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# A score to predict the risk of emergency caesarean delivery in women with antepartum bleeding and placenta praevia

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ABSTRACT

*Objective:* To identify antenatal events associated with emergency caesarean sections in women presenting with antepartum bleeding and placenta praevia and to establish a score to predict the risk of emergency caesarean after a first bleeding episode has resolved.

*Study design:* This retrospective multicentre study included 250 women presenting with antepartum bleeding and placenta praevia from 20 weeks of gestation until term in three maternity units. The score was constructed from data from 163 women after identification of antenatal risk factors associated with emergency caesareans for profuse bleeding due to placenta praevia. It was validated on a second independent cohort of 87 women.

*Results:* Three variables were significantly associated with emergency caesareans: major or complete praevia, defined as complete or partial praevia (OR = 33.15 (95% CI 4.3–257); $p = 0.001$), occurrence of 3 or more episodes of antepartum of uterine bleeding (OR = 2.53 (95% CI 1.1–5.86); $p = 0.03$), and a first (sentinel) bleeding episode before 29 weeks of gestation (OR = 2.64 (95% CI 1.17–5.98); $p = 0.02$). A fourth variable, moderate or severe antepartum uterine bleeding, was significantly associated with emergency caesareans in the univariate but not the multivariate analysis ($p = 0.006$). These four variables were incorporated into a weighted scoring system that included major praevia (4 points), three or more episodes of antepartum bleeding (3), first bleeding episode before 29 weeks of gestation (3), and bleeding episode estimated as moderate or severe (1). A score ≥6/11 had a sensitivity of 83% and a specificity of 65% for predicting an emergency caesarean in the score development group and 95% and 62% in the validation group.

*Conclusion:* A scoring system for placenta praevia with previous bleeding events, based on intensity, gestational age at sentinel bleed (before 29 weeks), number of bleeding episodes (≥3) and type of praevia (major) might be helpful to guide obstetric management and especially to determine the need for admission.



## Introduction

Placenta praevia (PP) with antepartum bleeding has a reported incidence rate of 0.3–0.5% and is associated with high rates of maternal and fetal morbidity [1]. As the main risk factors for PP – maternal age above 40 years and previous caesarean deliveries [2,3] – continue to rise, the rates of PP and its complications will increase with them. Maternal risks include antepartum bleeding, intrapartum and postpartum haemorrhage, and need for hysterectomy and blood transfusion [1,4–6]. Outcomes of pregnancies complicated by PP are highly variable, and it is difficult to predict antenatal events of heavy and sudden uterine haemorrhaging that requires emergency caesarean delivery. Guidelines (most recently republished in 2011) by the Royal College of Obstetricians and Gynaecologists [7] recommend that women with major praevia (complete and partial PP) with previous bleeding events should be admitted at or after 34 weeks'

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gestation, and that outpatient care should be considered for those with minor praevia (marginal and low-lying PP) or those without previous antepartum bleeding episodes. Nonetheless, a randomized controlled trial comparing hospital vs home care published in 1996 [8] showed a significant reduction in length of hospital stay without severe maternal and neonatal complications. The current literature has otherwise failed to identify antenatal events associated with a high risk of maternal or fetal morbidity. This study sought to identify antenatal events associated with emergency caesarean sections for profuse haemorrhage in women presenting with antepartum bleeding and PP after a first episode of such bleeding. Our objective was to establish a predictive score for emergency caesareans after the resolution of a first (sentinel) bleeding episode to help guide the obstetric management of these women.

## Material and methods

This retrospective multicentre study examined records of women with PP from 1998 to 2013 in three maternity departments: two in Marseille, Hôpital Nord and Hôpital de la Conception, and the Hôpital d'Aix en Provence. Using the hospital's standard codes, we searched for all pregnant women during the study period who were admitted with intact membranes for antepartum bleeding and PP from 20 weeks of gestation until term and gave birth at the same hospital to a live newborn after 24 weeks. Women with multiple pregnancies or a fetal malformation or who gave birth within 48 h after the first bleeding due to PP were excluded from the study, the latter because an emergency caesarean cannot be prevented for them. The PP diagnosis was based on transvaginal ultrasound performed at admission and confirmed after active vaginal bleeding stopped. A sagittal scan was obtained of the entire length of the cervix, including the lower segment of the uterus.

The study included only those women for whom the distance between the lower edge of the placenta and the internal cervical os was 3 cm or less [9,10]. As recommended by Love et al. [9] and by the RCOG [7], we classified PP by ultrasound imaging "according to what is relevant clinically: if the placenta lies over the internal cervical os, it is considered a major praevia; if the leading edge of the placenta is in the lower uterine segment but not covering the cervical os, minor or partial praevia exists [7]".

The following maternal and neonatal data were retrospectively collected from medical charts: maternal age, number of pregnancies, parity, gestational age at first antepartum bleeding, number and intensity of antepartum bleeding episodes, distance between the lower placental edge and the internal cervical os, cervical length, gestational age at birth, mode of delivery, any postpartum haemorrhage, birth weight, and duration of hospitalization. The obstetrician assessed the clinical intensity of the antepartum bleeding episodes as mild, moderate or severe (subjectively by visual inspection or by weighing pads and sponges or using a collection bag). A bleeding episode was considered new if it began 24 h or more after the cessation of the previous episode. Postpartum haemorrhage was defined as a blood loss >500 mL for women delivering vaginally and >1000 mL for women undergoing a caesarean, measured with a collection bag. Elective caesareans for PP were scheduled at 39 weeks of gestation. The primary outcome variable considered in the analysis was an emergency caesarean for women with PP and massive vaginal bleeding before or during labour.

The study included 250 women with antepartum bleeding for PP. A first cohort of 163 patients admitted to Hôpital d'Aix en Provence and Hôpital Nord comprised the score development group. The score was validated in a second independent cohort of 87 patients managed at another tertiary reference centre (Hôpital de la Conception, Marseille).

The French institutional review board (Ethics Committee on Research in Gynecology and Obstetrics) approved this study (CEROG 2013-08-06).

### *Statistical analysis*

We first studied the risk factors for our primary endpoint, an emergency caesarean for severe bleeding and PP, comparing women with and without surgery. Comparisons were tested with either the Chi-square test for categorical variables or Student's *t* test for continuous variables. Variables significantly associated with this endpoint in the univariate analysis ($p < 0.05$) were introduced into a logistic regression analysis. The final model expressed the odds ratios (OR) and 95% confidence intervals (CI). To derive a score to predict the risk of an emergency caesarean for antepartum bleeding from PP, we combined the logistic regression and calculated weighting factors. We first selected the significant antepartum variables and determined the optimal cutoff for each variable, which we used to transform the continuous variables into categorical variables. Then we calculated a weighting factor for each risk factor identified and accordingly attributed a point value to each of the 4 variables. The discriminative performance of the score was evaluated with a Receiver Operating Characteristic (ROC) curve and quantified by calculating the area under the curve and its 95% CI. The best cutoff value was identified as the point with highest sensitivity and specificity (Younden index: SE + SP −1) and was chosen as the threshold value of the score. Because we sought to make the score as intuitive as possible, it can be calculated by summing the points for each variable. PASW Statistics Version 17.0 (SPSS Inc., Chicago, IL, USA) software was used for the statistical analysis. The significance level was set at 5%.

## Results

This study included 250 patients: 163 for the score development, and 87 for its validation. Of the 163 patients in the score development group, 46 had emergency caesareans for profuse antepartum bleeding for PP and 117 gave birth by other modes: either other caesareans ($n = 81$) or vaginal delivery ($n = 36$). An earlier gestational age at delivery (34.8 vs 37.6 weeks' gestation; $p < 0.001$), lower birth weight (2128 g vs 2809 g, $p < 0.001$), and more postpartum haemorrhages (30.4% vs 8.5%, $p < 0.001$) were all associated with these emergency caesareans for profuse antepartum bleeding from PP compared to other deliveries (Table 1). Four antepartum factors were also significantly associated with emergency caesareans compared with other deliveries in the univariate analysis: a major praevia (97.8% vs 53.8%; $p < 0.001$), three or more antepartum bleeding episodes during pregnancy (69.6% vs 35.9%; $p < 0.001$), an antepartum bleeding event before 29 weeks of gestation (65.2% vs 40.2%; $p = 0.004$), and moderate or severe antepartum bleeding (50% vs 27.4%; $p = 0.006$). None of the following factors were associated with a high risk of emergency caesarean: age, previous caesarean, number of previous pregnancies, parity, or cervical length (Table 1). A multiple regression analysis of age, number of pregnancies, parity, gestational age at first bleeding, intensity of antepartum bleeding, number of antepartum bleeding events and type of PP (major or minor) identified three significant independent risk factors (Table 2): major praevia (OR = 33.15 (95% CI 4.3–257); $p = 0.001$), 3 or more antepartum bleeding episodes (OR = 2.53 (95% CI 1.1–5.86); $p = 0.03$), and first antepartum bleeding episode before 29 weeks' gestation (OR = 2.64 (95% CI 1.17–5.98); $p = 0.02$). Moderate or severe antepartum bleeding was not an independent risk factor for emergency caesarean in the bivariate analysis (OR = 1.03 (95% CI 0.44–2.39); $p = 0.945$). We nonetheless chose to include it in the score, because of its clinical interest.