years	35 (26 to 40)
Gestational age, median (range), weeks	9 (6 to 13)
Mode of conception	
Spontaneous	17 (85)
IVF	3 (15)
Previous pregnancies, median (range)	4 (1-13)
Previous deliveries, median (range)	2 (0-7)
Previous pregnancy loss N (%)	
None	7 (37)
1 early missed abortion	11 (58%)
2 or more early missed abortions	1 (5%)
Previous cesarean sections	
None	7 (37)
1	11 (58)
2 or more	1 (5)

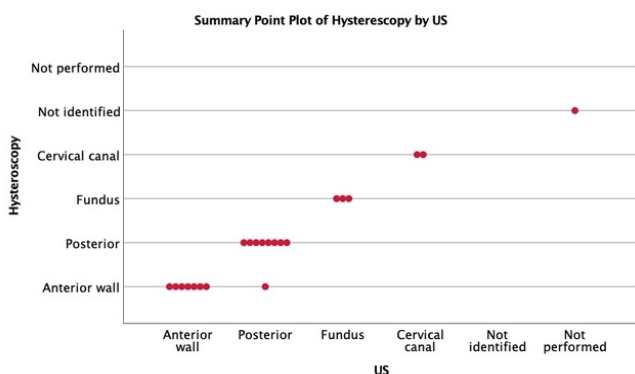


Figure 3: The distribution of gestational implantation site in US (ultrasound scan) versus Hysteroscopy.

or placenta accreta with significant complications. The early detection of pathologies in such women will allow for early specialist referral for further evaluation and management. [2] The placenta/sac insertion location is also essential information for cases of first-trimester spontaneous abortion where cesarean scar pregnancy is managed differently and has a different outcome to intrauterine abortion and in cases of uterine malformations or abnormalities (e.g., subserous fibroids, uterine septum, etc.) where the implantation is essential for further counseling the patient.[2],[3] Another aspect of first-trimester spontaneous abortion is intrauterine adhesions. Friedler et al reported on an incidence of 16.3% of intrauterine adhesion in women after one curettage due to first-trimester abortion.[4] Knowing the location of the sac insertion will enable a more guided curettage approach, reduce the time of the procedure, and reduce the risk of intrauterine adhesions and residual trophoblastic tissue.

Our study included a subgroup of patients who participated in more extensive research investigating the procedure of hysteroscopy-guided suction curettage for early pregnancy loss. This provided us with accurate information on the location of the implantation wall on hysteroscopy and allowed us to compare the two modalities. Since the ultrasound team and the surgical team performed their examinations separately, each team was blinded to the other team's results. Although our study included a small patient cohort, our results support the current clinical practice of using ultrasound for identifying the implantation wall in the first trimester.

Among 22 gestational sacs identified, we found high concordance between these two modalities. This is reassuring and in line with current practice.

Although large-scale data using current imaging technology is lacking, early reports identified the uterine fundus and the posterior wall as more common implantation sites.[5] Nonetheless, in our study, implantation loci were evenly distributed between the posterior and the anterior uterine walls. We do not know why this discrepancy exists, although we cannot rule out that implantation in the anterior wall is associated with higher rates of early missed abortion. Other studies demonstrated a connection between placental location and adverse perinatal outcomes such as Preeclampsia and fetal growth restriction.[6],[7] The excellent correlation between the ultrasound scan and the hysteroscopy was demonstrated both in singleton and twin pregnancies. Our group published data regarding factors that allow for the prediction of hypertensive disorders in the first trimester in twin pregnancies[8],[9] so maybe placental location can be thought to be included in further studies.

Our study has several limitations. The study cohort was relatively small and included only women with first-trimester pregnancy loss. Also, the ultrasound scans were performed in optimal conditions (i.e., by expert sonographers using

transabdominal and transvaginal probes and Doppler studies). Thus, our results may not be generalized to all practitioners.

In conclusion, an ultrasound scan can accurately identify implantation location in early gestation and compares favorably with diagnostic hysteroscopy.

The accurate identification of the implantation wall could be of benefit in various clinical scenarios such as a history of previous cesarean section, known intrauterine pathologies, and in women undergoing surgical termination of pregnancy.

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Disclosures

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