Diagnostic value of transvaginal color Doppler ultrasonography findings in post treatment follow up of cesarean scar pregnancy

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Research Article

Keywords: cesarean scar pregnancy, medical management, resistance index, transvaginal color Doppler ultrasonography

Posted Date: May 4th, 2023

DOI: https://doi.org/10.21203/rs.3.rs-2870970/v1

Abstract

Aim: Cesarean scar pregnancy can cause life-threatening complications for pregnant women, so early diagnosis and treatment is crucial for prevention of maternal mortality. Transvaginal color Doppler ultrasonography besides serum β-hCG level follow-up can be a noninvasive and proper method for post-treatment follow-up of a cesarean scar pregnancy. In the present study, we investigated the Doppler resistance index changes in cesarean scar pregnancies after medical management together with sac diameter and serum β-hCG level measurement.

Methods: 28 patients with cesarean scar pregnancy and a history of previous cesarean delivery, gestational age of less than 9 completed weeks at ultrasonography, decision to medical management by gynecologist and with having a β-hCG level before treatment were enrolled and initially examined by ultrasound and Doppler studies. The resistance index of the closest myometrial artery to cesarean scar pregnancy mass and its diameter were measured. After 72 hours, 1 week and 2 weeks after medical therapy, mentioned variables were measured again and were compared to the values of the pretreatment time point.

Results: Resistance index values were significantly higher in all of the follow-up time points compared with the pretreatment time points, while serum β-hCG levels were significantly lower. Moreover, sac diameter values were increased 72 hours post-treatment and then declined.

Conclusions: Serial Doppler ultrasound examinations can be a useful method to evaluate the success or failure of medical management of cesarean scar pregnancies as the increase in resistance index values occur rapidly after medical treatment and correlate well with serum β-hCG levels.

What does this study adds to the clinical work

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Introduction

Cesarean scar pregnancy (CSP) occurs when a gestational sac implants at the site of a previous cesarean section scar(1). CSP is extremely rare, with an estimated incidence of 1 in 1800 to 1 in 2500 pregnancies(2, 3). However, the occurrence of CSP has increased due to the notable rise in the rates of cesarean deliveries and the development of imaging tools like transvaginal ultrasonography (TVUS)(4). Vaginal bleeding with or without lower abdominal pain is the most common clinical manifestation of a CSP(5). However, almost one-third of incidentally diagnosed CSPs are asymptomatic(6, 7). Life-threatening complications including placental abnormalities like accreta, massive hemorrhage, and uterine rupture may occur if CSP is not diagnosed timely and allowed to progress(2). Thus, early diagnosis and management of CSPs is vital. Any pregnant woman with a prior history of cesarean

delivery should be scanned for a CSP with TVUS and with transvaginal color Doppler ultrasonography (TVCDUS) to detect the site of the gestational sac as soon as possible during first trimester(5, 8).

The management strategy of a CSP may differ individually. Expectant management, medical treatment, various surgical approaches or a combination of these may be considered(9). Nevertheless, there are few standardized guidelines for a CSP management.

Checking Serum β-hCG level is commonly used for post-treatment follow-up of a CSP. However, it has been shown to have some restrictions such as not providing any information on the blood flow of the mass(10). Therefore, some studies have suggested serial Doppler ultrasound examinations for a CSP post-treatment follow-up together with the serum β-hCG measurement(9). In this study, we aimed to investigate the Doppler resistance index (RI) changes in CSPs after medical management together with sac diameter and serum β-hCG level measurement.

Methods

This cross-sectional study was conducted at the department of radiology, Al-Zahra hospital of Tabriz Medical University, Iran, from January 2021 to June 2022. 30 patients with CSP were enrolled in the study after the approval by the ethics committee of Tabriz university of medical sciences. The inclusion criteria were having a history of previous cesarean delivery, CSP report with gestational age of less than 9 completed weeks at ultrasonography, decision to medical management by gynecologist and with having a beta human chorionic gonadotropin (β-hCG) level before treatment. Decision to surgical management by gynecologist, not having a serum β-hCG level before treatment, and not having consent to be included in the study were the exclusion criteria.

The patients included in the study were initially examined by TVUS and TVCDUS. The resistance index (RI) of the closest myometrial artery to CSP mass, CSP mass diameter and the pretreatment β-hCG level were measured and recorded. Patients with non-viable embryos and a β-hCG level of less than 5000 mIU/mL were treated by a single dose of 50 mg systemic methotrexate (MTX) and those with a beta-hCG level of more than 5000 mIU/mL were treated by an injection of 25 mg intragestational (intrasaccular) MTX in addition to the single dose of systemic MTX. Moreover, CSPs with fetal heart beats were treated by an injection of 8 mEq intrasacculr potassium chloride (KCl) in addition to the single dose of systemic MTX. The mentioned variables were measured and recorded after 72 hours, 1 week, and 2 weeks of medical management and compared with the values of the previous time point. All the TVS and color Doppler ultrasound examinations were performed by a radiologist with proper experience in obstetrics ultrasound using Philips Affiniti 70 ultrasound device, a convex ultrasound probe with a frequency range of 2–5 MHz and a 4–7 MHz vaginal probe. Several traces were taken in all the color Doppler evaluations and RI was measured and recorded. Serum β-hCG levels were obtained by enzyme-linked immunosorbent assay (ELISA). The patients were included in the study after giving their written informed consent.

Numerical data was calculated and presented by mean (SD) or median (IQR) based on their shape of distribution. P-values for comparing RI and sac diameter at each time with the values of previous time

points were calculated by parametric test of Repeated Measures Analysis of Variance (ANOVA) and paired comparisons were done using Bonferoni adjusment. Also, non-parametric test of Friedman was used for calculating p-values used for comparing β-hCG levels before abd after treatment time points and Dunn adjustment was used for paired comparisons. Graphpad Prism version 9 was used for statistical analysis and a P-value of more than 0.05 was considered significant.

Results

Based on the inclusion and exclusion criteria, 28 cases were included in the study and 2 were excluded due to medical treatment failure and decision to surgical treatment. Demographic and obstetric characteristics of the studied cases are presented in Table 1. Of 28 cases before the treatment, 5 (17.86%) cases were diagnosed with fetal heart beats. 72 hours after the treatment, no heart beats were detected in the ultrasonography.

The data analysis demonstrated that RI values were significantly higher in all the follow-up time points compared with the previous time point, while the serum β-hCG levels were significantly lower (Fig. 1, Table 2). Moreover, sac diameter values were increased 72 hours post-treatment then declined.

Discussion

CSP is a very rare type of ectopic pregnancy with life-threatening complications(10), accounting for 6.1% of ectopic pregnancies among women with a previous history of cesarean delivery(2, 11). Recently, there has been a rise in CSP rates due to the considerably elevated number of cesarean deliveries worldwide(10). Therefore, early diagnosis and effective management and follow-up of CSP is crucial. The exact etiology of this condition remains unknown. A small defect in the uterine incision due to poor healing of the injuries caused by cesarean deliveries, several uterine curettages, and adenomyosis are some of proposed possible mechanisms of CSP development. Also, multiple risk factors such as the number of previous cesarean sections, the interval between the prior cesarean delivery and next pregnancy, the indications for the previous cesarean sections, and the surgery technique have been suggested, though the correlation between these factors and CSP has not been proved yet(12). Delay in the diagnosis and treatment of patients with CSP may be associated with a high risk of uterine rupture, massive hemorrhage, hysterectomy, fertility loss, and maternal mortality(12–14). Diagnosis of CSP is usually difficult and the reported rate of misdiagnosis is significant(15, 16). Sonography is the first-line imaging modality for CSP diagnosis(17). Recent progress in transvaginal and three-dimensional ultrasonography has led to earlier diagnosis and more effective management of a CSP to prevent its catastrophic complications(18). Moreover, it has been indicated that color Doppler imaging may be very useful in early and accurate detection of CSPs(19).

Due to the rarity of CSPs, there has been no consensus for optimal management strategy of CSPs(5, 17). A variety of treatment options including expectant management, medical treatment programs, multiple surgical interventions have been described in the literature(5). In most cases, a combination of these

methods has been used to eliminate these ectopic embryos(2). Selecting the most appropriate treatment approach depends on the patient's clinical features, gestational age, size of the mass, serum β-hCG levels, and clinical experience of the physician(8).

In clinically stable patients with gestational age of less than 8 weeks and the myometrium thickness of less than 2 mm between the CSP and the bladder, medical management is usually applied(10). Although there are no guidelines for optimal follow-up method after the medical management of a CSP, the serum β-hCG level has been shown to be a suitable marker(10). However, serum β-hCG levels do not bring about any information on the blood flow of the mass(20). Moreover, some cases have been reported that despite the excessive drop (even to normal values) in β-hCG levels after medical therapy, the mass did not resolve, resulting in serious consequences(8, 15, 21). In this case, it has been suggested that serial transvaginal Doppler ultrasound examinations may be helpful to investigate the medical management success(10).

The data obtained by the present study showed that serum β-hCG levels decreased significantly after medical treatment at each time point compared with the previous time point and the baseline (before the treatment) levels, while the RI values of Doppler ultrasound increased significantly. In a study on evaluation of the efficacy of High Intensity Focused Ultrasound (HIFU) in treatment of cesarean section scar pregnancies, Huo et al. observed that four weeks after the treatment RI values were significantly elevated while blood β-hCG levels significantly decreased compared with their pretreatment values(20).

Small sample size and single-index observation were some of the limitations of this study. Further studies with a larger sample size are required to investigate the value of serial Doppler ultrasound examination for follow-up after medical treatment of a CSP.

The results of this study demonstrated that serial Doppler ultrasound examinations can be a useful method to evaluate the success or failure of medical management of CSPs as the increase in RI values occur rapidly after medical treatment and correlate well with blood β-hCG levels' measurement.

Declarations

Acknowledgments

We would like to thank our kind staff of hospital for friendly cooperation and support.

Disclosure

No conflict of interest.

Conflict of Interest

The authors declare that they have no conflict of interest.

Author contribution

M Sodabi: Project development, Data collection, Data analysis, Manuscript writing and editing.

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Tables and Figure

Tables 1 and 2 and Figure 1 are not available with this version