



Cesarean scar ectopic pregnancy: Do ultrasound play a cornerstone in its diagnosis and management?

Elshaimaa Mohamed, Mohamed, Nader Ali Alayouty, Mona Mohammed Refaat Ismail, MD, diagnostic radiology department, Zagazig university faculty of medicine, Zagazig, Ash Sharqia Governorate, 44519, Egypt.

Corresponding author:

Elshaimaa Mohamed

Mohamed, MD, assistant professor diagnostic radiology, radiology department, Zagazig university faculty of medicine, Zagazig, Ash Sharqia Governorate, 44519, Egypt.

Email:

bosy.radiology@gmail.com

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ABSTRACT

Background: Cesarean scar ectopic pregnancy (CSP) is an exceptional subtype of ectopic pregnancy that results in a critical life-threatening outcome. In addition to magnetic resonance imaging in challenging scenarios, prompt diagnosis with sonography can restrict maternal morbidity and mortality. Quick detection had a powerful impact on the success of available treatment options. Local injection of methotrexate under sonographic guidance looks to be an actual substitute modality for its management. The goal of this research is to highlight the task of US and MRI in the diagnosis and interventional radiological management of this ectopic pregnancy.

Methods

This study included thirteen pregnant females in the first trimester diagnosed with CSP, their ages range from 28-41 years with a mean age of 34.6 ± 4.3 .

It was carried out in the period from February 2014 to November 2021.

All thirteen patients were examined by pelvic ultrasound and only two of them required complementary MRI study.

Results: The mean thickness of the myometrium between the sac and urinary bladder in all our cases by pelvic ultrasound was 2.4 ± 0.9 mm. Only two cases had a suspicion of marked myometrial thinning with questionable urinary bladder invasion. MRI was done for confirmation of CSP and exclusion of urinary bladder invasion. Among thirteen cases, twelve were managed conservatively, nine of them treated by local methotrexate (MTX) and potassium chloride (KCL) injection under ultrasound guidance. Three cases were managed by dilatation and curettage (D&C) under intra-operative ultrasound guidance.

Conclusions: Pelvic ultrasound has a magic role in the diagnosis of CSP and its management. Either local injection of MTX and KCL or D&C under ultrasound guidance consider successful conservative modalities with significant radiology incorporation.

Keywords: Cesarean scar pregnancy, Methotrexate, Dilatation and curettage, Ultrasound, Magnetic resonance imaging.



INTRODUCTION

Cesarean scar ectopic pregnancy (CSP) is an uncommon variety of ectopic pregnancies that has the potential to be life-threatening [1,2]. In early pregnancy, implantation of blastocyst on the existing cesarean section (CS) scar created CSP [3]. It is increasing in incidence due to the increased frequency of CS as well as the drop in vaginal births following former cesarean sections and accounts for 6.1 % of whole ectopic pregnancies [4]. The myometrial defect is a thin band of fibrous tissue that connects to the endometrial canal and is present in

the anterior lower uterine segment (LUS). If this aberrant implantation goes unnoticed and untreated, it can lead to serious consequences such as placental abnormalities like accreta, life-threatening bleeding, and rupture of the uterus [5-7].

This invariably results in the patient's fertility being lost, as well as major long-term negative consequences for her health [8]. The patient can attempt a future pregnancy trial if the uterus is effectively preserved after CSP treatment. As a result, early detection and successful conservative therapy have become more important [9].

Early diagnosis using sonography, in synchronicity with magnetic resonance imaging (MRI) in controversial cases, can reduce maternal mortality and morbidity. The success of current treatment options is also influenced by early detection [10].

A cervical ectopic pregnancy or an ongoing miscarriage may be mistaken as a CSP [11,12]. The most prevalent imaging modalities are transvaginal (TVUS) and abdominal Ultrasonography (US). The United States, on the other hand, is unable to make a clear diagnosis in all cases [13]. When ultrasonography is unclear in determining pregnancy location, MRI may be effective for problem-solving. The attenuated thickness of the myometrium between the gestational sac and the bladder can be shown on MRI [14]. As a result, it gives critical information for establishing the treatment strategy [12].

Dislike the insufficiency of available standard management strategies, conservative, and surgical therapy techniques have lately been advocated. Management techniques include dilatation and curettage (D&C), systemic or local methotrexate (MTX), transvaginal embryo aspiration, and potassium chloride (KCL) injection [15]. The utilization of MTX locally under sonographic supervision appears to be a valuable therapeutic option for this kind of ectopic pregnancy. These non-surgical modalities are alternatives to classical and laparoscopic management, eluding their associated morbidity and the drawback of general anesthesia [16].

The aim of this study is to highlight the valuable task of US in the diagnosis of CSP and its interventional radiological management.

METHODS

This prospective study included thirteen pregnant females in the first trimester diagnosed with CSP, their ages range from 28-41 years with a mean age of 34.6 ± 4.3 .

It was carried out in the period from February 2014 to November 2021.

Twelve of these patients were admitted to our institute prior to the termination of their pregnancy, and one was referred to us from another facility.

All thirteen patients were examined by pelvic ultrasound and only two of them required complementary MRI study.

Written informed consent was obtained from all participants, the study was approved by the research ethics committee of the Faculty of Medicine, Zagazig University. The study was done according to The Code of Ethics of the World Medical Association

(Declaration of Helsinki) for studies involving humans.

Hemodynamic stable first trimester pregnant female with a history of previous CS and suspicious pelvic ultrasound by her obstetric physician either asymptomatic or symptomatic was included. We excluded any patients who refused to share in the study or had a normal ultrasound of intrauterine pregnancy.

All authors were observant of the cases since they were exactly involved in the initial US/MRI imaging diagnostic and/or US-guided local management via embryocidal injection.

Examination protocol:

All patients were subjected to Full history (name, age, marital status, gravidity, number of CS, and previous D&C).

CSP was diagnosed by transabdominal with or without TVUS (Philips EPIQ7, convex probe 1-6MHZ, and Endo cavitary probe 3-10 MHZ).

Six cases were diagnosed clearly by the transabdominal US approach only and five cases by TVUS. Only two cases needed complementary MRI after examination by both transabdominal and TVUS.

MRI examination using Siemens Magnetom Avanto, 1.5 Tesla was done using a pelvic coil for two cases. We used sagittal T2 fast spin-echo (FSE; TR=2380 ms, TE=48 ms, Echo train length =12, matrix=320x256, Bandwidth=31 Hz, FOV=180, Thickness=2 mm, Gap=0.2 mm). Sagittal, coronal, and axial FS T1(fat-suppressed, TR/TE=7/4.0, flip angle=90°, slices=24, resolution=1.37 x 1.37 mm, FOV=340, slice thickness=1.5 mm, gap=0.6 mm).

Conservative treatment by local utilization of MTX and KCL was performed via fetal intracardiac injection of 1 ml of 10% KCL under local anesthesia with lidocaine using a 20 G needle guided by ultrasound. The amniotic sac fluid was then extracted, and a dose of 1 mg/kg MTX was injected, split into one-fifth in 2 ml of normal saline. Each patient's extracted fluid was forwarded to the histopathology for trophoblast cell detection. D&C in our cases done under US guidance to minimize the drawbacks of routine blind maneuvers.

Beta subunit Human Chorionic Gonadotropin testing for (B-hCG) was done on a weekly basis till its quantity dropped below 5 mIU/mL. Every week, a follow-up US was done till confirmed no intrauterine contents were.

Statistical analysis:

SPSS version 18.0, Windows XP, and Excel were used to calculate all statistics.

RESULTS

The mean maternal age was 34.6 ± 4.3 years when parity and mean gravity were 4.5 ± 1.4 and 2.5 ± 1.2 correspondingly. The mean number of prior CS and D&C were 2.5 ± 1.2 and 1 ± 1.2 respectively. The mean of time passed between existing CSP and prior CS was 2.6 ± 1.6 years. The mean gestational age at the time of assessment of CSP was 7 ± 1.3 weeks (Table 1).

Nine cases (69.2%) were clinically asymptomatic and discovered incidentally during routine first-trimester scanning. Two cases (15.4%) presented with vaginal bleeding and the other two (15.4%) had vague abdominal pain (Table 2).

All our cases were diagnosed by pelvic ultrasound as the mean myometrial girth between the sac and urinary bladder was 2.4 ± 0.9 mm and the mean distance between the fundal endometrial cavity and sac was 35.5 ± 2.5 mm (Table 3).

The following ultrasonography requirements were fulfilled: unfilled uterine cavity and endocervical canal; delineation of sac in the anterior part of the LUS at the expected site of CS niche. The significantly attenuated girth of intervening myometrium between the urinary bladder wall and the gestational sac [9].

Only two cases had a suspicion of marked myometrial thinning with questionable urinary bladder invasion. (Table 1): Participant's characteristics:

Cases (n)	Maternal Age (years)	Gravity and parity	Number of previous CS	Number of D&C	The time between last CS and CSP (years)
1	38	G5P3+1	3	1	2
2	40	G6P4+1	4	1	3
3	32	G3P2	2	0	1
4	30	G4P3	3	0	1
5	35	G5P2+2	2	2	2
6	31	G3P1+1	1	1	2
7	41	G7P5+1	5	1	4
8	33	G3P2	2	0	3
9	37	G4P1+2	1	2	2
10	36	G7P2+4	2	4	5
11	30	G4P3	3	0	2
12	28	G3P1+1	1	1	1
13	39	G4P3	3	0	6

Table (2): Clinical presenting symptoms of our patients:

Clinical presentation	Number of patients	percentage
Asymptomatic	9	69.2%
Vaginal bleeding	2	15.4%
Abdominal pain	2	15.4%
Total	13	100%

bladder invasion. MRI examination was done for confirmation of CSP and exclusion of urinary bladder invasion. When clear both uterine and endocervical cavities were identified, and a conception sac was seen implanted inside the CS niche, with significantly attenuated myometrium next to the sac, MRI criteria for CSP diagnosis were done. Protruding of the sac through the myometrium, either with or without bladder infiltration [10]. Seven weeks pregnant lady refused termination of pregnancy, with instruction to return for short-term follow-up. She returned in five days with spontaneous complete abortion with an eventual outcome.

The remaining twelve cases were managed conservatively, nine of them treated by local MTX and KCL injection under ultrasound guidance. Among them, only one case on follow-up failed to decline the B-hCG level with vaginal spotting. So, her physician decided to do suction evacuation under ultrasound guidance with a good prognosis.

Three cases were managed by D&C under intra-operative ultrasound guidance, one of them went in excessive bleeding and a significant drop in vital signs. Emergency hysterectomy is done with the eventual outcome (Table 4).

Table (3): The main ultrasound findings in CSP diagnosis:

Mean of Gestational age (weeks)	7+/-1.2
Mean sac diameter (mm)	21.6+/-8.8
Mean of Crown-rump length (mm)	10.5+/-4.7
Mean of myometrial thickness (mm)	2.4+/-0.96
Mean of distance between fundal endometrium and the sac (mm)	35.5+/-2.5
Mean of maternal age years)	34.6+/-4.3

Table (4): Treatment strategies used in our study:

Treatment modality	Number	Success	Failed	Hysterectomy
Local injection of methotrexate +/- KCL	9	8	1	0
D&C	3	2	1	1
Total	12	10	2	1

KCL (potassium chloride), D&C (Dilatation and curettage).

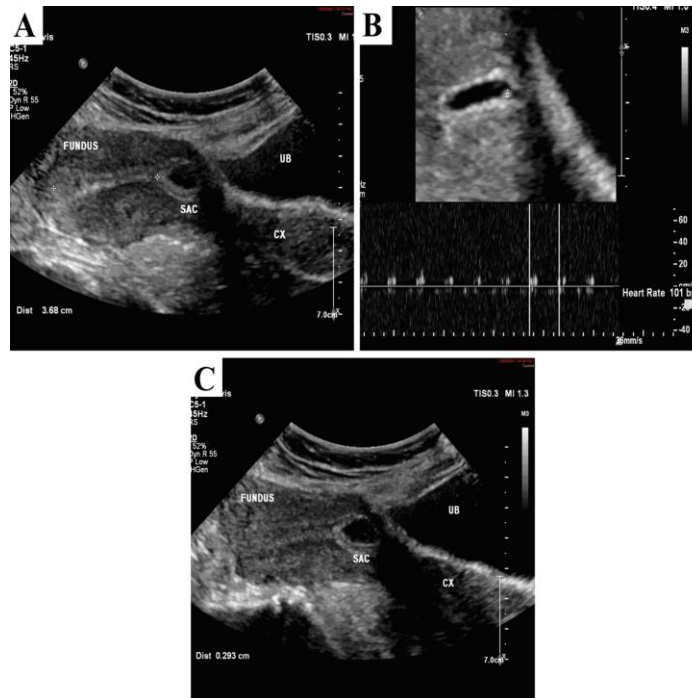


Figure (1): A; the pelvic US shows an intrauterine single gestational sac is about 3.7 cm away from the fundal endometrial cavity with an empty endocervical canal.
 B; viable fetal pole with fetal heart rate equals 101 beats per minute.
 C; abnormal location of the gestational sac at CS scar with 3 mm anterior myometrial wall thickness between the sac and UB.

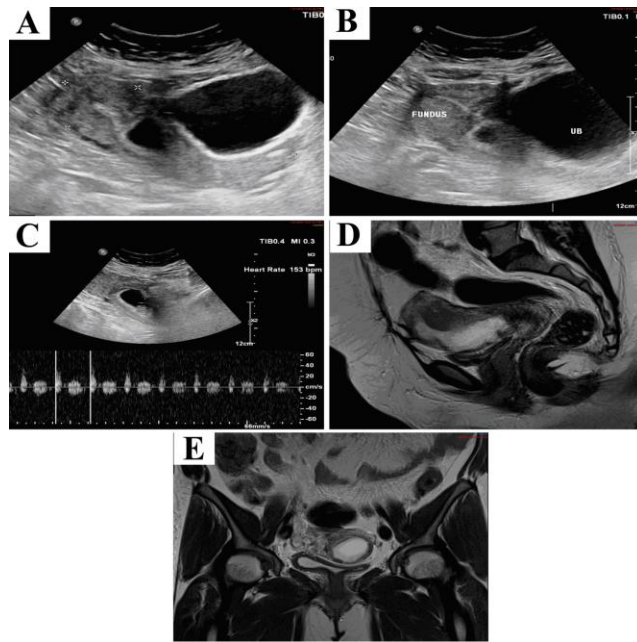


Figure (2): A and B; the pelvic US revealed low positioning of the intrauterine gestational sac with a 3 cm distance from the fundal endometrium. C; viable fetal pole with 180 beats per minute fetal heart rate. Questionable UB invasion is suspected by the US so, further MRI has been done. D; sagittal, E; axial, F; coronal T2WI confirmed the presence of CSP with thinning of the anterior myometrial wall, however, excluded the presence of any UB invasion.

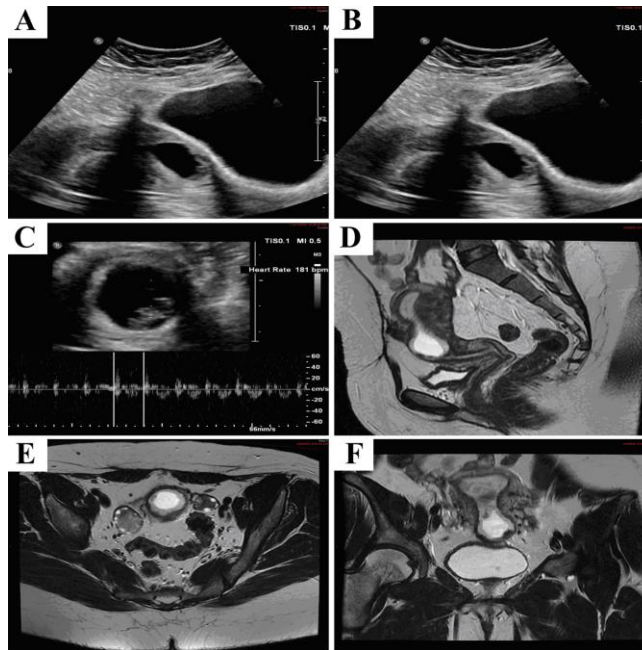


Figure (3): A and B; the pelvic US shows the abnormal location of the sac at CS scar intrauterine gestational sac with empty fundal endometrial cavity and endocervical canal. C; viable fetal pole with 153 beats per minute fetal heart rate. D; Sagittal and E; coronal T2WI MRI was done for confirmation of CSP with significant thinning of anterior myometrium.

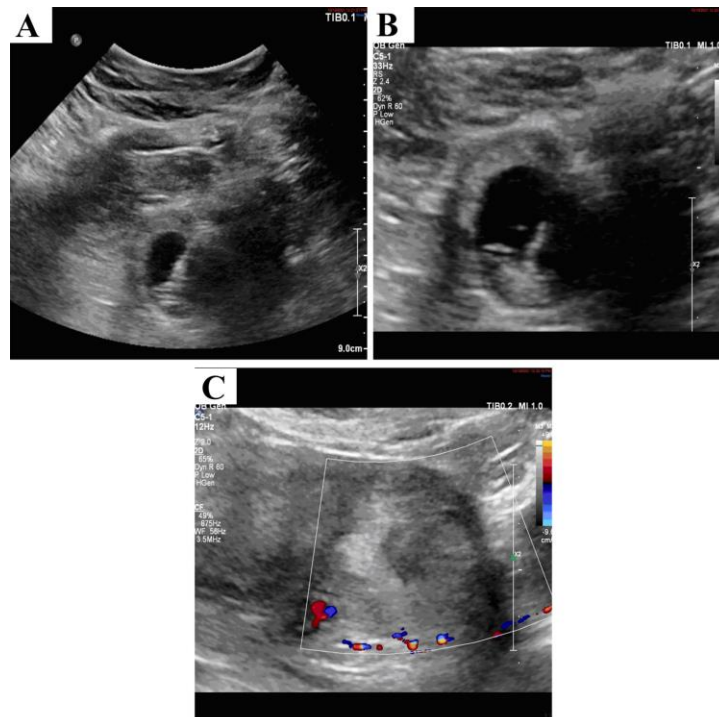


Figure (4): A and B; local injection of MTX and KCL under the pelvic ultrasound guidance shows the needle directed into the cardiac fetal activity. C; post aspiration of amniotic fluid and injection of MTX shows a nonvascular bulky heterogeneous anterior lower myometrial region without any fetal cardiac activity.

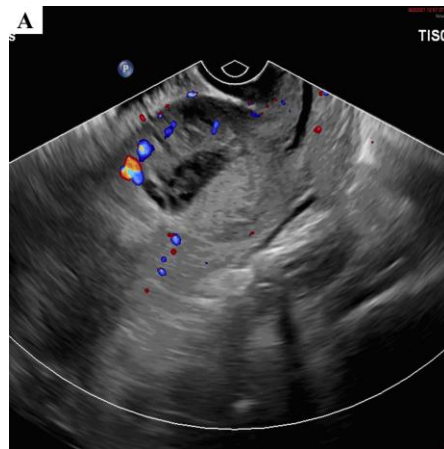


Figure (5): A; TVUS follow-up after local injection of MTX shows heterogeneous bulky anterior myometrium lower uterine segment with a central anechoic area and opened an endocervical canal. This case was represented by no dropping of B-hCG level and vaginal spotting so the decision was made to do the suction evacuation.

DISCUSSION

CSP was initially documented in 1978, and just 19 patients were recorded between 1978 and 2001 [5,17]. Meanwhile, the number of recorded reports has risen rapidly over the world, possibly as a result of rising cesarean section rates and better identification because of tremendous breakthroughs in diagnostic procedures [18-20]. Individual clinicians' inadequate recognition of CSP resulted in misdiagnosis [9]. Currently, pelvic

ultrasound is used to diagnose CSP, however other modalities such as MRI can help make a more specific diagnosis. As it is problematic to distinguish CSP from abortion in the progress or a cervical pregnancy, diagnosis of CSP can be delayed. Accurate diagnosis is critical for administering appropriate treatment and enhancing prognosis [21]. Because it gives the finest picture resolution, pelvic ultrasound is the best technique for evaluating suggested CSP [3]. If the pregnancy continues, MRI

may be useful in determining the extent of myometrial infiltration and degree of placenta accrete spectrum (PAS) [22]. Because pelvic ultrasound imaging is thought to be reliable in achieving a proper diagnosis, most physicians do not propose MRI as a standard utility of CSP management. However, MRI could be used as a supplement to ultrasonic imaging in circumstances when it is inconclusive [23]. Vaginal bleeding can occur in women who have had a cesarean birth. It's possible that abdominal pain isn't constantly present [1].

The current study included thirteen pregnant females diagnosed with first trimester CSP, their ages ranging from 28-41 years with mean age 34.6 ± 4.3 . Nine cases (69.2%) were asymptomatic, two cases (15.4%) presented with vaginal bleeding, and the other two cases (15.4%) presented with abdominal pain. Eleven out of thirteen cases were diagnosed sufficiently by pelvic US (Fig 1) while the other two cases had very thin myometrium with fear of possible bladder invasion as the US was inconclusive in those two cases (Figs.2, 3), so MRI was done for precious diagnosis and exclusion of bladder invasion. This is going with Awad et al [24], who stated that on TVUS, CSP was established in six patients, however, due to significant attenuation of the myometrium adjacent to the gestational sacs, an MRI was ordered to rule out the possibility of urinary bladder involvement.

In our two patients, MRI settled the CSP criteria with no signs of the uterine wall or urinary bladder invasion.

The minimum number of gravities was three times while the maximum number was seven times, all cases had at least one previous CS while a maximum number of prior CS was five times. Ten of our cases (77%) had two or more CS. Regarding the history of previous D&C, eight cases (61.5%) have one or more prior D&C, and five cases (33.5%) with no previous D&C.

In the study done by Kim et al [21], the mean age was 35.7 ± 3.8 years while the mean gravity and parity were 4.1 ± 1.4 and 1.7 ± 0.6 correspondingly. The number of prior CS was verified, and 24 (41.4%) of patients had one CS, 30 (51.7%) had two CS, 3 (5.2%) had three CS, and 1 (1.7%) had four CS. The mean number of prior D&C was 0.9 ± 1.1 . Our results stated that the mean age of our participants was 34.6 ± 4.3 years. The number of prior CS was confirmed and 3 (23%) patients had one CS, 4 (30.8%) had two CS, 4 (30.8%) had three CS, 1 (7.7%) had 4 CS and 1 (7.7%) had 5 C.S. The mean

gravity and parity were 4.5 ± 1.4 and 2.5 ± 1.2 respectively. The mean number of prior D&C was 1 ± 1.2 .

Management modalities

All cases involved in our study were managed in our institution.

The election of the management strategy is based on the patient's clinical condition and her physician's clinical experience [9].

Short-term monitoring is not advised because the risk of first-trimester problems rises as the pregnancy advances. This strategy is kept for the patient's desire to continue the pregnancy, unfortunately, the expected outcome of CSP may be an unprompted abortion [10].

One case among our participants preferred the former approach, presented after five days by spontaneous complete abortion without complications.

The most common conservative line is the local injection of MTX and KCL under ultrasound guidance by an expert interventional radiologist.

Parental administration of MTX has a success rate of roughly 95% in most cases of ectopic pregnancy. It does, however, have the disadvantage of having harmful side effects. (e.g stomatitis, dermatitis, hepatotoxicity, alopecia, vomiting, diarrhea, and bone marrow depression) [16]. Because CSP is embedded in a fibrous scar instead of typically healthy myometrium, systemic MTX absorption appears to be low [21]. The most significant potential benefits of local MTX over the systemic approach are its highest antitrophoblastic effect, short therapy time, the quantity is lowered, and drawbacks are minimal [16]. When the fetal cardiac rhythm is found in a CSP, targeted fetal reduction in situ and cardiac injection of KCL is usually chosen [15]. Nine of the remaining twelve patients underwent the local injection of MTX and KCL under US guide with success in eight cases (Fig. 4). Only one case failed to record a significant declination in serum B-hCG level with vaginal spotting. So, her physician's decision was suction evacuation under ultrasound guidance which came out without complications (Fig. 5).

Although D&C had a good cure rate, there was a 20% probability of needing an emergency hysterectomy due to significant hemorrhage [21].

Since the gestational sac is generally found in the incision scar, blind D&C should not be suggested for CSP. Curettage can't reach the pregnancy tissue and can cause life-threatening bleeding. Overcome this limitation by performing curettage under ultrasound

guidance by an experienced doctor, but still has the risk of hemorrhage [9].

The remaining three cases underwent D&C under the guidance of pelvic intra-operative ultrasound with success in two cases. Only one case experienced excessive vaginal bleeding with a drop of vital signs, so an emergency hysterectomy was done.

Main differential diagnosis of CSP in early pregnancy

Unprompted ongoing abortion can mimic CSP, however, the gestational sac will be found in the endometrial cavity. In addition, as the abortion progresses, the sac location and form will vary on short-range follow-up US examination. The facility to change the location of a failed pregnancy inside the endometrial cavity via transducer movement has been suggested to assist in distinguishing ongoing abortion in LUS from CSP. An additional point no fetal cardiac activity was recorded in abortion in progress [10]. All our cases involved in the study had recorded fetal cardiac activity by the time of diagnosis.

The second differential diagnosis is cervical ectopic pregnancy. The sac will be found in the endocervical cavity unlike being embedded in the anterior LUS. The myometrium persists unaffected [10].

Limitations and recommendations

Although our study is prospective, there was insufficient information on the next pregnancy. No available feedback about the long-term fertility of our successful treated patients.

We had several treatment regimens based on the preferences of each physician, and it was quite difficult to locate an absolutely reliable technique.

As a result, CSP treatment will necessitate randomized controlled studies.

Patients who have had a previous CS should have a routine pelvic ultrasound, which is critical for detecting CSP early.

Individual radiologists failed to recognize CSP, resulting in a misdiagnosis. It is critical to be talented to pick this uncommon entity as soon as feasible to provide effective management.

CONCLUSION

CSP is a rare subtype of all ectopic pregnancies, however, its misinterpretation will dramatically result in significant maternal mortality and morbidity. Pelvic ultrasound has the priority in its diagnosis but MRI is still an adjunct to the US in a few cases. Pelvic ultrasound has a magic role not only in the diagnosis but also in its management. Either local injection of MTX and KCL under

ultrasound guidance or D&C under ultrasound consider successful conservative modalities with significant radiology incorporation. Despite advances in diagnostic procedures and the publication of an increasing number of studies on CSP, CSP diagnosis and therapy remain difficult.

List of Abbreviations

CSP: cesarian scar pregnancy; CS: cesarian section; US: ultrasound; TVUS: transvaginal ultrasound; MRI: magnetic resonance imaging; MTX: methotrexate; KCL: potassium chloride; FSE: fast spin-echo; FS: fat-suppressed. D&C: dilatation and curettage. LUS: lower uterine segment; PAS: placenta accreta spectrum; B-hCG: Beta subunit Human Chorionic Gonadotropin.

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