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VIETNAM - FRANCE - ASIA - PACIFIC
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16th

CESAREAN SCAR DEFECT

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Introduction

- Increase in prevalence of Cesarean section deliveries 6.2% ➔ 36% (average 21.1%)
- Rise in long-term complications
- Presence of a niche at the site of a CS scar on ultrasound imaging
- Many terms for the niche
- Growing number of published studies

Betrán AP *et al. Paediatr Perinat Epidemiol* 2007; **21**: 98–113.
Bij de Vaate AJ *et al. Ultrasound Obstet Gynecol.* 2014 Apr;43(4):372-82.

Alternative terms

- **Cesarean scar defect**
- Cesarean section uterine scar dehiscence
- Deficient Cesarean scar
- Diverticulum
- Pouch
- Isthmocele

Problems of Cesarean scar defect

1. Why did Cesarean scar defect occur?
2. Fluid-filled cavity at the site of CS incision
3. Symptoms
4. Role of detective methods
5. Indications of treatment Surgical intervention
6. Prevention

What is the Cesarean scar defect?

- Discontinuity of the myometrium at the site of C scar
- Triangular anechoic image in anterior lower uterus muscle/ transvaginal ultrasound ➔ niche
- Having obstetric and gynecological impacts on the sufferers

Prevalence

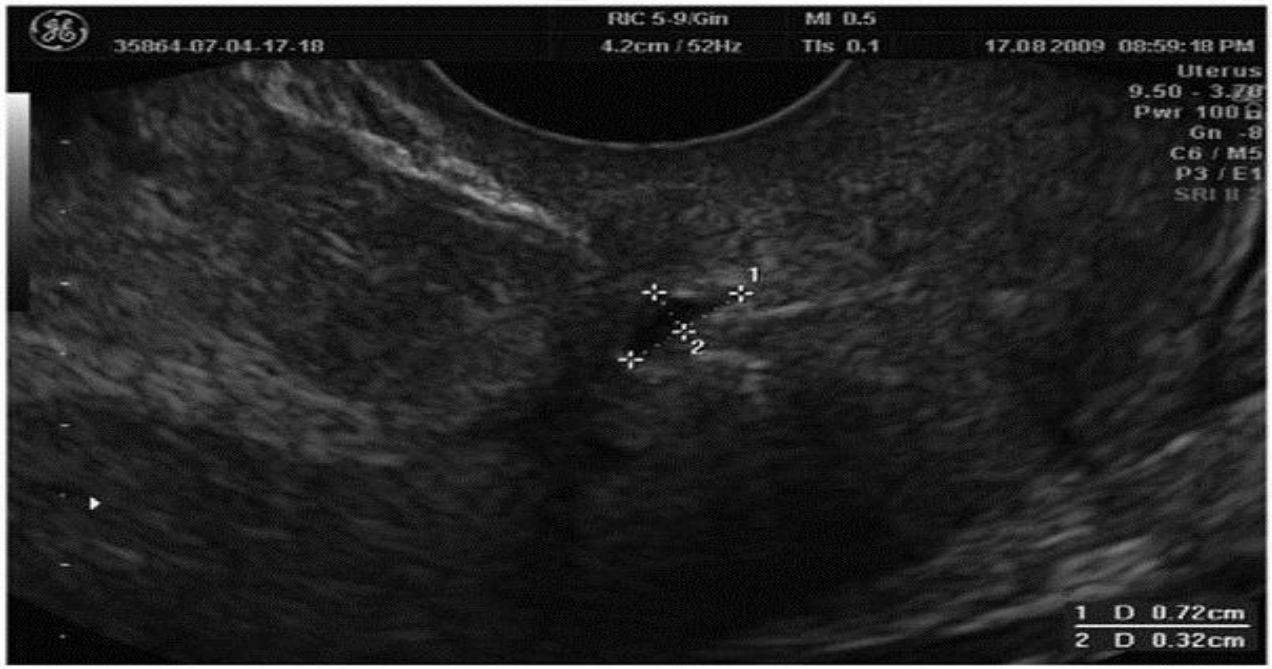
- Fabres *et al* (2003), Regnard *et al* (2004): 0.6% and 3.8%
- Ofili-Yebovi *et al* (2008) :

  → 99.1% Cesarean scars

  → 19.4% having evidence of deficient CS scars

  → 9.9% severe deficiency (loss > 50% of myometrium at the scar site)
- Osser *et al* (2009): any detectable thinning of myometrium 0.6%
- Wang *et al* (2009): defect in CS scar 6.6% - 69%


RIC 5-9/Gin
MI 0.6
55866-09-13-12-7
5.4cm / 46Hz
TIs 0.1
12.12.2011 01:18:22 PM
Uterus
9.50 - 3.70
Pwr 100
Gn -9
C6 / M5
P3 / E1
SRI II 2
1
2
1 D 0.75cm
2 D 0.71cm


RIC 5-9/Gin
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35864-07-04-17-18
4.2cm / 52Hz
TIs 0.1
17.08.2009 08:59:18 PM
Uterus
9.50 - 3.70
Pwr 100
Gn -8
C6 / M5
P3 / E1
SRI II 2
1
2
1 D 0.72cm
2 D 0.32cm


4
2

Causes

- Low segment Cesarean section, placenta previa, oxytocin augmentation…
- History of uterine surgeries: fibroid or uterine septum
- Risk factors: diabetes, emergency CS or lower uterine segment incision…

Bij de Vaate AJ *et al. Ultrasound Obstet Gynecol.* 2014 Apr;43(4):372-82.

Why did Cesarean scar defect occur?

- Closure technique during CS
- Development of lower uterine segment/ location of uterine incision
- Wound healing
- Other factors

Closure technique during CS

Yazicioglu et al (2006):

- 2 techniques among 98 patients
  - full-thickness, including the endometrial layer
  - split-thickness, excluding the endometrial layer
- Results: lower CS scar defect in full-thickness closure

➔ single-layer uterine closure may not be able to guarantee an accurate alignment of the uterine edges

Yazicioglu F. *et al. Eur J Obstet Gynecol Reprod Biol.* 2006; 124:32–36.

Lower uterine segment

- Benefits of the development of lower segment
  - Rich in fiber tissue ➔ good for wound healing
  - Thin myometrium, less hemorrhage ➔ easy for suturing
  - Low risk of uterine rupture
  - Low risk of adhesion-formation
  - Capable to suture single or multiple layers

Florio P *et al. Curr Opin Obstet Gynecol.* 2012 Jun;24(3):180-6.

Lower uterine segment

- Drawbacks of the development of lower segment
  - Differences in myometrial contraction on either side of the incision
  - Superior edge: thicker than inferior edge
  - Discrepancy of myometrial thickness increases consistently to the number of CS
  - Difficult to suture two incision edges evenly

Florio P *et al. Curr Opin Obstet Gynecol.* 2012 Jun;24(3):180-6.

Low uterine segment & scar

Hayakawa *et al* (2006)

→ Scar defect increase 2 times in uterine retroflexion

- Flexion point of the uterus: at the level of the internal os
- Lower segment of the uterus: places under a degree of tension
- Stretching and reduced vascular perfusion

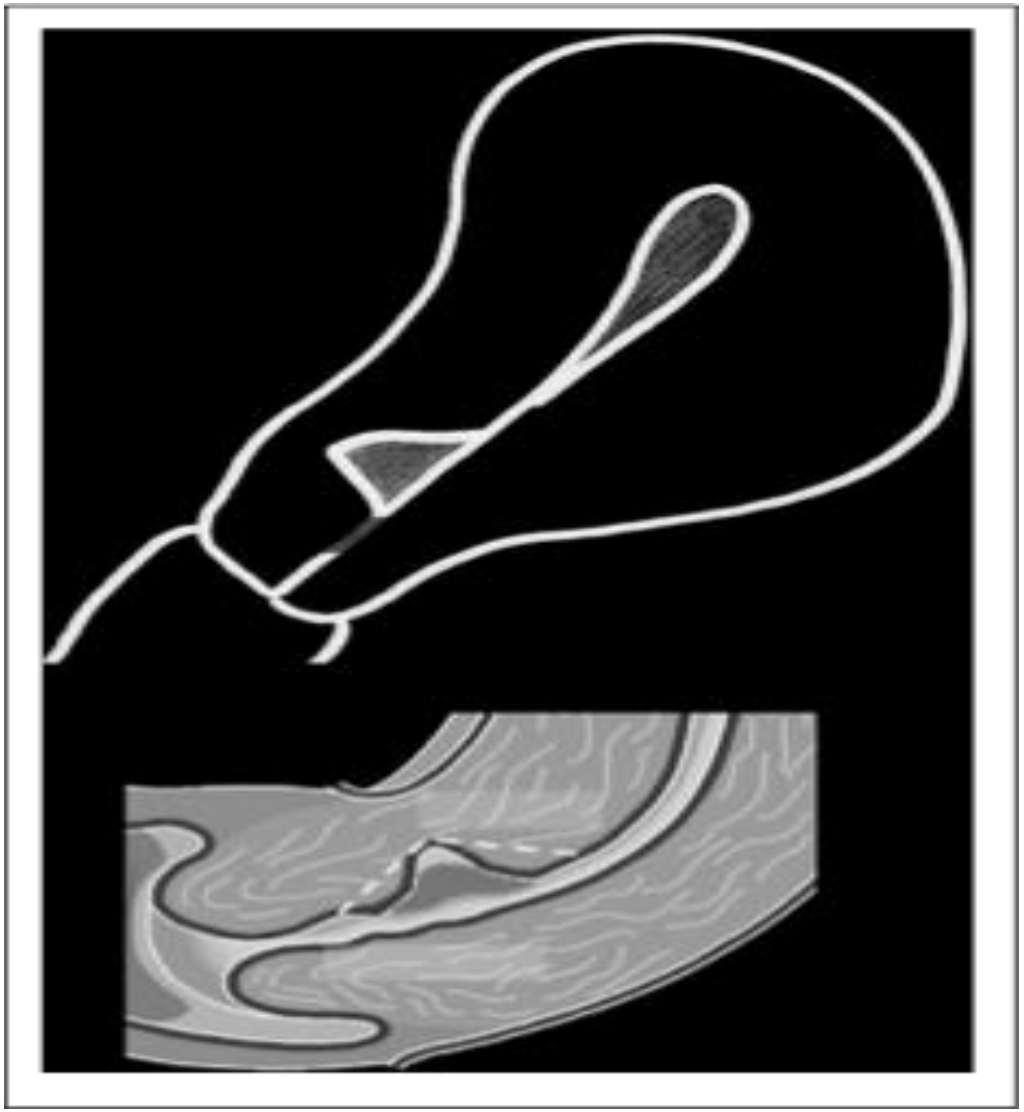
→ *delay wound healing*

→ Increased chances of scar defect:

- Presenting part of the fetus at CS: below the pelvic inlet
- Cervical dilatation ≥ 5 cm
- Duration of labor at CS ≥ 5 hours

Hayakawa H. *et al. Acta Obstet Gynecol Scand.* 2006; 85:429 – 434

Hốc (niche)



Niche formation

- **Thurmond (2004):**

1. Poor contractility of the uterine muscle around the scar ➔ accumulation of blood in the defect

2. Dilation of vascular vessel of myometrium, thin endometrium

➔ accelerated accumulation of menstrual blood

➔ Fluid-filled cavity (+)/ TVS

Thurmond AS, *et al*. J Ultrasound Med 1999; 18: 13–16.

Niche after Cesarean section

- Incidence 24-70% (TVS) and 56 -84% (SHG)
- Risk factors:
  - Single layer closure
  - Multiple Cesarean deliveries
  - Retroflexed uterus
- Main symptom → postmenstrual spotting

Bij de Vaate AJ *et al. Ultrasound Obstet Gynecol.* 2014 Apr;43(4):372-82.

Pathogenesis & related symptoms

1. Congested endometrial fold (61%), small polyps in the scar recess (16%) ➔ abnormal uterine bleeding

2. Lymphocytic infiltration (65%), distortion of the lower uterine segment (75%) ➔ chronic pelvic pain & dyspareunia

3. Adenomyosis confined to the scar (28%) ➔ dysmenorrhea

Wang *et al. Ultrasound Obstet Gynecol* 2009; **34**: 85–89

Gynecological symptoms

- Postmenstrual spotting
- Abnormal uterine bleeding
- Secondary infertility
- Embryo implantation failure
- Chronic pelvic pain
- Dysmenorrhea
- Dyspareunia

Wang *et al. Ultrasound Obstet Gynecol* 2009; **34**: 85–89

Gynecological symptoms

Wang *et al* (2009): 293 women with previous CS delivery, having Cesarean scar defects (+) / TVS

- Postmenstrual spotting (64%)
- Dysmenorrhea (53%)
- Chronic pelvic pain (40%)
- Dyspareunia (18%)

Wang *et al. Ultrasound Obstet Gynecol* 2009; **34**: 85–89

Obstetric complications

- Uterine rupture
- Placenta previa
- Placenta accreta
- Cesarean scar pregnancy

Wang *et al. Ultrasound Obstet Gynecol* 2009; **34**: 85–89

Infertility & CS scar defect

Thurmond (2004), Florio (2012):

Poor contractility of the uterine muscle around the scar

➔ old blood retention

- Obstruct sperm transport through the cervical canal & affect sperm quality
- Negatively influence the mucus quality
- Challenge to embryo transfer
- Toxic environment for embryo implantation

Thurmond AS, *et al*. *J Ultrasound Med* 1999; 18: 13–16
Florio P *et al. Curr Opin Obstet Gynecol.* 2012 Jun;24(3):180-6.

Infertility & CS scar defect

- Evidences supported the pathogenesis of secondary infertility associated to isthmocele
- Many surgical techniques to correct CS scar defect: combined laparoscopic-vaginal, purely vaginal
- Removal of the local inflamed and fibrosis tissue inside the niche
- Histological examination: inflammatory infiltration of the endocervix, fibrosis and necrotic tissue, endometriosis

Florio P *et al. Curr Opin Obstet Gynecol.* 2012 Jun;24(3):180-6.

Postmenstrual abnormal uterine bleeding

- **Fabres (2003):**
  - PAUB (+), presence of niche/TVS → 64%
  - Perimenopausal women, detectable niche/ TVS

  → 83% abnormal uterine bleeding & 76% PAUB
- **Bij de Vaate (2011):** 34% PAUB: highly related to niche in CS scar/ SHG & reversely
- **Other studies:**
  - PAUB: more frequent in women with diverticula
  - TVS: anechoic round structures, deformation of the cervical canal at the scar site
  - Relationship between the presence of a CS scar & PAUB

Bij de Vaate *et al. Ultrasound Obstet Gynecol* 2011; **37**: 93–99.
Menada Valenzano *et al. Gynecol Obstet Invest* 2006; **61**: 216–222.

Postmenstrual abnormal uterine bleeding

- **Wang (2009):** association bw niche features & PAUB
  - Depth or residual thickness→ no significant association
  - Defect width→ significantly correlated to PAUB, dysmenorrhea, chronic pelvic pain

- **Menada Valenzano (2006):** no association between the presence of a niche/SHG & abnormal uterine bleeding

Fabres *et al. J Ultrasound Med* 2003; **22**: 695–700.
Wang *et al. Ultrasound Obstet Gynecol* 2009; **34**: 85–89.

Table 1 Relationship between Cesarean scar defect dimensions, clinical symptoms and uterine position

	Defect width		*Defect depth*		*Residual myometrium thickness*	
	mm (mean ± SD)	P	*mm (mean ± SD)*	P	*mm (mean ± SD)*	P
Clinical symptoms						
Postmenstrual bleeding		< 0.001		0.440		0.922
Absent ($n = 76$)	5.04 ± 2.28		7.50 ± 2.28		4.78 ± 2.27	
Present ($n = 131$)	7.13 ± 3.85		7.76 ± 2.70		4.81 ± 2.21	
Dysmenorrhea		0.001		0.740		0.646
Absent ($n = 99$)	5.26 ± 2.59		7.51 ± 2.69		4.67 ± 2.18	
Present ($n = 108$)	7.36 ± 3.92		7.81 ± 2.43		4.91 ± 2.26	
Chronic pelvic pain		< 0.001		0.245		0.726
Absent ($n = 125$)	5.27 ± 2.60		7.48 ± 2.47		4.83 ± 2.31	
Present ($n = 82$)	8.08 ± 4.02		7.96 ± 2.67		4.75 ± 2.10	
Dyspareunia		0.686		0.984		0.630
Absent ($n = 169$)	6.19 ± 3.35		7.69 ± 2.55		4.79 ± 2.27	
Present ($n = 38$)	7.19 ± 4.10		7.56 ± 2.60		4.84 ± 2.06	
Uterine position		< 0.001		0.535		0.067
Anteflexed ($n = 174$)	5.94 ± 3.03		7.77 ± 2.55		4.97 ± 2.27	
Retroflexed ($n = 33$)	8.68 ± 4.84		7.10 ± 2.60		3.87 ± 1.78	

Wang *et al. Ultrasound Obstet Gynecol* 2009; **34**: 85–89.

Table 2 Relationship between the measured parameters of Cesarean scar defects and the number of previous Cesarean sections (CS)

Number of previous CS	*Defect width (mm (mean ± SD))*	*Defect depth (mm (mean ± SD))*	*Residual myometrium thickness (mm (mean ± SD))*
One ($n = 57$)	5.05 ± 3.04	7.33 ± 2.51	4.87 ± 2.42
Two or more ($n = 150$)	6.90 ± 3.56	8.53 ± 2.50	4.79 ± 2.16
P	0.001	0.002	0.822

Wang *et al. Ultrasound Obstet Gynecol* 2009; **34**: 85–89.

Diagnosis by TVS & SHG

- **Regnard (2004)**: SHG (+), niche whose depth was at least 80% of the anterior myometrium → dehiscence
- A triangular or semicircular anechoic area
  - **Monteagudo (2001)**→ niche
  - **Gubbini (2011)**→ isthmocele
- **SHG**: - Not change the niche shape

  - Capable to identify many niches

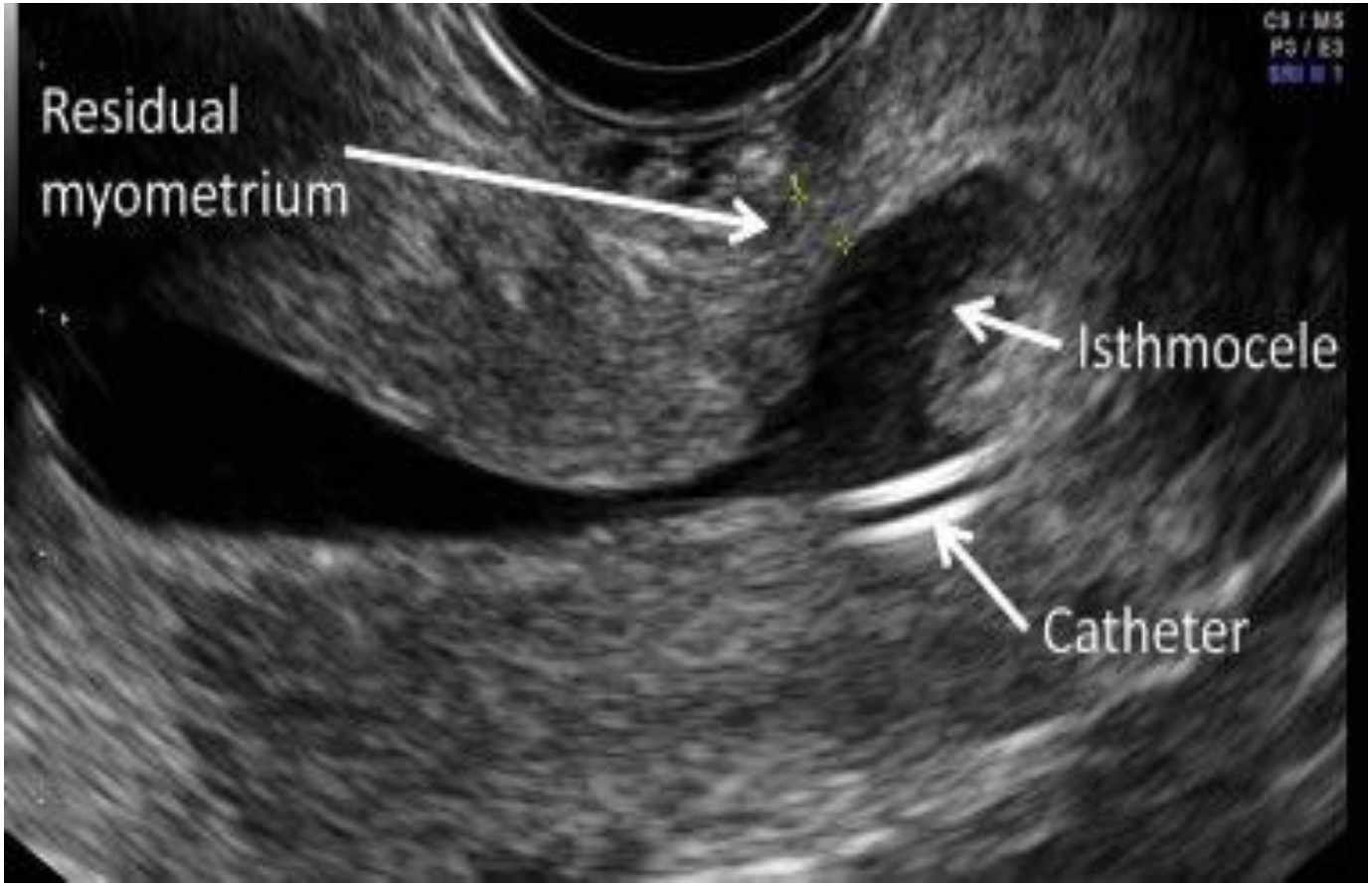
  - Easy to classify the niche

Monteagudo *et al. J Ultrasound Med.* 2001; **20**: 1105–1115.
Gubbini *et al.* J Minim Invasive Gynecol. 2011; 18:234–237.
Regnard *et al. Ultrasound Obstet Gynecol.* 2004; **23**: 289–292

TVS

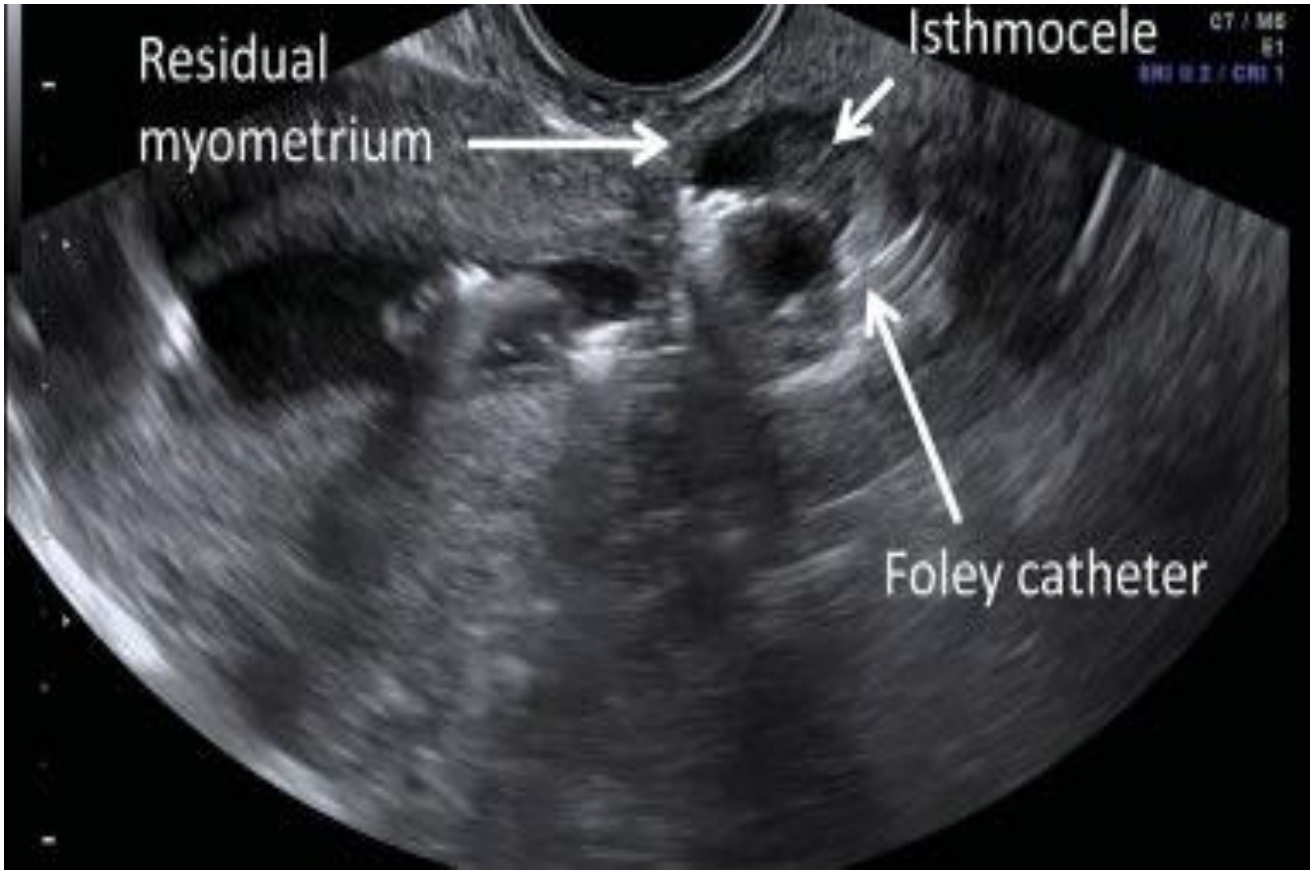
Florio P *et al. Curr Opin Obstet Gynecol.* 2012 Jun;24(3):180-6.

SHG



Florio P *et al. Curr Opin Obstet Gynecol.* 2012 Jun;24(3):180-6.

SHG



Florio P *et al. Curr Opin Obstet Gynecol.* 2012 Jun;24(3):180-6.

Hysteroscopy

- **Similarities between TVS and Hysteroscopy**:
  - High accuracy (100% correlation with hysteroscopy)
  - Similar PPV and NPV

- **TVS**:
  - Simple, non-invasive
  - Low-cost

→ First choice for screening and finding concomitant causes

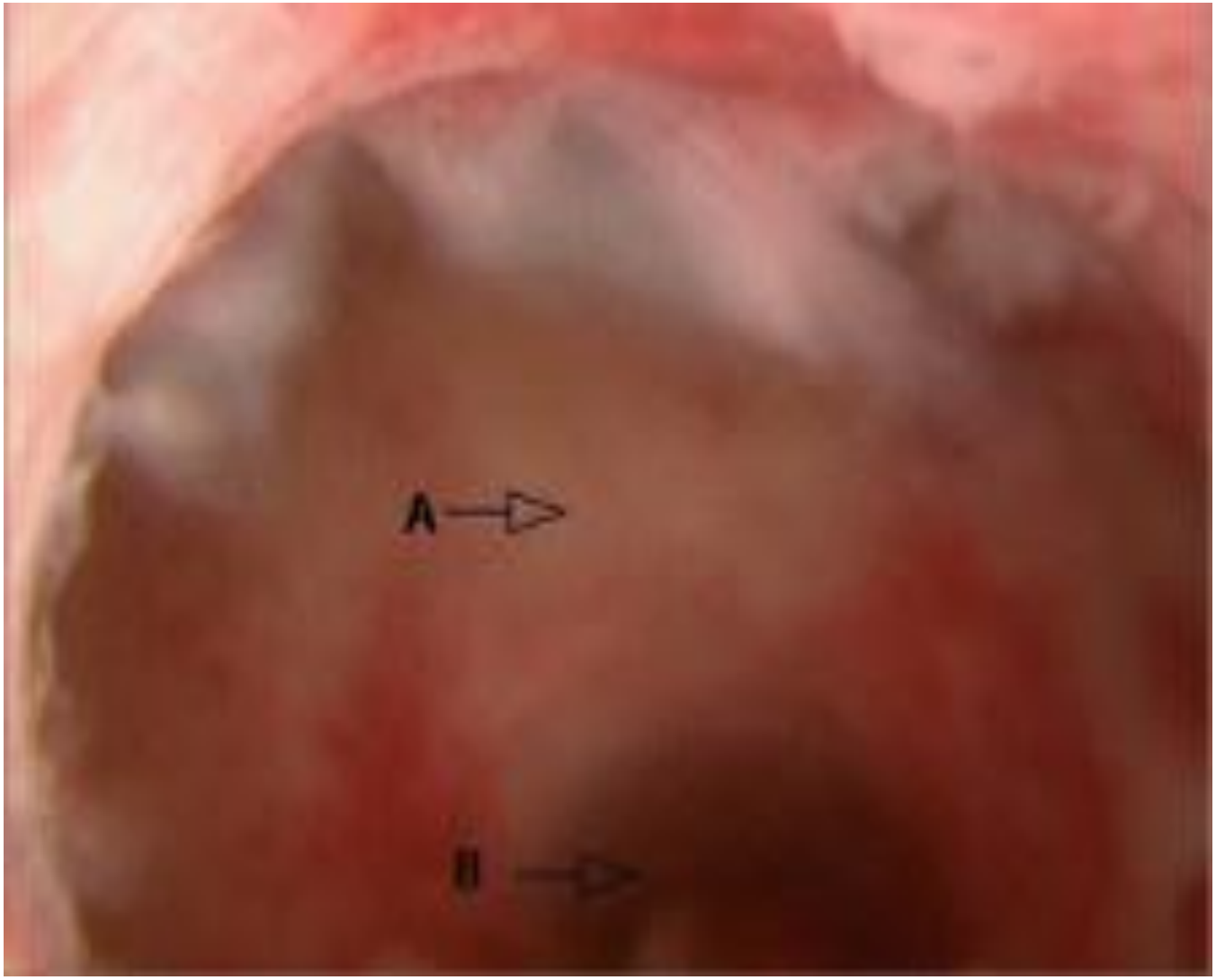
Hysteroscopy

- **Hysteroscopy evaluation**
  - Capable to diagnosis at emergency phase
  - Navigate pouch-like anatomic defect on the anterior wall of the isthmus or of the cervical canal
  - Lower part of the cervical canal ➔ CS in presence of cervical modification
  - Higher part ➔ previously underwent elective CS

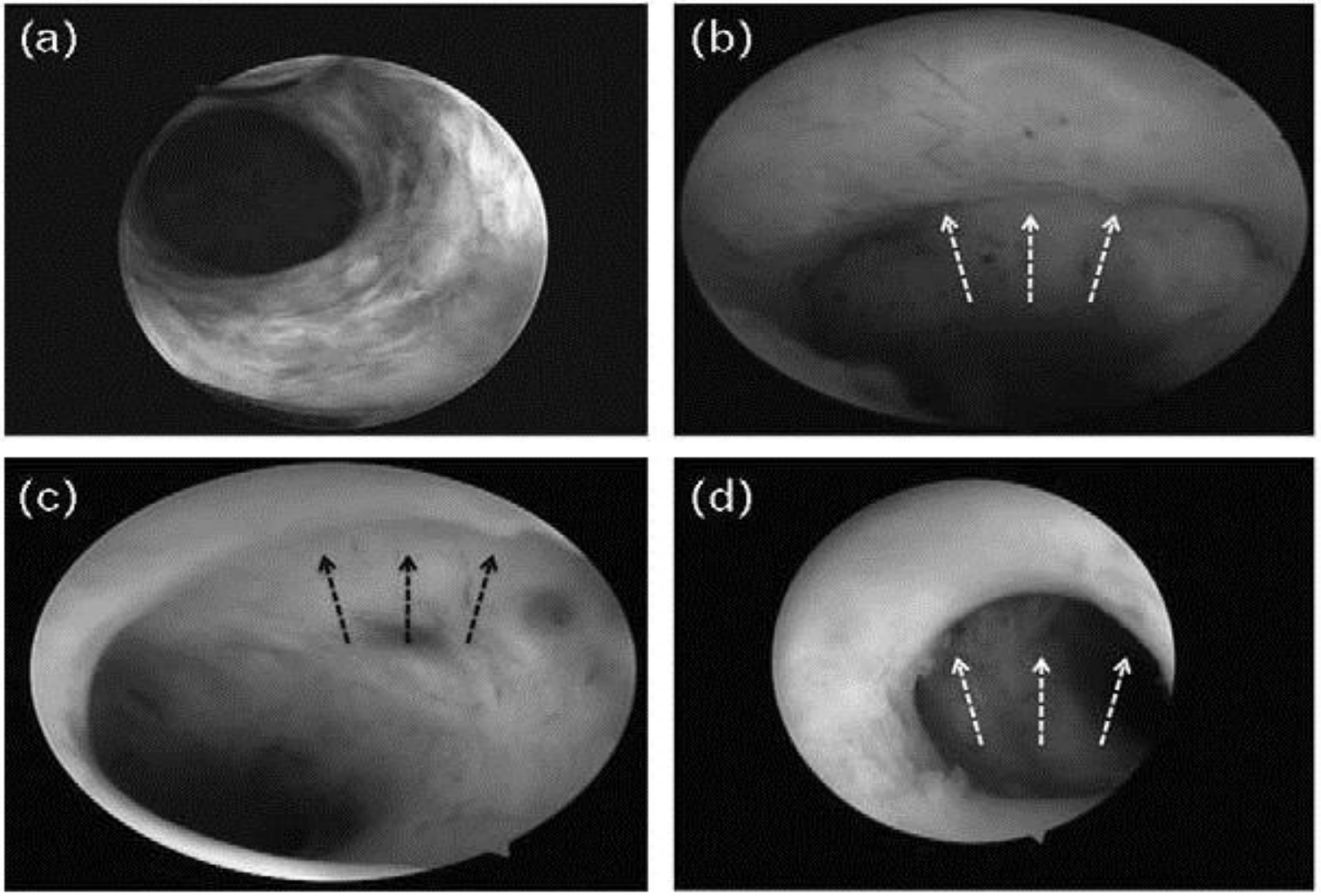
Gubbini *et al.* J Minim Invasive Gynecol. 2011; 18:234–237.
Florio P *et al. Curr Opin Obstet Gynecol.* 2012 Jun;24(3):180-6.

TVS

Hysteroscopy



Hysteroscopy

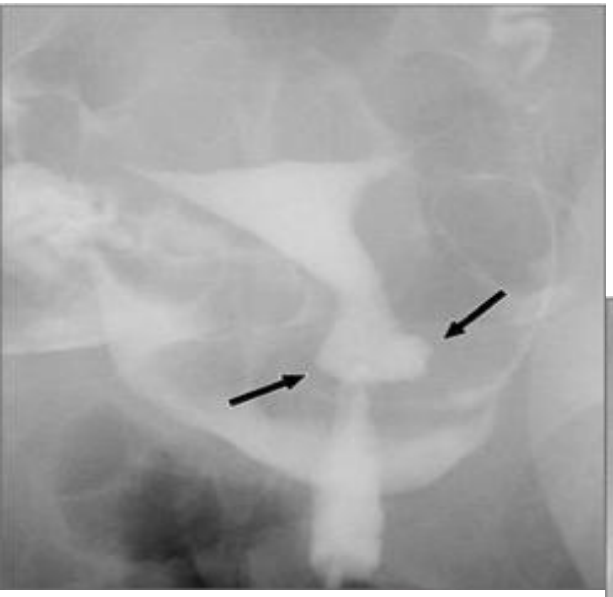


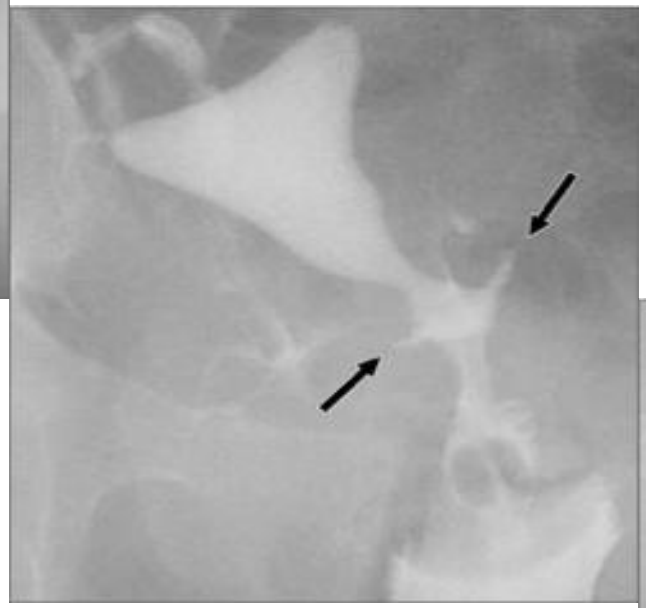
MRI

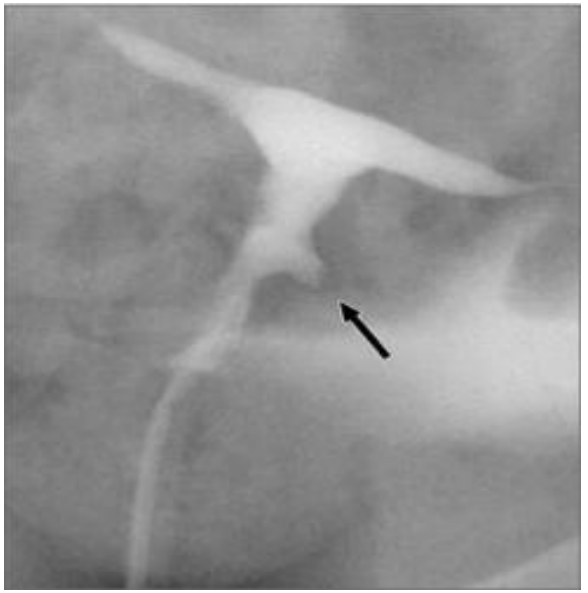
- Assess incision healing after CS deliveries
- No limitation in cases of obese constitution or gas in bower ➔ highly accuracy in evaluation the niche
- Differentiate tumor/ hematoma/ cyst
- Ongoing pregnancy + CS scar defect ➔ confirmatory diagnosis by MRI and subsequent follow-up by US
- Capable to diagnose the defect on the posterior wall due to myomectomy ➔ TVS not able to detect

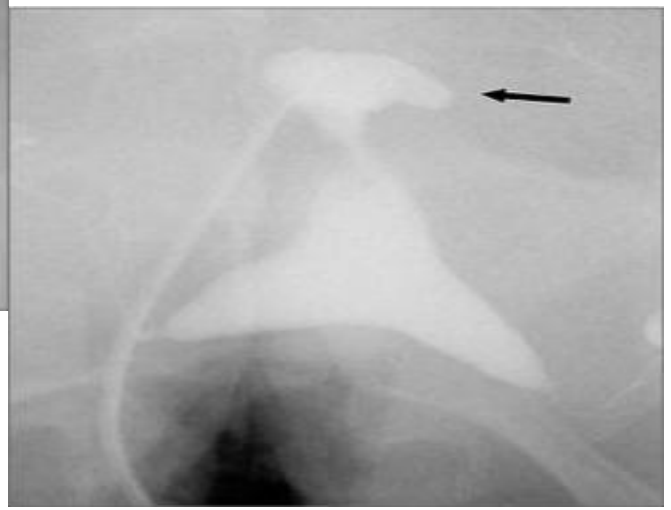
Dicle *et al. Eur Radiol.* 1997;7(1):31-4.

HSG









Surapaneni *et al. AJR Am J Roentgenol.* 2008 Apr;190(4):870-4.

Diagnostic challenges

- **Lack of agreement with**:

  →Gold standard for diagnosis

  →Criteria to measure the niche

- **Not all CS scars have defects**

  → Determine risk factors

  → Estimate the formation of the CS scar defect

Niche shape

- Sagittal plane with TVS or SHG: triangular anechoic area
- **Osser (2009)**: 83% triangular, 2% round, 4% oval
  - 10 % no remaining myometrium over the defect
  - wedge defect in 21% of women with previous CS
    - 6% inward protrusion
    - 15% outward protrusion (external surface bulging toward the bladder or abdominal cavity)
    - 4% hematoma
    - 4% inward retraction (external surface of the scar dimpled toward the myometrial layer)

Osser V. *et al. Ultrasound Obstet Gynecol*. 2009; 34: 90–97.

Niche shape

- **Bij de Vaate (2011)** ➔ SHG:
  - 50% semicircular
  - 32% triangular
  - 10% droplet-shape ➔ 7% cyst

Bij de Vaate *et al. Ultrasound Obstet Gynecol.* 2011; 37: 93–99.

Niche size

- 8 studies evaluated niche size, but using different definitions to describe large niches
- **Osser (2011):**
  - Classification of niches/ TVS/ random population of women with previous CS
  - ≥ 1 large defect observed in 14%, 23% and 45% of the women with 1, 2 and 3 CSs, respectively
  - ≥ 1 total defect (with no remaining myometrium over the defect) observed in 6%, 7% and 18%of the women with 1, 2 and 3 CSs, respectively

Osser V. *et al. Ultrasound Obstet Gynecol*. 2009; 34: 90–97.

Niche size

- Agreement from abovementioned studies ➔ cut-off values to measure scar defect in women with a history of one CS
- Large defect ➔ remaining myometrial thickness/ history of one CS
  - ≤ 2.2 mm when evaluated by TVS
  - ≤ 2.5 mm when evaluated by SHG

Osser *et al. Ultrasound Obstet Gynecol* 2010; **35**:75–83.

Niche size

Large defect → based on the penetration of the niche into myometrium

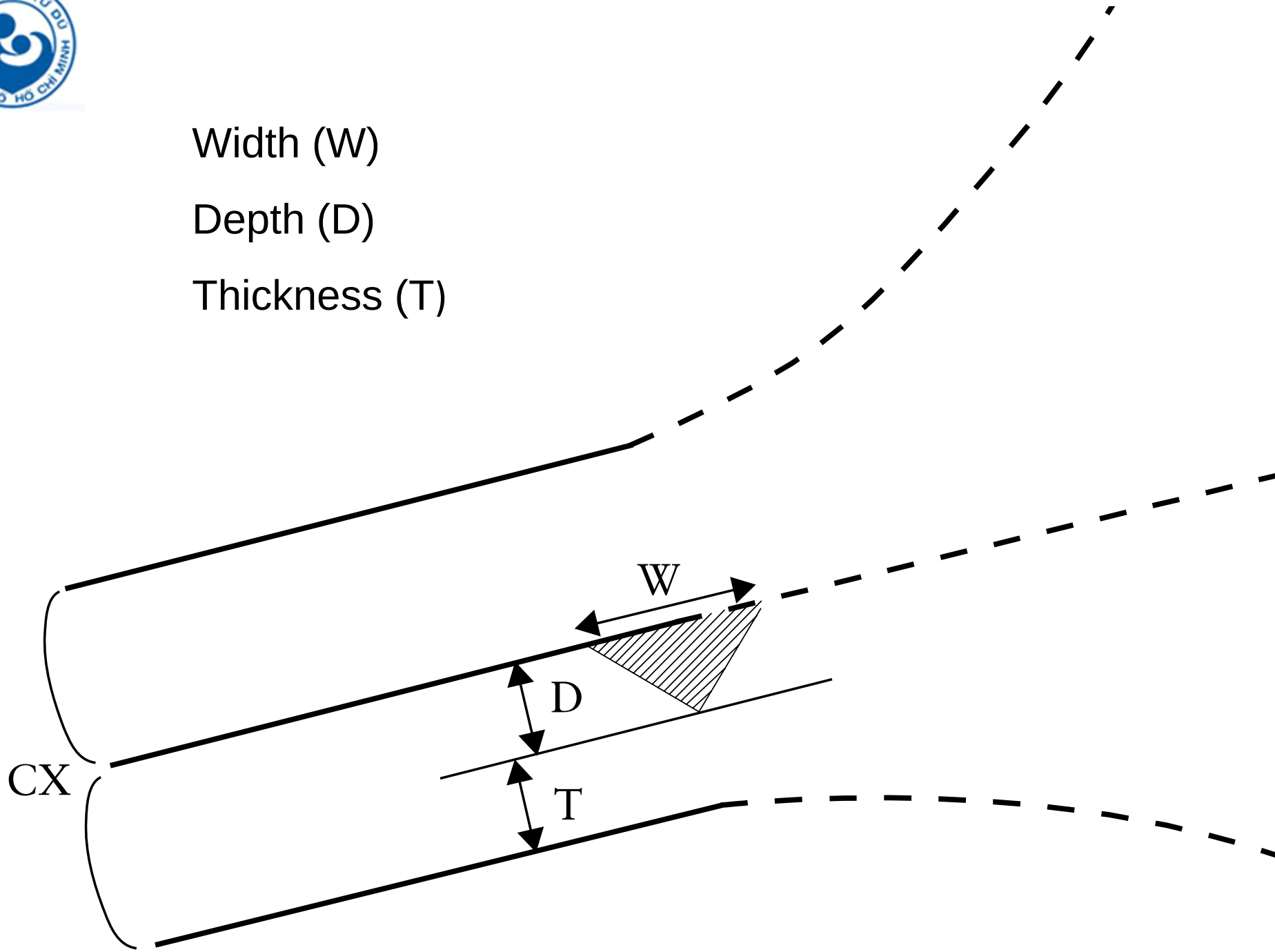
- ≥ 50% or 80% of the anterior myometrium
- Myometrial thickness ≤ 2.2 mm(TVS), ≤ 2.5 mm/ (SHG)
- Total defect: no remaining myometrium over the defect

Florio P *et al. Curr Opin Obstet Gynecol.* 2012 Jun;24(3):180-6.

Width (W)

Depth (D)

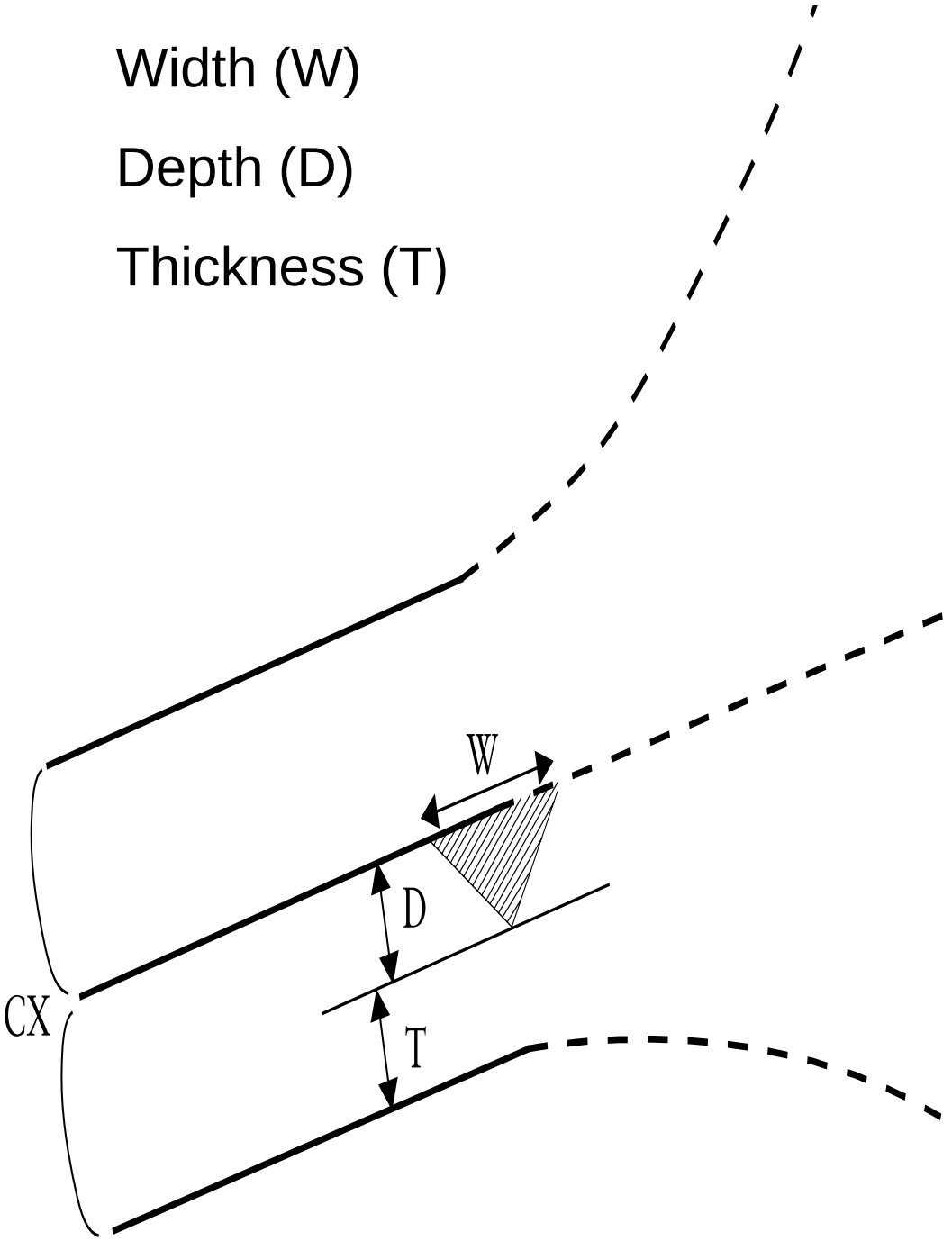
Thickness (T)



Width (W)

Depth (D)

Thickness (T)



Treatment

- Do not know the impact of a niche on future fertility

➔ offers further investigations when having suspected abnormalities on the morphology of CS scars

- Ongoing pregnancy/ previous CS scar defect

➔ risk of uterine rupture

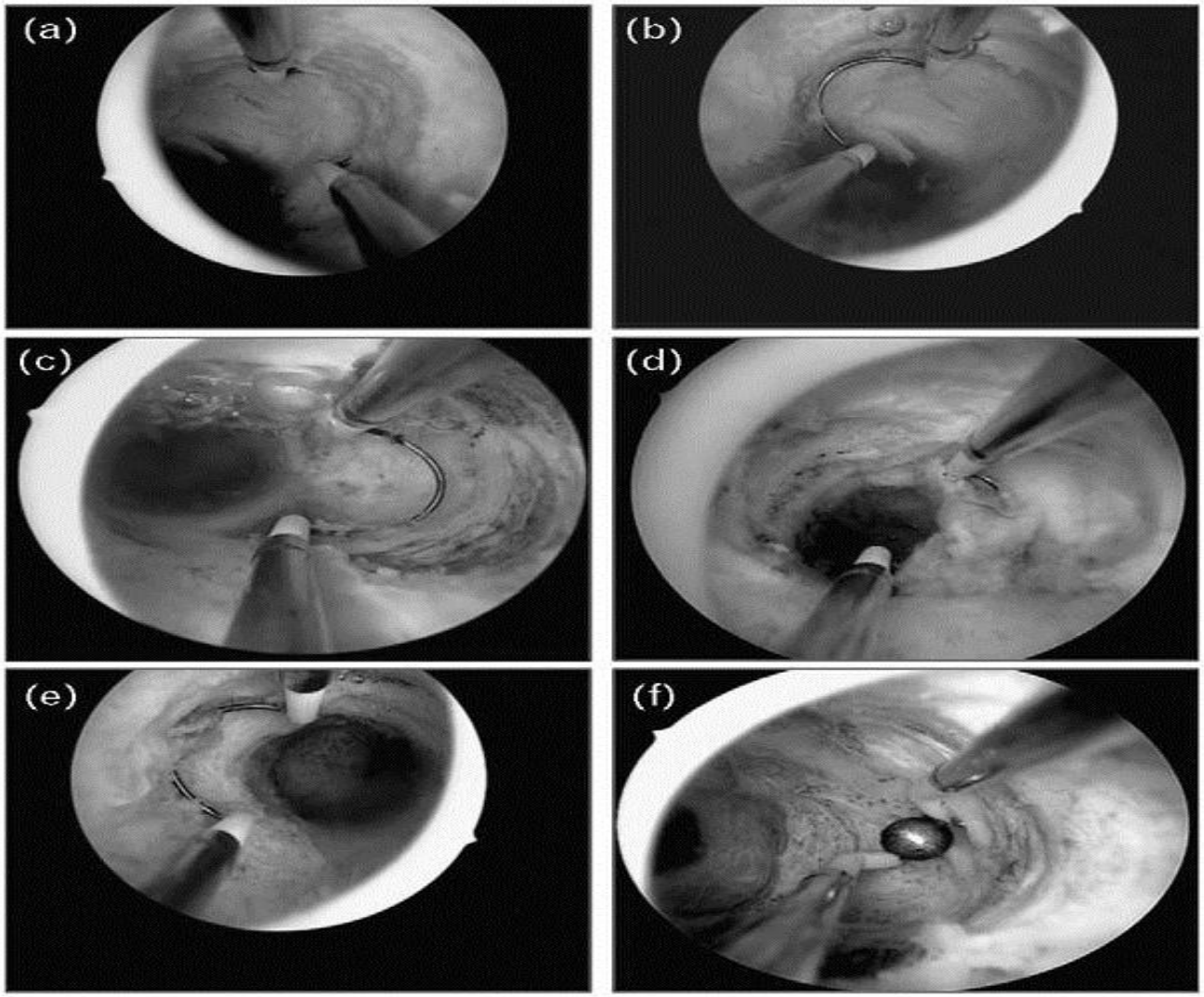
➔ assessment of CS scar defect before conception

Treatment

- Indication for surgical treatment:
  - PAUB after long period of diagnosis and medical treatment
  - Patients with fertility desire

- No treatment for asymptomatic patients

Therapeutic Hysteroscopy



Prevention

- Aims: reduce CS complications and CS scar defect
- Considered points:
  - Removal pubic hair on operative area by electrical shaver
  - Surgical skin preparation using Chlorhexidine Gluconate
  - Broad-spectrum antibiotic prophylaxis
  - Placental extraction using controlled cord traction
  - **Double-layer uterine closure**
  - Close the subcutaneous adipose layer with interrupted delayed-absorbable sutures if the layer is ≥2 cm
  - Thromboembolism prophylaxis

Wang *et al. Ultrasound Obstet Gynecol* 2009; **34**: 85–89.
NICE guidelines. CG132. August 2012.

Conclusion

- CS scar defect ➔ severe obstetric & long-term gynecological complications ➔ affect quality of life

- Clinical examination suspected CS scar defect ➔ further investigations, TVS is first choice

- Accurate diagnosis & correction of the defect

  ➔ Improve living standard, future fertility

  ➔ Reduce maternal and natal mortalities

Thank you