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Contribution of Ultrasonography in the Diagnosis of Pregnancies on Cesarean Scar : Clinical Application of the 2024 Updated Classification

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Introduction

Cesarean scar pregnancy (CSP) is a rare but potentially life-threatening form of ectopic pregnancy that can lead to severe maternal morbidity if not promptly diagnosed and managed. Rising cesarean delivery rates worldwide have contributed to an increased incidence of CSP, highlighting the need for reliable diagnostic and management frameworks. Traditional approaches to classification have been limited, creating challenges in guiding therapeutic decisions. Recently, a novel ultrasound-based classification system proposed by Fu et al. (2024) has offered a new perspective on stratifying CSP severity and tailoring treatment strategies.

Objective

This study was undertaken to assess the effectiveness of a novel classification system for cesarean scar pregnancies (CSP) and to evaluate its influence on clinical management strategies for affected patients.

Methods

This study is a retrospective single-center investigation conducted in the Department of Obstetrics and Gynecology at Kairouan, involving 39 patients diagnosed with cesarean scar pregnancies between January 1, 2016, and December 2023. The patients were categorized into three groups based on the new classification system developed by a Chinese research team and published by Fu et al. in 2024 (type I, type II or type III).

Positive Diagnosis of CSP According to the Classification of Vial *et al.*, 2000

The classification of cesarean scar pregnancies (CSP), proposed by Vial *et al.* in 2000, aims to categorize this condition according to its development and associated risks. It is primarily based on the implantation site of the gestational sac within the cesarean scar and the depth of its invasion into the myometrium.

- **Direct signs** (Figure 1):
 - A low-lying gestational sac with trophoblastic implantation at the site of the hysterotomy scar. Before 7 weeks of gestation, the sac may appear as a niche at the level of the scar.
 - On a sagittal section of the uterus, disruption of the gestational sac along the anterior uterine wall.
- **Indirect signs** (Figure 2):
 - An empty uterine cavity.
 - A free cervical canal.
 - Absence or marked thinning of the myometrium.
 - Peri-trophoblastic hypervascularization demonstrated on color or power Doppler.

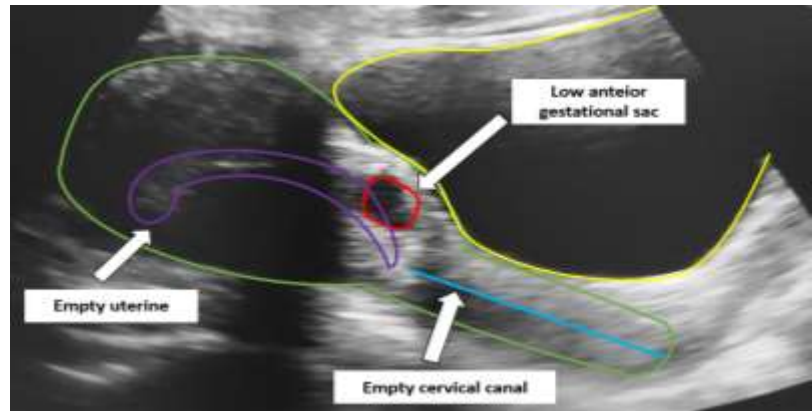


Figure 1. Sagittal section showing a cesarean scar pregnancy with visualization of the bladder (B). A gestational sac (highlighted in red) is implanted in the lower anterior uterine wall, distant from the endometrial cavity.

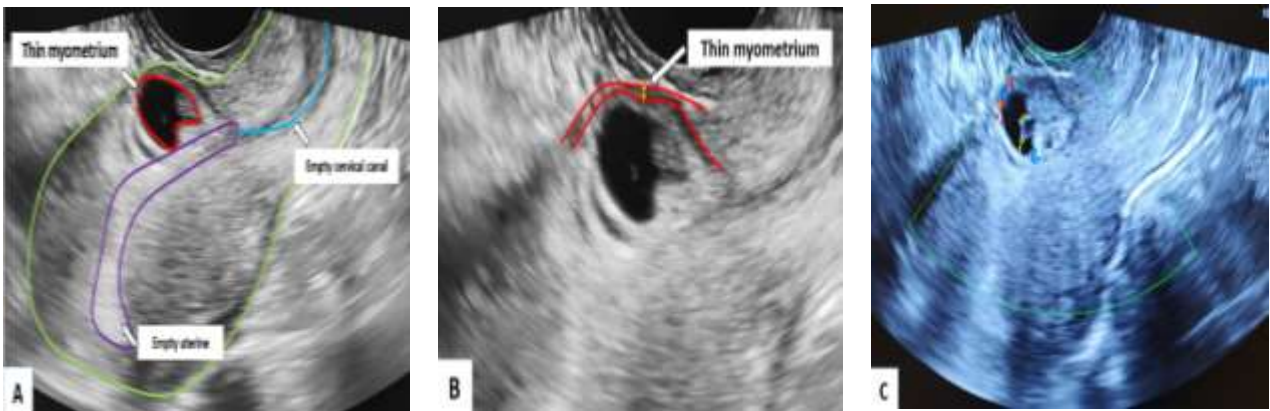


Figure 2. Ultrasonographic criteria for the diagnosis of cesarean scar pregnancy: low anterior implantation of the trophoblast/gestational sac, empty uterine cavity, empty cervical canal (image A), thin or absent myometrium between the gestational sac/trophoblast and the bladder (image B), and marked vascularization between the gestational sac/trophoblast and the bladder or the internal cervical os.

Classification of CSP According to Fu *et al.*, 2024

All patients included in this study were classified according to the system published in 2024 by Fu *et al.* The classification of cesarean scar pregnancies proposed by Fu *et al.* aims to improve understanding and management of this rare condition by relying on more precise and detailed ultrasonographic criteria. It is based on a thorough analysis of gestational sac implantation within the cesarean scar and on the assessment of the risk of serious complications such as uterine rupture and hemorrhage. Fu *et al.* introduced a novel approach that enhances the evaluation of cesarean scar pregnancies through ultrasound and Doppler imaging. This classification is divided into three major types, each further subdivided into two subtypes, a and b.

Type I (Closer type)
The gestational sac is located in immediate proximity to the cesarean section scar.
•Ia: The gestational sac is situated in the lower uterine segment within the uterine cavity.
•Ib: The gestational sac is located within the cervical canal.
Type II (Implantation type)
The gestational sac is implanted at the site of the cesarean section scar.
•IIa: Residual myometrial thickness ≥ 0.2 cm.
•IIb: Residual myometrial thickness 0.1 cm ≤ T < 0.2 cm.
Type III (Infiltration type)
Trophoblastic tissue infiltrates the cesarean section scar.
•IIla: Residual myometrial thickness < 0.1 cm, with the gestational sac not yet protruding beyond the serosal layer.
•IIlb: The gestational sac extends beyond the serosal layer.

The patients included in the study were divided into three groups according to the classification:

- Group 1:** Patients with CSP Type I.
- Group 2:** Patients with CSP Type II.
- Group 3:** Patients with CSP Type III.

Conclusion

- **The implementation of the new Chinese classification system in 2024 provides a structured and relevant framework for better understanding the diverse clinical presentations of this condition.**
- **This facilitates the selection of appropriate treatment strategies and ensures optimal follow-up care for patients.**

Table 1: Comparison of Demographic and Clinical Characteristics of Patients According to the Ultrasound Classification

Facteurs	GROUPE1 Type I	GROUPE 2 Type II		GROUPE 3 Type III		P
	Ia	Ila	Ilb	IIla	IIlb	
	N = 6	N = 11	N = 11	N = 4	N = 7	
Age						0,007
* < 35 ans	3 (50%)	7 (63,6%)	5 (45,4%)	3 (75%)	6 (85,7%)	
* > 35 ans	3 (50%)	4 (36,4%)	6 (54,6%)	1 (25%)	1 (14,3%)	
Gravity						0,003
* [2 – 3]	2 (33,3%)	4 (36,3%)	3 (27,3%)	1 (25%)	5 (71,4%)	
* [4 – 5]	3 (50%)	3 (27,4%)	7 (63,6%)	1 (25%)	2 (28,6%)	
* > 5	1 (16,7%)	4 (36,3%)	1 (0,1%)	2 (50%)	0 (0%)	
Parity						<0,001
* 1	1 (16,6%)	4 (36,3%)	2 (18,2%)	0 (0%)	1 (14,3%)	
* [2 – 3]	5 (83,4%)	4 (36,3%)	7 (63,6%)	2 (50%)	5 (71,4%)	
* [4 – 5]	0 (0%)	2 (18,3%)	2 (18,2%)	2 (50%)	1 (14,3%)	
* > 5	0 (0%)	1 (0,1%)	0 (0%)	0 (0%)	0 (0%)	
Number of Previous Cesarean Deliveries						0,003
* 1	2 (33,3%)	4 (36,3%)	5 (45,4%)	0 (0%)	3 (42,8%)	
* ≥ 2	4 (66,7%)	7 (63,7%)	6 (54,6%)	4 (100%)	4 (57,2%)	
Interval Between Last Cesarean Section and CSP (years)						<0,001
* ≤ 1	1 (16,6%)	6 (54,5%)	4 (36,3%)	3 (75%)	2 (28,5%)	
* 2 – 4	2 (33,3%)	2 (18,2%)	4 (36,3%)	0 (0%)	3 (42,8%)	
* ≥ 5	1 (16,6%)	1 (0,1%)	2 (18,2%)	1 (25%)	1 (14,3%)	
* Undetermined	2 (33,3%)	2 (18,2%)	1 (0,1%)	0 (0%)	1 (14,4%)	
Gestational Age (weeks of amenorrhea)						0,028
* ≤ 6	1 (16,6%)	5 (45,4%)	4 (36,3%)	3 (75%)a	0 (0%)	
* 7 – 8	1 (16,6%)	5 (45,4%)	3 (27,3%)	0 (0%)	3 (42,8%)	
* 9 – 10	2 (33,4%)	0 (0%)	2 (18,2%)	1 (25%)	1 (14,3%)	
* ≥ 11	2 (33,4%)	1 (0,1%)	2 (18,2%)	0 (0%)	3 (42,8%)	

Table 2 : Comparison of Sonographic Characteristics of Patients According to the Ultrasound Classification

Factors	GROUPE1 Type I	GROUPE 2 Type II		GROUPE 3 Type III		P
	Ia	Ila	Ilb	IIla	IIlb	
	N = 6	N = 11	N = 11	N = 4	N = 7	
Mean gestational sac diameter (mm)	24,95 +/- 20,3 mm	25,40 +/- 16,9 mm	33,26 +/- 25,6 mm	22,92 +/- 20,4 mm	46,6 +/- 38,6 mm	1,000
Residual myometrial thickness (mm)	3,08 +/- 2,5 mm	3,10 +/- 1,3 mm	1,33 +/- 1,1 mm	0,85 +/- 0,6 mm	0 mm (absence du mur de sécurité)	0,220
Hypervascularization on Doppler						0,260
* YES	4 (66,6%)	3 (27,3%)	7 (63,6%)	3 (75%)	4 (57,1%)	
* NO	2 (33,4%)	8 (72,7%)	4 (36,4%)	1 (25%)	3 (42,9%)	
Presence of an embryo						0,630
* YES	4 (66,6%)	8 (72,7%)	4 (36,4%)	2 (50%)	3 (57,1%)	
* NO	2 (33,4%)	3 (27,3%)	7 (63,6%)	2 (50%)	4 (42,9%)	
Positive cardiac activity						0,340
* YES	2 (33,3%)	1 (0,1%)	0 (0%)	2 (50%)	2(28,6%)	
* NO	2 (33,3%)	7 (63,6%)	4 (36,3%)	0 (0%)	1 (14,3%)	
Bladder bulging						0,016
* YES	1 (16,6%)	3 (27,3%)	4 (36,4%)	4 (100%)	7 (100%)	
* NO	5 (83,3%)	8 (72,7%)	7 (63,6%)	0 (0%)	0 (0%)	

Table 3 : Comparison of Therapeutic Modalities in Patients According to the Ultrasound Classification

Factors	GROUPE 1 Type I	GROUPE 2 Type II		GROUPE 3 Type III		P
	Ia	Ila	Ilb	IIla	IIlb	< 0,001
	N = 6	N = 11	N = 11	N = 4	N = 7	
Methotrexate	5 (83,3%)	10 (90,9%)	8 (72,7%)	4 (100%)	4 (57,1%)	
Cytotec (misoprostol)	1 (16,7%)	0 (0%)	1 (0,1%)	0 (0%)	1 (14,2%)	
Ultrasound-guided aspiration	0 (0%)	1 (0,1%)	0 (0,1%)	0 (0%)	0 (0%)	
Laparotomy	0 (0%)	0 (0%)	1 (01%)	0 (0%)	2 (28,5%)	
Expectant management	0 (0%)	0 (0%)	1 (0,1%)	0 (0%)	0 (0%)	