



# Expectant management of viable cesarean scar pregnancies: a systematic review

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Received: 10 August 2022 / Accepted: 21 October 2022 / Published online: 17 November 2022  
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## Abstract

**Objective** Cesarean scar pregnancy (CSP) is a potentially life-threatening disease that has been steadily increasing in prevalence. Pregnancy termination is usually recommended given the risk of life-threatening complications. In some cases, patients refuse to terminate viable CSPs, even after counseling. Recent studies report that, even with a high burden of possible complications and maternal morbidity, many CSPs progress to live, close to term births. The aim of this study is to further demonstrate the natural history of viable cesarean scar pregnancies.

**Methods** We conducted a systematic review of original studies reporting cases of expectant management of CSPs with positive fetal heartbeats.

**Results** After selection, 28 studies were included in the review, with a total of 398 cases of CSP, 136 managed expectantly and 117 with positive fetal heartbeat managed expectantly. This study confirmed that the majority of patients experience live births, as 78% of patients selected for expectant management experienced live births at or close to term, with 79% developing morbidly adherent placenta, 55% requiring hysterectomy, and 40% having severe bleeding.

**Discussion** The optimal management protocol for CSP is still to be defined and more studies are needed to further elucidate this rare but rising disease. Our study provides information on the natural history of untreated CSPs and suggests that termination may not be the only option offered to the patient.

**Keywords** Cesarean scar pregnancy · Expectant management · Morbidly adherent placenta · Pregnancy termination · Ectopic pregnancy

### What does this study add to the clinical work

This review helps broaden the knowledge of cesarean scar pregnancies' natural history and contributes to the decision making of the clinician on whether to recommend termination in all cases.

## Introduction

Cesarean scar pregnancy (CSP) is a potentially life-threatening disease that has been steadily increasing in prevalence, following the worldwide rise of cesarean delivery [1, 2].

Defined as the development of the gestational sac in the hysterotomy scar, it is now considered an early form of morbidly adherent placenta (MAP) [3]. The risks of CSP include severe hemorrhage, uterine rupture, prematurity, MAP, hysterectomy, development of arteriovenous malformation and maternal death [4, 5].

The clinical presentation of CSP can vary greatly, as it may be asymptomatic in early pregnancy [1]. CSP can be diagnosed by abdominal or transvaginal ultrasound by the identification of an empty endometrial cavity, a placenta or gestational sac implanted in the anterior segment, in some cases filling the niche of the scar or bulging from it, and a thin or absent myometrial layer between gestational sac and bladder [1]. However, some cases can remain undiagnosed and present themselves as severe vaginal bleeding and abdominal pain [2].

Considering the severity of the possible outcomes, screening for early signs of CSP and MAP is now recommended, with a detailed evaluation of the uterus in the mid-sagittal plane to document the gestational sac location by transvaginal ultrasound [5].

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Following diagnosis, the patient should thoroughly be counseled on the possible outcomes and risks involved in this disease [6]. Many treatment options have been proposed, but there is no universally agreed upon management protocol [6, 7]. In the past, pregnancy termination was usually recommended given the risk of life-threatening complications, although recent evidence suggests that expectant management frequently results in live births complicated by placenta accreta spectrum disorder [7, 8].

It is of utmost importance to determine the pregnancy viability. If there is no yolk sac and/or embryo and/or fetal heartbeat, and this remains to be the case in regular new ultrasound examinations, the management could be restricted to sonographic and biochemical follow up [6]. Many studies have shown safety in conservative management of non-viable CSPs, with uncommon adverse outcomes [6, 9].

In some cases, however, patients refuse to terminate viable CSPs, even after counseling, based on their personal beliefs or their reluctance to terminate a pregnancy conceived after a long wait or by medical infertility treatments. Recent studies report that, even with a high burden of possible complications and maternal morbidity, many CSPs progress to live, close to term births [6]. This knowledge changes the options given during patient counseling—she must be informed that a placenta accreta and cesarean-hysterectomy may probably occur, but expectant management is a possibility [2, 6].

The aim of this systematic review is to update knowledge of the natural history of expectant management of cesarean scar pregnancies.

## Methods

Before data extraction, the review was registered with the PROSPERO International Prospective Register of Systematic Reviews (Registration No: CRD42022343548) following the PRISMA guidelines for protocols (PRISMA-P).

We conducted a systematic review of original studies reporting cases of expectant management of viable CSPs. An electronic search was performed using the MEDLINE, Embase, Web of Science and BVS databases on April 2022, utilizing combinations of MeSH terms and keywords variants for ‘Cesarean scar pregnancy’ (‘cesarean scar ectopic pregnancy’ or ‘c-section pregnancy’) and ‘expectant management’. Reference lists of relevant articles were also hand-searched. Reports were excluded if there were insufficient details of the outcomes. We considered all study designs including case reports, case series, comparative studies and controlled trials. We did not consider for inclusion other systematic or narrative reviews, editorials and opinion articles.

Study eligibility was assessed independently by 3 reviewers screening abstracts, and full text publications when required. Only full text articles in English were considered eligible for inclusion. Only studies including women diagnosed with single CSP by ultrasound, with positive fetal heartbeat and undergoing expectant management were included. Studies reporting only cases of CSP undergoing treatment were excluded, as were studies reporting only non-viable CSPs undergoing expectant management and reports of women diagnosed with heterotopic pregnancies. We included case series written by the same authors but had the care to remove the specific repeated cases when the authors made them clearly distinguishable.

The selected outcomes were uncomplicated miscarriage, complicated miscarriage (defined as the need of intervention or surgical treatment), severe bleeding (defined as the need for blood transfusions), uterine rupture, hysterectomy, live birth, MAP (diagnosed during surgery or histopathological examination), maternal death or other complications.

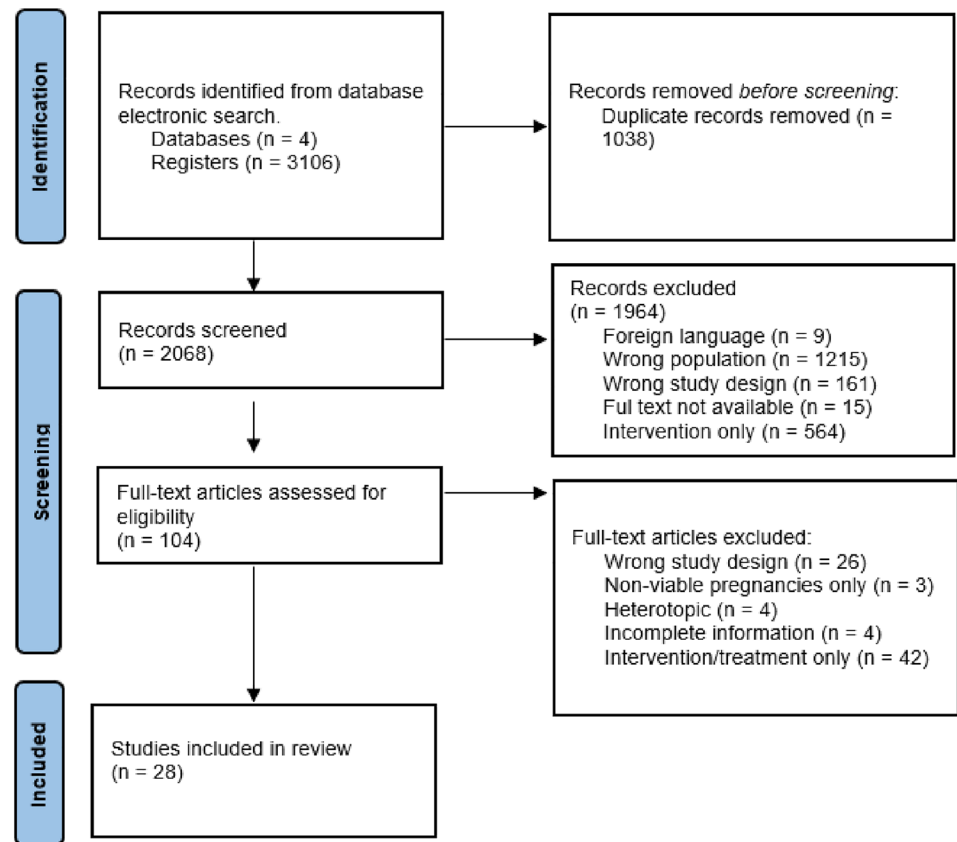
## Results

A total of 3106 articles were identified from the search, of which 104 were assessed for eligibility in full text (Fig. 1). After selection, 28 studies were included in the review, with a total of 398 cases of CSP, 136 managed expectantly and 117 with positive fetal heartbeat managed expectantly (Table 1).

The main weaknesses of the studies were the retrospective design, small sample size, lack of stratification according to position of the gestational sac and corresponding classification of the CSP, lack of detailed information on the volume of blood loss and interventions required, and incomplete information on the patients included in some studies. Also, we included case reports that could lead to publication bias.

The mean number of previous cesarean sections (CS) was rounded up whenever needed. Of all cases where the number of previous CSs were informed, the average was 1.6. Only 3 cases of CSP were reported as being a product of assisted reproduction.

Outcomes of viable CSPs managed expectantly are summarized in Table 2. Of the 117 cases of CSP with positive heartbeat managed expectantly, 6 cases experienced an uncomplicated miscarriage (5%), while 13 cases (11%) experienced complicated miscarriages that required treatment and surgical intervention. Uterine rupture occurred in 11 cases (9%), all required hysterectomies. Severe bleeding was reported in 47 cases (40%), either previous to or during surgeries. Of all cases, in 65 women hysterectomies were performed (55%).

**Fig. 1** Flowchart summarizing study selection

Ninety-two live births were the result of the 117 cases of viable CSPs (78%). Morbidly adherent placenta was reported in 81 cases, diagnoses either during surgery or by histopathological evaluation (69%). No maternal deaths were reported.

Other complications were reported in 11 cases, being prematurity the most frequent complication. One study reported 2 cases of infection leading to sepsis. One case reported a live fetus with prenatal diagnosis of neural tube defect sequence-type myelomeningocele-anencephaly-iniencephaly, but the patient refused termination due to religious beliefs, gave birth to a stillborn baby and a hysterectomy was performed. One study reported a case of preeclampsia, leading to an emergency cesarean section and hysterectomy at 29 weeks due to MAP. One study reported a case of placenta percreta, in which the placenta was implanted into the bladder.

## Discussion

This study confirmed that the majority of patients experience live births, at or close to term, during expectant management of CSP (78%), which are frequently complicated by MAP (69%) and need for hysterectomy (55%). This information needs to be part of the patient counseling, to provide all the

possibilities and help make an informed decision. In case the patient decides not to terminate the pregnancy, even knowing all possible outcomes, providers need to understand the natural history of CSP and how to manage it.

We found that 69% of cases progressed to MAP. Considering that other studies have demonstrated that CSP and MAP are part of the same spectrum of diseases, we believe this number may have been underestimated by publication bias or incomplete information of some reports [3, 5, 14].

There is still a high maternal morbidity related to expectant management of viable CSPs, with 40% of cases developing severe bleeding and 55% requiring hysterectomies. The risk of hysterectomy is reported to be 66% in cases of MAP [36].

Our finding of 11% cases of miscarriages in CSP patients that required surgical intervention was not higher than the need of unplanned surgical treatment in miscarriages in the general population, that can be as high as 28% [37]. However, we understand that said surgical interventions may be more severe than the usual curettage or aspiration required in the general population, as demonstrated by the 9 nine cases of uterine rupture (11%) in CSPs patients after miscarriages. This rate of uterine rupture in the first trimester was similar to that found by Cali et al (9.9% of CSP cases with positive fetal heartbeat) [2].

**Table 1** General characteristics of the 28 studies included

Study	Country	Study design	Period analyzed	Total cases of CSP	Total cases managed expectantly	Total CSPs with FHB	Total CSP without FHB
Maymon (2004) [10]	Israel	Retrospective (cohort)	1995–2002	8	2	1	1
Nagi (2005) [11]	UK	Retrospective (case report)	2005	1	1	1	0
El-Matary (2007) [12]	UK	Retrospective (case report)	2007	1	1	1	0
Timor-Tritsch (2011) [1]	USA	Retrospective (case series)	2009–2011	26	4	2	2
Abraham (2012) [13]	UK	Retrospective (case report)	2012	1	1	1	0
Sinha (2012) [14]	UK	Retrospective (case series)	NI	2	1	1	0
Ahmadi (2013) [15]	Iran	Retrospective (case report)	2013	1	1	1	0
Nishida (2013) [16]	Japan	Retrospective (case report)	2013	1	1	1	0
Michaels (2014) [4]	USA	Retrospective (case series)	2000–2012	34	11	8	3
Timor-Tritsch (2014) [3]	USA	Retrospective (case series)	2 years	10	10	10	0
Riaz (2015) [17]	USA	Retrospective (case series)	2008–2015	20	4	3	1
Timor-Tritsch (2015) [18]	USA	Retrospective (case series)	2009–2014	60	10	48	12
Zosmer (2015) [19]	UK	Prospective (case series)	2011–2013	10	10	10	0
Agten (2017) [20]	USA + Italy	Retrospective (case series)	2013–2015	17	17	17	0
Bennett (2017) [21]	USA	Retrospective (case report)	2017	1	1	1	0
Hsu (2017) [22]	Taiwan	Retrospective (case report)	2017	1	1	1	0
Tamada (2017) [23]	Japan	Retrospective (case report)	2016	1	1	1	0
Harb (2018) [24]	UK	Retrospective (cohort)	2013–2015	92	21	9	12
Ramkrishna (2018) [25]	Australia	Retrospective (cohort)	2003–2014	32	1	1	31
López (2019) [26]	Colombia	Retrospective (case report)	2019	1	1	1	0
Orhan (2019) [27]	Turkey	Retrospective (case series)	2011–2017	31	1	18	13
Kutlesic (2020) [28]	Serbia	Retrospective (case report)	2020	1	1	1	0
Lopez-Giron (2020) [29]	Colombia	Retrospective (case series)	2010–2019	10	3	3	0
Nieto-Calvache (2020) [30]	Colombia	Retrospective (case report)	2020	1	1	1	0
Suzuki (2020) [31]	Japan	Retrospective (case report)	2020	1	1	1	0
Yang (2021) [32]	China	Retrospective (case series)	2014–2018	13	8	13	0
Fu (2022) [33]	China	Retrospective (cohort)	2017–2020	21	21	21	0

CSP cesarean scar pregnancy, FHB fetal heartbeat

The strength of this study is its methodology for identifying all possible studies and the large number of cases reported of a rare disease, that even more scarcely is allowed to progress to the third trimester.

Our limitations include primarily the high risk of publication bias associated with including case reports. It is possible that only the most drastic outcomes were published or that the authors chose not to publish cases of maternal death. Also, their retrospective design and different follow up periods limit the quality of evidence.

We believe that the most relevant limitation involves the lack of stratification of the cases according to the position of the gestation sac. Some authors have already proposed classifications of CSP and their correlation likely prognosis, such as the COS criteria [34, 35]. The natural history of a pregnancy in which the gestational sac is implanted within the myometrial wall will probably

progress differently than a case in which the gestational sac is implanted above the endometrial line, but most studies included have not stratified the cases as such. The position of the gestational sac in relation to the scar and the endometrial line is determinant to the pregnancy's prognosis and natural history, therefore each classification of CSP should be treated differently [34]. Also, it is important that future studies and case reports use tools such as the COS criteria to stratify CSP cases [34].

The optimal management protocol for CSP is still to be defined and more studies are needed to further elucidate this rare but rising disease. Our study provides information on the natural history of untreated CSPs and suggests that expectant management should be offered along with termination, in the context of full informed consent about the risks and benefits of each.

**Table 2** Outcomes of viable CSPs managed expectantly

Study	Mean number of previous CS	Assisted reproductive conception	Uncomplicated miscarriage	Complicated miscarriage	Severe bleeding	Uterine rupture	Hysterectomy	Live births	MAP	Maternal deaths	Other complications
Maymon (2004) [10]	1	NI	0	0	1	1	1	1	1	0	None
Nagi (2005) [11]	3	0	0	0	1	0	1	1	1	0	None
El-Matary (2007) [12]	1	0	0	0	1	0	1	1	1	0	None
Timor-Tritsch (2011) [1]	1	NI	0	2	2	2	2	0	2	0	None
Abraham (2012) [13]	3	0	0	0	1	1	1	1	1	0	Prematurity (28 weeks)
Sinha (2012) [14]	1	NI	0	0	1	0	1	1	1	0	None
Ahmadi (2013) [15]	1	1	0	0	1	0	1	1	1	0	None
Nishida (2013) [16]	1	NI	0	1	1	0	1	1	1	0	None
Michaels (2014) [4]	NI	NI	3	0	NI	0	3	5	3	0	None
Timor-Tritsch (2014) [3]	1	NI	0	1	2	1	10	9	10	0	Bladder injury (1 case)
Riaz (2015) [17]	NI	NI	1	0	3	0	2	3	3	0	Prematurity
Timor-Tritsch (2015) [18]	NI	NI	0	5	1	3	8	4	3	0	Preterm live birth
Zosmer (2015) [19]	1.9	NI	0	0	6	0	8	10	10	0	None
Agten (2017) [20]	1.5	NI	0	0	5	0	9	14	8	0	None
Bennett (2017) [21]	2	NI	0	0	1	0	1	1	1	0	Fifth recurrence of CSP
Hsu (2017) [22]	3	NI	0	0	1	0	1	1	1	0	None
Tamada (2017) [23]	3	0	0	0	0	0	1	1	1	0	Preterm live birth
Harb (2018) [24]	NI	NI	2	1	2	1	4	5	3	0	Infection: 2
Ramkrishna (2018) [25]	NI	NI	0	0	1	NI	1	1	1	0	Preterm live birth
López (2019) [26]	2	0	0	0	1	0	1	1	1	0	None
Orhan (2019) [27]	1	NI	0	0	1	0	0	1	1	0	None
Kutlesic (2020) [28]	1	0	0	0	1	0	1	1	1	0	None
Lopez-Giron (2020) [29]	NI	NI	0	0	2	0	3	3	2	0	None
Nieto-Calvache (2020) [30]	2	0	0	0	1	0	1	0	1	0	Neural tube defect sequence—stillborn
Suzuki (2020) [31]	2	0	0	0	0	0	1	1	1	0	Preeclampsia, prematurity
Yang (2021) [32]	1	2	0	2	3	2	0	5	8	0	5 preterm live births
Fu (2022) [33]	NI	NI	0	1	7	0	1	20	14	0	1.5 preterm live births, 1 placenta praevia implanted into the bladder

CS Cesarean section, MAP morbidly adherent placenta, NI not informed

**Author contributions** PVM: project development, data collection, data analysis, manuscript writing. RFB: project development, manuscript editing. CFK: data collection, manuscript editing. LRH: data collection, manuscript editing. All authors contributed to this study. RFB envisioned this review, material preparation, data collection and analysis were performed by PVM, assisted by LRH and CFK. The first manuscript was written by PVM and all authors commented, edited and approved the final manuscript.

**Funding** No funds, grants, or other support was received. The authors have no financial or proprietary interests in any material discussed in this article.

**Data availability** The data that support this systematic review and meta-analysis are available from the corresponding author, upon reasonable request.

## Declarations

**Conflict of interest** The authors declare that they have no conflict of interest.

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