Screening for placenta accreta at 11-14 weeks of gestation

Julien J. Stirnemann, MD; Eve Mousty, MD; Gihad Chalouhi, MD; Laurent J. Salomon, MD, PhD; Jean-Pierre Bernard, MD; Yves Ville, MD

OBJECTIVE: We sought to describe the potential value of 11-14 weeks’ screening for placenta accreta (PA).

STUDY DESIGN: Patients with a history of lower segment cesarean section were prospectively included between 11-13+6 weeks over a 1.5-year period. The first 258 were offered standard screening whereas the following 105 underwent screening for PA. Women were considered high-risk when the trophoblast overlapped the scar visualized by transvaginal ultrasound and low-risk otherwise.

RESULTS: The group screened for PA did not differ from the non-screened group for demographic characteristics. In all, 6 of 105 (5.8%) women were considered high-risk. In the nonscreened group, 1 case of PA was discovered during an elective repeat cesarean. In the screened population, 1 case of PA occurred in a high-risk patient allowing a conservative planned management at 35 weeks.

CONCLUSION: At 11-14 weeks, ultrasound may help risk stratification for PA with a specific follow-up. Early recognition of patients at risk might improve the perinatal outcome of PA.
screening at 11-13+6 weeks as defined by a crown-rump length between 45-84 mm. During a first period of time, patients were not specifically screened for placenta and scar location. In a second period, patients were screened for PA by transvaginal ultrasound.

All ultrasounds were performed using a General Electrics Voluson E8 or 730 Expert (GE Medical System Europe, Buc, France) with a 3.5- to 5-MHz or 6- to 8-MHz transvaginal transducer. Demographic data as well as obstetrical and perinatal management and outcome were prospectively recorded in our electronic database (Astraia, Munich, Germany). Patients considered high-risk were followed up prospectively with serial ultrasound focusing on ultrasound signs of placental invasion in our unit up until delivery.

The statistical analysis was conducted using R (www.r-project.org). Quantitative variables are summarized by the median and interquartile range (25th-75th centile) and qualitative variables are described by N (%). Comparisons of demographic characteristics between the screened and nonscreened populations were performed using Mann-Whitney U tests for quantitative variables and Fisher exact tests for qualitative variables.

Since transvaginal ultrasound is offered routinely for first-trimester screening in our practice, this study did not require an institutional review board; however, written informed consent was obtained from all women.

**RESULTS**

Over the study period, 363 women with a history of LSCS attended our unit for first-trimester screening at 11-13+6 weeks’ gestation. Among these, the first 258 women were screened only for aneuploidy and fetal defects whereas the following 105 were also prospectively screened for PA. No significant differences in demographic characteristics were found between the screened and the nonscreened populations (Table 1). In particular, considering risk factors for PA, maternal age (P = .12), parity (P = .46), number of scars (P = .28), and rates of emergency cesarean operations (P =
The overall rate of loss to follow-up was 38/363 (10.5%) and was similar in both groups (9/105 [8.6%] and 29/258 [11.2%], \( P = .57 \)). The delivery mode was unknown in 5 cases.

Obstetrical and perinatal management of the study population is summarized in Figure 3. Two patients underwent termination of pregnancy and 3 miscarried <24 weeks’ gestation. These patients together with 3 cases of intrauterine fetal demise delivered vaginally. All live-born pregnancies with at least 2 uterine scars delivered by elective cesarean whereas patients with only 1 scar attempted vaginal birth in 162/262 (61.8%) with a 105/262 (64.8%) success rate.

Perinatal complications related to prior cesarean included 2 cases (0.6%) of PA, 16 cases (5%) of severe postpartum hemorrhage requiring suprostone or surgery, 2 cases (0.6%) of placenta previa, and 2 cases (0.6%) of complete uterine rupture. The occurrence of PA in the study population is summarized in Figure 4 with respect to screening results.

Within the nonscreened population, 1 case of placenta percreta was discovered during elective cesarean at 39+5 weeks in a 31-year-old, 4-parous patient with a history of 2 cesareans. This patient had an uneventful follow-up until delivery. Upon opening of the peritoneum, placental bulging through the anterior uterine wall required a fundal incision. A conservative management was performed leaving the placenta and the uterus. Embolization of uterine and internal iliac arteries was subsequently performed. Follow-up was uneventful apart from episodic bleeding without signs of infection, with MRI examinations showing progressive involution of the placenta at 8 months after cesarean.

Within the screened population, 1 scar was not visualized, 6 of 104 (5.8%) patients were considered high-risk based upon a trophoblast overlapping an exposed scar, and 98 of 104 were considered low-risk. One case of PA was discovered in the sixth high-risk patient. This patient had been followed-up by serial ultrasound at 16+1, 18+1, 22+1, 25+1, and 29+1 weeks confirming signs of PA both on ultrasound and MRI with a low-lying anterior placenta. Elective cesarean section was performed at 35 weeks under epidural anesthesia after a course of betamethasone given for fetal lung maturity enhancement. The inferior segment was richly vascularized. Hysterotomy was performed through a fundal vertical incision. No attempt was made to extract the placenta. Uterine and internal iliac arteries embolization was then performed systematically. Blood loss was 300 mL and the postpartum period was uneventful. The placenta was still intrauterine at 3 months when she developed

### Table 1

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Overall n = 363</th>
<th>Without 11-14 wk’ screening n = 258</th>
<th>With 11-14 wk’ screening n = 105</th>
<th>( P ) value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td></td>
<td></td>
<td></td>
<td>.12</td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>35 (31–38)</td>
<td>35 (32–39)</td>
<td>34 (30–38)</td>
<td></td>
</tr>
<tr>
<td>Parity</td>
<td></td>
<td></td>
<td></td>
<td>.46</td>
</tr>
<tr>
<td>1</td>
<td>212 (58.4%)</td>
<td>157 (60.9%)</td>
<td>52 (55.9%)</td>
<td></td>
</tr>
<tr>
<td>&gt;1</td>
<td>139 (38.3%)</td>
<td>101 (39.1%)</td>
<td>41 (44.1%)</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>12 (3.3%)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of scars</td>
<td></td>
<td></td>
<td></td>
<td>.28</td>
</tr>
<tr>
<td>1</td>
<td>305 (84.0%)</td>
<td>221 (85.7%)</td>
<td>84 (80%)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>54 (14.9%)</td>
<td>34 (13.2%)</td>
<td>20 (19%)</td>
<td></td>
</tr>
<tr>
<td>≥3</td>
<td>4 (1.1%)</td>
<td>3 (1.1%)</td>
<td>1 (1%)</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interval since last delivery, mo</td>
<td></td>
<td></td>
<td></td>
<td>.14</td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>28 (12–49)</td>
<td>26.5 (11.7–45.5)</td>
<td>32 (14–54)</td>
<td></td>
</tr>
<tr>
<td>History of vaginal birth</td>
<td></td>
<td></td>
<td></td>
<td>.36</td>
</tr>
<tr>
<td>Yes</td>
<td>64 (17.6%)</td>
<td>42 (17.4%)</td>
<td>22 (21.8%)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>279 (76.9%)</td>
<td>200 (82.6%)</td>
<td>79 (78.2%)</td>
<td></td>
</tr>
<tr>
<td>VBAC</td>
<td></td>
<td></td>
<td></td>
<td>.16</td>
</tr>
<tr>
<td>Yes</td>
<td>33 (9.1%)</td>
<td>27 (11.3%)</td>
<td>6 (5.8%)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>309 (85.1%)</td>
<td>212 (88.7%)</td>
<td>97 (94.2%)</td>
<td></td>
</tr>
<tr>
<td>Emergency cesarean</td>
<td></td>
<td></td>
<td></td>
<td>.06</td>
</tr>
<tr>
<td>Yes</td>
<td>119 (32.8%)</td>
<td>77 (29.8%)</td>
<td>42 (40%)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>244 (67.2%)</td>
<td>181 (70.2%)</td>
<td>63 (60%)</td>
<td></td>
</tr>
<tr>
<td>Postpartum pyrexia</td>
<td></td>
<td></td>
<td></td>
<td>.38</td>
</tr>
<tr>
<td>Yes</td>
<td>15 (4.1%)</td>
<td>9 (3.5%)</td>
<td>6 (5.7%)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>348 (95.9%)</td>
<td>249 (96.5%)</td>
<td>99 (94.3%)</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

endometritis and hysterectomy was easily performed without technical problems. She was discharged home after 54 days. Pathology examination confirmed placenta increta. The 5 other patients considered high-risk based upon 11-14 weeks’ ultrasound had an uneventful follow-up (Table 2) and delivered vaginally (n = 2) or by cesarean (n = 3) without complications at between 38-40 weeks’ gestation.

**COMMENT**

PA is a life-threatening obstetrical emergency. Its incidence has risen in parallel with that of cesarean deliveries and it remains a major cause of maternal mortality and morbidity as the principal indication for postpartum hysterectomy with high blood loss, intensive care unit admission, and intraoperative injury to the bladder or bowel.13,15,16

Efforts have been made to refine the ultrasound diagnosis of PA in the second and third trimester of pregnancy, consisting in the presence of placental lacunae (irregularly shaped vascular spaces with turbulent blood flow at the color Doppler), loss of retroplacental clear space, thinning of the myometrium overlying the placenta and interruption of the bladder line with protrusion of the placenta into the bladder, or evidence of hypervascularization by Doppler.21,29-31

The performance of ultrasound has been studied in very high-risk populations, with a prevalence of PA ranging from 9-44%. In these studies the sensitivity of ultrasound, with contemporary signs, varies from 77-93% and the positive predictive value from 65-93%.18-21 Although MRI may help refine the diagnosis following ultrasonography,32,33 its overall sensitivity remains unclear.19,29

However, most cases of PA remain undiagnosed until the time of delivery.13,15,16

PA, however, is likely to develop at the time of the trophoblast invasion in the first trimester.34,35 The study of the trophoblast’s location in the first trimester is feasible as part of the routine 11-13+6 weeks’ scan. Mustafá et al36 in 2002 have well established the probability of placenta previa at term in relation to the distance/overlap of the lower placental edge
with respect to the internal cervical os. The cesarean scar has been studied and described in nonpregnant women as part of the investigation of the relationship between scar defects and postmenstrual spotting, dysmenorrhea, and pelvic pain.37-40

The sonographic diagnosis in the first trimester has been reported in a few cases,22-25 mainly as a low gestational sac in early first trimester, suggesting a direct implantation of the trophoblast over the scar.26 However, these cases are difficult to differentiate from ectopic pregnancies developing in the LSCS scar. These cases of PA detected in early pregnancy all showed very specific sonographic features. These findings, however, are unlikely to be fit for 11-14 weeks’ screening policy, since their prevalence in PA as well as in normal pregnancies has not been formally studied. We believe these ultrasound findings should be used in second-line diagnostic scans in screen-positive patients.

Ultrasound examination is now routinely offered to all pregnant women at 11-14 weeks of gestation in many developed countries.41 To date, the aim of this examination is mainly to confirm viability and gestational age, diagnose and determine chorionicity of multiple pregnancies, as well as screening for fetal aneuploidy and for some severe malformations. Promising attempts at predicting severe obstetrical conditions developing in the second or third trimester such as preeclampsia by ultrasound and Doppler examination at 12 weeks are promising.42,43 We believe that screening for PA in a high-risk group with previous cesarean section is justified by the severity of this condition at the time of delivery and by the feasibility of both scar and placental examination at 11-14 weeks.26 Early recognition of PA is likely to be associated with lesser maternal morbidity.13,16 Elective cesarean section with a conservative approach of the placenta left in place has shown to improve the prognosis for the mother.14 In our population, a case of placenta percreta went to delivery undiagnosed in the non-screened group, whereas early recognition of PA in the high-risk group allowed for planning optimal management. This suggests that the rationale for 11-14 weeks’ screening is to help plan further investigations and follow-up thus avoiding unanticipated peripartum discoveries of PA as well as to reassure patients otherwise at risk based on demographic characteristics. Nonetheless, it is likely that a trophoblast overlapping the scar is not the only factor that determines the occurrence of PA. Indeed, as shown by Miller et al,11 PA may develop at a distance from the scar at a rate of 3.7% and 9.1% for patients <35 years and ≥35 years with 1 previous cesarean section. Therefore, although 11-14 weeks’ screening is likely to identify most cases it is anticipated that it will fail in identifying all cases.

We propose that systematic evaluation of the uterine scar and placental location be tested in a large prospective study at the time of the 11-14 weeks’ ultrasound examination in women with a uterine scar. Our data suggest that 5.8% of women with ≥1 previous LSCS could be considered at high risk of PA with scars covered by the trophoblast insertion at 12 weeks. Conversely, scars located within the cervical canal or yet undevolved isthmus appear to be protected from this risk even with a low-lying trophoblast over the internal os. Accounting for maternal age and history could lead to objective individual risk calculation for PA as early as 12 weeks and help refine the care of women, including specialized imaging investigations such as an early ultrasound at 16-18 weeks21 or MRI together with a planned delivery in an appropriate obstetrical unit.

**TABLE 2**

<table>
<thead>
<tr>
<th>Cases</th>
<th>Gestational age at follow-up, wk</th>
<th>Placental location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>21 + 5</td>
<td>Posterior, high</td>
</tr>
<tr>
<td>2</td>
<td>32 + 2</td>
<td>Posterior, high</td>
</tr>
<tr>
<td>3</td>
<td>17 + 6</td>
<td>Anterior, high</td>
</tr>
<tr>
<td>4</td>
<td>18 + 3</td>
<td>Posterolateral, low lying</td>
</tr>
<tr>
<td>5</td>
<td>22 + 2</td>
<td>Posterior, high</td>
</tr>
<tr>
<td>6</td>
<td>16 + 0</td>
<td>Posterior, high</td>
</tr>
<tr>
<td></td>
<td>18 + 1</td>
<td>US signs of placenta accreta</td>
</tr>
<tr>
<td></td>
<td>22 + 1</td>
<td>Anterolateral low-lying</td>
</tr>
<tr>
<td></td>
<td>25 + 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>29 + 1</td>
<td></td>
</tr>
</tbody>
</table>

US, ultrasound.


**REFERENCES**

8. Kwee A, Bots ML, Visser GHA, Bruinse HW. Emergency peripartum hysterec-
9. Smith J, Moussa HA. Peripartum hysterectomy for primary postpartum hemorrhage: a pro-
10. Rahman J, Al-Ali M, Qutub HO, Al-Suleiman SS, Al-Jamra FE, Rahman MS. Emergency ob-
11. Miller DA, Chollet JA, Goodwin TM. Clinical risk factors for placenta previa-placenta ac-
12. Wu S, Kocherginsky M, Hildard JU. Abnor-
tirpatory management in cases of placenta ac-
15. Eller AG, Porter TF, Soisson P, Silver RM. Optimal management strategies for placenta ac-
16. Eller AG, Bennett MA, Sharshiner M, et al. Maternal morbidity in cases of placenta accreta managed by a multidisciplinary care team com-
18. Chou MM, Ho ES, Lee YH. Prenatal diag-
nosis of placenta previa accreta by transab-
19. Levine D, Hulka CA, Ludmir J, Li W, Edel-
man RR. Placenta accreta: evaluation with color Doppler US, power Doppler US, and MR imag-
26. Comstock CH, Lee W, Vettriano IM, Bron-
pin concentrations and nuchal translucency are associated with obstetric complications: a pop-
28. Stirnimann JJ, Chalouli OE, Former S, Sai-
29. Comstock CH. Antenatal diagnosis of pla-
30. Chou MM, Tseng JJ, Ho ES, Hwang JI. Three-dimensional color power Doppler imaging in the assessment of uteroplacental neovas-
31. Shih JC, Palacios Jaramuenda JMP, Su 
YN, et al. Role of three-dimensional power Doppler in the antenatal diagnosis of placenta ac-
cretia: comparison with gray-scale and color Doppler techniques. Ultrasound Obstet Gynecol 
2009;33:193-203.
32. Warshak CR, Eskander R, Hull AD, et al. Accuracy of ultrasonography and magnetic res-
onance imaging in the diagnosis of placenta ac-
34. Khong TY. The pathology of placenta ac-
35. Pijnenburg R, Dixon G, Robertson WB, Brosens I. Trophoblastic invasion of human de-
cidua from 8 to 18 weeks of pregnancy. Pla-
centa 1980;1:3-19.
36. Mustafá SA, Brizot ML, Carvalho MHib, Wa-
relation between cesarean section number, defect size, clinical symptoms and uterine posi-
38. Osser OV, Jokubkiene L, Valertin L. High prevalence of defects in cesarean section scars at transvaginal ultrasound examination. Ultra-
42. Audibert F, Boucioran I, An N, et al. Screen-
ing for preeclampsia using first-trimester serum markers and uterine artery Doppler in nullipar-
43. Poon LCY, Stratiavea V, Piras S, Piri S, Nico-
lides KH. Hypertensive disorders in pregnan-
cy: combined screening by uterine artery Dopp-