Cesarean Scar Pregnancies and Their Management

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Agenda

▪ Definition
▪ Prevalence
▪ Risk Factors
▪ Pathogenesis
▪ Complications
▪ Diagnosis and differential diagnosis
▪ Management and follow-up
▪ Prevention
▪ Concluding remarks
Cesarean scar defect = uterine scar defect = uterine diverticulum = niche = isthmocele = pouch = sacculation

- no clear criteria for diagnosing a cesarean scar defect.
- May be described as thinning of the myometrium, an anechoic area with a depth of at least 1 mm, and indentation of the myometrium of at least 2-mm depth at the site of the cesarean scar.

Voet LF., BJOG. 2014
Longitudinal Section
Non-pregnant
Well-healed lower segment C/S scar

Longitudinal Section of a retroverted
Non-pregnant uterus
Highly deficient lower segment C/S scar
Schematic presentation of niche measurement

(1) niche depth (in the sagittal plane)

(2) residual myometrium (RM), from the serosal surface of the uterus to the apex of the niche

(3) adjacent myometrial thickness (AMT)

LF van der Voet, BJOG; 2013
Definition of CSP

• A relatively new type of **ectopic pregnancy**
  – related to the increasing number of cesarean deliveries
  – the advances in imaging technology

• **GS implanted in a previous cesarean scar** and is surrounded by myometrium and connective tissue.
  – Terminology; *scar pregnancy, cesarean scar pregnancy, cesarean ectopic pregnancy*.

Seow KM., Ultrasound Obstet Gynecol;2004*
Prevalence

• 6% of all ectopic pregnancies in women with at least 1 previous low uterine segment incision

• The incidence does not appear to correlate with the number of CD

• The estimated incidence of CSP is
  – 1 in 1688 pregnancies
  – 1 in 3000 in the general obstetric population
  – 1 in 2000 of all CD

Gonzalez N., J Min Inv Gynecol; 2017
Parker VL., Arch Gynecol Obstet; 2016
Risk Factors
The myometrial Defect

- Previous C/S
- Previous D&C
- Adenomyosis,
- IVF
- IVF associated heterotopic CSP
- Metroplasty
- Myomectomy
- Manual removal of the placenta
Pathogenesis

Migration of the embryo through either a wedge defect in the lower uterine segment or a microscopic fistula within the scar

Roeder HA., reprod Sci., 2012
Yang OZ., J Ultrasound Med., 2014
Pathogenesis

- **impaired healing of the cesarean incision**
  - Factors predisposing to poor wound healing:
    - inadequate closure of the uterine incision,
    - postoperative infections,
    - impaired health conditions; diabetes or collagen disturbances
    - decreased blood flow to the affected tissue predisposes incomplete or delayed healing.
    - Clinically, a short interval between the cesarean pregnancy and a subsequent pregnancy
Uterine Closure Technique

• Whether the technique of uterine closure during cesarean sections (i.e., either single or double uterine closure) correlates with the occurrence of CSP remains unclear

Rotas MA., Obstet Gynecol. 2006
low- to moderate-quality evidence that single- and double-layer closure of the uterine incision following CD are associated with similar incidences of uterine scar defects detected by ultrasound after CD, and uterine dehiscence and rupture in subsequent pregnancy
Types of CSP

• **Type I, endogenic type:** Progression to the cervicoisthmic space or uterine cavity
  – could result in a viable pregnancy but with a high risk of bleeding at the placental site.

• **Type II, exogenic type:** Deep invasion of a scar defect with progression toward the bladder and abdominal cavity.
  – could be complicated with uterine rupture and bleeding early in pregnancy.
Type I, Endogenic
Type II, Exogenic
• CSP implanted “on the scar” had a substantially better outcome than CSP implanted “in the niche.”

• Myometrial thickness <2 mm in the first-trimester TVUS is associated with morbidly adherent placenta at delivery.
FIGURE 1
Cesarean scar pregnancies implanted “on the scar”

A, Image of a well-healed, nondeficient cesarean scar. Grey scale B, ultrasound and C, color illustration of the placenta implanted “on top of” the scar. D, Power Doppler ultrasound image shows the rich vascular pattern in the area of the scar.


In CSP, the gestation sac is completely surrounded by myometrium and the fibrous tissue of the scar, quite separate from the endometrial cavity.

Clark SL, Obstet Gynecol; 1985
Complications

- Placental adhesion abnormalities
  - Placenta accreta X4-5
- Invasion of the bladder by the growing placenta
- Uterine rupture with catastrophic haemorrhage
- Risk of hysterectomy causing serious maternal morbidity
- Increased maternal morbidity and mortality
- Preterm labour
- Loss of future fertility

Ash A., BJOG; 2007
Miller DA., Am J Obstet Gynecol; 1997
CSP & Placenta accreta

• **CSP and placenta accreta share a common histology.**
  - deep invasion of the myometrium that could reach the uterine serosa.
  - Trophoblastic implantations in CSP and placenta accreta are histologically undistinguishable


• **Placenta accreta could be a progression of CSP.**

• The endometrium at the cesarean scar site differs from the rest of the endometrium
  - fewer leukocytes and less vascularization

FIGURE 4
Example of a patient with cesarean scar pregnancy implanted “in the niche” with placenta percreta at delivery

Images of case no. 16: A, Grey scale image of cesarean scar pregnancy implanted “in the niche” at 9 weeks gestation. B and C, In the second trimester, signs of morbidly adherent placenta are demonstrated: vascular lacunae, interrupted bladder line, myometrial thinning, and uterovesical hypervascularity. D, Uterus specimen after delivery.

Diagnosis

- Due to the serious consequences of CSP, **early diagnosis and management** are paramount
  - 1/3 of incidentally diagnosed CSP are asymptomatic
  - usually **non-specific symptoms**
  - The most common clinical finding is **vaginal bleeding**
  - 24.6% of cases **low abdominal pain ± vaginal bleeding**
  - GA at the time of diagnosis ranged from **5 to 16 weeks** with a mean of **7 ± 2.5 weeks**

*Riaz RM., Abdom Imaging; 2015
Zhang Y., J Obstet Gynaecol Res; 2013*
Ultrasound

• **The first-line diagnostic tool**

  – visualization of an empty uterine cavity;
  – Detection of the placenta and/or gestational sac embedded in a hysterotomy scar;
  – triangular gestational sac filling the niche of the scar;
  – thin (1–3 mm) or absent myometrial layer between the gestational sac and the bladder;
  – closed cervix and empty endocervical canal;
  – Presence of an embryonic/fetal pole and/or yolk sac with or without heart activity;
  – presence of a prominent, and at times rich, vascular pattern at or around the chorionic sac and placenta.

_Cali G., Ultrasound Obstet Gynecol; 2018_
A midline sagittal transvaginal image demonstrating a gestation sac implanted at the previous caesarean scar with an empty uterine cavity.

Maymon R, Hum Reprod 2004
US image of a sagittal section of uterus showing protrusion of the GS with fetus anteriorly through the scar, with empty uterine cavity at fundus.

Ash A., BJOG; 2007
In sagittal view of uterus, a straight line is drawn connecting internal cervical os and uterine fundus through endometrium (endometrial line; long yellow line). Gestational sac is identified and superior–inferior (S–I) diameter perpendicular to endometrial line is traced (short yellow line).
Figure 2 Ultrasound images of different types of crossover sign (COS) in pregnancies with morbidly adherent placenta: (a) COS-1, (b) COS-2+ and (c) COS-2−. B, bladder; C, cervix; CS, Cesarean scar; EL, endometrial line; GS, gestational sac; SID, superior–inferior diameter.
The Crossover Sign

- Cesarean scar pregnancy (CSP) is the precursor of Morbidly Adherent Placenta
  - Pl. accreta
  - Pl. percreta
  - Pl. increta

a positive “sliding sac sign” suggests an aborted IU pregnancy where the sac slides with a slight pressure of the endovaginal probe to the cervix, suggesting no intimate attachment between the sac and the uterus.

Timor-Tritsch IE., Am J Obstet Gynecol; 2012
Heterotopic CSP

Fig. 2 Ultrasound findings of a HCSP. Longitudinal section of the uterus showing the coexistence of an intrauterine pregnancy with a live embryo (F2, crown–rump length: 11.1 mm) and a gestational sac with a dead embryo (F1, crown–rump length: 3 mm) implanted into the lower segment Cesarean section scar in Case 9 at 7 + 4 weeks.

Ouyang Y., Reprod Biol Endocrinol; 2015
Sonographic Diagnosis of Cesarean Scar Pregnancy at 16 Weeks

Alison Smith, DMU,1 Alok Ash, FRCOG,2 Darryl Maxwell, FRCOG3

1 Emergency Gynaecology Unit, St. Thomas’ Hospital, London SE1 7EH, United Kingdom

• a case of a CSP diagnosed at 16 weeks
• The patient subsequently suffered a ruptured uterus, who was preserved at surgery

**Doppler US**

- Additional diagnostic information can be obtained by **colour flow Doppler**
  
  - **distinct circular peritrophoblastic perfusion** surrounding the gestation sac
  
  - with **pulsed Doppler functions** consistent with normal early pregnancy
    
    - a prominent **high-velocity** (peak velocity > 20 cm/second),
  
    - **low impedance** (pulsatility index < 1) flow velocity waveforms
  
  - **an aborted IU pregnancy** has no vascular flow bordering

*Jurkovic D, Obstet Gynecol; 1991*
The presence of a prominent, and at times rich, vascular pattern at or around the chorionic sac and placenta.
Doppler US helps in Differential Diagnosis

Peri-trophoblastic flow
CSP

No blood flow around the sac
“Missed Abortion”
• could be helpful when TV US + power Doppler US is inconclusive

• **T2-weighed sagittal section** is best to identify a cesarean scar defect, the trophoblastic layer, and the myometrium separately

• **does not detect placental invasion to the cesarean scar and its extension**

*Peng KW, Clin Radiol; 2015*
Sagittal T2 MRI:

- Implantation of GS in the anterior LUS with bulging of the anterior contour and thinning of the myometrium between GS and bladder (long arrows).
- Empty endometrial and cervical canals.
- CS scar is shown in the anterior lower abdominal wall (short arrows).

Elnashar A. Cesarean scar Pregnancy; 2015
Treatment of CSP

- No consensus yet
- Early treatment will provide the best results,
- most are combined treatments
  - expectant management,
  - medical management,
  - local treatment,
  - surgical approach
Treatment should be individualized, based on

• Medical Center capacity
  – Availability
  – Expertise of the clinicians

• Patient- Fertility status
  – Age
  – Number of children
  – Number of previous C/S
  – Clinical symptoms at presentation
  – Severity of symptoms

• CSP
  – Gestational age
  – Viability
  – Evidence of myometrial deficiency
  – Level of HCG
  – Thickness of covering myometrium
Treatment Objectives

• should be to perform feticide prior to rupture,

• to remove the gestation sac and to retain patient’s future fertility.

Ash A., BJOG; 2007
Outcome of Cesarean scar pregnancy managed expectantly: systematic review and meta-analysis

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- **Expectant management may be a reasonable option** for CSP with no detectable embryonic/fetal heart activity, as 70% of the included cases did not experience any major maternal complication and had an uncomplicated miscarriage.
Proposed algorithm for management of Cesarean scar pregnancy

CSP

With FHB

Available evidence-based counseling

Patient requests TOP

Select treatment; stop heart with no or minimal delay

Monitor hCG weekly; rescan and look for EMV

Patient wishes to continue pregnancy

Determine if placenta/gestational sac is on scar or within niche; measure RMT

Placenta/gestational sac within niche or RMT ≤ 5 mm: high risk for AIP (increta or percreta) and need for hysterectomy

Placenta/gestational sac on scar or RMT > 5 mm: low risk for AIP (accreta) and need for hysterectomy

Without FHB

Rescan in 3 days

No FHB after 3 scans or at 7 weeks by reliable dating

Follow hCG until zero
**Conservative medical treatment**

- **Systemic administration of MTX**
  - No reason to doubt its efficacy on CSP
  - in those with β-hCG levels < 5000 miu/ml
  - at a dose of 50 mg/m²

- appropriate for a woman who is **pain free** and **haemodynamically stable** with an **unruptured CSP of <8 GW** and a **myometrial thickness < 2 mm** between the CSP and the bladder

*Chuang J., BLOG; 2003*
Local injection of embryocides

- MTX
- potassium chloride
- hyperosmolar glucose
- crystalline trichosanthis

• 16-gauge **double-lumen oocyte-retrieval IVF needles** may be used to ensure better aspiration of the trophoblastic tissue via one lumen and injection of MTX through the other.

_Hwu YM., BJOG; 2005_
Combined medical treatment

• Local injection of 8 mEq KCl (2 mEq/ml) followed by 60mg of MTX injected into the GS,

• Direct injection of 3 ml of 50% glucose + oral MTX (2.5mg three times a day for 5 days),

• Multi-dose systemic MTX (1mg/kg) with alternate day folinic acid rescue,

• Failed systemic MTX followed by successful local MTX,

Donnez J., Br J Obstet Gynaecol; 1997
Uterine curettage

- **Blind uterine curettage as a primary treatment for CSP is insufficient and should be discouraged.**
  - not only the trophoblastic tissue is unreachable by the curette but also such attempts can potentially rupture the uterine scar leading to severe haemorrhage and cause more harm
  - Profuse bleeding during the procedure and absence of chorionic villi in the specimen obtained by curettage must prompt immediate laparoscopy/laparotomy.

Arslan M., Int J Gynecol Obstet; 2005
MTX and Suction Curettage

• Similar success rates compared with MTX treatment alone

• Can be preferred when the serum β-hCG <50 IU/L and US revealed the absence of blood flow velocity

Wang JH., Fertil Steril; 2009
Uterine Artery Embolization

• Adjuvant treatment of CS
  – an efficient treatment for bleeding prevention before curettage
  – embolization particles are a gelatin sponge or polyvinyl alcohol

• Concomitant use of UAE increases
  – the success rate of the primary treatment of CSP
  – it might be associated with decreased ovarian reserve, IUGR, premature delivery, placental abruption, or placenta accreta.

Lian F., Cardiovasc Intervent Radiol; 2012
Zhuang Y., Am J Obstet Gynecol; 2009
Hysteroscopic evacuation

- offers an important alternative treatment
  - with a short operative time (mean 36.7 ± 20.8 minutes),
  - less blood loss (mean 50.0 ± 0.0 ml),
  - short postoperative stay (mean 1.1 ± 0.9 days)
  - rapid return of the pregnancy test to negative (<4 weeks)

- The fertility is conserved after the surgery.

Primary open surgical treatment

- L/T followed by *wedge resection of the lesion (hysterotomy)* should be considered in women who do not respond to conservative medical and/or surgical treatments, present too late or if facilities and expertise for operative endoscopy are not available.

- **mandatory when uterine rupture is confirmed or strongly suspected**

- has the advantage of complete removal of the CSP and simultaneous repair of the scar, followed by a quick return of the β-hCG to normal level within 1–2 weeks.

- a larger surgical wound, longer hospital stay and longer recovery time, with a possible higher risk of a future placenta praevia accreta.

*Fylstra DL., Am J Obstet Gynecol; 2002*
Hysterectomy

- In case of failed all other treatment modalities

"CSP is a potentially serious condition despite advances in many of the diagnostic techniques and therapeutic measures."

Gonzalez N., JMIG; 2017
Laparoscopic Removal

- safe and less time consuming in trained hands,
  - The CSP mass is incised and the pregnancy tissue removed in an endobag,
  - Bleeding can be minimised by local injection of vasopressin (1 unit/ml, 5–10 ml),
  - haemostasis achieved by bipolar diathermy and the uterine defect closed with endoscopic suturing.

Wang YL., BJOG; 2006
Lee CL., Hum Reprod; 1999
Endoscopic Removal

• **Operative hysteroscopy** should be preferred for *Type I*, endogenic type

• **Laparoscopy** is more justified for a deeply implanted CSP growing towards the abdominal cavity and bladder (*Type II*, exogenic type)
Hysteroscopic removal of CSP

Empty uterine cavity with type-I endogenic CSP

Uterine cavity view after hysteroscopic removal of CSP

Xiaogang Zhu., Medicine; 2015
Randomized trials of treatment of CSP

<table>
<thead>
<tr>
<th>Author</th>
<th>Study period</th>
<th>Number of cases</th>
<th>Gestational age (weeks)</th>
<th>Intervention</th>
<th>Follow-up (months)</th>
<th>Success rate, n (%)</th>
<th>Conclusion</th>
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<td>Zhuang et al, 2003–2007 72</td>
<td>7.3 ± 0.2</td>
<td>UAE + D&amp;C</td>
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<td>35/37 (94.5) UAE followed by D&amp;C seems to be superior alternative for treatment</td>
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<td>2009 [50]</td>
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<td>Li et al, 2002–2009 44</td>
<td>7.4 ± 0.4</td>
<td>Systemic MTX + D&amp;C</td>
<td>33/35 (88.5) Uterine chemoembolization followed by D&amp;C is more effective than systemic MTX</td>
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<td>2011 [51]</td>
<td>10.3 ± 1.8</td>
<td>UAE with MTX and polyvinyl alcohol + D&amp;C</td>
<td>16/16 (100)</td>
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<td>9.8 ± 7.25</td>
<td>UAE with MTX and gelatin sponge + D&amp;C</td>
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<td>Peng et al, 2008–2013 104</td>
<td>9.7 ± 2.5</td>
<td>Systemic MTX + D&amp;C</td>
<td>10/13 (76.9)</td>
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<td>2015 [44]</td>
<td>7.9 ± 2.9</td>
<td>Local MTX</td>
<td>36/52 (69.2) Local and systemic MTX are both effective</td>
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<td>Qian et al, 2008–2013 66</td>
<td>8.0 ± 3.2</td>
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<td>2015 [53]</td>
<td>7.4 ± 1.6</td>
<td>UAE + D&amp;C + hysteroscopy</td>
<td>30/33 (90.9) Both treatments are equally effective</td>
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<td>Li et al, 2010–2014 144</td>
<td>7.3 ± 1.1</td>
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HIFU combined with suction curettage under hysteroscopic guidance is safe and effective in treating patients with CSP at gestational ages <8 weeks.
For patients who are searching for definitive symptom release and future children bearing plans,

- **HIFU treatment is a better therapeutic option** due to its significant lower adverse effects and better quality of life improvement than UAE treatment.
Concluding Remarks

• CSP remains rare; however, it may lead to severe hemorrhage

• Because *early diagnosis* and *treatment* are important for the best outcome, *every pregnant woman with history of a cesarean delivery should be screened early in the first trimester of pregnancy* to rule out this life-threatening complication

• Diagnosis can be achieved with *ultrasound and Doppler imaging*
Concluding Remarks

• Treatment should be individualized
  – Termination of pregnancy in the first trimester is strongly recommended
  – D&C should be avoided because it can lead to profuse bleeding and in many instances laparotomy and loss of the uterus
A Conservative Approach for CSP

• **Multidose MTX therapy** with or without *intra-amniotic and/or intrafetal injection of local KCl* when FHR is present.

• The dose of **MTX is 1 mg/kg** body weight intramuscularly on days 1, 3, 5, and 7 and oral leucovorin (0.1 mg/kg) on days 2, 4, 6, and 8.

• **Hysteroscopic removal of the gestation** for type I CSP or **laparoscopic excision** for type II CSP is performed when the hCG levels do not adequately decline or when the patient becomes symptomatic.

• **Hysterectomy is life saving** in profusely bleeding patients with scar dehiscence.
Thank you...