

Role of Interventional Radiology in Management of C-Section Scar Ectopics

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Abstract. Background: Cesarean Scar Ectopic Pregnancy (CSEP) is an uncommon but potentially fatal syndrome defined by the implantation of the gestational sac inside the scar tissue of a prior cesarean surgery. The incidence of cesarean deliveries is rising, currently accounting for up to 6% of all ectopic pregnancies. CSEP causes unique challenges in diagnosis and treatment because it can lead to serious problems like uterine rupture, placenta accreta spectrum, bleeding, and infertility.

Case report: This report describes two patients with Type I CSEP who were treated by using a less invasive method that involved injecting methotrexate and potassium chloride (KCl) guided by ultrasound. Both patients showed improvement, quickly lost fetal heart activity, and had lower blood beta hCG levels without any issues during the procedure. Transvaginal ultrasonography was important in diagnosis and therapy planning. Interventional radiology approaches, especially image-guided targeted therapy, provide promising fertility-preserving options compared to the traditional surgery. The research backs this careful approach for patients who are stable, with Uterine Artery Embolization (UAE) being helpful in some cases.

Conclusion: Our study highlights the importance of using a team of specialists and shows that interventional radiology is a key part of improving treatment for CSEP, making it safer for patients, lowering risks of complications, and protecting their ability to have children in the future.

Keywords: cesarean scar pregnancy, transvaginal ultrasound, methotrexate, KCL.

Intervencinės radiologijos vaidmuo gydant cezario pjūvio randų negimdinį nėštumą

Santrauka. Įvadas: Cezario pjūvio randų negimdinis nėštumas (CSEP) yra retas, bet potencialiai mirtinas sindromas, kurį apibūdina vaisiaus maišelio implantacija ankstesnio cezario pjūvio operacijos randų audinyje. Gimdymų, kurie baigiami atliekant cezario pjūvį, dažnis didėja ir dabar sudaro iki 6 proc. visų negimdinio nėštumo atvejų. CSEP kelia unikalių iššūkių diagnozuojant ir gydant, nes gali sukelti rimtų problemų, pvz., gimdos plyšimą, *placenta accreta* spektrą, kraujavimą ir nevaisingumą.

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Atvejo aprašymas: Dvi pacientės su I tipo CSEP buvo gydytos mažiau invaziniu metodu, joms kontroliuojant ultragarsu buvo švirkščiamas metotreksato ir kalio chlorido (KCl). Abiejų pacienčių būklė pagerėjo, greitai normalizavosi vaisiaus širdies veikla, sumažėjo beta hCG kiekis kraujyje, o procedūros metu nekilo jokių problemų. Transvaginalinė ultragarsinė diagnostika buvo svarbi diagnozuojant ir planuojant gydymą. Intervencinės radiologijos metodai, ypač vaizdais paremta tikslinė terapija, yra perspektyvūs vaisingumo išsaugojimo būdai, palyginti su tradicine chirurgija. Tyrimai patvirtina šį atsargų požiūrį į stabilios būklės pacientės, kai tam tikrais atvejais gali padėti gimdos arterijų embolizacija.

Išvada: Mūsų tyrimas pabrėžia specialistų komandos svarbą ir rodo, kad intervencinė radiologija yra svarbi CSEP gydymo sudedamoji dalis, leidžia padidinti pacienčių saugumą, mažinti komplikacijų riziką ir išsaugoti pacienčių galimybę turėti vaikų.

Raktažodžiai: Cezario pjūvio randų negimdinis nėštumas, transvaginalinis ultragarsinis tyrimas, metotreksatas.

Introduction

Cesarean Scar Ectopic Pregnancy (CSEP) is a rare but potentially life-threatening type of ectopic gestation in which the embryo implants within the myometrial scar or defect of a previous cesarean section [1]. Its incidence has risen alongside increasing cesarean delivery rates, now accounting for approximately 6% of all ectopic pregnancies [2]. Unlike tubal ectopic pregnancies, cesarean scar ectopic pregnancies can progress and result in live births; however, they can also lead to catastrophic complications such as the placenta accreta spectrum, uterine rupture, life-threatening bleeding, and, in some cases, hysterectomy and loss of fertility [2,3].

In the absence of standardised treatment guidelines, therapeutic decisions are often tailored to individual circumstances based on the gestational age, clinical stability, reproductive wishes, and institutional expertise. Interventional radiology has increasingly taken on a prominent role in the conservative management of CSEP, by providing minimally invasive options that preserve fertility while reducing the risk of haemorrhagic complications [1]. This case series aims to contribute to the growing body of evidence advocating for multidisciplinary approaches in the management of CSEP, emphasising the importance of interventional techniques. Both patients gave consent for the procedure after counselling on the possible options (systemic methotrexate, surgical evacuation, UAE). Both patients explicitly chose fertility-preserving, minimum-intrusive treatment. Written informed consent for the publication of anonymised clinical facts and photographs was obtained from the two patients.

Case 1

A 38-year-old female, G5P2L2A2, presented to gynaecological emergency with complaints of BPV for 2 days following self-administration of the MTP pill. The patient also reported a history of one LSCS. Baseline serum beta hCG was 47,062 IU/ml. Emergency Transvaginal Sonography (TVS) revealed a gestational sac containing the fetus and observable cardiac activity in the lower uterine segment, with thinning of the overlying myometrium (Figure 1b). Based on the clinical scenario and imaging findings, a diagnosis of cesarean scar ectopic pregnancy was established.

Procedure. After a multidisciplinary team discussion, a minimally invasive transvaginal ultrasound (TVS)-guided intrasac injection of Methotrexate (50 mg) and intracardiac potassium chloride (2 ml of 15%) was proposed and agreed upon. By using transvaginal ultrasound guidance (Figure 1a), a 22-G Chiba needle was directed into the ectopic gestational sac (Figure 1c), and 50 mg of intrasac Methotrexate was injected. Following this, under continuous monitoring, the needle was inserted into the fetal heart, and intracardiac KCl (2 ml of 15%) was administered. Continuous ECG

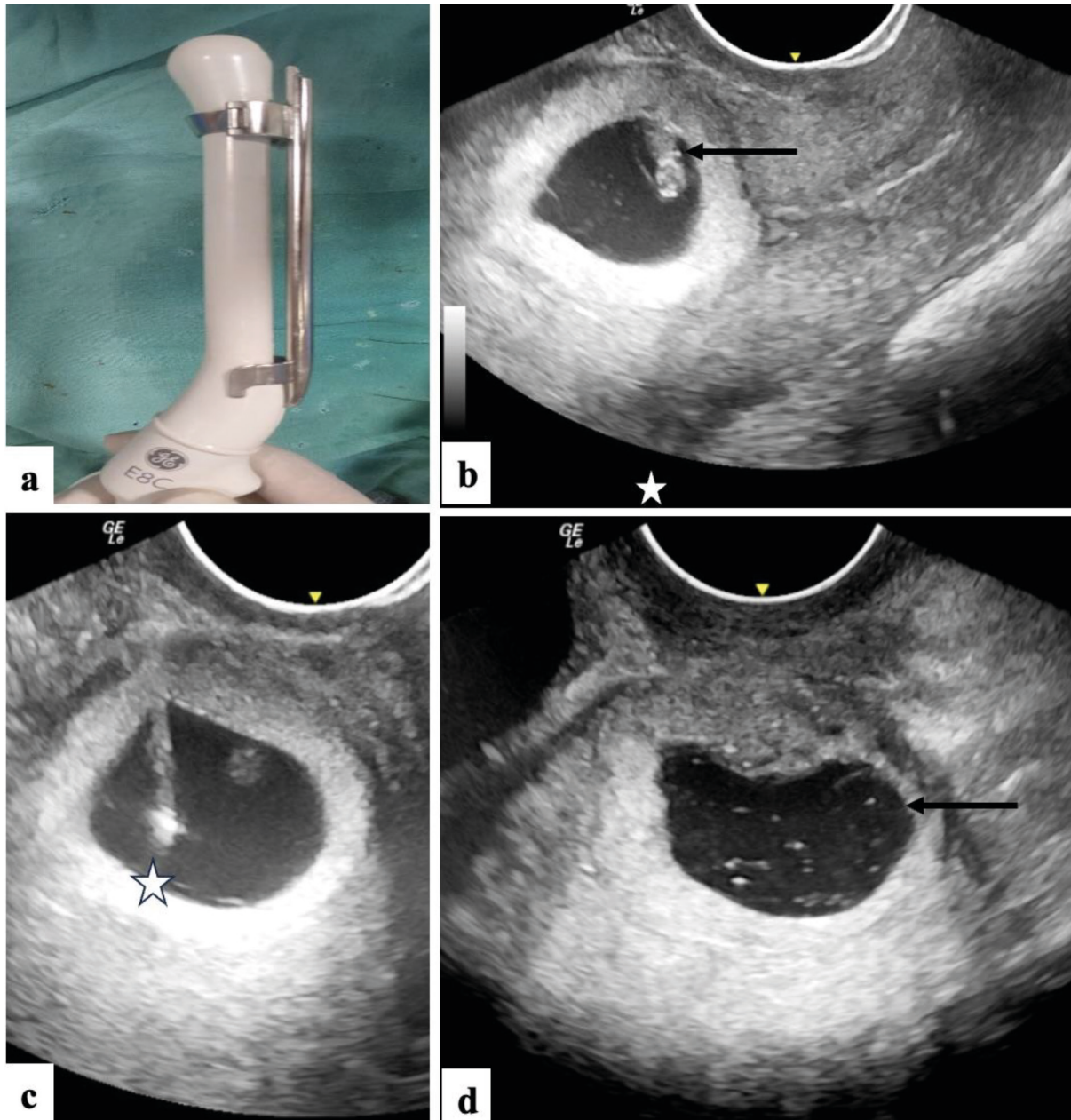


Figure 1. Figure 1a shows a transvaginal sonography (TVS) probe with a straight metallic frame for Chiba needle advancement. On TVS, there was an intrauterine gestational sac with a fetal pole (the black arrow) within it (Figure 1b). Under TVS guidance, the needle tip (shown as the star) was advanced into the gestational sac for the delivery of an intrasac injection of Methotrexate (50 mg) and intracardiac potassium chloride (2 ml of 15%). A 24-hour follow-up TVS shows an absence of fetal parts in the endometrial cavity (the black arrow).

monitoring was performed while administering the KCl to observe for signs of systemic toxicity. The procedure was uneventful, and no periprocedural complications were noted.

During the post-procedure follow-up, cardiac activity ceased 30 minutes after the injection (Figure 1d), and, by the following day, the patient's BPV had resolved. Two days after the procedure, the patient was discharged due to a declining trend in serum beta hCG, and the patient showed clinical improvement. The patient's serum beta-hCG levels returned to baseline by week 5.

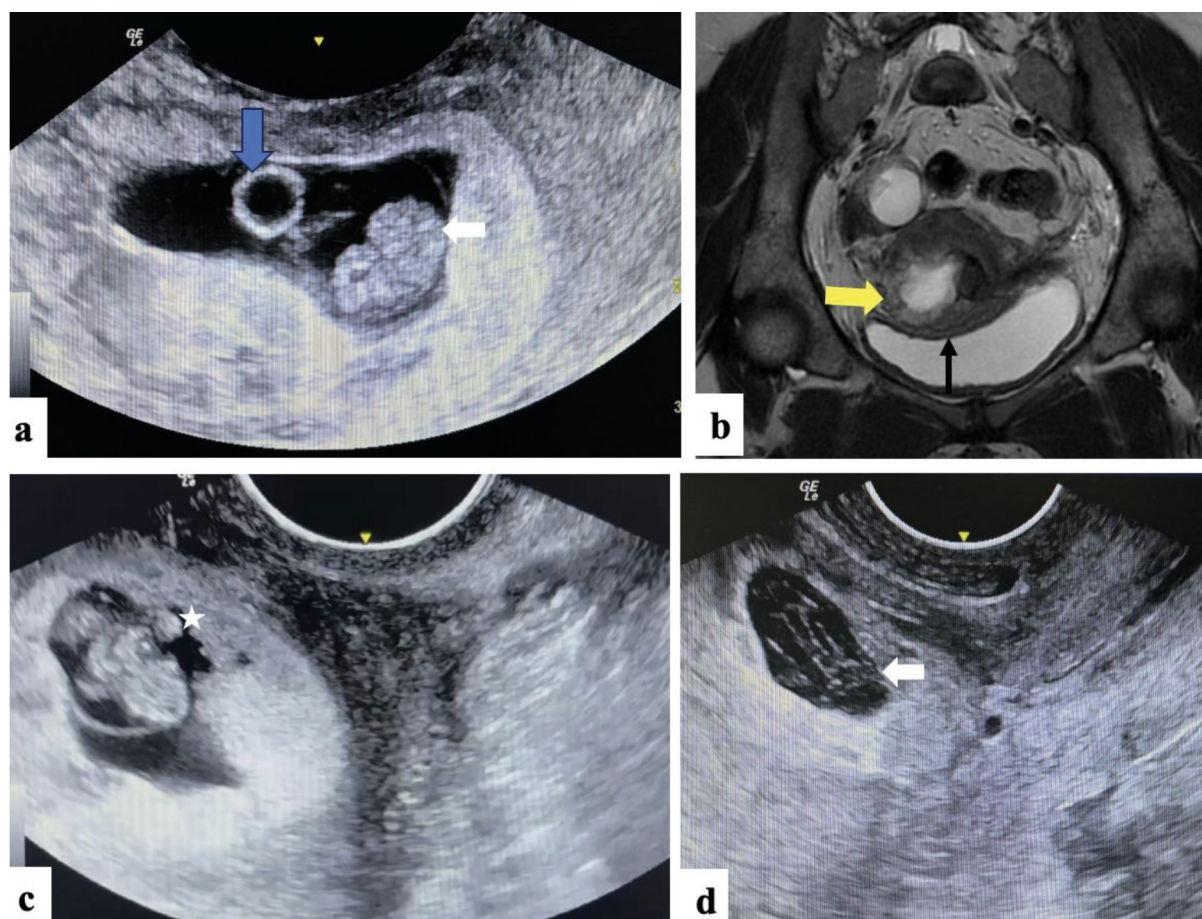


Figure 2. Section (a) displays an intrauterine gestational sac containing a fetal pole (the white arrow) and a yolk sac (the blue arrow); Section (b): A coronal T2-weighted MRI illustrates a gestational sac implanted in the lower uterine segment (the yellow arrow), with thinning of the overlying myometrium (the black arrow); Section (c): The needle tip (the star) is observed within the gestational sac during the injection of intra-sac Methotrexate (50 mg), followed by the administration of intracardiac potassium chloride (2 ml of 15%); Section (d): A 24-hour follow-up TVS reveals the absence of fetal parts in the endometrial cavity (the white arrow).

Case 2

A 35-year-old female, G5P3L2A1, presented to the gynaecological emergency with chief complaints of bleeding per vaginam (BPV), soaking 10–12 pads per day, and experiencing pain in the lower abdomen for two weeks. The patient had undergone three previous lower segment cesarean sections (LSCS) and one dilatation and curettage. She also provided a history of self-administration of the MTP pill following confirmation of pregnancy via a UPT kit. Upon examination, her general condition was fair, with a pulse of 82 per minute, a blood pressure of 108/72 mmHg, and mild pallor was noted.

TVS revealed a single intrauterine gestational sac adjacent to the lower uterine scar site, containing a fetal pole and yolk sac, with good cardiac activity, indicating a CRL of 7 weeks and 2 days (Figure 2a). A non-contrast MRI confirmed the cesarean scar ectopic pregnancy, showing a gestational sac in the anterior part of the lower uterine segment at the location of the cesarean scar (Figure 2b). The baseline S. Beta hCG measured 50,887 IU/ml. The patient was scheduled for conservative management and was initially treated with an intramuscular administration of 50 mg of Methotrexate. Following the methotrexate administration, the patient remained clinically stable; however, the S. Beta hCG remained elevated at 46,254 IU/ml, and BPV persisted. TVS-guided intrasac methotrexate and intracardiac KCl administration was planned due to the persistently elevated beta hCG.

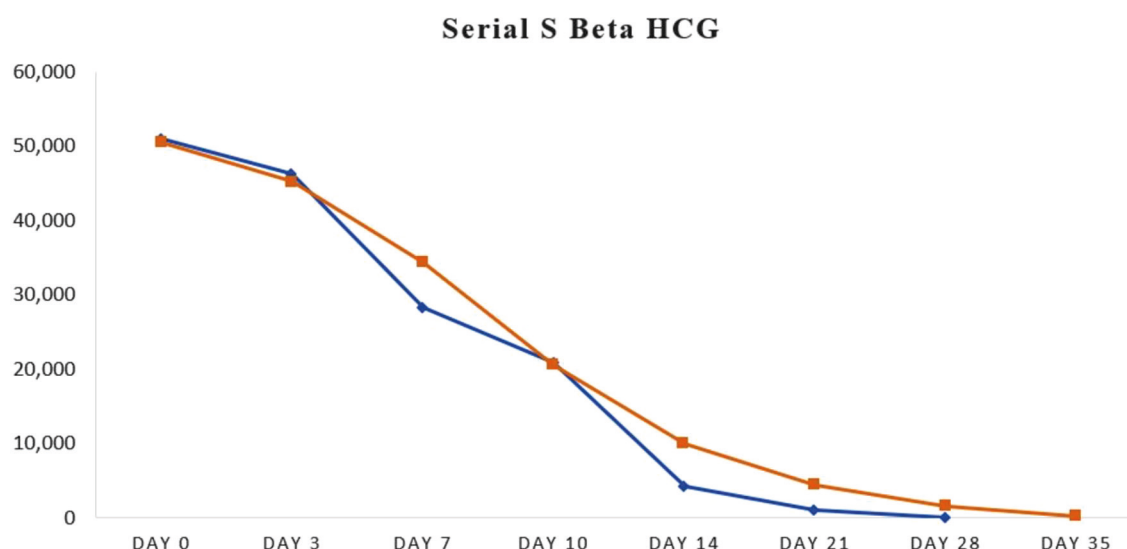


Figure 3. Line diagram depicting the serial serum beta hCG values for Case 1 (in red) and Case 2 (in blue), with the Y-axis representing the serum beta hCG values in IU/ml. Intervention was carried out on Day 0 for both cases.

Procedure. By using transvaginal ultrasound guidance, a 22-G Chiba needle was directed into the ectopic gestational sac (Figure 2c), and Methotrexate 50 mg was injected. Following this, under continuous monitoring, the needle was advanced into the fetal heart, and intracardiac KCl 2 ml (15%) was administered.

Continuous ECG monitoring was performed while administering KCl to detect signs of systemic toxicity. The procedure was uneventful, and no periprocedural complications were noted. On post-procedure follow-up, the cardiac activity ceased during the procedure (Figure 2d), and, by the following day, the patient's BPV had decreased to be spotted.

Two days post-procedure, the patient was discharged as a declining trend of serum beta HCG was observed, and the patient's clinical condition improved. The patient's serum beta-hCG levels returned to baseline within four weeks. Figure 3 illustrates the serial serum beta HCG levels in both cases during the pre- and post-procedural periods.

Discussion

CSEP is a subtype of ectopic pregnancy, where the gestational sac implants in the scar tissue of a previous cesarean delivery. Larsen and Solomon first described it in 1978 [4].

Two pathological types of CSEP have been reported in the literature. Type 1, or the Endogenic type, refers to cases where the gestational sac is implanted in the scar but grows towards the endometrial cavity. Type 2, or the Exogenic type, involves deep invasion of the gestational sac into the scar, progressing towards the bladder and abdominal cavity [5]. Both our cases were Type I CSEP.

Transvaginal ultrasound is the first-line investigation for the diagnosis of CSEP, with diagnostic clues on ultrasound including (a) the absence of an intrauterine gestation and an empty cervical canal, (b) a gestational sac located in the anterior isthmus, surrounded by scar tissue, and (c) Doppler evaluation showing that the gestational sac is surrounded by vascular flows denoted by high velocity and low impedance [6].

MRI can serve as a problem-solving tool in ambiguous cases and guide management [6,7]. It facilitates the easy identification of the cesarean scar, which appears as a T2 hypointense area in the lower uterine segment. The collection of findings, including an empty uterine cavity and endocer-

vical canal with the gestational sac at the scar site and localisation of placental tissue, enhances diagnostic confidence. Furthermore, MRI contributes to measuring the cesarean scar and assists in determining the associated risk in the case under consideration [7].

Given the numerous treatment options available and the lack of clear guidelines, management must be customised for each individual case, while taking into account the clinical features, haemodynamic status, serum hCG levels, imaging characteristics, and institutional preferences [1]. Table 1 outlines the available treatment options. Expectant management is reserved for instances where the patient declines consent for termination, and imaging reveals a small, endophytic CSEP with no fetal cardiac activity [1].

Table 1. Management options for CSEP

Expectant	In a selected few cases with optimum parameters
Medical	Systemic Methotrexate
Surgical	Dilatation and Curettage
	Suction and Evacuation
	Laparoscopic/Abdominal Resection
	Hysteroscopic resection
Interventional Radiology	USG-guided Targeted Injection
	Uterine Artery Embolization

Medical management involves systemic Methotrexate therapy. It offers the advantage of being non-invasive but carries a significant risk of haemorrhage. Several regimens have been recommended, with the most common approach being 50 mg/m² of Methotrexate administered intramuscularly and repeated weekly if necessary. A success rate of up to 80% has been reported in the literature with systemic Methotrexate therapy.

Surgical management is preferred in complicated cases, for haemodynamically unstable patients, and in situations where medical management has failed. Ideally, it should be performed before nine weeks to avoid complications. It can be used as a stand-alone treatment or in conjunction with systemic therapy to enhance the results. Surgical options include evacuation (Dilatation and Curettage), laparoscopic or abdominal resection, and hysteroscopic resection [9]. Resection of the gestational sac is preferably carried out via the hysteroscopic or laparoscopic route, with the hysteroscopic approach offering the advantage of lower complication rates [2,9].

Interventional radiology presents a promising therapeutic alternative for these patients, by employing minimally invasive techniques such as ultrasound-guided targeted injections and uterine artery embolisation. In our case, a USG-guided intrasac injection of Methotrexate (50 mg) and intracardiac potassium chloride (2 ml of 15%) was administered. Other embryocides, including etoposide and hyperosmolar glucose, have also been utilised [9]. Both transvaginal and transabdominal approaches are viable options; however, the transvaginal method is preferred due to its anatomical proximity, greater accuracy, and a reduced risk of visceral injury [9]. This approach was first reported in a case with elevated serum beta hCG titres and observed cardiac activity. The combined use of intrasac Methotrexate and intracardiac KCl has been reported to entail a decreased risk of haemorrhage and faster resolution rates [1]. In 2018, Kaur et al. indicated that the utilisation of intracardiac KCl for fetocide in CSEP is associated with a reduction in haemorrhage [10]. Gundewar et al. documented a case series of six patients managed with intrinsic Methotrexate and KCl, reporting no complications, an earlier restoration of normal menstruation, and normal fecundity [11].

Uterine Artery Embolisation (UAE) provides an endovascular method for managing CSEP. It can be employed in acutely haemorrhaging patients to control bleeding or as an adjunct prior to dilatation and curettage to minimise the risk of intraoperative bleeding. In 2018, Guo et al. compared the

efficacy of UAE with the laparoscopic management of CSEP and reported comparable efficacy for both treatment options, with UAE offering the additional benefits of reduced intraoperative blood loss and a decreased risk of hysterectomy, thereby enhancing the chances of preserving fertility [12].

Some authors have also reported on the use of transvaginal ultrasound-guided HIFU, either alone or in combination with suction and evacuation, for the successful management of CSEP [2].

In both instances, localized intrasac methotrexate combined with intracardiac KCl was favoured over systemic treatment alone owing to chronically elevated β -hCG levels, the presence of fetal cardiac activity, and the intention to avert surgical evacuation in a compromised uterus. The targeted injection facilitated rapid feticide and mitigated the haemorrhagic risks linked to dilatation and curettage, as well as the failure rates seen with systemic methotrexate. This case series comprises just two cases, rendering the results non-generalizable. The clinical trajectory and results may vary in bigger and more heterogeneous groups. Another limitation of this paper is the point that the follow-up duration was limited to the initial post-treatment clinical and biochemical recovery. Information about the subsequent fertility, recurrence, or future pregnancy outcomes was not accessible.

Conclusion

The management of cesarean scar ectopic pregnancies necessitates a tailored, multidisciplinary approach that prioritises patient safety, fertility preservation, and procedural efficacy. Our series highlights the crucial role of interventional radiology in optimising outcomes through minimally invasive techniques such as ultrasound-guided targeted therapies and UAE, particularly in haemodynamically stable patients or as adjuncts to surgical interventions. Systemic or intrasac methotrexate administration remains a cornerstone for early, unruptured cases, while laparoscopic or hysteroscopic resection with a concurrent scar repair demonstrates superior efficacy in refractory scenarios.

Author contributions

U. R.: conceptualisation, methodology, formal analysis, writing – original draft preparation, writing – review and editing, visualisation.

P. G.: conceptualisation, methodology, formal analysis, investigation, writing – original draft preparation, writing – review and editing.

G. S.: conceptualisation, methodology, formal analysis, investigation, writing – original draft preparation, writing – review and editing.

R. S.: conceptualisation, methodology, formal analysis, investigation, writing – original draft preparation, writing – review and editing.

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